CoCoNet Project
Collaborative project
Theme: OCEAN.2011-4
Grant agreement no: 287844

CoCoNet

Towards COast to Coast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential.

Second WP10 Progress Report

August 2013 - July 2014

Due date of deliverable: 15-08-2014
Actual submission date: 23-08-2014

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Relevant WP: WP10

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under Grant Agreement No. 287844 for the project "Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential" (COCONET).

Proiectul este cofinanţat de Unitatea Executivă pentru Finanţarea Învăţământului Superior, a Cercetării, Dezvoltării şi Inovării (UEFISCDI) prin Programul Capacităţi Modulul III – Subprogram "Cofinanţarea participării României la Programul Cadru 7"(contract nr. 209EU/09.07.2014).

WP NUMBER AND NAME	WP10- Black Sea Pilot Project
WP LEADER	Dragos Micu (INCDM)
TYPE OF ACTIVITY	RTD
START MONTH	13

Objectives:

1. Acquisition of new geological, biological, oceanographic data in the Black Sea pilot area relevant for MPAs implementation;
2. Identification, within the pilot area, of key variables regarding connectivity (distance, size, strength and direction of currents, genetic connectivity, propagule supply) to be considered in the design of MPA network.
3. Definition of what is specific to the Black Sea and what can be generalised at larger scale within management plans in terms of connectivity processes.
4. Examination of the main natural and human driven causes of changes, potentially affecting the functioning and dynamics of the Pilot Areas ecosystems and description of potential implications for establishment of MPA networks.
5. Assessment of ecosystem vulnerability and implications for MPA network design and management in the Pilot area.
6. Evaluation of the impacts of offshore wind farm development on ocean circulation, wave action, bottom morphology and marine life near or within the pilot network of MPAs in the pilot area.
7. Identification of socio-economic impacts caused by offshore wind farm development within the network of MPAs
8. Transfer of the field data generated by WP10 to the WP9 Geodatabase, and to contribute via other WPs to the final synthesis

Significant results

During the second year of the COCONET project, the work within the WP10 was essentially focused on Task 1 (Multi scale mapping of geological, biological, oceanographic features characteristic for different habitats), with some activities also dedicated to tasks 2 (Mapping of physical and biochemical variables in the sea surface layer based on Remote Sensing), 3 (Sensitivity of the marine ecosystems in Pilot Area to natural and anthropogenic drivers. Implications for MPA networks), 4 (Ecosystem vulnerability and implications for MPA network design and management in the Black Sea), 5 (Site selection for OWF installation within the pilot project areas), 6 (Impacts of OWF development on wild-life in the selected sites), 7 (Socio-economic impacts from OWFs planning/siting within or near MPAs), as well as other activities which developed from close cooperation with WP 3 and WP 8.

WP 10 is generally progressing on time towards its objectives, with some minor delays.

Significant results:

1. A new classification of marine habitats, integrating the Mediterranean and

Black Sea. Certain WP10 partners have already started to map and sample habitats.

2. Genetic sampling has been completed all around the Black Sea, due in no small measure to the successful joint WP3-WP10 expeditions. Help has been provided to WP11 for sampling certain species from southern Italy (Puglia) and Greece.
3. Work on D 10.3 "Report on field measurements of currents" and D10.7 "Maps of areas with distinct water column dynamics" was completed ahead of schedule (Vladimir Malinovski, MHI).
4. 20 scientific publications which acknowledge COCONET have been published or submitted until now by WP 10 partners.
5. The COCONET summer course "GIS and MARXAN Training, 9-15 September 2013, Constanta, Romania " was organized in cooperation with WP 8 and hosted by INCDM.
6. Two international expeditions (COCOCBLAS13 and COCOBLAS14) with the R/V Mare Nigrum of GeoEcoMar have been carried out on the NorthWestern shelf.

Details for each task

Task 1 Multi scale mapping of geological, biological, oceanographic features characteristic for different habitats

Subtask 1.1 Geological, geophysical and biological mapping

The habitat classification scheme developed by WP2 and the guidance on the methodology should be sent to Black Sea partners in order to harmonize the habitat mapping activities and results between the Med and Black Seas. This newly developed approach has already been tested in the Med Sea. CNR ISMAR support will be needed by Black Sea partners to implement the approach in the Black Sea.

Even before this integration is finalized, some of the WP 10 partners (IO-BAS, IBER-BAS, IU, INCDM) are mapping marine habitats at 3 pilot sites in the Black Sea: Costinesti – Cap Aurora (RO), Ropotamo-Kiten (BG) and Sile (TR).

IO-BAS has been processing the multi-beam and side-scan sonar data to produce GIS layers for bathymetry and substrate at Ropotamo-Kiten Pilot Site, while IBER-BAS has been processing drop-down camera images.

INCDM is mapping shallow habitats at Costinesti – Cap Aurora Pilot Site using satellite imagery, aerial photography and scientific diving.

IBSS conducted large-scale studies of marine habitats at Dzhangulsky, Tarkhankutsky Peninsula, Karkinitsky Gulf, "Charivna gavan" National Park. The profiling method was used with a detailed description of transects and plots. 13 landscape profiles were laid (from Cape Large Castel to Cape Ocheretay), total equals 3 km. These profiles have compiled with full geomorphologic and biological descriptions for: topography, the composition of modern sediments and bedrock outcrops, hydrological conditions, and the composition and structure of bottom vegetation. Landscape descriptions for each profile were conducted at points located at a distance of 20 m from each other with photo and video fixation, with a total of more than 260 points of description. The data provided the basis for selection of similar morphological units in the structure of benthic landscapes, with the subsequent approximation of depth. It was described as 26 bottom facies, with the predominant facies being the steel underwater steep coastal slope and the medium abrasion-sculpted slopes with *Cystoseira crinita* + *C. barbata* and *Zanardinia* + *Nereia*, *Phyllophora cripsa* communities. The landscape mapped system

profiles crossing the waters, so it was possible to distinguish the typical bottom landscapes, key habitats, establish their borders, and to find out the patterns of distribution. The allocation and mapping of coastal landscape complexes along the Dzhangulsky landslide coast was interpreted using a bathymetric map of the area with the same parameters, which will make the generalized landscape map for benthic systems of the study area.
Benthic vegetation mapping has been done for the shallow part of Tendrovskaya Bay and Yagorlytskay Bay (Black Sea Biosphere Reserve, BSBR) during July-August, 2014. The qualitative and quantitative samples of macrophytes were taken at 54 stations, and the current state of macrophytes communities was described. The obtained data will be used for detailed mapping of benthicphytocenoses, as well as the assessment of *Chara* communities as one of the key elements of BSBR benthic vegetation.

Subtask 1.2 Biological sampling of offshore and coastal areas

GENETIC SAMPLING. Genetic analysis of certain species will be performed to test for population structure and gene flow but also to identify origin of migrants, when possible. Testing for genetic heterogeneity is done on the assumption that genetic differentiation indicates breaks in connectivity within the metapopulation of a species. A number of species was selected for genetic analysis, based on the coverage of a broad number of taxa, their role in the ecosystems functioning (priority to habitat formers or characteristic species), their presence in the two pilot areas (Black Sea and Adriatic Sea) and life-history traits that maximize the amount of useful information which can be inferred through their analysis.
Taking into consideration the uneven distribution of genetic sampling capacity among the Black Sea partners, it was agreed during the WP3-WP10 coordination meeting in Paris (Dec 2012) that the WP3 and WP10 leaders will conduct a series of sampling expeditions around the Black Sea. The main aim of the expeditions is to make sure that the sampling collection is completed, but there is also the aspect of direct cooperation with local partners, knowledge transfer and capacity building during these expeditions.
At the time of this report two joint expeditions WP3-WP10 have been completed in the Black Sea (Ukraine and Georgia) and two in the Mediterranean Sea, in support of WP11.
At the time of this report genetic sampling in the Black Sea has been finalized, the results being as shown in Table 1.

Actions are needed with regards to hydrographic connectivity in the Black Sea. The successful reporting of D 10.10 *Report/paper on ecological connectivity and population dynamics in the Black Sea Pilot Areas* depends on the timely development of the hydrodynamic model of the Black Sea, which then can be related to the genetics and population dynamics. The hydrodynamic information will be provided by METU (data) and DTU will provide the modelling results. Good contact has been established already. Connectivity measures will be generated based on the hydrodynamic data and individual modeling. This will be combined with the genetic connectivity information.

Table1. Genetic sampling synopsis for the Black Sea

Scientific name	Karadag (UA)	Tarhankut (UA)	Cap Aurora (RO)	Kaliakra (BG)	Kiten (BG)	Sile (TR)	Sinop (TR)	Batumi (GE)
Phyllophora crispa	50	50	Not present	Not present	50	50	Not present	Not present
Cystoseira barbata	50	50	50	50	50	50	50	50
Zostera noltii	50	50	150	50	50	50	50	Not present
Gibbula divaricata	50	50	50	50	50	Not sampled	Not sampled	50
Cyclope neritea	50	50	150	50	50	50	Not sampled	Not present
Mytilus galloprovincialis	50	50	100	50	50	50	50	50
Donacilla cornea	100	100	50	50	50	Not sampled	50	100
Pachygrapsus marmoratus	50	50	50	50	50	50	>50	50
Scorpaena porcus	50	50	50	50	50	50	>50	50
*Symphodus tinca**	50	50	Not present	Not present	Not present	11	21	4

Table2. Genetic sampling synopsis for the Mediterranean Sea expeditions WP10-11

Scientific name	Panaghia (GR Ionian)	Paralia Katerini (GR Aegean)	Perigiali Kavala (GR Aegean)	Torre Guacetto	Otranto (IT)	Porto Cesareo (IT)
Zostera noltii				Not present	50	Not present
Gibbula divaricata				50		50
Cyclope neritea		50		15	50	50
Donacilla cornea	50	50	50	Not present	Not present	Not present

BIOLOGICAL SAMPLING FOR HABITAT DESCRIPTION AND DIVERSITY ANALYSIS.
During 16-19 August 2013 and 24-29 June 2014 R/V *Mare Nigrum* of GeoEcoMar went on the international research cruises COCOBLAS 2013 and COCOBLAS 2014 along the border between Romanian and Ukrainian EEZs. Participants were mostly from GEOECOMAR and INCDM, with a few participants from NatureBureau and CONISMA.
Benthic samples were collected by dredging (1.2m opening, ~400m^2 swept area per tow) and grabbing (Van Veen grab 1200 cm^2), while still and video imagery was obtained by towed cameras and ROV.
Of a total of 15 dredges and 12 grabs taken during the cruise, only 6 dredges and 2 grabs contained tufts of *Coccotylus truncatus,* all of them consisting of young thalli, mostly 1 and 2 year olds.
The area occupied by the *Phyllophora* field in Romania seems to have increased, although the density of the algae is very sparse for the time being. Their occurrence has extended across isobaths beyond the historical distribution, both to deeper waters, but especially towards the shallower part. Also, their extent southwards of the EEZ border has more than doubled compared with the historical distribution. The overall coverage of macroalgae on ZPF (including its largest part in Ukrainian waters) does not exceed 5%, Key species *Phyllophora crispa* average biomass decreased by almost an order of magnitude, but *Coccotylus truncatus* biomass decreased only slightly. At present, layers of unattached *Phyllophora crispa* are no longer found. The biological factor that limits recovery of ZPF is the almost complete replacement of *Phyllophora crispa* (diploid sporophyte, 2n) by *Coccotylus truncatus* (haploid gametophyte, 1n) and the reduction of the most stable generation of its life cycle. At present, *Coccotylus truncatus* occurs in almost all parts of ZPF. The frequency of this species increased from 52 to 70%. The range of *C. truncatus* distribution shifted to the west and south-west of the

former ZPF.
During COCOBLAS 2013, associated species which are characteristic for the *Phyllophora* field ecosystem, like the crustose coralline alga *Lithothamnion propontidis* and the crab *Liocarcinus navigator*, were found to be abundant inside and in the vicinity of the area where *Coccotylus* occurred in the Romanian EEZ.
Our observations indicate that the process of degradation of Zernov's *Phyllophora* Field has stopped and gradual recovery of the ecosystem is underway, even though its structure has changed considerably. The state of the ecosystem still has a long way to go until it eventually reaches levels of the 1960s, but it is certain that they have markedly improved.

IBER-BAS has performed underwater georeferenced digital photography of benthic transects and drop-down camera photos in the Bulgarian Pilot Site Ropotamo-Kiten, in order to assess the variety of benthic substrates and phytobenthic communities within the surveyed reef.

IOBAS has performed processing of biological samples, sorting, identification, enumeration of invertebrates, image analyses and biological communities analyses, processing sediment samples for grain size and benthic invertebrate fauna.

IU has conducted underwater surveys at the Şile Pilot Site, with more than 900 pictures taken from the from infralittoral zone.

In Russia, SIO-RAS performed its regular collection of new abiotic and biotic data during 2013-2014. This monitoring program is targeted at the whole ecosystem of the shelf and the open waters and uses a multidisciplinary approach to ecosystem monitoring, which includes physical, chemical and biological parameters. Data were collected on 3 stations located on the inner shelf, outer shelf and in pelagic waters.
Sampling is performed 1-2 times per month during the warm season of the year (April-November). Currently, the samples are being processed. Preliminary results will be available at the end of the year. This program will be continued in 2014-2015 at the same scale.
All activities within this task are running to schedule.

Task 2 Mapping of physical and biochemical variables in the sea surface layer based on Remote Sensing
By June 2014 no work had been accomplished by the responsible partner Anton Korozov (NERSC), which put in jeopardy the completion of WP10 deliverables 10.3, 10.7, and 10.9 – currents, water column and light regimes - reports and maps due in month 36, 40 and 42 respectively.
In response to this situation, the MHI team (Vladimir Malinovsky, Evgeny Lemeshko, Aleksandr Korinenko, Sergey Motyzhev, Anatoly Tolstosheev, Evgeny Lunev) has stepped up and took charge of the completion of D10.*7 Maps of areas with distinct water column dynamics.*

Task 3 Sensitivity of the marine ecosystems in Pilot Area to natural and anthropogenic drivers. Implications for MPA networks.
IBSS carried out the analysis and synthesis of original and published data on the evaluation of modern radioecological state of the north-western part of the Black Sea

(NWBS) with regards to the decision of the problems of preservation of the environment, including marine protected areas (MPAs). The review is devoted to the analysis of a radioecological situation in the NWBS and concerns the levels of contamination of the components of an ecosystem by the main artificial radioactive isotopes (^{90}Sr, ^{137}Cs, ^{239,240}Pu). The long-term accumulation trends of these radionuclides were analyzed in components of the Black Sea ecosystem after the Chernobyl nuclear power plant accident. Zones were revealed that have an increased ability to accumulate these radioisotopes. The assessment was obtained of irradiation dose rates formed by ^{90}Sr, ^{137}Cs and ^{239,240}Pu in Black Sea hydrobionts. The strategy for biodiversity conservation and sustainable management of natural resources should include monitoring of the radioecological state of the marine ecosystems, and the formation of a complex of biogeochemical criteria for assessment of an ecological situation in the sea areas. This approach is important for MPAs, since it allows the formation of a basis for scientific and practical function.

SIO-RAS has published three papers acknowledging COCONET funding:

Sara Ghabooli, Tamara A. Shiganova, Elizabeta Briski, Stefano Piraino, Veronica Fuentes, Delphine Thibault-Botha, Dror Angel , Melania E.Cristescu, Hugh J. MacIsaac (2013). Invasion pathway of the ctenophore *Mnemiopsis leidyi* in the Mediterranean Sea. PLOS ONE. Open Access PLOS ONE | www.plosone.org 9 November 2013 | Volume 8 | Issue 11 | e81067: DOI: 10.1371/journal.pone.0081067

Tamara A. Shiganova, Louis Legendre , Alexander S. Kazmin, Paul Nival (2014). Interactions between invasive ctenophores in the Black Sea: assessment of mechanisms based on long-term observations Vol. 507: 111–123, 2014 doi: 10.3354/meps10806

Tamara Shiganova, Hans Ulrik Riisgård, Sara Ghabooli, Ole Secher Tendal First report on *Beroe ovata* in an unusual mixture of ctenophores in Great Belt (Denmark) (2014). Aquatic Invasions (2014) Volume 9, Issue 1: 111–116

IO-BAS has uploaded shapefiles in the CoCoNet ftp with a number of threats and pressures in the Bulgarian Black Sea. Ukrainian partners have uploaded a shapefile for threats in the Ukrainian Black Sea too.

Task 4 Ecosystem vulnerability and implications for MPA network design and management in the Black Sea

IBSS determined for the first time the concentrations of 26 macro- and microelements (Na, Mg, Al, Cl, K, Ca, Sc, V, Mn, Fe, Co, Ni, Zn, As, Br, Rb, Sr, Sb, I, Cs, Ba, Sm, Nd, Ag, Au, and U) in the thalli of brown algae *Cystoseira barbata* and *Cystoseira crinita* by instrumental neutron activation analysis (INAA), in Sevastopol region, south-western Crimea, the Black Sea. The observed peculiarities of the elemental accumulation showed that *Cystoseira* spp. can be used as a biomonitor of coastal waters pollution in the study area.

The influence of ecological conditions on the activity of the antioxidant system of the Black Sea macroalgae was studied for different species and life forms, according their habitats and depths. It was showed that *Phyllophora crispa* (lithophyte) and *Ceramium diaphanum* and *Polysiphonia subulifera* (typical epiphytes), have big variability in the process of lipid peroxidation (LPO), catalase activity (CA) and total carotenoid content.

A steady increase in CA was found for *Phyllophora crispa* in the waters with a low level

of pollution : from 195.90 ± 16,34 mkg H_2O_2/g at a depth of 3 m to 453.65 ± 8, 66 mkg H_2O_2/g * min at a depth of 17 m. Indices of LPO have increased in *Phyllophora crispa* in the direction from 3 to 15 m (from 26. 58 ± 1,45 nM MDA/g to 49. 81 ± 4.05 nM MDA/g). The level of these indicators was 0,5 - 2 times higher in strongly polluted waters.
The biochemical indicators of water quality for *Ceramium diaphanum* and *Polysiphonia subulifera* were studied in the beach coastal zone. The total content of carotenoids decreased in the thallus of *Ceramium diaphanum* from 1.28 to 1.03 mg/g at a depth from 1 to 3 m. For *Polysiphonia subulifera* observed a significant decrease in the concentration of carotenoids in the same depth range (from 2.88 ± 0.33 to 1.18 ± 0.15 mg/g). It was shown that the decrease of carotenoids concentration in macroalgae may indicate the stress which is connected with ecological factors and

INCDM is performing in situ pilot experiments for the rehabilitation/reconstruction of *Cystoseira* canopies and *Zostera* meadows. Sites are being selected for transplanting *Cystoseira* and *Zostera.* Two sites have already received *Cystoseira* transplants and are being monitored for survival and proliferation.

Task 5 Site selection for OWF installation within the pilot project area (MPAs networks)
Several WP 10 partners (MHI, METU, GEOECOMAR) contributed data to WP5.
Within Subtask 5.1 Site selection for potential OWF development within the proposed network of MPAs in the Black Sea, Costinesti (RO) has been selected as a pilot site for studying the impact of OWFs on plankton and benthos.

Task 6: Impacts of OWF development on wild-life in the selected sites.
Subtask 6.1 Impacts of OWF installations on benthos and plankton
This task is focussed on assessing and analysing the impacts of OWFs on the benthic and plankton communities. Introduction of artificial features on the sea floor, such as OWF turbine bases, can influence the benthic and plankton communities by altering existing or creating new habitats. New structures can also destroy existing habitats. A change or increase in benthic communities can have an influence on other species in the area, which in turn, can alter the wider ecosystem. As a result, it is important to understand the impacts that OWF developments will have on these communities.
INCDM will assess the potential impacts of OWF on benthos and plankton by biological sampling and performing in-situ experiments on an already existing artificial reef which are present in or around the Romanian pilot site “Costinesti – Cap Aurora”.
INCDM has already conducted a diving survey covering the pilot site and its vicinities and located a suitable site on a wreck. The precise GPS coordinates are N 43 51 02.7, E 028 40 45.1 and the depth is 32m. Background data is available for bathymetry and biology (benthos, plankton, fish).
The experiment will be carried out by scientific diving. A large number of experimental plates simulating the material of the foundations of the offshore wind turbines will be affixed on the wreck and left there to be colonized by benthic organisms. The site around the wreck will be monitored at 3 months intervals (3^{rd}m, 6^{th}m, 9^{th}, 12^{th}m) for diversity of benthos and plankton using both visual methods and destructive sampling. Each time a fixed number of replicates (plates) will be removed from the experimental set-up and colonization by marine biota will be analyzed in the laboratory.
The experiment should have started in June 2014 but, due to technical problems, is being delayed and will start in December 2014.

Subtask 6.2 Impacts of OWF installations on fisheries
SNU-FF have compiled a literature review on the Impacts of OWF installations on fisheries.The installation of an OWF has the potential to have positive and negative impacts on the ability of the ecosystem to sustain fisheries.

Subtask 6.3 Impacts of OWF installations on other vertebrates
NatureBureau and IU reported that baseline data are being collected on the populations of birds and dolphins in the Black Sea (Turkey, Romania). More surveys on dolphins and birds will be carried out in Sile (TUR).
ACCOBAMS and other sources of data published in literature will be explored and the recent data collected will be correlated with what has been done in UK. UK surveys on OWF impacts on wildlife will be used.

Task 7: Socio-economic impacts from OWFs planning/siting within or near MPAs.
Subtask 7.1 Review on strategies and plans
A list of legislation related to the establishment of MPAs in Europe and Black Sea is due soon. IBSS and INCDM have supplied to UROS the national legislation and management plans concerning the MPAs from their countries.

Subtask 7.2 Analysis of the social dynamics in Southern Europe compared to Northern Europe and of lay people perceptions
A critical element influencing OWF developments are public perceptions and the influence of cultural dynamics on the decision making process. If the weight of public opinion is firmly against an OWF development, this can influence political decisions and block developments. Similarly, strong public support for a development can positively influence the decision making process.
This task will compare the perceptions and dynamics between northern Europe (where OWF developments already exist) and southern Europe (where no OWF developments exist and which includes the project areas of the Mediterranean and Black Sea's).
Existing studies will be analysed and fuzzy-cognitive mapping techniques applied to understand the conflicts generation, escalation and resolutions.
NatureBureau reported that Stakeholders Position paper on the perceptions of OWF at the Danube Delta reserve has been submitted. Several Ukrainian and Romanian partners have contributed data.

Tasks 7.3 and 7.4 Economic impact, costs and benefits
NatureBureau reported that the work is in progress.

Deviations from Annex I

1. **Subtask 1.2** Incomplete collection of samples for genetic analyses. D 10.2 was delayed to month T31.

Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning

Subtask 1.2. The incomplete collection of samples for genetic analyses was motivated by:

- the difficulty to collect some samples where the species was rare / less prepared local partners
- persistent bad weather conditions experienced during the sampling season of

2013 - logistic difficulties inherent to field work The delay had no impact on resources or other tasks.
Use of resources and potential deviations
Corrective actions
1. To complete collection of samples deliverable D 10.2 was postponed from month T24 to month T30 and then delayed to T31.