



PERSEUS Scientific Workshop - Athens 2014

Book of Abstracts



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**PERSEUS SCIENTIFIC WORKSHOP, Athens, 29-30 January 2014****PROGRAMME****29/1/2014****SESSION 1****Chairs: M. Gregoire & A. Shivarov**

9:00	M. Pantazi, Vassilopoulou V., Gonzalez-Fernandez D., Laroche S., Andral B., Vasile D., Gomoiu M.T., Hanke G.	Analysis of marine environmental assessment approaches regarding commercial fish and marine food webs
9:15	G. Hanke and Gonzalez D.	Identification of MSFD Assessment Elements in EU countries
9:30	D. Sauzade, N. Beaumont, B. Boteler, M. Breil, E. Gileva, M. Grüning, A. Kontogianni, I. Krüger, J. Le Tellier, V. Melikidze, D. March Morlà, A. Markandya, Marta M.9; Roeleveld G.; Salukvadze J.; Shivarov A.; Skourtos M.	Development of science-based marine policies in the Mediterranean and Black Seas
9:45	M. Breil, D. Sauzade, N. Beaumont, B. Boteler, E. Gileva, M. Grüning, A. Kontogianni, I. Krüger, J. Le Tellier, V. Melikidze, D. March Morlà, A. Markandya, M. Marta, G. Roeleveld, J. Salukvadze, A. Shivarov, M. Skourtos	Setting the scene for building adaptive policies for GES achievement
10:00	J. Le Tellier, D. March Morlà, M. Breil, A. Kontogianni, A. Shivarov, E. Gileva, N. Beaumont, and M. Pascual	Governance of Coastal and Marine Ecosystems and 'Stakeholder Dialogue' in the Southern European Seas
10:15	M. Breil, D. Sauzade, N. Beaumont, B. Boteler, E. Gileva, M. Grüning, A. Kontogianni, I. Krüger, J. Le Tellier, V. Melikidze, D. March Morlà, A. Markandya, M. Marta, G. Roeleveld, J. Salukvadze, A. Shivarov, M. Skourtos	Concept and design of an Adaptive Policy Tool Box based on a step by step policy cycle
10:30	M. Skourtos, D. Damigos, A. Kontogianni, D. Tsitakis, B. Zanou and D. Sauzade	Social Values for Southern European Seas Marine Ecosystem Services. Inventory and Critical Assessment



10:45	<b>COFFEE BREAK (Poster 1<sup>st</sup> Round Discussion)</b> Coffee will be served in the Poster Room so a First Look of the Posters can be done	
11:15	<b>Invited Speaker: Jana Friedrich</b>	<b>Monitoring hypoxia: approaches to addressing a complex phenomenon in the Black Sea</b>
11:45	G. Shapiro, F. Wobus, F. Zhou	Exchanges across the shelf break in the northwestern Black Sea
12:00	J. Staneva, Y. He, E. Yakushev and E. Stanev	The Black Sea Biogeochemistry: Its Temporal and Spatial Variability
12:15	A. Capet, J.-M. Beckers, and M Grégoire	From Scylla to Charybdis: Eutrophication and climate drivers of hypoxia in the Black Sea north western shelf
12:30	A. Deidun, A. Gauci, J. Azzopardi, D. Cutajar	A preliminary analyses of water column data collected from in situ loggers deployed within the Maltese Islands
12:45	Gertman, Y. Krivenko, T. Ozer, B. Katsenelson, V. Belokopytov, A. Ingerov, A. Khaliulin, J. Tintoré, L. Petit de La Villéon	PERSEUS oriented system for storage and operational exploration of Mediterranean and Black Sea cast data.
13:00	<b>Discussion</b>	
13:30	<b>LUNCH BREAK</b>	

## SESSION 2

**Chairs: L. Prieto & P. Panayotidis**

14:45	S. Marullo, A. Di Cicco, M. Sammartino, R. Santoleri	Mediterranean variability of Phytoplankton Size Classes and Particle Size Distribution during the SeaWiFS Era
15:00	S. Tugrul	Impacts of Human-Induced Eutrophication on Upper Layer Chemistry and Reference Nutrient Conditions for GES Targets in the Black Sea
15:15	V. Medinets, N. Kovalova, N. Derezyuk, Ye Gazyetov, S. Snigirev, S. Medinets, O. Konareva, S. Kotogura, I. Gruzova, A. Mileva, I. Soltys	Investigations of nutrients level influence to the costal marine waters phytoplankton in the Black Sea North-Western part (Zmiinyi Island area)
15:30	U. Im, S. Christodoulaki, K. Violaki, P. Zarmas, M. Kocak, N. Daskalakis, N. Mihalopoulos, M. Kanakidou	Atmospheric deposition of inorganic nutrients (N & P) over Mediterranean and Black Sea
15:45	V. Gerakaris, K. Tsiamis and P. Panayotidis	Preliminary results of ecological quality evaluation based on marine angiosperms and macroalgae in the PERSEUS experimental area Saronikos Gulf-Athens (Aegean Sea, Greece)
16:00	A. Terlizzi, S. Felling	<i>Caulerpa racemosa</i> and <i>Diplodus sargus</i> : an integrated approach for studying the subtle effects of biological invasions on Mediterranean marine systems



16:15	N. Simboura, S. Reizopoulou, M.A. Pancucci-Papadopoulou, K. Sigala, N. Streftaris	Schemes of Integrating the Indicators of the Benthic Community Condition (Sea Floor Integrity–MSFD): An Application in Saronikos Gulf
16:30	M. Puig, J. Casal, R.M. Darbra	Environmental pressures caused by ports in the Mediterranean and Black Sea
16:45	S. Gana & K. Souissi	Identification of pressures and impacts quantification on coastal ecosystems of the Gulf of Tunis
17:00	G. Fytis, I. Yiannoukos, L. Liyue Cai, Y. Samuel-Rhoads	Preliminary Study of the Alien Species In the Coastal Area of Cyprus
17:15	<b>Discussion</b>	
17:30-18:30	<b>POSTER SESSION (Including Coffee)</b>	
18:30		
18:30	<b>End of the first Day</b>	

**30/1/2014**

### SESSION 3

**Chairs: A. Oros & A. Karageorgis**

9:00	X. Tubau, M. Canals, A. Sanchez-Vidal, G. Lastras, X. Rayo and A.M. Calafat	Marine litter in deep submarine canyons of the North Catalan margin: nature, distribution, sources and dispersal processes
9:15	C. Ioakeimidis, C. Zeri, H. Kaberi, G. Papatheodorou	An integrated monitoring of marine litter in Eastern Mediterranean Sea.
9:30	M. N. Anagnostou, D. Kassis, P. Pagonis, L. Perivoliotis and A. Prospathopoulos	Monitoring physical and anthropogenic ambient noise in Mediterranean Sea using Underwater Passive Aquatic Listener on moored observatories
9:45	A. Shatravin, A. Vedenev, O. Kochetov, A. Tsibulsky	Preliminary Results of the Underwater Noise Measurements at the North-Eastern Black Sea Shelf near Gelendzhik
10:00	X. Durrieu de Madron, C. Estournel, C. Ulses, M. Canals, A. Sanchez-Vidal, A. Calafat, P. Puig, J.B. Company, A. Palanques	LIONEX: Northwestern Mediterranean Sea Experiment - Gulf of Lions
10:15	E. Souvermezoglou, E. Krasakopoulou and A. Pavlidou	Temporal variability of nutrients and oxygen in the North Aegean Sea



10:30	AEGEX Group	The Aegean Sea Experiment (AEGEX): Cruise rationale and preliminary results
10:45	S. Tugrul, N. Yucel, Z. Uysal, O. Gurses, E. Tutsak, A. Yuksek, I.D. Ozturk, A. Kideys	MAREX: Marmara Sea and Turkish Straits Experiments in June 2013
11:00	Atabay, H., Beken, C., Boicenco, L., Djurova, B., Hristova, O., Krastev, A., Lazar, L., Moncheva, S., Ediger D., Sahin, F., Secrieru, D., Shtereva, G., Vasiliu, D., Vlas, O.	MISIS Joint Cruise in support of a harmonized approach of Descriptor 5 (MSFD) in the Western Black Sea
<b>11:15</b>	<b>COFFEE BREAK</b>	
11:45	G.E. Shulman, V.N. Nikolsky, T.V. Yuneva, O.A. Yunev, A.M. Shchepkina	Anchovy and sprat as models for study and estimation small pelagic fish condition in the Black sea
12:00	A. Oros, V. Coatu, D. Tiganus, L. Lazar	Acquiring new data on chemical contaminants in biota from Romanian marine waters as support for MSFD implementation, Descriptors 8 and 9
12:15	N. Romanova, V. Chasovnikov, E. Arashkevich	The effect of contaminants and nutrients on the microplankton community in the Gelendzhik bay and the adjacent shelf (NE Black Sea).
12:30	P. Reglero, F. J Alemany, R. Balbín, J. Luis López Jurado, J. Tintoré, D. Alvarez-Berastegui, A. Pascual	Spawning bluefin tuna in the Mediterranean Sea: integrating environmental variability in management policies
12:45	J. Ruiz, D. Macías, M. M. Rincón, A. Pascual, I. A. Catalán, G. Navarro	Atlantic Inflow Control Fish Recruitment at the Western Mediterranean
<b>13:00</b>	<b>Discussion</b>	
<b>13:30</b>	<b>LUNCH BREAK</b>	

## SESSION 4

### **Chairs: E. Arashkevich & C. Solidoro**

14:45	D. Van Apeldoorn, A.H.W. Beusen, A.F. Bouwman	Hindcast and future projection of the impact of wastewater and agriculture on nitrogen and phosphorus river loads in the Mediterranean Sea and Black Sea
15:00	S. Libralato, C. Solidoro, T. Ballerini, D. Banaru, P. Lazzari, and K. Tsagarakis	Steps toward operational applications of end-to-end modelling to assess the ecological status of the Mediterranean Sea.
15:15	B. Salihoglu, S. Arkin, B. A. Fach, E. Akoglu, T. Oguz, V. L. Dorofeyev, G. K. Korotaev	A new generation end-to-end model to analyse the Black Sea environmental status
15:30	L. Prieto, D. Macías, A. Peliz and J. Ruiz	<i>Physalia physalis</i> swarms nearby the Strait of Gibraltar: a modeling study



15:45	L. Lazar, L. Boicenco, A. Oros, V. Coatu, D. Tiganus	BEAST -A New Tool Proposed for the Black Sea Eutrophication Assessment – Case Study Romania
16:00	P. Testor, A. Bosse, L. Mortier, P. Cauchy, F. D’Ortenzio, H. Lavigne, O. de Fommervault, V. Taillandier, L. Prieur, L. Coppola, C. Estourne, X. Durrieu de Madron, L. Houpert, L. Beguery, H. Benabdelmoumene, E. Godhino, K. Bernardet, H. Giordani, G. Caniaux, S. Somot M-N Bouin, P. Conan, A. Alvarez, R. Onken, D. Cecchi, B. Garau, A. Olita, S. Sparnocchia, J. Tintore, S. Ruiz, M. Tomas	Multi-scale and Multi-Platform Analysis of Deep Convection Processes in the Northwestern Mediterranean Sea
16:15	E. Arashkevich, A. Ostrovskii, V. Solovyev	Application of the moored profiler <i>Aqualog</i> for measurement of the acoustical backscatter by mesozooplankton in the NE Black Sea
16:30	<b>COFFEE BREAK</b>	
17:00	P-M. Poulain, G Manzella, K. Schroeder, D. Kassis, P. Testor, L. Mortier, M. Ribera, V. Dadic, R. Santoleri, E. Heslop, J. Tintoré	Identifications of gaps and recommendations on upgrades of the SES observing systems to serve PERSEUS needs
17:15	J. Tintoré, E. Heslop, P-M. Poulain, D. Kassis, P. Testor, L. Mortier, L. Petit de la Villeon	Strategies for future European observing systems
17:30	M. A. Lange, C. Jimenez, R. Abu Alhaija and M. Evriviadou	Med-CPR: A new observational facility for assessing marine plankton in the Mediterranean
17:45	T. Russo, D’Andrea L., Parisi A., Martinelli M., Belardinelli A., Santojanni and S. Cataudella	Processing VMS data for the study of fishing effort: progresses and insights from the Italian experience
18:00	I. Maina, S. Kavadas, D. Mantopoulou and V. Vassilopoulou	The use of Vessel Monitoring System data to identify and map migration spatiotemporal patterns of trawlers in the Aegean Sea
18:15	<b>Discussion</b>	
18:30	<b>End of the Scientific Workshop</b>	

**POSTERS****(the numbers in the front column represent the marked places in the panels)**

No	Authors	Titles
1	E. Cherkez, Pavlik T., Medinets V., Gazyetov Ye, Shatalin S., Shmuratko V.	Dynamic of coasts line changes in the Black Sea North-Western part for past 30 years
2	V. Medinets, Yu. Denga, S. Snigirov, T. Vostrikova, I. Gruzova, K. Tsimbalyuk, Konareva O.	Results of investigations of Marine Environment Toxic Pollution in Zmiinyi island area (2011-2013)
3	S. Medinets, V. Medinets, N. Kovalova, S. Kotogura, I. Gruzova, A. Mileva, I. Soltys	Estimation of atmospheric input role for the Black Sea waters from Nitrogen balance perspective
4	Y. Tokarev	The Biophysical Ecology Methods In Biological Oceanography: Are there perspectives?
5	K. Pagou, M. Pantazi, M. Gianni, S. Moncheva, I. Marasovic	Long term trend analysis in nutrients and phytoplankton biomass in selected sites of Mediterranean and Black Sea.
6	F. Spagnoli, H. Kaberi, P. Giordano, C. Zeri, L. Borgognoni, G. Bortoluzzi, V. Martinotti	Benthic fluxes of dissolved heavy metals and nutrients in polluted sediments of the Adriatic Sea
7	K. Tsagarakis, S. Libralato, C. Solidoro, P. Lazzari, A. Machias, S. Somarakis, M. Giannoulaki, C. Frangoulis	Development of an end-to-end model for the North Aegean Sea ecosystem
8	B. Salihoglu, B. Anninsky, G. Finenko, A. Cemal Gucu, E. Lemesko, S. Moncheva, V. Nikolsky, M. Panayotova, S. Kremena, L. Prieto, A. Kideys, G. Korotaev, S. Tugrul, L. Svetlichny, A. Seghedi, G. Shulman, T. Shiganova, Z. Uysal, Y. Tatjana	Black Sea Experiment (BSEX)
9	A. Gazihan-Akoğlu, B. Salihoğlu, E. Akoğlu, T. Oğuz	On the Implementation of Ecosystem Approach to Fisheries to Turkish Fisheries; Key Challenges and Ways Forward
10	R. Balbín, J.L. López Jurado, A. Aparicio, J.C. Alonso, T. Amengual, M.C. García-Martínez, J. Jansá, F. Moyá, R. Santiago, M. Serra, M. Vargas-Yáñez.	RADMED-DOS monitoring program and IBAMar regional database, new tools for the Western Mediterranean Sea.
11	S. Tuğrul, A. Yüsek, H. Altıok, E. Okus	Chemical Exchanges between the Marmara and Black Seas through the Bosphorus Strait
12	E. Huertas, S. Flecha and J. Ruiz	Tracking ocean acidification in the Mediterranean





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| 13 | D. Hayes, G. Zodiatis, G. Georgiou, E. Mauri, P. Poulain, R. Gerin, G. Notarstefano, P. Testor and I. Gertman                        | The Circulation and Properties of Water Masses of the Eastern Mediterranean   |
| 14 | A. Deidun, N. Daly Yahia, O. Daly Yahia, V. Fuentes, A. Vella, S. Piraino  | Getting to grips with jellyfish blooms through innovative tools: the Med-JELLYRISK experience   |
| 15 | A. Zoppini, N. Ademollo, L. Patrolecco, S. Amalfitano, P. Mancino, W. Dellisanti, L. Langone, S. Miserocchi                          | Organic priority substances and microbial processes in marine coastal sediments (Adriatic Sea, Italy)   |
| 16 | S. Psarra A.C. Banks N. Spyridakis A. Lagaria C. Frangoulis A. Karageorgis   | The South Aegean Sea Experiment (AEGEX-I): Marine Optics and Biogeochemistry (preliminary results)  |
| 17 | M. Mureșan, A. Teacă, T. Begun   | Analysis of level of harmonization of “Biological Diversity” descriptor of Marine Strategy Directive in Southern European Seas (SES) countries and contributions to its future implementation in the non-EU countries |
| 18 | M. Dimiza, M. Triantaphyllou, O. Koukousioura, P. Hallock, N. Simbhora   | Assessing The Coastal Ecosystem Quality Using Benthic Foraminifera Assemblages: The Foram Stress Index  |
| 19 | A. Yuksek, Z. Uysal, S. Tugrul   | Species composition of the soft-bottom macrozoobenthos of the Sea of Marmara  |
| 20 | M. Puig, J. Casal, R.M. Darbra   | Socio-economic impact of the maritime transport and ports in the Mediterranean and Black Seas.  |
| 21 | P.-M. Poulain, G. Manzella, K. Schroeder, D. Kassis, P. Testor, L. Mortier, M. Ribera, V. Dadic, R. Santoleri, E. Heslop, J. Tintoré | Review of the observing systems in the SES  |
| 22 | I. Gertman, R. Goldman, T. Ozer, G. Zodiatis   | Interannual changes in the thermohaline structure of the south eastern Mediterranean  |
| 23 | A. Oros, V. Coatu, D. Secieru, D. Tiganus, D. Vasiliu, H. Atabay, C. Beken, L. Tolun, S. Moncheva, L. Bat                            | Preliminary results of the assessment of the Western Black Sea environmental status in respect of contaminants in the frame of MSFD   |
| 24 | R. Drion, A. Capet and M. Grégoire   | Taxonomical versus Functional responses of macrobenthic communities to environmental conditions on the Black sea’s north-western shelf  |
| 25 | C. Kalkavouras, V. Lakkes, A. Batis and A. Lykiardopoulos  | A Financial Management System (FMS) for PERSEUS in HCMR, as a tool for efficient project management   |





## **SESSION 1**



**Analysis of marine environmental assessment approaches regarding commercial fish and marine food webs.**

Pantazi M.(HCMR), Vassilopoulou V. (HCMR), Gonzalez-Fernandez D.(EC JRC IES), Laroche S.(IFREMER), Andral B. (IFREMER), Vasile D.(GeoEcoMar), Gomoiu M.T. (GeoEcoMar), Hanke G. (EC JRC IES)

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**Abstract**

A review of the methodological elements used by five EU countries (Spain, France, Greece, Cyprus and Romania) in their Initial Assessments during the first phase of the implementation of the Marine Strategy Framework Directive (MSFD) (Commission Decision 2010/477/EU) has been carried out within the FP7 project PERSEUS. The focal reason of this review was to identify, develop and promote tools and methods to ensure consistency in marine environmental status assessments across the Mediterranean and the Black Sea basins. This study focuses on outcomes for Descriptor 3: commercial fish, and Descriptor 4: marine food webs.

Methodological approaches used for assessments under Descriptor 3 were based on the relevant intergovernmental frameworks (ICES, GFCM, ICCAT, and CFP). However, the need for further development of this descriptor and for harmonization at European level is underlined, along with the need to establish consistent reference points, as well as to develop additional indicators.

The methodologies used for Descriptor 4 assessments revealed the implementation of diverse strategies with no predominance of one single approach, while the lack of data and knowledge were highlighted as issues of great importance. Therefore, significant efforts are required towards filling the aforementioned data and knowledge gaps, as well as for adopting harmonized methodological approaches.

On-going and future scientific activities planned within PERSEUS aim to tackle data and knowledge gaps, and enable the basin-wide environmental status assessment in a harmonized way with the participation of both EU and non-EU partners.

**WP5 Task 5.1. Identification of MSFD Assessment Elements in EU countries.**

Gonzalez D., Hanke G. (EC JRC IES)

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**Abstract**

This presentation summarizes the work developed under WP5 Task 5.1, regarding the identification of Assessment Elements applied to assess the marine environmental status by EU members in the Mediterranean Sea and Black Sea. The work is based on the review and analysis of information extracted from MSFD Art. 8, 9 and 10 reports, as delivered by EU members. This task involved three deliverables. The outline and content of each deliverable will be explained, highlighting the general output and messages provided to both PERSEUS future tasks and to other potential users, such as within the MSFD implementation strategy.

Within Subtask 5.1.1, Deliverable 5.1 included an excel file database with qualitative information on methodological approaches used at descriptor, criteria and indicator levels by EU countries. This database has been a dynamic tool throughout Task 5.1, since some EU members have delivered their reports gradually during the process. In Deliverable 5.2, following the outcome of the Umbrella Workshop, this database was used to undertake a gap analysis for each descriptor considering information gathered from draft reports of 5 EU countries: Cyprus, France, Greece, Spain and Romania. Further, an indicative gap score was developed based on a set of qualitative questions in order to assess the extent of gaps within each descriptor.

Finally, Subtask 5.1.2, dedicated to the development of assessment elements for application in non-EU countries, included Deliverable 5.3. In this case, final reports from 7 EU countries were considered: the ones involved in Deliverable 5.2, plus Italy and Bulgaria. Assessment elements were identified and synthesized in tree diagrams to provide a decision making tool document to help non-EU users in the selection of common principles and options for marine environmental assessments.



**Development of science-based marine policies in the Mediterranean and Black Seas.**

Sauzade D. (Plan Bleu), Beaumont N. (PML), Boteler B. (Ecologic), Breil M. (CMCC), Gileva E. (BSNN), Grüning M. (Ecologic), Kontogianni A. (UOWM), Krüger I. (Deltares), Le Tellier J. (Plan Bleu), Melikidze V. (TSU), March Morlà D. (CSIC), Markandya A. (BC3), Marta M. (BC3), Roeleveld G. (Deltares), Salukvadze J. (TSU), Shivarov A. (BSNN), Skourtos M. (AUA)

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**Abstract**

Marine ecosystems produce goods and services essential to humanity. Yet their degradation continues due to the combined increase in human and natural pressures.

The PERSEUS project was launched to offer policies to achieve and maintain good ecological status (GES) in the Mediterranean and Black Seas, to support the implementation of the Marine Strategy Framework Directive, and similar initiatives of ecosystem based management in the Mediterranean (MAP) and in Black Sea (BSAP). PERSEUS develops a framework for building adaptive policies, robust to uncertainties about pressure evolutions, based on scientific evidences and involving stakeholders, intermediaries between scientists and policymakers.

This presentation will present the principles and progresses of this Adaptive Policy Framework (APF), which includes a toolbox centered around a policy cycle in five steps, each involving knowledge gathered or generated by the project in natural sciences, such as identifying risks of not achieving GES and in socioeconomics as the analysis of prospective studies with regards to these seas, current legal and institutional frameworks, identification of possible measures to achieve GES and inventory of data needed for the impact assessment of the futures measures.

The development of this political framework calls for participation of stakeholders, structured into platforms, which have contributed to the design of the APF and will participate in its implementation at the level of sub-regional pilot cases and at basins scale, thus interfacing scientists and policy makers to develop a durable tool to support ecosystem based management of marine and coastal environments.

**Setting the scene for building adaptive policies for GES achievement.**

Breil M.(CMCC), Sauzade D. (Plan Bleu), Beaumont N.(PML), Boteler B. (Ecologic), Gileva E. (BSNN), Grüning M. (Ecologic), Kontogianni A. (UOWM), Krüger I. (Deltares), Le Tellier J.(Plan Bleu), Melikidze V. (TSU), March Morlà D. (CSIC), Markandya A. (BC3), Marta M. (BC3), Roeleveld G. (Deltares), Salukvadze J. (TSU), Shivarov A. (BSNN), Skourtos M. (AUA)

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**Abstract**

Aim of the PERSEUS project is to provide scientific input for better marine policies. Strategies and measures for marine ecosystems need to prepare for an uncertain future and can be based on only partial knowledge about the complex interactions in the socio-ecologic systems it is required to manage. So further to the best targeted scientific knowledge, the construction of policies needs to aim at robustness and adaptiveness in order to cope with different possible futures. One potential strategy of for widening the view on possible future implications of potential relevance of the policy consists of the involvement of a wide range of actors in order to obtain their views and information. Furthermore policy making needs to take into account different time horizons and should design different possible pathways of implementation and mechanisms for adaptation of policies to new social or environmental conditions or to new evidence. Whereas models are the tools chosen for simulating complex physical interdependencies into the future, the political and social development is less easy to be anticipated, so that scenario and foresight analysis exercises can help in shaping an idea of future developments.

The PERSEUS tool provides both types of inputs for the policy maker, describing the present state of play in terms of foresight analysis and scenarios which provide sufficient detail for the area of the SES, and outputs from modelling which can be used for anticipating and testing outcomes of policies. It furthermore provides guidance on how to combine policy interventions in order to make them robust against future changes using a scenario planning and pathways approaches.



## **Governance of Coastal and Marine Ecosystems and ‘Stakeholder Dialogue’ in the Southern European Seas.**

Le Tellier J. (Plan Bleu), March Morlà D.(CSIC-IMEDE), Breil M.(CMCC), Kontogianni A. (UOWM), Shivarov A. (BSNN), Gileva E. (BSNN), Beaumont N. (PML), Pascual M. (BC3)

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### **Abstract**

In the framework of the PERSEUS project, key-activities aim to strengthen ‘stakeholder dialogue’ by building stakeholder platforms to facilitate exchanges between scientists and decision-makers concerned by the implementation of the EU Marine Strategy Framework Directive (MSFD) in the Southern European Seas (SES - Mediterranean and Black Sea basins). Having a role of interface between scientifically based knowledge and stakeholders communities within four pilot case areas (Western Mediterranean, Northern Adriatic, Aegean Sea, and Western Black Sea), these stakeholder platforms represent a way to bridge the gap between scientists (knowledge) and decision-makers (policy), towards an adaptive management of the coastal and marine ecosystems in the SES. The stakeholder platforms are designed to support, by using a participatory process, the preparation and future implementation of adaptive policies, management schemes, and operational tools to promote better governance of coastal and marine ecosystems across the Mediterranean and Black Sea. Supporting dialogue between scientists and decision-makers, these platforms represent a way to build a common understanding of issues and institutional perspectives affecting coastal and marine ecosystems of the SES.

The ‘stakeholder dialogue’ activities are structured in several steps: setting- and follow-up of the stakeholder platforms (getting a detailed stakeholder database), stakeholder mapping, stakeholder consultation (questionnaire, interviews, etc.), and stakeholder meetings. During the two first years of the project, several exercises of stakeholder consultation were implemented: online questionnaires, face-to-face and in-depth interviews, in addition to regular contacts by email and phone. The first round of interviews allowed: Clarifying the scope of the work; Better knowing the stakeholders’ professional background, position, and role in the MSFD process, as well as links with other players; Asking feedback and needs regarding the ‘policy-oriented tools’ the project should develop. The results of those consultations are currently synthesized for communication and integration among the main stakeholders and institutional bodies that promote, at various scales from global to local, sustainable development of the Mediterranean and Black Seas.

Preliminary results of the first stakeholder consultation highlight some of their main concerns and recommendations in terms of challenges, notably: (i) Challenge of translation of scientifically based messages and of integration from sciences into policy (as well as need for new knowledge and for improvement of monitoring tools); (ii) Challenge of dissemination of the scientific results in a suitable manner (concrete advice for stakeholders and decision-makers; clear interpretation of scientific results). Finally, the interviews were particularly useful to collect qualitative materials for the examination of local governance of maritime affairs and the existing schemes of coastal management, at the pilot case scales and in each country studied, in terms of organization (interactions between stakeholders), which was a prerequisite to go further regarding the policy-oriented aspects of the project.

**Concept and design of an Adaptive Policy Tool Box based on a step by step policy cycle.**

Breil M. (CMCC), Sauzade D. (Plan Bleu), Beaumont N. (PML), Boteler B. (Ecologic), Gileva E. (BSNN), Grüning M. (Ecologic), Kontogianni A. (UOWM), Krüger I. (Deltares), Le Tellier J. (Plan Bleu), Melikidze V. (TSU), March Morlà D. (CSIC), Markandya A. (BC3), Marta M. (BC3), Roeleveld G. (Deltares), Salukvadze J. (TSU), Shivarov A. (BSNN), Skourtos M. (AUA)

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**Abstract**

One aim of PERSEUS is to connect the knowledge provided by scientific research with implementation practices on the ground. Therefore, the project is building a guidance-framework for the construction of robust ecosystem based policies for the marine environment in a situation of relative uncertainty. In fact marine policy potentially need to be easily adapted to new (scientific and factual) evidence on conditions and outcomes of policies and changing framework conditions for interventions both in the social and political and the physical sphere (climate change). The toolbox, based on an adaptive policy cycle framework, includes in fact information and tools useful for supporting policy makers in each of the five steps of the underlying adaptive policy cycle. This five steps approach divides policy making into a process which reaches from recognition of objectives, issues and actors to the final step of the loop consisting in revisioning the policies, as step that potentially triggers the subsequent start of a new policy cycle.

Each part of the toolbox, which corresponds to one of the five phases of the underlying framework of the “adaptive policy cycle” offers indeed specific information and tools for the tasks of policy design, implementation and revision, and provides users with access to specific sources of information created either within PERSEUS or available outside the project. The presentation intends presenting contents and first impressions of the implementation of the toolbox.

## **Social values for Southern European Seas marine ecosystem services. Inventory and critical assessment.**

Skourtos M. (AUA), Damigos D. (NTUA), Kontogianni A. (UOWM), Tsitakis D. (AUA),  
Zanou B. (HCMR), Sauzade D. (Plan Bleu)

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### **Abstract**

The Marine Strategy Framework Directive (MSFD) introduces an ecosystem-based approach to protect more effectively the marine environment across Europe. This approach recognizes that coastal and marine ecosystems provide a wide variety of benefits to society that should be described in terms of their economic and social importance. Towards this direction, an inventory of existing economic valuation studies on marine goods and services in the Southern European Seas (SES) was carried out developing a spatially explicit valuation database, namely V-MESSES, with the explicit objective of serving the specific Adaptive Policy Framework (APF) of the EU funded PERSEUS research, the overall objective of which is to bridge the gaps between scientists and policy-makers.

V-MESSES is the first, comprehensive inventory of SES ecosystem values. At present, the database contains 93 studies offering over 110 value estimates for four categories and 20 subcategories of marine ecosystem services covering all regions of SES. Thus, the database enables so far the estimation of the aggregated value of all ecosystem services, as well as the economic value of: (a) provision of food, raw materials and genetic resources/medicine; (b) gas and climate regulation, erosion control, bioremediation of waste and water purification; (c) recreation and leisure, aesthetics, cultural heritage, spiritual values and science and education; (d) primary production, biochemical cycling, ecosystem stability, habitats and biodiversity.

We provide a range of economic estimates for 17 subcategories of marine ecosystem services. However, the selection of appropriate, policy relevant value estimates for SES is not a simple and straightforward task, since several conditions should be met in order to conduct effective and efficient value transfers. For instance, as a rough estimate for the Mediterranean Sea, the economic value of marine ecosystem benefits estimated by Mangos et al. (2010) (i.e. 125€ (2012) per ha per year) or the value of 161,000€ (2012) per ha per year obtained from the study of Brenner et al. (2010) could be used. The disparity in the estimates is attributed to the 'assets' valued and the different areas of interest, i.e. an entire sea region vs. a coastal area. The same conclusions were drawn from the results provided by TEEB (2010). For example, the monetary value of the potential use of all services of coastal ecosystems varies between 248 and 79,580 USD per ha per year. Furthermore, there are additional difficulties in applying benefit transfer in the context of marine and coastal ecosystem services, as a result of the particularities of marine environment and because of a shortage of available primary valuation studies per ecosystem, scale and service. For instance, Naber et al. (2008) note that a major gap in the valuation of marine ecosystem services is the relative absence of studies that tackle the valuation of deep-sea marine ecosystems.

Bearing in mind the above limitations, tentative reference value estimates may be compiled from the V-MESSES database for a number of coastal and marine ecosystem services, although not all service categories are covered sufficiently. The reference values could be up-scaled, averaged or aggregated. Yet, it should be kept always in mind that there exist

methodological difficulties encountered in assessing individual monetary values (e.g. double-counting, marginality, etc.), as well as uncertainties attributed to imperfect knowledge of ecological and economic relationships in the marine environment.

### References

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**Monitoring hypoxia: approaches to addressing a complex phenomenon in the Black Sea****INVITED TALK**

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**Abstract**

In this contribution we present an overview of results and share experiences from monitoring and assessing various hypoxia phenomena in the Black Sea. The focus is on approaches and technologies for monitoring of, e.g., mesoscale seasonal patterns in water column oxygenation, multi-decadal trends in oxycline boundary shifts, fast oxygen fluctuations at the pelagic redoxcline and the sediment-water interface, and seasonal changes in bottom-water oxygen. The various temporal scales (from hours to decades) and spatial patterns (from local to basin-scale) in water column oxygenation were addressed using state-of-the-art technologies, e.g., a free-falling pump CTD, a profiling instrumentation platform, ARGO floats and static moorings equipped with oxygen optodes, and long-term monitoring programs based on standard CTD casts.

Examples from four study sites in the Black Sea and one in the Baltic Sea are presented. Oxygen sensor equipped ARGO type profiling floats proved to be powerful tools to resolve seasonal changes in water column oxygenation and emphasize the importance of mesoscale processes for oxygen distribution in the Black Sea basin.

Multi-decadal time-series monitoring data based on standard CTD measurements revealed the imprint of climate change and eutrophication on long-term oxygen distributions in the central Black Sea and hence, highlight the importance of maintaining long-term commitments to oxygen monitoring programs. Monitoring data from 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. Such long time series data allow separating out the effects that climatic forcing and eutrophication exert on oxygen depletion i.e., in the Black Sea.

A free-falling pump-CTD provided high-resolution profiles of oxygen and reduced compounds in the Bosphorus outflow to the Black Sea, and proved highly suitable to resolve oxygen intrusions into highly stratified systems and hence, to identify and localize processes in complex redoxclines.

We also present an example of novel technology applied in the Baltic Sea, which would be highly suitable for the Black Sea. The time series recordings of the profiling instrumentation platform GODESS in the Gotland Basin allowed a thorough characterization of oscillating redoxclines as temporally dynamic, three-dimensional systems.

Stand-alone static moorings equipped with optical oxygen sensors, current meters, and turbidity sensors allowed to resolve fast oxygen fluctuations at the sediment-water interface due to, e.g., internal waves and Ekman pumping on the Crimean shelf and identified the formation of seasonal (summer) hypoxia as an highly dynamic process on the north-western Black Sea shelf.

This comprehensive study originated by 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](http://www.hypox.net)) was able to address many aspects of hypoxia, e.g., in the Black Sea, and revealed the vital need for dedicated oxygen monitoring programs to adequately address the risk of hypoxia formation and ecosystem response. The challenge in any kind of monitoring is to choose the appropriate approach and technology that is suited to resolve the temporal and spatial scales on which the phenomenon occurs.

## **From Scylla to Charybdis: Eutrophication and climate drivers of hypoxia in the Black Sea north western shelf.**

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### **Abstract**

As other stratified continental shelves exposed to eutrophication (Diaz and Rosenberg (2008), *Science*, 321(5891)) the Black Sea North-western shelf (NWS) is affected by seasonal hypoxia : summer stratification prevents ventilation to compensate for benthic and pelagic respiration triggered by large nutrients inputs. We used a 3D coupled physical biogeochemical model to investigate the dynamics of bottom hypoxia in the Black Sea NWS at seasonal and interannual scales (1981-2009). The model (Capet et al. (2013), *Biogeosciences*, 10) integrates a dynamical representation of organic matter in the sediment layer. Specific validation procedures prove the model's ability to resolve the seasonal cycle and interannual variability of oxygen concentration as well as the spatial location of the oxygen depleted waters and the resolution of the specific threshold of hypoxia ( $[O_2] < 62 \text{ mmolO/m}^3$ ). Spatial variability and seasonal fluctuations complicate the monitoring of hypoxia, which led to contradictions between studies based on different sets. In particular, the recovery process was overestimated after 1995 due to the concentration of observations in areas and months not typically affected by hypoxia.

We quantify the annual severity of hypoxia by an index H that combines the spatial and temporal extension of the seasonal hypoxia event. A multilinear stepwise regression analysis ( $p < 0.01$ ) is applied on the long time series given by the 3D model, providing specific relationships between H and key eutrophication and climate related predictors that are proposed on the basis of an in-depth analysis of the seasonal mechanism of hypoxia.

We show that the accumulation of organic matter in the sediments, during the years of high nutrient discharge, continues to cause an important benthic oxygen demand after the reduction of riverine discharge (in the early 1990's for the Black Sea NWS), introducing an inertial aspect in the recovery dynamics. The major climate-related driver of hypoxia are (1) the sea surface temperature (SST) in March, which fixes oxygen solubility in the last days of mixing, hence the initial pool of oxygen locked in summer under the thermocline and (2) late summer SST, which determines the duration of the stratification period. Delayed autumnal mixing effectively increases the damages caused by hypoxia since bottom waters then bear the lowest oxygenation levels, and eventually reach anoxic level with subsequent releases of hydrosulphide from the sediments.

Higher summer temperature, observed in the Black Sea during the last decade, succeeded to eutrophication drivers of the late 80's in sustaining hypoxia. This study thus highlights an additional urge to consider foreseen global warming to derive sound GES management policies.

**The Black Sea Biogeochemistry: Its Temporal and Spatial Variability.**

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**Abstract**

The temporal and spatial variability of the upper ocean hydrochemistry in the Black Sea down to its suboxic zone was analyzed using data originating from historical observations, profiling floats with oxygen sensors and numerical simulations carried out with a coupled three-dimensional hydro-physical-biogeochemical model including 24 biochemical state variables. The validation of the numerical model against observations demonstrated that it replicated in a realistic way the statistics seen in the observations. The suboxic zone shoaled in the central area and deepened in the coastal area, which was very well pronounced in winter. It also varied with time in concert with the variability of the physical system. Two different regimes of ventilation of the pycnocline were clearly identified: gyre-dominated regime in winter and eddy dominated regime in summer. These contrasting regimes were characterized by very different pathways of oxygen intrusions along the isopycnals. The contribution of the three-dimensional modelling to the understanding of the Black Sea hydro-chemistry, and in particular the coast-to-open-sea diapycnal mixing was also demonstrated.

**Exchanges across the shelf break in the northwestern Black Sea.**

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**Abstract**

The transports of water, heat and salt between the northwestern shelf and deep interior of the Black Sea is investigated using a high resolution three-dimensional primitive equation model (NEMO-SHELF) over the period April 1 to August 31, 2005. During this period, both onshore and offshore cross-shelf-break transports in the biologically active top 20 m were on average 0.24 Sv each, which is equivalent to the replacement of 60% of the total volume surface shelf waters (0-20m) per month. Two main exchange mechanisms are studied in detail: (i) Ekman transport and (ii) transport by mesoscale eddies and associated meanders of the Rim Current. The Ekman drift causes nearly uniform onshore or offshore flows over a large section of the shelf break, but it is confined to only the top layer of approximately 20 m depth. In contrast, eddies and meanders penetrate deep down the bottom at the shelf break, but they are restricted laterally. During the two strong wind events, April 15 – 22 and July 1 – 4,  $0.66 \times 10^{12} \text{ m}^3$  and  $0.44 \times 10^{12} \text{ m}^3$  of water were removed from the northwestern (NW) shelf respectively. In comparison, the single long-lived Sevastopol eddy generated a much larger offshore transfer of  $2.84 \times 10^{12} \text{ m}^3$  of water over the period April 23 to June 30, which is equivalent to 102% of the overall volume of NW shelf waters. Over the 5 months under study, salt exchanges increased the average density of shelf waters by  $0.67 \text{ kg m}^{-3}$  and hence smoothed the density contrast between the shelf and deep sea. It was less intuitive to find out that lateral heat exchanges reduced the density of shelf waters by  $0.16 \text{ kg m}^{-3}$  and hence contributed to sustainability of the density gradient across the shelf break front.



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**A preliminary analyses of water column data collected from in situ loggers deployed within the Maltese Islands.**

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**Abstract**

The operational measurement of water column temperature is one of the most fundamental requisites for the holistic monitoring of coastal waters and for the development of ad hoc tools such as hydrodynamic and biogeochemical modeling for the same waters. Whilst remote sensing applications are limited to the measurement of SST only, operational field measurement of the sea temperature at different water column depths is possible only through the field deployment of data loggers. As part of the Tropical Signals programme promoted by CIESM, and also through funds made available through the PANACEA project, a number of water temperature data loggers were deployed by SCUBA divers at different water depths, ranging from 5m down to 40m, at two different locations in the Maltese Islands (Central Mediterranean), between 2011 and 2013, with loggers being secured within natural crevices in submerged vertical walls in one coastal location and along a buoy anchor line in a second offshore location. Loggers were left in the field for a number of consecutive months up to a maximum of one year, after which they were retrieved and temperature data held was downloaded by means of an IR reader, with the loggers being re-deployed in the same locations soon after. Detachment of the same loggers, both as a result of inclement weather and by divers, resulted in fragmented temporal data being collected for the coastal sites, whilst a full-year of consecutive water column data was collected only for the offshore site. The in situ temperature values recorded by the loggers were confronted statistically against daily water column data for depths ranging from 1m to 40m, gleaned from a forecast model. The degree of concordance between the two sets of values is discussed in the study so as to assess the suitability of both the model and the data loggers in accurately monitoring changes in water column temperature. The deployment of the data loggers made it possible to make a number of observations, including the seasonal onset of the thermocline and diurnal and seasonal fluctuations in water column temperature.

## **PERSEUS oriented system for storage and operative exploration of Mediterranean and Black Sea cast data.**

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### **Abstract**

To fulfil scientific and society needs addressed by PERSEUS, WP3 “Upgrade & Expand the Existing Observational Systems...” and WP9 “Communication, Outreach & Information Management” are collaborating to provide an end to end system from observation data acquisition to project marine information delivery.

The first objective is to provide end users an aggregated and consistent marine observation data set. The second objective is to provide tools that allow monitoring the PERSEUS observation network. The third objective is to advertise the PERSEUS contribution to a wider Southern European Seas observation system. The last objective aims to provide a user’s friendly interface which provide access to Mediterranean and Black Seas data in a timely manner, following the regulations of the PERSEUS Data Policy. To reach these four objectives, task 9.1 and task3.4 are working in a consistent manner.

A Memorandum of Understanding has been drafted between PERSEUS, SeaDataNet and MyOcean to enhance the collaboration between the three projects and distribute the PERSEUS marine observation data to a wider community in an efficient way. A dedicated multi-parametric oceanographic database (DB) was developed to collect all available historical data of Mediterranean and Black Sea observed as vertical profiles (excluding XBT data). The DB allows online selection and download of any part of the data to a wide community of users with different levels of data accessibility (defined according to PERSEUS data policy). In addition, the DB includes tools for importing new data, which will be gathered in the framework of the PERSEUS project. As the primary source for the historical data, the SESAME cast data base was used. In contrast to the old SESAME system, where the primary DB was MS ACCESS DB, the new system has a primary MS SQL DB which includes direct online interface for data import and QC of new data in ODV format. The identification of parameters in the PERSEUS system is based completely on the Common Vocabularies which were introduced as standard terms by SeaDataNet: P011 (parameter usage vocabulary), P061 (data storage units) and P021 (parameters discovery vocabulary). GIS like on line user interface provides flexible data selection and analysis of metadata. The system supports two ways to export and download selected data:

- Single cruise or small group of cruises in ODV format. Parameters and units are the same as in the original submission.
- Aggregate of large number of cruises in MS ACCESS DB format. Parameters and units are selected by the user.

During 2013 PERSEUS cast DB was significantly extended by merging with NOAA/NODC data base. At the end of 2013 the DB contained about 313,000 casts with 200 different parameters. Most of the historical data including data assembled during SESAME project have become public available on 01/APR/2013 and can be downloaded by any registered user.

Two autonomous relocatable applications developed by MHI co-authors are available for tuneable quality control and scientific analysis of the data exported to MS ACCESS DB (of aggregated data).





## **SESSION 2**





## **Mediterranean variability of Phytoplankton Size Classes and Particle Size Distribution during the SeaWiFS Era.**

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### **Abstract**

Phytoplankton represents an important element for the survival and comprehension of marine world. Its scientific importance is owing to its ecological role in the global carbon cycle and greenhouse effect. Its bio-geographic distribution, on global and regional scales, is directly influenced by biological, chemical and physical factors, as light, nutrients availability, presence of competitors, predators, pH, all connected to the dynamic of the water masses. The distribution of the phytoplankton community in functional classes is an index of the variability of the marine environment status. In this sense, if a relationship between dimensions and pigmentary content, different taxa or stages of growth in the same taxon, photosynthetic efficiency and bio-optical phytoplankton properties exists, then “cell size” becomes an important descriptor for the community structure.

High quality information over sparse locations about the composition of phytoplankton community structure can be obtained from the analysis of in situ samples such as flow-cytometry, HPLC or spectrophotometry (which provides the pigments light absorption in the visible spectrum). On the other hand, the composition of the community is also reflected in different optical properties of the ocean waters. For this reason, satellite remote sensing represents the other tool to obtain synoptic information on the distribution and diversity of phytoplankton community using, either empirical, analytic or semi-analytical models.

This work focus on satellite remote sensing contribution to the analysis of the spatial and temporal variability of the Phytoplankton Size Classes (PSCs) and Particles Size Distribution (PSD) in the surface waters of the Mediterranean Sea.

Three models, proposed by Hirata et al. (2011), Brewin et al. (2011) and Kostadinov et al. (2009) were tested on a Mediterranean sub-set of SeaBASS in-situ dataset, in order to select the most appropriate for this basin. A first validation of the Hirata and Brewin models, performed using in situ SeaBASS HPLC Total Chlorophyll\_a (TChl\_a) and phytoplankton functional types via diagnostic pigment ratios (Vidussi et al. 2001), indicates the Hirata et al. (2011) model as the most appropriate for Mediterranean Sea. The comparison between PFTs derived from in-situ HPLC pigments and PFTs derived from matched up SeaWiFS data using the PSD method is underway.

The three selected models were applied to the full SeaWiFS time series (1998 – 2010).

In general we observed that micro component gives a greater contribute to the TChl\_a during spring blooms events in correspondence of high productivity areas. Differently, the nano class seems to be nearly constant along the years with higher values in the western Mediterranean basin. The maps relative to pico-phytoplankton fractions shows an increase of its specific contribution in summertime especially in Levantine basin, reaching percentages of 70-75% of the TChl\_a. Similar results were obtained considering particle size distribution derived using Kostadinov et al. (2009). In this case, considering that the algorithm is sensitive to the entire particle assemblage, not just to phytoplankton, following Kostadinov we must intend these

percentages as percent of phytoplankton-sized particles rather than percent of phytoplankton. Citing Kostadinov: “Essentially this is similar to making a case I bio-optical assumption, stating that the ocean’s backscattering is driven to first order by living cells and their covariates”.

Mediterranean monthly decadal averages were used to investigate bloom dynamics and succession patterns in three contrasting locations of the Mediterranean Sea: The Liguro-Provençal basin in the Northwestern Mediterranean Sea, the northernmost area of the Adriatic Sea and the Levantine basin. The shape of the PSC and PSD curves in the Levantine basin and in the NW Med are very similar describing a common seasonal succession. In the Levantine site Pico dominates all around the year followed by Nano and Micro while in the NW Med Pico and Nano are very similar and predominate respect to Micro for most of the year except for March and April when the three components are comparable. In the North Adriatic Sea, on the contrary, Micro-plankton chlorophyll is dominant for most of the year while the volume concentration of micro-plankton sized particles is always the less significant.

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## **Impacts of Human-Induced Eutrophication on Upper Layer Chemistry and Reference Nutrient Conditions for GES Targets in the Black Sea.**

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### **Abstract**

Assessment of long term impacts of human-induced eutrophication on the Black Sea sub-basins are essential to assess 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 and precipitation have led to enhanced eutrophication and POM production over the entire basin. In the pre-anthropogenic period before the 1960's, the surface waters contained excess amounts of silicate (30-70  $\mu\text{M}$ ), and phosphate (0.1-0.3  $\mu\text{M}$ ) but exhibited very low nitrate concentrations ( $< 0.1 \mu\text{M}$ ), resulting in extremely high Si/N but very low N/P ratios. Then, the increased DIN and TP inputs by the major rivers with lower Si concentrations enhanced eutrophication and resulted in the utilization of excess Si and  $\text{PO}_4$  stocks in the near surface waters and changed Si/N/P ratios during the 1980's. The increased POM export to depths has led to seasonal/decadal changes in both the euphotic zone thickness and boundaries of the chemocline in the halocline. The upward shift of the SOL boundary ( $\text{O}_2 < 10.0 \mu\text{M}$ ), has reduced lateral fluxes of particulate Mn from the shelf, which has a catalyzing role in oxidation of sulfide ions at the anoxic boundary. To reach GES targets, DIN and TP inputs from both rivers and precipitation should be reduced to threshold levels that can only be estimated by N-P-Si coupled ecosystem + input models. The winter reference values of reactive Si and the Si/DIN ratio for GES targets should remain high; ( $\text{Si} > 10 \mu\text{M}$ ) and Si/DIN ratio ( $> 10$ ) in the near surface waters even under changing climatic (warming/cooling) conditions. Under the present conditions, the Si deficiencies in the surface mixed layer can only be compensated by winter inputs from the upper halocline. The SOL boundary ( $\text{O}_2 < 10.0 \mu\text{M}$ ) in the coastal and open sea should be used as an indicator. The oxycline enlarged in winter should remain unchanged in summer and allow the enhancement of the part-Mn flux from the shelf break to open sea.

**Investigations of nutrients level influence to the costal marine waters phytoplankton in the Black Sea North-Western part (Zmiinyi Island area)**

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**Abstract**

North-western part of the Black Sea (NWBS) is one of the areas where eutrophication not only brings down the quality of marine environment causing blooms of phytoplankton, but also causes hypoxia and mass mortalities of marine organisms. As it has been shown in our previous studies the quality of the NWBS marine waters is closely connected with nutrients levels. The aim of this work has been to estimate the changes, trends and influence of the main physical and chemical characteristics, especially the nutrients levels, to the phytoplankton biomass and number in the Zmiinyi Island area of the Black Sea in 2004-2012. Material for analysis comprised results of observations carried out during 2004-2012 in the Zmiinyi Island coastal waters by the staff of Marine Research Station “Zmiinyi Island” of Odessa National I.I. Mechnikov University. Results of determination of physical (salinity), chemical (oxygen, nitrites, nitrates, ammonium, total nitrogen, phosphates, total phosphorus) and biological (chlorophyll, phytoplankton) characteristics of surface waters in 2004-2012 are presented. Changes and trends of these parameters in the Zmiinyi Island area have been analyzed. Correlation analyses of their interrelations have been presented. Cases of high chlorophyll and nutrients concentration levels in the coastal waters have been described and their reasons analyzed. The conclusion has been made that the main reason of Nutrients and Phytoplankton changes is the origin of marine water in the Zmiinyi Island area. At the same time maximal levels of Nutrients and Phytoplankton Biomass and Number have been registered during advection of the Danube waters to the Zmiinyi Island area.



## Atmospheric deposition of inorganic nutrients (N &P) over Mediterranean and Black Sea

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### Abstract

Atmosphere has now been recognised as one of the major external nutrient source for open ocean. The atmospheric deposition of nutrients has an important role to marine productivity, especially in Mediterranean Sea; one of the most oligotrophic surface waters in the world. Its contribution may exceed riverine inputs even in the region of freshwater influence (*e.g.*, North-eastern Levantine Basin). The present study aims to enhance our knowledge in atmospheric deposition fluxes of inorganic nutrients over West & East Mediterranean and Black Sea.

The role of atmospheric deposition of nitrogen to the marine ecosystem has already simulated with a high resolution model (Im et al., 2013). The main findings are that the annual N deposition flux is calculated to be, 0.92 Tg(N) yr<sup>-1</sup> over West Mediterranean, 1.10 Tg(N) yr<sup>-1</sup> over East Mediterranean and 0.36 Tg(N) yr<sup>-1</sup> over the Black Sea. Comparison to available observations associates the annual mean model estimates with about 40-30% of uncertainty depending on location. Dry deposition dominates over wet deposition for N in agreement with the observations. Results suggest that an important fraction of the N deposited over the Mediterranean basin can be attributed to transported N species.

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**Preliminary results of ecological quality evaluation based on marine angiosperms and macroalgae in the PERSEUS experimental area Saronikos Gulf-Athens (Aegean Sea, Greece).**

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**Abstract**

The aim of the study is the evaluation of the ecological quality using three (3) indices based on the marine angiosperm *Posidonia oceanica* (PREI, BiPo, VALENCIA CS) and one (1) index based on macroalgae (EEIc). Six (6) sampling sites were chosen along the east coasts of Saronikos Gulf where the major human pressures occur. The choice of sampling stations was based on an anthropogenic pressure gradient along the different parts of Saronikos Gulf (Inner and Outer Gulf) evaluated by the Land Use Simplified Index (LUSI).

The results showed that the sampling stations in the Inner Gulf were characterized by Low or Moderate ecological quality while sampling stations in the Outer Gulf presented Good or High ecological quality. The resulting EQR values were correlated with the anthropogenic pressures. The absolute average class difference (AACD) results indicated the comparability between the classification systems based on *P. oceanica* and macroalgae.





***Caulerpa racemosa* and *Diplodus sargus*: an integrated approach for studying the subtle effects of biological invasions on Mediterranean marine systems.**

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**Abstract**

Biological invasions are deemed as one of the most severe threats to terrestrial and marine biodiversity and can result in huge economic impacts on natural resources. Many studies have assessed structural changes caused by the introduction of non-indigenous species on native assemblages, but there is a lot to do for understanding the complex indirect effects of invasive pests on marine biodiversity at the species and ecosystem level.

In the Mediterranean Sea, the biological invasion by the green alga *Caulerpa racemosa* is maybe the most striking marine sea-bottom landscape change of the last decades, due to its high potential of dispersal and to deep modifications produced in the invaded benthic communities. However, the impacts of such invasion on functional properties of marine ecosystems are still far to be clearly elucidated.

Within the PERSEUS WP1, ADREX experiment, we have explored the effects of *C. racemosa* by considering how pest metabolites can affect functional properties of marine subtidal systems such as those represented by trophic relationships and cascade effects. Because of its ecological importance in modulating trophic cascade effects and thus influencing the diversity of benthic assemblages, the white sea bream *Diplodus sargus* has been chosen as a model.

Through a first preliminary investigation it has been found that the alkaloid caulerpin, the main *C. racemosa* secondary metabolite, has the potential to enter in trophic chains and accumulate in tissues of this fish of great ecological and economic importance.

General biological condition markers associated with fish health and reproductive development were measured and correlated with the caulerpin levels in the fish tissues, used here as indicator of the trophic exposure to the invasive pest. Significant correlations among caulerpin tissue load (determined by liquid chromatography-mass spectrometry analysis) and fish condition factor and hepatosomatic index were obtained, suggesting a possible detrimental effect of the dietary exposure to *C. racemosa* on *D. sargus*. Glutathione peroxidase and catalase activity were also significantly correlated with caulerpin concentrations in the liver, suggesting a possible interaction between algal metabolites and liver antioxidant mechanisms.

The effects of the *C. racemosa* spread have been subsequently evaluated by analyzing *D. sargus* population sampled in three locations differing in terms of the alien seaweed substrate colonisation and regime protection. Fish revealed a high frequency of occurrence of *C. racemosa* in the stomach contents at invaded areas (72.7 and 85.7%) while the alga was not detected in organisms from a control, non-invaded area. The presence of *C. racemosa* in the diet of *D. sargus*, as indicated by the significant accumulation of caulerpin in tissues, caused the onset of various biological effects, including activation of some enzymatic pathways (catalase, glutathione peroxidases, glutathione S-transferases, total glutathione and the total oxyradical scavenging capacity, 7-ethoxy resorufin *O*-deethylase), the inhibition of others

(acetylcholinesterase and acylCoA oxidase), an increase of hepatosomatic index and the decrease of gonadosomatic index.

Besides the changes in the cellular and molecular activity, we found also that the *C. racemosa* based-diet has the potential to induce changes in the nutritional properties of *D. sargus*.

Fish feeding on *C. racemosa* showed indeed, an altered muscle fatty acids composition, with a lower percentage of polyunsaturated fatty acids (PUFA) of the n-3 and n-6 series, such as eicosapentaenoic (EPA, C20:5), docosahexaenoic (DHA, C22:6) and arachidonic acids (AA, C20:4) than fish not feeding on this seaweed. Such a reduction not only could represent a risk for the health of fish unable to biosynthesize these essential fatty acids, but also lowered the nutritional value of white seabream flesh because of the key role of long-chain n-3 PUFA in the prevention of cardiovascular diseases, diabetes, cancer and neurological disorders.

Finally, considering the negative consequences arising from the consumption of *C. racemosa*, we tried to understand why fish eat such large amount of the algae. Specifically, in order to know if the invasive seaweed is accidentally ingested while fish search for invertebrates or, on the contrary, actively selected, we carried out two experiments for assessing the attractiveness of *C. racemosa* on *D. sargus*.

The experiments were designed to evaluate the effects of the algae on the endocannabinoid system, a fundamental system in vertebrates responsible of appetite regulation, by measuring the affinity of the main algal metabolite with endocannabinoid receptors.

Moreover, monosodium glutamate, a well-known appetent substance able to activate the brain circuitry contributing to the learning of additive behavior (dependence-behaviour) was quantified in the algae and used for analyzing the ethological responses to the administration of food implemented with glutamate.

Caulerpin has proved active on both CB1 and CB2 receptors at micro-molar concentrations (IC<sub>50</sub> equal to 2.80 μM and 5.07 μM, respectively) supporting its possible involvement in producing gratification/additive-behaviors in *D. sargus*. The quantification of glutamate in *C. racemosa*, revealed a higher concentrations than in the congeneric *C. prolifera* (5564.0 mg and 3825 mg per 100 g ww, respectively), probably making alien seaweed more tasty, triggering also in this case, dependence-behaviours.

These results might explain the great amounts of *C. racemosa* found in stomach contents, suggesting that fish voluntary search for the alga, whereas, the appearance of biochemical alterations might imply a detrimental health status and altered behaviors, potentially preventing the success of fish populations.

On the whole, through an integrated approach which conjugated organic chemistry, cellular biology, neurobiology, ecotoxicology and ecology, this study has attempted at elucidating the potential impact of *C. racemosa* spread on *D. sargus* so to provide further insights to the mechanisms by which biological invasions can affect marine biodiversity with, also, critical implications of nutritional interest for human health.

## **Schemes of integrating the indicators of the benthic community condition (sea floor integrity-MSFD): An application in Saronikos Gulf.**

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### **Abstract**

Benthic samples were collected in winter 2012 from a network of 13 stations in Saronikos Gulf and Elefsis Bay (Aegean Sea, Eastern Mediterranean). Taxonomic and biomass (size) analysis was conducted to species level. Four benthic indices assessing all indicators of benthic community condition, one of the two criteria for Sea-floor integrity within the MSFD, were applied to the data. The Bentix index was used to assess the presence of particularly sensitive and/or tolerant species (indicator 6.2.1.) and the proportion of opportunistic to sensitive species (6.2.2). The Shannon diversity and species richness indices were used to assess the indicator 6.2.2., and the ISD index was used to assess the proportion of biomass or the number of individuals above a specified length/size (6.2.3.) and the size spectrum of benthic communities (6.2.4.).

The values of all the indices at each station were expressed in a standardized way either using the Ecological Quality Ratio scale based upon the WFD or using an equivalence system for diversity indices with no discrete EQR values.

For the Shannon diversity and the species richness indices the values were evaluated performing analysis of variance to a large set of data for discrete ecotypes and on standard sample sizes (Simboura et al., 2012), and also on Mediterranean scales for Shannon diversity (UNEP/MAP, 2004). Two schemes of aggregation of these indicators were applied and proposed as integration methods:

The first aggregation scheme proposed is a conditional rule updated in this work using the size indicator. If the three out of the four indicators are assessed as passing the GES threshold, the station is assessed as in GES.

The second aggregation scheme proposed is an adaptation of a similar method applied across MSFD descriptors in the Basque country (Borja et al., 2011). The proposed scheme is a modular formula assigning weighting scores to each one of the components of a formula including: one “biotic” component, two “diversity” components and one “size” component. Each component in the formula is expressed by EQR or equivalence values weighted accordingly and the sum of all weighted values correspond to the final Environmental Status.

The weighting scores were selected taking into account a) that the Ecological Quality Status (EQS) within the WFD and the Environmental Status (ES) within the MSFD should be harmonized and the two Directives should be fully and seamlessly integrated (Borja et al., 2010); b) the conclusion that at least in the Mediterranean Sea the Shannon diversity shows a non monotonic response to pressure gradients and that the biotic indices are more efficient to assess the EQS (Subida et al. 2012); c) the species richness is a highly variable indicator and shows a weaker correlation with EQS than the Shannon index (Simboura et al., 2012); d) the level of maturity of the size indicators for status assessment of marine benthic communities;. ISD index with class boundaries set originally for transitional waters shows a good agreement

with the biotic component but a stronger relationship with the Shannon index and indices that contain it. The derived formula is :

$$60\% \text{ (biotic)} + 20\% \text{ (diversity)} + 10\% \text{ (richness)} + 10\% \text{ (size)} = \text{ES}$$

The final ES is expressed as an EQR value and classified according to a standard scale:

1-high; 0.8-good; 0.6-moderate; 0.4-poor; 0-bad.

Specifically for the indices used in this work:

$$0,06 \text{ (Bentix index)} + 0,02 \text{ (Shannon index)} + 0,01 \text{ (species richness)} + 0,01 \text{ (ISD index)} = \text{ES}$$

Although the two integration schemes are highly compatible showing a divergence of GES only at one case, the second weighted scheme is more conditioned and adaptable to the particularities of a given MSFD sub-region or area. More testing and validation of the formula within different geographical areas may provide a common approach for assessing the benthic community condition for MSFD.



## **Environmental pressures caused by ports in the Mediterranean and Black Sea**

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### **Abstract**

Although ports contribute significantly to the economic and social development of coastal regions, it is widely acknowledged that port operations also may pose notable threats and pressures on the environment. This paper aims at identifying and describing the pressures caused on the environment by port and ships' activities and operations.

The paper focuses on ports located in the Mediterranean and Black Seas. Four Pilot ports were selected, two from the Mediterranean Sea and two from the Black Sea. The Mediterranean ports were the Port of Barcelona (Catalonia, Spain) and the Port of Thessaloniki (Greece). The ports from the Black Sea were the Port of Constanta (Romania) and the Port of Varna (Bulgaria).

The research was carried out in two phases. Initially, a questionnaire was developed and sent to the environmental managers of the Pilot ports. This questionnaire included questions about different aspects related with the environmental management of the port such as its main environmental priorities and the Environmental Performance Indicators (EPIs) used to monitor the condition of the environment.

Environmental managers answered the questionnaire and sent it electronically via email to the research team. The questionnaire was useful to create an initial overview of the environmental performance of the Pilot ports and their major concerns and problems.

Secondly, the research team visited the above-mentioned Pilot ports. These visits were useful to discover first-hand the daily environmental management of the ports and the best practices that have been implemented to prevent and mitigate environmental impacts. An interview was carried out with the environmental manager of the ports, where their environmental concerns were discussed.

Using this two sources of information, specific reports on each port have been prepared and sent to the port for their approval. These reports summarize the environmental management performance of the pilot ports.

## Identification of pressures and impacts quantification on coastal ecosystems of the Gulf of Tunis.

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### Abstract

In order to achieve the Good Environmental Status “GES” in a given area, it is first necessary to identify threats and their impacts on marine ecosystems. The Gulf of Tunis was selected as a case area for “PERSEUS”, in order to demonstrate implementation of MSFD’s principles.

In accordance with task “WP2.1. Identification of pressures and impacts on coastal ecosystems and gaps analysis”, we start our work by “the initial assessment of the environmental status”, on the basis of collection of existing information, publications and miscellaneous studies on marine ecosystems and anthropogenic pressures exerted on the Gulf of Tunis. All the data was gathered in a Geographical Information System.

Then, we quantified the impacts of anthropogenic pressures on marine ecosystems of the Gulf of Tunis using a methodology developed by Halpern et al. (2007, 2008), which is based on expert survey to determine the cumulative impact index of anthropogenic pressures on marine ecosystems in our study area. This index will help decision-making for a sustainable management of the marine environment to achieve “the Good Environmental Status (GES)”.

For this aim, we have defined 8 ecosystem-types of the Gulf of Tunis, 7 threat forms and 5 different categories for vulnerability scale: Scale, Frequency, Functional impact, Resistance, Recovery time. The experts on marine environment will evaluate (by assessing a score) on the importance of the impact of every threat on the considered ecosystem.

We found that the eastern part of the Gulf is less impacted than the western one because of the low volume of existing pressures in this area (from Korbous to Ras Et-Tib). The determination of the weighted average vulnerability score shows that the most important vulnerability score is assigned to the Posidonia meadow against trawling (2.90) and the lowest vulnerability score is assigned to the cliffs (0). In addition, the result can be different in relation to the ecosystems considered in the study area.

Then, we analyzed gaps and defined programs of measure that will take place in the next steps of the MSFD and PERSEUS strategy.

In the case of the seagrass habitat mapping (WP.2.3.2.a) (*Posidonia oceanica* and *Cymodocea nodosa*), we carried out a first underwater video/camera inspection to obtain an idea about their distribution and the status of the seagrass before the sampling and mapping task. We will then establish the ecological status of the seagrass by monitoring their distribution, status and evolution, compare them to the previous status and identify the anthropogenic pressures which threaten the seagrass and disturb their habitat.

In addition, we contributed to “WP.2.3.3. NIS”. We prepared a database of the NIS mentioned in the Gulf of Tunis (Their origin, Date and area of record, population state...). Then we will identify which of them are invasive species, and assess the origin of their introduction (Anthropogenic or not) and their impact on the indigenous species.

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**Preliminary study of the Alien species in the coastal area of Cyprus.**

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**Abstract**

Cyprus is the closest Mediterranean island to the Suez Canal, and has been extensively affected by Lessepsian migrants, especially during the last decades. Some of the alien species have already successfully established themselves in the coastal waters of Cyprus.

This study aims to observe and record native and alien species following the CIESM Tropical Signals project methodology. Six stations were studied in July 2013, three in Ayia Napa (Southeast coast) and three in Larnaca (South coast). Each station was divided into two zones parallel to the shoreline (100m each) with 100m distance between them. Timed observations of 15 minutes were made both in the intertidal (the surf and swash zone, from 0 to 0.5m) and the subtidal zones (shallow waters, 0 to 3m) by snorkeling.

Preliminary results showed a total number of 86 taxa of which 13 were alien (one macrophyte, six invertebrates and six fish). Ayia Napa presented higher total abundance and slightly higher percentage of alien species (17,74%) in comparison with Larnaca (15,51%). All alien species that were recorded are Lessepsian migrants.

The monitoring of the abundance of alien species and the study of their impact on the native marine biodiversity is necessary for the management and protection of the marine environment of Cyprus. Further research is needed to identify the extent of the impact of each alien species to the native marine biodiversity and how their increasing numbers will affect the marine trophic web.





## **SESSION 3**



**Marine litter in deep submarine canyons of the North Catalan margin: nature, distribution, sources and dispersal processes.**

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**Abstract**

A systematic ROV inspection of Blanes, La Fonera and Cap de Creus submarine canyons and adjacent open slopes down to 2,000 m deep in the NW Mediterranean Sea allowed identifying litter types, distribution and relative abundance. The most likely sources and the hydrodynamic processes or anthropogenic factors determining the observed distribution were subsequently assessed.

Three main types of litter were identified according to their density and associated floatability: i) light litter, mostly dominated by plastics; ii) intermediate density litter, including aluminum beverage cans, and fabrics; and iii) heavy litter consisting mostly of metallic objects such as fishing gear eventually with steel cables, drums, pottery, glass and a large variety of other items. Light and intermediate density litter point to a dominant coastal origin, as it could be easily transported far from their sources till it accumulates on the deep seafloor. On the contrary, heavy litter is ship originated. As main pathways for the transfer of the coastal and shallow ocean signals to the deep, submarine canyons are identified as likely preferential routes for the transport of litter to the deep continental margin too. Such a role of submarine canyons is favored when they are deeply incised into the continental shelf and their heads are at short distance from the shoreline, as this increases their capability to interfere with shallow water dynamics and capture natural and man-made objects, which is the case for the investigated canyons.

In the study area, dense shelf water cascading (DSWC) and severe storms are known to trigger massive transfers of water, sediment and pollutants from the continental shelf to the deep margin and basin mostly along submarine canyons. Such events, lasting several weeks (DSWC) or hours (storms), are thus suggested as the main carriers of coast-sourced relatively light litter to the deep. This means that the pattern for the transfer of most litter objects from shallow to deep is event-driven. In contrast, heavy litter distribution directly relates to the main navigation routes and the location of fishing grounds. Dumping of useless or damaged fishing gear at specific sites where fishing is not practiced either because of excessive depth or rough topography, or both, such as in some submarine canyon axes, lead to local concentrations of large sized, heavy litter. However, such large and heavy litter is often partly buried due to the intense sediment transport that occurs within the canyons during the above-described short-lived events.

**An integrated monitoring of marine litter in Eastern Mediterranean Sea.**

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**Abstract**

The aim of our work is to create a complete «marine litter profile» for selected study areas in the Eastern Mediterranean. The different kinds of marine litter (benthic, beach, floating, ingested etc) in most cases are interconnected eg. beach litter are transferred into the sea (floating), which are further broken into smaller particles (microplastics), which might be potentially ingested by marine biota etc. Thus we believe that, all different types of marine litter should be examined prior to final assessment. We present preliminary data on the qualitative and quantitative composition of certain aspects of marine litter found in various compartments of eastern Mediterranean Sea as well as our plans for 2014.

**i)** Benthic marine litter are studied in three regions of the Eastern Mediterranean; i.e. Saronikos Gulf (Greece), Patraikos Gulf (Greece), Limassol Gulf (Cyprus). Our methodological approach is based on the use of selected professional trawlers, while a standardized protocol proposed by the Technical Subtask Group on Marine Litter (TSGML) has been adopted. In these three study areas, density, composition, weight and origin of use are examined towards the identification of the main sources; **ii)** Marine litter in shallow waters is examined by scuba divers in a small bay in the South Peloponnese. A relevant protocol has been developed with the help of which, marine litter is monitored in a similar way to benthic marine litter. The target of this study is to monitor marine litter on shallow waters for at least one year and combine these results with relevant benthic marine litter data; **iii)** Fish stomachs from seven different, fish species (demersal and pelagic), commercially valuable, are examined for microplastics; **iv)** Marine litter monitoring on selected beaches is planned for 2014 with the use of “Marine Litter Watch” smartphone application (developed by EEA); **v)** a “Manta Net” sampling device will be used for the assessment of floating marine litter during 2014.



## **Monitoring physical and anthropogenic ambient noise in Mediterranean Sea using Underwater Passive Aquatic Listener on moored observatories.**

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### **Abstract**

Ambient noise pollution is one of the essential physical variables affecting the marine environment and ecosystem is mainly caused from excess human activities. The continuous increasing maritime traffic, seismic activities for oil and gases exploration, use of sonar for military purposes and oil drilling and pumping are some examples. Anthropogenic sounds may be of short duration (e.g. impulsive from seismic surveys, piling from wind farms and platforms, as well as explosions) or be long lasting (e.g. dredging, shipping and energy installations) thus affecting the marine ecosystem in different ways. An important task is to study the impact of these activities on marine mammals by monitoring their movements, communications and feeding processes using underwater passive acoustics instrumentation.

In the framework of PERSEUS FP7 project, under WP3 activities, new state-of-art recorders (i.e. hardware and software) have been integrated on pre-existed oceanographic mooring sites across the Mediterranean Sea in order to use the ambient sound for quantitative monitoring of the marine environment. Three moored stations (Saronikos, Athos in Aegean and W2M3A in Ligurian Sea) were upgraded with Passive Aquatic Listener (PAL). Furthermore a new autonomous underwater PAL has been developed for in-situ real-time detection and processing of any underwater ambient noise in any marine environment. This work presents the new upgraded system and its capacities. It also shows results on physical ambient noise processes detection, classification and quantification of the data collected by a sensor that was deployed in the Aegean Sea (i.e. Saronikos Sea) adjacent to the Hellenic Center of Marine Center (HCMR) Poseidon network buoy. Validation of the noise interpretation estimates from the PAL spectrums are provided by direct comparison with *in-situ* wind speed of the atmospheric sensors onboard the buoy (i.e. anemometer) and precipitation measurements collected by the hourly rainfall accumulations from the nearby Hellenic National Meteorological Service (HNMS) operation C-band weather radar.

**Preliminary results of the underwater noise measurements at the north-eastern Black Sea shelf near Gelendzhik.**

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**Abstract**

According to the PERSEUS work plan continuous recordings of underwater sound (total time of 553 hours) were carried out at two locations at the north-eastern Black Sea shelf close to the Gelendzhik Bay in June and September/October 2013. Shipping traffic in the region is very busy due to closeness of the Novorossiysk port and recreational activities (mostly in the summer), which makes it an interesting example of an environment with a relatively large number of anthropogenic sound sources highly variable in temporal and spectral properties. We present some results of statistical analysis of obtained data in frequency bands up to 16 kHz, including the 63 Hz and 125 Hz centre-frequency 1/3-octave bands recommended as basic frequency bands for continuous low frequency sound indicators. Relation between frequency bands and average sound pressure levels received in those bands is studied as well as time distribution of the received levels in a number of frequency bands. We also analyze energy input from time periods with strong peaks of received sound pressure levels, that correspond to various transient events such as close-passing ships. The data remaining after discarding these periods were also used to analyse relation between weather conditions (mainly, the wind velocity) and received sound pressure levels. Although it is clear that the amount of data is not sufficient to describe representatively the ambient noise and trends in its changeability, it could be used as a starting point for future monitoring.

**LIONEX: Northwestern Mediterranean Sea Experiment - Gulf of Lions**

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**Abstract**

During the 2012-13 period, the LIONEX experiment focused on the study of the effects of dense water formation on the northwestern Mediterranean deep ecosystem through open-ocean convection and dense shelf water cascading processes.

LIONEX aimed particularly at investigating (i) the effects of dense water formation processes on the basin hydrology and the pelagic ecosystem, (ii) the relationship between the occurrence of convection and cascading events and the population dynamics and recruitment processes of commercial deep-sea specie, and (iii) the dispersal of natural and anthropogenic contaminants in the basin by such processes.

These subjects look specifically at certain pressures (interference with hydrological processes, contamination by hazardous substances) and their impact on various characteristics (physical, chemical, and biological features) of deep-sea ecosystems. They mostly address descriptors 3 (Population of commercial fish / shell fish), 4 (Elements of marine food webs), 7 (Alteration of hydrographical condition) and 8 (contaminants) of the MFSD.

Several multi-parametric mooring stations were deployed by CNRS, UB and CSIC in submarine canyons incising the Gulf of Lions and Catalan slope) and in the deep basin to monitor the intensity of dense water formation processes and the dispersal of particulate matter during wintertime. Data obtained in 2012-13 allowed gaining insight about the formation of dense water on the continental shelf and offshore and its subsequent effect on the export and spreading of metallic contaminants of atmospheric, riverine and sedimentary origins. Besides, Information provided by daily fishing landings, enabled to interpret the evolution of high market value (the blue and red shrimp *Aristeus antennatus*) populations.

Numerical modeling was also undertaken to establish a multi-year simulation coupling hydrodynamics and biogeochemistry in order to understand how air-sea fluxes and the associated mixing and convection processes impact the dynamics of the pelagic ecosystem. The modeling simulated the recent 2010-13 period for which observations are available, thus allowing to calibrate and check the hydrodynamic model itself, constrain uncertainties on the atmospheric forcing, and define the boundary conditions for biogeochemical variables in the northwestern Mediterranean region. Simulations are now being analyzed and first comparisons with observations are being made, in particular with those collected during the DEWEX cruises in 2012-13.

**Temporal variability of nutrients and oxygen in the North Aegean Sea.**

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**Abstract**

The extensive survey carried out by HCMR during the last decades, showed that the supply of nutrients in the euphotic layer of the North Aegean Sea is closely related to the buoyancy inflow from Dardanelles. The deep waters of the North Aegean Sea as well, play an important role in the nutrient distribution and dynamics as North Aegean is considered to be one of the regions of bottom water formation in the Mediterranean.

Most of the time “normal periods” high buoyancy inflow from Dardanelles is observed and the inflowing BSW fuels the North Aegean mostly with organic than in inorganic nutrients. This supply through the BSW, apart of its dependence from the buoyancy and the related water fluxes through the Dardanelles strait, is equally dependent on the nutrient content of the inflowing water mass.

During the long “normal periods” of estuarine functioning of the North Aegean, the decomposition of dissolved and of settling particulate organic matter results to a gradual consumption of dissolved oxygen followed by a concomitant accumulation of inorganic nutrients in the stagnant deep layers of the basins.

Anomalously low buoyancy inflow from Dardanelles “unusual periods”, combined with severe winter meteorological conditions, promote episodic dense water formation events.

The dense water formation over the shelves (Samothraki in the north, Lemnos in the south) ventilates the deep basins of the North Aegean Sea. These formation events have two different effects on the biochemistry of the Northern Aegean Sea:

- On the one hand constitute a mechanism for the direct downward transport of the inorganic and the newly formed organic matter, from the surface layer. The organic matter that reaches the bottom layer just after the deep water formation event, is rich in labile and easily oxidizable material and its decomposition lead to a significant oxygen uptake.
- On the other hand contribute to the enrichment of the euphotic and intermediate layers by large quantities of inorganic nutrients injected upwards, due to the displacement of the stagnant deep waters (rich in inorganic nutrients) caused by the deep water formation process.

Historical hydrographical data in the North Aegean Sea suggest that there was extensive production of dense waters in two occasions during the last decades in winters of 1987 and 1992-1993. Intermediate-intensity formation appears to have taken place in 2008, and minor events in the winters of 2001 and 2005.

It is evident that during stagnation periods, the deep basins progressively become nutrient reservoirs for the Aegean Sea. After formation episodes, large quantities of nutrients are injected into the euphotic zone, setting the scene for new production and having implications on the biogeochemical functioning of the N. Aegean.





## The North Aegean Sea Experiment (AEGEX-II): Cruise rationale and preliminary results

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### Abstract

In the framework of PERSEUS project, an integrated study of inherent and apparent optical properties (IOPs, AOPs) of sea-water was designed to be carried out for the first time in the Aegean Sea waters based on satellite, *in situ* and laboratory data, so called the Aegean Sea Experiment (AEGEX). The experiment comprises a cruise in the south and another one in the north Aegean Sea, in areas relatively well-studied and coupled with time-series data.

The South Aegean Sea Experiment During was conducted in May 2013 along a coastal-offshore transect of 7 stations in the S. Aegean Sea. Biogeochemical sampling involved inorganic nutrients, particles (POC/N/P, and SPM), Chl-a measurements and planktonic community analysis (heterotrophic bacteria, pico-, nano- and micro-phytoplankton). Primary production experiments were performed in 3 stations. These measurements are in support of the bio-optics work in two different levels: a) the profiles of Chl-a are used in the study of the inherent optical properties obtained from the *in situ* optical profile measurements (TRIOS hyperspectral profiles, particle profiles, PAR profiles, transmissometry, *in situ* fluorescence) and b) integrated surface Chl-a measurements (down to 20-30 m) together with historical data from the area will be used in calibrating the employed ocean color algorithms.

We conducted the North Aegean Sea Experiment in October 2013 aboard RV Aegaeo. The cruise was designed as a multi-purpose set of experiments aiming at addressing different components of MSFD descriptors and individual indicators. A total of 14 stations were occupied in a N-S transect north of Limnos Isl. passing over the deepest sector of the north Aegean trough. Previous studies conducted in the region during past decades provide a good background on major biogeochemical processes, however outlining several gaps in data and knowledge. CTD casts, water samples and box cores were obtained, and primary production experiments were conducted. A suite of optical sensors was used to measure radiance, irradiance, absorption, fluorescence and other inherent optical properties of seawater, for the first time in the region. Laboratory analyses are underway and preliminary results will be linked to biogeochemical processes, continental shelf-deep sea interactions, dense water formation and cascading, Black Sea Water optical properties, ocean color and remote sensing, biodiversity, organic and inorganic contaminants, and more.

The marine optics work in PERSEUS, combined with some of the other biogeochemical measurements concurrently performed, is expected to improve our understanding of phytoplankton occurrence (blooms etc.) in the oligotrophic Aegean/Eastern Mediterranean, contribute to an increase in accuracy of remote sensing products for the area through ocean color validation and algorithm development work using the AEGEX data. It may thus improve the monitoring of phytoplankton, the biogeochemical modelling of marine ecosystems, and the historical trend analysis for the Aegean which is in direct support of the MSFD.

**MAREX: Marmara Sea and Turkish Straits Experiments in June 2013**

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**Abstract**

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 ( $S \sim 38.5$ ) 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 framework 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/NO<sub>3</sub> 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  $\mu$ M; nitrate < 1.0  $\mu$ M) in the bottom waters of the eastern deep basin and Izmit Bay in late June. Markedly high ammonia concentrations (5-10  $\mu$ M) 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.



## **MISIS Joint Cruise in support of a harmonized approach of Descriptor 5 (MSFD) in the Western Black Sea.**

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### **Abstract**

The MISIS Joint Cruise, the main activity of the WP2 of the project MISIS (MSFD GUIDING IMPROVEMENTS IN THE BLACK SEA INTEGRATED MONITORING SYSTEM), has aimed, amongst others, to collect additional data and produce homogeneous datasets based on a common sampling procedure and laboratory analysis of specified determinants and biological quality elements, as well as to provide useful information regarding the assessment of laboratories' performances in the Western Black Sea region.

In addition, the expected results of the cruise could contribute to the improvement and revision of national monitoring strategies in the region, as well as to bring new knowledge in order to prepare the Articles 11 and 13 of MSFD by the EU countries in the region.

The cruise was carried out onboard R/V Akademik in the Western Black Sea, during 22-31 July 2013. The transects selected, Constanta, in the Romanian waters, Galata, in the Bulgarian waters, and Igneada, in the Turkish waters, were considered representative for the purposes of the projects. A total of 18 stations were performed (7 in RO waters, 6 in BG water, and 5 in the TR waters) covering the coastal, shelf and open waters.

As related the Descriptor 5, Dissolved Oxygen (DO), nutrients, chlorophyll *a*, and phytoplankton were analyzed at all stations; the sampling depth were selected according to CTD profiles.

One intercomparison station, in the open waters, was selected for DO and nutrients, while for chlorophyll and phytoplankton, two intercomparison stations were selected (the first one, in the open waters, for low Chl *a* concentration and phytoplankton abundances and biomasses, whilst the second one, for high Chl *a* concentrations and phytoplankton abundances and biomasses, was located in the coastal waters).

**Anchovy and sprat as models for study and estimation small pelagic fish condition in the Black sea.**

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**Abstract**

Anchovy *Engraulis encrasicolus ponticus* and sprat *Sprattus sprattus phalericus* are the most studied objects among small pelagic fishes in the Black Sea basin. During many years researchers studied physiological and biochemical features of their life history, behavior, productivity, significance in transformation of substance and energy in pelagic ecosystem, relation with various ecological factors. Special attention was paid for indicators that characterize the condition of these species in different environment. The data obtained can have important significance in “Perseus” Project which directs on the revealing regularities of basal components of marine ecosystems of Mediterranean and the Black Sea. Last years it was shown considerable influence of eutrophication, temperature trend and food supply on stocks of these species. These factors lead to large fluctuation of their abundance, levels of accumulated energy (fat) stores, character of behavior and distribution. So concentration of primary producer (phytoplankton) in the Northern – West part of the Black Sea through the posterior links of trophic chain affects positively on the anchovy and sprat abundance as well as on the levels of fat stores in their populations (Shulman et al., 2009; Yunev et al., 2009; Nikolsky et al., 2009, 2011). These stores relate closely with fish survival and reproduction success. Large influence on studied factors invasion of ctenophore *Mnemiopsis leidyi* has: this predator undermines fodder base of plankton eating fishes. Last years in connection with water warming in the Black Sea condition of warm tolerate anchovy improved but of cold tolerate sprat became worse. Accordingly accumulated fat content in first species grew till 16 % and in second one fell till 6 %. It is also important the attempt to estimate contribution in bioresources of the Black Sea pelagic fishes Azov subspecies of anchovy *E.e. maeoticus* which about half of year habits in the Black Sea. This estimation will allow correcting considerably the management of rational fishery of both subspecies. First step in this direction was made by Yuneva et al. (2011, 2012), who found out the differences in fatty acid content between the Black Sea and Azov Sea anchovies. Content of most unsaturated docosahexaenoic fatty acid (C22:6 omega – 3) in phospholipids of the Black Sea anchovy was found considerably higher than in Azov subspecies (22-27 % and 12-15% correspondingly). Perhaps these differences are caused with behavior features of these subspecies during feeding period

## Acquiring new data on chemical contaminants in biota from Romanian marine waters as support for MSFD implementation, Descriptors 8 and 9.

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### Abstract

This paper studies the processes governing the fate of pollutants in coastal area, research work being focused on bioaccumulation of contaminants in marine organisms (e.g. mollusks and demersal or pelagic fish of high commercial value). Bioaccumulation processes are investigated in order to assess the risk induced to coastal marine ecosystems by pressures (e.g. industrial pollution, port pollution, WWTP, etc.) exerted in the vicinity of large coastal cities and harbours where highly contaminated sediments might be encountered.

This work is based on sampling and analysis of contaminants in mollusks and fish species sampled during 2012 - 2013 from various sampling sites along the Romanian coastal zone. In the selected areas, emphasis is given in filling data gaps in terms of areas and/or specific contaminants. The assessment of relevant selected inorganic (heavy metals Cu, Cd, Pb, Ni, Cr, by GF-AAS) and organic pollutants (chlorinated pesticides – OCPs, and polychlorinated biphenyls – PCBs, by GC-ECD; 16 priority polycyclic aromatic hydrocarbons – PAHs, by GC-MS) was performed in study areas close to major sources in order to assess their impact in terms of bioaccumulation effects in relevant benthic and pelagic organisms.

The compliance of the measured contaminant concentrations with the maximum admissible levels in seafood for human consumption established by national and European legislation, or with the thresholds values set up to define GES in the frame of MSFD, was evaluated. Possible correlations between hazardous substances levels in biota and environmental concentrations (water, sediment), and, where data available, temporal trends, were examined.

Cadmium registered higher values in 2 species of mollusks (bivalve *Scapharca inequivalvis* and gastropode *Rapana venosa*). Few cases of exceedance of regulated levels for cadmium and lead were reported for small pelagic fish (*Sprattus sprattus*) sampled from northern sector of the coastal zone. Generally, the concentration of the chlorinated compounds in fish didn't exceed admissible values, whereas in mussels the concentration of PCB 28, PCB 118 and PCB 138 were higher than thresholds. According to the European Regulation 208/ 2005/EC, that fixed the maximum admissible concentrations for benzo[a] pyrene in bivalve molluscs and fish at 2-10 ng /g wet weight, none of the samples exceeded this concentration. The values of LMW/HMW indexes >1 for 81% of samples indicate a PAHs pollution of petrogenic origin (petroleum). The phenanthrene is the dominant compound in all samples, with the maximum value in *Mytilus galloprovincialis* collected from polluted site.

Defining GES with respect to contaminants implies an improved understanding the processes affecting contaminant cycling and availability, the responses of marine organisms to contaminants, knowledge on the marine food-webs and the identification of sources. Effective implementation of the Directive to improve marine environmental quality will be greatly dependent on improvements in knowledge in key areas.

### **The effect of contaminants and nutrients on the microplankton community in the Gelendzhik bay and the adjacent shelf (NE Black Sea).**

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#### **Abstract**

The study concerns the effect of contaminants and nutrients on the microplankton community in the NE Black Sea. The heavy metals, organochlorine compounds, TPHs and detergents, DIN, total phosphorus, Si along with chlorophyll "a" and bacterial abundance were measured in the Gelendzhik bay, on the adjacent shelf and continental slope in the different seasons of 2013.

The detected concentrations of Mn and Fe were higher in the Gelendzhik bay (0.015-0.03 mg/l and 0.003-0.015 mg/l respectively) compared to the inner shelf. Concentrations of other heavy metals in the port area (Zn up to 32.35 µg/l, Pb up to 19.18 µg/l, Cu up to 8.23 µg/l) exceeded the values measured in the inner shelf as well. In summer pesticide concentrations in the bay were 5-20 times higher than on the inner shelf (35-151.3 ng/dm<sup>3</sup>), while in the autumn detergent (up to 0.037 mg/l) and TPHs (up to 0.016 mg/l) concentrations were elevated in the bay.

Chlorophyll "a" concentrations in the upper 10-meter layer changed from 0.05-0.4 µg/l in summer to 0.6-1.2 µg/l in autumn. On the contrary bacterial abundance decreased almost twofold from June to September (710 and 398×10<sup>3</sup> cells/ml respectively). In the bay the values of bacterial abundance remained 1.5-2 times higher than at the shelf. Despite the seasonal changes vertical distribution of bacterioplankton and chlorophyll "a" had similar patterns ( $r=0.86$ ,  $p<0.05$ ).

However TRIX values did not exceed "4" both in the bay and at the shelf, indicating coastal water quality conditions as "elevated". The nutrients utilization efficiency was almost absolute in summer, while in autumn it was much lower.

**Spawning bluefin tuna in the Mediterranean Sea: integrating environmental variability in management policies.**

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**Abstract**

Tuna species are large predators that inhabit the marine pelagic environment. As valuable economic resources worldwide, most tuna species are heavily fished, and scientists have raised concerns about the sustainable exploitation of most stocks. As occur with other top predators, their global diversity and distribution is subject to long-term environmental changes. Because they occupy a top position in the food web, changes in their abundance can alter the structure of the trophic relationships in the ecosystem. Therefore tuna is a good model organism that links to several MSFD descriptors: descriptor 1 (biodiversity), 3 (population of commercial species) and 4 (food webs). Herein we have focused on the large migratory Atlantic bluefin tuna that comes from the Atlantic and crosses the Strait of Gibraltar reaching the Balearic Islands to spawn. However, similar approaches can be used in other areas of the Mediterranean Sea or other top predatory species.

We have analysed together biological and physical data obtained from R/V monitoring surveys, developing models that allowed us to describe the relationship between the bluefin tuna spawning ecology and the environmental variability. Our results emphasize the importance of short-term and long-term environmental changes in the distribution and survival of bluefin tuna. These models can help us to reduce uncertainties in current assessments, for example including environmental dependencies in the recruitment estimations.

Our ultimate aim is to provide stakeholders with alternative management approaches that combine operational oceanographic tools for the conservation and management of tuna species in the Mediterranean Sea. Our way forward is that in the future sustainable oriented quotas could be implemented including environmental variability in their estimations (e.g. recruitment) and the development of tools that lead us towards a dynamic spatial management of large pelagic species. We also emphasize the need to specifically consider pelagic environments in the implementation of MSFD descriptors.

**Atlantic inflow control fish recruitment at the western Mediterranean.**

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**Abstract**

The eastward current at the Strait of Gibraltar (the Atlantic Jet) fertilizes the southwestern Mediterranean and it is the responsible for the comparatively high fish landing of this region. However, we demonstrate in this communication that the high kinetic energy of this current negatively impacts the recruitment of anchovy owing to the advection and dispersion of larvae and post-larvae. The inhibitory effect of kinetic energy on anchovy landings is not a transient but a persistent state. Only an exceptional combination of events can release anchovy recruitment from this inhibition to create landing outbreaks. As such, the dynamics of anchovy in the Alborán Sea is more akin to a pest than to a standard fishery. We disentangle here what are these events and their high sensitivity to climatic fluctuations.





## **SESSION 4**





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**Hindcast and future projection of the impact of wastewater and agriculture on nitrogen and phosphorus river loads in the Mediterranean Sea and Black Sea**

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**Abstract**

Nutrients are transported from land to sea through the continuum formed by soils, groundwater, riparian zones, floodplains, streams, rivers, lakes, and reservoirs. The hydrology, ecology and biogeochemical processing in each of these components are strongly coupled and result in retention of a significant fraction of the nutrients transported. The changes in nutrient delivery to streams and rivers draining into the Mediterranean Sea and Black Sea will be analyzed for the past decades (1900-1950-1980-2010) and for coming decades based on a set of scenarios used in the PERSEUS project. During the past decades there have been major changes in nutrient cycles in Western Europe, with peaking agricultural nutrient budget surpluses around 1980 in Western European countries inside the Danube river basin, and a rapid decline of fertilizer use and animal manure production in the early 1990's in Eastern Europe. In more recent years, agricultural surpluses are declining, with even deficits in a number of Southern European countries. While sewage treatment has started to be important in the 1970s in Northern Europe, in other parts of Europe this development was later, and in North Africa the degree of connection to sewage systems and wastewater treatment is still low. All these changes, together with the changes in hydrology, and construction of dams, have major consequences for the nutrient stoichiometry in river water.

### **Steps toward operational applications of end-to-end modelling to assess the ecological status of the Mediterranean Sea.**

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#### **Abstract**

The development of End-to-End (E2E) models in the Mediterranean Sea represents an important opportunity for setting a common framework useful for harmonization, intercomparison and generalization of results achieved at sub-basin scales. This will allow to compare Mediterranean sub-regions (Gulf of Lions, Adriatic Sea, North Aegean Sea), to evaluate the effectiveness of policy scenarios and to assess space variability and trends in terms of ecological indicators such as ecosystem vigor, organization and resilience.

The E2E modelling approach we implemented capitalizes on already existing and state-of-the-art tools in hydrodynamic and biogeochemistry (LTL model: OPATM-BFM), as well as food web models (HTL models: Ecopath with Ecosim - EwE), which are linked through a methodology which enables integration of LTL and HTL sub-models with no, or minor, re-parameterization of their closure terms. The integrated approach followed the processes of a) standardization of the structure of the HTL models; b) aggregation of the information of the LTL model for coupling; c) extension of HTL models to represent also the LTL processes and building the E2E model; d) correction of the trajectory of E2E model to account for different biological, temporal and spatial resolution of the integrated E2E model.

The standardization of the structure of the HTL models is needed because several ecological indicators are sensitive to the number and composition of functional groups used to describe a system. An intermediate complexity structure specific for the Mediterranean Sea, also able to account for fisheries impacts was applied. The LTL part of the E2E models has been achieved by using a common biogeochemical plankton functional type model (OPATM-BFM) for the whole Mediterranean region. The results of the BFM model were aggregated in order to be used efficiently in the E2E modelling scheme. Phosphorous was defined as the single limiting nutrient for the Mediterranean Sea. The E2E model implemented in EwE extended to represent LTL, was built using the information from the standardized HTL structure plus estimates of average annual fluxes between LTL compartments calculated by BFM for the parameterization of the lumped LTL functional groups. Therefore, the extended E2E model, consists of 37 functional groups covering 5 trophic levels, from nutrients and detritus to plankton, small, medium and large demersal and pelagic fish, marine mammals and seabirds and includes fisheries dynamics, all embedded in a 3D description of hydrodynamics and physical properties. Results of the E2E model provided the first estimates of vigor and resilience at the Mediterranean scale.

**A new generation end-to-end model to analyse the Black Sea environmental status**

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**Abstract**

A three-dimensional hydrodynamic ecosystem model developed for the Black Sea to provide synthetic indices that can indicate the “state” of the environment and to provide an integrated analysis of ecosystem attributes that will contribute to the criteria relevant to the MSFD descriptors. The biogeochemical model, including the carbonate module, comprises 19 state variables that are expressed in nitrogen units ( $\text{mmol N m}^{-3}$ ) and is linked to phosphorus and carbon through fixed N:P and N:C ratios. The trophic interactions within the food web are controlled by top-down pressures introduced by small pelagic fish and gelatinous carnivore (*Beroe ovata*) and from the bottom-up by resource availability. The autotrophs are represented by four groups of phytoplankton; bacillariophyta (diatoms;  $P_d$ ), dinophyta (non-toxic dinoflagellates;  $P_f$ ), chrysophyta (coccolithophores;  $P_c$ ), and the small phytoplankton group ( $P_s$ ) representing picophytoplankton (e.g. *Synechococcus* spp., *Prochlorococcus* spp., picoeukaryotes) and nanophytoplankton (e.g. autotrophic flagellates). Coccolithophores are introduced as a separate group due to their special feature of calcification ( $\text{CaCO}_3$  formation). Concentration of  $\text{CaCO}_3$  attached to coccoliths and some small zooplankton species is also introduced as an independent state variable (Ca). The consumers comprise four zooplankton functional/species groups: the microzooplankton ( $Z_s$ ) group with a size of  $< 200 \mu\text{m}$  (dominated by heterotrophic flagellates and ciliates), the mesozooplankton ( $Z_l$ ) group with a size range of 0.2–2 mm (consisting of copepods, cladocerans, and appendicularians), the opportunistic omnivorous dinoflagellate species *Noctiluca scintillans* ( $Z_n$ ) and the carnivorous gelatinous species *Mnemiopsis leidyi* ( $Z_g$ ). The bacterioplankton group (B) decomposes particulate organic nitrogen ( $D_n$ ) and phosphorus ( $D_p$ ) to produce inorganic nutrients that include ammonium ( $N_a$ ), nitrate ( $N_n$ ) and phosphate ( $N_p$ ). Dissolved oxygen ( $O_2$ ) and hydrogen sulfide (HS) are two additional state variables describing the redox processes across the suboxic-anoxic interface. The redox model of the oxic-anoxic interface zone is represented by a simplified set of reaction kinetics, which maintain stability of the anoxic interface without resolving many details of the complex biogeochemical features. Preliminary results of the long-term simulations of the ecosystem dynamics (for the first two decades of the 21st century) assuming current and “business as usual” conditions in the anthropogenic pressure acting on the Black Sea will be presented.

**Physalia physalis swarms nearby the Strait of Gibraltar: a modeling study.**

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**Abstract**

A comprehensive analysis of the facts associated to the Portuguese Man-of-War (*Physalia physalis*) swarms events in year 2010 was performed. All the *Physalia* sightings during several years and the climatic/oceanographic conditions have been analyzed. Finally, a virtual experiment of the drifting of the individuals using a hydrodynamical model, consisting of a ROMS based numerical simulation forced with realistic winds (ASCAT) and heat fluxes from ERA-Interim, together with an Individual Based Model (IBM) simulations was performed. The results showed small differences in the overall estimated arrival of *Physalia* between the model experiment and the real observations.

**BEAST - A new toll proposed for the Black Sea eutrophication assessment – case study Romania.**

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**Abstract**

A new tool developed for the Black Sea in the frame of the Baltic2Black project was tested for the eutrophication assessment of the Romanian Black Sea waters. BEAST is based on the HEAT principle (HELCOM eutrophication assessment tool) and was tested on the Romanian Black Sea waters. The eutrophication assessment was done based on complete sets of data (N=192 - chemical and biological parameters sampled and analyzed simultaneously), achieved from 36 stations along the entire Romanian littoral (transitional, coastal and marine waters). The analyzed parameters represents a core set indicators for the eutrophication as follows: causative factors – nutrients (DIP - ortophosphate, DIN – sum of nitrate, nitrite and ammonium), direct effects – phytoplankton blooms – chlorophyll a (as an estimate of the FPK Total biomass) and FPK Total abundance and indirect effects – dissolved oxygen (%), transparency. Additionally, due to BEAST requirements, were assessed the reference conditions and target values for the same parameters. The results of the assessment showed that BEAST is a reliable tool for the eutrophication assessment of the Black Sea at national and regional levels. The actual assessment of the eutrophication state of the Romanian Black Sea waters confirms the phenomenon complexity. The emphasis of the spatial and seasonal variability contributed to define the actual state as moderate-good which, under the climate factors and the anthropogenic impact more pronounced in the transitional and coastal waters, could easily passes to one extreme state (bad or high), occasionally meet, mostly seasonally.

### **Multi-scale and Multi-Platform Analysis of Deep Convection Processes in the North-western Mediterranean Sea.**

Testor P. (UPMC), Bosse A. (UPMC), Mortier L. (UPMC), Cauchy P. (UPMC), D'Ortenzio F. (LOV), Lavigne H. (LOV), de Fommervault O. (LOV), Taillandier V. (LOV), Prieur L. (LOV), Coppola L. (LOV), Estournel C. (LA), Durrieu de Madron X. (CEFREM), Houpert L. (CEFREM), Beguery L. (DT-INSU), Benabdelmoumene H. (DT-INSU), Godhino E. (DT-INSU), Bernardet K. (DT-INSU), Giordani H. (CNRM), Caniaux G. (CNRM), Somot S. (CNRM), Bouin M-N. (CNRM), Conan P. (LOMIC), Alvarez A. (CMRE), Onken R. (CMRE), Cecchi D. (CMRE), Garau B. (CMRE), Olita A. (CNR-IAMC), Sparnocchia S. (CNR-ISMAR), Tintore J. (IMEDEA/SOCIB), Ruiz S. (IMEDEA/SOCIB), Tomas M. (IMEDEA/SOCIB)

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#### **Abstract**

From September 2012 to September 2013, intensive multiplatform observations have been carried out in the northwestern Mediterranean Sea thanks to PERSEUS and several national and European projects. Forty-six deployments of gliders equipped with biogeochemical sensors have been carried out during this period. Eleven profiling floats equipped with bioeocchemical sensors were deployed too and together with five cruises, this multiplatform network covers for the first time the seasonal cycle at the basin scale.

Such a high density network of platform has allowed a 3D description of the biogeochemical parameters of the most important blooming area in the Mediterranean. This network was designed to accurately capture the seasonal variations with respects to the evolution of the mixed layer. Deep convection reached the bottom in winter. Subsequently, an intense bloom activity developed during the restratification phase. The history of the water column during the six months before appears to be critical for the onset of the bloom. We also show that the mesoscale and submesoscale activity triggers vertical motions that are predominant for the development of the phytoplankton during the whole period and conclude about the variability that can be resolved by such an observing system.

This experiment also shows the capability of autonomous platforms, such as gliders and profilers equipped with physical and biogeochemical sensors, to monitor on the long term large areas of the marine Mediterranean ecosystem. This is particularly relevant in the context of the climate warming which is supposed to have dramatic impacts on the deep water formation and the related primary production.





## **Application of the moored profiler Aqualog for measurement of the acoustical backscatter by mesozooplankton in the NE Black Sea.**

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### **Abstract**

This report presents data on zooplankton distribution obtained by a new ocean autonomous profiler for multi-parametric surveys along with data on net sampling at fixed geographical location. The profiler moves down and up along a mooring line, which is taut vertically between a subsurface flotation and an anchor. This modern observational platform carries the acoustic Doppler current meter Nortek Aquadopp (2MHz) and CTD probe Idronaut Ocean Seven 316plus with the dissolved oxygen and oxidation-reduction potential sensors. The profiler makes repeated round trips between the near-surface ocean layer and the anoxic zone every 1 h. As a result of the survey we got the time series of the vertical profiles of the ocean parameters including the amplitude of the acoustic backscatter. Stratified net sampling was performed nearby the moored profiler Aqualog to study the taxonomic and quantitative patterns of zooplankton vertical distribution. Juday net hauls targeted aggregation layers visual in the in-situ backscattering data. The temporal variability of the fine-scale structure of the acoustic backscatter was interpreted along with physical and chemical data. General pattern of fine scale stratification of water column revealed from the backscatter data corresponded to the zooplankton vertical distribution obtained by 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.

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**Identifications of gaps and recommendations on upgrades of the SES observing systems to serve PERSEUS needs.**

Poulain P.M (OGS), Manzella G. (ENEA), Schroeder K. (CNR), Kassis D.(HCMR), Testor P. (UPMC), Mortier L. (UPMC), Ribera M. (SZN), Dadic V. (IOF), Santoleri R. (CNR), Heslop E. (CSIC), Tintoré J. (CSIC)

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**Abstract**

Following the assessment of the present state of the SES observing systems, including mobile autonomous platforms (drifters, floats and gliders), moored instruments, oceanographic cruises onboard research vessels, coastal/local observing networks and satellite measurements, gaps and needs were identified in order to expand the present observing capacity towards fulfilment of the scientific and society needs addressed by PERSEUS with an emphasis on increasing forecasting capabilities and the provision of solid grounds for the implementation of the EU Marine Strategy Framework Directive.

Gaps are identified in terms of geographical coverage (for instance observations are scarce in the southern areas of the SES), multi-parametric observations (for example biogeochemical observations are lacking in most areas. Improvements are needed into the technical developments of new sensors, calibration of both in-situ and satellite instruments, and good practices for data collection, management and dissemination, including standards compatible with other international observing systems (e.g., Argo).

Recommendations are provided in order to try to fill the gaps of the present SES observing system, with particular emphasis on the complementary use of different kinds of observations to study multi-scales processes relevant to PERSEUS. Integration is essential so as to combine the different monitoring capabilities and to understand key factors, such as scale interactions, for addressing adequately PERSEUS needs and later, provide recommendations for the European Ocean Observing Strategy.

**Strategies for future European observing systems.**

Tintoré J. (CSIC)), Heslop E. (CSIC), Poulain P.-M. (OGS), Kassis D. (HCMR), Testor P. (UPMC), Mortier L. (UPMC), Petit de la Villeon L. (IFREMER).

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**Abstract**

New technologies now allow the real time observation of the ocean state and its variability. These, combined with numerical models and with a distributed data system, enable the development of new multi platform observing systems and provide a jump in scientific knowledge and capacity to respond to society needs. By upgrading existing platforms with new technology, supporting new systems and through providing this data in real time and delayed mode, Perseus contributes to developing ocean monitoring at different scales in the SES, helping to address in particular the multiple scale approach that society requests, from local to global, and thus contributing directly to the needs of science and society, in particular to providing data for MSFD pressures, descriptors, and indicators and by this also contributing to enhancing the role of science in blue growth oriented European actions.

Looking beyond Perseus, it is important to discuss, define and establish an optimized European long-term observing strategy for the Mediterranean and Black Sea, to support EU policies in general. Accordingly, we have considered the existing international framework and identified the key elements needed to (1) justify the need of a European Observing Strategy in the SES, (2) guarantee the sound implementation and benefits for European citizens and (3) identify how this fits within the current EU framework. The presentation will review the present situation and will be asking for inputs to discuss the major elements from this Strategy and a specific future European observing system strategies workshop will be planned for 2014.

### **Med-CPR: A new observational facility for assessing marine plankton in the Mediterranean.**

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#### **Abstract**

One of PERSEUS' major goals lies in an assessment of the marine ecosystem of the Mediterranean in order to address common environmental pressures and challenges. This is aimed at providing a sound scientific basis for adequate adaptation strategies. However, this requires novel observational platforms as well as basin-wide common sampling strategies. The Mediterranean Continuous Plankton Recorder initiative (MedCPR) will significantly contribute to the establishment as well as an expansion of PERSEUS-supported observational infrastructure. The CPR is a robust instrument designed for plankton sampling by volunteer ships of opportunity and will be initially deployed in the easternmost basin of the Mediterranean, the Levantine Sea. The Levantine Sea, one of the most oligotrophic places in the world, is a natural marine laboratory where ecological processes develop under demanding environmental conditions that are caused by human activities and Climate Change. Once considered a barren seascape, the Levantine Sea is teeming with biological species, native and exotic, interacting with the environment through highly dynamic ecological and oceanographic pathways. Once operational, MedCPR will provide important plankton time-series that can be studied in relation to ecological as well as oceanographic/atmospheric processes. Additionally, the systematic sampling of the main dispersion pathway for alien/Lessepsian species will provide invaluable ecological data for determining the environmental status of the Levantine Sea. This will be instrumental in designing management options aimed to cope with almost 80% of all Mediterranean alien species that are found here. As part of the implementation of the MedCPR facility, CyI personnel was trained at the Sir Alister Hardy Foundation for Ocean Science (SAHFOS), Plymouth, on the logistical and technical installation of a new CPR facility and related activities (e.g. methods for sample handling). Furthermore, with the aim of starting the organization of a Mediterranean and Black Sea CPR survey network of institutions, the CyI participated in the 2013 workshop of the Global Alliance Continuous Plankton Recorder Surveys (GACS) held at Plymouth, and approached other institutions with on-going studies on plankton in the Mediterranean. A collaborative approach between research partners, involving coordinated activities such as the exchange of information/samples, capacity building, and generation of grant proposals to acquire the necessary resources for long-term CPR surveys is envisioned.



## **Processing VMS data for the study of fishing effort: progresses and insights from the Italian experience.**

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### **Abstract**

The interaction between spatial dynamics of biological resources and fishermen strategies definitively generates complex spatial patterns of fishing mortalities on exploited stock and of environmental disturbance. A sound evaluation of modeling of these phenomena is essential to understand and predict resources trends or assess environmental alterations. As consequence, assessment and management of fisheries are moving toward a class of spatially explicit and bio-economic approaches in which 1) both the impact of fishing activities and the response of resources in space are taken into consideration and possibly modeled, and 2) management measures are evaluated on the basis of their observed or hypothesized effects in space. This short paper reports the path taken by the Italian research community in contributing to the development of methods and approaches for the processing and use of VMS data in this framework. While a summary of consolidated methodological steps is presented, an overview of in progress analyses and future challenges is reported to give an idea of the potentiality of this frontier in fisheries sciences.

Recently, a new platform for managing and processing VMS data was realized and distributed by a group of Italian researchers. This platform consists on an R add-on package, called VMSbase.

VMSbase is an R package devised to manage, process, and visualize information about commercial fishing vessels activity (provided by the vessel monitoring system - VMS) and catches/landings (as reported in the logbooks). VMSbase is primarily conceived to be user-friendly, to that a suite of state-of-the-art methodologies and analyses are accessible via a graphical interface. In addition, the package uses a database platform allowing to store, manage and process large dataset with a great efficiency. Methodologies include data cleaning, that is removal of redundant or evidently erroneous records, and data enhancing, that is interpolation and joining with external data sources. In particular, VMSbase is able to estimate sea bottom depth for single VMS pings using an on-line connection to the National Oceanic and Atmospheric Administration (NOAA) database. It also allows to assign VMS ping to whatever geographic partitioning selected by user, including the standards ICES rectangles, Mediterranean Geographic Sub-Areas or Large Marine Ecosystems. Standard analyses comprise: 1) métier identification (using a modified CLARA clustering approach on Logbook data or Artificial Neural Networks on VMS data); 2) linkage between VMS and Logbook records, with the first ones organized in fishing trips; 3) Discrimination between steaming and fishing points; 4) computation of spatial effort with respect to user-selected grids; 5) calculation of standard fishing effort indicators within Data Collection Framework; 6) a variety of mapping tools, including an interface for Google viewer; 7) estimation of trawled area. Here we report a sample workflow for the accessory sample datasets (available with the package) in order to explore the potentialities of VMSbase. Preliminary applications, carried out both on Italian VMS data and FOS data indicate that VMSbase can represent a step beyond in extracting and valorising information from VMS/logbook data for fisheries studies. Presently, the VMSbase package is used within PERSEUS and BENTHIS projects.

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**The use of Vessel Monitoring System data to identify and map migration spatiotemporal patterns of trawlers in the Aegean Sea.**

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**Abstract**

Vessel Monitoring System (VMS) is used to control the activities of professional fishing vessels with total length greater than 15m. VMS provides data of each vessel's location, direction and speed, to the fisheries authorities, at a two-hour interval dataset. The objective of this work is to study VMS data in order to identify and map migration spatiotemporal patterns of trawlers during the period 2010-2011 in Aegean Sea. The preliminary exploration of patterns is based on the combination of VMS signals with the registration ports which are categorized by nine fishing areas of Aegean Sea, according to the Hellenic Statistical Authority sampling scheme. Also a more analytical identification and visualization of migration patterns is based on Fishing Effort from trawlers spatial distribution and to a method which identifies spatial clusters, Ancelin Local Moran's I statistic. Finally, the transmitted signals analyzed by vessel, fishing area, registration port and combined with Fishing Effort from trawlers at annual and monthly scale. The results revealed a significant variation in migration patterns in Aegean Sea. Saronikos gulf presents the highest migration of trawlers, contributing to the fishing effort in the majority of other fishing areas. Also some local migrations are observed in the Northern part of Aegean Sea, but during spring period a significant part of this fishing fleet migrates to Northeast part of Aegean Sea.



## **POSTERS**





**Dynamic of coasts line changes in the Black Sea North-Western part for past 30 years.**

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**Abstract**

In line with the EU Marine Strategy Framework Directive coastal abrasion has been chosen one of indicators of impact on coastal ecosystems including the Black Sea.

Aim of the work has been study of dynamics of changes of coast lines under abrasion and accumulation processes in the North-Western Black Sea (NWBS) under the influence of natural and anthropogenic factors for the past 30 years. Materials of investigations were LANDSAT space images from 1983 till 2013 and own experimental data of authors.

Maps of the NWBS coasts destruction intensity and dynamics of coastline between Danube and Dnieper areas have been presented. Analysis of the maps has shown that processes intensity is different in different NWBS areas. Discussed the reasons of moving of coastline especially depending on geological structure and lithological composition of the material exposing on coastal cliffs; sea level, direction and intensity of waves; composition, direction and rate of sediments flow; and human economic activities.

Very detailed are analysed the main areas with maximal changes of location coastline such as river deltas (Danube, Dnister, Dnipro), as well as bay-bars of practically all the Black Sea limans. It has been shown that velocity of coastline retreat as the result of abrasion is not uniform. Coastline segments of high speed of changes have been revealed in the NWBS. Discussed are peculiarities of coastline changes in the deltaic areas of the Dnipro, the Dnister and the Danube and in the area of the city of Odessa, where natural and anthropogenic displacement of coast towards the sea – formation of new land areas.

### **Results of investigations of Marine Environment Toxic Pollution in Zmiinyi island area (2011-2013)**

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#### **Abstract**

Toxic Pollution of marine environment (water, bottom sediments and hydrobionts) has been one of the main Black Sea problems. The aim of our studies in framework of PERSEUS project has been to investigate the current state of marine environment toxic pollution with trace metals (TM), organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs) in the Zmiinyi Island area, which according to our previous studies is the area with practically natural conditions. During 2011-2013 the Research Station of Odessa National I.I.Mechnikov University carried out the sampling programme. Analyses of marine environment samples have been carried out in accordance with the national methods and the methods recommended by the ISO in the laboratory of the Ukrainian Scientific Centre of the Ecology of Sea. The data on coastal sea waters, bottom sediments and fish and molluscs pollution for 2011-2013 with OCPs, PCBs, TM and PAHs are presented and being analyzed. Analyses of the results of marine environment pollution studies have shown that toxicity of water and bottom sediments in 2011-2013 decreased compared to previous years. The origin of pollution in coastal waters, sediments and fish and mussel species near the Zmiinyi Island is being discussed. Coefficients of pollutants accumulation in fish and mollusk tissues have been calculated and are discussed using the data on the pollutants' concentration in water. It is proposed to study the levels of TMs, OCPs and PCBs accumulation in hydrobionts in more details depending on the age of hydrobionts (fish and mollusks) and, first of all, on the peculiarities of their food chains, from which accumulation of toxicants in their tissues takes place. The main conclusions of our studies during 2011-2013 are the following: the levels of pollution for all toxicants are lower than in previous years; the results of comparison with the other Ukrainian areas of the Black Sea has shown that the Zmiinyi Island area could be used as a reference area.



### **Estimation of atmospheric input role for the Black Sea waters from Nitrogen balance perspective.**

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#### **Abstract**

Three main nutrient pollution sources, such as coastal, riverine and atmospheric, are known for the Black Sea ecosystem. Nitrogen (N) contamination plays most important role for ecosystem, since N is crucial element for any organism metabolism. It is known N excess could effect on water quality, ecosystem and biodiversity, leading to acidification, eutrophication and even hypoxia. It was shown that coastal zones of the Black Sea consider as a sink of N for open sea waters, where growth of phytoplankton is limited by N availability. Periodically eutrophication events occur on huge area of Black Sea, which associated with N load, but source and detailed scheme has not identified yet. The aim of this work is to develop balance scheme of N in the Black Sea ecosystem, determine and quantitatively assess the role of main N pollution sources with the description of contributor chemical forms, estimate main threats, propose the mitigation procedures.

The peculiarities of Black Sea ecosystem has been considered to find special aspects of nutrients distribution and consumption. Assessments of atmospheric, riverine and coastal inputs have been performed. A dominant contribution of atmospheric input for open sea areas has been challenged and the main constituents have been characterized. Aerosol removing by dry deposition from atmosphere has been shown as a prevailing way for the Black sea open waters. Significant meaning of atmospheric organic pollutants, which are usually neglected, has been demonstrated and discussed. Relationships of eutrophication associated events with excessive atmospheric N loads episodes have been considered. Basic directions for mitigation of N harmful effect on the Black Sea ecosystem have been proposed.

**The biophysical ecology methods in biological oceanography: Are there perspectives?**

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**Abstract**

Constant differentiation and integration of scientific directions are objectively necessary for science development. But the most important task of modern hydrobiology underwent no changes:

- optimization of the World Ocean raw resources exploitation;
- preservation of its population biological diversity;
- studying the processes of hydrobionts adaptation to the effect of physical and chemical fields with the purpose to minimize biota damaging by anthropogenic press.
- Interconnection of these tasks needs studies of the biological production processes.

Obviously, parameters of marine organisms non-trophic interactions (chemical, optical, acoustical, electrical, mechanical etc.), able to considerably modify and transform the trophic factors action, must be added to traditionally used in diagnostic and forecasting models trophic characteristics.

The studies of the physical fields, occurring directly in the process of marine organisms communities functioning or considerably modified by them – biophysical fields in water column, present in connection with this special interest and is an object of the biophysical ecology investigations. Every field can serve for communication of individuals of one (intraspecific or populational channels of communication) or different species (biocenotic channels of interspecific communications), as well as common integral links of all biotop.

Biophysical ecology is a science about interaction of the organisms, their populations and communities by utilization, transformation or modification of biophysical fields, produced in the process of their life activity. The methods of biophysical ecology can be for sure attributed to the number of the most essential ones in modern biological oceanography. The studies of the spatial structure, functional properties and temporal changeability of the biophysical (signal) fields as obligatory attributes of biological fields can suggest not only principally new possibilities for studying pelagic communities of the World ocean, but solve as well actual objectives of the effective exploitation of useful species and the most important problems of the environment protection.

Multiversions of observations, operative counting of different hydrobionts taxons number and studies of their spatial structuredness, express – evaluation of these taxons functional state as well as creation of forecasting models for rational ecosystem management – all this is modern modification of the classic hydrobiological methods. The following tasks should be considered as the main in biophysical ecology for the nearest 25 years:

- investigation of interrelation in population structure and function in kinetics of substance and energy exchange in pelagial ecosystems;
- usage of the biophysical fields parameters for evaluation of the anthropogenic press influence on the functional condition of pelagic communities;
- studies of the biophysical fields ecological role in pelagic communities;
- working out biophysical grounds for evaluation of pelagial productivity and optimization of getting its food resources.

Importance of solution of each named task is obvious, especially in the epoch of rapid growth of population our planet undergoes, increasing divergence in economical and financial development of the states and everlasting non-rational usage of the natural resources.



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## Long term trend analysis in nutrients and phytoplankton biomass in selected sites of Mediterranean and Black Sea.

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### Abstract

Monitoring data of temperature, salinity, nutrients and chlorophyll a (as a proxy to phytoplankton biomass) from selected sites in Mediterranean Sea (Northern Adriatic - Gulf of Trieste, Central Adriatic - Stončica, Aegean Sea - Saronikos Gulf) and Black Sea (Varna bay) were investigated for long-term trends. Stations spanned a large range of trophic status from oligotrophic to moderately eutrophic. Yearly anomalies and cumulative sum analysis applied to the time series available at least since 2000 to 2012, in order to summarize the major change(s) in the datasets.

The trends and changes of the above parameters detected during this study could be due to the changes in the anthropogenic forcing, as in Saronikos Gulf, or to possible evidence on connections between the shifts in the northern and central Adriatic ecosystem and the Northern Hemisphere climate system *via* changes in regional atmospheric conditions.

Observed changes in trends during the time series might indicate shifts in the ecosystem and need to be considered in future studies of marine ecosystems, geochemical cycling, ocean circulation and fisheries.

### **Benthic fluxes of dissolved heavy metals and nutrients in polluted sediments of the Adriatic Sea**

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#### **Abstract**

The Po River drains one of the most industrialized areas of Europe (the Po Valley) and discharge into the Adriatic Sea a large amount of organic and inorganic, dissolved and particulate pollutants. These pollutants are spread, by the general cyclonic Adriatic circulation, along the western Adriatic Sea southward; by this way the pollutants are accumulated in the surface sediments of the muddy bottom of the western Adriatic Sea. This processes created a general decreasing trend of pollutant concentrations in the western Adriatic surface muddy sediments from the Po River mouths southward. Furthermore, the Po River inputs and the low hydrodynamic in summer create, in the western Adriatic Sea, strong eutrophic conditions and anoxia phenomena.

One on the main aims of the PERSEUS project is to evaluate the anthropic pressure in strongly polluted marine areas of the Southern European Seas (SES) to individuate key parameters as indicators of Good Environmental Status (GES).

In this context the aim of this research in the sub-task 2.3.4 of the PERSEUS project is to determine the dissolved benthic fluxes of heavy metals and nutrients in sediments affected by the Po River inputs and to evaluate the role of sediments in the contamination and eutrophication of the western Adriatic Sea water column. In order to measure dissolved pollutant fluxes at the sediment-water interface two cruises have been carried out in spring and autumn 2013 while a third one is scheduled in 2014. Sampling stations are located along a south-eastward pollution gradient. In each station one benthic chamber has been deployed for 8-24 hours. During the spring cruise benthic fluxes have been measured in five stations while in summer cruise benthic flux measurements have been performed only in two stations due to bad weather conditions. In autumn stations, also early diagenesis studies have been carried out to understand the processes that generate the benthic fluxes.

The early diagenesis studies have been studied by core extrusion in inert atmosphere and pore water analysis.

First results indicate, in spring, high fluxes of Mn (50-248  $\mu\text{mol/m}^2\text{d}$ ), variable fluxes of Fe (-13 - +76  $\mu\text{mol/m}^2\text{d}$ ) and DIC (7-68  $\text{mmol/m}^2\text{d}$ ) and, in summer, general higher fluxes (DIC 77-94  $\text{mmol/m}^2\text{d}$ ). The nutrient benthic fluxes are due mainly to the mineralization of the reactive organic matter that reaches the bottom while the metal fluxes are due to the dissolution of the iron and manganese oxyhydroxides near the sediment-water interface.

The higher benthic fluxes in summer are due to the higher temperature on the bottom that increases the microbiological activities and subsequently the organic matter degradation kinetic, and to the sub-oxic environment that favors the dissolution of the Fe-Mn-oxyhydroxides film at the sediment-water interface.

**Development of an end-to-end model for the North Aegean Sea ecosystem.**

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**Abstract**

An End-to-End (E2E) model for the North Aegean Sea was built in order to assess ecological traits, processes and policies. Existing High Trophic Level (HTL) and Low Trophic Level (LTL) models were modified, adjusted and reparameterized towards this end.

The HTL model is based on the previously developed Ecopath model in the area for the period 2003-2006, which was adjusted to input data from the 1990s, averaging data from separate years. Input data for the 1990s model derived from bottom trawl surveys, fisheries statistics, surveys on board commercial vessels, other surveys and the literature. For each species, diet composition, production and consumption values were retrieved from the literature or estimated based on empirical equations, while for multispecies functional groups (FG) these values were weighted with the relative biomass of each species in the FG. Two versions of the HTL model were defined. The first was system-specific and included 41 FGs, while a second version with 29 aggregated FGs was constructed following a common structure, standardized for three Mediterranean models (from the Adriatic Sea, N. Aegean Sea and Gulf of Lions) to avoid structural biases in the comparisons among regions which will be a future task.

Towards constructing an end-to-end model, the above models were fed with data outcomes of the LTL (OPATM-BFM) biogeochemical model. The BFM outcomes included biomass, production, consumption and diets of five plankton groups (Phytoplankton, Picophytoplankton, Bacteria, Nano-microzooplankton and Mesozooplankton) and four detritus groups (Input PO<sub>4</sub>, PO<sub>4</sub>, DOP and POP). Inputs from the original LTL model structure were aggregated for some FGs to correspond to the HTL models structure. The LTL groups were reparameterized to represent nutrient and phytoplankton dynamics. Since the originally developed HTL model was in wet weight (WW) while LTL model outputs were in mg P m<sup>-2</sup>, standard conversion factors from WW to C and from C to P were used to develop the model in the finally required format.

Overall, results were in line with previous works in the area, although not directly comparable due to differences in structure and, mainly in the units used. Results indicate the importance of planktonic ecosystem and detritus, as well as the impact of other key FGs (e.g. small pelagic fish, benthopelagic cephalopods), as also identified in earlier works. The coupled model will serve as the basis to explore vigor, organization and resilience in the N. Aegean Sea ecosystem in the next steps of the project.

**Black Sea Experiment (BSEX)**

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**Abstract**

Experienced teams in several of the Black Sea regions designed a specialised study with emphasis on addressing MSFD descriptors, which demand more detailed investigations. By making use of experimental investigations or process models the BSEX team aims to address; basin hydrology and water balance, atmospheric deposition, material and contaminant fluxes, biochemical interactions, productivity, food web structure, non-indigenous species, jellyfish, and feeding/spawning/inter-basin fish migrations. In this poster a summary of the joint experiments that are carried out during 2013 will be given under 3 categories: eutrophication, invasive ctenophores, anchovy spawning areas.

During the BSEX joint cruises the level of eutrophication and distribution of phytoplankton, zooplankton and impact of gelatinous zooplankton is studied and changes in the phytoplankton composition are addressed with respect to decreased concentrations of certain micronutrients (such as silica and phosphorus). Temporal levels in the concentration of invasive ctenophores and their impact on native zooplankton and especially on fish are updated. Modern spawning areas most abundant fish is investigated by sampling eggs and larvae of anchovy during the peak spawning seasons.





## **On the Implementation of Ecosystem Approach to Fisheries to Turkish Fisheries; Key Challenges and Ways Forward**

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### **Abstract**

This study evaluates the long-term management policies to regulate fishing grounds surrounding Turkey in relation to corresponding alterations in the ecological and socio-economic dynamics at national and regional scales during the last four decades. Therefore, it may be considered as a complementary case study example for the Adaptive Policy Framework of PERSEUS that focusses on national level policy decisions and promoting the implementation of the Ecosystem approach and Marine Strategy Framework Directive in the SES. At the national level, fisheries contribution to the employment, the diet and the Gross National Productivity (GNP) in Turkey was used to assess the role that fisheries played on the socio-economic and nutritive demands of the population. On the regional level (i.e. the Black Sea, the Marmara Sea, the Aegean Sea and the Mediterranean Sea Turkish EEZs), socio-economic and ecological assessments of the fisheries were performed using the time series of landings, fishing effort of the fleet, the Catch per Unit Effort (CPUE), number of fishers, the Catch per Fishers (CPF), the Mean Trophic Level of the Catch (mTLc), the predator to forage fish landings ratio, the Primary Production Required (PPR), and the Fishing in Balance (FiB) indices.

Overall, the study documents that the increasing population and growing demands for food, employment and other related needs might be the major cause for the rapid and unbalanced development of the Turkish fisheries that indeed resulted in considerable adverse impacts on the socio-economical and the ecological characteristics of the regional seas. These deficiencies indicate the urgent necessity to implement “Ecosystem Approach to Fisheries” specific to each regional sea to ensure the services made from these ecosystems sustainable for the future generations. The key challenges to transform the current policies to ecosystem based Adaptive Policy Framework as well as the ways forward to implement Ecosystem Approach to Fisheries in Turkish coasts are discussed.

**RADMED-DOS monitoring program and IBAMar regional database, new tools for the Western Mediterranean Sea.**

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**Abstract**

The long-term monitoring of basic hydrological parameters in key places of the Mediterranean Sea like straits and channels or zones of dense water formation, is a priority in the context of global changes. The environmental monitoring that the Spanish Institute of Oceanography (IEO) has developed historically from 1995, has been reinforced from 2012 within the framework of the campaigns of RADMED-DOS project. RADMED ship work consists in four annual campaigns making transects along the Spanish Mediterranean coast and at key points like the Ibiza and Mallorca channels. Sampled variables are temperature, salinity, dissolved oxygen, chlorophyll-a, inorganic nutrients, phyto and zooplankton abundance and taxonomic composition, pH, total inorganic Carbon, nitrous oxide and methane.

IBAMar is a regional database that put together all physic biochemical data obtained by multiparametric probes (CTDs equipped with different sensors), in the cruises carried out by the IEO-COB. It has been recently extended to include bio-chemical data, part of them obtained from classical hydro casts using oceanographic Nansen bottles and reversing thermometers. The result is a database which include a main core formed by hydrographic data; temperature (T), salinity (S), dissolved oxygen (DO), fluorescence and turbidity, complemented by bio-chemical data; dissolved inorganic nutrients (phosphates, nitrates, nitrites and silicates) and chlorophyll \_a.

RADMED project and IBAMar database later results will be presented.

**Chemical Exchanges between the Marmara and Black Seas through the Bosphorus Strait**

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**Abstract**

The less saline Black Sea surface waters (S~17) polluted by the major rivers exports nutrients to the Sea of Marmara. The first estimates of the nutrient exchanges between these adjacent seas were carried out in the 1990's [1]. The present study evaluates chemical data collected systematically by the METU-IMS and IU-IMSM groups between 1987-2010 were compiled to assess temporal changes in the concentrations and fluxes of nutrients (DIN, PO<sub>4</sub>; TP) and total organic carbon (TOC) exchanged between the adjacent seas of Marmara and Black Sea via the two-layer flow regimes in the Bosphorus. Chemicals exported by the Black Sea outflow (0-30 m depth) increased in winter due to changes in both the concentrations and volume fluxes; but no significant long-term trend was seen in the upper layer fluxes whereas the DIN and phosphate loads of the counterflow have increased gradually in the last decade due to wastewater discharges. The majority of the Black Sea nutrient inputs accumulate in the Marmara lower layer waters flowing into the Black Sea with high concentrations (NO<sub>3</sub>: 8-12 µM and PO<sub>4</sub>: 0.7-1.2 µM phosphate; N/P: 8-10). The nitrate outflux ( $6.6 \times 10^8$  moles/year) from the Black Sea was about 4- 6 times the exports in summer and autumn. However, seasonal variations were less pronounced in the TP and TOC exports. Phosphate constituted about 30% of the Black Sea TP outflux whilst the nitrate outflux was about 10% of the total-N export. The Black TOC outflux was about 5 times that of the Marmara export via the Bosphorus underflow. However, the Marmara TP export the Black Sea slightly exceeded the TP input from Black Sea via the Bosphorus surface flow, indicating that the TN (biochemically labile) and TP export to the Marmara is nearly compensated by the Bosphorus underflow in the forms of phosphate and nitrate with molar ratios of about 8-10.

Enhancement of eutrophication in the Marmara Sea by the BS inputs and wastewater discharges has limited the photosynthetic production to upper layer of 5-10m. The increased POM export into the steep halocline and subhalocline waters has shifted upward the nutricline and oxycline to the halocline depths (15-30m), resulting in the formation of suboxic conditions (O<sub>2</sub>:10-50 µM) in the subhalocline waters and thus less oxygen but more nutrients have been exported to the Black Sea suboxic/anoxic layers since the 1980's compared the reference conditions of the 1950s-1960's.

### Tracking ocean acidification in the Mediterranean

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#### Abstract

The Strait of Gibraltar is the only connection of the Mediterranean Sea with the rest of the world's oceans. Water circulation in the Strait is characterized by an eastward surface inflow of Atlantic waters (AI) that is compensated by a deep outflow of Mediterranean waters (MOW) that abandons the basin towards the North Atlantic through the Gulf of Cadiz. This pattern of water exchange exhibits large fluctuations at different time scales, from seasonal and subinertial modulated by the change of atmospheric pressure in the Mediterranean basin, to tidal variability. The MOW and AI are the mixture of different water bodies that appear either intermittently or mixed in changing proportions throughout the year, which creates considerable spatial and temporal variations in the position and intensity of both water flows. This exchange of water masses with distinct thermohaline properties and carrying compounds at a different concentration influences the biogeochemical inventories of the Mediterranean and Atlantic basins. In particular, carbon transport through the Strait of Gibraltar is a complex process that markedly governs carbon balance in the two neighbor ocean regions and it is being monitored through the periodic sampling of the Gibraltar Fixed Time Series (GIFT). A mooring line has been recently deployed at the GIFT to examine the temporal variability of the carbon content in the Mediterranean water. The mooring line contains submersible autonomous sensors (SAMI-CO<sub>2</sub> and SAMI-pH) to continuously record in situ pCO<sub>2</sub> and pH. A summary of the main results obtained in the area as a consequence of the monitoring program established almost one decade ago is presented here along with new data at a high temporal resolution. Sampling the GIFT allows us to track the Mediterranean carbon content and identify ocean acidification trends at a basin scale.

**The Circulation and Properties of Water Masses of the Eastern Mediterranean.**

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**Abstract**

As part of the FP7 PERSEUS project, marine in situ observing systems have been evaluated: their existing coverage, possible gaps, recommended strategies for the future. In the Eastern Mediterranean, these observing systems have shed light a number of scientific questions such as:

What is the pathway (or pathways) of Atlantic Water (AW)?

What is the position, size, and intensity of the mesoscale eddy features, such as the Cyprus eddy?

How is Levantine Intermediate Water (LIW) formed and spread?

How are the Cyprus and Shikmona eddies generated, maintained, destroyed?

How does all of the above change over seasons and years?

The way in which each element of the observing system has contributed to improving understanding of these questions will be presented, including results from the long-term ship-based Cyprus Basin Oceanography (CYBO) and the HaiSec programs, the International Argo Program (in particular Euro Argo and Med Argo), and the Cyprus glider activities. These are the most significant sources of in situ data with respect to the above questions.

An extended approach to collect more information by combining upgraded observing platforms will be presented. By more targeted sampling, the new observing system will more efficiently and more satisfactorily address the above questions. In particular, new mooring and glider deployments, in concert with coordinated deployments of profiling floats can be utilized with relatively low costs but high gains in terms of understanding: for general circulation and its variability, water mass properties and long-term changes, and the resulting influence on heat, salt, and carbon budgets of the Mediterranean.

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**Getting to grips with jellyfish blooms through innovative tools: the Med-JELLYRISK experience.**

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**Abstract**

The proliferation of gelatinous plankton in the global ocean, with ever more frequent blooming episodes, is one of the most insidious signals of the fragility of marine ecosystems. The Mediterranean Basin is not immune to such a phenomenon, with the brunt being borne by tourism, fishing and other economic activities in many coastal areas of the Basin. MED-JELLYRISK is the first ENPI-CBCMED Cooperation project, involving 5 partners from Italy, Spain, Tunisia and Malta, focusing mainly on monitoring and informative campaigns, the socio-economic assessment of jellyfish bloom impacts, through ad hoc interviews with specific stakeholder groups, and the development of preventive and mitigating countermeasures. These include smart phone applications providing up-to-date jellyfish sighting information to bathers, protective anti-jellyfish nets in a number of bathing areas, the development of jellyfish dispersion models and risk mapping to act as an early warning system to managers of coastal areas, and the establishment of Local Emergency Response Teams. Above all, MED-JELLYRISK, which will run till December 2015, aspires to foster trans-boundary cooperation in monitoring 10 Marine Coastal Zones (MCZ's) for jellyfish outbreaks. In so doing, MED-JELLYRISK will ultimately create a Mediterranean Jellyfish scientific community. During the first of the project's implementation, a number of scientific discoveries concerning jellyfish were also made.



**Organic priority substances and microbial processes in marine coastal sediments  
(Adriatic Sea, Italy)**

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**Abstract**

PERSEUS EU FP7 Project (Policy-oriented marine Environmental research in the Southern European Seas) aims to identify the interacting patterns of natural and human-derived pressures on the Mediterranean and Black Seas, to assess their impact on marine ecosystems and, using the objectives and principles of the Marine Strategy Framework Directive as a vehicle, to design an effective and innovative research governance framework based on sound scientific knowledge. In the frame of this Project (subtask 1.3.3 ADREX: Adriatic and Ionian Seas Experiment), a preliminary monitoring survey has been conducted in the Adriatic Sea (Italy) in order to verify the occurrence and the variation of selected classes of organic priority substances in sediments and to study the structural and functional characteristics of native bacterial communities. The study site represented a good natural laboratory sensitive to climate variability and human pressure, owing to the semi-enclosed nature of the Adriatic Sea and to the increasing trend of human activities in the coastal regions. During the cruise ADRI 13, (November 2013) three coastal areas sited in front of Ancona, Gargano Promontory and Bari were sampled. In every sites surface sediment was collected and in selected sites dated sediment cores were analysed. The compounds investigated are included in the list of organic priority substances: PAHs, bisphenol A (BPA), alkylphenols (Aps), selected on the basis of the anthropogenic pressure. The extraction-clean-up was performed by ultrasonic bath with the appropriate solvent, followed by analytical determination with LC-MS and HPLC UV-fluorescence. The microbiological analysis of bacterial abundance was determined by epifluorescence microscopy and flow cytometry; the rate of bacterial carbon production was determined by measuring the  $^3\text{H}$ -leucine uptake rate and the community respiration was estimated by the measurement of the *electron transport system* (ETS) activity. Microbes associated with marine sediments play an important role in the C-flux being responsible for the transformation of organic carbon (autochthonous and allochthonous) into biomass. The results of these studies will improve the knowledge on how the environmental factors and the human pressure influence the changes in the assimilation or mineralization rates, affect the C-flux in the trophic chain and potentially the fate of organic pollutants.

### **The South Aegean Sea Experiment (AEGEX-I): Marine Optics and Biogeochemistry (preliminary results)**

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#### **Abstract**

During an oceanographic cruise along a coastal-offshore transect of 7 stations in the S. Aegean Sea, undertaken in the framework of PERSEUS project, an integrated study of inherent and apparent optical properties (IOPs, AOPs) of sea-water was carried out for the first time in the Aegean Sea waters based on satellite, *in situ* and laboratory data.

The marine optics work in PERSEUS, combined with some of the other biogeochemical measurements concurrently performed, is expected to improve our understanding of phytoplankton occurrence (blooms etc.) in the oligotrophic Aegean/Eastern Mediterranean, contribute to an increase in accuracy of remote sensing products for the area through ocean color validation and algorithm development work using the AEGEX data. It may thus improve the monitoring of phytoplankton, the biogeochemical modelling of marine ecosystems, and the historical trend analysis for the Aegean which is in direct support of the MSFD.

Here we present the results of biogeochemical parameters and optical measurements. Biogeochemical sampling involved inorganic nutrients, particles (POC/N/P, and SPM), Chl*a* measurements and planktonic community analysis (heterotrophic bacteria, pico-, nano- and micro-phytoplankton). Primary production experiments were performed in 3 out of 7 stations. These measurements are in support of the bio-optics work in two different levels: a) the profiles of Chl*a* are used in the study of the inherent optical properties obtained from the *in situ* optical profile measurements (TRIOS hyperspectral profiles, particle profiles, PAR profiles, transmissometry, *in situ* fluorescence) and b) integrated surface Chl*a* measurements (down to 20-30 m) together with historical data from the area will be used in calibrating the employed ocean color algorithms.





**Analysis of level of harmonization of “Biological Diversity” descriptor of Marine Strategy Directive in Southern European Seas (SES) countries and contributions to its future implementation in the non-EU countries - results from Work package 5 (“Basin-wide promotion of MSFD principles”)**

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**Abstract**

Within the PERSEUS framework project a complex analysis on harmonization of Marine Strategy Framework Directive (MSFD) descriptors development in SES countries was performed. One of the specific objectives of the analysis was to highlight the differences and similarities among the methodologies applied in SES countries in the ongoing process towards assessing the Good Environmental Status (GES) of descriptors promoted by Directive. We also wanted to emphasize the best approaches regarding the methodologies of which non-EU countries could take advantage, during MSFD implementation.

To make easier the process of assimilation of SES countries’ experience, within the workpackage WP5 (“Basin-wide promotion of MSFD principles”) of the project PERSEUS, much effort was put on synthesis of information about the indicators used for GES assessment, identification of gaps encountered in the available methodologies and on coupling the findings in a simple and quick readable scheme to everybody’s understanding. In order to be consequent with the steps required by the proper implementation of MSFD principles, in the report produced the following aspects were described: the descriptors approached, the data availability, the indicators considered or newly proposed, the methods used for assessment, the reference methodology, the understanding level of each descriptor approached and how and whether the GES and targets were set. In this paper we discussed the results obtained following the analysis performed on Descriptor 1 “*Biological Biodiversity*”, and their contribution to the implementation of MSFD policy in the non-EU countries.

## Assessing the Coastal Ecosystem Quality Using Benthic Foraminifera Assemblages: The Foram Stress Index

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### Abstract

The Saronikos Gulf, including the industrial zone of Elefsis Bay and the Piraeus port, has been considered one of the most heavily polluted regions of Greece. In addition to intensive shipping activities, domestic and industrial effluents were released untreated into the sea until the early 1990s, prior to the establishment of a primary treatment plant in 1994, which was upgraded to secondary biological treatment in 2004 and eventually to tertiary treatment in 2007. Benthic foraminifera were collected to assess the environmental conditions of the Saronikos Gulf, aiming to better understand the changes induced by anthropogenic pressures on benthic ecosystems. Eleven stations, two in Elefsis Bay and nine in the Saronikos gulf, at water depths ranging from 20 to 94m, were sampled during a R/V Aegaeo cruise in January 2012. Surface sediments (0-2 cm) were collected using a Box Corer benthic sampler of 1000 cm<sup>2</sup> and immediately stained with rose Bengal to facilitate distinguishing live from dead foraminiferal tests. A low-abundance, low-diversity foraminiferal fauna was found along the northern coast (industrial zone of Elefsis Bay). The most abundant taxa are stress tolerant, including *Bulimina* spp., *Nonionella turgida*, *Ammonia tepida*, indicating low oxygen conditions and slightly decreased salinity. In contrast, the assemblages from central Saronikos surface sediments are rich and diverse, including small rotaliids (e.g., *Rosalina bradyi*, *Asterigerinata mamilla*, *Lobatula lobatula*, *Neoconorbina terquemi*, *Reussella spinulosa*, *Elphidium* spp.), agglutinated species (mostly *Textularia* spp.) and a large number of miliolids.

Based on ongoing macroinvertebrate monitoring data from Saronikos Gulf, applying Water Framework Directive classification tools (BENTIX index), Elefsis Bay is classified in the poor ecological quality class, whereas the central Saronikos qualifies as moderate ecological status. Our goal is to develop a foraminiferal index of ecosystem quality for the Mediterranean Sea that can be used in the context of the Marine Strategy Framework Directive. Our new index, the Foram Stress Index (FSI), is proposed for ecological and environmental status assessment of soft bottom benthic communities. This index is based upon the FORAM index, as an adaptation and range expansion to accommodate soft bottom sediments, coastal and offshore areas, as well as low salinity areas or areas with significant fresh water inputs. The ecological groups of the FORAM index are re-combined, assigning a stronger weight coefficient to the stress tolerant group, re-assigning species scores according to frequency occurrences of species and providing a modification of the class boundaries and reference conditions for cases of naturally stressed environments such as lagoons or low salinity basins (ex. Black Sea).

The FSI index is validated by correlations with abiotic factors and its strong correlation with the BENTIX index (i.e., Saronikos Gulf case study). The FSI index provides a new tool for the assessment of sediment or substrate quality by quantifying the status of benthic foraminiferal assemblages, which are significant components of living benthic communities that are not considered by most benthic indices. The FSI index can be used in combination with the BENTIX index for benthic ecosystems status assessments and as a specific tool for status assessments of sediment quality. The FSI as an index that includes the condition of calcareous-shelled organisms has the potential to sensitively reflect short and long-term impacts attributed to climate change such as global warming and ocean acidification.

## Species composition of the soft-bottom macrozoobenthos of the Sea of Marmara

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### Abstract

Zoobenthic communities display reactions in a wide range against the changing doses of natural and anthropogenic stresses. According to the model proposed by Pearson & Rosenberg (1978), in parallel to decrease in species diversity and biomass of the community with increasing quantities of organic matter in the sediment, an increase in abundance of some opportunistic species that are resistant to pollution may occur as a result of intense self-invasion of the substrate. In order to delineate species composition of macrobenthic assemblages that best describe regional pressures in the sea of Marmara, benthic samplings have been performed at total 17 stations representing distinct ecosystems, using a “Van Veen grab” in 2010. Information gained from these stations allowed us to determine species composition per unit area and build maps for classification of the benthic ecosystems of the basin. Results clearly illustrated highs both in abundance and biomass in the west and an apparent high in abundance in the east. As a follow up, benthic samplings were also performed at 8 stations in the basin within the ongoing PERSEUS (MAREX) project in 2013 to highlight recent changes in benthic communities. Diversity was found highest (total 29 species) in Erdek bay (MD12A) having relatively higher dissolved oxygen content. In contrast, diversity was found lowest in Izmit & Gemlik bays both displaying severe symptoms of organic pollution. Due to high near-bottom oxygen content as well as presence of relatively efficient deep currents, sedimentation at the entrance of all three bays namely, Erdek, Tekirdag and Bandirma have been found low which further enhance the diversity indice measures. Moreover, Pielou’s Evenness indice value of 1 calculated for such less polluted stations indicates almost equal sharing of total abundance by all individuals of the benthic community. Both the Margalef and Shannon-Wiener species richness indices have been found between 0 and 1 at inner bay stations suffering from severe organic pollution (at stations IZ-17, Iz-30 and MD22) and in Buyukcekmece displaying anoxic & hypoxic conditions nearbottom due to receival of effluents from the deep discharge of Istanbul. Ecological Quality Status (EQS) of all stations have been made according to Zenetos & Simboura (2001) based on calculated Shannon-Wiener diversity measures. According to this classification, EQS value was found high for Erdek bay, good for stations D1, MD72 ve MD59, moderate for K0, MD54, D7, MD67, ER1, MD19A, MD18, MD24Y and poor for the station MD16.

## **Socio-economic impact of the maritime transport and ports in the Mediterranean and Black Seas.**

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### **Abstract**

The main objective of this paper is to analyse the socio-economic impact generated by the maritime transport and ports located in the Mediterranean and Black Seas.

Initially, the paper presents the importance of the shipping industry as a way to trade goods and commodities all over the world, and the importance of ports as key nodes of the global logistic chain. Shipping is the main mean of transport for international trade, being estimated that more than 80% of world trade is transported by sea. There are over 50 000 merchant ships trading internationally, transporting every kind of cargo, such as raw materials and commodities, finished goods, food or fuel.

Secondly, the study provides information and data on several indicators related specifically to the maritime transport and ports. These indicators include not only the gross weight of goods transported, but also the tonnes of liquid bulk, dry bulk, containers and general cargo handled in ports. In addition, the number of passengers embarked and disembarked and the number of vessels' calls are provided.

The results are presented according to the four regions identified in PERSEUS, namely West Mediterranean, Central Mediterranean, East Mediterranean and Black Sea.

Thirdly, the turnover of the main Mediterranean and Black Sea ports and the employment generated by the maritime sector are displayed, in order to provide a comprehensive view of the socio-economic impacts.

With all this information, it is demonstrated that in the Mediterranean and Black Sea the maritime activity is very intense and ports contribute significantly to the South European economy.



### Review of the observing systems in the SES

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#### Abstract

The overall objective of PERSEUS WP3 is to upgrade and expand the present observing capacity in the SES towards fulfilment of the scientific and society needs addressed by PERSEUS with an emphasis on the characterization of the present state, increasing forecasting capabilities and the provision of solid grounds for the implementation of the EU Marine Strategy Framework Directive.

To this end, a comprehensive review of the existing observing networks in the SES at the beginning of the PERSEUS project was first produced. The review includes a description of the existing observing capacities that enable monitoring at basin, sub-basin and local scale, with focus on four major observing in-situ platforms: 1. Lagrangian profilers, surface drifters and other expendable sensors; 2. research vessels; 3. moorings; and 4. gliders. In addition, 5. local and coastal observing systems are considered, including meteo-marine buoys, waverider buoys, HF coastal radars, multi-parametric moorings, etc. The capacities provided by 6. satellite data and the new possibilities from recently developed algorithms in the coastal and open ocean are also assessed.

**Interannual changes in the thermohaline structure of the south eastern Mediterranean**

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**Abstract**

The South Eastern Mediterranean is the region with the highest temperature and salinity values in the upper layer. The so called Levantine Surface Water (LSW) originates from Atlantic Water (AW) whose properties change through evaporation and heating in the course of their eastward propagation. When sufficiently saline LSW propagates further to the Aegean it can cool down to reach densities of Eastern Mediterranean Deep Water (EMDW) and cause intensive deep water formation, as occurred during the Eastern Mediterranean Transient (EMT). In this study we estimated interannual variability of thermohaline structure in the region where LSW circulates and accumulates before it propagates further to LIW and EMDW formation regions

Thermohaline structure was obtained by analysis of CTD profiles from a regional cast database. For the analysis we used only CTD profiles in the south eastern Mediterranean which are at least 50 km away from the coast. This was done in order to eliminate influence of coastal upwelling. To characterize the thermohaline structure variability we derived the following parameters from the vertical profiles of potential temperature, salinity and density: depth of the seasonal mixed layer and its temperature and salinity (LSW parameters); thickness of minimal salinity layer, location of salinity minimum as well as water temperature and salinity of the minimum (AW parameters); thickness of intermediate maximal salinity layer, location of salinity maximum as well as water temperature and salinity of the maximum (Levantine Intermediate Water (LIW) parameters). In order to increase the robustness of the estimated parameters, all CTD profiles were smoothed initially by low pass median filter (effective to eliminate spikes) and then by running average filter to finalize the smoothing. Thickness of LSW during summer fluctuates between 10 m and 50 m and between 20 m and 350 m during winter. Time series of summer and winter salinity show long term increase of the LSW salinity with a rate of about 0.01 per year. In the summer salinity time series, two periods of salinity increase can be observed: from 1978 (39.10) to 1991 (39.55) and from 1996 (39.4) to 2008 (39.7). The first period preceded the EMT. It is not yet clear whether the second increase in salinity will cause another EMT, however data observed during 2010-2012 shows some decrease of the LSW salinity. Summer and winter temperature series shows a long term tendency of the LSW warming with the rate of about 0.1°C/year. Fluctuations of salinity and temperature in the AW and LIW also show statistically significant positive long term tendencies.



## **Preliminary results of the assessment of the Western Black Sea Environmental status in respect of contaminants in the frame of MSFD**

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### **Abstract**

The MISIS Joint Cruise, the main activity of the WP2 of the project MISIS (MSFD GUIDING IMPROVEMENTS IN THE BLACK SEA INTEGRATED MONITORING SYSTEM), has aimed, among others, to collect additional data and produce homogeneous datasets based on a common sampling procedure and laboratory analysis of specific contaminants, as well as to provide useful information regarding the assessment of laboratories' performances in the Western Black Sea region.

In addition, the expected results of the cruise could contribute to the improvement and revision of national monitoring strategies in the region, as well as to bring new knowledge in order to prepare the Articles 11 and 13 of MSFD by the EU countries in the region.

The cruise was carried out onboard R/V Akademik in the Western Black Sea, during 22-31 July 2013. The transects selected, Constanta, in the Romanian waters, Galata, in the Bulgarian waters, and Igneada, in the Turkish waters, were considered representative for the purposes of the projects. A total of 18 stations were performed (7 in RO waters, 6 in BG water, and 5 in the TR waters) covering the coastal, shelf and open waters.

As related to the Descriptor 8, contaminants: trace metals, and persistent organic pollutants (TPH, PAH, OCP, PCB) were analyzed at all stations, in three matrices: seawater, sediments and biota.

Two intercomparison stations, one in the open waters and the second one in the coastal waters, were selected for contaminants in the sediments.

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**Taxonomical versus Functional responses of macrobenthic communities to environmental conditions on the Black sea's north-western shelf**

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**Abstract**

The functional and taxonomic composition of the macrobenthos of the Black sea's north-western shelf is linked to environmental conditions using appropriate statistical tools. In-situ data collected during past EU projects on biomass of macrobenthic species and on environmental conditions in the sediment (e.g. granulometry, carbon and nitrogen content, C/N ratio,  $\text{CaCO}_3$  content) are separately analyzed through clustering and ordination methods and are then related in order to identify environmental variables significantly correlated with the macrobenthos biomass. To complement the analysis, physical and biogeochemical conditions simulated by a 3D dynamic model (e.g. shear stress, level of oxygen stress, flux of organic matter to the sediments) are used in the correlation analysis. Then, the aspect of functional diversity is addressed using a trait-based approach. Ecological and biological traits of the macrobenthos are first determined and then correlated to the environment. This will allow to appraise how local conditions determine the functional and taxonomical diversity and to identify the critical environmental factors for the health of the macrobenthos.



## **A Financial Management System (FMS) for PERSEUS in HCMR, as a tool for efficient project management.**

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### **Abstract**

Throughout the life of Research Projects the need of monitoring and tracking expenses of the project is always present. The tracking process is usually a complicated task, whether regarding the investigation for a specific expense or the necessities of accumulating expense categories in order for the overall expense snapshot to be created.

The Financial Management System (FMS) is constituted as a management tool with the objective to monitor and administer the expenses of Research Projects. FMS is capable of visualising all the necessary financial information of an expense as well as the concrete steps of the life cycle of an expense from the timestamp of its requisition up to its completion to Project Leaders, Work Package leaders and Researchers in a Project.

The system supports various ways of breaking down the budget of a Project. In particular, the budget breakdown may be depicted throughout the system among its various Work Packages and in every Work Package subdivision, for example: Scientific Groups, Teams, tasks etc. In this way, any expense is binned on a specific budget division and it is fulfilled following the financial and processing rules of the division.

At the same time, the concept of the expense category is present in the system in order to split the scope of the expenses among the different Project needs. Any category may be constituted by various subcategories as needed.

Work packages and their divisions are connected with specific expense categories and subcategories and in this way an expense planning tree can be constructed. Project Leaders/Coordinators may split the Project budget among the leaves of the tree and monitor expenses and balances of any part of the tree.

The system provides aggregations/accumulations in the form of a bottom up data mining analysis which starts from the (available amount for expenses) root sources of expenses (Work Package/Category), spreads into the various subdivisions and categories and lands on to a specific expense.

Additionally, the system supports the splitting of budgets into percentages or timeslots so that it can follow the flow of the incoming amounts of money.

The system is enforced with a modular user subsystem capable to host various user categories depending on their roles in the Project. The end user is given information based on the privileges provided by the role that the user has been given.

To sum up, it is a system that can be exploited into either the improvement of financial management of research programs or the simplification of procedures that need multiple approvals. It actually helps end users to follow the correct way towards the fulfillment of expenses as well as to be able to monitor the life cycle of each expense. Regarding the decision makers of projects, the system makes their life much easier by giving them real time information in order to both approve or decline requests and to have a clear picture of what they manage.







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