INTERNATIONAL CONFERENCE

MARINE RESEARCH HORIZON 2020

17-20 SEPTEMBER 2013, VARNA, BULGARIA

MARES2020

BOOK OF ABSTRACTS

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MAIN TOPICS:

1. Methods of operational oceanography
   The Black Sea as a test basin

2. Marine Biodiversity and challenges for good environemntal status assessment

3. Improving governance, management and building capacities

4. Extending the Euro-Argo activities in the regional seas
   Black Sea Argo initiative

5. Marine resources and observations for sustainable ecosystem management

6. Achieving marine resources and ecosystem management and sustainability

7. EMODNET
   Achievements and Future

8. Black Sea ARGO workshop

9. Regional Seas
   Differences and Similarity

10. PERSEUS
    Black Sea experiment

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PLENARY SESSION

B21014

OCEAN SCIENCES: CHALLENGES AFTER RIO+20

Luis Valdes[1]

[1]*Ocean Sciences, IOC-UNESCO*

Keywords: ***ocean sciences, Rio+20, international cooperation, sustainable development goals***

Within the last 20 years the major global initiatives such as the Chapter 17 of Agenda 21 from the first Rio summit and the Johannesburg Plan of Implementation have advanced principles, goals, timelines and targets for managing the issues facing the ocean and coasts and the living and non/living resources. Rio 1992 was the starting point for the Global Environmental Change core programmes: the World Climate Research Program (WCRP), the International Geosphere-Biosphere Program (IGBP), DIVERSITAS, and the Earth System Science Partnership (ESSP). Since then, several projects, investigating anthropogenic influences on the Earth system were launched and financed. Now we have reached a point where gaps in knowledge need to be identified and a new generation of projects be developed.

Rio+20 offered a unique opportunity to define pathways to a safer, more equitable, cleaner, greener and more prosperous world and ocean for all. Several tangible recommendations for action were identified:

(i) Rio+20 has place the investigation of the seas and environmental challenges within the context of sustainability, linking ocean management and sustainability to other development challenges (e.g. food security and human wellbeing) in order to re-shape our knowledge, understanding, values and attitudes to take the future of the planet actively into account.

(ii) Many actors intervening in Rio+20, including the Intergovernmental Oceanographic Commission, have highlighted the UN spirit of strengthening research by increasing international cooperation; and the proposals and commitments for ocean science were summarized in the document 'The future we want'.

(iii) There was widespread support among countries for the formulation of a Sustainable Development Goal dedicated to the ocean.

The presentation will focus on the Rio+20 commitments for ocean science, but will discuss as well the problems we face, the barriers to break down in order to implement these commitments and to embrace integrated ocean and coastal management for a sustainable development of economic activities in our coasts and oceans.

B21002

JOINT PROGRAMMING INITIATIVE "HEALTHY AND PRODUCTIVE SEAS AND OCEANS"

Kathrine Angell-Hansen[1, a], Gilles Lericolais[2, b]

[1]Director JPI Oceans the Research Council of Norway, Rue du Trône 130, BE-1050 Brussels
[2]Director, European and International Affairs – IFREMER, 155, rue Jean-Jacques Rousseau – 92138 Issy-les-Moulineaux Cedex France, Alternate Member JPI Oceans Management Board

[a]ka@rcn.no, [b]gilles.lericolais@ifremer.fr

Keywords: research programming, European cooperation, marine sciences

The concept of Joint Programming

The Joint Programming concept was introduced by the European Commission in 2008 as one of five initiatives for implementing the European Research Area. Joint Programming is a comprehensive, long-term and strategic process in which participating countries cooperate to tackle societal challenges that cannot be solved solely on the national level.

Why?

Joint Programming is intended to increase the efficiency of national public research & development spending by enhancing and improving cross-border collaboration, coordination and integration of national research activities. It aims to boost Europe's ability to address major economic and societal challenges whose resolution depends critically on research.

How?

Member States and Associated Countries are invited to engage on a variable-geometry basis in order to define, develop and implement common strategic research agendas based on a common vision in order to tackle common societal challenges. Importantly, JPIs are flexible and free in choosing the means to implement this end (see below). Joint Programming is, therefore, about defining common visions and strategic research, infrastructure and innovation agendas as a basis for long-term cooperation and implementing them with fit for purpose solutions.

What is JPI Oceans?

- The Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans) is the only high-level strategic body that exists, to provide a long-term integrated approach to marine and maritime research and technology development in Europe.
- JPI Oceans is a coordinating and integrating platform across disciplines and sectors, open to all EU Members and Associated Countries.
- The authority of JPI Oceans lies in the high-level management board which consists of representatives of 18 member countries appointed for their ability to agree on joint action plans and potential funding initiatives across Europe (ministries and research funding agencies).

Fit for purpose solutions

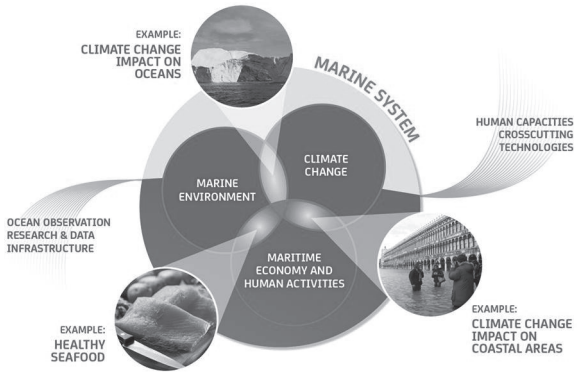
Joint Programming is a flexible process, which allows participating countries to cooperate and implement joint activities in a quick and uncomplicated manner. JPI Oceans is being implemented through an interactive involvement of relevant stakeholders (e.g. researchers, technologists, industry representatives, policy-makers and civil society), in order to ensure the relevance and coherence of its work. JPI Oceans acts to achieve its goals and objectives (see below) by (i) defining a societal challenge together with the identified stakeholders (ii) analysing the needs and gaps related to the challenge (iii) implementing fit for purpose solutions to address the issue (see Annex 1 for an illustrative example).

What form the solution might take depends entirely on the challenge at hand. JPI Oceans will try and implement the most effective and appropriate action, which could include but not be limited to, devising common research, innovation, infrastructure and monitoring strategies and programmes; developing science-to-policy mechanisms; sharing of human capacity, data and infrastructures; thematic workshops (e.g. on modelling), strategic workshops (e.g. on policy issues) and conferences; joint calls; common programmes; networks of organisations, institutional agreements, etc. The action can take on any form that is deemed relevant and necessary to solve the given challenge.

Thematic focus

The JPI Oceans' Vision document was developed by the JPI Oceans' Interim Management Board and adopted by the Management Board in their first meeting. It constitutes the context and basis from which the Strategic Research and Innovation Agenda will be developed. It focuses on the intersections between climate change, the marine environment and the maritime economy. Human capacities, technology, observations, data, infrastructures play an enabling role therein.

Fig. 1. The JPI Oceans has identified broad cross-thematic areas which need to be addressed as a priority and which lie at the intersections of the marine environment, climate change and human activities.



The Vision Document outlines the following three goals of JPI Oceans all requiring a long-term perspective: (1) Enable the advent of a maritime economy, maximising its value in a sustainable way; (2) Ensure good environmental status of the seas and optimise planning of activities in the marine space; (3) Optimise the response to climate change and mitigate human impact on the marine environment.

A11031

THE SCIENCE OF OCEAN PREDICTIONS AND ITS APPLICATIONS TO THE MEDITERRANEAN SEA

Nadia Pinardi[1, a], M. Tonani[2, b], P. Oddo[2], C. Fratianni[2], A. Guarnieri[2], S. Simoncelli[2], M. De Dominicis[2], M. Drudi[2]

[1]University of Bologna, Department of Physics and Astronomy, Viale Berti Pichat 6/2, 40100 Bologna, Italy
[2]Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Bologna, Viale A.Moro 44, 40127 Bologna

[a]nadia.pinardi@unibo.it, [b]marina.tonani@bo.ingv.it

Keywords: ***ocean predictions, operational oceanography, uncertainty estimation***

Ocean Forecasting has started in the eighties in limited ocean regions and now it is a reality in the global open ocean and coastal regions. Predictability of oceanic flows is connected, as for the atmosphere, to initial condition inaccuracies and to model representation errors, both numerical and process wise. To this common set of uncertainty sources the ocean forecasting adds the uncertainty about atmospheric forcing and especially the wind stress, the major forcing of the ocean circulation in general. The effects of uncertainties is reviewed and forecast errors discussed.

The application of these concepts to an operational ocean forecasting system for the Mediterranean Sea (Mediterranean Forecasting System, MFS) is then illustrated by showing the components and the issues associated with real time data QC, data assimilation algorithms and numerical model errors. The MFS is now a component of the European Copernicus Marine Service that delivers open and free forecasting products with a one-stop-shop service that allows several user-oriented applications to be developed.

A11033

ENGINEERING FOR THE BLACK SEA FUTURE

William B.F. Ryan[1, a]

[1]*Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY 10964 USA*

[a]*billr@ldeo.columbia.edu*

Keywords: carbon dioxide, greenhouse, hydrogen sulfide, hydrologic deficit, sequestration

It is now evident that our human society is not going to reduce its demand for fossil fuels before the level of carbon dioxide in the atmosphere reaches such extremes that rising sea level and increasing annual temperatures become inescapable and our Black Sea environment is radically altered. The Danube delta with its vital wetlands will submerge as well as our coastal cities with their historical heritage and economic importance. Surface salinity will increase, the pycnocline will shoal, and the poisonous hydrogen sulfide within the interior of the sea will threaten fisheries and our breathable air during storms of predicted greater intensity. Either we wait for this to happen, or we take action in planning for and then undertaking the engineering to minimize the impact. The delivery of fresh river water is diminishing as more and more of this resource is diverted to support agriculture and industrial consumption. The climate history of the Black Sea shows two post-glacial periods of rapid warming when the Black Sea lake lost its outflow to the global ocean. This condition of hydrologic deficit lies in our future as the atmospheric greenhouse returns us to the intense heat and aridity of the past.

I propose that when applying our knowledge for societal benefit we consider two engineering projects. The first is to take the hydrocarbons arriving at our Black Sea coasts through the new undersea pipelines and burn these resources at the edge of the sea to make electricity for consumption and export. Capture the carbon dioxide there and pump it into the abyss to oxidize the hydrogen sulfide and detoxify the Black Sea interior. Use the money from the carbon tax income during sequestration and the selling of the electricity to pay for the enterprise. The second project is to build a dam across the Dardanelles so that the combination of rising external global sea level and the internal hydrologic deficit can be balanced to keep the surface of the Black and Marmara Seas close to the present height. Increasing salinity in the Black Sea is inevitable even without a dam. The reduced contrast between the salinity and hence the density of the surface and interior water will eventually lead to an overturn of the water masses. Either we begin to detoxify the interior or nature will take its course with consequences for the coastal environment.

We have at MARES2000 the scientists, industry and policy experts assembled to address sustainable management. This conference provides the ideal opportunity to put all of our ideas on the table for discussion and consideration as we engage in the strategic planning for HORIZON 2020.

C32006

MAPPING EUROPEAN MARINE/MARITIME LANDSCAPE

Luis Valdes[1]

[1]*Ocean Sciences, IOC-UNESCO*

Keywords: ***Europe, ocean governance, marine/maritime organizations, decision makers, stakeholders***

Europe is a vast land space surrounded by four regional seas: The Baltic Sea, the North Sea, the Mediterranean Sea and the Black Sea. Over 2/3 of the EU's continental borders are coastal with a total of 65,993 km of coastline (mostly in the Atlantic but also the Arctic Ocean borders the northern coasts of Europe) and the maritime spaces under the MSs jurisdiction are much larger than their terrestrial territory. Through its outermost regions, the EU is also present in the Indian Ocean, Pacific and the Caribbean Sea.

The European Community is a Party to three of the four regional sea conventions (HELCOM, OSPAR, and Barcelona Convention) and Bulgaria and Romania are members of the Bucharest Convention. There are four high level intergovernmental commissions that intervene in ocean sciences in Europe: the Arctic Council, the International Council for the Exploration of the Sea (ICES), the Mediterranean Science Commission CIESM and the Black Sea Commission (BSC). And several Regional Fisheries organizations intervene in the management of European fish stocks (NEAFC, GFCM, NASCO and ICCAT).

Europe is also involved in international conventions (e.g. London Convention/Protocol, UNFCCC, Stockholm Convention, CBD, CITES, etc.) and produce its own legal framework and directives on marine and maritime policies. The European Commission has developed its own agencies (EEA, EMSA, EFCA, JRC, REA) and also the ESA runs programmes related with the observation of the oceans.

There are many more organizations that are important for the European marine/maritime landscape and it is a challenge to summarize their roles in a systematic, relational and useful way that makes the figure understandable for the scientific community, the stakeholders and the decision makers.

In this talk a proposal to map the European marine and maritime landscape will be presented and discussed.

A14006

TOWARD GLOBALY HARMONIZED TSUNAMI WARNING SYSTEM -INITIATIVES OF IOC/UNESCO-

Yutaka Michida[1, 2, a]

[1]*Professor, the University of Tokyo, Kashiwanoha 5-1-5 Kashiwa 277-8564 JAPAN*
[2]*Vice-Chair of the Intergovernmental Oceanographic Commission, Unesco*

[a]*ymichida@aori.u-tokyo.ac.jp1*

Keywords: IOC, tsunami

After the hege Indian Ocean Tsunami in December 2004, with which over 200,000 lives were lost, the Intergovernmental Oceanographic Commission (IOC) of Unesco established Intergovernmental Coordination Group for Tsunami Early Warning System for the Indian Oceann (ICG/IOTWS), then for other oceanic regions including Northeast Atlantic and Midetteranian Sea (ICG/NEAMTWS), and the Caribbean Seas (ICG/CARIBBE), by 2006 respectively. It is noted that such a system for the Pacific Oean has been providing its services since 1970s, that is currently named as 'ICG/PTWS.' As these coordination groups and their systems are being developed, there have been emerging needs to design their operating structure and implementation methods to be more globally harmonized. And a number of issues of common interest among 4 ICGs have been recognized. The IOC decided to establish 'Working Group on Tsunamis and Other Hazards Related To Sea-Level Warning And Mitigation Systems (TOWS-WG)' at its 24th Assembly with the Resolution XXIV-14 in 2007, to advise on co-ordinated development and implementation activities on warning and mitigation systems for tsunamis and other hazards related to sea level of common priority to all ICGs. Special emphasis have been given on: (i) harmonization and standardization of relevant observation, data management and communication, forecast and warning practices (ii) development of synergies in capacity-building and outreach activities (iii) reinforcement of intergovernmental, international and national capabilities on hazard knowledge, vulnerability, and impact assessment (iv) effective coordination with all related subsidiary bodies, experts groups and partner organizations with relevant mandates.

The present paper briefs on a number of achievements acomplished since the establishment of IOC's tsunami program focusing on the activities of TOWS-WG.

A13009

GLIDERS FOR SUSTAINED OBSERVATIONS AND RESEARCH

Peter M. Haugan[1, a]

[1]*Geophysical Institute, University of Bergen, Allegaten 70, N-5007 Bergen, Norway*

[a]*Peter.Haugan@gfi.uib.no*

Keywords: gliders, sustained observations, Norwegian Sea, sections, seaglider, Slocum

Initially, gliders were mainly used for short, personnel intensive scientific process studies, often in connection with research vessel cruises. Recently, cross-basin transects have been successfully performed demonstrating the possibility for long term continuous sampling. In Norway, we established in 2011 a national research infrastructure for gliders called the Norwegian Atlantic Current Observatory. Currently we have 6 Seagliders and 3 Slocum gliders available to support research needs. These serve both special purpose detailed oceanographic process studies and longer term sustained observations.

At the time of writing we have operated Seagliders on two long sections in the Norwegian Sea, 450 km and 900 km respectively, nearly continuously for approximately one year. The sections are taken to 1000m, all with temperature, salinity and dive averaged currents, some with oxygen and fluorescence. The establishment of the research facility has included development of operational capability to pilot gliders with trained technical personnel on a watch cycle, streamlining of software and routines, as well as workshop and routines for deployment and recovery.

Our experience so far is very positive with good coverage and no loss of equipment. Very interesting data have been obtained. Individual glider missions have lasted up to 6 months. The present durability and streamlined operational procedures allow simultaneous operation of several gliders by a small team. A growing suite of sensors can be added to serve regional needs. We believe that gliders hold great potential for regional seas.

A11037

MULTIPHASE OCEAN AND CLIMATE

R.I. Nigmatulin

An overview of the ongoing and prospective climate change in the ocean is presented, with the emphasis given to the increase of temperature and CO_2 uptake, sea level rise, ice cover reduction, and alteration of the global thermohaline circulation. The ocean is interpreted as a multiphase thermodynamic system. Some recent analyses of the air-sea fluxes pointing, in particular, on the importance of the entrainment of droplets at the sea surface are demonstrated, as well as their implications for the global and regional heat, moisture, and CO_2 budgets. The fundamental inter-relations between temporal scales in variability of the ocean (the “fast” and “slow” variables) are discussed. Finally, a global perspective of sustainable development in the context of changing marine environment is addressed.

C37002

A COMPARATIVE STUDY ON ^{137}Cs UPTAKE FOR TWO CULTURED FRESH WATER FISH: CARP (CYPRINUS CAPRIO) AND EEL (ANGUILLA ANGUILLA)

F.K. Vosniakos[1], A. Giouvanoudi[1], A. Kalfa[1], A. Moumtzis[1], P.A. Karakoltsidids[2]

[1]Science Dept. Applied Physics Lab., Technological Educational Institution of Thessaloniki (T.E.I.)
[2]School of Food Technology and Nutrition, Technological Educational Institution of Thessaloniki (T.E.I.)

Keywords:* ^{137}*Cs, uptake, Cyprinus C., A.- anguilla, γ-spectroscopy

Comparative studies were carried out in two cultured fresh-water fish, *Cyprinus caprio* and *Anguilla anguilla*, to determine their tolerance in the uptake of ^{137}Cs (3000 Bq/l). The results showed that the concentration of ^{137}Cs in the muscular tissues was treated in the carp and lesser in the eel. The accumulation was progressive for both species and for a period of six months.

The histological studies were concentrated in muscular tissues livers, kidneys and gills. The symptoms observed include hyperemia, hydropsy, anaemia and degeneration of liver and kidney tissues. The physiology and anatomy of each species played an important role in the accumulation process of ^{137}Cs.

A13010

MONITORING HYPOXIA: DIVERSE APPROACHES TO ADDRESSING A COMPLEX PHENOMENON WITH FOCUS ON THE BLACK SEA

J. Friedrich[1, a], F. Janssen[2, 3, b], Y. He[1], M. Holtappel[2], S. Konovalov[4], R. Prien[5], G. Rehder[5], E. Stanev[1]

[1]Helmholtz Zentrum Geesthacht Center for Materials and Coastal Research, Max-Planck Str. 1, D-21502 Geesthacht, Germany
[2]Max Planck Society for the Advancement of Science / Max Planck Institute for Marine Microbiology, Celsiusstr. 2, D-28359 Bremen, Germany
[3]Alfred-Wegener-Institutefor Polar and Marine Research, Am Handelshafen 12, D-27570 Bremerhaven, Germany
[4]A.O. Kovalevskiy Institute of Biology of Southern Seas, Nakhimov Av. 2, 99011 Sevastopol, Ukraine
[5]Institut für Ostseeforschung Warnemünde an der Universität Rostock,Seestr. 15, D-18119 Rostock, Germany

[a]Jana.Friedrich@hzg.de, [b]Felix.Janssen@awi.de

Keywords: hypoxia, observatories, monitoring, novel technologies

We present our experiences in monitoring hypoxia and assessing oxygen-related phenomena in aquatic systems, resulting from the EU-FP7 project HYPOX ("In situ monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and land-locked water bodies", www.hypox.net). For this presentation, we selected approaches and technologies which could be relevant for monitoring fast fluctuations at the pelagic redoxcline, seasonal benthic hypoxia and decadal trends oxycline boundary shifts in the Black Sea. Using novel technologies like e.g., the profiling instrumentation platform GODESS, ARGO floats with oxygen optodes and long-term moorings equipped with ADCP and oxygen optodes, temporal and spatial patterns of water column oxygenation from hours to seasons, and from basin-scale to local-scale patterns were resolved.

We present examples from study sites in the Baltic Sea and in the Black Sea. The time series recordings of GODESS and mooring arrays allowed a thorough characterization of oscillating redoxclines in the central Baltic Sea and in the Black Sea off southwestern Crimea as temporally dynamic, three-dimensional systems. For the first time, oxygen sensor equipped ARGO type profiling floats were deployed in the Black Sea and proved to be powerful tools to address seasonal changes in patterns of water column oxygenation on larger spatial scales and emphasize the importance of mesoscale processes for oxygen distribution in the Black Sea basin. A 3-month continuous time series recording of a stand-alone static mooring equipped with optical oxygen sensors, current meters, and turbidity sensors identified summer hypoxia to be a highly dynamic process and provided insights into the controls of hypoxia formation on the north-western Black Sea shelf. Existing multi-decadal time-series monitoring data were used to demonstrate the imprint of climate change and eutrophication on long-term oxygen distributions and, hence, the importance of maintaining long-term commitments to oxygen monitoring programs. Such time series data allow separating out the effects that climatic forcing and eutrophication exert on oxygen depletion i.e., in the Black Sea. Standard CTD

measurements in the central Black Sea over the last 90 years reflect the rising of the upper boundary of the suboxic zone in the 1970s and 1980s due to eutrophication, and again in the 1990s and 2000s due to NAO forcing, while eutrophication relaxed.

Our comprehensive study within HYPOX was able to address many aspects of hypoxia in aquatic systems and revealed the vital need for dedicated oxygen monitoring at appropriate spatial and temporal scales with appropriate technologies. The variety of hypoxia characteristics and consequences emphasizes also the need for a careful selection of locations and periods of time for oxygen observations in order to adequately address the risk for hypoxia formation and ecosystem response.

C33001

CHALLENGES IN ASSESSING THE STATUS OF MARINE WATERS: ASSISTING POLICY-MAKERS AND STAKEHOLDERS IN SUCH COMPLEX TASK FROM THE EU PROJECT DEVOTES

Angel Borja[1, a]

[1]*AZTI-Tecnalia, Marine Research Division, Herrera Kaia, Portualdea z/g E-20110 Pasaia Spain*

[a]*e-mail: aborja@azti.es*

Keywords: ***WFD, MSFD, GES assessment, science, environmental policy***

Human activities are increasing in marine waters, producing pressures and impacts. Hence, the European Commission have approved some legislation (Water Framework Directive; Marine Strategy Framework Directive) trying to minimize the impacts of human activities and achieving good status of marine waters in coming years. The way in which the assessment of the status should be done is still under development and scientists must assist policy-makers and stakeholders in developing cost-effective methods to monitor diverse ecosystem components, classify marine systems and assess the status in an integrative way. The European project DEVOTES (DEVelopment Of innovative Tools for understanding marine biodiversity and assessing good Environmental Status) is involved in developing such kind of tools and an overview on the ways in which scientists can help stakeholders in this challenge will be presented.

C34002

IMPROVING GOVERNANCE, MANAGEMENT AND BUILDING CAPACITIES

Alice Newton[1, a]

[1]*NILU-IMPEC, Box 100, 2027 Kjeller, Norway*

[a]*anewton.ualg@gmail.com*

Keywords : EU marine policy, marine sectors, Regional conventions, cooperation, capacity building

The EU Integrated Marine Policy brings together policies, (eg environment MSFD), sectors (maritime transport, fisheries, offshore energy) and furthermore has a broad geographical scope, covering all the regional seas.

International cooperation amongst the EU member States, and also with non-members, is key to solving challenges in governance and management of complicate multinational sectors such as fisheries. Cooperation is needed in Maritime Spatial Planning, integrated maritime surveillance and sea-basin strategies. The EU policies must work with partners such as OSPAR and HELCOM and the UN Convention on the Law of the Sea. Cooperation and governance for the protection of marine biodiversity is essential for the development of new products from marine species through biotechnology. Multinational and interdisciplinary capacity building is a necessary building block for the multiple competencies and skill sets required for the management and governance of our shared Seas and Oceans.

METHODS OF OPERATIONAL OCEANOGRAPHY

THE BLACK SEA AS A TEST BASIN

A11014

MATHEMATICAL MODELS AND NUMERICAL METHODS OF GEOPHYSICAL FLUID DYNAMICS – TO THE MEMORY OF G.I. MARCHUK

V.B Zalesny[1], V.I. Agoshkov[1]

[1]Institue of Numerical Mathematics RAS, 8 Gubkin str., 119333 Moscow, Russia

[a]zalesny@inm.ras.rul, [b]agoshkov@inm.ras.ru

Keywords: numerical modeling, splitting, World Ocean, Black Sea

The creation of efficient mathematical models of geophysical fluid dynamics represents an urgent problem of present day research as well as the comprehensive analysis of the observational data. Such models are a numerical tools used to understand and predict ocean global circulation its interaction with the atmosphere and the regional variability of the seas and oceans. Special emphasis is placed on the models when dealing with the assimilation of the observed data.

A mathematical model of the ocean general circulation and a numerical algorithm for its solution are considered. An approach based on a flexible procedure from the family of splitting methods (Marchuk, 1980, 1988) is used. Governing equations are written in a generalized -coordinate system. The model has a flexible computational structure and consists of two parts a forward prognostic model and its adjoint analog. The numerical algorithm for the forward and adjoint models is constructed based on the method of multicomponent splitting. The method includes splitting with respect to physical processes and space coordinates. We discuss three important steps of our approach: (1) the symmetrized form of governing equations, (2) splitting of model operator into a sum of simpler nonnegative suboperators, and (3) construction a particular model of ocean/marine dynamics of a different physical complexity. Some examples of the World Ocean circulation and the Black Sea dynamics are presented.

A12005

MY OCEAN BLACK SEA MONITORING AND FORECASTING CENTER: CIRCULATION AND ECOSYSTEM PREDICTIONS

G.K. Korotaev[1, a], Yu.B. Ratner[1, b], A.L. Kholod[1, c]

[1]MHI, Ukraine

[a]gkorotaev@mhi.net.ua, [b]yubrat@gmail.com, [c]antonholod@mail.ru

Keywords: forecasting center, circulation, ecosystem, product accuracy, reanalysis, Copernicus program

The Black Sea monitoring and forecasting center is functioning now during four years as part of the My Ocean project. The set of new products concerning the Black Sea circulation and ecosystem are implemented starting from spring of the current year, Careful evaluation of product accuracy is available now to customers. Analysis of user requests shows the continuous growth of interest to different kind of products including reanalysis results, nowcast and forecast of circulation and ecosystem. The Black Sea monitoring and forecasting center products are available via the MyOcean central facilities which include extended viewing tools and data downloading instruments. The real-time operation of the center is planned in the framework of MyOcean2 project until its end in autumn 2014. Then the European Center of Ocean Monitoring and Forecast should prolong the delivery of operational products as the Marine Service of Copernicus program (former GMES).

A13012

NUMERICAL MODELING AND RESULTS FROM CALCULATIONS OF HIGH RESOLUTION THERMO-HYDRODYNAMICS PROCESSES IN THE BLACK SEA AND SEA OF AZOV

Dimitar Trukhchev[1, a], Rashit Ibrayev[2, b]

[1]Institute of Oceanology BULGARIAN Academy of Sciences, P.O. Box 152, Varna 9000, Bulgaria
[2]Institute of Numerical Mathematics Russian Academy of Sciences, Gubkin str., 8, Moscow, 119333, Russia

[a]truhi@io-bas.bg, [b]ibrayev@inm.ras.ru

Keywords: numerical modelling, Black Sea

The main objectives of the study are: 1) further development of models of regional sea thermo-hydrodynamics; 2) research of the intra- and interannual variability of the main hydrophysical fields in the Black Sea and the Sea of Azov. A three-dimensional model of currents based on the complete system of primitive equations of geophysical hydrodynamics is used. A set of various parameterizations for sub-greed processes, "sea-atmosphere" interactions, and icing processes are incorporated into the model. The model is elaborated at the Institute of Numerical Mathematics in Moscow and co-developed with IO-BAS for the Black Sea. The spatial resolution is ~1.4 km, with 48 irregular levels vertically from the sea surface to the bottom - at present, this model is with the best resolution for the region and the only one in which there are calculated jointly these two seas. The evolution of monthly average discharge of 20 rivers is taken into account, as well the flows through the Upper and Lower Bosphorus Strait. The thermo-hydrophysical fields are reconstructed for a period of 40 years by ERA40 data for atmospheric impact from ECMWF re-analysis. The basic number of experiments is conducted on supercomputer centers of BAS, RAS and Moscow State University "Lomonosov". The results reproduce basic features of the Black Sea hydrophysics: i) the specific vertical hydrological structure and its seasonal variability including seasonal thermocline and Cold Intermediate Layer growth; ii) the principal dynamical peculiarity – the Main Black Sea Current and the submesoscale processes of eddy generation on its periphery.

A11004

NUMERICAL SIMULATION OF THE OCEAN GENERAL CIRCULATION AND ITS CLIMATIC VARIABILITY FOR THE 1948-2007 USING THE INMOM

A.V. Gusev[1, a], N.A. Diansky[1]

[1]Institute of Numerical Mathematics RAS, Gubkina st., 8, 119333, Moscow, Russia

[a]e-mail: anatoly.v.gusev@gmail.com.

Keywords: ocean general circulation, numerical simulation, sea ice physics, climate change

The results of simulating global ocean circulation and its interannual variability in 1948-2007 using INM RAS ocean general circulation model INMOM (Institute of Numerical Mathematics Ocean Model) are presented. The CORE datasets were used to set realistic atmospheric forcing. Sea ice area decrease by 2007 was reproduced in the Arctic Ocean that is in good agreement with observations. The interdecadal climatic variability was revealed with significant decrease of Atlantic thermohaline circulation (ATHC) and meridional heat transport (MHT) in North Atlantic (NA) since the late 1990's. MHT presents decrease of heat transport from NA to the atmosphere since the mid-1990's. Therefore the negative feedback is revealed in the Earth climate system that leads to reducing of climate warming caused primarily by anthropogenic factor for the last decades. Long-term variability (60 years) of ATHC is revealed as well which influences NA thermal state with 10 year delay. The assumption is argued that this mechanism can make a contribution in the ATHC own long-term variability.

A11005

NUMERICAL SIMULATION OF BLACK SEA CIRCULATION AND POLLUTION PROPAGATION IN COASTAL WATERS OF THE GREAT SOCHI

N.A. Diansky[1, 3, a], V.V. Fomin[2, 3, b], S.N. Moshonkin[1, c]

[1]Institute of Numerical Mathematics RAS, Gubkina st., 8, 119333, Moscow, Russia
[2]Moscow Institute of Physics and Technology, Kerchenskaya st., 1A, 117303, Moscow, Russia
[3]State Oceanography Institute, Kropotkinsky lane, 6, 119034, Moscow, Russia

[a]nikolay.diansky@gmail.com, [b]lihar_89@mail.ru, [c]atrexm@himki.net

Keywords: ocean general circulation, numerical simulation, Black Sea, pollution propagation

The numerical modeling of the Black Sea (BS) is considered by using INMOM (Institute of Numerical Mathematics Ocean Model). The model is based on the primitive equations in spherical σ-coordinate system with free surface boundary condition. The numerical algorithm is based on the method of multicomponent splitting and has a flexible modular structure. The splitting with respect to physical processes and spatial coordinate is used.

A computational method is proposed of the polluting substances (PS) transport in the BS region adjacent to the Great Sochi. It is based on INMOM application for the BS in two versions: M1 and M2. In the M1 INMOM has a uniform spatial resolution ~4 km, while M2 has non-uniform one with refinement to 50 m in the BS region near Great Sochi coast. The M2 is used only during the periods of PS transport computation for which the initial hydrothermodynamic conditions are taken from M1. Both versions reveal complexity of the BS circulation nature, however, M2 more adequately reproduces eddy circulation due to higher horizontal resolution in its eastern part.

Hence, a suggestion is made that BS eddy structure simulation requires model resolution ~1,5 km, and the major factor of quasistationary Batumi anti-cyclonic gyre formation is the topographical features in this part of the sea. A computation of PS distribution from the rivers Sochi, Host and Mzymta and from 18 pipes of deep-water sewage production was performed for the high-water period from 01.04.2007 to 30.04.2007. It is shown that the significant contribution to PS distribution from these punctual sources is made by whirlwind mesoscale formations generating complicated 3-dimensional PS distribution.

A11018

LONG WAVES AT THE SOUTH CRIMEAN COAST: NUMERICAL MODELLING AND ARCHIVE DATA ANALYSIS

V.A. Ivanov[1, a], A.V. Bagaiev[1, b]

[1]Marine Hydrophysical Institute of National Academy of Sciences of Ukraine, 2 Kapitanskaya Street, Sevastopol, 99011 Ukraine

[a]vaivanov@inbox.ru, [b]bagaiev.andrii@gmail.com

Keywords: numerical modelling, barotropic and baroclinic oscillations, inventory

Mixing processes on the continental slope with the scale 1 to 10 km make an important contribution to the energy transfer (so called “cascade”) and various tracer fluxes, such as carbon dioxide for example. Since the issue of an explicit reproduction of these processes is on the cutting edge of the modern high-res hydrodynamical models, the appearance of such oscillations have to be quantified and parameterized in order to be included in the climate and biogeochemical models.

The operative Black Sea hydrophysical field monitoring system that had been developed at MHI NASU is used to simulate mesoscale and sub-mesoscale features. The core of the system consists of the 3D numerical thermodynamic model written down in Lamb-Gromeka form for the Cartesian coordinate system. Finite difference approximation on the 1.6x1.6 km horizontal grid and 27 non-uniformly distributed vertical levels is implemented. Model is driven with the 12-hour wind stress field and thermohaline fluxes at the sea surface obtained via local (2.5 km) atmospheric model ALADIN. April 2006 model output at 1 h frequency is analyzed.

The area of interest for our study is the Southern Crimean Coast due to anthropogenic overloading and as a pattern of multidisciplinary monitoring at Katsiveli oceanographic platform. The domain dynamics is influenced by the basin-scale Rim current that encounters the continental slope and is modulated by interannual and high frequency wind forcing variability.

The fluctuations of sea surface height (SSH), kinetic energy (KE), temperature and salinity are analyzed, interpreted and compared with the previous researches. More than 50 frequency and wavenumber power spectra (PSD) are computed. A wide range of barotropic and baroclinic waves are distinguished, from the barotropic seiches with the period of 2–10 hours to coastal-trapped waves of 30–70 hours. SSH oscillations is dominated by the atmospheric forcing with the period of approximately 15 days but local power spectral density maxima also correspond to topographic trapped waves. In the subinertial range there are Kelvin waves with the periods of 3.8 and 8.8 hours that is supported with observations. For the kinetic energy oscillation there are also sub-inertial maxima for PSD (3.3, 3.95 and 5.9) that correspond to observed oscillations typical for the Crimean coast. A local maximum at 15 hours is well illustrated by vertical Hovmoller KE diagram for a station on the shelf break; also the high-frequency inertia-gravity oscillations are clearly seen when dominating current weakens. Profiles of horizontal velocity clearly show the presence of topographic Rossby waves with the maximum of energy close to the shelf slope. But there is also present a region of KE maxima propagating shoreward (with the approximate speed of 10 km per day): its nature supposed to be connected with

the RIM current meandering. Horizontal time-space section of temperature illustrates the presence of combination of baroclinic waves with the different phase speed: one of them with length scale around 20 km propagates westward with the coast on its right and another one propagates seaward. Vertical temperature profiles shows long-term oscillations of CIL minima and short-term vertical movements in the seasonal pycnocline with frequencies that are also present on PSD diagrams for KE, SSH and salinity. That may support the idea of interaction between barotropic and baroclinic movements.

Inventory of the barotropic and baroclinic oscillations, which were experimentally observed and numerically simulated, is performed. In general, this task was aimed at study of climatological variability of the mesoscale and sub-mesoscale oscillations in the Black Sea. It is concluded that one of the possible pathway for energy transfer is due to unbalanced mesoscale instabilities of the along-shore currents. Problem of the wave classification with respect to dispersion relation and seasonal stratification needs the further investigation.

A11011

VARIATIONAL DATA ASSIMILATION PROBLEMS FOR SEA AND OCEAN CIRCULATION MODELS AND METHODS FOR THEIR SOLVING – TO THE MEMORY OF G.I. MARCHUK

V.I. Agoshkov[1, a], V.B. Zalesny[2, b]

[1]Institute of Numerical Mathematics, RAS, Gubkina str., 8, Moscow, 119333 Russia.

[a]agoshkov@inm.ras.ru, [b]zalesny@inm.ras.ru

Keywords: ***Black Sea circulation model, variational data assimilation, satellite observational data, ocean surface temperature, salinity field, ocean surface level, problem of initialization of geophysical fields, mathematical model of World Ocean circulation***

In this work we consider a class of problems of four-dimensional variational assimilation of satellite observational data on the temperature and level of the ocean surface, as well as measurement data from the international ARGO system. At each time step, derivativeswith respect to t of the basic mathematical model are substituted by difference approximations, and the assimilation process is implemented successively in all subintevals of t. In this case, the assimilation process at each time step becomes locally threedimensional, which makes it possible to substantially decrease the volume of assimilated information and, consequently, computational expenditures. On the other hand, in spite of such a simplification, the assimilation problem remains four-dimensional in the entire calculated interval.

It should be particularly noted that, in formulating problems of the variational assimilation of measurement data, we introduce only the quantities which can be uniquely defined with the use of the observational data under consideration as additional unknowns (controls).

In this work, the water areas of the Black Sea or the entire World Ocean are used as test regions for performing numerical experiments with the use of versions of the mathematical model of sea and ocean circulation developed at the Institute of Numerical Mathematics, Russian Academy of Sciences (INM RAS)

The work was supported by RFBR (grants No. 13-01-00753), and the program of the Presidium of the Russian Academy of Sciences no. 23.

A11009

NUMERICAL SOLVING OF VARIATIONAL DATA ASSIMILATION PROBLEMS IN THE BLACK SEA HYDROTHERMODYNAMICS MODEL USING REAL-TIME DATA

E.I. Parmuzin[1, a]

[1]*Institute of numerical mathematics RAS, Gubkin str., 8, 199333, Moscow, Russia.*

[a]*parm@inm.ras.ru*

Keywords: ***assimilation algorithms, variational data assimilation, sea surface temperature (SST), variational methods, heat flux***

The variational data assimilation problems of finding the flux on the ocean surface using real-time SST data were formulated and studied.

We assume, that the unique function which is obtained by observation data processing is the function T_{OBS} and we permit that the function is known only on a part of considering area (for example, on a part of the Black Sea).

Numerical experiments on restoring the ocean heat flux and obtaining solution of the system (temperature, salinity, velocity, and sea surface height) in the Black Sea primitive equation model with assimilation procedure and using real-time SST data were carried out. The spatial resolution of the model with respect to the horizontal variables amounted to 0.05*0.04 grad. The grid domain size was 286*159*27. The numerical experiments confirm the theoretical results and advisability of using the assimilation procedure in 3D Black Sea hydrothermodynamics model.

The work was supported by RFBR (grants No. 13-01-00753), and the program of the Presidium of the Russian Academy of Sciences no. 23.

A11008

SENSITIVITY OF THE OPTIMAL SOLUTION OF THE VARIATIONAL DATA ASSIMILATION PROBLEM FOR THE BLACK SEA DYNAMICS MODEL

V.I. Agoshkov[1, a], E.I. Parmuzin[1, b], V.P. Shutyaev[1, c]

[1]Institute of Numerical Mathematics, RAS, Gubkina str., 8, Moscow, 119333 Russia

[a]agoshkov@inm.ras.ru, [b]parm@inm.ras.ru, [c]shutyaev@inm.ras.ru

Keywords: ***Black Sea dynamics model, variational data assimilation, sensitivity of the optimal solution, Hessian***

Four-dimensional variational assimilation of observation data is the most versatile and promising solution technology for problems of monitoring and analysis of natural environment. Along with the development and justification of numerical solution algorithms for problems of variational data assimilation, the properties of the optimal solution are of great importance in this case. The sensitivity of solutions in variational assimilation problems to observation data errors remain poorly studied. Some results concerning the study of the sensitivity of solutions in variational data assimilation problems can be found in [2-3]. We consider the problem of variational assimilation of data related to sea surface temperature for the thermodynamic model in a formulation similar to that introduced in [1]. Here we obtain an equation relating the errors of the optimal solution of the variational data assimilation problem to the observation data errors with the help of the Hessian of the cost functional. We also present algorithms calculating the sensitivity coefficients as the norms of response operators arising in the equations for errors. Numerical experiments for the calculation of the spectrum of the Hessian and comparison of optimal solutions (surface fluxes) have been performed for perturbed and unperturbed variational assimilation problems applied to the Black Sea area.

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A12007

THE SYSTEM OF MONITORING OF THE REGIONS OF BLACK SEA OF ZUBOV'S STATE OCEANOGRAPHIC INSTITUTE

A. Grigoriev[1, a]

[1]Zubov's State Oceanographic Institute, Moscow, Russia, 6, Kropotkinskiy lane

[a]ag-privat@mail.ru

Keywords: coastal modelling, operative oceanography.

The results of using the system of monitoring of the regions of Black Sea of Zubov's State Oceanographic Institute are presented. Modelling of the Black Sea waters dynamics (Russian zone) was conducted within the framework of the European ECOOP project and Russian project JISWO on the basis of Princeton Ocean Model (POM). Nowcasting and three days forecasting of the Black Sea dynamics was carried out in a daily mode with horizontal resolution of ~1 km along the Russian coast of the basin and ~100 m near Big Sochi. Examples of calculations are presented and their comparison with space remote sensing and in situ (hydrological measurements) data is fulfilled, results of model validation are discussed. The conclusion that the proposed modeling technology can adequately monitor the variability of the waters of the region with the spatial and temporal resolution, unattainable using only field data, can prove important for operational oceanography.

A12003

EXPANSION OF THE REGIONAL FORECASTING SYSTEM OF THE STATE OF THE EASTERNMOST PART OF THE BLACK SEA WITH ECOLOGICAL PROBLEMS

Avtandil Kordzadze[1, a], Demuri Demetrashvili[1, b]

[1]M. Nodia Institute of Geophysics, I. Javakhishvili Tbilisi State University, M. Alexidze str.,1, 0171 Tbilisi, Georgia

[a]akordzadze@yahoo.com, [b]demetr_48@yahoo.com

Keywords: forecast, hydrodynamic module, regional model, circulation, boundary conditions

Contribution of the Black Sea to socio-economic state of the Black Sea riparian countries is very important. Besides the Black Sea is a source of biological and mineral resources it has great recreational and transportation value. Therefore, ecological safety of coastal/ shelf domains which undergo more anthropogenic loading, is very important for the Black Sea countries. In such situation there is necessity to have the reliable Black Sea forecasting system which will allow to receive operatively information not only about dynamical state of the Black Sea, also to provide forecast of polluting zones and pollution concentrations of oil and other polluting substances in accidental situations. Nowadays at M. Nodia Institute of Iv. Javakhishvili Tbilisi State University the regional forecasting system for the easternmost part of the Black Sea is functioning in the near-real time, which is one of the parts of the Black Sea Nowcasting/Forecasting system and provides 3-days' forecasts of current, temperature and salinity fields with 1 km space resolution. At present the expansion of the regional forecasting system is planned, which will be consist from hydrodynamic and ecological modules. The ecological module will be submitted as a set of the tasks describing distribution of different nonconservative impurity in the sea environment. The hydrodynamic module will provide the ecological module with information on 3-D current and turbulent fields. The tasks containing in the ecological module will be based on 2-D and 3-D advection-diffusion equations for nonconservative admixture.

A11010

A NEW INTERPOLATION METHOD OF BLACK SEA SST DATA

N.B. Zakharova[1, a], V.I. Agoshkov[1, b], E.I. Parmuzin[1, c]

[1]Institute of Numerical Mathematics, RAS, Gubkina str., 8, Moscow, 119333 Russia.

[a]zakharova_nb@mail.ru, [b]agoshkov@inm.ras.ru, [c]parm@inm.ras.ru

Keywords: ***Black Sea, SST data, observation data interpolation, sea surface temperature, circulation model, variational data assimilation.***

The study and solution of many problems of geophysical hydrodynamics involve experimental or observation data obtained from satellites, monitoring stations, buoys, ships, etc. In spite of a large amount of accumulated observation data, they remain insufficient. Besides, those data as a rule, are presented on sets of irregular points at asynchronous time moments. That is why data interpolation (or extrapolation) is very significant, because the quality of interpolation often determines the accuracy of solution of problems in meteorology, oceanology, geology. etc.

In this work we propose an interpolation method for construction of temperature fields on a regular grid based on SST observation data subject to their transportation by currents. Using this method, one can obtain 'pseudo-observations' at the required time moments and thus solve the problem of asynchronicity of geophysical information.

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A11012

LONG-TERM VARIABILITY OF THE BLACK SEA DYNAMICS DERIVED FROM MODELLING

V. Dorofeyev[1, a], G. Korotaev[1, b], L. Sukhikh[1, c]

[1]Marine Hydrophysical Institute, 2 Kapitanskaya str. 99011, Sevastopol, Ukraine

[a]dorofeyev_viktor@mail.ru, [b]gkorotaev@gmail.com, [c]l.sukhikh@gmail.com

Keywords: numerical modeling, Black Sea, circulation, ecosystem

Long-term evolution of the Black Sea dynamics (1980 – 2020) is reconstructed by means of numerical simulation. The model of the Black Sea circulation is z-coordinate model with 4.8 km horizontal space resolution and 40 levels in vertical direction. Mixing processes in the upper layer are parameterized with Mellor-Yamada turbulent model. The key parameter for modelling is atmospheric forcing. In this work we used atmospheric forcing functions for the Black Sea region provided by CMCC using regional climate model COSMO-CLM in the frame of PERSEUS project. These data have a spatial resolution of 14 km and a daily temporal resolution. To evaluate quality of the Black Sea circulation dynamics driven by CMCC atmospheric forcing the modelling results are compared with the set of 3D hydrographical fields prepared in MHI as a result of reanalysis of the Black Sea dynamics. This reanalysis was performed by assimilating the temperature and salinity profiles from hydrographic surveys conducted during 1971 – 1993 into the regional circulation model. The comparison was carried out for the time interval when these data are available (1980 – 1993). Results of the modelling on the circulation model are used then as input parameters in the lower trophic level model (LTLM) of the Black Sea ecosystem.

A12008

FUELING PLANKTON BLOOMS WITHIN COASTAL ANTICYCLONIC EDDIES OF THE BLACK SEA RIM CURRENT FRONTAL ZONE

T. Oguz

Small-scale (~10 km) physical phenomena such as eddies, fronts and filaments associated with physical dynamics including frontogenesis, turbulence mixing, baroclinic frontal instabilities, and eddy and Ekman pumping may fuel an efficient primary production in coastal frontal zones. As observed persistently throughout the year by the satellite ocean altimeter and ocean color data, the Black Sea Rim Current frontal zone appears to offer one of the best examples of these phenomena among the coastal and marginal seas. Using an eddy-resolving coupled physical-biological model simulations, this observed structure is best explained by the ageostrophic, cross-frontal processes of the Rim Current and associated vertical motions due to a confluent (diffluent) flow at the meander trough (crest) of the front that complement the quasi-geostrophic large scale flow structure. They result in enhanced primary production on the less dense (anticyclonic) side and subduction of water mass on the more dense (cyclonic) side. In the case of a weaker front, the frontal dynamics can no longer support this structure indicating that the models need to properly resolve the Rim Current frontal zone.

A12009

SEASONALITY IN UPWARD AND REGENERATION FLUXES OF INORGANIC NITROGEN AND PHOSPHORUS IN EUPHOTIC ZONE OF THE DEEP-WATER AREAS OF THE BLACK SEA

O. Kryvenko[1, a], A. Parkhomenko[1, b]

[1]A.O. Kovalevsky Institute of Biology of Southern Seas NASU, Nakhimov Ave. 2, Sevastopol 99011, Ukraine

[a]kryvenko@i.ua, [b]parkhomenko.al@yandex.ua

Keywords: ***Black Sea, nitrogen, phosphorus, nutrient fluxes, primary production***

Upward and regeneration fluxes of inorganic nitrogen and phosphorus in the euphotic zone of the Black Sea deep-waters were estimated using data from long-term observations of nitrate and phosphate vertical distribution and modeling of plankton nutrients excretion on average per month and on average for the deep-water area. The upward fluxes were calculated using average monthly nitrate and phosphate concentrations and their gradients beneath the euphotic layer, assuming that the vertical transport rates are controlled by the density gradient at the upper layer of the main pycnocline throughout the year. According to the calculations, the nutrient input into the euphotic layer due to physical processes changes gradually throughout the year from minimum values in July – August (0.1 – 0.3 mg-atN•m^{-2}•day^{-1} and 0.02 – 0.04 mg-atN•m^{-2}•day^{-1}) up to maximum in February – March (1.2 – 1.8 mg-atN•m^{-2}•day^{-1} and 0.2 – 0.3 mg-atP•m^{-2}•day^{-1}), contrary to the seasonal dynamics of the regeneration flux rates. In the summer, plankton regeneration rates increase nearly five-fold compared to the winter months. Total inorganic nitrogen and phosphorus supply increases slightly in the summer, but differences from the winter average monthly values (in 1.5 – 1.2 times for N and P respectively) are not statistically significant. The contribution of the upward flux to the total nutrient euphotic zone input was calculated and named as F_N-(F_P)-ratio along the lines with the f-ratio and p*e*-ratio that reflects the ratio of «new» production and particle export to primary production, respectively. The monthly means vary for F_N from 5% to 50%, and F_P – from 10% to 70%, throughout the year in the same manner as the upward flux. The differences between F_N and F_P values are explained by lower ratio between concentrations of nitrate and phosphate in the gradient layer in comparison to the Radfield ratio used to calculate the regeneration flux. Relationships between the monthly mean values of $F_{N,P}$ and SST, vertically integrated nitrate and phosphate concentrations, chlorophyll “a”, phytoplankton biomass and primary production in the euphotic zone were established. The obtained dependencies correspond to the general dependencies between primary production, “new” production and the sinking flux of particles known for the Ocean. Potential values of “new”, regenerated and total production of phytoplankton in the deep-water areas of the Black Sea are identified. Average monthly and annual primary production estimates, calculated based on the nutrient flows, are consistent with estimates of primary production according to the averaged data of *in situ* measures.

A11013

DEVELOPMENT OF SIO RAS HYDROPHYSICAL POLYGON IN THE SHELF-SLOPE ZONE OF THE NE BLACK SEA

A.G. Zatsepin[1, a], A.G. Ostrovskii[1], V.V. Kremenetskiy[1], V.B. Piotoukh[1], S.B. Kuklev[2, b], O.N. Kukleva[2], L.V. Moskalenko[3], O.I. Podymov[2], V.I. Baranov[3, c], A.A. Kondrashov[3], A.O. Korzh[3], A.A. Kubryakov[4], D.M. Soloviev[4], S.V. Stanichny[4, d]

[1]P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, 117997, Nakhimovsky, 36, Moscow, Russia
[2]Southern Branch of the P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, 353467, Prostornaya,1g, Gelendzhik-7, Russia
[3]Atlantic Branch of the P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, 236022, prospect Mira, 1, Kaliningrad, Russia
[4]Marine Hydrophysical Institute, National Academy of Sciences, 99011, Kapitanskaya, 2, Sevastopol, Ukraine.

[a]zatsepin@ocean.ru, [b]kuklev@ecologpro.ru, [c]baranovvlad@mail.ru, [d]sstanichny@mail.ru

Keywords: ***NE Black Sea, shelf-slope zone, hydrophysical polygon, autonomous stations, permanent monitoring***

Hydrophysical polygon based on anchored autonomous measuring platforms is developed by SIO RAS for permanent monitoring of the aquatic environment at the shelf and continental slope zone in the north-eastern Black Sea. The polygon occupies an area of 10*10 km^2 near Gelendzhik, where the Southern Branch of SIO RAS is situated and used as a monitoring center. Three types of autonomous platforms are exploited: 1) acoustic Doppler velocity profiler (ADCP) at the bottom station, 2) thermo-chain at the mooring line, 3) robotic profiler “Akvalog” at the moored buoy station. By these platforms the long rows of hydrophysical and bio-optical data (vertical profiles of temperature, salinity, density, current velocity, acoustic backscatter, water transparency, chlorophyll ”a” fluorescence, etc.) of high spatial and temporal resolution are obtained. In the nearest future the data from the autonomous platforms will be transferred via a telecommunication system to the coastal center for real-time operability. The data is available for studies of the variability in the marine environment and biota, exchange processes in the “shelf-deep basin” system, ocean-atmosphere interactions, climate change, etc. It is needed for validation of satellite measurements, verification of the results of sea ecosystem numerical modeling. In the presentation of the report some results of the field observations fulfilled at the SIO RAS Black Sea hydrophysical polygon in 2012 would be described and analyzed.

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A11007

APPLICATION OF THE MOORED PROFILER AQUALOG FOR MEASUREMENT OF THE ACOUSTICAL BACKSCATTER BY THE MESOZOOPLANKTON IN THE NE BLACK SEA

E. Arashkevich[1, a], A. Ostrovskii[1, b], A. Timonin[3, c]

[1]Institute of Oceanology RAS, 36 Nakhimovkiy pr., 117997 Moscow, Russia

[a]aelena@ocean.ru, [b]osasha@ocean.ru, [c]timoninalex42@gmail.com

Keywords: acoustic backscatter, zooplankton, Black Sea

This report presents new data on zooplankton distribution obtained by a new ocean autonomous profiler for multi-parametric surveys along with data on net sampling at fixed geographical locations. The moored automatic mobile profiler Aqualog equipped with the acoustic Doppler current meter Nortek Aquadopp (2 MHz) was deployed at the upper part of the continental slope at the depth of 265 – 270 m (44°29.44'N, 37°58.38'E) in July 2007, June 2011 and September 2012. The current meter had a side-looking sensor head transmitting and receiving sound along three narrow acoustic beams. Transducers are mounted on one side to assure that the beams are pointing into the undisturbed flow away from the hydrodynamic boundary layer around the profiler. The profiler also carried the CTD probe Idronaut Ocean Seven 316plus with the dissolved oxygen and oxidation-reduction potential sensors. The profiler made repeated round trips between the near-surface ocean layer and the anoxic zone every 1 h. We got the time series of the vertical profiles of the ocean parameters including the amplitude of the acoustic backscatter. Zooplankton was sampled nearby the moored profiler to study the taxonomic and quantitative patterns of zooplankton vertical distribution. Stratified Juday net hauls targeted aggregation layers manifested themselves in the in-situ backscattering data. Time of sampling corresponded with the day and night time aggregations of migrating zooplankters in the deeper and upper layers, respectively, as well as with upward and downward migration. General pattern of fine scale stratification of water column revealed from the backscatter data corresponded to the zooplankton vertical distribution obtained by means of net sampling. Both migration amplitude and aggregation depth depended on the position of thermocline and the depth of the suboxic layer. It was also modified by zooplankton response to variations in oxygen concentration at the different stages of their life span. By using the profiler, new data on the layered organization of the marine environment in the waters were obtained. The temporal variability of the fine-scale structure of the acoustic backscatter at 2 MHz was interpreted along with physical and chemical data. The patchy patterns of the acoustic backscatter were associated with physical and biological processes such as the advection, propagation of sub-mesoscale eddy, and diel vertical migration of zooplankton.

A13003

TECHNOLOGY FOR MARINE ENVIRONMENT DYNAMICS CONTROL IN THE COASTAL AREA

A.S. Kuznetsov[1, a]

[1]*Marine Hydrophysical Institute of NAS of Ukraine, 2, Kapitanskaya St., Sevastopol, 99011, Ukraine*

[a]*vaivanov@inbox.ru*

Keywords: marine environment, water dynamics, energy flows, sea monitoring, hydrodynamic processes, operative oceanography

Water dynamics vary on the high sea and in the coastal area. Regional peculiarities of geomorphology of the coastal area form the patterns and directions of continental and sea energy flows and coastal ecotone substances.

Accurate assessment of energy and substance flows in the marine environment requires long sets of representative characteristics of the current velocities. In the coastal area, large-scale currents degradation causes a specific set of intensive medium – and small-scale water motions. Under such conditions, dynamic errors in most types of sensors used in the marine environment occur much more frequently. Moreover, near the coast, the opportunities and resolution of traditional aerospace methods and means of water dynamics research are also limited.

Information technology for monitoring the dynamics of coastal waters was created in MHI NAS of Ukraine as a set of prospective measuring tools, techniques of organization of field experiments and complex information processing. In the base of the experiment lie meters which integrate in the given space-time limits. Comprehensive analysis of a set of meteorological and oceanographic data allows to research energy, evolutionary direction and causal connections within the global and local hydrodynamic processes and phenomena in the region.

We have considered the current state of the distributed technical network of marine observing system on the stationary range for interdisciplinary studies of MHI NAS of Ukraine near cape Kikineiz and the main practical results of multi-year field studies.

We have assessed the prospects of development of scientific and technical base of operative oceanography in the recreation zone and main sea transport corridor of the Black Sea at the Southern Coast of the Crimea for the needs of the regional system of geoecological monitoring.

MARINE BIODIVERSITY AND CHALLENGES FOR GOOD ENVIRONEMNTAL STATUS ASSESSMENT

C31003

OPTIONS FOR DELIVERING ECOSYSTEM-BASED MARINE MANAGEMENT (ODEMM PROJECT): CURRENT STATE AND RISK TO ACHIEVING GES IN THE BLACK SEA

T. Churilova[1, a], S. Moncheva[2, b], T. Oguz[3, c], O. Kryvenko[1, d], Z. Finenko[1, e], K. Stefanova[2, f], E. Akoglu[3, g], F. Timofte[4, h], L. Boicenko[4, i]

[1]Institute of Biology of the Southern Seas of National Academy of Sciences of Ukraine, 2 Nakhimov Ave., Sevastopol, 99011 Ukraine;
[2]Institute of Oceanology Bulgarian Academy of Sciences, Parvi Maj Str. 40, Varna, 9000, Bulgaria;
[3]Middle East Technical University, Inonu Blvd, Campus Ankara, 06531, Turkey;
[4]National Institute for Marine Research and Development, Mamaia Blvd., 300, Constanta, 900581, Romania;

[a]tanya.churilova@gmail.com, [b]snejanam@abv.bg, [c]oguz@ims.metu.edu.tr, [d]kryvenko@i.ua, [e]zosim_finenko@mail.ru, [f]stefanova@io-bas.bg, [g]ekinakoglu@gmail.com, [h]florintimofte@yahoo.com, [i]laura_boicenco@yahoo.com

Keywords: ***ecosystem-based management, GES, ODEMM project, Black Sea***

The Marine Strategy Framework Directive (MSFD) is aimed to promote clean, healthy, biologically diverse and sustainable seas. European Marine policy currently focuses on achieving Good Environmental Status (GES) by 2020. Sustainable exploitation of the European seas requires developing of ecosystem-based management taking into account current state of the regional seas and effect of human activities on their ecosystem.

The current state of the Black Sea has been assessed based on available information of status and trends of the main abiotic and biotic components (from plankton to mammals and birds) of the ecosystem, evaluation of the spatial and temporal extent of pressure associated with a specific human activity and the generic sensitivity of sector/pressure interaction with an ecological characteristic. Pressure assessment approach developed by the ODEMM project was employed to define high threat pressure-impact combinations that arise from four sectors, namely agriculture, coastal infrastructure, fishing and shipping as key deteriorating human activities at basin scale and the corresponding most vulnerable ecosystem characteristics.

Risk assessment approach developed by the ODEMM project was used to determine the likelihood of failure to achieve GES under present conditions. Out of the 11 GES descriptors, 5 were classified as currently being at high risk of failure: Introduction of non-indigenous species, Commercial fish and shellfish, Foodwebs, Seafloor integrity and Marine litter. For realization of high level objectives the operational objectives related to Eutrophication and Fisheries were shown to be extremely compelling and crucial for sustaining the quality of the Black Sea food-web.

To achieve GES in the Black Sea it is necessary to integrate social and economic growth with the natural environment protection on the basis of integrated ecosystem management, which requires improved political and social institutions coordination via new-developed cross-border platforms.

B21019

INTEGRATED PHYTOPLANKTON INDEX (IBI-PH) – A DESIGN FOR ECOLOGICAL/ENVIRONMENT QUALITY ASSESSMENT

Snejana Moncheva[1, a]

[1]*Institute of Oceanology-BAS, Parvi Mai str. 40, P.O. Box 152, 9000 Varna, Bulgaria*

[a]*snejanam@abv.bg*

Keywords: phytoplankton, indicators, MSFD, Black Sea, ecological quality

Phytoplankton growth and productivity is a function of a multiple suit of biotic and abiotic interactions that precondition its integrated growth environment. As a fast response component of the marine biota it is a valuable indicator of the ecological/environmental status (Biological quality element *sensu* WFD). Among the main challenges in the implementation of WFD and MSFD is the growing demand for robust and reliable methodological approaches to take into account the complexity of multifactor drivers/pressures interactions and phytoplankton responses that are likely non-linear, species and region specific and time dependant.

The study presents a composite Integrated Phytoplankton Index (IBI-PH) designed to integrate several phytoplankton community traits conceived to capture different aspects of phytoplankton reaction to the marine environment conditions: quantitative indicators (abundance, biomass and chlorophyll a), two nonparametric indices – Biodiversity Index Menhinick (1964) and Evenness Index Sheldon (1969) developed originally as a phytoplankton metric for the Mediterranean Sea and taxonomic based indicators – 1) C strategy species (after Smayda & Reynolds, 2003), as a proportion of the total abundance of Dinoflagellates – (DE %) *Heterocapsa rotundata, Heterocapsa triquetra, Scrippsiella trochoidea, Prorocentrum minimum, Prorocentrum micans and Gymnodinium/ Gyrodinium* and 2) the sum of the abundance [cells/l] of species of 3 taxonomic groups (microflagellates + Euglenophyceae + Cyanophyceae) as a % from the total abundance of the phytoplankton community.

The IBI-PH was calculated as an average score of the EQR value calculated for each sample and for each single metric to yield a final integrated score (EQR-IBI) based on which the ecological category is assigned (the combination rule). The EQRs for the IBI-PH are calculated as simple arithmetic average of the EQRs for each quality class, since these ratios are standardized in the 0-1 range. The performance of the index is tested on a 10 years long-term data set for several stations from the National Monitoring program along pressure gradient, presented as a total pressure score. The results demonstrate the ability of the index to discriminate best between different levels of disturbance as compared to the single metrics. The pros and cons of the application of the index are also discussed.

B21007

THE ROLE OF MARINE SCIENCE IN IMPLEMENTING MARINE STRATEGY FRAMEWORK DIRECTIVE (MSFD)

Evangelos Papathanassiou[1, a], Nikos Streftaris[1, b], Nikoleta Bellou[1, c]

[1]Hellenic Centre for Marine Research, 46.7Km Athens-Sounion Av. Anavissos 19013, Greece

[a]vpapath@hcmr.gr, [b]nstrefta@hcmr.gr, [c]bellou@hcmr.gr

Keywords: science-policy connections, MSFD, PERSEUS

The pressures in the marine environment especially in enclosed seas, like the Mediterranean and the Black Sea can have different origin but they are referred as natural (e.g. from climatic variability) and as anthropogenic (e.g. fast population growth in coastal areas, pollution, overfishing, etc). Management of pressures needs to be dealt mainly through shared policy and decision-making based on scientific knowledge.

At a European Level a new approach in EU legislation started in 1994, with a Proposal for a Directive of the EU Commission (OJ 94/c222/06), in which the term "ecological quality" of surface waters is defined for the first time as a value, which is autonomous and independent of any use, economic exploitation and aesthetic approach. The concept of the ecological quality was commonly developed by scientists and policy makers and integrated in the Water Framework Directive (WFD), adopted on 2000. Following the implementation of WFD, the "Marine Strategy Framework Directive" (MSFD) was adopted in 2008 having as targets for a "Good Environmental Status" (GES) of marine water bodies by 2020.

To achieve its objectives, the role of major EU projects is essential as they can provide the scientific support needed particularly at regional level as it required in MSFD.

PERSEUS (**P**olicy-oriented marine **E**nvironmental **R**esearch in **S**outhern **EU**ropean **S**eas) Project is an FP7 EU project trying to assess and predict the combined effects of human and natural pressures on the Mediterranean and Black Seas, assess their impact and, using the objectives and principles of the Marine Strategy Framework Directive (MSFD), designs an effective and innovative research governance framework. All the new scientific knowledge and tools which will be developed under PERSEUS is blended with socio-economic analysis to produce concrete recommendations and tools for policy-makers to introduce science-based policy-making, in view of achieving GES, thereby taking a step towards the sustainable development of the Mediterranean and Black Sea regions.

Scientific research is carried out from basin to coastal scale, while the surfacing of new knowledge advances our current understanding on the selection and application of the appropriate indicators of the MSFD. Similarly, new tools help to evaluate the current environmental status and a scenario-based framework of adaptive policies and management schemes are being developed in order to support an ecosystem-based approach to management.

The emerging new knowledge and tools will help the scientific community to create more accurate and dynamic forecasting of possible risk scenarios. Using this input, combined with socio-economic analysis, the scientific community can provide science-based advice to policy and decision-makers, with a view to achieving good environmental status in the SES.

Within the Project, Stakeholder platforms have been developed, with relevant experts and decision-makers, involved from the onset in the construction process. This component of the project synthesises the results for communication and integration among the main actors and infrastructures that promote Sustainable Development of the SES.

PERSEUS will ensure that several steps are taken to propose management strategies at basin scale and create an impact on policy-makers, from national to International levels, while the project will also propose multiscale management schemes and adaptive policies involving, in an interacting way, stakeholders/decision makers and scientists from EU and non-EU countries throughout the process.

B21018

MAJOR PRESSURES AND THEIR IMPACTS IN THE EASTERN MEDITERRANEAN SEA – ANALYSIS PERFORMED IN THE FRAMEWORK OF PERSEUS EU PROJECT

H. Kaberi[1, a], N. Streftaris[1, b], A. Karageorgis[1, c], E. Christou[1, d], D. Angel[2, e], C. Gucu[3, f], D. Sauzade[4, g], M. Skourtos[5, h]

[1]Hellenic Centre for Marine Research, 46.7km Athinon-Souniou Ave., 19013, Anavyssos, Greece
[2]University of Haifa, Mount Carmel, Abba Khoushi Blvd 31905, Haifa, Israel
[3]Institute of Marine Sciences, Middle East Technical University, P.O. Box 28, 33731, Erdemli, Icel, Turkey
[4]Plan Bleu pour l'Environnement et le Developpement en Mediterranee, 15, rue Beethoven, Valbonne, 06560, France
[5]University of the Aegean, Lofos Panepistimiou, 81100, Mytilini, Greece

[a]ekaberi@hcmr.gr, [b]nstrefta@hcmr.gr, [c]ak@hcmr.gr, [d]edc@hcmr.gr, [e]adror@research.haifa.ac.il, [f]gucu@ims.metu.edu.tr, [g]dsauzade@planbleu.org, [h]mskour@aegean.gr

Keywords: ***environmental pressures, Eastern Mediterranean, Marine Strategy Framework Directive***

A thorough analysis of environmental processes and pressures exerted on selected coastal ecosystems and the open sea was performed in the framework of PERSEUS project. The analysis was focused first on the identification of main anthropogenic activities in the study areas, the deriving pressures and their impacts on the marine environment and the issues jeopardizing the achievement of the Good Environmental Status (GES). At a second level the lack of data and the gaps in knowledge referring to the above issues were identified. The environmental issues were screened with respect to the descriptors used by the Marine Strategy Framework Directive (MSFD) for the definition of the GES. The results of these analyses were presented and discussed in detail during the Umbrella Workshop held in Barcelona at the end of the first year of PERSEUS project.

This presentation will deal with the analysis performed for the Eastern Mediterranean basin by natural and social scientists from Greece, Cyprus, Israel and Turkey.

B22011

MSFD DESCRIPTOR 2 – "NON-INDIGENOUS SPECIES (NIS) INTRODUCED BY HUMAN ACTIVITIES" – GAP ANALYSIS

Marian-Traian Gomoiu[1, a], Gheorghe Oaie[1], Daniela Vasile[1], Daniel Gonzalez-Fernandez[2], Georg Hanke[2], Nikolaos Zampoukas[2], Sophie Laroche[3], Bruno Andral[3], Maria Pantazi[4], Vassiliki Vassilopoulou[4]

[1]GeoEcoMar, Romania
[2]EC JRC IES, Italy
[3]IFREMER, France
[4]HCMR, Greece

[a]mtgomoiu@gmail.com

Keywords: GES, MSFD Descriptor 2, methodological gaps, perspectives in NIS analysis

Based on the Marine Strategy Framework Directive (MSFD, 2008/56/EC) EU FP7 Project Perseus offers large and complex opportunities to evaluate the impact of natural and human-derived pressures on marine ecosystems in Southern European Seas (SES) having in view solutions, methods and tools for a better scientific management proper to the knowledge society, to the sustainable development and to the new condition of the global changes in the world system of systems. EU FP7 Project PERSEUS analysed, among the 11 MSFD Descriptors (Commission Decision 2010/477/EU), Descriptor 2 referring to non-indigenous species (NIS) on which the authors have focused their attention. Their paper is based on the review and analysis of methodological elements provided by five EU countries (Spain, France, Greece, Cyprus and Romania) in their draft MSFD Initial Assessments. It aims to contribute to EU requirements linked to the limited knowledge about the effects of non-indigenous species on the environment. The general conclusion of the overall assessment is the lack of information concerning D2. NIS problems are emerging at global scale and difficult to solve since they depend on the chance of recording the newcomers in particular geographic areas in due time. The problems must be integrated in the general study of biodiversity far from some scientists' fake problem of "hunting after NIS". Likewise, it is necessary that NIS multiple potential impacts on the systems be under permanent monitoring. Spatial and temporal distribution control - monitoring should be a powerful and flexible system control of biodiversity, capable to interfere and record the newcomer in an area; and when an alien species is found, its presence requires an early warning of the scientific community on a large scale. NIS challenge remains an open subject and its management requires specific tools and methods, the identification of the sources of pressures and impacts, including their cumulative and synergetic effects upon the good environmental status; obtaining data on NIS is one of the important conditions to support the ecosystem-based management of human activities linked to the sea. By developing the methodologies and new approaches to improve the assessment of GES we consider to be both in the letter and spirit of the EC documents. Identifying and assessing pathways and vectors of NIS spreading and applying an action program should be permanent tasks for scientific community and stakeholders of marine environment.

B21001

LONG TERM EVOLUTION OF THE BLACK SEA'S ENVIRONMENTAL CONDITIONS AND POSSIBLE LINK TO THE ASSESSMENT OF THE GOOD ENVIRONMENTAL STATUS

M. Gregoire[1, a], A. Capet[1, b]

[1]Laboratory of Oceanology, Liege University,B6c Sart-tilman, 4000 Liege, Belgium

[a]mgregoire@ulg.ac.be, [b]arthurcapet@gmail.com

Keywords: hypoxia, biogeochemical cycling, atmospheric-land-ocean-sediment interactions, Black sea

Due to its nearly landlocked character and the presence of a permanent halocline at ~100 – 150 m, the Black sea is a region particularly sensitive to perturbations of its environment. During the last decades, the Black Sea's has suffered from several human perturbations of its environment such as eutrophication, overfishing, introduction of invasive species. The potential effects of long-term natural variability and climate change further aggravate current environmental problems by adding another dimension to the complexity and uncertainty about the causes, rate, and timing of various types of variability. Mathematical models are potential tools to integrate these different drivers of variability in a single framework.

In the frame of the EU Sesame project, the long term variability of the Black Sea's physical and biogeochemical properties has been studies using a three-dimensional coupled hydrodynamical-biogeochemical model and has been connected with the variability of atmospheric (including large scale atmospheric pattern) and river discharges conditions. More specifically, we attempt to connect the long term variability of the physical environment with that of the ecosystem and in particular, with the drastic environmental changes that occurred at the end of the 80s. During the period 1962-2000, an increase of the duration of persistent atmospheric anomalies regime may have the potential to drive the system away from its average state as exemplified by the pronounced enhancement of the main current at the end of the 80's as a consequence of a persistent cyclonic wind anomaly affecting the Black Sea over 5 years. We propose that the variability of productivity of the deep basin is influenced by the presence of periods of intensification (weakening) of the main circulation and the resulting formation of the Cold Intermediate Layer which constitutes an important vector of transport of NWS materials towards the deep basin. The different regimes of the Rim current may have had an important impact on the possibilities of fish larvae retentions and hence, may have played in the collapse of small pelagic fishes in favor to the invasive *Mnemiopsis leydii*.

In relation to GES preservation, in the frame of the EU PERSEUS Project model simulations over the last 3 decades show evidences that hypoxia is still occurring seasonally on a non-negligible area of the bottom waters of the Black Sea NWS. This important finding (corroborated by the monitoring of local institutes) is in contradiction with the general idea that bottom hypoxia vanished with the reduction after 1992 of riverborne nutrient discharge. We found that the overestimation of recovering was due to the use of observations concentrated in areas and months not typically affected by hypoxia. Drivers of hypoxia (climate versus eutrophication) and mechanisms of occurrence are determined using mechanistic and statistical modeling. An index H which merges the aspects of the spatial and temporal extension of the hypoxic event

is proposed to quantify, for each year, the intensity of hypoxia as an environmental stressor. The potential increased of water stratification in a global change context may promote the occurrence of seasonal hypoxia which could be catastrophic for benthic ecosystem and compromise the GES of NWS waters. The possible increase in the instability of the physical environment in answer to an increase of the duration of persistent atmospheric anomalies regime may also affect the ecosystems by making them more sensitive to human perturbations in the future. This underlines the utmost importance of preserving and promoting the ecosystem resilience (Costanza and Mageau, 1999) by a sound management, as it was already shown to be significantly affected in the Black Sea by human activity (Llope et al., 2011).

B22003

DIVERSITY OF MACROZOOBENTHIC COMMUNITIES FROM ZOSTERA SPP. MEADOWS IN SOZOPOL BAY, BULGARIA (SOUTH-WESTERN BLACK SEA)

Stefania Klayn[1, a], Ventzislav Karamfilov[1, b]

[1]Institute of Biodiversity and Ecosystem Research (IBER-BAS), 2 Yurii Gagarin Street, 1113 Sofia, Bulgaria

[a]stefaniaklayn@yahoo.com, [b]karamfilov.v@gmail.com

Keywords: ***macrozoobenthos, Zostera spp. meadows, community structure, diversity, Bulgarian Black Sea***

Seagrass meadows are an important feature of coastal marine habitats, regarded as highly productive and supporting diverse communities of associated flora and fauna.

This study aims to examine the current state of macroinvertebrate biodiversity in Zostera spp. habitats from the Southern Bulgarian Black Sea. The macrozoobenthic communities from three Zostera spp. meadows in Sozopol Bay (large Burgas Bay) were sampled in July 2012. A total of 24 samples were collected and 4071 individuals identified, representing 51 taxa belonging to five faunal groups: Mollusca, Crustacea, Polychaeta, Oligochaeta and Nemertea. High values of abundance and biomass were recorded mainly due to the presence of large numbers of mollusc species. Molluscs were the most abundant group (66.3% of the total number of individuals), followed by polychaetes (15.6%), oligochaetes (14.8%), crustaceans (3%) and nemerteans (0.3%). Molluscs had the highest number of taxa (19), followed by polychaetes (18) and crustaceans (12). Shannon-Wiener diversity (H') varied between 0.712 and 1.984, and Evenness (J') – between 0.319 and 0.913. These results show that seagrass systems in Sozopol Bay support diverse macroinvertebrate communities. Their proper conservation is important for maintaining the biodiversity and ecosystem services in the coastal zone.

B21004

DEVELOPING METHODOLOGICAL STANDARDS FOR FAVORABLE CONSERVATION STATUS AND GOOD ENVIRONMENTAL STATUS ASSESSMENT OF MYTILUS GALLOPROVINCIALIS BEDS FOR THE HABITATS DIRECTIVE AND THE MARINE STRATEGY FRAMEWORK DIRECTIVE IMPLEMENTATION IN THE BULGARIAN BLACK SEA

Valentina Todorova[1, a], Lyubomir Dimitrov[1, b], Valentina Doncheva[1, c]

[1]Institute of Oceanology, 40 "Parvi May" Str., P.O.Box 152, 9000 Varna, Bulgaria

[a]vtodorova@io-bas.bg, [b]geos@io-bas.bg, [c]doncheva@io-bas.bg

Keywords: Mytilus galloprovincialis biogenic reefs, methodological standards for assessment, Habitats Directive, Marine Strategy Framework Directive

Mytilus galloprovincialis beds on shelf sediments in the Black Sea are qualified as a subtype of the Habitats Directive (HD) Annex I habitat type 1170 "Reefs", as well as a subtype of the predominant seabed habitat "Shelf sublittoral rock and biogenic reefs" sensu the Marine Strategy Framework Directive (MSFD).

The present study aims at developing and approbation of methodological standards for the evaluation of mussel beds conservation and environmental status in the Bulgarian Black Sea.

For the first time multi-beam hydroacoustic mapping of the seabed was used as an appropriate methodology for assessing the distributional pattern of mussel beds in the Bulgarian Black Sea. The acoustic images were validated by means of beam trawling for catching mussels. Relevant indicators of the distributional pattern (MSFD Descriptor 1, Criteria 1.1.2 and 1.4.2) and the population size (MSFD Descriptor 1, Criterion 1.2.1) were tested. The coverage of mussel beds was assessed against the CPUA of Mytilus galloprovincialis. Population condition (MSFD Descriptor 1, Criterion 1.3.1) of mussel population was assessed using body size class structure.

Based on the results new SCIs were proposed for inclusion in the European ecological network NATURA 2000.

Environmental targets and associated indicators were established and reported to the European Commission to guide the process towards achieving or maintaining good environmental status in the marine environment by the year 2020 at the latest.

B21017

ESTABLISHING BOUNDARY CLASSES FOR THE QUALITY CLASSIFICATION OF SOUTH-EASTERN BLACK SEA USING PHYTOPLANKTON BIOMASS

D. Ediger[1], M. Feyzioglu[2], F. Sahin[3], C. Beken[1]

[1]TÜBİTAK MRC Environment and Cleaner Production Institute Gebze Kocaeli TURKEY
[2]KTU, Faculty of Marine Sciences, Camburnu, Trabzon,TURKEY
[3]Sinop University, Faculty of Fisheries, TURKEY

Keywords: ***Chlorophyll-a, Boundary conditions, Classification, Water Framework Directive, Black Sea***

Benthic macroinvertebrates, macroalgae and phytoplankton constitute the Biological Quality Elements (BQE) proposed in the Water Framework Directive (WFD, 2000/60/EC) to be used for the classification of the ecological status of a water body. Chlorophyll-a is a usefull expression of phytoplankton biomass and this indicator is an effective and relevant BQE for coastal ecosystems which is universally accepted. In the present work, interpretations of the class boundaries according to normative definitions of WFD, are presented for chlorophyll-a in South Eastern (SE) Black Sea as a part of the Project named, "Classification and Identification of Quality Status of Marine and Coastal Waters" supported by the Ministry of Environment and Urbanization. Water quality classification was determined in five different categories as "high, good, moderate, poor and bad".

The coastal waters of SE Black Sea were classified in 8 different typologies (K1 – K8) based on depth, salinity and substratum types. In this study, types K1 and K2 (> 17.5 salinity, > 30 m depth) were considered because of availability of time-series data for those typologies. Sinop and Sürmene sites were selected due to the best (the only) available long-term data set, over the period 2002 – 2012 and 2001 – 2011 for chlorophyll-a respectively.

Type specific chlorophyll-a reference and threshold values were determined based on the 10 (high), 25, 50, 75 and 90 percentile (bad) of the long-term data set. Due to the high seasonal variability of phytoplankton communities composition and abundance, the annual values were not considered adequate and the classification tool was developed on seasonal basis. The H/G boundaries obtained from the long term data sets for both sites did not show significant difference (0.23 µg/L) whereas the G/M boundaries for Sinop and Sürmene were found 0.49 and 0.39 µg/L respectively. All the boundaries were higher at the Sinop site. Ecological quality ratios distributed between 0-1. It would be necessary to underline the fact that these class boundaries might be higher for waters where depths are below 30 m and salinity values are less than 17.5. However, there is not enough data to support this assumption for the near coast waters of the SE Black Sea.

Eventhough chlorophyll-a scaling can not be used as a single tool for the ecological quality classification it is a reliable approach to use the obtained boundaries at temporal and spatial scales for the quality classification of SE Black Sea waters above 30 m depth.

A14001

ECOLOGICAL RISK ASSESSMENT OF NUTRIENTS DISCHARGES FROM DANUBE RIVER TO BLACK SEA

Iustina Popescu[1, a], Gyorgy Deak[1], Gabriela Dorobantu[1], Georgiana Tanase[1]

[1]INCDPM – National Institute for Research and Development in Environmental Protection, 294 Splaiul Independentei, 060031, Bucharest, Romania

[a]iustina.popescu@incdpm.ro

Keywords: ecological risk assessment, ammonia, nitrites, nitrates, Danube River, Black Sea

Anthropic activities have affected the north-western part of Black Sea ecosystem mainly through large concentrations of nutrients discharged by the Danube River. Scientific community widely recognizes that nitrogen species contributes significantly to ecosystem disturbance from soil chemistry disequilibrium, soil fertility lose, intensive water plankton grow, water acidification and eutrophication and important impact on fish species. The main aim of this study was to assess whether or not nitrogen levels from Danube River pose a potential eutrophication risk to ecological receptors. In this regard, ammonia, nitrites and nitrates concentration were monitored on a sector of Danube River located between km 375 and km 175 during summer months. Results are showing that nitrites concentration exceeds the threshold for quality class I and II, according to Romanian legislation, concentration which leads to ecosystem disturbance.

B22005

BACTERIAL DIVERSITY IN ZOSTERA SP. BEDS ANALYZED BY MOLECULAR FINGERPRINT METHOD ARDRA

Nadezhda H. Todorova[1, a], Ventzislav K. Karamfilov[1, b]

[1]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Yurii Gagarin 2 str., 1113 Sofia, Bulgaria

[a]nadeshda@abv.bg, [b]karamfilov.v@gmail.com

Keywords: ***microbial ecology, Bacterial sediment communities, Zostera sp. beds, 16S rRNA gene, ARDRA***

Sea grasses are characteristic features of shallow coastal ecosystems and genera *Zostera* are growing on silty and sandy sediments of Black Sea. While they have a large biomass of leaves, their roots are deep penetrating the substrate and are important for obtaining nutrients from sediments. The plants, by root excretion of organic compounds and oxygen, may have considerable impact on the activity and structure of the microbial communities in the sediment. Bacterial diversity is high in sediments colonized by *Zostera* and data indicate a close interaction between the plants and the natural microbial communities.

The present study aims to compare natural bacterial diversity in *Zostera* sp. beds and in bare sediments. Structure and diversity of sediment microbial communities are studied taking also into account the impact of a point source of unpurified municipal wastewaters near the town of Sozopol. Molecular techniques are used as marine sediments are dominated by not culturable bacteria with the highest phylogenetic diversity among natural habitats. ARDRA (Amplified Ribosomal DNA Restriction enzyme Analysis) fingerprint method is chosen for assessment of dominant members of bacterial communities in root zone sediment of pristine *Zostera* meadows as well as in affected ones, as it allows the simultaneous analysis of multiple samples, which makes it possible to compare the genetic diversity of microbial communities. Significant bacterial diversity was detected in *Zostera* sp. beds, as well as in bare sediments. ARDRA comparison showed similar community profiles, thus demonstrating no difference in dominant bacterial members related to vegetation. Although highly diverse, sediment community showed also stable interannual tendency. This suggested no significant effect of anthropogenic impact on the main characteristics of bacterial community in Zostera vegetated sediments.

B22008

POLYMORPHISM OF LOCUS MDH, LDH, ADH IN ROUND GOBY NEOGOBIUS MELANOSTOMUS (PALLAS) FROM THE ODESSA GULF AND WATERS OF ZMIINYI ISLAND

K.V. Kulikova[1, a], V.V. Zamorov[1, b], D.B. Radionov[1, c]

[1]Odessa I. I. Mechnikov National University, 65026, Odessa, Dvoryanskaya str., 2

[a]ok.druzenko@gmail.com, [b]hydrobiologia@mail.ru, [c]pankovae@yandex.ru

Keywords: populations, allele and phenotype frequencies, Neogobius melanostomus

The study of genetic variability in the populations gives us an opportunity to assess their adaptive capacity and the degree of divergence from other groups of organisms of the same species. Round goby plays an important role in benthic biological communities of the Black Sea. Also it is the substantial object of commercial fishing in this region. Despite that, the population's genetic structure of this species of fish is not fully described. Therefore, the purpose of our studies was to evaluate the genetic structure of natural populations inhabiting the Black Sea of Round goby bymeans of electrophoresis analysis of biochemical markers.

As the material for research it was used the gobies sampled in 2012 in the Odessa Gulf and near Zmiinyi Island. On the basis of electrophoregrams analysis of muscle tissue extracts the presence of two major molecular types of the enzyme MDH (EC: 1.1.1.37) were revealed: cytoplasmic and mitochondrial forms. We have identified two phenotypes represented respectively by 5 and 3 electromorphs of soluble MDH. The frequency of the first phenotype between fish lived near Zmiinyi Island was 92 %. At the same time, this index for the fish from the Odessa Gulf was 44 %. This fact suggests that the investigated groups of fish can be determined as different populations.

Besides, we studied the frequency of S-alleles at locus Adh (EC: 1.1.1.1) and Ldh (EC 1.1.1.27) in the population of round goby from the Odessa Gulf. Adh–S gene variant occurred with a frequency 0.33. The frequency of allele Ldh-S in the test group of fish was 0.67. Our results indicate the presence of polymorphisms in investigated loci. This allows us to use these biochemical markers for investigation of the genetic diversity of different Round goby populations.

IMPROVING GOVERNANCE, MANAGEMENT AND BUILDING CAPACITIES

C36010

OFF-SHORE POLLUTION MONITORING AND ASSESSMENT OF MID-BLACK SEA REGION OF TURKEY

Gulfem Bakan[1, a], Hanife Buyukgungor[1, b], Feryal Akbal[1, c]

[1]Ondokuz Mayıs University, Engineering Faculty, Environmental Engineering Dept., 55139 Samsun/ TURKEY

[a]gbakan@omu.edu.tr, [b]hbuyukg@omu.edu.tr, [c]fakbal@omu.edu.tr

Keywords: ***Black Sea coast of Turkey, off-shore pollution, heavy metal pollution, monitoring and assessment of pollution***

At the end of the last century, as a result of an integrated impact of natural and anthropogenic factors, the environmental system of the Black Sea was damaged seriously and by the estimates of many specialists the Black Sea is now one of the world's most polluted water bodies. The Black Sea countries have embarked on several initiatives at national and regional levels to address the environmental problems in this large marine ecosystem.

The results of environmental monitoring revealed considerable pollution of sea waters and bottom sediments with total phosphorus and nitrogen (Danube seaside), detergents and phenols (southern coast of Crimea), phenols and pesticides (Odessa coast), oil products (nearby Sevastopol and Georgian coast), toxic and heavy metals, polyaromatic hydrocarbons and radionuclides causing degradation of the sea ecosystem.

The Black sea coast of Turkey is 1695 km long extending from the Bulgarian border in the west to the Georgia border in the east. At one of the last monitioring study, a total of ten sampling stations for water quality assessment were selected along the coast of Samsun city and rivers in the mid-Black Sea region of Turkey. Annual loads of all pollutants flowing into the Black Sea showed strong correlation with discharge. Among the rivers and streams the Kızılırmak and Yesilırmak rivers are important riverine sources of most of the conventional pollutants, because these rivers have the highest annual water discharge. The domestic and industrial discharges are important sources of marine pollution in major cities along the Black Sea coast of Turkey. TOC concentration in the coastal waters was very variable, the highest concentrations were observed at Bafra and Kurupelit shores.

The determination of heavy metals especially at offshore sampling points means that the Black Sea is seriously exposed to pollution-originating marine activities. It can be seen that the concentrations of Pb and Cu increase gradually between 2000 and 2011 taking into consideration same parameters and sampling stations.

The emphasis of chemical pollution assessment, especially heavy metal pollution, should be on point source loads and sediment/body burden monitoring within the marine environment. Local investigations are key to understanding sources of pollution.

C31002

MISMANAGEMENT OF THE NATURA 2000 SITES IN THE GREEK SEAS URGES FOR EFFECTIVE AND PARTICIPATORY MARINE SPATIAL PLANS

V. Vassilopoulou[1, a], P. Panayotidis[1, b]

[1]Hellenic Centre for Marine Research, Anavyssos Attica, 19013, Greece

[a]celia@hcmr.gr, [b]ppanag@hcmr.gr

Keywords: conflicts, conservation, human uses, governance, stakeholders, integration

The Habitats Directive (HD, 92/43/EEC) forms the cornerstone for the conservation policy of Europe. In most of the sites of the Natura 2000 network designated for the HD implementation the conservation targets have not been achieved due to either lack of management plans, or lack of implementation of protective measures, or lack of enforcement. The present study is part of the FP7 MESMA project and it aims to evaluate the status of three sites in central-western Greece belonging to the Greek marine Natura 2000 network investigating possible conflicts between conservation priority features and human activities. Natura sites are considered as a type of Spatially Managed Areas (SMAs), for which site-specific management plans based on the respective priority conservation objective(s) should exist with the aim to achieve or maintain Favorable Conservation Status (FCS). However, from a managerial perspective the legal status of Natura sites in Greece is far from being clear, and management plans are either non-existing or vague. The management regimes of the three Natura sites are different, which appeared to have a pronounced impact on their conservation status conflicting either with fishery activities, or with tourism. In particular, in the first site, proclaimed also as National Marine Park, the additional legal framework appeared to facilitate the achievement of the priority objectives of conservation. In the second site which currently seems to deviate from achieving FCS, measures imposed by another, fishery-related, legal framework appeared to be rather promising for the improvement of the existing situation. On the other hand, the third site, where practically there is no management, has totally failed to achieve the foreseen conservation goals. Our findings suggest that only in cases when the legal status is solid and straightforward (eg. like in Marine Parks) there is a clear management plan with well-established mechanisms between the central government and the local authorities to support its implementation. Mismanagement of the network of marine Natura 2000 sites highlights the need for integrated decision making processes both on high level EU policies, and the Marine Spatial Planning (MSP) proposal directive may bridge this gap, and between different levels of national governance. Moreover, by involving key stakeholders in the process, will promote the adoption of transparent top-down and bottom-up approaches which is crucial for developing and implementing effective spatial plans that aim to sustainable development of the marine environment by balancing trade-offs between conservation and socio-economic objectives.

C32001

POPULATION AND TOURISM DEVELOPMENT GROWTH IN BULGARIAN COASTAL ZONE: IMPACTS AND IMPLICATIONS

Hristo Stanchev[1, a], Atanas Palazov[1, b], Robert Young[2, c], Margarita Stancheva[1]

[1]Institute of Oceanology – BAS, 40 First May Street, 9000 Varna, Bulgaria
[2]Program for the Study of Developed Shorelines, Western Carolina University, Belk 294 Cullowhee, NC 28723, USA

[a]stanchev@io-bas.bg, [b]palazov@io-bas.bg, [c]ryoung@email.wcu.edu

Keywords: coastal population, coastal tourism, human pressure, coastal environment, GIS

Coastal zones are mobile and sensitive boundaries between sea and land. They are also highly attractive both for settlements and human activities, comprising a great variety of natural ecosystems and resources. In addition, coastal tourism is a powerful economic engine for all coastal countries. This, in turn, has caused a rapid development and urbanization of the coast: and, coastal ecosystems are being pressured by population, pollution, habitat degradation and loss, overfishing and increased coastal hazards. Thus, the conservation of the coastal zone is a challenge due to the strong economic interests of coastal developers and residents, and the multiple uses.

In present study the population trends for the period 1934 – 2011 and tourist dynamics for the period 1999-2011 in the coastal zone of Bulgaria are investigated with application of Geographic Information System (GIS). The research aims also to assess the growth of population along the Bulgarian Black Sea coast as a common indicator for the human pressure on the coastal zone. The coastal population growth is driven by an expansion in tourism over the recent decades. Recent (2011) census data for Bulgaria indicate that population density within 10 km of the coast is approximately 223 people per square km, while in 10 – 30 km and 30-60 km from the coast, the density is 27 and 33 people per square km respectively. Therefore, coastal municipalities are challenged to meet the increasing pressure of human impacts on ecosystems and resources with existing facilities and infrastructures. Taking into account that coastal zone is limited land area, but very sensitive to several risks, this high population growth could be considered as one of the major hazard factors that reduces the resilience of the coastal zone. Both decision-makers and coastal developers are now faced with the challenge of finding a balance between benefiting from economic increase while mitigating the effects of expanded population growth on coastal environment.

C32002

BULGARIAN COASTAL DEVELOPMENT IN A GLOBAL PERSPECTIVE

Robert Young[1, a], Margarita Stancheva[2, b], Hristo Stanchev[2], Atanas Palazov[2, c]

[1]Program for the Study of Developed Shorelines, Western Carolina University, Belk 294 Cullowhee, NC 28723, USA
[2]Institute of Oceanology – BAS, 40 First May Street, 9000 Varna, Bulgaria

[a]ryoung@email.wcu.edu, [b]stancheva@io-bas.bg, [c]palazov@io-bas.bg

Keywords: ***coastal development, coastal engineering, beach and dune management, ecotourism***

Over the last several decades, many of the world's beaches have experienced rapid development. The vast majority of this development is in the form of vacation homes, investment property (hotels, condominiums) and the infrastructure to support tourism. As the value of coastal property has skyrocketed, the demand to protect these investments from coastal erosion and storms has grown. The result has been a massive transformation of the world's beaches and dune systems from fully functioning, geomorphic systems with high quality habitat to non-stop engineering projects designed primarily to function as storm buffers for infrastructure. The United States has very few beaches remaining that are entirely natural.

The Bulgarian coast has also experienced significant development and alteration of both active and relict dune fields in areas like Kamchia – Shkorpilovtsi beach, Nessebar town – Sunny Beach Resort and Primorsko town. Much of this development has occurred with an inadequate coastal setback, requiring the use of coastal engineering to protect the buildings and, in some cases, beach fill projects to add sand to the beach. In other areas of the coast, engineering structures have been used to halt the retreat of coastal cliffs even where there is little of no infrastructure to protect. It must be clearly understood that all of these activities may protect buildings, but they increase the rate of erosion along the entire coast and accelerate the loss of beaches.

There are many areas along the Bulgarian Black Sea coast that remain natural and unaltered yet. It is critical that any beaches and dunes that still have fully functioning physical and biological systems be identified, mapped, and protected. In addition, a science-based coastal setback should be established along all coastal cliffs and beaches. As most of the world's beaches become overdeveloped with degraded ecosystems, there remains the possibility in Bulgaria to highlight the touristic potential of those beaches and shorelines that remain natural (ecotourism). There is the possibility to attract a different kind of tourist who may be willing to spend more money for the kind of beach experience that is disappearing from the rest of Europe. This would include development set far back from the sea and very natural and pristine coastal dunes and beaches.

C32004

CONSTRUCTION OF COMMON MODEL FOR ENVIRONMENTALLY FRIENDLY DEVELOPMENT OF THE SOUTH EAST EUROPEAN SEA PORTS

Jordan Marinski[1, a], Dimitar Marinov[2, b], Leonardo Damiani[3, c]

[1]Professor, National Institute of Meteorology and Hydrology, Sofia, 1784 Bulgaria
[2]Asoc.Professor, National Institute of Meteorology and Hydrology, Sofia, 1784 Bulgaria
[3]Professor, Polytechnic of Bari, Bari 70123 Italy

[a]marinski@bas.bg, [b]dimitar.marinov@meteo.bg, [c]damiani@poliba.it,

Keywords: common model, environment, South East European sea ports, TENECOPORT

Nearly half of the global population resides in coastal areas. The dramatic increase of human impact on the environment along the coast, in particular for harbors, leads to environmental degradation and destruction of habitats. The overwhelming human pressures on the coastal environment have demanded for action in order to stop the ecological deterioration. For this reason a common ecological framework for port activities has become acutely necessary and the construction of Common Model for Environmently Friendly Development of the South East European (SEE) ports is proposed as one of the main global objectives in European projects ECOPORT 8 and TEN ECOPORT founded by South East Europe Program, (www.ecoport8.eu; www.tenecoport.eu).

The general criteria that comply with the construction of the present common model are: elaboration of a shared strategy and policy approach for environmental management and solving of common problems in SEE port areas, creation of harmonize Programme for monitoring and management at national, local and regional level of the port areas; development of wider network among ports areas with web-GIS for sharing results and advanced applications (meteo and monitoring data); and enhancement of the permanent information channel among TEN ECOPORT community via EDI (electronic data interchange) system. The pillars of the common model are: mapping of critical issues of port areas; definition a set of critical problems for a common management action plan, and elaboration of advance WEB GIS for port areas. The Model contributes in the development of integrated policies for coordinated risk prevention by providing plans, measures, and sets of vulnerability studies within the chosen sea-network and as a whole in the improvement of the Green Model for sea-corridors. It could serve for the creation of a transnational subject and to support a multidisciplinary Task Force for gathering the knowledge and experience including data base, with research methodologies for improving port environment, gained by the present project and other future experience aimed to keep supporting and providing services to ports of SEE.

C32005

THE HISTORICAL EVOLUTION AND THE CURRENT STATUS OF THE TRAKYA REGION ENVIRONMENTAL MANAGEMENT PLAN IN TURKEY

Hasan Hayri Tok[1, a], D. Poyraz[2]

[1]Namık Kemal University, Tekirdağ, Turkey (ret'd)
[2]Namık Kemal University, Soil Science Dept., Tekirdağ, Turkey

[a]hasanhayritok@gmail.com

Keywords: seahorses, threats, anthropogenic factors, management measures

Apparent outcome of missusage and unplanned management of the natural resources, especially just after the fast-track industrial growth, has brought in the need to place more emphasize on the planning process. Currently, the situation has reached to an irreversible ecological disaster level, not only in the domestic regional borders, but also at neighboring countries and even at continents. Especially in the surrounding areas of the Megapols like Istanbul, the pollution and environmental degradation in forests, agricultural lands, wetlands, water resources and related fauna have reached to very high, even irreversible cases. In consideration of such degradation of environmental quality at the eastern and western parts of Istanbul, several studies on preparation of Environmental Management Plans were started in the last decade despite being late. However, the current administrative ambiguities between the authorities and their lack of management competencies, implementation of the plans at macro and sub-scale plans and their application codes for the urban and rural areas have faced some legislative difficulties. The objective of this presentation is to summarize the apparent influence of the outcome of the historical and current effects of Istanbul's growth and related Environmental Management Plans on the neighboring Trakya Region Environmental Management Plan.

C34001

ECOTOURISM AND ENVIRONMENTAL EDUCATION

Marius Popescu[1, a], Mariana Golumbeanu[2, b], George-Marius Cracu[1], Liliana Panaitescu[1], Zoia Prefac[1], Marius-Laurentiu Lungu[1]

[1]Ovidius University from Constanta, Faculty of Natural and Agricultural Sciences, 124 Mamaia Bvd, 900527, Constanta, Romania
[2]National Institute for Marine Research and Development "Gr. Antipa", 300 Mamaia Bvd, 900581, Constanta, Romania

[a]mpopescu74@gmail.com, [b]golumbeanum@gmail.com

Keywords: ecotourism, student, environmental education

In this paper gives emphasis relation between ecotourism and environmental education. Ecotourism is a kind of tourism practiced in protected areas and environmental education through ecotourism may have a positive impact especially on school population. For identification environmental problems determined of tourism activities was realized a questionnaire with 20 questions applied to 200 students about Geography and Environmental Science studies programs from Ovidius University of Constanta. The results have emphasized the students knowledge about biodiversity, tourism, the tourism impact of environment and environmental education. The conclusions showed that through ecotourism and practice application with students, the level of educational process is superior and has an important contribution in environmental education.

C36001

POLLUTION OF COASTAL WATERS OF THE BLACK SEA BY MINERAL ELEMENTS, WITH CYSTOSEIRA BARBATA USE AS THE TYPE-INDICATOR OF POLLUTION

Olga Bunkova[1, a]

[1]*Student, Moscow, Lenin mountains, Moscow State University*

[a]*BunkovaOlga@yandex.ru*

Keywords: biological monitoring, heavy metals, Cystoseira barbata, the Black Sea

The actual direction of ecological researches are monitoring of a condition of flora and ground vegetation, identification of types indicators of pollution of water areas by various polluting substances, including heavy metals. Biological monitoring of a condition of natural systems is the most reasonable as assumes the accounting of a response of real multispecific community on all multicomponent loading of interacting factors of the environment.

Studying of mineral structure of Cystoseira barbata in a sublittoral zone of the northeast coast of the Black Sea carried out during 2011 – 2013 on specially chosen ranges: city of Novorossiysk, cape Big Utrish, Plantations of mollusks, confluence of the river of Sukko, city of Anapa (Sewerage), peninsulas Taman. Selected plants of three-four year age at a depth of 0,5 meters in the same month in the areas, differing type and degree of anthropogenou loading, frequency were selected within 10 meters. Definition carried out a nuclear and absorbing method. During work the following conclusions were received:

Cu distribution on the main Cystoseira barbata axis increases to the basis, distribution of Zn has inverse relationship. A number of decrease of average concentration of mineral elements (Fe>Pb≥Mn>Zn>Cu≥Ni≥Cd) reflects noticeable increase in the maintenance of Pb in comparison with researches of 1988. The maximum concentration of Cu is characteristic for the water area of the city of Anapa; Mg, Ca, Zn, Fe, Na – for coastal waters of the city of Novorossiysk, Cd, Mn, Pb, K – the peninsula Taman water area. The minimum concentration is, as a rule, characteristic for Big Utrish's cape that is the wildlife area territory. High concentration of mineral elements can be explained with fields of iron, copper ores, availability of underground thermal waters, application of pesticides and the fertilizers, the increasing volume of household waste and dumps.

Receiving estimates of a condition of communities by means of which it would be possible to distinguish a safe ecosystem from an ecosystem in which there were the violations caused anthropogenic influences, is necessary for realization of biotic approach.

C36002

THE INFLUENCES OF LAND-BASED INPUT ON NUTRIENT POLLUTION ALONG THE TURKISH COASTS OF THE BLACK SEA

Ahsen Yuksek[1, a], Ahmet Kides[2], Halil Ibrahim Sur[1], Husne Altıok[1], Erdogan Okus[1]

[1]Istanbul University, Institute of Marine Science and Management Müşküle Sokak, No:1, Vefa, 34116, Istanbul, Turkey
[2]ODTÜ- Deniz Bilimleri Enstitüsü, P. K. 28, Erdemli 33731, Mersin, Türkiye

[a]ayuksek@istanbul.edu.tr

The effects of anthropogonic inputs to the nutrient content of the surface water along the Turkish coast of the Black Sea were investigated at the 69 stations in fall and winter season in 2010. The stations network were made according to distance from the coast (1 mile, 3 miles and 5 miles) and anthropogenic inputs. In the wide shelf area, depth conturs (20, 50, 100 meters) was taken into account.

The salinity transects at 1 mile line clearly indicates that the river inputs are pronounced at Sakarya River in fall, Sakarya and Danube Rivers in winter months in the West Black Sea. In the Middle Black Sea, Kızılırmak is pronounced in both seasons. In the East Black Sea, it was observed the influence of the a lot of small scale rivers especially in rainy seasons. At the 5 miles line, the river inputs were less pronounced. The effects of Danube and Sakarya Rivers were observed in winter months.

Generally in winter months, nitrogen values are considerably higher and, the phosphorus values are lower. The high phosphorus values are found at the stations located far from the coast while the high nitrogen values are found at the stations in the near the coast. The deep waters are observed to be considerably rich with silicate and phosphate which are both main elements for primary production.

The main source of nitrogen and phosporus is the rivers. Especially the nutrients carried by Sakarya and Kızılırmak Rivers were observed having lower value at the 5 miles far away from the coast. The main source of the silica is the Kızılırmak River. The silica was found at the 1 mile far away from the coast.

The ratio of TN:TP increases from coast to open waters. Its value is lower in the river inputs according to the effects of primary productivity. The surface distribution of chlorophyll-a indicates that the highest values of productivity were observed coast of Sakarya and Kızılırmak Rivers discharges. It decreases at the 5 miles transect.

There is an evident difference between the two seasons according to trophic index (TRIX). It is calculated as good status in the West Black Sea whereas it is poor status at the station 9 in fall season. As it can be clearly seen from the figures the effects of Kızılırmak, Yeşilırmak and Danube were observed in winter season.

In general, the Black Sea TRIX is mediocre in fall while it is good in winter according to current system and weather conditions.

Consequently, it is observed that the river inputs is more pronounced than deep discharge. Its effects is observed at the 1 mile line and, its lower concentration is found rarely in 5 miles line.

C36005

EVALUATION OF MICROBIOLOGYC WATER SITUATION IN SHENGJIN BEACH, ALBANIA

Mirela Lika (Cekani)[1, a], Ilir Malollari[2], Rigerta Sadikaj[3], Dritan Arapi[1]

[1]Department of Biology, Faculty of Natural Science, University of Tirana, Albania
[2]Department of Chemistry, Faculty of Natural Science, University of Tirana, Albania
[3]Department of Biotecnology, Faculty of Natural Science, University of Tirana, Albania

[a]mirela2422@yahoo.com

Keywords: evaluation, microbiologyc water, pollution, beach

The water pollution on marine ecosystems could cause health problems through water contamination and in a direct contact, when used for recreation aims, or in indirect way, by the negative impacts to marine ecosystems and by consuming of polluted marine products. The samplings of marine water (2011) are taken from the stratum water surface about 10 cm, at a distance 10-20 m by sea coast. At sandy beaches, where water depth in sea coast is shallow, water samples are taken at distance 10-30 m from sea coast with water depth ≥ 0.5 m, while at rocky coast with larger water depth, the samples are taken at distance 5 – 10 m from sea coast.These samples are examined in laboratory for determination of two micro organisms, indicators excrements pollution Faecal Coliform (FC) (ISO 9803) and Faecal Coliform, probably (Streptococcus Faecal FS) with Filtrate Membrane Method's in specific areas (ISO 7899-2). The results and monitored results discussion are carried out by the WHO/UNEP recommendations (Interim Criteria 1985).For Shëngjin zone the microbiologic elaborated analyses have resulted as follows:For Faecal Coliform and Streptococcus Faecal are given the minimal values FC-50, FS-50 and maximal values FC-90, FS-90 per 100/ml. About the evaluation of reaction (pH) is concluded that in Albania the sea waters coastal zones have a lightly alkaline ambient, where pH value is in the range 7.5 □ 8.3, estimated according to recommended standards 6-9. No cases of red-tide algae development have been observed.

C36006

ECOREMEDIATION

Hrustem Smailhodzic[1, a], Mirza Smailhodzic[2, b], Amra Ovcina[3, c]

[1]Department of physics, University of Tuzla,Pere Kosorica 6, 75000 Tuzla, Bosnia & Herzegovina
[2]University of Travnik, Jevrejska 15, 75000 Tuzla, Bosnia & Herzegovina
[3]University of Travnik, Drage Karamana 9, 75000 Tuzla, Bosnia & Herzegovina

[a]hrustem@gmail.com; [b]mirza.smailhodzic@gmail.com; [c]amra.ovcina@gmail.com

Keywords: ***ecoremediation, bioremediation, phytoremedioation, exchange of substance, waste, technology, moss***

There are various theories and definitions of what is ecoremediation and what the purpose of ecoremediation is. More generally it can be said ecoremediation – phytoremediation is a method for stabilisation or for removing pollutants from contaminated sediments, soil and wastewater. In modern science it means “repair” of polluted environment, with treatment ecosystem process trying to get closer to the natural process of regeneration. It is a method of integrated ecosystem management through conservation, purification and improvement of ecosystem elements supporting sustainability through dynamic change in the structure of ecosystem. It is primarily used for the recovery of degraded natural resources destroyed by human activities. We are using water, forests, land and air to the maximum, while not taking care of their protection and restoration. This paper describes the procedures of soil ecoremediation, groundwater, waste and ecoremediation technology itself, as well as bio, micro and phytoremediation.

A special emphasis in this paper is given to ecoremediation in Bosnia & Herzegovina under IPA project on Biotechnology, University of Bihać.

Living systems first respond to the pollution of environment in different ways, with different intensity. The paper also explains how nature, in this case moss, gives the research results of moss usefulness as an indicator of the validity of the water.

As the capacity of natural exchange of substance is not unlimited, increasing quantities of waste has become an important factor in disrupting the natural balance.

The method of ecoremediation – phytoremediation is based on the fact that the plants are solar pumps, which, through the process of photosynthesis and evapotranspiration from the environment are able to adopt defined elements. Due to their long-term, sustainability, efficiency, cost moderation and landscape attractiveness, this method is becoming more and more popular in the world

A14002

TORRENTIAL RAINFALL EVENT IN ROMANIA AND BULGARIA. IMPACT ASSESSMENT

Brindusa-Cristina Chiotoroiu[1, a], Veneta Ivanova Todorova[2, b], Boryana Markova[2], Mirela Nita[3]

[1]Constanta Maritime University, 104 Mircea cel Bătrân str., 900663 Constanta, Romania
[2]National Institute of Meteorology and Hydrology, Bulgarian Academy of Sciences, branch Varna, District "Sveti Nikola"10, Varna 9010, Bulgaria
[3]Monsson Energy Trading, 241 Mamaia blvd, Constanta, Romania

[a]b_chiotoroiu@yahoo.com, [b]veneta74@abv.bg

Keywords: rainfall, Black Sea coast, convective storm, hazard, flash flood

In association with the effects of climate change, it is likely that the frequency of heavy precipitation or the proportion of total rainfall from heavy rainfalls will increase in the 21st century over many areas of the globe (IPCC Report 2012). These phenomena can cause significant property damages and losses of life with important economic and societal impact in Bulgaria and Romania.

This is the case of the hazardous event studied in this paper, the flood consequences from 2005 being dramatic for this droughty region, close to the Black sea coast. For the study of the evolution of the severe convective storm, radar images, precipitation records, satellite images and reanalysis maps have been used.

Comparisons of the social and economic impacts, together with the measures taken in order to remove the effects and to eliminate future harm, loss and damage of people, livelihoods, resources and infrastructure are also presented in this paper.

Assembling together information about the meteorological records and the economic impact of the flash floods in the south-eastern part of Romania and north-eastern part of Bulgaria can contribute to adequate perception of risk and disaster risk reduction in the study area.

B21015

COMPARISON OF METHODOLOGICAL APPROACHES FOR THE ASSESSMENT OF CONTAMINANTS IN THE SOUTHERN EUROPEAN SEAS: MSFD AND REGIONAL SEA CONVENTIONS

D. Gonzalez-Fernandez[1, a], G. Hanke[1], M. Pantazi[2], V. Vassilopoulou[2], S. Laroche[3], B. Andral[3], D. Vasile[4], M.T. Gomoiu[4]

[1]EC JRC IES, Ispra, Italy
[2]HCMR, 19013, Anavyssos, Athens, Greece
[3]IFREMER, Zone portuaire de Brégaillon,83 507 La Seyne-sur-Mer,
[4]GeoEcoMar, 23-25 Dimitrie Onciul Str, Bucharest, Romania

[a]daniel.gonzalez@jrc.ec.europa.eu

Keywords: ***Contaminants, hazardous substances, MSFD, Mediterranean Action Plan, Black Sea Commission***

The overall goal of the Marine Strategy Framework Directive (MSFD) is to achieve Good Environmental Status (GES) of EU's marine waters by 2020. Cooperation to establish common approaches among countries is essential for the protection of the marine environment. Besides, the Regional Sea Conventions: Mediterranean Action Plan (UNEP/MAP) and the Black Sea Commission (BSC) are the cooperation structures to protect the marine environment in these two regions. Coordinated efforts are needed between EU and non-EU countries to attain a successful conservation and management in the Mediterranean Sea and Black Sea basins. For that reason, PERSEUS FP7 project, based on the objectives and principles of the Marine Strategy Framework Directive (MSFD, 2008/56/EC), assesses the impact of natural and human-derived pressures on marine ecosystems in Southern European Seas (SES). In this work, commonalities and differences in the methodological approaches for the assessment of contaminants are studied considering these three major frameworks: MSFD, UNEP/MAP and BSC. MSFD includes Descriptors 8 and 9 for the assessment of contaminants, then descriptors are developed down to Criteria and Indicators. UNEP/MAP considers Ecological Objective 9 on contaminants and develops it down to Operational Objectives and Indicators. The Black Sea Integrated Monitoring and Assessment Program (BSIMAP) sets up a list of mandatory and optional parameters for Pollution monitoring and Assessment (PMA). BSC is currently preparing a new text of the BSIMAP for years 2013-2018, where Ecosystem Quality Objective number 4 (EcoQO 4) will include contaminants issues. These three frameworks are still at different stages of their own implementation process. Communication and coordination will be needed among them for harmonization and comparability purposes.

A13004

THE METHODOLOGY ELABORATION FOR THE ORGANIZATION OF REMOTE GROUNDWATER MONITORING IN REPUBLIC OF MOLDOVA

A. Sidorenko[1, a], O. Bogdevich[1], Gh. Duca[1], A. Vaseashta[1, 2]

[1]Academy of Science of Moldova, Chisinau, Moldova

[2]Norwich University of Applied Research Institutes Northfield, VT, USA

[a]anatoli.sidorenko@kit.edu

Keywords: groundwater, monitoring network, level measurements

The water management is one of the key problems for any country including Moldova Republic. The semiarid climate in Moldova makes a necessity to use groundwater resources in the complex with surface waters. The intensive utilization of principal aquifers is monitored by the national monitoring groundwater network. This activity is made by near 180 boreholes for different aquifers. The seven principal aquifers are distinguished: alluvial aA_3; pontian - N_2p; upper sarmatian-meotian – N_1s_3-m; middle sarmatian – N_1s_2; baden-sarmatian – N_1b_3-s_1; silurian-cretaceous S-K_2; proterozoic-vendian Pt – V. The aim of this work was the methodology elaboration for the site selection for the remote groundwater monitoring network. The effective monitoring network should to use modern physical and chemical sensors, which can measure continuously principal groundwater parameters, and INTERNET transmitter. The monitoring network should to be organized after the Identification Delineation and Classification (IDC) of principal groundwater bodies. The approach to developing the part of the IDC methodology for ground water bodies should to be based on the EU Water Framework Directive (WFD) guidelines. This work was made for the pilot area: Bic and Botna river basins.

Groundwater level is the principal parameter for the assessing of the quantitative status and conceptual understanding (conceptual model) with a resource assessment and the impact evaluation of the groundwater abstraction. The very important approach is to use boreholes or other water objects with a long time monitoring series. Groundwater levels are also important for developing an understanding of the direction of groundwater movement and the interaction of groundwater with surface water, that is, whether groundwater is discharging to surface water or surface waters are recharging groundwater. Water level measurement should be undertaken in a selection of wells, boreholes and spring-heads, depending on the aquifer and location.

The review of the existing groundwater monitoring network identified a number of gaps which need to be addressed. There are a number of blank areas on the map with no evident monitoring sites, and in other areas, there are dense clusters of boreholes. This would require the search for possible boreholes in the blank areas on the map. The distribution of monitoring sites within a groundwater body should ensure that the spatial and temporal variability of the measured parameters can be sufficiently well recorded. The distribution and density of the monitoring points would depend on the hydrogeological conditions and other factors that influence both the chemistry and quantity, such as land-use and recharge.

C37004

CONSTANTA DOLPHINARIUM – FOCAL POINT TO DISSEMINATE THE EDUCATION, CONSERVATION AND PROTECTION OF DOLPHINS FUND IN ROMANIAN MARINE WATERS

A. Curlisca[1, a], N.C. Papadopol[1, b], M. Candea[2, c], M. Paiu[2, d]

[1]Complex Museum of Natural Sciences, 255 Mamaia Bv. 90052 Constanta / Romania
[2]NGO Mare Nostrum,3 Bv 1 Decembrie 1918, Bl. F17, ap.3, 900711 Constanta / Romania

[a]curlisca.angelica@gmail.com, [b]angysan2002@yahoo.com,
[c]mihaela_candea@marenostrum.ro, [d]marian_paiu@marenostrum.ro

Keywords: environmental education, dolphin, Romanian Black Sea shore

Constanta Dolphinarium, part of the Natural Science Museum Complex Constanta is a focal point on the Romanian Coast for education and dissemination of conservation and environmental protection and in particular for the dolphins fund in national marine waters.

To achieve this goal our institution specialists, in collaboration with NGO "Mare Nostrum" and experts from INCDM "Grigore Antipa" Constanta, Scientific Research Centre for the Navy, Naval Academy "Mircea cel Batrin" and Divers Center Constanta carries on activities as: identification, throughout the year, to stranded dolphins (through the volunteers observers network of NGO'S Mare Nostrum and terrestrial expeditions on the whole Romanian seacoast); identification of acoustic stress factors for dolphins (in captivity and in the high seas); photo identification courses of dolphins; training campaigns for fishermen; participating in the pilot projects – for example the location of hydro acoustic devices for removing dolphin from fishing nets (ADD-uri/PINGERE on nets- project coordinated by NGO Mare Nostrum), etc.

Dissemination of the results of these activities shall be carried out in both directly, by presenting them to the public who participates in each demonstration, as well as in the training campaigns carried out in local fishery communities, lectures at the complex conference room or in schools from the county, by distribution of leaflets, flyers, etc.

The aim is:

- Raising awareness of nature and increasing the responsibility regarding dolphins fund issues from Romanian marine waters through information of public opinion;
- Thorough knowledge of essential aspects related to the status of dolphins populations in the Romanian marine waters, the impact of various anthropogenic actions;
- Formation of skills and abilities of observation, experimentation and research;
- Formation of environmental ethic (attitudes, principles, beliefs);

Relevant is the fact that in the last few years, due to the joint work of our specialists and NGO Mare Nostrum were created new social behaviors reflecting the public concern regarding the dolphin's population status from Romanian seaside, this increased substantially occurrences of dolphins in some coastal areas, even in harbors areas, without these flocks/ specimens manifest restraint or fear.

A15001

DIGITAL PHOTOGRAMMETRY METHODS FOR BENTHIC RESEARCH – CURRENT APPLICATIONS AND FUTURE PERSPECTIVES

Dimitar Berov[1, a], Georgi Hiebaum[1, b]

[1]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Street, 1113 Sofia, Bulgaria

[a]dimitar.berov@gmail.com1, [b]hiebaum2001@yahoo.com2

Keywords: benthos, mapping, digital photography, photogrammetry, environmental parameters, monitoring

Benthic marine research has used imaging technologies as a tool since the development of modern photography. It allows researchers to observe inaccessible for humans marine environments and to gather visual information in the short durations of underwater human and automated. The rapid development of digital image technologies in the last decades gave new and affordable tools in the hands of marine researchers. They were integrated in ROV and AUV devices, which became standard tools for deep-sea research. Due to the high cost, complexity of maintenance and unsuitability for complex samplings of these systems, scuba diver-based research is still a widely-used alternative in shallow water. A digital photogrammetry system with surface GPS referencing operated by divers has been used in shallow-water benthic research by the IBER-BAS team in recent years. The original system (Preskitt et al. 2003) was significantly improved by the usage of high-resolution digital camera. The method was widely applied in sampling of phytobenthic ecosystems Cystoseira spp. and Zostera spp. Communities and mapping of their distribution. Comparison of results from 'classical' destructive sampling reviewed similar community structure, yet allowed us to sample much larger areas of the benthal in the limited time underwater. The usage of GPS referencing allowed us to study the benthic communities on a large scale, reviewing patterns of spatial change in their structure and distribution along different environmental gradients.

A significant improvement of this methodology is suggested through the integration of automated system for the measurement of environmental parameters, e.g. pressure/depth, inclination, temperature, salinity, PAR, pH, oxygen, Chl-a, nutrient concentrations (Bulgarian Patent Organization utility model 002242). Data logging is synchronized with the work of the camera and the surface GPS tracking, which allows the measured environmental parameters to be integrated with data from the analysis photo. The integrated results will be included in a GIS databases for further analysis. The development of this system will significantly improve sampling efforts in mapping of benthic communities and monitoring activities for the purposes of evaluation of the ecological status of coastal marine ecosystems. Future development of the methodology could include automated image analysis based on machine-learning algorithms (e.g. Purser et al. 2009) and automated generation of georeferenced photomosaics of the studied areas of the benthos (Ginert et al. 2012).

A14005

A SCIENTIFIC NETWORK FOR THE PREVENTION OF ENVIRONMENTAL HAZARDS IN THE BLACK SEA BASIN

K. Papatheodorou[1, a], L. Tofan[2, b], G. Stanciu[2], D.T. Epure[2], Z. Prefac[2], M. Lungu[2], I. Moise[2], L. Panaitescu[2], M. Arpenti[2], B. Trandafirescu[2], M. Golumbeanu[2], C. Constantin[2], T.J. Ehlinger[3, c]

[1]Terma Magnissias Str., 62124 Serres, Greece
[2]Ovidius University Of Constanta, 124 Mamaia Street, 900527, Constanta, Romania
[3]Department. of Biological Sciences – Univ.Wisconsin Milwaukee, 3209 N. Maryland Ave, Milwaukee, Wisconsin 53211, U.S.A.

[a]conpap@teiser.gr, [b]tofanlucica@gmail.com, [c]ehlinger@uwm.edu

Keywords: a scientific network, natural hazards, risk assessment

A Scientific Network for Earthquake, Landslide and Flood Hazard Prevention (SciNetNatHaz) has been established under the coordination of The Technological Education Institute of Serres, Greece, in the frame of Joint Operational Programme "BLACK SEA BASIN 2007-2013". The Partnership gethered 8 partners from Greece, Bulgaria, Romania, Turkey, Moldova and Ukraine.

Natural hazards can lead to Natural Disasters. Disaster Mitigation is a management process to reduce the impact disasters on people and property. This process includes pre-event measures, actions during and immediately following an event and post-disaster measures. The Key elements for natural Disaster mitigation are Hazard Identification and Risk assessment and Applied Research and Technology transfer. Pre-event measures are the most cost effective, provided that they are based on accurate and Reliable Hazard identification and Risk Assessment, which in turn must be based on accurate and reliable data, and scientifically proven methodologies.

The global objective of this project is to achieve a strong regional partnership and cooperation by the Development of a Scientific Network for the establishment a scientific consensus, in order to setup common strategies and natural hazard prevention methods. The Scientific Network members work together, sharing competencies and resources to address earthquake, landslide and flood hazards which have Transboundary consequences both on the economy and on the environment.

The project targets Policy makers, local authorities, scientific community, non-governmental organizations, and business enterprises, having as final beneficiaries: Academic Community, Public Authorities and the Public-at-large.

The expected results include cross boundary cooperation in hazard risk management, cross border know-how and expertise transfer, a WebGIS platform with an accessible geodatabaseand training.

EXTENDING THE EURO-ARGO ACTIVITIES IN THE REGIONAL SEAS

BLACK SEA ARGO INITIATIVE

A13001

MEDARGO: THE ARGO REGIONAL CENTER FOR THE MEDITERRANEAN AND BLACK SEAS

Pierre-Marie Poulain[1]

[1]*Istituto Nazionale di Oceanografia e Geofisica Sperimentale, Borgo Grotta Gigante, 42/c, 34010 Sgonico (Trieste), Italy*

[o]*ppoulain@inogs.it*

Keywords: Argo floats, temperature and salinity profiles, Mediterranean, Black Sea

MedArgo is the official Argo Regional Center (MED-ARC) for the Mediterranean and Black Seas. Its main responsibility is the overall coordination of profiling float operations in the Mediterranean and Black Seas. MedArgo conducts the following activities: 1) the coordination of float deployments in the Mediterranean and Black Seas; 2) the preparation and distribution of Mediterranean and Black Sea Argo products and services; 3) and the comparison of the Mediterranean and Black Sea Argo data with ancillary hydrographic data and model products. In addition, MedArgo serves as an Delayed Mode Operator (DMO) for the delayed-mode processing of the Argo data with specific quality control techniques tailored for the Mediterranean and Black Seas. The MedArgo web site is: http://nettuno.ogs.trieste.it/sire/medargo

MedArgo is part of the Italian "Gruppo Nazionale di Oceanografia Operativa" (GNOO) and of the Mediterranean Operational Oceanography Network (MOON). Partial support is provided by the EuroArgo (and related FP7 projects such as SIDERI and E-AIMS), MyOcean and Argo-Italy programs.

As of May 2013, more than 50 profiling floats were active in the Mediterranean and Black Seas. All floats provide temperature and salinity profiles every 5 – 10 days between 2000 m and the surface. In addition, several instruments measure profiles of biogeochemical properties (dissolved oxygen, chlorophyll fluorescence, nitrate concentration and optical properties). In the Mediterranean Sea, the parking depth is predominantly at 350 m. Data are telemetered via satellite links (Argos and Iridium).

A13013

CROSS-VALIDATION OF SATELLITE DERIVED SST WHIT DATA FORM BULARGO FLOATS

Violeta Slabakova[1, a], Elisaveta Peneva[2, b], Anna Kortcheva[3, c], Milena Milanova[2, d], Atanas Palazov[1, e]

[1]Institute of Oceanology – BAS, Varna, Bulgaria
Sofia University "St. Kliment Ohridski", Department of Meteorology and Geophysics,Sofia, Bulagaria
[3]National Institute of Meteorology and Hydrology-BAS, Sofia, Bulgaria

v.slabakova@io-bas.bg, [b]elfa@phys.uni-sofia.bg, [c]anna_kortcheva@yahoo.com, [d]mimilanova@iphys.uni-sofia.bg, [e]palazov@io-bas.bg

Keywords: ***profiling floats, SST, AMRS-E, GHRSST, Black Sea***

The majority of in situ observations that are commonly used for monitoring of the Black Sea are generally based on near-shore monitoring programmes or irregular oceanographic cruises that provide either non-synoptic, coarse resolution realizations of large scale processes or detailed, but time and space specific snapshots of local features and processes. These gaps can be filled in by satellite information which provides quasi-synoptic, extensive coverage and excellent space/time resolution data. However the satellite observations still need to be validated before using for more general applications. The commonly used method of validation is comparison of satellite-derived data with in situ measurements from vessels, moorings, buoys and XBTs.

In this study, in order to assess the accuracy of satellite derived Sea Surface Temperature in the Black Sea, data from Advanced Microwave Scanning Radiometer for Earth Observing System (AMSR-E) and Group of High Resolution Sea Surface (GHRSST) datasets from merged SSTs are compared with in situ measurements from Argo floats. A strict comparison method is adopted resulting in 482 and 53 match-ups for GHESST and AMRS-E respectively. The estimated root-mean-square errors (RMSEs) are 0.39 °C between GHRSST and Argo and 0.65 °C between microwave SST and float data mostly under weak wind conditions.

The obtained results are closer to the satellite missions requirement (accuracy better than 0.4 K) that is quite encouraging for future operational oceanography applications in the Black Sea.

A11034

MESOSCALE EDDIES AND COLD WATER DYNAMICS OBTAINED FROM PROFILING FLOATS

Anil Akpinar[1, a], Bettina Fach[1], Temel Oguz[1], Baris Salihoglu[1]

[1]Institute of Marine Sciences, Middle East Technical University, Erdemli, Turkey

[a]anil@ims.metu.edu.tr

Keywords: Black Sea, Cold Intermediate Layer, profiling floats, cyclone, anticyclone

Data from seven profiling floats operating in the Black Sea between 2002 – 2009 have been used in this study to investigate the temporal and spatial distribution Cold Intermediate layer (CIL) as an indicator for the ventilation of upper 200m water column. Relatively thick CIL is observed in March; otherwise mesoscale flow structure controls predominantly its spatial and temporal structures, including its formation. The observations confirm the earlier findings about thicker and deeper CIL in anticyclones and vise versa for cyclones. Simultaneous observations in cyclonic and anticyclonic patterns reveal an 80m difference in the lower boundary of CIL and a 60 m difference in CIL thickness. It's typical average thickness is about 30 m in the cyclonic eddies and 100 m in anticyclonic eddies. The extent of ventilation of the subsurface waters during the CIL formation and afterwards is particularly pronounced within the coastal anticyclonic eddies such as Kizilirmak, Batumi, Kerch, Sinop and Caucasian eddies. Geostrophic velocities as high as 6 cm/s are observed at 1550 m depth whereas the corresponding current intensity reaches at 60 cm/s at the surface, particularly in December-February.

A13017

USE OF THE ARGO FLOAT THERMOHALINE DATA IN NUMERICAL MODEL VALIDATION AND STATISTICAL ANALYSIS IN THE BLACK SEA

V.A. Ivanov, A.V. Bagaiev, V.N. Belokopytov, S.G. Demyshev

Along with accumulation of experimental data on the vertical thermohaline structure of the Black Sea there are many constantly developing methods of their application for initialization and assimilation in the ocean forecasting model created at MHI NASU. Currently, the model based on the primitive equations of thermohydrodynamics in Cartesian coordinates works on quasi-operational mode in the Black Sea. Original technique and software based on ARGO profile data has been designed for the model validation and skill assessment.

Comparison of circulation and thermohaline structure simulated in the Black Sea with ARGO data set has been conducted at synoptic and seasonal scale over 2007-2009. It is shown that in general, the model reproduces well the basin-scale features, since some well-known interannual signals appear clearly. The RMS differences obtained allow the apparent seasonal separation. Maximum RMS differences are observed in the permanent halocline and seasonal thermocline in the areas with the complex bottom topography and/or under the direct influence of freshwater runoff.

A13011

OBSERVING SYSTEM EVALUATION (OSE) FOR THE BLACK SEA: FOCUS ON ARGO FLOATS AND ALTIMETRY DURING 2005 – 2012

Sebastian Grayek[1, a], Emil V. Stanev[1]

[1]Institute for Coastal Research, HZG, Max-Planck-Straße 1, 21502 Geesthacht, Germany

[a]sebastian.grayek@hzg.de

Keywords: Black Sea, temperature, salinity, sea surface heights, ARGO floats, altimetry

Availability of ARGO float observations for the Black Sea varied strongly over the last years. Ongoing efforts increased and will further increase the number of deployed floats therefore an objective estimate of the enhancement of the quality of observing network may give useful information for further development strategies. An observation system evaluation (OSE) exploiting the combined observations from ARGO floats and altimetry during the period from 2005 up to now has been performed. The analyses are focused on the temperature, salinity and steric sea level elevation. Based on statistical background information derived from numerical simulations the OSE gives a quantitative estimate of the feasibility to reconstruct data of larger areas based on the availability, the accuracy and the spatial configuration of the measurements. Additional state reconstruction experiments were carried out in order to optimise the usage of the data, to check the plausibility of estimates derived from the OSE and for a detailed investigation of the utilised correlation patterns. During the investigated period measurements from altimetry and at least one float were available at all time. The highest density of observations including measurements from four and six floats were found during the time intervals from July-2006 to October-2010 and from March-2011 to January-2012, respectively. Preliminary observation system simulation experiments (OSSE) assuming idealised ARGO measurements with a regular distribution of floats gave support to the optimistic hypothesis that a state reconstruction of the deeper part of the Black Sea would be feasible within a reasonable error range based on observations from five floats. By investigating the mentioned two periods with relatively high density of measurements this hypothesis is reviewed under realistic conditions.

A11019

DATA MANAGEMENT IN THE BULARGO PROGRAM

A. Stefanov[1, a], A. Palazov[1, b], V. Slabakova[1, c], E. Peneva[2, d]

[1]Institute of Oceanology, Bulgarian Academy of Sciences, Varna, Bulgaria
[2]University of Sofia "St. Kliment Ohridski", Sofia, Bulgaria

[a]a.stefanov@io-bas.bg, [b]palazov@io-bas.bg, [c]v.slabakova@io-bas.bg, [d]elfa@phys.uni-sofia.bg

Keywords: Argo float, database, oceanography

The Monitoring of the Black Sea from surface down to the standard deep layers is essential. The coastal meteorological and oceanographic data is usually presented but observation for the open sea is rather insufficient. These gaps can be filled in with Argo floats observations. BulArgo is a project supported by the Bulgarian National Science. The purpose of the project is to establish a national research infrastructure in the frame of Euro-Argo activities.

The inventory of the Argo data in the Black Sea is done in close relation to the work in the BulArgo project. Special efforts were made for the establishment and development of effective local means for publishing of Argo data. The development of the oceanographic and information management system (DMS) is based on relational databases that provide an efficient way of managing and retrieving data. It is now commonplace to see also maps or other geographic information integrated seamlessly into an existing oceanographic DMS and presented on data center's websites. The Bulgarian National Oceanographic Data Centre (BGODC) decided to integrate geographic information system (GIS) interface for Argo data. During realization the existing information technologies and scientific standards are used whenever possible in preference to development of own solutions. As well the experience of the leading oceanographic centers is accounted.

The data management infrastructure for the successful implementation of the project and the achievement of its objectives is based on Microsoft technology. The foundation for the integrated solution is Microsoft Windows 2008 Server operating system, including Microsoft SQL Server 2008 with Reporting Services. For building the WEB portal the DotNetNuke Open Source Framework technology is chosen. In the center of BGODC general data dissemination architecture is a MS SQL Report Server, a Web-based middle-tier layer that receives incoming report requests, generates, renders, and delivers reports. These reporting services are based on network-based model of web services. Using data driven subscriptions, reports may be "broadcast" to a large audience and can be downloaded in a variety of formats, including HTML, or export to a spreadsheet application. The spatial mode data dissemination is based on ESRI's Arc Info for development and ArcGIS Server for publishing of the GIS resource. The GIS projects are shared by first hosting them on ArcGIS Server, publishing as services and building web applications that user access through web browser.

In this way, the results from the two web applications, one created and published through ArcGIS Server and reports published through Report Server, are combined. The advantages of such an approach are: The development time is significantly shortening; there are no needs to transfer all attribute information to geo database when using MS Report services; end user may have simultaneous access to both data from a GIS server and data from the general RDBMS. The next steps in the improvement of Argo Web publishing system is to embed Google maps services in web site and combine them with Report server capabilities.

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MARINE RESOURCES AND OBSERVATIONS FOR SUSTAINABLE ECOSYSTEM MANAGEMENT

B21003

THE CONTRIBUTION OF ENVIRONMENTAL INDICES IN MEETING THE OBJECTIVES AND PRINCIPLES OF MSFD

Mariana Golumbeanu[1, a], Andra Oros[1, b], Magda Nenciu[1, c], Marco Zavatarelli[2], Aldo Drago[3]

[1]1NIRDEP - National Institute for Marine Research and Development "Grigore Antipa", 300 Mamaia Blvd., Constanta, Romania, Tel.: 0040241543288
[2]University of Malta, Msida MSD 2080, Malta
[3]Consorzio Nazionale Interuniversitario per le Scienze del Mare, Via Isonzo, 32 Rome 00198, Italy

[a]golumbeanum@gmail.com, [b]aoros@alpha.rmri.ro, [c]mnenciu@alpha.rmri.ro

Keywords: ***environmental indices, MSFD, training, fishery related indices, AMBI, M-AMBI, TRIX, Ocean Color***

The summer school on "The contribution of environmental indices in meeting the objectives and principles of the Marine Strategy Framework Directive" was organized in Constanta, Romania, during 3-7 June 2013, within the framework of Work Package 8 (WP8) of the PERSEUS project. The main focus was to create training opportunities which will strengthen the existing RTD network in the Mediterranean and Black Seas in principles such as ecosystem modeling, monitoring and environmental assessment.

The school targeted the need that both EU and non-EU states should adopt a common framework and regional approach with regards to environmental policy development, common monitoring practices and the use of common assessment tools.

The main objectives of the PERSEUS Summer School on the contribution of environmental indices in meeting the objectives and principles of the Marine Strategy Framework Directive were the:

(i) to expose participants to aspects of the theoretical and practical background on the assessment of the benthic ecological status using the index M-AMBI (multivariate AMBI - AZTI's Marine Biotic Index) and MSFD assessment issues;

(ii) to provide participants with the most important concepts related to the fishery related indices;

(iii) to get participants acquainted with the main applications of ocean color based index/eutrophication-related core set indicators CSI023 (chlorophyll-a);

(iv) to present theoretical and practical aspects of characterization of the ecological state of marine and coastal waters using Trophic index (TRIX);

(v) to establish links between different researchers involved in the field of environmental indicators related with MSFD.

20 students from various Black Sea and Mediterranean countries and with different backgrounds completed the school successfully, blending a thorough lecture programme with social interaction and exchange of ideas.

B24007

FISH POPULATION INDICATORS – AN EXAMPLE OF SPRAT FROM BULGARIAN MARINE AREA

Violin St. Raykov[1, a], Marina Panayotova[1, b], Maria Yankova[1, c]

[1]Institute of Oceanology - BAS, 40 Parvi Mai str., P.O.Box 152, Varna 9000, Bulgaria

[a]vraykov@io-bas.bg, [b]mpanayotova@io-bas.bg, [c]maria_y@abv.bg

Keywords: ***Sprat, CPUE, length, age, biomass, Black Sea, MSFD***

The present paper attempts to give an answer of what is healthy state of sprat stock analyzing biomass, length, and weight and age distribution for 11 years period (2002 – 2012). The parameters were derived from scientific surveys and market sampling from Bulgarian marine area of Black Sea. The biomass levels estimated by swept area method varied from 29 180 – 75 080 t (2007 – 2010). The total counts of the hauls for this period was 146 and Catch per Unit Effort varied from 0 to 3880$kg*h^{-1}$, since the mean value for the whole researched period of this parameter was 540 kg*$^{h-1}$. The length oscillates around the multiannual mean (total length of 8cm) excluding 2010-2011 when significant decrease in mean sizes was observed. Age of sprat was in term of 0+ to 4 year, the recruitment was established for the first time in the catch in June. 1-2+ old specimens were prevalent in the catches and 5 years old were totally absent. The present state of stock in the area of research interest was found stable in terms of biomass. Latest decrease of individual sizes, together with negative age acceleration should be studied further in order to make strong conclusions on the effects of fishing press and oscillating environmental conditions on sprat stock in the whole Black Sea. The study on population parameters significantly contributes to the analysis of indicators for Descriptor 3 from MSFD.

B22001

IMPROVED MONITORING OF MIGRATORY ANADROMOUS MARINE STURGEONS USING DKTB TELEMETRY STATION

Alin Marius Badilita[1, 2, a], Gyorgy Deak[2], Adrian Ionascu[1], Iustina Popescu[1, b], Georgiana Tanase[1]

[1]INCDPM - National Institute for Research and Development in Environmental Protection, 294 Splaiul Independentei, 060031, Bucharest, Romania

[2]University of Agricultural Sciences and Veterinary Medicine, Bucharest, 59 Marasti, District 1, 011464, Bucharest, Romania

[a]badilita_alin@yahoo.com, [b]iustina.popescu@incdpm.ro

Keywords: ***anadromous sturgeons, sturgeons monitoring, ultrasonic tag detection, DKTB telemetry station***

Anadromous sturgeon populations from Danube River have experienced severe decline lately due to anthropic activities like river fragmentation, water quality decreasing and inadequate fishery practices. The main aim of this paper is to gain a better understanding of anadromous sturgeons' spawning migration by applying a new monitoring technique with increased performances which provides a unique database at European level. This method uses DKTB telemetry station (a new device developed by INCDPM's researchers – invention patent registered with no. A100773/30.10.2012) which is based on ultrasonic tag detection and is composed of a slotted metal tube having a special closing system and a bank anchorage device. The main advantage of this technique consists of preventing monitoring equipment loss which has direct impact on informational database (irreversible loss of data). Moreover, using of this innovative technique decreases monitoring costs and, also, necessary time for data collecting.

B24006

STATE AND POPULATION DYNAMICS OF TURBOT STOCK (SCOPHTHALMUS MAXIMUS L.) OFF BULGARIAN BLACK SEA COAST IN 2006 – 2012

Marina Panayotova[1, a], Violin Raykov[1, b]

[1]Institute of oceanology-BAS,"Parvi may"40 Str., P.O.Box 152, 9000 Varna, Bulgaria

[a]mpanayotova@io-bas.bg, [b]vio_raykov@abv.bg

Keywords: turbot, abundance and biomass indices, age and size structure, indicators

Scientific surveys for assessment of turbot stock biomass and population parameters were executed along the Bulgarian Black Sea coast during the period 2006 – 2012 by swept area method. Different indices and indicators were derived from survey data, collected during 12 demersal trawl surveys and more than 400 hauls. Estimated indicators were applied for assessment of turbot stock state and meet the requirements of Marine Strategy Framework Directive.

The results show that the estimated turbot relative biomass by swept area method ranged between 447.4 and 1966.2 t, at the average 1140.16 t, showing decreasing trend since 2008. In 2012, the level of the relative biomass index is critically low, compared to the previous years. Similar trends were observed in abundance and density indices.

Size structure of turbot population was negatively impacted by the fisheries and the abundance of size groups between 48 and 55 cm, which compose predominantly the spawning stock, was very low in 2012. The mean length of the individuals caught was used as indicator of demographic structure of turbot population compared to the reference value, estimated for the period, when the stock was in good state. Analysis showed that the mean lengths decreased since 2010, combined with negative alterations in age structure and turbot stock was classified as in not good condition.

Turbot stock in Black Sea is subject of special concern at national and European community levels and variety of technical and management measures were introduced. But despite of EU introduced quotas and measures in force, significant improvement in state of turbot stock in front of the Bulgarian coast was not observed. For the recovery of turbot population, additional reduction of fishing pressure and conservation activities are necessary, in order to ensure species successful reproduction and stock revival.

B24009

TRENDS IN THE BLACK SEA TURBOT POPULATION STATUS IN SEVASTOPOL AREA (1998 – 2013)

Vitaly Giragosov[1, a], Antonina Khanaychenko[1, b], Dmitry Smirnov[1]

[1]A.O.Kovalevsky Institute of Biology of the Southern Seas National Academy of Sciences of Ukraine, 2 Nakhimov avenue, 99011 Sevastopol Ukraine

[a]vitaly.giragosov@gmail.com, [b]a.khanaychenko@gmail.com

Keywords: Black Sea, turbot, Sevastopol area, population status

Black Sea Turbot (BST), one of the largest fish valuable for Ukrainian fishery occurred in grouped local shoals over continental shelf of the Black Sea up to 110 m depths. State-of-art of the adult BST being the top piscivore predator reflects the combined effect of numerous drivers impacting its population, i.e. fishery pressure, state of feeding and spawning grounds, habitat status, pollution (including POPs and DDT, Malakhova et al., 2008) and vulnerability of planktonic food chain. Comparison of historical (over the period 1998 - 2010)(Giragosov, Khanaychenko, 2012) and new (2012 – 2013) field data on biological and morphological analysis, norm and abnormalities in pigmentation and skeleton of 2805 specimens from BST spawning wild stock collected during scientific monitoring from Sevastopol area (S-W Crimean shelf) at the depths 25 – 95 m (mainly, 75 – 95 m) during its spawning period (April – June) resulted in integrated view of BST population dynamics under the fluctuating changes in the Black Sea S-W Crimean shelf communities.

General trend for decrease in standard body length (SL) and total weight (W) of BST caught by gill-nets in Sevastopol area was observed from 1998 to 2008. The lowest average parameters for males (SL = 38.2 cm and W = 1.83 kg) were registered in 2007, and for females (SL = 44.4 cm and W = 3.21 kg) in 2008. The trend for increase SL and W was observed in 2009 – 2013. The maximum average values of these parameters during this period were registered in 2012: 41.6 cm and 2.36 kg for males and 51.1 cm and 5.23 kg for females, while in 2013 SL and W decreased to 39.4 cm and 1.95 kg for males being relatively constant for females. Increase in SL and W of BST from gill-net catches in 2009 – 2013 could be considered the positive tendency in rehabilitation of BST forage resources. Increase of the relative female number in catches – up to 36% in 2013 in comparison with the mean female percentage – 17% – during 1999 – 2012 should positively affect the reproductive potential of BST spawning population.

Still, analysis of relative catches (RC = total number and total weight of specimens per 1000 m of gill-net per fishing day) revealed the decrease of BST stock in Sevastopol area that could result possibly, from its low health status observed earlier (Khanaychenko et al., 2012) and undoubtedly from negative impact of fishery pressure. Over a period 2007 – 2013 maximum RC (4.0 specimens and 9.4 kg) was registered in 2009, and it decreased to minimum 0.6 sps and 1.8 kg in 2013 when in fact fishing of BST in Sevastopol area became unprofitable.

B24011

INITIAL ASSESSMENT OF THE PHYSICAL PRESSURE FROM COMMERCIAL FISHERIES ON THE SEAFLOOR IN THE BULGARIAN BLACK SEA

Valentina Todorova[1, a], Marina Panayotova[1, b], Lyubomir Dimitrov[1, c], Bogdan Prodanov[1, d], Iliyan Kotsev[1, e]

[1]Institute of Oceanology "Fridtjof Nansen", Bulgarian Academy of Sciences, complex "Asparuhovo", No 40 Parvy may str., Varna, Bulgaria

[a]vtodorova@io-bas.bg, [b]mpanayotova@io-bas.bg, [c]geos@io-bas.bg, [d]bprodanov@io-bas.bg, [e]ikotsev@io-bas.bg

Keywords: MSFD, seafloor integrity, physical damage, commercial trawling

The current study presents the first quantitative evaluation of the trawling pressure on the seabed in the Bulgarian Black Sea. It was carried out in fulfillment of the obligations under the Marine Strategy Framework Directive to estimate the Sea-floor integrity (Descriptor 6) and the Physical damage (Descriptor 6.1), in particular from abrasion, as part of the initial assessment of the marine environmental status.

The trawling pressure within the Bulgarian Black Sea was assessed using the statistical data from the vessel monitoring system (VMS) for 2011, provided by the National Agency for Fisheries and Aquaculture. The trawling routes were filtered from the VMS dataset using criteria such as speed, course and length of vessel trajectory. The length of the trawling routes was calculated and visualized spatially in GIS environment. A coefficient k was introduced for quantification of the trawling pressure, representing the ratio between the total trawling routes length within a given assessment area and the seafloor surface of the area in question. The extent of the trawling pressure was evaluated for different substrate types – mussel beds (biogenic substrate), sand, mud and shelly bottom, as well as in relation to six assessment areas – shallow sublittoral (down to 20 m depth), northern, central and southern shelf (20 – 100 m depth), peripheral shelf (100 – 150 m depth) and deep-water basin. The results demonstrated varied magnitude of the trawling-related pressure within the Bulgarian EEZ with the highest levels on shelly bottom and in mussel beds at the southern (k = 2.02) and central (k = 1.83) shelf zones. Based on expert judgment, boundary values for k were proposed to differentiate high, moderate and low trawling pressure. The analyses of the VMS data demonstrated that in 2011, despite the legal ban of mobile bottom fishing gear, 23.4% of the Bulgarian Black Sea shelf down to 100 m was subjected to high pressure from trawling (k = 4.5). Increasing trends in the trawling pressure are expected until 2020 in view of the lifted ban for use of beam trawls in 2012.

A11002

FIRST HIGH-RESOLUTION MARINOPALYNOLOGICAL STRATIGRAPHY OF LATE QUATERNARY SEDIMENTS FROM THE CENTRAL PART OF THE BULGARIAN BLACK SEA AREA

Mariana Filipova-Marinova[1, 2, a], Danail Pavlov[2, b], Marco Coolen[3, c], Liviu Giosan[3, d]

[1]Museum of Natural History Varna, 41 Maria Louisa Blvd., 9000 Varna, Bulgaria
[2]Society of Innovative Ecologists of Bulgaria, 1 Silistra Str., 9010 Varna, Bulgaria
[3]Woods Hole Oceanographic Institution, 360 Woods Hole Rd., MA 02543, USA

[a]marianafilipova@yahoo.com, [b]danailpavlov@gmail.com, [c]mcoolen@whoi.edu, [d]lgiosan@whoi.edu

Keywords: Palaeoecology, Vegetation history, Climate changes, Palaeohydrological changes

Spores, pollen and dinoflagellate cysts of Late Pleistocene and Holocene sediments were analyzed from Giant Gravity Core 18 from the Black Sea continental slope, recovered from a water depth of 971 m. The investigated length of the core is 203.5 cm. It includes 3 lithological units: light grey clay, sapropels and coccolith-bearing ooze. The core was sampled at 5 – 10 cm intervals. Sampling of the interval 141.5 – 126 cm was carried out at every cm. AMS radiocarbon dating of bulk organic carbon was performed on 18 selected sediment layers. This chronological data allowed the first high-resolution pollen stratigraphy of Late Quaternary sediments from the western Black Sea area to be presented. The percentage spore-pollen diagram is divided into 6 local pollen assemblage zones. The trends in the vegetation dynamics and climate changes and the early history of migration of the majority of the arboreal taxa that nowadays occur in the Eastern Balkan Range were traced out. The palynological record suggests that open oak forests were spread in the Eastern Balkan Range at the beginning of the Holocene and shows early migration of the major temperate arboreal species such as Quercus, Ulmus, Tilia and Carpinus betulus. This vegetation palaeosuccession continues with the spreading of mixed oak forests from 8950 until 2620 cal. BP (8650 ± 40 until 3120 ± 35 14C BP) followed by destructive changes due to human impact and climate deterioration. A cooling of Holocene climate that is well known in the North Atlantic region as the "8200 yrs cold event" is identified for the first time in marine records from the Bulgarian Black Sea area. The assemblages of dinoflagellate cysts and acritarchs were investigated to provide a reconstruction of surface seawater salinity and surface seawater temperature changes. Two main dinoflagellate cyst assemblages, one dominated by fresh- to brackish water species such as Spiniferites cruciformis and Pyxidinopsis psilata and a subsequent one, that is characterized by euryhaline marine Mediterranean species such as Lingulodinium machaerophorum, Spiniferites belerius, Spiniferites bentorii, Operculodinium centrocarpum and acritarchs Cymatiosphaera globulosa testified a change in SSS from low salinity (< 7‰) to present day conditions after 7990 cal. BP. Substantial freshening of Black Sea surface waters at 2570 cal. BP is established and connected with the transition from a relatively dry and warm to relatively cold and wet climate.

A13005

NEW ANALYSIS OF TIDE GAUGES DAILY TIME SERIES FOR VARNA AND BURGAS SPANNING 1928-2006

Tassi Belyashki[1], Ivan Georgiev[1], Anton Ivanov[1, a], Radost Pachalieva[1]

[1]National Institute of Geophysics, Geodesy and Geography, Bulgarian Academy of Sciences, Sofia 1113, Acad. G. Bonchev Str. Bl. 3

[a]ivan@bas.bg1

Keywords: tide gauges, time series analysis, mean sea level

Time series of daily sea level registration data from Varna and Burgas tide gauge stations spanning 1928 – 2006 are analyzed. First, the data are corrected for the local vertical crustal motions by removing from the registration the subsidence of the tide gaude staffs. The vertical motions are obtained by repeated (every year) leveling from control benchmarks outside the local area to the tide gauge staffs. For the whole period of the tide gauge registrations there is a clear tendency for tide gauge staffs subsidence. The obtained time series are analyzed to remove the seasonal components. Finally, a new multi-year solution for the sea level trends for Varna and Burgas are calculated.

A11032

LEVIGATES IONS SEPARATION BY SORBTION-FLOTATION

Carolina Constantin[1], Ligia Stoica[1]

[1]University POLITEHNICA of Bucharest, Faculty of Applied Chemistry and Materials Science, Bucharest, Romania

Keywords: levigates, wastewater, depollution, separation, sorbtion-flotation

The levigates represent a category of liquid mediums with a complex composition and majority of pollutant species concentration were more than assessed limits by Romanian legislation.

Selection of levigates treatment technologies are in view both speciation composition and cost of these application[1]. For this reason were studied the possibility of N-NO_3^-, N-NH_4^+ and P-PO_4^{-3} removal by sorbtion-decantation-flotation (ADF) in two variant of adsorptive material formation:

1. „in situ" (obtained of adsorptive material in liquid medium);
2. adsorption on solid material with adsorbing properties.

For flotation process was selected DAF technique-microbubbles generated with controled diameter and possibility to apply in industrial scale2.

Systematic research followed to establish the operational parameters (adsorption time, molar ratio adsorptive material-pollutant, contact time, pH etc) and after that will be establish the optimum separation parameters3. With these parameters were proposed the process scheme ADF available for R.A.G.C. Targoviste-South Wastewater Treatment Plant. The remanent concentration of all ions after ADF were framed in assessed limits by Romanian legislation.

A12006

POPULATIONS OF HETEROTROPHIC DINOFLAGELLATE NOCTILUCA SCINTILLANS IN THE BLACK SEA AND THE NORTHERN ADRIATIC SEA

Alexander S. Mikaelyan[1], Alenka Malej[2], Tamara A. Shiganova[1], Valentina Turk[2], Anastasia E. Sivkovitch[1], Eteri I. Musaeva[1], Tjasa Kogovsek[2], Taisia A. Lukasheva[3]

[1]Institute of Oceanology RAS, Nakhimovsky prosp., 36, Moscow, 117997, Russia
[2]Marine Biological Station Piran, Fornace 41, 6330, Piran, Slovenia
[3]Southern Branch of P.P.Shirshov Institute of Oceanology RAS, Prospornaya str. 1, Gelendzhik, 353470, Russia

Keywords: ***Noctiluca scintillans, seasonal dynamics, inter-annual changes, feeding, wind, northern Adriatic, Black Sea***

Comparative analysis of the 'red tide' producing dinoflagellate *Noctiluca scintillans* (hereafter *Noctiluca*) scintillans from the northeastern-central part of the Black Sea and the northern Adriatic Sea has been performed. In both seas samples were collected in near-shore waters 2-3 times per month during 2004 – 2012. For analysis of feeding activities and seasonal dynamics additional data on the open waters of the Black Sea have been used. Comparison between two populations shows similarity in size structure with two classes 400-500 μm and 500-600 μm being the most numerous. The general pattern of seasonal changes in *Noctiluca* abundance in the Black Sea and in the Adriatic Sea is described as a regular annual maximum which is occurs in spring - early summer and additional sporadic peaks appearing in other seasons. In spring the average number of the food vacuoles in the cell (1.78) and the proportion of feeding cells in populations (79%) in the Adriatic Sea were similar to those in the Black Sea (1.58 and 76%). In September-October, these parameters were lower both in the Adriatic Sea (0.69 and 49%) and in the Black Sea (1.46 and 65%) demonstrated that *Noctiluca* was better provided with food in spring. The interannual variations in both areas during 2004 – 2012 did not coincide completely showing more years with high *Noctiluca* abundance in the northern Adriatic compared with the Black Sea. Among all biotic parameters (phytoplankton biomass, chlorophyll a, zooplankton species) only the concentration of eggs of *Calanus euxinus* was well positively correlated with abundance of *Noctiluca* in the open waters of the Black Sea. An obvious negative relationship was observed between the *Noctiluca* cell number in the peak period and wind velocity in both seas. The most strong negative correlation was observed between the number of windy hours per month and the cell concentrations in the Black Sea ($r = -0.92$) and in the northern Adriatic Sea ($r = -0.67$). On this basis, a new hypothesis has been proposed: due to particularities of food behavior of Noctiluca, its mass developments during the peak period are controlled by the wind. Close relationship was also observed between the number of *Noctiluca* in the peak period and its quantity in the preceding months in both seas.

A12012

PERSPECTIVES IN APPLICATION OF REMOTE SENSING AND ECOSYSTEM MODELS FOR ECOSYSTEM STATE ASSESSMENT IN LINE WITH MSFD

T. Churilova[1, a], Z. Finenko[1], O. Kryvenko[1], G. Korotaev[2], V. Suslin[2, b], V. Dorofeev[2], A. Kubryakov[2]

[1]Institute of Biology of the Southern Seas of National Academy of Sciences of Ukraine, 2 Nakhimov Ave., Sevastopol, 99011 Ukraine;
[2]Marine Hydrophysical Institute of National Academy of Sciences of Ukraine, 2 Kapitanskaya Str., Sevastopol, Ukraine, 99011;

[a]tanya.churilova@gmail.com, [b]slava.suslin@gmail.com ,

Keywords: MSFD, descriptors, indicators, regional algorithms, remote sensing and ecosystem models, operative mode

Following European marine policy outlined in the Marine Strategy Framework Directive (MSFD, 2008) Good Environmental Status (GES), which should be achieved by 2020, is described by eleven descriptors. Satellite optical sensors information gives new opportunities in assessment of GES because provide relevant information at spatial and temporal scales, which could not be realized by traditional in situ monitoring system. Application of this innovative approach requires set of regional algorithms based on bio-optical peculiarities and photo-physiological characteristics of the Black Sea, which transform correctly optical information of satellite sensors into ecological features: chlorophyll a, phytoplankton biomass, size structure of phytoplankton (PSD/PFT), waters transparency, suspended and dissolved organic matter light absorption coefficient, total primary production (PP) and new PP. For the first GES descriptor Biodiversity (D1) waters transparency and light conditions could be considered as indicators of habitat condition. Size structure of phytoplankton, coccolithophores bloom intensity and area extension are significant indicators of D1. Phytoplankton biomass, total PP and f-ratio (as part of new in total PP) could be considered as meaningful indicators related to Food Webs (D4). The f-ratio provides additional information on downward organic matter flux. The later is related for Eutrophication (D5) and Sea Floor integrity (D6) descriptors as well. For the Black Sea as key indicators of D4 could be considered Mnemiopsis leidyi biomass and fodder/jelly zooplankton ratio simulated by ecosystem dynamics model. As indicators of D5 could be used water transparency, chlorophyll a concentration in surface layer, which allow to assess frequency, intensity and area extent of phytoplankton bloom in “hot” spots. Estimation of near bottom light intensity and spectral features could be applicable for assessment of environment condition for benthic flora; which is related to the D6. Satellite-tracking of oil plumes (spills appearance, area size, spatial location and dynamics) is directly related to the Contaminants descriptor (D8). The regional models could be applied for express assessment of the indicators relevant to D1, D4, D5, D6, D8. The application of recent advance of modelling allows to monitor variability of indicators on different temporal and spatial scales in operative mode, which provide necessary information to reveal reference level of indicators, to define target and operative measures and follow up to feedback of ecosystem on management.

A12013

MODELING BIOGEOCHEMISTRY OF THE SEDIMENT WATER INTERFACE: ROLE OF REDOX CONDITIONS CHANGES

Evgeniy Yakushev[1]

[1]*Norwegian Institute for Ware Research, Oslo, Norway*

Keywords: ***modelling, biogeochemistry, eutrophication, oxygen depletion, sediment water interface***

Climate Change affects oxygen depletion and leads to spreading of the bottom areas with hypoxic and anoxic conditions in the coastal areas of the seas and inland waters. This work aimed in estimation of a role of changes of redox conditions in the biogeochemical structure there.

We use a 1-dimensional C-N-P-Si-O-S-Mn-Fe vertical transport-reaction model describing the water column, bottom boundary layer and benthic boundary layer with biogeochemical block simulating redox conditions changeability. A biogeochemical block is based on ROLM (RedOx Layer Model), that was constructed to simulate basic features of the water column biogeochemical structure changes in oxic, anoxic and changeable conditions (Yakushev et al., 2007). Organic matter (OM) formation and decay, reduction and oxidation of species of nitrogen, sulfur, manganese, iron, and the transformation of phosphorus species are parameterized in the model. ROLM includes a simplified ecological model with phytoplankton, heterotrophic organisms, aerobic autotrophic and heterotrophic bacteria, anaerobic autotrophic and heterotrophic bacteria. We simulate changes in the parameters distributions and fluxes connected with the vertical displacement of redox interface from the sediments to the water.

Model demonstrates that:

- Seasonality in production and destruction of OM together with seasonal mixing can lead to redox conditions variations in the bottom boundary layer.
- Bacteria play a significant role in the fate of OM due to chemosynthesis (autotrophs) and comsumption of DOM (heterotrophs).
- Changes in the bottom boundary layer redox conditions affect distribution of nutrients (N and P), redox metals (Mn and Fe) and carbonate system parameters; determine magnitudes and directions of fluxes.

Model can be used for analysing and interpreting of data on sediment-water exchange and estimating consequences of forcing (i.e. eutrophication, climate connected mixing).

ACHIEVING MARINE RESOURCES AND ECOSYSTEM MANAGEMENT AND SUSTAINABILITY

B24013

THE BLACK SEA FISHING FLEET: AN ASSESSMENT

Aleksandar Shivarov[1, a]

[1]*Black Sea NGO Network, PO Box 91, 9000 Varna, Bulgaria*

[a]*a.shivarov@ue-varna.bg*

Keywords: Black Sea, fishing fleet, employment, economic indicators

The development of the Black Sea fisheries has received substantial attention since the crash of 1989 – 1991. While this remains a closely monitored subject both at national and international level, there is less information about the state of the fishing fleet based in the coastal countries.

The paper makes an attempt to describe the contemporary state of the fishing fleets of Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine as the main factor for pressure on the marine living resources. The quality of the available data varies widely from country to country. Bulgaria and Romania have largely brought in line their statistical systems with the requirements of the European Union. Turkey publishes data about the fishery sector on a regular basis yet uses its own classification criteria. The information about the state of the Ukrainian fleet remains sporadic and the data on the Russian Black Sea fleet is even more patchy. Finally, data on Georgian vessels and fishing industry is available only from primary research.

The aim of the paper is to summarize the available information on the number of vessels, their main characteristics as size, tonnage, power, gear type. An important feature of the industry is the employment it generates and its role in the local communities. Where available, the economic indicators of the sector, such as value of landings, subsides and links to other sectors, are discussed.

The regional picture of the fishing fleet in the Black Sea may serve as a contribution in the efforts to find a sustainable solution for the management of the marine living resources.

B24017

COMPREHENSIVE SOCIOECONOMIC DATA COLLECTION FOR THE IONIAN SEA AND ROMANIAN COASTS FISHERIES

K. Kapiris[1, a], A. Conides[1, b], G. Christides[1, c], A. Dogrammatzi[1, d], D. Klaoudatos[1, e], G. Radu[2, f], V. Maximov[2, g], E. Anton[2, h], T. Zaharia[2, i]

[1]Hellenic Centre of Marine Research, Institute of Marine Biological Resources and Inland Waters, 46,7 km Athens-Sounio, P.O.Box 712, 19013, Anavissos, Greece
[2]NIRDEP-National Institute for Marine Research and Development "Grigore Antipa", Constantza, Romania

[a]kkapir@hcmr.gr, [b]conides@hcmr.gr, [c]gorge@hcmr.gr. [d]dogrammatzi@hcmr.gr, [e]dklaoudatos@hcmr.gr, [f]radu@alpha.rmri.ro, [g]vmaximov@alpha.rmri.ro, [h]eanton@alpha.rmri.ro, [i]tzaharia@alpha.rmri.ro

Keywords: socioeconomic data, fishery, Ionian, Romanian coasts, Black Sea

In this study the results of two surveys conducted in the Ionian Sea (Greece) and the Romanian coast of the Black Sea related to the socio-economic dimensions of fishery in both regions are presented. The data were collected through interviews from the local fishermen of coastal and middle fishery, using the almost same questions. During the last years an almost stable fishery production is presented in the Ionian Sea, despite the gradual reduction of fleet, while in the Romanian coasts the total catch in the last years (2000 – 2011) has been dramatically decreased. During the last years (1990 – 2012) the total fishing effort presents a slight reduction in the Ionian Sea and the small scale fishery in the Romanian coasts of Black Sea has been decreased gradually also. The owners of the boats in the Ionian Sea ranged from 1 (75%) to 3 (8, 33%), their mean age ranged from 35-50 yrs and their educational level is mostly of elementary or high school level. The 70% of the vessels in the same area is employing fishermen (1 ? 9 persons), while in the Romanian coasts the number of the owners was 79 (2012) and, most of them employed 5-6 fishermen/boat. The fishery time at sea increased in the Romanian coasts by around 75% (2008-2010), while the total fishing days remained stable during the same period. According to the Greek data, the mean daily fishing time is 13,74 ± 4,22 hours/day. The fishery time of the trawlers and purse seines can be up to 24 hours daily. The most commercially important species in the Greek fishery of the Ionian Sea are anchovy, sole, bogue, mullets, while in the other study area are rapana, sprat, turbot, anchovy, horse mackerel and gobies. A great proportion of the Greek coastal fishermen (33,4%) supplement their income from a secondary occupation, like agriculture, fish shop, tourism The total amount of income generated by the Romanian national fleet decreased in the period 2008 – 2010 and increased in 2011 consisted solely of income from landings The mean price of the costs increase from the small scale to the middle fishery. In both countries the most expenditure items are the fuels and the wages. The collection of socioeconomic fishery data is necessary for the establishment of a consistent monitoring, control and enforcement management system.

C36008

POLYCHLORINATED BIPHENYLS IN FISH FROM BLACK SEA

Mona Stancheva[1], Lubomir Makedonski[1], Stanislava Georgieva[1, a]

[1]Medical University - Varna, Marin Drinov 55, 9002 Varna, Bulgaria

[a]stanislavavn@mail.bg

Keywords: PCB, fish, Black Sea, Bulgaria

Polychlorinated biphenyls (PCBs) are characterized by high lipophilicity and persistence in the environment and will therefore bioaccumulate and biomagnify in the food chain. PCBs were determined in muscle tissue of ten marine fish species: goby (Neogobius cephalargoides), sprat (Sprattus sprattus sulinus), grey mullet (Mugil cephalus), horse mackerel (Trachurus Mediterraneus ponticus), shad (Alosa pontica pontica), bluefish (Pomatomus saltatrix), bonito (Sarda sarda), garfish (Belone belone), turbot (Psetta maxima) and red mullet (Mullus barbatus). Samples were collected from different parts of Bulgarian Black Sea coast during 2007 – 2011. The PCBs were analyzed in order to evaluate the status of pollution in Bulgarian Black Sea coastal area.

The fifteen congeners of PCBs were determined by capillary gas chromatography – mass spectrometry. The quality control was performed by regular analyses of certified reference material BB350 (PCBs in Fish oil). Experimental results were shown by fish species, by year and by sampling sites.

PCBs (calculated as the sum of 15 PCB congeners) were found in all fish species at concentrations ranging between 134 ng/g lw (lipid weight) and 572 ng/g lw in bluefish and turbot, respectively. The most abundant PCB congeners in all fish species were the indicator PCBs constituting more than 80% of the total amount of PCBs. The statistical analysis indicated that the differences among mean annual concentrations of ∑PCBs were not statistically significant ($p > 0.05$). The experimental results for ∑PCBs in fish species from different sampling sites showed no significant differences between the Northern, Varna and Southern coast sampling area.

The PCBs in fish from Bulgarian Black Sea coast were found lower to those found in fish species from other investigations about fish species from other marine ecosystems.

C37005

EFFECT OF THE METEOROLOGICAL CONDITIONS IN TWO ECOLOGICAL REGIONS ON COMMON WHEAT DEVELOPMENT AND PRODUCTIVITY

Ivan Yanchev[1], Dafinka Ivanova[2, a], Veselin Ivanov[1]

[1]Agricultural University of Plovdiv, Department of plant Growing1, 12 Mendeleev Str, 4000 Plovdiv

[2]Agricultural University of Plovdiv, Department of Botany and Agrometeorology2, 12 Mendeleev Str, 4000 Plovdiv

[a]dafi_ivanova@yahoo.com

Keywords: ***Meteorological conditions, common wheat, ecological regions***

The experiment was carried out on the Training-and-Experimental fields of the Department of Crop Science at the Agricultural University – Plovdiv and on the experimental field of Agronom Company in the town of Dobrich. The basic meteorological factors affecting the quality and productivity of common wheat were analyzed. The cultivars 'Vyara', 'Factor'and 'Laska', included in the study, were grown after predecessor sunflower, following the standard technology adopted in the country.

The following characteristics were determined: test weight, grain weight, wet gluten yield, crude protein in dry matter, sedimentation number and grain yield in kg/ha. The results showed higher productivity of the cultivars under the conditions of the town of Dobrich, while the quality characteristics varied depending on both the region and the cultivar. 'Vyara' cultivar showed the highest productivity, followed by 'Laska' and 'Factor' cultivars.

C37006

THE EFFECT OF LEAF NUTRITION WITH HORTIGROW ON THE CONTENT, YIELD AND CHEMICAL COMPOSITION OF THE ESSENTIAL OIL FROM COMMON BASIL OF 'TRAKIA' CULTIVAR

Veselin Ivanov[1], Ivan Yanchev[1], Dafinka Ivanova[2, a], Lyudmil Angelov[1], Boyan Stalev[1]

[1]Agricultural University of Plovdiv, Department of plant Growing1, 12 Mendeleev Str, 4000 Plovdiv

[2]Agricultural University of Plovdiv, Department of Botany and Agrometeorology2, 12 Mendeleev Str, 4000 Plovdiv

[a]dafi_ivanova@yahoo.com

Keywords: ***Leaf nutrition, essential oil from common basil***

The aim of the study was to establish the effect of the leaf nutrition with Hortigrow on the content, yield and chemical composition of the essential oil distilled from dry leaf and stems biomass and flower spikes of common basil, 'Trakia' cultivar. The experiment was carried out in the period 2007-2009 on the Training-and-Experimental fields of the Agricultural University – Plovdiv, set by the block plot design in four replications, the plot size being 20 m^2. The following variants were studied: 1) Control; 2) Hortigrow with a N:P:K ratio 30:20:10, microelements MgO, B, Cu, Fe, Mn, Mo, Zn /1% of amino acids/; 3) Hortigrow with a N:P:K ratio 20:20:20; 4) – Hortigrow with a N:P:K ratio 5:50:20, applied three times during the vegetation period before flowering of the second-order branches after basic fertilization with 16 kg/da of nitrogen (applied three times) and irrigation to 80 – 100% of water holding capacity.

The results showed that the application of Hortigrow had a negative effect on the essential oil content. Nevertheless, higher essential oil yields were obtained in the treated variants thanks to the higher yield of dry matter, leading to a higher yield of essential oil per unit of area. Among the studied leaf fertilizers, the highest effect on the essential oil yield during the experimental period was reported in the variant with Hortigrow N:P:K 20:20:20, the yield increase reaching 29.2%.

The major components of the essential oil distilled from dry leaf and stem biomass and flower spikes are linalool, limonene, methyl chavicol and methyl cinnamate. In result of applying Hortigrow, some variations in the content of the essential oil components were established.

C37007

PROPHYLAXIS AND TREATMENT OF STRESS AS AN IMPORTANT FACTOR FOR IMPROVING PUBLIC HEALTH

Sidorenko Ludmila[1, a], Sidorenko Irina[2, b], Sidorenko Svetlana[3, c]

[1]MD, Department of Human Physiology at the State medical University of Moldova "Nicolae Testemitanu", N. Testemitanu Street 27, MD 2027 Chisinau, Republica Moldova
[2]MD, PhD Director of Medical Center of Chinese and European Medicine "Gesundheit", Kogalniceanu 45/2, MD 2009, Chisinau, MOLDOVA
[3]MD, Department of Neurology and Neurosurgery, at the State medical University of Moldova, "Nicolae Testemitanu", str. Korolenco 2, MD 2028, Chisinau, MOLDOVA

[a]lucie1@mail.ru, [b]dr_i_sidorenko@mail.ru, [c]svetlana.sidorenko@yahoo.com

Keywords: ***stress, heart rate variability, individual treatment schemes, general anti-stress treatment***

21-th century is the century of stress. Gigantic amounts of information which are directed to every person cause different vegetative and psychic disorders – consequences of stress. A short term for a big amount of troubled organic functions. So one of the important tasks of public health is to develop effective treatment methods and methods for objective determination.

Aim of our study is to investigate individual reactions on stress in persons of different professions with further working out of effective individual treatment schemes.

Materials and Methods. Our study includes investigation of persons which are under permanent influence of psycho-emotional stress. Conform to the chosen treatment scheme all persons were divided in 2 groups – main group and control group. Both gender were included – male and female, aging 23 – 56 years, with average age of 34 +/- 1,5. In the first group were 102 persons, in the second group – 89. Persons of the main group got individual chosen treatment scheme, including alternative treatment methods, like acupuncture, moxibustion, aromatherapy, music therapy, colour therapy, meridian massage and homeopathy. It was done in medical center of Chinese and European Medicine "Gesundheit". Persons of the control group got standard anti-stress treatment schemes with chemical drugs. They got the treatment at the hospital of neurology and neurosurgery, Moldova. For determining individual initial stress level was investigated heart rate variability (HRV) of every person, its spectral analysis data and time domain analysis. Changes of HRV parameters were also used as an objective comparison of treatment efficiency between both groups. Treatment methods of the main group are considered to be individual because the treatment complex was chosen for every patient on base of HRV analysis, versus the control group where all patients got almost the same anti-stress treatment scheme without regarding the results of individual HRV analysis.

Results and discussion. In the main group we obtained changes in the time domain and frequency domain of HRV which indicated a rising HRV level after treatment. This is a positive predictive factor. Increase of HRV was observed in 94 of 102 persons of the main group, with a statistical significance of $p \leq 0{,}0001$. In 8 of 102 persons HRV remained at the same level, $p \leq 0{,}001$. No cases were observed with decreased HRV after treatment. In the control group was

observed an increase of HRV in 11 cases out of 89 ($p \leq 0,05$), decrease in HRV – in 26 cases ($p \leq 0,001$), HRV remained without any significant changes in 52 of 89 cases. In the control group was an often side effect – depression in 24 cases out of 89 ($p \leq 0,001$) in the end of treatment or as one of manifestation of rebound-effect.

Conclusion. Results of our study show that individual chosen complex treatment, regarding initial individual vegetative status is more effective than without regarding of it just using general standard anti-stress schemes.

B24018

THE DISCRIMINATION OF ANCHOVY (ENGRAULIS ENCRASICOLUS, LINNAEUS 1758) FORMS FOUND IN THE BLACK SEA

Ezgi Sahin[1, a], Ali Cemal Gucu[1]

[1]Institute of Marine Sciences, Middle East Technical University, P.O. Box 28, Erdemli 33731, Mersin – TURKEY

[a]ezgisahin@ims.metu.edu.tr

Keywords: ***Black Sea anchovy, Azov anchovy, length-weight relationship, growth pattern, otolith shape, otolith morphology, condition factor***

In the Black Sea, according to most authors, the anchovy population is represented by at least two different stocks displaying two isolated spawning and nursery areas with some overlap in the overwintering grounds. The Black Sea anchovy mainly occupies the north-western shelf of the Black Sea whilst the Azov anchovy inhabits the Azov Sea. During the winter months both stocks migrate south .In addition, egg and larval surveys carried out earlier in the Black Sea indicated the possibility of a further non-migrating local stock in the southern Black Sea. These stocks exhibit differences in growth rates, otolith width / length ratios, parasitism rates, blood groups and some genetic sequences. In this study, we used the following assumptions according to widely accepted description, (1) the Black Sea anchovy is slightly longer but thinner than the Azov anchovy. Therefore, one may expect significant differences in the weight-length relationship and that the slope (b) of the logarithmic regression, should be higher for the Azov anchovy; ii) the diverse ecological conditions in the distinct nursery areas (NW shelf, Azov and Anatolian coasts). These geographical differences would naturally lead to variations in both spawning times and larval growth rates eventually being reflected in the size distribution of the juveniles when they arrive at the overwintering grounds. It was therefore assumed that the 0 year class anchovies arriving from the NW shelf and Sea of Azov (and those which do not migrate) should display normal size distributions with significantly different means and standard deviations; iii) the differences in both the nutritional conditions of the distinct nursery areas and the distances between nursery and overwintering ground (short for Azov, long for NW shelf and none for resident anchovies) should cause variation in the somatic condition of the 0 year class anchovies when they settle in the overwintering grounds. Based on these assumptions 0 year class anchovies sampled at 55 different pelagic trawl stations on the Turkish coast during two successive overwintering periods (2011 and 2012) were analyzed biometrically. In addition, the fish otoliths were compared morphometrically. The results indicated that different forms of anchovies with respect to their otolith condition, morphometry, allometry, somatic condition and size do exist along the Anatolian coast during the overwintering period. Yet, no sign of geographical preference leading to isolation among these forms could be found.

B24016

A REVIEW OF THE PARASITIC FAUNA OF TRACHURUS TRACHURUS AND T. MEDITERRANEUS IN THE MEDITERRANEAN AND BLACK SEA: COULD THIS INDICATOR USED FOR THEIR STOCK RECOGNITION?

K. Kapiris[1, a], A. Mannini[2, b], I. Maina[1, c]

[1]Hellenic Centre of Marine Research, Institute of Marine Biological Resources and Inland Waters, 46,7 km Athens-Sounio, P.O.Box 712, 19013, Anavissos, Greece
[2]Università di Genova - DISTAV (ex DIPTERIS) V.le Benedetto XV, 3 16132 Genova

[a]kkapir@hcmr.gr, [b]Alessandro.Mannini@unige.it, [c]imaina@hcmr.gr

Keywords: parasites, T. trachurus, T. mediterraneus, stock identification

Stock identification is an integral component of modern fisheries assessments, fisheries management and the management of endangered species. Parasites are used as indicators for fish stock recognition of several aspects of the fish biology and ecology such as growth, recruitment, natural mortality, fishing mortality and migratory behaviour.

The genus *Trachurus* (Carangidae) is represented from three species in the European waters: *T. trachurus*, *T. mediterraneus* and *T. picturatus*. The commercial species horse mackerel (*T. trachurus*) is commonly found in W. Africa, N. Sea, and Mediterranean Sea. The Mediterranean horse mackerel (*T. mediterraneus*) can be found in the E. Atlantic and the Mediterranean Sea. Both small pelagic fishes play an important role in terms of energy flow from planktonic organisms to higher predators in the food webs which they inhabit and, thus, their parasites could be used as biological tags in informing multidisciplinary studies on their stock identity. The aim of the present study is a review synopsis of the parasitic studies obtained in both carangids in all the GFCM-GSAs which could offer a valuable tool for their stock identification, among the other techniques, in the Mediterranean and Black Seas

For *T. trachurus* and *T. mediterraneus* 82 and 21 different cases of parasites have been reported in the literature found in the study areas, respectively. Most of the parasites (40 and 7 cases, for *T. trachurus* and *T. mediterraneus,* respectively) belonged to Nematoda (all in Anisakidae family), while a smaller number included to Platyhelminthes (14 and 7 cases), Arthropoda (13 and 4 cases), Myxozoa (11 and 3 cases) and one species belonged to Foraminifera, and Protobacteria. All the parasites found in the whole Mediterranean and Black Sea, but Nematoda (*Anisakis* sp.) and Platyhelminthes were more frequent in the western and central part. *Anisakis* is common in commercially important marine fishes and its presence is of great concern for both human health and economic reasons. The above results could suggest the hypothesis of some migration of both carangids from the Atlantic into the W. and C. Mediterranean Sea, representing possible different stocks that must be approach by other techniques (allozymes, SSCP, otholits) within the same project

B22006

SEAGRASS HABITATS DISTRIBUTION AND ECOLOGICAL STATE ALONG THE SOUTHERN BULGARIAN BLACK SEA COAST

Diana Deyanova[1, a], Dimitar Berov[1, b], Ventzislav Karamfilov[1, c]

[1]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Street, 1113 Sofia, Bulgaria

[a]diana_deyanova@yahoo.com, [b]dimitar.berov@gmail.com, [c]karamfilov.v@gmail.com

Keywords: seagrass habitats, Zostera spp., benthic mapping, GES, community structure

Seagrasses habitats are an important feature of shallow coastal ecosystems. Distributed worldwide they provide shelter and living resources for many invertebrate and fish species. By supporting higher biodiversity and preventing coastal erosion seagrass meadows play a significant role in the establishment and maintenance of the good environmental status of coastal marine environments.

Widely distributed along the Bulgarian Black Sea coast in the past, seagrass meadows dominated by *Zostera* spp are under decline in response to various anthropogenic pressures such as eutrophication, pollution and physical disturbance. Their modern distribution and state is not well studied. The present study aims on mapping of the seagrass meadows along the Southern Bulgarian Black Sea coast. A case study in the Sozopol Bay, where the influence of a local eutrophication gradient on *Zostera spp*. habitats was also assessed. Satellite and aerial images of the studied meadows were groung-truthed using georeferenced underwater photography methods. Destructive samples were also collected for the determination of species composition and quantities.

Eight meadows were mapped along the South coast of the Burgas Bay with a total area of approx. 89 ha. Several potential areas with an app. area of 200 ha were also outlined based on satellite images. Five species of angiosperms were found in the study areas – 3 true seagrasses – *Zostera marina*, *Zostera noltii* and *Ruppia maritima* and 2 freshwater species – *Zannichellia palustris* and *Potamogeton pectinatus*. They formed mixed communities with a well-defined depth structure where *Z. noltii* and *Z. palustris* were dominant down to 4.0 m and *Z.marina* – from 4.5 m down to the limit of distribution – 6.0 – 6.5 m. Mat forming algae (mainly *Cladophora* spp) and epiphytes formed a significant part of the community biomass in more eutrophicated areas. *Z. marina* dry biomass ranged from 48.24 to 264.12 $g.m^{-2}$ and shoot density from 128 to 478 $sh.m^{-2}$. *Z. noltii* had biomass in the range 63.33 – 149.75 $g.m^{-2}$ and shoot density between 316 $sh.m^{-2}$ and 1720 $sh.m^{-2}$. Calculations based on the areas of verified and prospective seagrass meadows provide information that more than 90% of the habitats along the Bulgarian Black Sea coast are located within the large Burgas Bay. Most of the studied habitats met the preliminary criteria for GES of seagrass meadows in Bulgarian Black Sea coastal ecosystems (total cover, shoot density, biomass, depth limit) with exception of the area of Otmanli Bay where seagrass habitats appeared to be significantly deteriorated.

B24005

COMPARATIVE STUDY OF THE CHEMICAL COMPOSITION OF BLACK SEA CHAETOMORPHA LINUM AND CYSTOSEIRA CRINITA

Veselina Panayotova[1, a], Mona Stancheva[1, b]

[1]Deparment of Chemistry, Medical University of Varna, 55 Marin Drinov str, 9002, Varna, Bulgaria

[a]veselina.ivanova@hotmail.com, [b]mona_stancheva@abv.bg

Keywords: macroalgae, Black Sea, fatty acids, pigments, vitamins

Green alga Chaetomorpha linum and brown alga Cystoseira crinita are widely distributed in the Black Sea. There is limited information about chemical composition of these species from the Bulgarian Black Sea coast. Total lipids, fatty acid composition, pigments, and fat soluble vitamin contents were investigated. Fat soluble vitamins (vitamin E and D), pigments (β-carotene and astaxanthin) and total cholesterol were analyzed simultaneously using HPLC/UV/FL system equipped with RP analytical column. Sample preparation procedure includes alkaline saponification, followed by liquid-liquid extraction. Generally, brown seaweeds Cystoseira crinita showed higher amounts of α-tocopherol, β-carotene, astaxanthin compared to green seaweed samples. Lipids were extracted by following the method of Bligh and Dyer. The residual lipid fraction was methylated using base-catalyzed transmethylation with methanolic potassium hydroxide. Fatty acid composition was analyzed by GC/MS. Although total lipid content was generally low, Cystoseira crinita was rich in eicosopentaenoic acid (C20:5n3) and oleic acid (C18:1n9), whereas Chaetomorpha linum – in linoleic acid (C18:2n6). Palmitic acid was the most abundant in both algae species. The obtained data showed that green algae Chaetomorpha linum have higher concentrations of PUFA, although they showed lower n-3 PUFA content. Both algae species investigated presented healthy Σn-6/Σn-3 and PUFA/saturated fatty acid ratios, which are within the WHO prescribed standards. In conclusion, macroalgae can be considered as a potential source for large-scale production of essential PUFA, α-tocopherol and β-carotene with wide applications in the nutraceutical, pharmacological industries and cosmetics.

B24004

THE INFLUENCE OF ENVIRONMENTAL FACTORS ON THE ECO-PHYSIOLOGICAL CONDITION OF MYTILUS GALLOPROVINCIALIS FROM THE ROMANIAN BLACK SEA COAST

Daniela Rosioru[1, a]

[1]*National Institute for Marine Research and Development "Grigore Antipa", 300 Mamaia Blvd., RO-900581, Constanţa, Romania.*

[a]*drosioru@alpha.rmri.ro*

Keywords: ***Mytilus galloprovincialis, Black Sea coast, laboratory conditions, salinity, temperature***

The mussel *Mytilus galloprovincialis* is a widespread commercially valuable species of the Black Sea with a very good capacity of adaptation and resistance to large fluctuations in environmental factors, especially salinity. The field observations since last 5 years indicated that mussel populations in the Romanian Black Sea coast have declined due to the anthropogenic impact and extreme natural phenomena (e.g. high temperatures during the summer and freezing temperatures during the winter).

I investigated the response of young and adult mussels under laboratory conditions to changes in salinity and temperature. Mussels collected from shallow waters of the Romanian Black Sea coast which are less affected by anthropogenic impact were used in the experiment. Prior to the experiments the mussels were acclimated for one week in natural seawater at salinity of 15.1 – 16.4‰. The first set of experiments consisted in maintaining the young and adult mussels placed in containers filled with seawater during 15 days at lower salinities of 10‰ (Variant 1), 8‰ (Variant 2), and 6‰ (Variant 3) at constant temperature. In a second set of experiments I increased progresively the temperature till 30°C for 9 days.

At salinities below 8‰ the mussels stop filtration of water and tightly closed their shell valves. The ability to attach by byssus to substrat decreases drastically by decreasing salinity and is lost at salinity of 6‰. The mortality is higher at youngs (30.6%) than adults (26.1%) at 6‰ salinity and constant temperature (laboratory conditions). The salinity of 8‰ and 6‰ associated with high seawater temperature regime till 30°C induced an 100% mortality in young and adult mussels. The experiments have showed that the salinity and temperature influence directely and in different ways the physiology and behavior of young and adult mussels.

B26001

ARCTIC GAS HYDRATE STABILITY ZONE MODEL: 5 MAIN QUESTIONS & ANSWERS

Atanas Vasilev[1, a], Emanuil Kozhuharov[1, b]

[1]Institute of Oceanology - BAS, PO Box 152, Varna 9000, Bulgaria

[a]gasberg@mail.bg, [b]jes-e@net.bg

Keywords: gas hydrates, model, Arctic

This work aims to create optimistic model of the Arctic gas hydrate stability zone (GHSZ); to assess GHs deposits, GHs structures, methane contents and multiple BSRs; to analyze the connection GHSZ – gas seepages (GSs) and the climate change impact from melting GH at 2050 and 2100. The optimistic approach estimates methane content optimistically.

The software program accounting for the two main theories of GHs formation – in situ bacterial and pore fluid expulsion; climate and sea level changes. The program results are 19 maps.

The main faults divide geological volumes with considerably different evolution and parameters. Therefore the separate data processing for every geological province gives results closer to reality.

The value of the deepest GHSZ base is mapped because more than one GHSZ could exist in the cross-section. The general parameters of the GHSZ and multiple BSRs are presented in tables and maps. Estimations are made for the trapped in the Arctic marine GH methane.

The “temperature engine” of the Arctic currents and the wider shelf areas form the main near bottom water volume with contrast temperatures. This is the area where we expect the full and low tides of GHSZ. The most scalable methane seepages could be found there.

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EMODNET

ACHEIVEMENTS AND FUTURE

B21008

EMODNET BATHYMETRY: DEVELOPING A HARMONISED DIGITAL BATHYMETRY FOR THE EUROPEAN SEAS

DMA Schaap[1, a]

[1]*MARIS, Koningin Julianalaan 345A, 2273 JJ Voorburg, The Netherlands*

[a]*dick@maris.nll*

Keywords: bathymetry, DTM, metadata, bathymetric surveys, EMODnet, SeaDataNet

The **EMODnet-Hydrography portal** (http://www.emodnet-hydrography.eu) development started in June 2009 and since June 2011 provides a range of options for freely browsing and downloading harmonised Digital Terrain Models (DTM) for a large part of the European seas:

- the Greater North Sea, including the Kattegat and stretches of water such as Fair Isle, Cromarty, Forth, Forties,Dover, Wight, and Portland
- the English Channel and Celtic Seas
- Western Mediterranean, the Ionian Sea and the Central Mediterranean Sea
- Iberian Coast and Bay of Biscay (Atlantic Ocean)
- Adriatic Sea (Mediterranean)
- Aegean – Levantine Sea (Mediterranean).

Users have access to water depth in gridded form (and vector form) over whole of the maritime basins on a grid of at least quarter a minute of longitude and latitude, and depth profiles along tracklines, including various metadata and viewing functions. The DTMs are freely available for downloading, including formats supported by 3D viewing softwares. The EMODnet digital bathymetry with a gridsize of 0,25 * 0,25 minutes has been produced from bathymetric survey data and aggregated bathymetry data sets collated from public and private organizations. These have been processed and quality controlled in a common way. An updating scheme is in place, including gathering additional survey data sets, resulting in regular new releases. The portal also provides a data discovery and access service, based upon the SeaDataNet CDI service, to identify and request access to the hydrographic survey data that are managed by the involved data providers and that are at the basis of the digital bathymetry products.

The EU Commission recently awarded a new service contract for further development of the EMODNet Hydrography portal, aiming at including also Baltic Sea, Norwegian Sea and Black Sea, improving the DTMs already produced and delivering these with an higher resolution (1/8 of minute of arc) and to expand the inventory of high resolution seabed mapping data sets.

B25002

EMODNET – PHYSICAL PARAMETERS

P. Gorringe[1, a], A. Novellino[2, b], G. Manzella[3, c], D. Schaap[4, d], L. Richards[5, e], S. Pouliquen[6, f]

[1]EuroGOOS AISBL, Avenue Louise 231, 1050 Brussels, Belgium
[2]ETT S.r.l, via Sestri 37, 16154 Genova, Italy
[3]ENEA, Pozzuolo di Lerici, 19032 Lerici, La Spezia, Italy
[4]MARIS BV, Koningin Julianalaan 345 A, 2273 JJ Voorburg, The Netherlands
[5]BODC, Joseph Proudman Building, 6 Brownlow Street, Liverpool, United Kingdom
[6]IFREMER, Technopolis 40 - 155 rue Jean-Jacques Rousseau - 92138 Issy-les-Moulineaux - France

[a]Patrick.Gorringe@smhi.se, [b]antonio.novellino@ettsolutions.com, [c]giuseppe.manzella@enea.it, [d]dick@maris.nl, [e]ljr@bodc.ac.uk, [f]sylvie.pouliquen@ifremer.fr

Keywords: ***EMODnet, Operational Oceanography, fixed stations and ferrybox, near real-time and archived data of time series, MyOcean, SeaDataNet, INSPIRE, MSFD***

European Marine Observation and Data Network (EMODnet) has been created to improve the usefulness to European users for scientific, regulatory and commercial purposes of observations and the resulting marine data collected and held by European public and private bodies, wherever that data has been collected from. European Commission, represented by the Directorate-General for Maritime Affairs and Fisheries (DG MARE), is running several service contracts for creating pilot components of the ur-EMODNET and it is assisted by a Marine Observation and Data Expert Group (MODEG).

The EMODNet Physics (http://www.emodnet-physics.eu/) is aimed at providing access to archived and real time data catalog on the physical condition in Europe's seas and oceans. The overall objectives are to provide access to archived and near real-time data on physical conditions in Europe's seas and oceans by means of a dedicated portal and to determine how well the data meet the needs of users from industry, public authorities and scientists.

The objectives are achieved through

- A portal that allows
    - Access to marine data from measurement stations and ferryboxes. Both near real-time and archived data of time series are to be made available.
    - Metadata for these data sets using EMODNet/INSPIRE standards
    - Metadata maps and overviews for whole seabasins showing the availability of data and monitoring intensity of that basin.
    - Gives access to thematic monitoring data that can be queried/selected
    - Gives access to monitoring observations
    - Provides data to GMES, researchers and specialised users
- Monitoring and reporting of the effectiveness of the portal in meeting the needs of users in terms of ease of use, quality of information and fitness for purpose of the product delivered.

EMODnet Physics aims to contribute to the broader initiative 'Marine Knowledge 2020', and in particular to the implementation of the European marine monitoring programme and marine services (GMES). It is based on a strong collaboration between EuroGOOS associates and its regional operational systems (ROOSs), MyOcean and SeaDataNet consortia.

In two years of activity, by means of joint acivities with its pillars EuroGOOS, SeaDataNet and MyOcean, EMODnet Physical Parameters was able to connect about 400 fixed stations.

B25003

HOW CAN EMODNET ENGAGE IN SUPPORT TO THE MARINE ENVIRONMENT ASSESSMENT

Marina Lipizer[1, a], Alessandra Giorgetti[1, b]

[1]OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale) Borgo Grotta Gigante 42/C - 34010 - Sgonico (TS) - Italy

[a]mlipizer@ogs.trieste.it, bagiorgetti@ogs.trieste.it

Keywords: chemical oceanography, sustainable management, marine environmental status, human pressures, data management, interoperability

The EU Green Paper for Marine Knowledge 2020 highlighted that Seas and Oceans surrounding Europe provide an essential part of our wealth and well-being but they are also under huge pressure from human activities and climate change. To support the marine and maritime economy whilst supporting environmental protection needs, the European Union promoted the development a European Marine Observation and Data Network (EMODnet), that would provide a single entry point for accessing and retrieving marine data currently fragmented in hundreds of databases managed by agencies, public authorities, research institutions and universities throughout Europe. EMODnet started as a 3-years pilot project (2009-12) with six thematic service contracts launched by the Directorate-General for Maritime Affairs and Fisheries (DG MARE): Hydrography, Marine geology, Chemistry, Biology, Habitants mapping and Physics. The second phase of EMODnet, Lot Chemistry (2013-15), prosecutes to assemble fragmented and inaccessible marine data into interoperable, continuous and publicly available data streams, focusing on the groups of chemicals required by the Marine Strategy Directive. The overall objective is the development of an efficient infrastructure for the data collection, management and analysis which will be used for the integrated assessment of the marine environment.

The main challenges of the Chemical Lot are represented by the data complexity and heterogeneity due to different matrices (sediment, water column and biota) and differences in analytical protocols and in geographical distribuition of target species (case of the Mytilus sp.). The complexity is approached by adapting SeaDataNet infrastructure, as an efficient distributed Marine Data Management system designed for physical oceanography and now adopted by a growing number of other communities. New visualization products will be defined to represent the chemical data and to satisfy the requirements for environmental data reporting. Data with spatial and temporal homogeneous distribution will be used to generate seasonal and annual interpolated maps for nutrients, metals and radionuclides. Time-series plots will be generated for hydrocarbons, pesticides, metals and fertilizers available with limited spatial or temporal coverage. The portal allows to visualize all available maps, the pre-computed time series plots and the original data.

B25004

A MARINE BIOLOGICAL DATA PORTAL WITHIN THE FRAMEWORK OF THE EUROPEAN MARINE OBSERVATION AND DATA NETWORK (EMODNET)

Simon Claus[1, a]

[1]*Flanders Marine Institute (VLIZ), Vismijn, Wandelaarkaai 7, B-8400 Oostende, Belgium*

[a]*Simon.claus@vliz.be*

Keywords: EMODnet, marine biodiversity, data portal, biological data products, MSFD

Marine biodiversity data are essential to measure and study the ecosystem health of maritime basins. These data are often collected with limited spatial and temporal scope and are scattered over different organizations in small datasets for a specific species group or habitat. Therefore there is a continuous need to assemble these individual datasets, and process them into interoperable biological data products for assessing the environmental state of overall ecosystems and complete sea basins.

Based on an extensive one-year consultation phase, the European Commission published a Maritime Policy Blue Book in 2007. One of the key-actions is the creation of a sustainable European Marine Observation and Data Network (EMODNet) in order to assemble fragmented and inaccessible marine data into interoperable, contiguous and publicly available data streams for European maritime basins. Since May 2009, six preparatory actions were launched creating pilot portals for respectively hydrographic data, marine geological data, chemical data, physical data, seabed habitats and biological data.

In 2013, a follow up phase was launched by the Commission within the framework of the Knowledge base for growth and innovation in ocean economy: assembly and dissemination of marine data for seabed mapping. The biology lot of this phase build upon the pilot activities carried out during the biological preparatory action, and will:

- Enhance the EMODnet biological data portal allowing public access to and viewing of data, metadata and data products of marine species occurring in European marine waters. The data portal will be fine-tuned to ensure interoperability with various databases and database systems and will be compliant with the Infrastructure for Spatial Information in the European Community (INSPIRE) taking into account INSPIRE implementing rules on metadata, data specifications and data services.
- Provide access to specified monitoring data from the EMODnet biological data portal, by building on a detailed inventory and gap analysis of existing holdings of biological marine monitoring data that was created during the pilot project, in collaboration with the consortium partners, representing national and regional marine data networks.
- Create specific biological data products to illustrate the temporal and geographic variability of occurrences and abundances of marine phytoplankton, zooplankton, macro-algae, angiosperms, fish, reptile, benthos, bird and sea mammal species. These products will be illustrative for the marine biological data available in the system, and priority will be given to non-indigenous, protected and indicator species of high relevance for environmental directives and legislations.

The project will collect and assemble data for all sea basins of Europe including the Black Sea, Mediterranean Sea, North East Atlantic, North Sea and Baltic Sea. Additionally, biological marine monitoring data from the Norwegian Sea and Barents Sea will be made accessible. Specific attention will be given to the collection and integration of coastal data.

Through close collaboration with the Marine Strategy Framework Directive working groups (MSFD), data and data products relevant for the MSFD assessments and monitoring will be defined. In turn, the portal will be set up to handle data collected through MSFD assessment and monitoring obligations. The EMODnet Biological data portal will closely collaborate with the other thematic assembly groups. The project will use the data and metadata standards that have been used and developed under the ur-EMODnet prototype. Common standards defined by SeaDataNet, WoRMS (World Register of Marine Species), OBIS INSPIRE, GBIF (Global Biodiversity Information Facility) and the Lifewatch infrastructure will be implemented to ensure interoperability and adapted if necessary.

BLACK SEA ARGO WORKSHOP

A13015

DATA QUALITY CONTROL OF THE RECENT ARGO FLOATS IN THE BLACK SEA

Milena S. Milanova[1, a], Elisaveta L. Peneva[1, b], Emil V. Stanev[1, c], Violeta H. Slabakova[2, d]

[1]Sofia University "St. Kliment Ohridski", Dept. "Meteorology and Geophysics"
[2]Institute of Oceanology, Bulgarian Academy of Science

[a]mimilanova@phys.uni-sofia.bg, [b]elfa@phys.uni-sofia.bg, [c]stanev@phys.uni-sofia.bg, [d]v.slabakova@io-bas.bg

Keywords: deep Black Sea, Argo profiles

Since 2009 eight Argo floats have been deployed in the Western Black Sea. One float deployed within the Argo project by the French institute IFREMER, 3 floats in the frame of the Bulgarian Argo program (one of them equipped with an oxygen sensor) and 4 floats donated by the Italian Argo program. The data coming from these 8 Argo floats are processed and analyzed. A chain of real-time quality control procedures for the temperature and salinity profiles is implemented and the data are quality validated taking into account the specific Black Sea regional characteristics. These procedures include missing cycle check; range tests for pressure, temperature and salinity based on the averaged termohaline structure of the Black Sea; inverse stratification test, to ensure the stable water column conditions; comparison with climatological data and comparison with other Argo data; impossible date and impossible location tests. As a final evaluation, a quality flag is assigned to each profile and conclusion about the overall quality of the data is given. The data measured by the float with the oxygen sensor are still under validation. The new data appear helpful to describe the main elements of the Black Sea circulation – the Rim current and the coastal anticyclonic eddies. A major change in the upper-ocean thermohaline structure was identified, which was manifested by a very weak or almost missing Cold Intermediate Layer during 2009 – 2012, which re-appeared again in 2012 due to the very cold winter conditions.

A13018

APPLICATION OF ARGO DRIFTER DATA FOR QUALITY CONTROL OF SST RECEIVED FROM REMOTE SENSING

G. Tvauri[1, a], G. Kordzakhia[2, b], L. Shengelia[2, c]

[1]Institute of Geophysics, Tbilisi State University, 1 Alexidze street, Tbilisi, 0171, Georgia.)
[2]Institute of Hydrometeorology, Tbilisi Technical University, 150a, D. Agmashenebeli Av. Tbilisi, 0112, Georgia

[a]gena_tvauri@yahoo.com, [b]giakordzakhia@gmail.com, [c]larisa.shengelia@gmail.com

Satellite derived sea surface temperature (SST) data are used for sea diagnosis.

Remote sensing SST data need special quality assessment/quality control (QA/QC) procedures. For this issues Argo drifter data are applied.

The special numerical experiments are carried for validation of quality of controlled SSTdata based on the Black Sea baroclinic forecasting model. The outputs of these experiments show that application of satellite derived SST data compared with the e.g. climatological data of temperature fields significantly enhances the forecast of the Black Sea conditions.

Thus submitted QA/QC procedures are effective for the formulated problem.

REGIONAL SEAS

DIFFERENCES AND SIMILARITY

A13008

BIG QUESTIONS IN EAST/JAPAN SEA RESEARCH

Kyung-Ryul Kim[1, a]

[1]*School of Earth and Environmental Sciences, Seoul National University, 599 Gwanak-ro, Gwanak-gu, Seoul 151-747, Korea*

[a]*krkim@snu.ac.kr*

Keywords: ***East/Japan Sea, CREAMS, ocean circulation, global change***

Recent studies clearly show that oceans are undergoing changes. The key issue is whether these changes are part of natural cycles or are related to recent global changes associated with human activities.

CREAMS (Circulation Research for East Asian Marginal Seas), an International research program, started in 1993, have confirmed the existence of most dramatic changes in the East Sea: warming of whole body and decrease of dissolved oxygen concentration in deep layers. The analysis of DO profiles strongly suggests that these changes are due to transition in the mode of the sea's conveyor belt system from bottom water formation in the past to intermediate water formation at the present time. These changes have remarkable resemblance to the changes anticipated in the world ocean circulation system associated with global warming in the coming century, allowing us to publish a paper titled:

"The East (Japan) Sea in Changes: A Clue to Future Changes in Global Oceans?"

We believe that East Sea may serve as a miniature test ocean for global changes in the future, meriting careful time-series studies to understand the effects of global changes on the ocean. The East Sea has great potential that we can pursue many BIG questions.

A12011

BLACK SEA OXYGEN DYNAMICS AS SEEN IN CONTINUOUS PROFILING FLOATS OBSERVATIONS AND 3D NUMERICAL SIMULATIONS

Emil V. Stanev[1, a]

[1]*Institute for Coastal Research, KSD, building 11, room 228, HZGMax-Planck-Strasse 1, D-21502 Geesthacht, Germany*

[a]*emil.stanev@hzg.de*

Keywords: profiling floats, hydrochemistry, numerical modeling.

The temporal and spatial variability of physical and bio-geochemical variables in the upper layer of the Black Sea and down to its suboxic zone was analyzed. Data used originated from historical observations, profiling floats with oxygen sensors and numerical simulations carried out with a coupled three-dimensional hydro-physical-biogeochemical model. The latter was a 3D extension of the Redox Layer Model (ROLM) including 24 biochemical state variables. The horizontal resolution was 1/12 degree, terrain following vertical coordinates have been used with the coarsest most vertical resolution of 2 m. It has been demonstrated that without this extremely fine vertical resolution the model was not in a position to realistically simulate the dynamics of suboxic zone, one of the basic elements of the Black Sea bio-geochemistry. Comparisons with the observations demonstrated that the coupled model replicated in a realistic way both the general circulation and bio-geochemical processes. The temporal evolution of the simulated subsurface oxygen maximum replicated well the continuously measured Argo floats oxygen data. The upper boundary of the suboxic zone (oxygen isoline 5 μM) shoaled in the central area and penetrated into deeper water in the coastal area in winter. However summer situation was dominated by an upward propagation of sulphide-rich waters along the northern continental slope. The depth of the suboxic zone varied with time in concert with the variability of the physical system. In particular, the seasonal variability of the suboxic zone was clearly present in the numerical simulations. The contribution of the three-dimensional modelling in the understanding of Black Sea hydro-chemistry, and in particular the coast-to-open-sea dipycnal mixing was also quantified. Analyses carried out in density coordinates demonstrated the role of the diapycnal mixing. It appeared very important both in the coastal regions and in the ocean interior.

A13007

DISSOLVED OXYGEN AT THE BOTTOM BOUNDARY LAYER OF THE ULLEUNG BASIN, EAST/JAPAN SEA

Dong-Jin Kang[1, a], Yun-Bae Kim[1], Kyung-Ryul Kim[2]

[1]Korea Institute of Ocean Science & Technology, 787 Hae-ar ro, Ansan, Gyeong-gi 426-200, Korea

[2]School of Earth & Environmental Sciences/Research Institute of Oceanography, Seoul National University, 599 Gwanak-ro, Gwanak-gu, Seoul 151-747, Korea

[a]djocean@kiost.ac

Keywords: ***dissolved oxygen, bottom boundary layer, East/Japan Sea, Ulleung Basin, organic matter decomposition***

General consensus on typical vertical profile of dissolved oxygen in the Ulleung Basin is that dissolved oxygen concentration beyond 300 m decreases with increasing depth. However, the results of our observations in 2005 and 2006 revealed three different dissolved oxygen distribution types in the deep layer of the Ulleung Basin. The first type showed oxygen concentration decreasing with increasing depth (Type-1), the second showed oxygen concentration decreasing very sharply near the bottom boundary layer but constant in the bottom adiabatic layer (Type-2), the final was of the oxygen minimum layer above the bottom boundary layer (Type-3). Type-2 was the most common pattern in the Ulleung Basin. Type-1 was most common close to the Japan Basin, including the Ulleung Interplane Gap, while Type-3 was found around Dok do. Oxygen Consumption Rate (OCR) at surface sediment estimated using the dissolved oxygen distribution at the bottom boundary layer was 0.2 ~ 5.8 mmol•m−2 d−1, which coincided with OCR from direct sediment incubation. This implies that organic matter decomposition at surface sediment may play an important role in dissolved oxygen distribution patterns at the bottom boundary layer of the Ulleung Basin.

A11003

CLIMATIC CHANGES OF THE BLACK SEA THERMOHALINE STRUCTURE

V.N. Belokopytov[1, a], A.B. Polonsky[1, b]

[1]Marine Hydrophysical Institute, 2, Kapitanskaya st., Sevastopol, Ukraine

[a]v.belokopytov@gmail.com, [b]apolonsky5@mail.ru

Keywords: Black Sea, thermohaline structure, climate change

Variability of the Black Sea hydrologic regime was analysed for the last 100 years on the basis of various sources: three MHI reanalyses of thermohaline structure with assimilation oceanographic surveys and drifting buoys data (statistical EOF-technique for 1923-2012, hydrodynamic modelling for 1971–1993 and 1992–2002), coastal meteorological stations and satellite data.

Total sea volume heat content variations represent cyclic process during last 100 years without evident basic tendency in contrast to clear positive trend estimates for the World Ocean published. The positive trend in the Black Sea also occurs but over period of last 30 years (0.39 ± 0.05 W m^{-2} or 0.015 °C/10 years), it is significant and corresponds to estimates for the World Ocean. Total salt content of the sea is persistently growing with the rate of 7.58 ± 1.06 kg m^{-2}/10 years or 0.0038 PSU/10 years.

Two-layer nature of the Black Sea becomes apparent in essentially different long-term variability in deep and upper layers. In the deep layer steady warming and salinization exists (maximal in permanent pycnocline), which indicate lack of salt balance and continuous increase of Mediterranean water volume. In the upper layer of 0 – 100 m alternation of warming/cooling and freshening/salinization events of various time scales occur. Phase combinations of temperature and salinity fluctuations makes a sequence of hydrologic modes of the sea, in general: cold and fresh in 1920 – 1954, cold and saline in 1954 – 1960, warm and saline in 1960-1980, cold and fresh in 1980 – 1996, sufficiently warm and fresh since 1996 till now. There is superimposition of high-frequency inter annual (1-3 year) fluctuations with generalized hydrologic modes mentioned above, especially during warm and saline (in whole) period of 1960-1980.

Variations of the upper layer salt budget exert the most influence on the density structure, which in turn affect vertical exchange and circulation. In general, the sea was fresh in 1920 – 1954, salt in 1954 – 1980 and fresh again since 1980. Accordingly, prior to 1954 and since 1980 vertical stratification grows, horizontal density gradients become sharper and circulation intensifies. Positive trend of the circulation kinetic energy over the last 30 years is apparent in spite of negative tendency of wind curl, which weighs heavily for thermohaline factors.

Atmospheric forcing variability causing salt/water budget and the Black Sea hydrologic regime changes is discussed.

A13006

N2 PRODUCTION THROUGH DENITRIFICATION AND ANAMMOX IN THE ULLEUNG BASIN, EAST SEA

Taehee Na[1, a], Jung-Ho Hyun[2, b]

[1]Research Institute of Oceanography, Seoul National University, 599 Gwanak-ro, Gwanak-gu, Seoul 151-747, Korea

[2]Department of Marine Sciences & Convergent Technology, Hanyang University, 55 Sangnok-gu, Ansan-si, Gyeonggi-do 426-791, Korea

[a]thna@snu.ac.kr, [b]hyunjh@hanyang.ac.kr

Keywords: East Sea, Ulleung Basin, nitrogen cycling, denitrification, anammox

N_2 (dinitrogen gas) production through microbial denitrification ($5CH_2O + 4NO_3^- \rightarrow 5CO_2 + 2N_2 + 7H_2O$) and anammox (anaerobic ammonium oxidation, $NH_4^+ + NO_2^- \rightarrow N_2 + 2H_2O$) is a major process for nitrogen removal in continental margin sediment, which may accounts for 50 – 70% of oceanic N loss (or where 50 – 70% of oceanic N loss may occur. But the precise roles and regulatory factors of these two pathways of N_2 production in deep marine sediments are still scarce.

The Ulleung Basin (UB) locating in the southwest of the East Sea is characterized by high organic carbon content (> 2.5% dry wt.) and Mn oxides (ca. 200 mol cm^{-3}) in the surface sediment. To study benthic nigrogen cycling in the UB, we conducted ^{15}N isotope incubations to determine the rates of denitrification and anammox at six sites along a depth transect, from shelf (> 100 m) to basin (> 2,000 m) in the UB. The sites were chosen to give a wide range of organic carbon and ambient NO_3^- concentration in marine sediments.

Total N_2 production rates using the intact core incubation ranged from 6.8 to 11.1 mol N m^{-2} h^{-1}. Anammox and denitrification rates were 3.0 – 6.6 and 3.7 – 4.8 mol N m^{-2} h^{-1}, which were shown to occur at rates higher than those observed other marginal deep sediments. The anammox comprised 45 – 60% of total N_2 production, and its significance increased with increasing water depth, whereas the relative significance of denitrification was not less important in the center of the basin. Our results demonstrate that anammox is confirmed as an important pathway in the UB sediments and future work is necessary to further identify the key factor in the control of anammox in the UB.

A11035

MESOSCALE VARIABILITY OF THE BLACK SEA CIRCULATION SEEN FROM SSALTO/DUAC ALTIMETER DATA

Elisaveta L. Peneva[1, a], Emil V. Stanev[2, b], Milena S. Milanova[3, c]

[1]Sofia University "St. Kliment Ohridski", Dept. "Meteorology and Geophysics"

[a]elfa@phys.uni-sofia.bg, [b]stanev@phys.uni-sofia.bg, [c]mimilanova@phys.uni-sofia.bg

Keywords: altimeter data, mesoscale variability

The near-real time altimeter data from AVISO archive are used to study the main characteristics of the Black Sea mesoscale circulation. The AVISO product SSALTO/DUAC compiles measurements of several altimeter missions (Topex/Poseidon, ERS 1 and 2, Jason-1 and 2, Envisat, Cryosat-2) and gives the sea level anomalies and calculated geosptrophic currents anomalies, optimally interpolated on a regular grid with spatial resolution of 1/8° x 1/8° degrees and temporal resolution of 1 week. The data cover the period October 1993 to 2012. Based on these gridded data the temporal and spatial variability of Black Sea circulation is quantified and regions with highest most eddy kinetic energy are identified. Major pathways of anticyclonic eddies are identified, as well as their transformation. Another focus of the presented analysis is on the seasonal variability, and more specifically on the evolution of gyre circulation. The interannual variability of Rim current is investigated using the difference between sea-level in coastal and open sea areas as a proxy.

PERSEUS

BLACK SEA EXPERIMENT

A12010

RESPONSE OF THE BLACK SEA ECOSYSTEM TO THE ANTHROPOGENIC DRIVER RIVER NUTRIENT LOADS

Bettina A. Fach[1], Heather Cannaby[1], Viktor L. Dorofeyev[2], Alexander I. Kubryakov[2], Baris Salihoglu[1, a], Gennady K. Korotaev[2], Temel Oguz[1]

[1]Institute of Marine Sciences, Middle East Technical University, PO Box 28, 33731 Erdemli, Turkey

[2]Marine Hydrophysical Institute National Academy of Sciences, Sevastopol, Ukraine

[a]baris@ims.metu.edu.tr

Keywords: ***ecosystem model, river nutrient load, bottom-up control, Black Sea***

A three-dimensional hydrodynamic ecosystem model developed for the Black Sea was used to investigate the influence of anthropogenic drivers on marine ecosystem functioning in the Black Sea with a special focus on regional differences. In this study we present the nutrient dynamics in the Black Sea as inferred from the model, as well as the regional influence of changing river nutrient loads as important anthropogenic driver on ecosystem dynamics.

We can demonstrate that the Black Sea ecosystem shows strong regional nitrate limitation, with the eastern regions reacting stronger to changes than the north-west shelf, and high sensitivity to increased eutrophication: A 50% increase in nutrient loading causes a 48% increase in primary production in the eastern regions of the Black Sea, while the north-western shelf reacts more moderately. Despite an increase in primary production, chlorophyll-a concentrations typically respond weakly to changes in nitrate availability. This indicates that increased grazing closely mirrors an increase in productivity, which is confirmed by an increase in zooplankton biomass. It is important to note that for this reason simulated chlorophyll concentration is not a good indicator of eutrophication in the Black Sea. The reduction in the productivity of the entire Black Sea system associated with a reduction in riverine nutrient loadings is much greater than the increase in productivity associated with an increase in nutrient loadings. Hence the model simulations represent a Black Sea ecosystem, which is highly sensitive to a reduction in nutrient loadings, suggesting management of river water quality is vital for the improvement of the ecosystem state of the Black Sea.

B22009

TRENDS AND CHANGES IN MESOZOOPLANKTON OF THE BLACK SEA COASTAL AREA AS THE FOOD SOURCE OF FISH LARVAE

A. Gubanova[1, a], D. Altukhov[1, b], E. Popova[1, c], I. Vdodovich[1], T. Klimova[1]

[1]Institute of Biology of the Southern Seas, National Academy of Sciences of Ukraine, 2, Nakhimov av., Sevastopol, 99011, Ukraine

[a]adgubanova@gmail.com, [b]dennalt@gmail.com, [c]el-popova@yandex.ru

Keywords: Black Sea zooplankton, non-indigenous species, Oithona davisae, fish larvae

Drastic changes in zooplankton community abundance and structure observed in the Black Sea over the last few decades were driven by anthropogenic factors: eutrophication, pollution, over-fishing and accidental introduction of non-indigenous species. The latter was considered as the most important impact on the Black Sea ecosystem.

The present study is based on long-term, regular studies of coastal plankton communities at the stations located within and adjacent to Sevastopol Bay, Crimea, northern Black Sea. Samples were collected in the period from 1976 to 2009 usually biweekly. Our research focuses on the changes of the fodder zooplankton abundance and composition in the Black Sea coastal waters, following the successful introduction of the most recent invader, *Oithona davisae* (Copepoda: Cyclopoida).

Usually, the invasion of a new species follows a number of changes in the ecosystem (Alimov et al., 2004).The low resilience of the native zooplankton community to invasions of new copepod has been preconditioned by changes in the ecosystem caused by invasions of the predatory ctenophores (*Mnemiopsis leidyi* – 1990s; *Beroe ovate* – 2000s).

O. davisae was found regularly in zooplankton samples from Sevastopol Bay since October 2005. From 2006 to 2009, its contribution to the total copepod abundance in Sevastopol Bay increased up to 99%, with its numbers rising up to about 90,000 ind. m-3. Since 2009 the copepod-invader has been expanding along the Black Sea coast (Altukhov, 2010; Selifonova, 2011; Mihneva and Stefanova, 2011). As a result of the *Oithona davisae* invasion, the total abundance of fodder zooplankton in the Black Sea coastal area increased to the values of mid 1970-ies.

It is well known that copepod nauplii, *Oithona* spp., and other small copepods are important prey of fish larvae (Turner, 2004; Tkach, 2003; Oguz, 2008). The increase in the food source led to the fish larvae abundance increase. For the first time since 1990s, a clear positive trend in the abundance of zooplankton and ichthyoplankton was observed since 2006. It can be assumed that the increase in food supply for fish larvae in the coastal areas of the Black Sea is the result of invasion and mass development of *O. davisae*.

B22013

ASSESSMENT OF LONG-TERM FIELD OBSERVATIONS OF INVASIVE CTENOPHORES INTERACTIONS IN THE BLACK SEA

Tamara Shiganova[1, a], Louis Legendre[2, 3], Alexander Kazmin[1], Paul Nival[2, 3]

[1]P.P.Shirshov Institute of oceanology Russian Academy of Sciences, Moscow, Russia, Nakhimovsky pr., 36

[2]Université Pierre et Marie Curie Paris 6, UMR 7093, Laboratoire d'Océanographie de Villefranche, F 06230 Villefranche-sur-Mer, France

[3]CNRS, UMR 7093, Laboratoire d'Océanographie de Villefranche, F 06230 Villefranche-sur-Mer, France

[a]shiganov@ocean.ru

Keywords: Mnemiopsis leidyi, Beroe ovata, predator-prey interactions, Black Sea

Invasion of carnivorous ctenophore *Mnemiopsis leidyi* in the Black Sea in early 1980s disrupted the ecosystem, which started to recover with the arrival of predatory ctenophore *Beroe ovata* in 1997. Here, we use results of > 25 years of data (field observations and experiments) in the northeastern Black Sea, to assess three basic hypotheses that we believe explain most of the population dynamics of *M. leidyi* and its predator. The first hypothesis (i.e. since its arrival, *B. ovata* controlled the period of the year during which *M. leidyi* was present in sizable numbers) is supported by the observation that significant occurrence of *M. leidyi* was restricted from four to two summer months after the arrival of *B. ovata*. The second hypothesis (i.e. the same sequence of predator-prey mechanisms led *B. ovata* to shorten the duration of high *M. leidyi* population size year after year irrespective of interannual environmental variability) is supported by the repetition of the same reproductive sequence of the two ctenophores yearly since 1999. The third hypothesis is supported by the observed covariability between the two species each year following the arrival of *B. ovata*. Experimental and field results identified temperature and food as the key environmental factors influencing *M. leidyi*, which suggested that interannual environmental variations that affect *M. leidyi* abundance cascade to proportional changes in *B. ovata* abundance. Some aspects of these hypotheses had been examined in previous publications, but this is the first study where they are assessed together on a consistent set of data.

A11036

BLACK SEA ANCHOVY CONDITION IN RELATION TO ENVIRONMENTAL STATUS

G.E. Shulman[a], V.N. Nikolsky, T.V. Yuneva, O.A. Yunev, A.M. Shchepkina

[a]georgiy_shulman@mail.ru

Anchovy Engraulis encrasicolus is, perhaps, the most attractive object for researchers in the Azov-Black Sea basin. First of all, this fish has some unique features (especially, migrations) and large numbers, which makes it the most important component of high trophic level in pelagic ecosystem. Due to all this biology of both races of anchovy E.e.maeoticus and E.e. ponticus is studied better than biology of other species. This relates also to study ecologo-physiological and ecologo-biochemical backgrounds of anchovy annual cycles and productivity. Factors that define terms and character of its wintering migrations (Shulman, 1974; Chashchin and Akselev, 1990), elements of energy budget of populations (Shulman, Urdenko, 1989; Shulman, Love, 1999), genetic (Dobrovolov, 1990; Dobrovolov et al., 2013) and phenotypic (Yuneva et al., 2013) differences of Azov and Black Sea subspecies, relationship of their numerals dynamics with food supply (Nikolsky et al., 2009; Yunev et al., 2009) are revealed. Undoubtedly, investigations curried out have priority in study biology of the World Ocean anchovies.

POSTER SESSION

A11001

BLACK SEA CONTINENTAL SHELF IN THE CONTEXT OF OFFSHORE EUROPEAN PREHISTORY

Preslav Peev[1, a]

[1]*Institutte of Oceanology, Department of Marine Geology and Archaeology, P.O. Box 152, 9000 Varna, Bulgaria*

[a]*peev@io-bas.bg*

Keywords: underwater geoarchaeology, submerged settlements, sea level change

Decades of research into offshore prehistoric submerged sites and a wide range of studies of seabed geology, sedimentation, geomorphology, and topography using advanced acoustic systems provide the basis for study of the prehistoric archaeology of the European continental shelf and its submerged landscapes over the last million years. Offshore surveys driven by commercial activities, hydrocarbons, aggregate dredging, and fisheries, have produced large archives of geophysical and sedimentological data that can be reanalyzed to extract descriptions of palaeo-landscapes.

More than 3000 submerged prehistoric sites are known from all parts of European seas. Along the Bulgarian Black Sea coast are known at least 18 submerged settlements dated to the Late Eneolithic and Early Bronze Age (between 6500 – 4000 BP) and one prehistoric necropolis near Cape Shabla. For the earlier periods of human occupation of the Eastern Balkans and Black Sea shores I do not have valuable data. The reasons should be found into the lower sea level than present.

The preliminary results showed that the Black Sea continental shelf has a great potential for future deep-sea investigation in the area of prehistoric archaeology.

This study is a contribution to COST Action TD 0902 SPLASHCOS, INQUA 1202 “Rapid Environmental Changes and Human Impact on Continental Shelves” and IGCP 610 “From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary.

A11006

A NEW TECHNOLOGY FOR WASTEWATER DEPURATION

Vasilica Daescu[1, a], Elena Holban[1, b], Maria Cristina Ene[1, c], Gyorgy Deak[1, d], Simona Georgiana Tanase[1, e]

[1]National Institute for Research and Development in Environmental Protection, 294 Splaiul Independentei, 6th District, 060031, Bucharest, Romania

[a]vasilica_daescu@yahoo.com, [b]holban.elena@yahoo.com, [c]nicanormam@yahoo.com, [d]dkrcontrol@yahoo.com, [e]tanasegs@gmail.com

Keywords: experimental research, wastewater, treatment plant, environmental protection.

The increased concern regarding water quality, rational use of it, due to the tendency of decreasing water reserves, at a global level, have contributed to the improvement of existing water treatment technologies and created favorable environment for development of new technologies in this field.

In this regard, a team of researchers from INCDPM have conducted a study on a mobile technology for wastewater treatment.

The analyzes carried out in the laboratories of National Institute for Research and Development on Environmental Protection concluded that wastewater treatment technology has increased efficiency in reducing the physico chemical and bacteriological indicators present in wastewater from various fields.

Mobile technology meets the problems facing Romania in the field of wastewater, being an innovative technical solution to sewage treatment with direct and significant impact on the environment by reducing its negative effects on natural resources and rational use of water.

This paper shows the efficiency of mobile technology testing wastewater.

A11015

CLIMATE AND VEGETATION CHANGES DURING THE LATE QUATERNARY IN NW TURKEY

H. Caner[1, a], N. Karlioglu[2, b]

[1]Istanbul University, The Institute of Marine Sciences and Management, Department of Marine Geology and Geophisics
[2]Istanbul University, The Faculty of Forestry, Department of Botany

[a]hcaner@istanbul. edu.tr, [b]nurgulk@istanbul.edu.tr

Keywords: ***Sea of Marmara, pollen analysis, climatic change***

Pollen analysis was carried out on three cores collected from the Marmara Sea. Pollen assemblages display slightly different composition in the eastern and western parts of the Marmara Sea. Artemisia exists in the cores KL 97 and DM18 but does not occur in core DM13. In addition, Picea points to woodland vegetation more like the present moister mountain forest in the Southern Black Sea where it occurs on the north slopes of the mountains. Cores DM18 and DM 13 from the Central basin, show different stratigraphic distributions of major pollen species.The pollen records of the sediment cores include several types of vegetation, from step to semi-desert taxa, to those of upland broad -leaved deciduous and coniferous forests. Quercus is the most common tree pollen all of cores, reflecting the eastern Mediterranean warm-dry summers and mild-wet winters. Total AP and NAP percentages, and changing abundance of individual tree and herb taxa allowed us to distinguish four different zones in studied cores.

A11016

STUDY OF COLD INTERMEDIATE LAYER FORMATION IN THE BLACK SEA

A.I. Kubryakov[1, a], V.V. Knysh[1], G.K. Korotaev[1]

[1]Marine Hydrophysical Institute, National Academy of Sciences of Ukraine, 2, Kapitanskaya Str., Sevastopol, 99011, Ukraine

[a]alex.kubr@gmail.com

Keywords: reanalysis, cold intermediate layer, advective and convective mechanisms

One of the features of the thermohaline structure of the Black Sea is the Cold Intermediate Layer (CIL). The CIL is composed of cool, salty surface waters with temperature lower than the mean annual temperature of the surface and deep layers. Understanding the basin-wide distribution of the CIL is important for the many application of ecology. Thus, a correlation exists between the upper boundaries of anchovy aggregations and CIL which is situated just below the seasonal thermocline in summer season. The lower boundary of the CIL can be used as an indirect estimation of the oxic/anoxic interface location.

The processes of CIL waters formation are analyzed on the base of reanalysis of the Black Sea hydrophysical fields for the period from 1971 to 1993 derived by assimilation temperature and salinity data in the POM-based circulation model.

The mechanisms of replenishment and renewal the CIL: advective mechanism- associated with the advection of cold waters formed in the North Western Shelf and convective mechanism – due to winter convection in the cyclonic eddies in the central part of the sea, are studied. The periods of interchange of atmospheric conditions: abnormally warm winter 1980 – 1981's., normal winter 1987 – 1988 and cold winter 1992 – 1993 are considered. Interannual features of updating and renewal of "old" CIL waters caused by these mechanisms are identified. In particular, the cooled shelf waters are descend along the continental slope and merge with the "old" CIL waters on abnormally warm winter 1980 – 1981 more than a month later than on the cold winter 1992 – 1993's, and more than three weeks later than during normal winter 1987 – 1988. Sevastopol anticyclonic eddy and the north-western part of the Rim Current exert a significant influence on the transformation of the captured cold waters NWS, transported to the south-west and to the central part of the basin.

Revealed that the process of forming local cold intermediate water depends on winter penetration convection over dome isosurfaces of temperature, salinity and density which originate due to the rise of permanent halocline (pycnocline) in the centers of cyclonic gyres because of intensification of the winter circulation. Abnormally cold surface water, with increased density gradually deepened. Analysis of TS – indexes suggests that the cold water is transformed over time and spreads along isopycnic surface, engaging in cyclonic circulation and spreading throughout the sea, renewing water of the "old" CIL.

A11017

QUALITY OF TOMATOES UNDER THE EARLY FIELD PRODUCTION DEPENDING ON THE VARIETY AND THE APPLIED POTASSIUM FERTILIZER

Nikolai Dinev[1, a], Ivanka Mitova[1, b], Vera Petrova[1, c]

[1]N. Poushkarov Institute of Soil Science Agriculture and Plant Protection, National Center of Agricultural Sciences, 7-Shosse Bankya str. 1080 So□a, Bulgaria;

[a]ndinev@iss-poushkarov.org; [b]smolyanovci@abv.bg ; [c]vera_zamfirova@abv.bg

Keywords: ***potassium, quality, dry biomass, Vitamin C, yield***

Field experiment with different tomatoes varieties aimed the evaluation of potassium fertilizer on the quality of fruits was carried out. Soil type is cinnamonic podzolic with high humus content and low available nitrogen, phosphorus and potassium at pH 5.0. In the study are used four tomato variety included in the official catalogue of Bulgaria-Trapezitsa, Elena F1, Nikolina F1 and Dora. Results showed that increasing of potassium norm leaded to higher fruit's biomass. Dry biomass is maximal at the highest norm of potassium for NikolinaF1 and Dora, but the doze of K16 is optimal for Trapeztsa and Elena F1 vatieties. Maximal sugar content in tomato fruits were determined in Dora variety. The highest content of Vitamin C is determined in Dora tomato fruits at K24. Maximal yield of red fruits was detected in Elena F1 plants at K16 doze. The data from experiment could be used in updating of technological schedule for tomato growth of new varieties planted in Bulgaria.

A11020

MAJOR THREATS ON SEAHORSES AT THE ROMANIAN BLACK SEA COAST

Nenciu Magda[1, a, b], Rosioru Daniela[1], Cristea Madalina[1], Golumbeanu Mariana[1], Rosoiu Natalia[2]

[1]1NIRDEP - National Institute for Marine Research and Development "Grigore Antipa,"300 Mamaia Blvd., Constanta, Romania, Tel.: 0040241543288
[2]"Ovidius"University Constanţa, Faculty of Medicine, Department of Biochemistry, Constanța, Romania; Academy of Romanian Scientists, 54 Splaiul Independentei 050094, Bucharest, Romania

[a]mnenciu@alpha.rmri.ro, [b]magdalena.nenciu@gmail.com

Keywords: seahorses, threats, anthropogenic factors, management measures

Some of the interest species at the Romanian Black Sea coast are the seahorses (Hippocampus guttulatus Cuvier 1829, Hippocampus hippocampus Linnaeus 1758, Hippocampus fuscus Rüppel 1838). Seahorse populations need to be protected due to ecological, biological, economical and medical reasons. According to IUCN, seahorses in the Black Sea are data deficient, thus further research is necessary in order to assess the population extent and trends, as well as to identify future management measures. This paper outlines the major threats seahorses are facing at the Romanian coast. Pollution and destruction of the specific habitats are the most significant factors causing pressure on seahorse populations at the Black Sea. The National Institute for Marine Research and Development Grigore Antipa monitors yearly the parameters which can influence the marine environment and, consequently marine organisms such as seahorses (eutrophication indicators - phosphates, nitrates, sylicates, contamination indicators - heavy metals, total petroleum hydrocarbons, polynuclear aromatic hydrocarbons, organochlorine pesticides). During the past years, all these pollution parameters have not recorded alarming values, however accidental exceedings were reported for particular elements which could affect the biota (certain heavy metals, pesticides). The destruction of the seahorse specific habitats (seagrass meadows) is caused, on the one hand, by the above mentioned polluting factors, but, on the other hand, by direct human intervention (chaotic development of tourism, coastal developments, exploitation of marine resources). NIMRD Grigore Antipa aims at performing a long-term research focused on several aspects concerning the seahorses: assessing the population levels and conservation state; identifying the main anthropogenic threats and the way these threats influence the ecology, physiology and biochemistry of the species; drawing-up recommendations for potential management measures (reducing accidental catches, rehabilitating specific habitats, developing aquaculture technologies for aquarists, as well as potential pharmaceutical use).

A11021

ATMOSPHERIC INPUT OF POLLUTANTS – OPPORTUNITY FOR INNOVATION

Sonja Stefanov[1, a], Rade Biocanin[2, b], Slobodan Neskovic[3, c]

[1]University of Novi Sad, Faculty of Technical Science,Trg Dositeja Obradovica 6, Novi Sad, Serbia

[2]University of Novi Pazar, Faculty of Technical Science, Vuka Karadzica bb, Novi Pazar, Serbia

[3]University of Novi Sad, Economy and Engineering Management Faculty, Economy Academy University, Trg Marije Trandafil 2, Novi Sad, Serbia

[a]stefanov.sonja@gmail.com, [b]rbiocanin@np.ac.rsl, [c]slobneskovic@gmail.com

Keywords: pollutants, innovation, ocean

For about a century oceanographers have tried to understand the budgets and processes associated with both natural and human-derived substances entering the ocean. Much of the early work focused on the most obvious inputs, those carried by rivers and streams. Later studies investigated sewage outfalls, dumping, and other direct input pathways for pollutants. Over the past decade or two, however, it has become apparent that the atmosphere is also not only a significant, but in some cases dominant, pathway by which both natural materials and contaminants are transported from the continents to both the coastal and open oceans. These substances include mineral dust and plant residues, metals, nitrogen compounds from combustion processes and fertilizers, and pesticides and a wide range of other synthetic organic compounds from industrial and domestic sources.

A11022

AIR TEMPERATURE VARIABILITY DURING THE FIRST DECADE OF 21st CENTURY IN SOUTH BULGARIA

Dafinka Ivanova[1, a]

[1]*Agricultural University of Plovdiv,Department of Botany and Agrometeorology, 12 Mendeleev Str, 4000 Plovdiv*

[a]*dafi_ivanova@yahoo.com*

Keywords: climate changes, South Bulgaria, air temperature, precipitation

A warming trend in Europe is well established. Warming since the and of the 1970s has been 0,26°C/decade for the globe, respectively 0,35°C and 1,6°C/decade for the Northern Hemisphere and Southern Hemisphere(e.g., Jones and Moberg, 2003). Surface annual temperature over the Balkan Peninsula region for the last century show that most of the countries were affected by the climate changes in the 1990s. Several weather stations in South Bulgaria were observed by a trend in average air temperature during the 21 century. An increasing trend in maximum and minimum air temperature data also has relevant impacts on the climatic norms for the 20th century.

The number of the used weather stations with series of average air temperature was limited to 10, because of long-term observation in privet agricultural fields.

A11023

PRECIPITATION VARIABILITY IN SOUTH BULGARIA DURING 21st CENTURY

Dafinka Ivanova[1, a]

[1]*Agricultural University of Plovdiv,Department of Botany and Agrometeorology, 12 Mendeleev Str, 4000 Plovdiv*

[a]*dafi_ivanova@yahoo.com*

Keywords: climate changes, South Bulgaria, precipitation

Since 1976, the global average temperature has risen at a rate approximately three times faster than the 20th century (almost 0,6°C). Precipitation trends are more spatially variable. Mean precipitation is increasing in Northern Europe and decreasing in Southern Europe (e.g. ,Frish et al, 2002). Regional differences in climate variability and change were more considerable in precipitation during the previous century.

The major annual and monthly precipitation trend detected in this study for the Southern half of Bulgaria. In relation with agricultural production we have investigate the spatial distribution of the trends in spring, summer, autumn and winter precipitation (2004-2014) by applying statistical methods.

A11025

2DH BEACH EROSION MODELLING ON VARNA CENTRAL BEACH

P. Eftimova[1], E. Trifonova[1], N. Valchev[1], N. Andreeva[1]

[1]Institute of Oceanology, Bulgarian Academy of Sciences – Varna

Keywords: 2DH morphological modelling, storm waves, erosion, XBeach

Beaches as ones of the most dynamical units of the coast experience significant deformations due to storm waves and currents. Recent example of such an impact was the storm occurred in February 2012. It caused damages on the whole Bulgarian coast and raised big public interest. A major problem is the erosion of the beaches leading to beach area reduction and increasing of beach face slopes. Thus the beaches become more vulnerable to future storms.

In this connection the present study focuses on beach erosion through methods of 2DH morphological modelling. Varna central Beach (Bulgaria) is chosen for examination as a very important recreational area for Varna city. The 2DH mophological model Xbeach is set up on irregular rectangular grid up to 20 m depth. Registered February 2012 storm wave conditions are used for model runs. The model simulations give satisfying results as the erosion calculated on the beach face is in reasonable limits compared with the post-storm measurements.

A11026

CHARACTERISTICS OF THE SPATIAL DISTRIBUTION OF THE THERMOHALINE CLIMATIC FIELDS IN THE WESTERN PART OF THE BLACK SEA IN FRONT OF BULGARIAN COAST

D. Trukhchev[1, a], Z. Tomova[1, b]

[1]Institute of Oceanology BAS, P.O.Box 152, Varna 9000, Bulgaria

[a]truhi@io-bas.bg, [b]z.tomova@io-bas.bg

Keywords: temperature, salinity, hydrology, Black Sea

Main results from climatic seasonal averaging of data from long standing experimental measurements of the fields of water temperature T and salinity S are presented. The hydrological structure of the water area in front of the Bulgarian coast stretching 32˚E is described. The historical data set used consist of more than 21 000 hydrological stations and was built on the base of information from SeaDataNet infrastructure, NATO TU BlackSea Project Database, and available archive data from hydrological surveys in the Institute of Oceanology. As distinct from both the most complete of the present-day hydrological arrays prepared by V. Tuzhilkin (Russia) and V. Belokopitov (Ukraine) on a regular horizontally mesh for the entire Black sea basin, in this study the water area is divided into several regions according to their hydrodynamical characteristics and geographical location (coastal zone, open shelf, continental slope, and deep-sea). The next horizons: 0, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 500, 1000, 1500 и 2000 m are used describing the vertical peculiarities of T and S from the sea surface to the bottom. This work represents a first attempt at climatic-typification specifically for the investigated part from Western Black Sea. Principal features of the seasonal climatic variability of the thermohaline fields in the study water area are shown. The results obtained give possibility for assessments in wide range of fields relevant to external effects both from natural and anthropogenic character upon the marine environment.

A11027

VARIABILITY OF ELECTRON TRANSPORT SYSTEM ACTIVITY IN THE WATER MASSES OF SOUTHERN ADRIATIC PIT IN THE PERIOD 1993-2008

M. Azzaro[1, a], R. La Ferla[1, b]

[1]Institute for Coastal Marine Environment (IAMC), Italian National Research Council (CNR), Messina, Italy

[a]maurizio.azzaro@iamc.cnr.it, [b]rosabruna.laferla@iamc.cnr.it

Keywords: ***microbial respiration, deep convection site, Southern Adriatic Pit, Mediterranean Sea, PERSEUS***

This study presents the temporal variability of respiratory rates assayed by microbial Electron Transport System activity (ETSa) in a deep convection site of Eastern Mediterranean Sea (the Southern Adriatic Pit). Our data, collected from 1993 to 2008 during several cruises in the context of various scientific projects (AM3, MATER, SINAPSI, VECTOR, SESAME), shed light on the seasonal variability of microbial respiration. Moreover, the binding of the oxidation of organic matter in the deep water with the formation or non-formation of deep water during these 15 years in the study area was investigated. In fact, in the years in which the deep water formation was documented, a supply of preformed C transported was observed within the deep water masses. Such C supply was reflected in a high oxidation of organic matter in the deep waters, that was not justified by the normal sink of organic matter conveyed by the Biological Pump. These findings are the starting point for the ADREX experiment in the frame of PERSEUS project.

A11028

HYDROLOGICAL PECULIARITIES IN THE WESTERN BLACK SEA UNDER THE BLOCKING RIDGE DURING HOT SUMMER 2010

D. Trukhchev[1, a], V. Slabakova[2, b]

[1]Institute of Oceanology BAS, P.O.Box 152, Varna 9000, Bulgaria

[a]truhi@io-bas.bg, [b]v.slabakova@io-bas.bg

Keywords: temperature, salinity, hydrology, Black Sea, blocking ridge

During June, July and August of 2010 the Black Sea fall under the strong influence of an extreme heat wave. A blocking ridge stopped the west atmosphere transport for the large parts of Russia it is the longest and the most stable heat anomaly in the atmosphere registered since 1880. Above-norm amounts of precipitation leaded to a sharp increase in the river discharge from Danube the available data display the average monthly level near Silistra (the eastern Bulgarian stream-gauging station) for June and July was higher respectively with 277 cm and 221 cm from its climatic regime, in July the level reached the absolute maximum of 800 cm for the entire year. Furthermore a significant rise in the monthly mean and monthly average maximal air temperature was recorded (e.g. the exceeding for July in Varna is respectively with 1.4°C and 1.5°C). As a result of the atmospheric impact, non-typical for the Black Sea hydrological features were observed in the western shelf in front of Bulgarian coast: i) anomalous warming of the sea surface water (the absolute maximum values recorded in the history were measured during the period 7-15 August along the coast 31.0, 31.5 and 30.8°C respectively in synoptic whether stations Shabla, Varna and Burgas); ii) anomalously low salinity in the surface layer in the water area between cape Kaliakra and cape Galata (from 11.7 11.8 psu to about 13.2 psu for depths from ~ 20 m to 95 m respectively; above the continental slope at depths of 170 300 m the salinity rapidly increased to 16.8 17.5 psu). It is experimentally proved that the reason for decrease of salinity cannot be associated by an anomalously high runoff of Kamchiya (the biggest Bulgarian river pouring in the sea): the monthly mean discharge in July was more than 8 times higher than the monthly climatic norm. Under conditions of low atmospheric dynamics and weak processes of mixing and water exchange a specific surface layer of warm water and low salinity was formed, its height varied from 5 to 10 m and the values of t on its upper and lower boundary ranging between ~ 6.5 and 8.5 9 respectively. A rapid destruction of the halocline in this layer occurred after decay of the blocking anticyclone the sea water restored its typical seasonal vertical structure and the salinity in the shelf increased from ~12 psu to ~17 psu. Described phenomenon enables to estimate in natural conditions impacts of future climate change on the hydrological structure of the basin.

A11029

EFFECTS OF THE EXCESS NUTRIENTS ARRIVED IN THE BLACK SEA INTAKE BY THE DANUBE RIVER IN THE DANUBE DELTA

Adrian Bilba[1, a]

[1]*Complex Museum of Natural Sciences, 255 Mamaia Bv. 90052 Constanta / Romania*

[a]*adrian.bilba@gmail.com*

Keywords: nutrients, river and marine ecosystems, anthropic impact, Black Sea

In the last decade the strictly verification of the discharges of pollutants in the Danube resulted in an overall improvement in water quality, but urban agglomerations and intensive agriculture leads to an even greater discharge of organic and inorganic substances which represent nutrients for the lower food chain (phytoplankton and zooplankton).

The quantity of water resulted from a rainfall system, very little grown and increasingly unequal during the year fails to dilute and process, without giving time to harness these nutrients in a higher trophic floor, especially ichtyofauna.

At this level the nutrients already arrived in the Black Sea causes seasonal explosions of algal pelagic species, which disturb the ecosystem and particularly the fish populations.

This paper proposes a solution whereby in the Black Sea will reach a lower amount of primary nutrients and a large number of juvenile euryhaline fish and such the impact on the marine ecosystem will be positive and not negative.

A11030

FLUCTUATIONS IN BLACK SEA LEVEL AND CYCLES OF SOLAR LUMINOSITY – CAUSE AND EFFECT

Krasimira Slavova[1, a]

[1]*Institute of Oceanology-BAS, First May Str. 40, P.O.Box 152, Varna 9000, Bulgaria*

[a]*slavova@io-bas.bg*

Keywords: ***Black Sea, regression, transgression, climatic variability, solar luminosity, Holocene***

This article supports the occurrence of an abrupt transition within the Black Sea system from a freshwater lake to a marine environment. Established cycles of solar luminosity are one important reason for the regression of the Black Sea during the interval 9500-8000 cal.years BP. The aim of this paper is to determine the causality between the cycles of solar luminosity on the one hand and the palaeoclimatic and palaeoenvironmental data from the Black Sea region, including fluctuations within the Black Sea basin, on other hand.

It has been ascertained that a stable warm climatic period began in the Black Sea region after the Last Glacial Maximum and that within this warm period, shorter episodes of cold and warm weather are observed. The latest results suggest that solar insolation, which is a result of variations in solar luminosity, can produce climatic variations with intensities comparable to that of orbital variations. Most likely, an understanding of the processes governing the formation of post-LGM palaeoclimatic records can give the established cycles of solar luminosity with different duration.

The reasons for the regression of the Black Sea basin during the interval between 9500-8000 cal. years BP are a combination of events. Probably the most important of them are the cycles of solar luminosity. These cycles were accompanied by an interruption of the outflow of the Caspian Sea into the Black Sea at about 9500 cal. years BP, and the second mini ice age in Europe at about 8200 cal. years BP.

Actually, the established cycles of solar luminosity are recorded in the change of palaeoecological setting in the Black Sea region. They can be used to explain fluctuations in Black Sea level.

A12001

THE INFLUENCE OF COASTAL UPWELLING AND DANUBE PLUME ON THE CHLOROPHYLL PATTERNS ON THE WESTERN BLACK SEA SHELF

Evgeny Lemeshko[1, a], Natalya Kyrylenko[1]

[1]Marine Hydrophysical Institute, 2 Kapitanskaya St., Sevastopol, 99011, Ukraine

[a]evgeny.lem@gmail.com

Keywords: SST, Upwelling, Chlorophyll concentration, Western Black Sea shelf, Danube

Previous descriptions of the seasonal and inter-annual distribution of chlorophyll of the Western Black Sea were mostly based on a temporally and spatially limited number of in situ measurements. Recently analyzed remote sensing data of chlorophyll concentrations derived from satellite CZCS and SeaWiFS permitted to improve the spatial descriptions for the shelf zone and classify their seasonal variability. But the composite extended data of SeaWiFS and MODIS imagery available at this moment allow us to study the relations of chlorophyll patterns on the Western Black Sea shelf with coastal upwelling events and river's plume impact in more details.

In present study, the classification of chlorophyll concentration into several regions was done on the base of Empirical Orthogonal Functions (EOF) analysis and Self Organization Map (SOM) approach in order to describe areas with specific characteristics of chlorophyll variability. Then, the relations between chlorophyll concentration and different physical drivers (SST, wind, upwelling events, river discharge) were studied for each specific region. All results are presented in tables, plots and maps. Thus, the values of multiple correlations between principal components of all parameters were analyzed for each region with the aim to assess the importance of various physical drivers influence.

A12002

MULTIVARIATE STATISTICAL ANALYSIS OF SATELLITE-DERIVED PATTERNS OF THE NORTH-WESTERN PART OF THE BLACK SEA

Natalya Kyrylenko[1, a], Vladyslav Evstigneev[1, b]

[1]Marine Hydrophysical Institute, 2 Kapitanskaya St., Sevastopol, 99011,Ukraine

[a]kyrylenkonatalya@gmail.com, [b]vladyslavevstigneev@gmail.com

Keywords: chlorophyll concentration, multivariate statistics, SeaWiFS, MODIS, DINEOF

Assimilation of satellite-derived products on ocean sub-surface parameters is the most promising challenge in the oceanography for the last few decades. Satellite data assimilation systems are of great importance for verification and validation of numerous global and regional ocean models, and more profound understanding of circulation impacts and functioning of ecosystem. By now these products can be already used for assessment of complex interactions in the coupled eco-air-sea system of inland basins like the Black sea. Prior to dynamical a multivariate statistical analysis has to be applied to find the main features of the coupled Black sea system.

In the present study we focused on the north-western part of the Black sea and relations between the physical forcing (wind, river discharge) and environmental parameters on intra-seasonal and inter-annual time scales. We examined chlorophyll concentration based on SeaWiFS and MODIS imagery, ERA-Interim 10-meter wind data and the data on Danube and Dnieper rivers' outflow. Missing data of satellite fields due to cloud-covering were preliminary filled by means of DINEOF algorithm (Alvera-Azcarate et al., 2005). This method allows one to reconstruct images with high percentage of missing values. We chose images with more than 20% of the total area visible. Statistical analysis included correlation, empirical orthogonal functions (EOF) and Maximum Covariance (MCA) analysis. Principal modes of joint variability were revealed. Time series of their principal components were analyzed with respect to different forcing factors (rivers discharge, wind stress) for various time-scales.

A12004

STUDY OF NUTRIENT BALANCE OF THE BLACK SEA ECOSYSTEM

Elena Kubryakova[1, a], Gennady Korotaev[1, b]

[1]Marine Hydrophysical Institute of National Academy of Science of Ukraine, Ukraine, Sevastopol, St. Kapitanskaya, 2

[a]elena.kubr@gmail.com, [b]gkorotaev@gmail.com

Keywords: nutrient balance, biogeochemical model, Black Sea

One-dimensional physic-biogeochemical model of upper 600-meter of the deep part of the Black Sea is used for the description of the nitrate balance in the upper layers of the basin. The model includes physical, biological and redox processes, taking into account the seasonal variability of atmospheric parameters and parameterized vertical fluid movements. Contributions of the different terms in the transport equation of nitrates, nitrites and ammonium are investigated. It is shown that the upward fluxes of the ammonium can provide a significant effect on the maintenance of the balance of nitrate in the central part of the sea.

A12014

DECOMPOSITION OF STORM EMISSIONS OF DIFFERENT ORIGIN ON THE BLACK SEA SANDY LITTORAL

B. Aleksandrov[1, a], V. Dyadichko[1, a], O. Garkusha[1, a], G. Ivanovych[1, a], N. Kopytina[1, a], A. Kurilov[1, a], L. Nidzvetska[1, a], S. Nikonova[1, a], A. Pavlova[1, a], I. Serbinova[1, a]

[1]Odessa Branch of Institute of Biology of the Southern Seas, NAS of Ukraine, Odessa,

[a]obibss@paco.net

Keywords: ***storm emissions' decomposition, sandy littoral, organic matter, saprophytic, phosphate-mobilizing and intestinal bacteria, marine fungi, algae, flagellates, ciliates, insects***

Sandy littoral is a powerful natural reactor, where regular decomposition of organic matter (OM) on a frontier contour habitat sea-coast is occurring. Decomposition rate of OM is determined by a number of physical, chemical and biological factors. Into the first group, for example, can be included temperature, chemical pollution, grain size distribution, which limit germination and life in the interstitial. The second group is the origin of OM from the coast. The purpose of this research is to study the response features of the sandy interstitial communities during the decomposition of storm emissions of different origin. Investigations were conducted under laboratory conditions at ambient temperature, in plastic containers 29 x 41 x 9 cm. Into each container a layer of sand with porosity of 37,9 – 43,1% and thickness of 5 cm was placed, than all containers were filled with filtered marine water from the water edge's layer. Storm emission (SE) of different volumes (5, 2.5 and 1.25 kg per container) were laid on the surface of the sand layers. Sand without SE has served as a control. During the experiment distilled water was automatically supplied to maintain moisture. As SE have been investigated: 1) macrophytes, represented mainly by *Enteromorpha* sp. and *Cladophora* sp.; 2) homogenate of mussels *Mytilus galloprovincialis*; 3) *Zostera* sp. Organic matter, saprophytic, phosphate-mobilizing and intestinal bacteria, marine fungi, algae, flagellates, ciliates, and insects were studied in the SE and sand. It was found that algae and mussel SE stimulated the development of interstitial population. At the same time increase of organic matter concentration in the SE reduced diversity of organisms while increasing their quantitative development. The maximum rate of the OM decline in the sand at the expense of developing organisms (to 5.3% dry weight·day^{-1}) was observed on the second day after the mussels exposure. The average concentration of OM in the sand in the experiment of algae and mussel SE amounted respectively to 12.4 and 6.0 mg of OM in 1 cm^{-3}. In the sand of algae and mussel SE (in brackets) were found 12 (11) taxa of fungi, 32 (23) microalgae, 55 (2) flagellates, 59 (37) ciliates and 2 (1) insects. The maximum abundance of the reported organisms was: 2.76 (65.67) mln CFU cm^{-3} (of dry weight) saprophytic bacteria, 13783 (1574) ind·cm^{-3} of fungi propagules, 106844 (38400) cells cm^{-3} of microalgae, 24740 (6100) ind cm^{-3} of flagellates, 5000 (20000) ind cm^{-3} of ciliates, and 43 (227) ind dm^{-3} of insects. SE of *Zostera* sp. exerted an inhibitory effect on interstitial organisms. Their quantitative development in the control was significantly higher than their abundance and biomass in the presence of SE in the experiments: saprophytic bacteria – by 2-3.5 times, fungi – 0.6 times, microalgae – 121 – 373 times, flagellates – 0.92 times, ciliates – 4.9 – 72.0 times. It is known that *Zostera* contains substances of bactericidal and fungicidal activity, and also it can inhibit the photosynthesis of algae (Gross, 2003; Choi et al., 2009).

A13002

ORGANIZATION OF DATABASES OF MARINE GEOLOGY IN INSTITUTE OF GEOLOGICAL SCIENCES OF NAS OF UKRAINE

A. Ivanova[1, a], A. Mitropolskiy[1, b]

[1]Institute of geological Sciences of NAS of Ukraine, 55-b O.Gonchara Str., Kyiv 54, 01601, Ukraine

[a]a_1207@mail.ru, [b]info@igs-nas.org.ua

Keywords: ***marine geology, Azov-Black Sea basin, marine expert systems, metadata, databases, multidisciplinary observations, mathematical modeling***

During the last decades databases about the state of marine environment became an important resource component of modern information systems in investigation of seas and oceans. These bases unite archival documents and the results of modern research.

The Institute of Geological Sciences of NAS of Ukraine has accumulated a significant amount of information on research of the Azov-Black Sea basin and various parts of the World Ocean. However, the accumulation of large amounts of integrated information, its diversity and spatial-temporal variability creates difficulties while using it in investigation of marine environment state.

Perfection of automatic processing and use of such information, development of databases and marine expert systems which allow to automatically solve specific problems in chosen subject area is an actual way to solve this problem.

In 2009 Grant Agreement “Up-Grade Black Sea Scientific Network” (Up-Grade BS-Scene) № 226592 between Institute of Geological Sciences of NAS of Ukraine, Commission of the European Communities and Mariene Informatie Service MARIS was signed. 50 organizations from 11 countries (Belgium, the Netherlands, Turkey, Russia, Georgia, Bulgaria, Romania, Ukraine, Greece, France, Cyprus) also took part in this contract. According to the project, IGS established a web-server for data transfer; the server is connected with the “Up-Grade BS-Scene” network. IGS created over 100 files with metadata, which were added to the unique network. Now the server is in operation.

Since 2012 the Institute of Geological Sciences has participated in the Ukraine-Russian research project “Black Sea as a simulation model of the ocean”. One of the main goals of this project is to create a database of multidisciplinary observations in the Black Sea. This database unifies the parameters with the interdisciplinary mathematical model. This model is developing in Marine Hydrophysical Institute in cooperation with Department of Geography of Moscow State University and Department of Modern Marine Sedimentogenesis of IGS.

Thus, a large number of archival and modern information obtained in numerous research expeditions requires integrating into a United system of marine geological data (database of Marine Geology). Further use of such databases / databanks will give the opportunity to investigate the variability of the geological characteristics of the marine environment at different spatial and temporal scales, create digital maps and atlases.

A13014

IDENTIFICATION OF SIMILARITIES IN THE BLACK SEA USING EOF ANALYSIS OF REMOTE SENSING DATA AND RELEVANCE TO MSFD IMPLEMENTATION

Elisaveta Peneva[1, a], Violeta Slabakova[2, b], Snejana Moncheva[2, c]

[1]Sofia University "St. Kliment Ohridski", Department of Meteorology and Geophysics, Sofia, Bulgaria
[2]Institute of Oceanology, BAS, Varna, Bulgaria

[a]elfa@phys.uni-sofia.bg, [b]v.slabakova@io-bas.bg, [c]snejanam@abv.bg

Keywords: EOF analysis, remote sensing data, Black Sea

At present a great amount of data is gathered through remote sensing techniques by various satellite missions. This method of observations is very useful as it renders data of high resolution and regular in time and space. However, the cost is that the large database requires significant efforts in data processing and analysis. A powerful method to derive useful statistics from a large amount of data is the EOF analysis. It helps to identify correlation between different points within the region of interest. The limitation that the data should be uniform in time and space is not restrictive for the satellite data.

In this study we use 2 sources of observations: 1) gridded data for Chl A, originating from SeaWiFs/SeaStar satellite mission with spatial resolution of 8 km and temporal resolution of 1 day; and 2) weekly gridded data of sea level anomaly (SLA) obtained from AVISO database with spatial resolution of ~ 9 km. The data are processed to obtain monthly mean values in order to identify similarities within the Black Sea in regard to the seasonal cycle in the ecosystem.

The first EOF of the Chl A data is responsible for significant part of variability, 47%. It discriminates very well the coastal, shelf and open sea areas, while an interesting anti-correlation between the CHL A pattern in the western and eastern side of the North-West Basin is revealed. The first EOF of the SLA data is responsible for 33% of the variance and distinguishes between the deep open sea basin and the coastal zone.

The study presents the application of the approach for delineation of pelagic habitats for the purpose of MSFD implementation in the Black Sea (Bulgaria) and further tested at basin-wide scale and definition of "specific ecohydrodynamic regions" crucial for optimization of monitoring strategy to ensure spatially and ecologically representative data.

A13016

BIOLOGICAL DATABASE-A VALUABLE TOOL TO STRUCTURE ENVIRONMENTAL INFORMATION FOR ECOLOGICAL ASSESSMENT

Eleonora Racheva[1, a], Asen Stefanov[1, b]

[1]Institute of Oceanology-BAS, Varna 9000, PO. BOX. 152, Bulgaria

[a]ainsteim@abv.bg1, [b]a.stefanov@io-bas.bg2

Keywords: biological database, taxonomic relevance

Marine biological database (MBD), aimed at data inventory with regards to taxonomic structure, abundance and biomass was created to structure environmental information and to further facilitate calculation of diversity indices necessary for ecological assessment. Since no such database has been made so far within IO-BAS, it was developed using already available know-how of MacroBen and LargeNet databases. Taxonomic relevance was achieved through utilizing the common naming references- WoRMS, CoL, ITIS, AlgaeBase, FishBase and Black Sea phytoplankton check list, thus solving the problem with synonyms and obsolete names. Single source of biological data (raw and analyzed), the database has the capability of taxon-based search of entities along with other traditional database features.

A14003

DETERMINED ACTIVE FAULTS SIGNIFICANT FOR THE IMPLEMENTATION OF THE PROJECT MARINEGEOHAZARD

Orlin Dimitrov[1, a, b], Ivan Genov[1, c]

[1]Institute of Oceanology - Bulgarian Academy of Science, Varna , 9000, P.O.B. 152

[a]ovdimitrov@gmail.com; [b]ovdimitrov@io-bas.bg, [c]idgenov@io-bas.bg

Keywords: neo-tectonic, seismic-stratigraphy, Moesian plate, Lower-Kamchia drop

Neo-tectonic research works presented in the report are based on the seismic-stratigraphy. The geological structures studied are located in the south-eastern area of Moesian plate and in the Lower-Kamchia drop from the Bulgarian Black Sea sector. The Quaternary sediments have been the subject of study. The main purpose is to define the active faults that have been essential importance for the seismic-tectonic research. The materials used here are seismic acoustic profiles gained during expedition of Institute of Oceanology-BAS, Varna. The method of seismic stratigraphic approach elaborated in the Russian Academy of Science is applied. Some methodological approaches developed in competent institutes in the USA and West Europe has been used.

As a result of geotectonic researches a lot of tectonic disorders were defined. It was found out that the trajectories of a series of faults pass through the trajectory of the 100 m. isobath. It can bee accepted that these faults represented separate segments of a large fault. On the east of above mentioned faults fault zone is fixed comprising plenty of faults directed north-east south-west. Their number on separate profiles varies from two-three to over ten. All these faults get close to the sea bottom and part of them appears on its surface. At many spots these faults reach the sea bottom surface.

The analysis of the facts presented here lines in the conclusion that during the Quaternary age there was active breaking process in the area studied.

The epicenters of earthquakes registered close to the studied area and their possible link to the faults whose surfaces reach the sea bottom are indicative of the present activity of these faults.

The submeridian faults defined here are probably a result of stretching tension in the trajectory studied here. The tendency in development of the continental terrace of the Bulgarian part of the Black sea is the stepped submergence in direction to the deep-water kettle over a system of new and renewed submeridian breaks and the fixed faults are gravitational dippers with steep break planes, typical of the areas subjected to stretching.

Determined location of the EUXBg 05-2 is adjacent to these faults. EUXBg 05-2 is a part of the technical equipment of the project MARINEGEOHAZARD, and the determination his location is a part of the implementation of this project. All tectonic disorders presented here probably reflect the development of a great fault located deeper.

A14004

ASPECTS REGARDING THE VULNERABILITY OF THE LANDSCAPES IN SOUTHERN DOBRUJA AND THE CONSEQUENCES OF THE RISK PHENOMENA

Mihalteanu Cristina[1, a]

[1]*Faculty of Natural Sciences and Agricultural Sciences, Ovidius University, University Alley, nr. 1, Campus Corp B, Constantza, Romania*

[a]*cristinamihalteanu@yahoo.com*

Keywords: climatic risk, hydrological risk, vulnerability, hazards

The present work aims at analysing the vulnerability of the natural landscapes of Southern Dobruja and also their capacity to be affected by hazards. Many pressures have been exerted over the Southern Dobruja's natural landscapes, generating a series of changes, a situation continuing until present. It represents the stage of the most intense and complex processes and interventions, with multiple consequences. The changes of the Southern Dobruja's landscape were made since the oldest times, the most influential one being the humans, with their activities, provoking irreversible alterations. The moment of emergence of the first urban and rural establishings in this territory represented the beginning of major alterations in the natural environment. The activities having the greatest impact were: foreign population colonization, resource exploitation (wood, construction stones), irrational animal grazing, construction of communication roads, etc. In studying the region, it is highly important to be aware of the existence and implications of hazards, considering their physical features, their specific action modality and impact on the environment. The relief conditions (fragmentation density, declivity, altitude) and also the petrographic componence in the studied region, indicate a differentiated vulnerability degree in the event of risks. From the climatic point of view, Southern Dobruja shows an increased vulnerability risk, due to low precipitations and frequent drought phenomena. Both the climatic and the hydrological risks that Southern Dobruja face generate the vulnerable state of the landscapes, attracting undesirable consequences.

B21005

MICROBIAL COMMUNITY AND ITS POTENTIAL AS DESCRIPTOR OF ENVIRONMENTAL STATUS WITHIN THE FP7 PERSEUS PROGRAM

G. Caruso[1, a], M. Azzaro[1, b], C. Caroppo[2, c], F. Decembrini[1, d], L.S. Monticelli[1, e], G. Maimone[1, f], R. Zaccone[1, g], R. La Ferla[1, h]

[1]Institute for Coastal Marine Environment (IAMC), Italian National Research Council (CNR), Messina, Italy
[2]IAMC-CNR, Taranto, Italy

[a]gabriella.caruso@iamc.cnr.it, [b]maurizio.azzaro@iamc.cnr.it, [c]carmela.caroppo@iamc.cnr.it, [d]franco.decembrini@iamc.cnr.it, [e]luis.monticelli@iamc.cnr.it, [f]giovanna.maimone@iamc.cnr.it, [g]renata.zaccone@iamc.cnr.it, [h]rosabruna.laferla@iamc.cnr.it

Keywords: ***PERSEUS, MSFD, microbial community, ecological indicators, Mediterranean Sea***

The FP7 "Policy-oriented marine Environmental Research for the Southern EUropean Seas" (PERSEUS) program aims 1) at identifying the patterns of natural and human-derived pressures on the Mediterranean and Black Seas and 2) at developing a scenario-based framework of adaptive policies and management schemes, according to the objectives and principles of the Marine Strategy Framework Directive (MSFD). In view of reaching the Good Environmental Status (GES) of marine ecosystems, this Directive has given great attention to the phyto- and zoo-planktonic communities, while the microbial communities (including Bacteria, Archaea, cyanobacteria and viruses) have been neglected. Besides the relevance of microbes – particularly of the pathogenic fraction – as water quality indicators, the abundance and the role that microorganisms play in the whole ecosystem functioning are important features that deserve to be focused within the MSFD, due to their implications in several descriptors: D1 (Biological Diversity), D4 (Food Webs) and D5 (Eutrophication). Since over a decade, complete datasets on microbial abundance and activities have been acquired by the IAMC-CNR Messina in several Mediterranean basins; the analysis of microbial parameters has allowed to follow their recent evolution in response to climate changes. An integrated approach, relying on both trophic (chlorophyll-a, particulate and dissolved organic matter contents) and microbial determinations (abundances, biomasses and activity rates: enzymatic hydrolysis, prokaryotic production and respiration) seems to be the most suitable tool for marine ecosystems monitoring. Microbial parameters and related processes within the biogeochemical fluxes have been proposed as early warning sentinels to detect changes in environmental quality. This approach will be adopted in the next cruises planned for 2014 in the Adriatic and Ionian Seas vulnerable to climate changes and Bimodal Oscillating System (BiOS).

B21006

RETROSPECTIVE ASSESSMENT OF THE ECOLOGICAL STATUS OF SHALLOW COASTAL WATERS BASED ON CHLOROPHYLL-A LONG-TERM MONITORING DATA (BURGAS BAY, SOUTH-WESTERN BLACK SEA, BULGARIA)

Ioana Georgieva[1, a], Ventzislav Karamfilov[1, b], Georgi Daskalov[1, c]

[1]Institute of Biodiversity and Ecosystem research Bulgarian Academy of Science, 2 Y Gagarin Str., 1113 Sofia, Bulgaria

[a]georgieva.ioana@gmail.com, [b]karamfilov.v@gmail.com, [c]georgi.m.daskalov@gmail.com

Keywords: ***Black Sea, Burgas Bay, chlorophyll-a, coastal waters, ecological status***

Anthropogenic eutrophication is a worldwide ecological problem most pronounced in semi-enclosed coastal bays such as Burgas Bay, Bulgaria.

Since the late 1970s increasing eutrophication and other human impacts (overfishing, introduction of alien species, climate changes) have considerably changed the structure and functioning of the Black Sea ecosystems, affecting both the qualitative and the quantitative state of the benthic and planktonic communities.

According to the European policies (Water Framework Directive 2000/60/EC, Marine Strategy Framework Directive 2008/56/EC), the phytoplankton biomass measured as chlorophyll-a is one of the mandatory components used for evaluation of ecosystem status and health. This study aims to assess the changes in the coastal waters quality of the Bulgarian Black Sea coast in the last 3 decades by investigating the dynamics of chlorophyll-a concentrations.

Data on chlorophyll-a concentrations in Burgas Bay for the period 1985-2012 were analyzed. Chlorophyll-a concentrations were higher in the period 1985 – 1996 corresponding to bad or poor ecological status, and showed an overall decline since the late 1990s when the prevalent status is very good. The changes in the water quality indicate an improvement of the ecological status after the period of intense eutrophication in the 1980s. Stations located closer to Burgas city, the principal source of anthropogenic influence in the area, are still characterized by moderate ecological status, most pronounced in winter and summer periods.

B21009

ANALYSIS OF MARINE ENVIRONMENTAL ASSESSMENT APPROACHES REGARDING FISHERIES WITHIN THE FRAMEWORK OF PERSEUS FP7 PROJECT

M. Pantazi[1, a], V. Vassilopoulou[1], D. Gonzalez-Fernandez[2], S. Laroche[3], B. Andral[3], D. Vasile[4], M.T. Gomoiu[4], G. Hanke[2]

[1]HCMR, 19013, Anavyssos, Athens, Greece
[2]EC JRC IES, Ispra, Italy
[3]IFREMER, Zone portuaire de Brégaillon, 83 507 La Seyne-sur-Mer, France
[4]GeoEcoMar, 23-25 Dimitrie Onciul Str, Bucharest, Romania

[a]mpantazi@ath.hcmr.gr, celia@hcmr.gr

Keywords: ***GES, MSFD Descriptor 3, methodological gaps, decision trees, harmonized methodologies***

Within the framework of the research project PERSEUS, methodological elements provided by five EU countries (Spain, France, Greece, Cyprus and Romania) in their draft MSFD Initial Assessments have been reviewed, with the aim to identify, develop and promote tools and methods to ensure consistency in marine environmental status assessments across the Mediterranean and the Black Sea basins. Information included in this study refers to the MSFD Descriptor 3, related to commercially exploited fish and shellfish. Our findings showed that methodological approaches used for assessments under Descriptor 3 were mainly based on commercial stock assessments carried out by international organizations, such as ICES, GFCM, or ICCAT, using collected data under the DCF. Hence, for assessed stocks primary indicators were provided, whereas for non-assessed stocks survey-derived (secondary) indicators were used. A synthetic representation of the methodological gaps identified within Descriptor 3 was attempted, by introducing a scoring system considering all relevant information (i.e. descriptors' scope, methodologies, data availability) reported by each of the five countries at criteria and indicator level. Six PERSEUS partners were involved in a qualitative assessment of 8 semi-quantitative criteria, based on a matrix aiming to assess the methodological gaps per descriptor. The analysis showed that most of the countries reported a lack of data, especially regarding the small number of species considered in the assessments and the need to establish consistent reference points, as well as to develop additional indicators. In order to formulate an effective and innovative framework to visualize the degree of harmonization of the applied methodologies, decision trees were designed which reflect the process of environmental status assessment from input to output.

B21010

PLANKTON COMMUNITY INDICATORS FOR ASSESSMENT OF BULGARIAN MARINE WATERS GES: CHALLENGES FOR MSFD IMPLEMENTATION

Snejana Moncheva[1, a], Kremena Stefanova[1, b]

[1]Institute of Oceanology-BAS, Parvi Mai str. 40, P.O. Box 152, 9000 Varna, Bulgaria

[a]snejanam@abv.bg, [b]stefanova@io-bas.bg

Keywords: phytoplankton, zooplankton, MSFD indicators, Black Sea

The study presents plankton indicators of marine state and pressures developed to assist scientifically-based assessment of Good Environmental Status (GES) for Marine Strategy Framework Directive (MSFD) implementation in the Black Sea (Bulgaria).

Operational environmental targets were quantified and associated uncertainties viewed to inform environmental and policy measures challenges.

Characteristics of good environmental status relevant to descriptors biodiversity (D1), non-indigenous species (D2) and eutrophication (D5) were associated to specific criteria and indicators. Plankton community assessment elements include phytoplankton and mesozooplankton biomass, biodiversity Indices, taxonomic – based ratios (MEC %, DE%, Bac:Din), proportion of Copepods and *Noctiluca scintillans* to mesozooplankton biomass, biomass of invasive species *Mnemiopsis leidyi*, non-indigenous/native species ratio etc. The concept of baseline conditions and setting thresholds/limits is discussed.

A scoring system to classify gaps developed within PERSEUS Project was applied to identify major deficiencies in knowledge and data.

The most significant gap in plankton monitoring occurs in the lack of an integrated monitoring strategy with relevant frequency which would allow a better understanding of the changes in the plankton communities of Bulgarian waters to construct a relevant assessment system.

B21011

APPLICATION OF OCEAN COLOR DATA TO CONSTRUCT PHYTOPLANKTON BLOOM INDICATORS FOR GES ASSESSMENT IN THE BLACK SEA

Violeta Slabakova[1, a], Snejana Moncheva[1, b], Valentina Doncheva[1, c]

[1]Institute of Oceanology – BAS, P.O. 152, Varna 9000, Bulgaria

[a]v.slabakova@io-bas.bg, [b]snejanam@abv.bg, [c]valentina.doncheva@gmail.com

Keywords: ocean color data, phytoplankton blooms, Black Sea, MSFD

Phytoplankton blooms play a central role as ecological/environmental status assessment traits of high policy importance sensu WFD and MSFD. One of the main challenges in their practical application however is the need of data with frequency corresponding to the scale of phytoplankton variability. The present study proposes an approach to use ocean color data to construct indicators that describe aspects of Black Sea ecosystem health evolution.

Thirteen years (1998-2010) of remotely sensed ocean colour data from Sea-viewing Wide Field-of-view Sensor (SeaWiFS) have been used to assess the patterns of spring and summer phytoplankton blooms (FPBs) dynamics in two distinct regions (shelf < 200 m and open sea > 200) of the Bulgarian Black Sea waters. The constant threshold method (Kim H.-J, 2009), defined as two standard deviations above the entire time series average has been applied to estimate the intensity and spatial extend of major and minor blooms in sprig and summer. The ocean color data reveal an overall decreasing trend of chlorophyll a concentrations. The time evolution of FBPs in the shelf was similar to that in open sea with low intensity in summer and high in spring. The spring FPBs in the two regions were featured as strong and long lived while the summer blooms were weak and widespread. In the open sea the recent trend (2006 – 2010) of the major FPBs spatial extend was a decline about 9 times in spring and 5 times in summer while their magnitude decreased about 2 times as compared to the 1998 – 2005 time interval. In contrast in the shelf region the magnitude of the FPBs didn't differ significantly between the two periods and the reduction in the size of bloom areas was negligible (about 1.5 times).

The results provide a quantitative estimation of phytoplankton bloom dynamics during spring and summer seasons in the Bulgarian Black Sea area as test indicators relevant to MSFD implementation.

B21013

IMPACTS OF HUMAN-INDUCED EUTROPHICATION ON UPPER LAYER CHEMISTRY AND REFERENCE NUTRIENT CONDITIONS FOR GES TARGETS IN THE BLACK SEA

Suleyman Tugrul[1, a]

[1]*Institute of Marine Sciences-Middle East Technical University 33731 Erdemli, Mersin, Turkey*

[a]*tugrul@ims.metu.edu.tr*

Keywords: ***good environmental status, eutrophication, nutrients, anthropogenic input, Black Sea***

Assessment of long term impacts of human-induced eutrophication on the Black Sea sub-basins are essential to determine the reference nutrient conditions for the sustainable GES(Good Environmental Status) in the Black Sea with prevailing physiographic, geographic and climate conditions. Since the mid 1970□s, the increased nutrient loads of rivers (mainly the Danube) and precipitation has led to enhanced eutrophication over the entire basin, resulting in drastically increased particulate organic matter (POM) production and export below the euphotic zone. Thus, significant ecological changes have been observed not only in the NW shelf waters but also in distinct chemical features of the oxic/anoxic transition zone in the deep basin. In the pre-anthropogenic and pre-dammed period before the 1960□s, the Black Sea surface waters contained excess amounts of silicate (30 □ 70 μM), and phosphate (0.1 □ 0.3 μM) but exhibited very low nitrate concentrations (< 0.1 μM), resulting in extremely high Si/NO_3 ratios (> 100) but very low NO_3/PO_4 ratios (N/P < 1.0) whereas the major rivers and wet deposition fed the system with high N/P ratios (> 25 – 50). The terrestrial DIN (nitrate+ ammonia) inputs were not sufficient for consumption of the excess inventories of reactive Si and P in the euphotic zone of the coastal and central gyres due to sufficient supply from the halocline depths in winter months before the 1970's. Then, the enhanced DIN and P inputs by the major rivers with lower Si concentrations decreased Si/DIN and Si/P ratios in the polluted rivers. The increased DIN inputs resulted in the utilization of excess Si and PO_4 stocks in the near surface waters during the 1980□s; the Si/N ratio declined drastically (< 1) as N/P ratios exhibited the opposite trend. The nutrient (N, P) loads of the River Danube gradually decreased after the mid 1990□s, resulting in increases in the Si/N ratio; however the N/P ratio remained high (> 25). The enhanced eutrophication also increased the DIN inventory of the upper layer down to the suboxic layer boundary (DO < 20 μM), where the silicate stock decreased markedly. The increased POM export to depths has led to seasonal/decadal changes in both the boundaries and thickness of the chemocline in the permanent halocline; moreover, the N/P ratio increased in the oxycline, which is still lower than in the adjacent Marmara Sea and the classical Redfield ratio. The upward shift of the O_2 boundary ≈ 5.0 μM within the enlarged SOL has increased the catalyzing role of Mn species and oxygen input by the Bosporus plume in maintaining the boundary of the hydrogen sulfide layer unchanged in recent decades. Reference conditions for GES describe the state of those marine environments in which there is considered to be none, or very minor disturbance caused by human activities. The reference values of reactive Si and the Si/DIN ratio should remain high; (Si > 1.0 μM) and Si/DIN ratio

(> 5) in the near surface waters during the more productive period even under changing climatic (warming/cooling) conditions. It may be achieved by further reducing DIN inputs from the major rivers, which should also reduce algae production with increasing abundance of diatoms. These changes should increase the euphotic zone thickness, allowing more oxygen to penetrate into the halocline depths, resulting in enlargement of the oxycline to greater depths.

However, in the Black Sea basin, reference conditions for GES targets will differ from those conditions prior to the 1960's simply because current and future nutrient inputs from anthropogenic sources are unlikely to decline to those of "pre-anthropogenic" conditions due to the irreversible changes in both the Si and DIN inputs and their molar ratios. Under the present conditions, the Si and PO_4 deficiencies in the surface mixed layer can only be compensated by winter inputs from the upper halocline. To achieve this objective, DIN inputs from both rivers and precipitation should be reduced to threshold levels that can only be estimated by N-P-Si coupled ecosystem models.

B21016

ECOLOGICAL STATUS OF COASTAL WATERS OF TURKISH BLACK SEA ASSESSED BY THE ECOLOGICAL EVALUATION INDEX (EEI) METHOD

Ergun Taskin[1, a], Mehmet Ozturk[1, b], Colpan Beken[2, c]

[1]Department of Biology, Faculty of Arts and Sciences, Celal Bayar University, Muradiye-Manisa 45140, Turkey
[2]TÜBİTAK MRC Environment and Cleaner Production Institute Gebze Kocaeli Turkey

[a]ergun.taskin@cbu.edu.tr, [b]mozturk@bayar.edu.tr, [c]coplan.beken@tubitak.gov.tr

Keywords: EEI, macroalgae, macrophytes, Black Sea, Turkey

EU Water Framework Directive (WFD, 2000/60/EC) requires that the ecological status of surface waters will be "high/good" by 2015. Macroalgae and angiosperms were declared as one of the biological quality elements to assess the ecological status of coastal waters and transitional systems by the WFD. Recently, the Ecological Evaluation Index (EEI) has been intercalibrated in the Mediterranean eco-region by the Mediterranean Geographic Intercalibration Group (MEDGIG) which is being used especially by the Eastern Mediterranean countries for the ecological quality classification of coastal waters.

In the present study, EEI is tested to measure the ecological status of coastal waters of Kilyos (İstanbul), Sinop and Samsun from the Black Sea coast of Turkey where the sites were selected as less and highly impacted areas. The study shows a high ecological quality for Sinop, a moderate-good quality for Kilyos whereas Samsun is of bad quality. The tested methodology could be recommended to be used in the future monitoring activities for the Black Sea with a sound spatial and temporal coverage in order to assess the ecological quality of coastal waters as part of the WFD assessment scheme.

This study, as part of a methodological approach for all Turkish seas, was designed within the frames of the Project called "Classification and Identification of Quality Status of Marine and Coastal Waters" supported by the Ministry of Environment and Urbanization.

B22002

MARINE PLANTS OF TRINITY BAY (FAR EAST, SEA OF JAPAN)

Oksana Belous[1, a]

[1]G.B. Elyakov Pacific Institute of Bioorganic Chemistry, Far Eastern Branch, Russian Academy of Sciences, 159 100-let Vladivostoku Prospect, Vladivostok, 690022, Russia

[a]ksu_bio@mail.ru

Keywords: marine plants, species compositions, macroalgae, diversity

On the results of our studies conducted in the spring-summer period from 2004 to 2012 in Trinity Bay (Far East, Sea of Japan, Russia) was found 102 species of marine plants, including Rhodophyta – 49 species, Ochrophyta – 35, Chlorophyta – 15 and sea grasses – 3 species. For the first time was found parasitic red algae *Janczewskia morimotoi*.

During the year vegetation on the intertidal and subtidal zones of the bay change significantly. Vegetation cover is formed by algae with different periods of the growing season: perennials (*Saccharina* spp., *Corallina pillulifera*, *Sargassum* spp.), macrophytes, vegetating most of the year (*Ulva* spp., *Gloiopeltis furcata*, *Chondrus* spp.) and ephemers – vegetating few months of the year (*Chaetomorpha* spp., *Lomentaria hakodatensis*, *Dictyota dichotoma*, *Dictyopteris divaricata*). Macrophytes occupy rocky-stony substrates, on soft substrates grows seagrass (*Zostera* spp.). Not attached to the substratum (sand, silt) red algae *Ahnfeltia tobuchiensis* accumulates on the bottom of the central part of the bay.

The most widely represented algae in the low intertidal and subtidal zones: *Codium* spp., *Punctaria plantaginea, Desmarestia viridis*, *Sargassum* spp., *Stephanocystis crassipes*. Upper intertidal algae are few: *Corallina pilulifera*, Nemalion *vermiculare*, *Gloiopeltis furcata* form a belts on the vertical surfaces of rocks. In the supralittoral zone marine plants were not found.

In the Trinity Bay by the number of species dominated red algae, among which by the number plants and their biomass is dominated *Ceramium kondoi*, *Corallina pilulifera*, *Neosiphonia japonica*, *Polysiphonia morrowii*, *Neorhodomela aculeata*. Rarely occur: *Porphyra* spp., *Ceramium japonicum*, *Gelidium amansii*, *Champia parvula*. Among brown algae are dominants *Sargassum* spp., *Stephanocystis crassipes*, *Desmarestia viridis*, *Chorda filum*. Green algae represented by a small number of species, among them dominate *Ulva linza* and *U. lactuca*.

Seagrasses are represented by three species: *Phyllospadix iwatensis*, *Zostera marina* and *Z. asiatica*.

Despite the close proximity of international trade port, Trinity Bay is characterized by rather a high diversity of marine plants.

B22004

ALLOZYME VARIATIONS IN TURBOT POPULATIONS FROM NORTH-WESTERN PART OF THE BLACK SEA AND AZOV SEA

V. Nikolov[1, a], P. Ivanova[1, a], I. Dobrovolov[1, a], D. Pavlov[2, b]

[1]Institute of Oceanology- BAS, First May Street 40, P.O. Box 152, Varna 9000, Bulgaria
[2]Society of Innovative Ecologists in Bulgaria, Dr. Bassanovich Str., 10, 9010 Varna, Bulgaria

[a]genombiogen@yahoo.com, [b]danailpavlov@gmail.com

Keywords: allozymes, turbot, populations, differentiation, Black Sea, Azov Sea

Data for electrophoretic pattern of 19 enzyme loci and 12 – 16 non-enzymatic loci were used to investigate population structure of turbot along the Bulgarian and Romanian Black Sea coasts. Two populations (southern and northern) along the Bulgarian coast and one in southern Romanian coast were found. Two of four esterase loci (EST-2* and EST-3*) were proved as a marker enzyme systems for distinguishing of turbot populations. The allele frequencies of EST-2* and EST-3* loci of north Bulgarian population were closely related to the frequencies of Romanian population, analyzing haemoglobins. Population of turbot from Sevastopol coast (Ukraine) didn't show differences from other analyzed populations.

A new potential genetical marker (LDH-C*) for distinguishing of turbot populations was found. The taxonomical position of turbot from Azov Sea also was analyzed. Allozyme comparisons between turbot form Black and Azov Seas showed that they are different on population level.

B22007

THE PLANT ASSOCIATION ALYSSO BORZAEANI – EPHEDRETUM DISTACHYAE TZONEV ET AL. 2005 IN THE WESTERN COASTAL AREA OF THE BLACK SEA

Marius Fagaras[1, a], Rodica Bercu[1]

[1]Ovidius University of Constanta, Faculty of Natural and Agricultural Sciences, University Street, No. 1 B, Constanta, Romania

[a]marius_fagaras@yahoo.com

Keywords: ***plant association, sand dunes, western coastal area, Black Sea, Romania, Bulgaria***

Alysso borzaeani-Ephedretum distachyae Tzonev et al. 2005 is a plant association recorded for the first time on the sand dunes of "Anna Maria" beach, in the northern coastal area of Bulgaria, near the border with Romania. Recently this plant association considered endemic by Tzonev et al. (2005) has been identified in the southern Romanian Black Sea coast, inside of "Marine sand dunes of Agigea" protected area, not very far from Constanta town.

The plant association belong to *Scabiosion ucrainicae* Boscaiu 1975 alliance and can be found on the low to medium fixed sand dunes in the littoral area. The characteristic plants of the association are *Alyssum borzaeanum Nyar*. and *Ephedra distachya* L. which build medium to high cover perennial coenoses together with other psammophilous herbaceous plants.

Alysso borzaeani-Ephedretum distachyae is one of the main recognize plant community of the "Northwestern Pontic fixed dunes" habitat (code 16.22B12 according to Palearctic Habitats classification) and of the priority habitat "Fixed coastal dunes with herbaceous vegetation" (code 2130* according to Habitats Directive), habitat of conservative importance for European Community.

Comparative considerations regarding floristic composition, coenotic structure, threats and conservation measures of the plant association in Romania and Bulgaria will be specified in the paper.

B22010

DISTRIBUTION OF THREE CETACEAN SPECIES ALONG BULGARIAN BLACK SEA COAST IN 2006 – 2012

Marina Panayotova[1, a], Violin Raykov[1, b], Valentina Todorova[1, c]

[1]Institute of oceanology-BAS,"Parvi may"40 Str., P.O.Box 152, 9000 Varna, Bulgaria

[a]mpanayotova@io-bas.bg, [b]vio_raykov@abv.bg, [c]vtodorova@io-bas.bg

Keywords: Bulgaria, Black Sea, cetaceans, sightings, distribution

Three small cetacean species inhabit Bulgarian Black Sea area, distributed both in costal and offshore areas. Due to lack of specialized large scale surveys in Bulgarian waters which would provide more accurate data on distribution and abundance of cetaceans, the pooling of sightings data from different surveys provides an alternative way to collect a large data set. Sightings data were collected during 19 surveys over the period 2006 – 2012 in coastal and open sea areas with total effort of 230 days. A total of 1398 cetacean sightings off the coast of Bulgaria were recorded including the three species – common bottlenose dolphin (Tursiops truncatus ponticus), short-beaked common dolphin (Delphinus delphis ponticus) and harbour porpoise (Phocoena phocoena relicta). The most abundant species in observations was common bottlenose dolphin (n = 610), followed by short-beaked common dolphin (n = 547) and harbour porpoise (n = 241). Cetaceans were distributed randomly in territorial waters and EEZ of Bulgaria during the all seasons and years, related to the hydrological conditions and food ability.

Despite the lack of specialized research surveys on cetaceans, all these data were used recently for designation of new marine NATURA 2000 zones, dedicated to conservation of marine mammals.

B22012

SEASONAL SUCCESSION IN THE COASTAL ZONE PHYTOPLANKTON IN RECENT CONDITIONS OF REDUCED EUTROPHICATION AND CURRENT CLIMATE CHANGES (BULGARIAN BLACK SEA COAST)

R. Mavrodieva[1], S. Moncheva[1], G. Hiebaum[2]

[1]Institute of Oceanology, BAS, 9000 Varna, P.O.Box 152.

[2]Central Laboratory of General ecology, BAS, 1113 Sofia, 2 Y. Gagarin Str.

Keywords: ***phytoplankton, taxonomic structure, seasonal succession, Black sea coastal zone***

The main goal of this study is to investigate the phytoplankton taxonomic structure in Sozopol Bay to assess the seasonal succession changes in recent conditions of reduced eutrophication and current climate changes. This is a first detail phytoplankton research in Sozopol Bay area built on monthly base. Phytoplankton samples as well as hydrophisical and chemical parameters were collected at 8 stations, monthly from January to December 2005. A total of 134 species, varieties and forms, from 10 taxonomic classes were identified. The phytoplankton community was featured by high species diversity and richness and relatively low abundance and biomass. Dinophyceae species build up the bulk of the winter phytoplankton biomass (more than 75% of the total), while Bacillariophyceae contributing to more than 60% in the summer and autumn. The results have shown a deviation from classical succession dynamic and disturbance in the phytoplankton community.

B24001

EVALUATION OF THE FEEDING REGIMEN IMPACT ABOVE THE TYPE OF PARASITES OF THE FISH

Rigerta Sadikaj[1, a], Dritan Arapi[1, b], Vladimir Spaho[2], Mirela Lika[1, c]

[1]University of Tirana, Faculty of Natural Sciences, Blv Zogu I, Tirana, Albania,
[2]Agricultural University of Tirana, Agricultural and Environmental Faculty, Koderkamez,Tirana, Albania

[a]rsadikaj@hotmail.com, [b]d_arapi@hotmail.com, [c]mirela2422@yahoo.com

Keywords: food, parasit, fish, ecosystems

The aim of this work is the study of dependence of miscellaneous compaund of the fish parasitofauna from character of food that thay consumed in artificial ecosystems of cultivation or in natyral waters.

This study is realized in the experimental economy of cyprinidae family fishes in Tapiza (Fushe Kruje) and in economy of Klosi (Elbasan) during 2011 – 2012. Some samples are taken in some natyral systems.

By results of this study we can note that Cypinus carpio Linnaeus 1758 is distinguished as most touched kind from parasits. In this fish we have found 35.13% of the total number of kinds of parasits determinated. In Alburnus alburnus alborella and Anguilla anguilla we have found respectively 18.9% and 13.5% of the total number of kinds. Onchorhyncus mykiss and Aristichthys nobilis had the smaller number of parasits.

B24002

ALIMENTARY INTERACTION BETWEEN POPULATIONS OF RUTILUS RUBILIO RUBILIO BONAPARTE, 1837 AND LEUCISCUS CEPHALUS BONAPARTE, 1838 IN SHKODRA LAKE

Dritan Arapi[1, a], Rigerta Sadikaj[1, b], Vladimir Spaho[2], Mirela Lika[1, c]

[1]University of Tirana, Faculty of Natural Sciences, Blv Zogu I, Tirana, Albania,
[2]Agricultural University of Tirana, Agricultural and Environmental Faculty, Koderkamez,Tirana, Albania

[a]d_arapi@hotmail.com, [b]rsadikaj@hotmail.com, [c]mirela2422@yahoo.com

Keywords: alimentary, growth, interaction, Shkodra lake

This study is focused in examination of alimentari behaviour of Rutilus rubilio rubilio Bonaparte,1837 and Leuciscus cephalus Bonaparte,1838 and also in evaluation of the rate of alimentary competition between two ictic populations which are concentrated in the same site.

The study is realized in three zones of Shkodra lake; in the sector of lake in front of Zogaj village, in the sector of Drini river 2 – 3 km under dike of lake of Vau Dejes and in the conjuction zone of Buna river with Shkodra lake (near Mesi bridge).

In this study are included and some informations about intensity of growth and reproducer potentials of two ictic populations, in distinguished zones of Shkodra lake.

By results of this study we can note that Rutilus rubilio rubilio Bonaparte,1837 and Leuciscus cephalus Bonaparte,1838 are distinguished for the same alimentar regimen. The results of this study prove that the rhythm of growth of individs in two populations decreased in habitats where the values of diet overlaps were hight.

B24003

LENGTH FREQUENCY DISTRIBUTION AND LENGTH-WEIGHT RELATIONSHIP OF HORSE MACKEREL, TRACHURUS MEDITERRANEUS PONTICUS ALEEV, 1956 (OSTEICHTHYES: CARANGIDAE) FROM BULGARIAN BLACK SEA COAST

Maria Yankova[1, a]

[1]*Institute of Oceanology, BAS 40 Parvi Mai str., P.O. Box 152*

[a]*maria_y@abv.bg*

Keywords: ***Horse mackerel, Trachurus mediterraneus ponticus, length-weight relationship, Black Sea, Bulgaria***

This study was conducted to determine length-weight relationship and length-frequency distribution of *Trachurus mediterraneus ponticus* (Aleev, 1956) from Bulgarian Black Sea coast. Samples taken at monthly intervals (May-December 2008-2009) were analyzed. The relationship between total length (TL) and total weight (TW) was determined according to the power regression model. The older fish did not constitute the highest percentage of all the catches. The exponent n of equation determined a positive allometry power length-weight relationship as: $W=0.0199*L^{2.657}$ ($r^2 = 0.994$) and $W=0.0038*L^{3.277}$ ($r^2 = 0.997$) for 2008 and 2009 respectively. The n value in the length-weight relationship didn't differ significantly between years (t-test, $P > 0.05$).

B24008

TROPHIC STRUCTURE, BIODIVERSITY AND ACTIVITY OF THE MICROBIAL COMMUNITY IN AN AREA OF DEPOSITION OF EGGS OF ENGRAULIS ENCRASICOLUS IN THE SICILIAN CHANNEL

R. La Ferla[1, a], M. Azzaro[1, b], F. Decembrini[1, c], G. Caruso[1, d], L.S. Monticelli[1, e], C. Caroppo[2, f], S. Fonda Umani[3], F. Azzaro[1, g], G. Maimone[1, h], M. Leonardi[1, i], R. Paranhos[4, j], R. Zaccone[1, k], A. Cuttitta[5, l], F. Placenti[5, m], R. Larosa[1, 6, n], B. Patti[5, o]

[1]CNR, IAMC,Spianata S.Raineri 86,98122 Messina, Italy
[2]CNR, IAMC,Via Roma 3, 74123 Taranto, Italy
[3]CoNISMa, University of Trieste, Via Valerio 28/1, 34127 Trieste, Italy
[4]CNPq, UFRJ, Institute of Biology, Av. Prof. R.Rocco 211, Ilha do Fundão, [2]1.941-617, Rio de Janeiro, Brazil
[5]CNR, IAMC, Via del Mare 3. 91021 Capo Granitola (TP), Italy
[6]UniPi,Università di Pisa, Lungarno Pacinotti 43 - 56126 Pisa, , Italy

[a]rosabruna.laferla@cnr.it, [b]maurizio.azzaro@iamc.cnr.it, [c]franco.decembrini@iamc.cnr.it, [d]gabriella.caruso@iamc.cnr.it, [e]luis.monticelli@iamc.cnr.it, [f]carmela.caroppo@cnr.it, [g]filippo.azzaro@iamc.cnr.it, [h]giovanna.maimone@iamc.cnr.it, [i]marcella.leonardi@iamc.cnr.it, [j]rodolfo@biologia.ufrj.br, [k]renata.zaccone@iamc.cnr.it, [l]angela.cuttitta@cnr.it, [m]francesco.placenti@iamc.cnr.it, [n]roberta_larosa@hotmail.it, [o]bernardo.patti@cnr.it

Keywords: ***microplankton food web, Biodiversity, Microbial activity, Engraulis encrasicolus, Strait of Sicily, Mediterranean***

In order to obtain an holistic picture of the microplankton food web which sustains the fish stocks in the Strait of Sicily, a multidisciplinary research in the Iblean-Maltese platform was carried out (BANSIC12 survey, July 2012).

The objects of study were the description of the planktonic populations and the analysis of the functioning of the microbial food web in an area of spawning of a pelagic species of commercial interest (anchovy, Engraulis encrasicolus).

The water masses were characterized through the use of θ_S diagrams. The water samples, collected in the euphotic layer, underwent quantitative analysis for the plankton populations (prokaryotes, nanoplankton, phytoplankton, micro-zooplankton and viruses) by microscopy and flow cytometry. The total and fractionated biomass (by ATP and CHLa), the particulate organic matter content (POC, PN), the rates of primary and secondary production, respiration, enzymatic hydrolysis of organic polymers were determined.

The prokaryotes were abundant between the thermocline and the Deep Chla Max, where the highest rates of heterotrophic and degradative activities were found. The phytoplankton abundance and biomass were dominated by nanoflagellates of uncertain taxonomic classification and dinoflagellates (36 identified species). In general, the microzooplanctonic biomass showed its maximum in surface or subsurface. Differences in terms of microbial functionality were found in the investigated area, which results to be oligotrophic.

B24010

GROWTH AND SURVIVAL RATES OF HEDISTE DIVERSICOLOR (O.F. MULER, 1776) FED ON THREE DIFFERENT DIETS IN CONTROLLED ENVIRONMENT

Veselina Mihaleva[1, a]

[1]*Institute of Oceanology – BAS*

[a]*vesselina.mihaleva@gmail.com1*

Keywords: Hediste diversicolor, growth rate, survival, diet

Polychaetes *Hediste diversicolor* are commonly found in shallow brackish soft-bottoms in the temperate zone of the northern hemisphere (Bass & Brafield 1972, Kristensen 1984). Varna and Beloslav lakes are only areas of *H. diversicolor* distribution in Bulgaria. This species is commercially used as fish bite. Consequently, intensive collection of polychaete from natural environment is considered non-sustainable for the marine ecosystem. In this context, the environmental benefits gained from bait farming (worm aquaculture) and a reduction in digging activity are considerable i.e. ecologicaly and economically justified. The current knowledge on potential use of ragwarm is still insufficient in Bulgaria and preliminary experimental work is needed.

Juveniles of *Hediste diversicolor* (O.F. Müler, 1776), obtained from laboratory cultures, were fed with three different food regimes in controlled conditions. During the experiment temperature and salinity were maintained at 20 ± 1°C and 16 ÷ 17‰, respectively and the photoperiod was fixed to 16:8 h (light:dark). The experiment was carried out in modified triplicate tanks equipped with recirculation and aeration systems. The density of population in each section was made equal to 300 ind.m^{-2}. The polychaetes were fed three times per week *ad libitum*. The diets involved: 1) laboratory-prepared high-protein food; 2) homogenized green seaweeds Ulva rigida; 3) Spirulina wafers® (fish dry food). The aim of the experiment was to determine growth and survival rates of the worms at three different protein content diets.

B24012

FEEDING HABITS OF THORNBACK RAY RAJA CLAVATA (CHONDRICHTHYES: RAJIDAE) FROM SOUTH EASTERN BLACK

Orhan Ak[1, a]

[1]*Central Fisheries Research Institute, Vali Adil Yazar Cad., 14 Kasustu Yomra 61250*

[a]*oak@sumae.gov.tr*

Keywords: ***Thornback ray, Black Sea, feeding, stomach contents***

Specimens of thornback ray (Raja clavata) were collected by bottom trawl from the south-eastern Black Sea in Turkey between January 2008 and December 2009, in order to study the feeding habits in relation with season, sex and size class. The stomach contents of 357 specimens with a total length of between 14.3 to 93 cm were analyzed. Twenty one taxonomic levels of prey items were identified: 14 fish, 6 crustaceans and 1 mollusk. Mud shrimp *(Upogebia pusilla)* were the dominant prey items with the number and frequency of occurrence. Teleost species were the second most important prey with N% and O%. Crab, isopod, amphipod and mollusk were less consumed by thornback rays. No interaction was recorded between season and sex in the diet composition of *R.* clavata. However, an ontogenetic pattern was found.

B24014

STRIPED VENUS (CHAMELEA GALLINA, L., 1758) DISTRIBUTION OF STOCKS THE BLACK SEA COAST OF TURKEY (SINOP-KASTAMONU)

Murat Dagtekin[1], Huseyin Selen[1], Murat Erbay[1], Ilkay Ozcan Akpinar[1], Goktug Dalgic[2], Orhan Ak[1], Mehmet Aydin[3], Suleyman Ozdemir[4], Sedat Karayucel[4]

[1]Central Fisheries Research Institute, 61250, Yomra-Trabzon, Turkey
[2]Recep Tayyip Erdoğan Universty Faculty of Marine, 53100, Rize, Turkey
[3]Ordu Üniversity Fatsa Marine Faculty 52400 Ordu, Turkey
[4]Sinop University Faculty of Marine, 57000 Sinop Turkey

Keywords: Striped venus, swept area, stock assessment

Striped venus which is many unknown by marine scientists until 1980 and is not catched by fisherman has a important place in seafood exports in these days in Turkey. Although very little consumption has in Turkey, in the EU countries, Japan and other countries is continuously increasing demand. Also, it comes begining important seafood by collectors because of interesting shells. The research area carried out from the Black Sea in the west of Sinop-Cide. The research area will be separated five main regions (Cide, İnebolu, Türkeli, Ayancık and Sarıkum). Studies in each region will be carried out in 0-20 m depth and this depth broken down into bottom layer in *"0-5 m, 5-10 m, 10-15 m and 15-20 m".* Within a year; in the seasonal studies 20- shot and in the summer studies for the stock detection 170 shot totaly 230 shot carried out in 2011 and 2012 year. In this study, the development of *Chamelea gallina* in the western Black Sea (Sinop-Cide), the amount of stock, the distribution of the depths and areas of stocks, the demographic structure of stock and the scanned area, according to the method of area-density, which used the hydraulics dredge in Striped venus fishery by fishermen was investigated. The stock biomass calculated by swept area method. The shell and age determination will be made for fixing the differences in population growth in between the regions. In the study, the shell length of individuals were found ranging from 3 to 30 mm. In terms of stock abundance, İnebolu, Cide and Sarıkum were determined to be more intense than the other regions. Environmental factors, especially the big floods, was determined that have the major impact in the distribution of this species.

B24015

PHYTOPLANKTON SPECIES SPECIFICITY IN PHOTOPHYSIOLOGY AND SHIFT IN DOMINATING SPECIES IN SUMMER IN THE BLACK SEA

T. Churilova[1, a], V. Suslin[2, b], Dzhulay[1], L. Manjos[1], O. Rylkova[1]

[1]Institute of Biology of the Southern Seas of National Academy of Sciences of Ukraine, 2 Nakhimov Ave. Sevastopol, 99011 Ukraine;
[2]Marine Hydrophysical Institute of National Academy of Sciences of Ukraine, 2 Kapitanskaya Str., Sevastopol, Ukraine, 99011;

[a]tanya.churilova@gmail.com, [b]slava.suslin@gmail.com

Keywords: ***intensity and spectral features of light, absorption efficiency, Emiliania huxleiy, cyanobacteria, photoinhibition, Black Sea***

Adaptation of phytoplankton community to seasonal or depth-dependent environmental conditions is accompanied by shift in dominating taxons/species. Ten years data base of bio-optical data in situ measured and simulated by regional models has been used for analysis of factors driving shift in summer phytoplankton community. In the warm season waters is stratified. Phytoplankton below thermocline exists under temperature, nutrient availability and light conditions, which markedly differ from those in upper mixed layer (UML). Key environmental factor driving species composition of deep phytoplankton community is spectral features of ambient irradiance. Blue-green domain of irradiance penetrating down to the bottom of euphotic zone matches well to the absorption band of phycobiliproteins (containing in cyanobacteria). The competitive absorbance of ambient light by cyanobacteria in comparison with other plankton taxons results in increase of efficiency of light absorption up to 20%, which in turn causes rising of photosynthesis and growth rates because of the strong light limitation near the bottom of euphotic zone. The advantage of the cyanobacteria in growth rate leads to changing of phytoplankton structure: increasing of cyanobacteria abundance with following their domination (upto 50-60% in total phytoplankton biomass at depths of 1 – 0.1% surface photosynthetic available radiation - PAR). High capacity of cyanobacteria in absorbance the blue-green light causes the deepening of euphotic zone down to 0.1 % PAR. Phytoplankton in UML exists under light intensity averaged within UML, which reaches its maximum value over the year period in early summer at the beginning of seasonal water stratification because of the maximum solar radiation and thin UML. At that time under extremely high level of light intensity blooming of coccolithophores Emiliania huxleyi is ussualy observed in the Black Sea. Start of the bloom generally coincides with location of thinnest UML. Spatial distribution of coccolithophores abundance and inter-annual variability of intensity of E.huxleyi blooming is inversely related with UML thickness, that depends on the meteorological conditions of the previous winter: in early summer the UML is thinner after cold winter than after mild winter. Coccolithophores specificity in photo-physiology, which gives advantage them under this condition, is associated with special light-scattering properties of coccoliths, covering the cell's membrane. It results in decreasing the efficiency of light penetration into the cell of coccolithophores by more than two times and in protection them from extremely high light intensity, which inhibiting the growth of the other taxons.

B25001

COMPARISONS OF FREE ANOMALY MAPPING THE BLACK SEA BASED ON SATELLITE-DERIVED GRAVITY MODELS

Lyubka Pashova[1, a, b]

[1]*National Institute of Geophysics, Geodesy and Geography, Bulgarian Academy of Sciences, Sofia 1113, Acad. G. Bonchev Str., Block 3, Bulgaria*

[a]*bismall@bas.bg,* [b]*lpashova.niggg@gmail.com*

Keywords: ***satellite altimetry, gravity field, Black Sea***

Nowadays the modelling of anomaly marine gravity field is improved substantially and the accuracy of details representation is increased after launching satellite altimetric (GEOAST, SEASAT, ERS1/2, Topex-Poseidon, Jason 1/2, etc.) and gravimetric (GRACE, CHAMP and GOCE) missions. This allows obtaining a globally marine gravity filed on a grid 1 (~ 2 x 2 km) or 2 (~ 4 x 4 km) arc minute resolution or better. Anomaly gravity field is an inherently expression of natural features of the Earth's surface relief on the dry land and oceans. This paper provides an overview of recent gravity models based on the satellite geodetic techniques over the Black Sea region. A comparative study of free anomaly data sets from three globally altimetry-derived models DNSC08GRA, SS20, and KMS02 has been performed. Free-air gravity anomalies are validated with available shipboard gravity data. Special discussions are presented on the gravity anomalies over tectonic units, which are mainly due to mass distribution of different depth and could be effectively use for the modeling of Earth's crust and upper mantle structures. Results obtained confirm that the satellite gravity data are an important contemporary source of information for scientific researches of the Black Sea region and for many practical applications.

B25005

METHODOLOGY OF CREATING A GEOINFORMATION SYSTEM FOR CARTOGRAPHIC SUPPORT TO DECISIONS RELATING TO THE BLACK SEA WATER RESOURCES PROTECTION

S. Zagorodnia[1, a], I. Radchuk[1, a]

[1]Institute of Telecommunications and Global Information Space of the National Academy of Sciences of Ukraine, Kiev, Ukraine, Chokolovskiy Boulevard, 13

[a]itelua@kv.ukrtel.net

Keywords: geoinformation systems (GIS), vectorization, database, water resources

Modern GIS technologies allow visualizing geospatial data and ensuring harmonization of a lot of databases structures into a single object-oriented information field. The structure of its data collection is shaped according to the nature and subject orientation of the application tasks implemented therein. In addition, provision is made for using the principle of new tasks that allows discovering new common factors of interaction of systems and objects. The data collection of the geoinformation system in the Black Sea water areas was formed with due account of these positions.

The geoinformation system of water areas was created in accordance with available cartographic documents, national statistical information, and the results of obtained contact measurements and observations.

The databases were formed by using the following sources:

- Paper medium (topographical maps of different scale series, nomenclature, specialized topological plans and ecological schematic maps);
- Electronic and base maps (shapefiles with visual and attributive georeferenced information);
- Attribute data, converted into spreadsheets followed by conversion into GIS format;
- The database of operational and archive space images.

In the process of creating thematic layers a method of manual vectorization in ArcGIS 9.3 was used by contouring referenced objects of halftone image.

This simplification resulted in substantial change of appearance of a map in the process of its visualization and of the method of automatic conversion of the function of transformation of attribute data in ArcGIS 9.3 Tools / Add XY Data.

The developed methodology allows creating cartographic images of sea areas with prescribed types of interlinks of data from the database. It also allows displaying the dynamics of the current state pollution of marine areas and predicting the rate and trends of its distribution, visualizing the characteristics of the marine areas in the form of thematic maps on the topographic base of complete scale range.

B25006

MARINE POLLUTION MONITORING OF THE BLACK SEA PORTS AND WATERWAYS BY GIS AND REMOTE SENSING

V. Radchuk[1, a], A. Palazov[2, b], G. Krasovskiy[1, a], V. Slabakova[2, b], O. Hristova[2, b], N. Novokhatska[1, a]

[1]Institute of Telecommunications and Global Information Space of the National Academy of Sciences of Ukraine, Kiev, Ukraine, Chokolovskiy Boulevard, 13

[2]Institute of Oceanology of the Bulgarian Academy of Sciences, Bulgaria, Varna, st. "May Day", 40

[a]itelua@kv.ukrtel.net, [b]office@io-bas.bg

Keywords: monitoring, ecologic state, pollution of the Black Sea, sea ports, waterways

The Institute of Telecommunications and Global Information Space of the National Academy of Sciences of Ukraine in cooperation with the Institute of Oceanology of the Bulgarian Academy of Sciences are implementing a join research project that aims to develop a prototype of geo-information system for ecological monitoring of the Bulgarian and Ukrainian Black Sea port areas and waterways based on satellite remote sensing observations.

The scientific activists resulted in the analysis of the general hydrological and ecological characteristics of the Black Sea as well as description of the coastal area under study and identification of water regions with high extent of vulnerability to technogenous and anthropogenic pollution. The impacts of sewage water discharges in the ports and the income of pollutants to the shelf area were assessed.

The studies have shown that the ecological state of the Black Sea waters is under strong impact of sea shipping and the marine transport facilities of Ukraine located in the coastal area of the Danube, Dnieper-Bug and the Black Sea-Azov basin. Thus, there are about 20 seaports and 7 ship repairing-yards in this area. They have impact on the marine environment by their operating activities including cargo handling and oil-products operations, repair of ships and so on.

On the basis of the GIS platform ARG / VIEW 9.3, the topographic vector map of Ukraine M 1:200,000, and the attribute data bases the models of ecologic maps of the Ukrainian sector of the Black Sea were prepared. A GIS prototype of mapping support to decisions concerning water resources protection of the Black Sea was developed. At this stage the database and the collection of satellite images are being filled. The research on this subject will continue.

B26002

BLACK SEA GAS HYDRATE STABILITY ZONE MODEL: FAULTS ROLE

Atanas Vasilev[1, a], Roman Kutas[2, b], Vladimir Kobolev[2, c], Emanuil Kozhuharov[1, d], Galina Shtereva[1, e], Dimitar Truhchev[1, f], Orlin Dimitrov[1, g]

[1]Institute of Oceanology - BAS, PO Box 152, Varna 9000, Bulgaria
[2]Institute of Geophysics - NASU, Palladin 32, Kiev 03680, Ukraine

[a]gasberg@mail.bg, [b]roman@igph.kiev.ua, [c]kobol@igph.kiev.ua, [d]jes-e@net.bg, [e]g.shtereva@io-bas.bg, [f]truhi@io-bas.bg, [g]ovdimitrov@io-bas.bg

Keywords: ***gas hydrates, model, faults, Black Sea***

Model. The presented GHSZ model is initiated in 1999 and developed consecutively for the projects CESUM-BS, GASHYDAT, CRIMEA, GEO-HYDRATE, ASSEMBLAGE, MARINEGEOHAZARD and GEO-METHANE. The program results are 19 maps with a horizontal step of 2 km.

Database. The database includes:

- Heat flow measurements at 568 stations;
- Grid of 2,320 points of bottom water temperature for the last 100;
- Main 64 basin's faults and Quaternary sediment thickness;
- BSRs – 21, Gas seepages – 2091.

Effect of the fault system. The main faults divide geological volumes with considerably different evolution and parameters. Therefore the separate data gridding at two sides of every fault gives visualization closer to reality than the traditional contouring resulted in anomalies gradation.

The BS heat flow shows a "zebra" type distribution, started and ended (from E to W) with the highest values (50-60 mW/m2) and with parallel NW-SE belts axes.

Number of GHSZs/BSRs. Double, triple and quadruple (and probably quintuple) BSRs are found in the W BS continental slope at water depths of 2-2.3 s TWT.

The maximum obtained number of GHSZs in the cross-sections of the model is 7.

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B26003

LITHOFACIAL RELATIONSHIPS OF RECENT SHELF AND DEEP-SEA SEDIMENTS

E. Kozhuharov[1, a], R.Hristova[1, b]

[1]Institute of oceanology, BAS, Varna

[a]jes-e@inet.bg, [b]r.hristova@io-bas.bg

Keywords: ***marine geology, lithology, stratigraphy, Upper Quaternary sediments, Black Sea shelf, Black Sea deep zone***

The variable conditions of depositional environment in Bulgarian sector of Black Sea had resulted in formation of a number of sediment types both in shelf and deep sea areas. Upper Quaternary sediments in the Bulgarian sector of the Black Sea were intensively studied and are divided into unofficial units. These sediment types are described by their temporal and spatial distribution in the literature where are nominated as units by indexes and lithological description.

There is well expressed meridian polarity of the sedimentogenesis during the Holocene, marked by the sedimentation rate and lithological content of the sediments both in the shelf and depression. Within the shelf area the polarity is marked in north-south direction where the northern Bulgarian shelf is in a regime of predominantly by-passing of the terrigenous material thus being an area of development of shelly condensates while further to the south the sediment material settles and the southern shelf is an area of very a high rate of sedimentation. The direction of the terrigenous path in the depression is opposite – high rates are related with the path from the Anatolian coast and therefore the distribution of terrigenic and biogenic facies of the deep-sea sediments is from south to north.

Apart from the supply routes, an important role play also the geomorphological features of the basin, the regime of the currents drifting the sediment masses and the stratification between surface oxygenated and more dense deep waters. These factors contribute to the spatial relations of the sedimentary units marking three types of lithofacial junctions between shelf and deep-sea units, spatially distributed in north-south direction. The northern area is an example of condensed sediments in shallow and deep marine environment, where junction is very clear and bathymetrically restricted. The southern area show gradual transition to deep marine sediments due to high sedimentary rates. There only features related to organic matter deposition can help definition of the units. The central areas show variable relations with predominantly neighbouring of biogenic deep sea sediments with silty shelfal muds.

C31001

SUSTAINABLE DEVELOPMENT OF THE BLACK SEA COASTLINE THROUGH ARCHITECTURE AND URBAN PLANNING CONVERSION OF THE PORT AREAS OF VARNA AND BURGAS WITH RECREATION AND TOURIST FUNCTIONS

Yordan Lyubenov[1, a]

[1]Ms Arch., PhD student in Department of Architecture and Urban Studies, Facylty of Architecture of Varna Free University 'Chernorizets Hrabar', 11 Maria Batsarova Str. Varna 9022, Bulgaria

[a]j.lubenov@gmail.com

Keywords: ***sustainable development, Black sea environment, architecture, urban, conversion, port areas***

The sustainable development of the Black Sea environment is a very important topic for the architecture and urban planning. It is especially true for the coastal spaces which are occupied by industrial ports that have been left in the centers of contemporary cities. Industrial processes in these ports begin to lag behind in technology because the territorial development of these specific areas is impossible. The cities suffocate their ports and make their operation inefficient and increasingly dangerous on the one hand to the people in the city, and on the other hand to the marine environment which is in a direct contact. This is a process which is observed in our two largest sea ports of Varna and Burgas. The rapid pace of development of the two maritime cities as major summer tourist and recreational destinations does not meet the industrial progress in their ports. Ports themselves from industrial hubs become one island zone doomed to urban isolation. This phenomenon continues to grow and the lack of measures for the conversion of these problematic port areas leads to their continued exploitation as dangerous to the marine environment. Creation of a new marine environment of recreation and tourist functions at the place of the old industrial port areas will contribute to the sustainable development of our major seaside towns. Opportunities for redevelopment of areas and port buildings will create more places for human contact with the sea. Such urban method aims to improve the environment and microclimate for living in the city, especially the city center as it minimizes the danger to sustainable development areas. In our urban practice there are available renovation projects in parts of the port areas of Varna and Burgas, which will be analyzed in this report. Thereby it is taken into account as far as they are affected by current environmental, urban and architectural trends of sustainable development.

C32003

INTEGRATED COASTAL ZONE MANAGEMENT: MERSIN TASUCU CASE IN TURKEY

Asım Mustafa Ayten[1, a], Sevim Seyhan Ayten[2, b]

[1]Asistant Professor Doctor, Abdullah Gül University Faculty of Architecture, Urban and Regional Planning Department-Kayseri
[2]Research Asistant, Erciyes University Faculty of Architecture, Architecture Department-Kayseri

[a]mustafa.ayten@agu.edu.tr, [b]seyhansevim@gmail.com

Keywords: integrated coastal zone management, sustainability, participation, Silifke, Taşucu

Integrated coastal zone management concept comprises protection of coastal zone and sea environments in Mediterranean sea according to Barcelona convention in 1976. Countries having territories nearby Mediterranean coast Which has common territorial sea and protection of sea eco-system efficiently and comprehensively. For this reason, prevention of every kind of polluted environment, coastal zone and Its hinterlands should be made. There must be balanced in conservation and utilization of resources in sustainability vision. In this context, Tourism and other sectors such as, housing, industry, agriculture must be evaluated Which create to impacts with each other. However, There are many archaeological ruins and sites Which ought to be conserved by state. Mediterranean Region has very rich and various flora, fauna Which locate back to coastal zone. Meanwhile, The most intensive summer housing pressure are emphasized in region. But tourism facilities and bed capacity has not been realized un-sufficiently. This condition tells us that Tourism has a potential for economic development in region. This development is focused on sustainable architecture and planning for ensuring sustainability. i.e. conserving natural, historical and cultural environments with tourism. It is called as Ecotourism.

Integrated coastal zone management have politics, goals and strategies in sustainability framework concerning with conservation. This approach has developed by applying from macro scale to micro scale in planning. Taşucu is 39 km far away from Silifke located on Mediterranean sea coast. Taşucu have special protection areas Which consist of different natural species on flora and fauna with archaeological sites. Taşucu has low capacity in Tourism sector. It's population of is 9000 in 2012.Taşucu port area development plans including the cancellation by the court taking into account the fort the privatization of industrial enterprises. So There is a plan decision Which transforms from industrial area to tourism facility areas in existing SEKA industrial campus area. Nevertheless, These area has not transformed yet. Next to this area, There is protection area called as The Special Environmental Protection Area. This paper is research on Integrated coastal zone management in Taşucu, Mersin on the following criteria's: Taşucu coastline, coastal protection zone and usage zone evaluation will be made. Macroform of Taşucu and It's relationships with coastal zones should be done. Tourism's effect and capacity must be considered in Taşucu in terms of economy and ecology dichotomy. Ecotourism facilities should be proposed in comprehensive sustainable planning approach.

C32007

SELECTION OF THE BEST MITIGATION OPTION FOR COASTAL PROTECTION BY THE MEANS OF OPTIMIZATION

Ekaterina Trifonova[1, a], Rosen Nikolaev[2, b], Jordan Petkov[2, c]

[1]Institute of Oceanology, Bulgarian Academy of Sciences, POBox 152, Varna, Bulgaria
[2]University of Economics - Varna, 77 Kniaz Boris I blvd, Varna, Bulgaria

[a]trifonova@io-bas.bg, [b]nikolaev_rosen@hotmail.com, [c]jr_petkov@ue-varna.bg

Keywords: coastal protection, optimization, coastal modeling, Varna bay, Black sea

Coastal regions all over the World face the pressure produced by heavy storms which provoke flood and erosion, initiate landslides. Measures for the protection of the coastal zone have traditionally been limited to the engineering coastal protection, which includes both hard and soft protection. Different mitigation options and their variants change the flooding patterns in different way. The selection of the best combination between different mitigation options or their variants is based on the solving the optimization problem. In this study we use the methodology developed for the selection of the best combination of engineering mitigation options for coastal protection. For Varna bay three mitigation options: beach nourishment, floating breakwater and submerged breakwater and different variants of their implementation are studied involving the results of numerical modeling of flood and erosion for the option "DoNothing" and variants of the engineering options' implementation. The optimization problem is solved by maximizing the unaffected area width when its variance and costs spent for it are minimized.

C36003

LEAD DISTRIBUTION AT AQUEOUS – SOLID PHASE INTERFACES IN AQUATIC ENVIRONMENT

Petra Ionescu[1, a], Violeta-Monica Radu[1], Gyorgy Deak[1], Aurel Varduca[1], Iustina Popescu[1], Elena Diacu[2]

[1]National Institute for Research & Development in Environmental Protection, Environmental Quality Control Department, Spl. Independenţei No. 294, 6th District, Bucharest, Romania
[2]"Politehnica" University of Bucharest, Faculty of Applied Chemistry and Materials Science, 1-7 Polizu Str., 011061, Bucharest, Romania

[a]petraionescu2012@yahoo.ro

Keywords: aquatic environment, lead, dissolved and particle concentration

Hazardous substances of synthetic or non-synthetic nature are characterized by relatively low water solubility and high capacity of chemisorption at the surface of suspended particles. Hazardous substances ar partitioned in surface aquatic environments (rivers) between water body and sediments, in several cases (high water flow), sediments being resuspended in large amounts into the water body. This paper presents an integrated approach of both transport and transfer processes of lead in aquatic environments studied on a section of lower Danube River between km 375 to km 175. The transfer of lead ions from the soluble phase to suspended matter bound phase has been determined based on the partition coefficient (Kp). Also, associated mass flow rate related to the water body was calculated in order to assess the transport phenomena in aquatic environment. The results showed that lead concentration decreased in the aqueous phase while lead ions were accumulated in the solid phase (material in suspension and/or sediment) or biota, conclusion which helps in performing an assessment of Danube River water quality and of lead pollution impact on coastal and marine waters.

C36004

PARAMETRICAL INTERCORRELATIONS ALGORITHMS BETWEEN WATER QUALITY INDICATORS IN THE DANUBE RIVER

Violeta-Monica Radu[1, a], Petra Ionescu[1], Gyorgy Deak[1], Iustina Popescu[1], Aurel Varduca[1], Elena Diacu[2]

[1]National Institute for Research & Development in Environmental Protection, Spl. Independenţei No. 294, 6th District, Bucharest, Romania
[2]"Politehnica" University of Bucharest, Faculty of Applied Chemistry and Materials Science, 1-7 Polizu Str., 011061, Bucharest, Romania

[a]radumonica33@yahoo.com

Keywords: environmental pollution, the Danube River, water quality, eutrophication

Pollutants are differentially distributed between the biotic and abiotic compartments or between solid and liquid phases at abiotic level. Moreover, physical and chemical structure of the pollutant is important because it leads directly or indirectly to disruption of the ecosystem, and thus it contributes significantly to environmental pollution. The aim of this work is to develop algorithms for the intercorrelations established between water quality indicators (pollutants concentration, water flow, load, nutrients ratio) for 10 monitoring stations located between km 375 and km 175 on the Danube River. The paper emphasizes diffuse sources percentage at total pollution with nitrogen, phosphorous and associated elements, as a result of soil washing, as well pollutants distribution in water and, also, the eutrophication level on monitored stations. Results showed that the Danube water quality, from the ecological point of view, according to M.O. 161/2006 and to Water Framework Directive (WFD, Directive 2000/60/EC) is good and pollutants' impact on marine and costal water is relatively low.

C36007

INDICATOR POLYCHLORINATED BIPHENYLS IN FISH FROM BLACK SEA COAST OF BULGARIA

Stanislava Georgieva[1, a], Mona Stancheva[1], Lubomir Makedonski[1]

[1]Medical University – Varna, Marin Drinov 55, 9002 Varna, Bulgaria

[a]stanislavavn@mail.bg

Keywords: PCB, fish, Black Sea, Bulgaria

Polychlorinated biphenyls (PCBs) were determined in three marine fish species: sprat *(Sprattus sprattus sulinus)*, horse mackerel *(Trachurus Mediterraneus ponticus)* and grey mullet *(Mugil cephalus)*. Samples were collected from different parts of Bulgarian Black Sea coast during 2007 – 2011. The PCBs were analyzed in order to evaluate the status of pollution in Bulgarian Black Sea coastal area.

The six indicator PCBs and six dioxin-like congeners of PCBs were determined by capillary gas chromatography system with mass spectrometry detection. The quality control was performed by regular analyses of certified reference material BB350 (PCBs in Fish oil). Experimental results were shown by fish species and by sampling area. The most abundant PCB congeners in all fish species were the indicator PCBs constituting more than 80% of the total amount of PCBs. The sum of six indicator PCBs were found in fish at concentration 10.7 ng/g wet weight (ww). The highest PCB content were found in grey mullet from North sampling area 21.0 ng/g ww. Dioxin-like PCBs ranged from 1.96 in grey mullet to 2.54 ng/g ww in sprat. TEQs of the 6 "dioxin-like" PCB congeners were calculated as 0.06 pg TEQ/g ww and did not exceed the limit of 6.5 pg TEQ/g ww, according to European Commission. The levels of PCBs in fish from Bulgarian Black Sea coast were found lower to those in fish species from neighboring seas – the Marmara Sea, the Aegean Sea and the Mediterranean Sea.

C36009

NUTRIENTS IN THE SEDIMENTS SURFACE LAYER OF BULGARIAN BLACK SEA SHELF

Valentina Doncheva[1, a], Galina Shtereva[1, b]

[1]Institute of Oceanology – BAS, PO Box 152

[a]valentina.doncheva@gmail.com, [b]g.shtereva@io-bas.bg

Keywords: Black Sea, eutrophication, sediments, nutrients, pore waters

An exchange of dissolved substances at the sediment /water boundary is a process largely defining the composition of the water layer and the biological activity. It is especially important in coastal areas where regeneration of nutrients from the sediment are comparable to rivers input and can provide resource necessary for maintenance of significant primary production. On one hand, external emissions of nutrients can be regarded as indicators of eutrophication and on the other hand, they have an internal source for supporting the trophic state (Jorgensen., Richardson. 1996 Glud., 2005).

The objectives of this paper are: to assess the spatial distribution of nutrients in the sediments of the western part of the Black Sea shelf, to assess the nutrients flux from the bottom to the water column, turn-over time and the role of sediments as a source of nutrients.

The main results are:

Sediments in the western shelf of the Black Sea appear significant internal source of nutrients, especially in regions with high primary production (coastal areas) and areas with high sedimentation rate (central part of the southern shelf), and thus maintain the eutrophication process in the pelagic domain;

Northern coastal part due to indirect effects of the Danube River and local sources is the area with the highest emissions, the estimated turn over time of phosphorus is about 10 days, and the for silicon around 15 days;

Sediments are a more significant source of silicon and phosphorus than nitrogen. Higher turnover time of nitrate nitrogen, the negative flux values and low values of the ratio of nitrogen / phosphorus probably are an indicator for denitrification processes, and the removal of nitrate nitrogen by biogeochemical cycles.

C36011

COASTAL AREA WATER QUALITY ALONG BULGARIAN COAST (2012)

Galina Shtereva[1, a], Ognyana Hristova[1], Boryana Dzhurova[1]

[1]Institute of Oceanology –BAS, Varna 9000, P.O.Box 152, Bulgaria

[a]g.shtereva@io-bas.bg

Keywords: Water quality, nutrients, oxygen

The study was carried out in the frame of 6 cruises with RV Akademik in 2012 in one mile zone along the Bulgarian coast. Water Quality (WQ) on 21 stations located in 13 water bodies were investigated. Water samples were collected by rosette sampling bottles system at standard depths down to 50 m. Dissolved oxygen (DO), oxygen saturation (OS), BOD and nutrients – phosphates (PO4), silica (SiO4), nitrates (NO3), nitrites (NO2) and ammonia (NH4) were measured on board by standard spectrophotometric methods.

The obtained results reveal higher nutrients content in rivers mouths coastal zone due to the impact of the river discharge and in the bays which are strongly affected by anthropogenic impact. High nitrogen content in spring, especially in north area was established due to the transformed river waters influence (from NW part). Oxygen conditions in bottom layer during the summer reveal a low content and saturation (OS values < 80%) as a result of the limited vertical circulation and the oxidation process of deposited organic matter. The summer oxygen concentrations in bottom water on some stations do not correspond to Bulgarian WQ standards.

On the base of obtained results for DO, BOD5 and nutrients 11 water bodies along Bulgarian Black Sea coast were categorized in “Good status”.

C36012

LAND-BASED INPUT ALONG THE BULGARIAN BLACK SEA COAST

G. Shtereva[1, a], V. Doncheva[1, b], V. Velikova[2, c]

[1]Institute of Oceanology –BAS, Varna 9000, P.O.Box 152, Bulgaria
[2]SuRDEP, 15 La Vue, Wierda Glen Estate, Pretoria, South Africa

[a]g.shtereva@io-bas.bg, [b]doncheva@io-bas.bg, [c]velikova_violeta@yahoo.com

Keywords: LBS, nutrients load, pollutants, river discharge, WWTP

This paper presents the evaluation of pollutants and nutrients input of Land-based sources (LBS) in the frame of the Initial Assessment of the Marine Environment of the Black Sea (prepared by the Institute of Oceanology) in implementation of the MSFD. The main drivers impacting on the marine environment are industry, tourism, navigation and port activity, urbanization and agriculture. The main types of industry contributing to the amount of industrial waste waters (WW) are chemical industry, energy production (thermal power stations), shipbuilding and ship repair. The aim of the paper is: identification and evaluation of the LBS input for the period 2006 – 2011.

Riverine nutrient input and municipal waste waters treatment plants (WWTPs) discharge are responsible for the enrichment of sea waters with nitrogen, phosphorus and organic substances. Waste waters from 11 municipal WWTPs directly discharge into the sea. They provide 68% of the total nitrogen load, 15% of the total phosphorus load and 47% of the BOD load. Additionally, waste waters from 5 sewages discharge (without treatment) into the sea and in areas like the Bay of Sozopol their impact is substantial. Some of the WWTPs discharge into coastal lakes and indirectly impact the water quality (WQ) of the sea because of their significant pollutants load. A number of new touristic facilities in the resorts are not connected to the sewage system. As a consequence, the nutrients input into the sea increases due to the discharge of untreated WW to the coastal area. Lack of sufficient capacity of WWTPs leads to overflow of not fully treated WWs and to elevated nutrients level in the sea as a result. The more significant share of rivers load belongs to the Kamchia River, the biggest Bulgarian river flowing into the sea. The share of the municipal WWs and river loads is significantly higher than that of industrial WWs directly discharging into the sea. Gap in data for pollutants loads from livestock and agriculture was established. The same stands for pollutant loads stemming through ground waters to the sea. Thus, it is impossible to properly evaluate the contribution of the diffuse sources along the Bulgarian coast.

The analysis of available data reveals two sites as areas with high anthropogenic impact Varna Bay and Burgas Bay, owing this to the direct or indirect influence of industrial and municipal runoff, port operations and marine transport with their related accidents and illegal discharges. Another impacted by eutrophication and pollution area is the Black Sea coast where the Kamchiya River enters the sea bringing significant loads of trace metals, nitrogen and phosphorus.

C37001

DETERMINATION OF HEAVY METAL CONCENTRATIONS IN FOUR FISH SPECIES FROM BULGARIAN BLACK SEA COAST

Veselina Panayotova[1, a], Lubomir Makedonski[1, b], Mona Stancheva[1, c]

[1]Deparment of Chemistry, Medical University of Varna, 55 Marin Drinov str, 9002, Varna, Bulgaria

[a]veselina.ivanova@hotmail.com, [b]mona_stancheva@abv.bg, [c]lubomir60@yahoo.com

Keywords: heavy metals, fish, Black Sea, Bulgaria

Heavy metals are ubiquitous in the environment. Being at the top of the aquatic food chain fish constitute a major source of heavy metals in food. The aim of the present study was to determine and compare heavy metals (Pb, Cd, Hg, As, Ni, and Cr) concentrations in edible muscle tissue of four Black Sea fish species, considered as "fine foods" in Bulgaria. Garfish (Belone belone), red mullet (Mullus barbatus ponticus), turbot (Psetta maxima) and atlantic bonito (Sarda sarda) were purchased from local market places. Samples of fish tissues were subjected to microwave digestion with nitric acid. Determinations of Pb, Cd, As, Ni, and Cr were performed by Electrothermal Atomic Absorption Spectroscopy (ETAAS), whereas Hg was analyzed by Milestone Direct Mercury Analyzer. Heavy metal contents varied within species. With the exeption of arsenic, studied elements were within the recommendations set by various health organizations. The results clearly indicated that the concentrations of As in red mullet exceed the maximum permissible levels (MLPs) of 2.0 mg/kg according to the Bulgarian Food Codex.

C37003

PROXIMATE COMPOSITION, FATTY ACID PROFILE AND FAT SOLUBLE VITAMINS CONTENT OF BLACK SEA SPRAT (SPRATTUS SPARATTUS)

A. Merdzhanova[1, a], A.D. Dobreva[1, b], M. Stancheva[1], L. Makedonski[1]

[1]Medical University, 55 M. Drinov Str.,9002 Varna, Bulgaria

[a]a.merdzhanova@gmail.com, [b]didobreva@gmail.com

Keywords: fish, energy value, GC/MS, RP-HPLC, human health

The aim of the present study were to determine and compare the seasonal changes in proximate composition, energy values, fatty acid profile and fat soluble vitamins content in spring and autumn sprat (Sprattus sprattus) from Bulgarian Black Sea waters.

Proximate composition (moisture, crude protein and total lipids) was determined using standard procedures of AOAC (1991). Analysis of fatty acid methyl esters was performed by gas chromatography system with MS detection. Vitamins A, D3 and E were analyzed simultaneously using RP-HPLC system.

Crude protein levels in fish samples were in the range 16.10 to 17.15%, while fat content was from 4.20 to 6.65 g.100g^{-1} ww (g per 100 g wet weight). Energy values have been calculated using FAO/WHO specific factors and were in interval 427.3 to 539.2 kJ.100g^{-1} ww.

The fatty acid and vitamins contents showed significant seasonal changes. The spring sprat was characterized with lower saturated fatty acid (SFA) (30.86%), higher mono unsaturated fatty acids (MUFA) (31.62%) and insignificantly lower poly unsaturated fatty acids (PUFA) (33.41%) compared to autumn samples. In both seasons omega-3 (n-3) PUFAs were higher than omega-6 (n-6) PUFAs levels.

Different amounts of alpha-tocopherol were found in two season's fish samples – 701.2 µg.100 g^{-1} ww for spring and 284.9 µg.100 g^{-1} ww for autumn Black Sea sprat. Higher amounts of all-trans retinol (142.3 µg.100 g^{-1} ww) and cholecalciferol (11.9 µg.100 g^{-1} ww) were found in spring samples, while in autumn these values were – 33.2 µg.100 g^{-1} ww and 10.5 µg.100 g^{-1} ww, respectively.

Regarding to the total lipid amount, protein and energy values, n-6/n-3 and PUFA/SFA ratios and fat soluble vitamins content we can conclude that both season sprats from the Bulgarian part of Black Sea are good sources of the identified biologically active substances with beneficial effect on human health.

B26011

DVURECHENSKII MUD VOLCANO, BLACK SEA: 4D GEOTHERMAL STRUCTURE AND GAS HYDRATES

Atanas Vasilev[1, a], Emanuil Kozhuharov[1, b], Raina Hristova[1, c]

[1]Institute of Oceanology - BAS, PO Box 152, Varna 9000, Bulgaria

[a]gasberg@mail.bg, [b]jes-e@net.bg, [c]raina_hr_bg@yahoo.com

Keywords: gas hydrates, model, mud volcanoes, "snail" eruption, seismicity, Black Sea

This work is a first try for monitoring the activity of Dvurechenskii mud volcano (DMV) manifested as temporal variability of methane emissions and probably gas hydrates with geothermal tools. Various data collected for a period of 8 years. Main tasks were to reconstruct the DMV gas hydrate stability zone changes and to analyze the regime of methane escapes from the crater.

The three adjacent objects are observed and discussed – DMV, no-name seep site and the new discovered Vodenitskiy MV. The results show the same activity source with spreading direction from ESE to WNW and connections between the objects. The crater's materials are assumed to form an "organ" type structure and the activity – to play a "melody" blowing in different "trumpets" with significantly smaller diameter than the crater (the flares are with changeable location, bottom area and height).

The analysis of seismicity in the area and studied mud volcanoes in the Black Sea allows the formulation of important for a future study hypotheses:

- The Black Sea mud volcanoes are at older stage of their evolution – they are not erupted during the last century but their necks are still main pathways for deep strata degasation. The eruption process is too slow – let name it "snail eruption", and thus is invisible for onshore seismic stations.
- Hypothetical mud volcanoes in the area of Bulgarian offshore obey to the same general rule of distribution according seismicity as known in the Black Sea (30 objects), as well as some other rules, determined by the sedimentation rate.

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B21012

MAREX: MARMARA SEA AND TURKISH STRAITS EXPERIMENTS IN JUNE 2013

S. Tugrul[1, a], N. Yucel[1, b], Z. Uysal[1, c], O. Gurses[1, d], E. Tutsak[1, e], A. Yuksek[2, f], I.D. Ozturk[1, g], A. Kideys[1, h]

[1]Institute of Marine Sciences-Middle East Technical University 33731 Erdemli, Mersin, Turkey
[2]Institute of Marine Sciences and Management-Istanbul University, 34116 Vefa, Istanbul, Turkey

[a]tugrul@ims.metu.edu.tr, [b]nebil@ims.metu.edu.tr, [c]uysal@ims.metu.edu.tr, [d]ozgur@ims.metu.edu.tr, [e]ersin@ims.metu.edu.tr, [f]ayuksek@istanbul.edu.tr [g]destan@ims.metu.edu.tr, [h]kideys@ims.metu.edu.tr

Keywords: ***eutrophication, nutrients, anthropogenic input, Marmara Sea, Turkish Straits system***

The Turkish Straits System (TSS), which is comprised of the Sea of Marmara and the Straits of Bosphorus (Istanbul) and Dardanelles (Canakkale) has a distinct two-layer ecosystem formed by the counterflow in the two straits. The upper layer ecosystem of about 15 m is naturally dominated by the less saline waters of the Black Sea. The salty Mediterranean waters (S~38.5) occupy the Marmara deep basin. In recent decades, the increased Danube input to the Black Sea has led to long-term changes in the Marmara Sea ecosystem. The largest changes in the upper layer salinity and the slope of the interface occur at the southern exit of the Bosphorus and also in the western region of the Dardanelles Strait. Within the frame work of the MAREX project, in June 2013, physical and chemical parameters (nutrients, oxygen, POM) were measured at approx. 80 stations throughout the TSS and semi-enclosed bays. Biological parameters (primary, chemoautotrophic and bacterial production, phytoplankton pigments, in-situ and extracted chlorophyll, abundance of heterotrophic bacteria, zooplankton and jellyfish) were measured only at selected stations. The Secchi disc depth ranged between 2-7 m, indicating upper-layer limited primary production. Therefore, surface nutrient concentrations were low including the reactive silicate, resulting in low Si/NO3 ratios in the Si-depleted waters. Higher concentration of surface chlorophyll were measured in the polluted bays (Izmit, Gemlik and Bandırma), increasing by about 5-8 fold from the Black Sea to the Marmara surface layer. The concentrations of oxygen and nitrate were highly depleted (O_2:10 □ 15 µM; nitrate < 1.0 µM) in the bottom waters of the eastern deep basin and Izmit Bay in late June. Markedly high ammonia concentrations (5 □ 10 µM) were observed in the lower layer flow along the Bosphorus due to domestic wastewater discharges into the Bosphorus bottom waters, indicating apparent increases in nutrient export to the Black Sea over the last decade.

B22014

SPATIAL DISTRIBUTION OF SPRAT (SPRATTUS SPRATTUS, L) BIOMASS ALONG THE BULGARIAN COAST OF THE BLACK SEA: INTERACTIONS AND EFFECTS ON MESOZOOPLANKTON ABUNDANCE

V. Raykov[1, a], V. Mihneva[2, b], K. Stefanova[1], M. Panayotova[1]

[1]IO-BAS, 40 Parvi Mai str., P.O.Box 152
[2]IFR-Varna, Bul. Primorski, 4, PO Box 72

[a]vraykov@io-bas.bg, [b]vvmihneva@yahoo.com

Keywords: ***Sprat, mezozooplankton, Bulgarian coast, condition***

This study generalizes results of four-year sprat trawls surveys along the Bulgarian Black Sea coast with aim to evaluate the stock biomass and spatial distribution of the sprat and to analyze effects of mesozooplankton abundance variance.

The main method used during the trawling was “the stratificated” sampling that provided basis for investigations of several stratums according to the bottom depth. The whole investigated area off the Bulgarian coast was divided into equal fields – 55 in the northern region, and 58 – in the south. Simultaneously was done the mesozooplankton sampling, while random fish individuals were preserved in 10% formaldehyde for laboratory analysis of stomach content. Index of relative importance and index of stomach fullness that characterize the sprat feeding peculiarities were calculated and analyzed. The ODV mapping was used to present the spatial distribution of sprat and zooplankton biomass and the variability of sprat food spectrum and diet characteristics along the Bulgarian coast. During the studied period the sprat biomass varied from 29 170 – 75 080 t with main concentration in front of Cape Galata and border area with Romania in northern part and in front of Sozopol in southern part of the coast, while the condition factor and mean length of the cohorts remained lower in comparison with the long-term average, proving relatively poor physiological condition for the sprat populations in the last years.

B22014

ABUNDANCE OF ROUND GOBY NEOGOBIUS MELANOSTOMUS (PALLAS) ON DIFFERENT SUBSTRATES IN NORTH-WESTERN PART OF THE BLACK SEA

V.V. Zamorov[1, a], Y.Y. Leonchyk[1, a], S. Chernikova[2, b], S.M. Snigirov[1, a]

[1]Odessa I. I. Mechnikov National University, 65026, Odessa, Dvoryanskaya str., 2
[2]Odessa Center of Southern Research Institute of Marine Fisheries and Oceanography, Mechnikov str., 132, Odessa, 65028

[a]hydrobiologia@mail.ru, [b]jugniro@meta.ua

Keywords: Black Sea, round goby, tagging, abundance

The round goby is a coastal euryhaline eurythermal species of fish. This species is widespread in the north-western part of the Black Sea region, forming commercial concentrations in the coastal zone of the sea and limans. The study of its population structure is not only of fundamental scientific interest but also of great practical importance. Understanding the dynamics of its population is a necessary scientific basis for the rational exploitation of the round goby stock in several areas of the Black Sea. The only one estimation of round goby abundance in the Azov and Black Sea basin conducted only on sand and shell substrate in the Azov Sea (Kostjuchenko, 1969, 1970). Therefore the aim of the present study was to assess the abundance of round goby on different substrates in the north-western part of the Black Sea. Investigations were carried out near the Zmiinyi Island in September-November 2010, on the water area of 1 hectare; substrate was composed of boulders (up to 1 m size). In the Odessa Gulf fish was caught in the same season in 2011 on the water area of 15 hectares; substrate was composed of sand mixed with shell rock between underwater limestone ridges. The fish was caught with nets and rods at a depth of 5 – 15 m.

To calculate the abundance of gobies the method of Petersen-Chapman (Ricker, 1975) was used based on the results of tagging the fish. The most active individuals were chosen. The top of second dorsal fin was tagged, and then the fish were let into the sea. In order to collect information about tagged fish all the fishermen engaged in fishing in this region were informed. In the water area near Zniinyi Island 207 individuals of fish were tagged and 21 were caught; in the Odessa Gulf – 300 and 34 individuals, respectively. During sampling procedure 600 individuals were collected near the Zniinyi Island and 2,500 individuals in the Gulf. The calculations were performed using the module “Analysis Package” in the program MS Excel.

On the basis of calculations the abundance of round goby in the waters of Zmiinyi Island was equal to 5682 ind./hectare, in the Odessa Gulf – 1434 ind./hectare. According to the method by Klopper-Pearson (Clopper, Pearson, 1934), with a confidence level of 95 %, the possible values of fish abundance near the Zniinyi Island were 3882-8784 ind./hectare; in the Gulf – 1068 – 2007 ind./hectare. The abundance of gobies on shell-sandy substrate in the Azov Sea reached 704 ind./hectare (Kostjuchenko, 1969, 1970). Our results and published data indicate compliance with the calculated abundance of fish from different areas of the Black and Azov Seas, as well as preference of rocky substrate by round goby.

The results of our investigation suggest that the method of calculation of fish abundance by Petersen-Chapman based on their tagging can be used to estimate abundance of round goby in coastal waters.

AUTHOR INDEX

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

Y

Z

TABLE OF CONTENTS

TABLE OF CONTENTS

Plenary Session

Methods of operational oceanography: The Black Sea as a test basin

Marine Biodiversity and challenges for good environemntal status assessment

Improving governance, management and building capacities

Extending the Euro-Argo activities in the regional seas – Black Sea Argo initiative

Marine resources and observations for sustainable ecosystem management

Achieving marine resources and ecosystem management and sustainability

EMODNET – Acheivements and Future

Black Sea Argo Workshop

Regional Seas – Differences and Similarity

PERSEUS – Black Sea experiment

Poster Session


MARES2020

Co-Organizers

PERSEUS

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