



EUR-OCEANS Web-based press conference, 30 September 2005

Full text of the presentations given by the speakers

➤ Oceanopolis, Brest, France:

Prof. Paul Treguer, Scientific Director of EUR-OCEANS, Université de Bretagne Occidentale, Institut Universitaire Européen de la Mer (treguer@univ-brest.fr), tel (+33) (0)2 98 49 86 01

Support to the EUR-OCEANS network by the European Commission

(not available – please contact eur-oceans@oceanopolis.com for more details about this presentation)

Eric Hussenot, Director of Oceanopolis and President of the Association of aquariums for the promotion of EUR-OCEANS (eric.hussenot@oceanopolis.com), tel (+33) (0)2 98 34 49 02

The public outreach dimension of EUR-OCEANS

During this century, we assist to an incredible development of sciences and technologies. In our democracy, the general public and, of course, politicians, must be informed of the meaning of these researches. This is what we call scientific culture.

For the first time, a European scientific program integrates the necessity of an explanation for the general public. Oceanopolis in Brest, France, is one of the biggest aquariums in Europe, but also a strong link between scientists and general public. So, when the scientific staff of EUR-OCEANS asked us to join them in their European project, we said yes.

We built a network with 11 other aquariums and scientific centres in Europe. Our job consists in creating a web site in several languages, about the aims and results of the program (films, multimedia animations). We will also create educative material using mainly the website. We plan to realise sixteen 6-minute-long films. Those films could be used for TV programs, and also on the website and in the exhibits of the aquariums.

And finally, at the end of the program, an exhibit about the impact of the climate change and the human activities on the marine ecosystems.

Prof. Paul Treguer, Scientific Director of EUR-OCEANS, Université de Bretagne Occidentale, Institut Universitaire Européen de la Mer (treguer@univ-brest.fr), tel (+33) (0)2 98 49 86 01

Major scientific questions

What scientific questions does EUR-OCEANS address?

On the one hand, we now have numerous evidences of strong links between key trophic levels of marine ecosystems and climatic fluctuations.

For example: from the fish catches recorded during the whole 20th century Francisco Chavez (Monterey Bay Aquarium, USA) showed that anchovies are abundant in the eastern Pacific when sea surface temperature are cold, and that sardines are abundant when warm waters dominate. The fluctuations of the sea surface temperature are directly related to climatic variations that we call the « Pacific Decadal Oscillation ».

Other example: in the North Atlantic, Gregory Beaugrand (now in CNRS Wimereux, France) in cooperation with scientists from the UK (Plymouth, Sir Alister Hardy Foundation) has shown that the variability of the distribution of pelagic crustaceans, that are food for fishes (cod, herring, etc...), is a function of the North Atlantic Oscillation. Those scientists also show that the migration to the north of cold water species is related to the on-going sea surface temperature warming.

On the second hand, we know that marine resources are already submitted to a drastic pressure caused by human activities:

Example: in the North Sea, it has been shown that the current biomass of fishes larger than 4 kg is only about 2.5% of its pre-trawling level, and the total biomass of all fishes is nearly 40% lower than it would have been in the absence of fishing.

Besides, Daniel Pauly (from the University of Columbia, Canada) has given numerous evidences of over fishing in the world ocean, as a whole.

This means that the world ocean catches cannot go much higher than the today total amount. In the beginning of the 21st century we have to face the reaction of the marine environment to global warming.

Therefore, the problem is: how the marine ecosystems, including exploited marine resources, will be affected by the global warming, and more generally by the anthropogenic pressures? Can we recommend solutions to policy-makers for a sustainable use of the marine resources? This is the major objective of EUR-OCEANS, which we want to achieve at the end of the 4-year contract with the European Commission.

➤ **National Space Agency (Centre National d'Etudes Spatiales), Paris, France:**

Prof. Louis Legendre, Deputy Scientific Director of EUR-OCEANS, Centre National de la Recherche Scientifique, Laboratoire d'Océanographie de Villefranche (legendre@obs-vlfr.fr), tel (+33) (0)4 93 76 38 36

EUR-OCEANS organisation

(not available – please contact eur-oceans@oceanopolis.com for more details about this presentation)

Dr Patrick Monfray, Centre National de la Recherche Scientifique, Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (patrick.monfray@cnes.fr), tel (+33) (0)5 61 33 29 02

Global aspects and modelling

The human activities impact marine environment and ecosystems not only at local scale or regional scale, by river loading, coastal management or fisheries, but also at global scale.

An example: while CO₂ is released massively in northern developed countries, we are acidifying the whole ocean by CO₂ dissolution in surface sea waters. A study published just yesterday in Nature, by a joint team from 13 labs, had showed that within 3 or 5 decades some key plankton will not be able to form longer their calcareous shell. Particularly endangered are the pteropods living in the Weddell Sea, off Antarctica, a key element there for the food web up to the whales.

Furthermore greenhouse gases as CO₂ induced other cascades from human activities to remote marine ecosystems: by increasing temperature we put lighter waters at the top of the ocean and thus stratified the whole system, and consequently reduce the return flow of deep nutrients that trigger primary production near surface.

In brief, the Earth System behaves as a whole continuum from physics to chemistry and biology, bridging land anthropogenic activities to worldwide ocean environmental problem.

Such big issue implies to restructure the research strategy at international and national level by launching coordinated interdisciplinary programs on Earth System Science. In this context, structuring the European Research Area is a crucial challenge that EUR-OCEANS undertake.

➤ **British Antarctic Survey, Cambridge, United Kingdom:**

Dr Eugene Murphy, British Antarctic Survey (e.murphy@bas.ac.uk), tel (+44) 1223 221614

Southern Ocean

The Southern Ocean is a long way away so why are European scientists involved in studying this remote region?

The Southern Ocean is the only ocean that encircles the globe, connecting all three of the world's main ocean basins.

The annual freeze and thaw of the Antarctic sea, the turbulent surface waters driven by powerful winds, and the strong flow of the Antarctic Circumpolar Current allows exchange of water between these ocean basins. These exchanges affect the physics, chemistry and biology of the global ocean and have an important role in determining the Earth's climate.

This system encompasses some 15% of the world's ocean ecosystems. During the short summer dense phytoplankton blooms develop, taking up large amounts of carbon dioxide which affects the global carbon budget and hence climate. This production supports unique biological diversity as demonstrated by the vast numbers of seals and penguins which breed in these regions. These ecological systems also support substantial European and international fisheries.

Some of the strongest regional expressions of recent climate change have come from Antarctica and the Southern Ocean. For example, substantial increases in air and sea temperatures, and precipitation accompanied by melting ice shelves and decreasing sea ice extent has been observed. These regional changes are already having an impact on the ecosystem. We must also remember that exploitation over more than 2 centuries has generated massive changes in the food web.

Understanding the impacts of climate and anthropogenic driven changes on Southern Ocean processes is therefore integral to stewardship of this ocean and to monitoring and forecasting the response of the Earth System to global change.

To generate this understanding requires a coordinated international effort. To address this, EUR-OCEANS is uniting the substantial but fragmented polar research capabilities of the European Research Area in conjunction with the Southern Ocean research of non-European Union nations.

EUR-OCEANS Southern Ocean studies are developing integrated, circumpolar analyses to understand how climate and human impacts may affect Southern Ocean ecosystems. We will examine aspects of climate variability, resource management and ocean biogeochemistry.

The Southern Ocean is then a key region in the global system and a unique ecological system in its own right. It is a barometer of the health of the planet and we are already seeing major changes. Developing integrated, circumpolar ecosystem analyses is crucial and EUR-OCEANS Southern Ocean scientists are helping to lead the way.

➤ **Gdynia Aquarium of the Sea Fisheries Institute, Gdynia, Poland:**

Prof Jan Marcin Weslawski, Institute of Oceanology, Polish Academy of Science
(weslaw@iopan.gda.pl), tel (+48) 58 551 72 83

Arctic and Nordic Seas

The Norwegian, Greenland and Barents seas form the European Arctic. This area is of key importance for the climate forming, not only for Europe, but also globally.

That is due to the difference between relatively warm sea water and cold air. This causes an intensive escape of heat from the Ocean to the Atmosphere. Cooled water gets heavier and sinks down, stirring the global circulation, that brings oxygenated water to the world ocean depths. Distant arm of Gulf Stream, carrying warm Atlantic waters flows into the Arctic as the West Spitsbergen Current. On the other hand, the sea area covered with ice pack shrinks rapidly. At the ice pack edge, and in areas, where cold and warmer water is mixing, ocean productivity is elevated. The most numerous seabird and sea mammals populations are linked to the Nordic seas – one of the reasons for this, is presence of large, fatty plankton, typical to low temperature regime. Warmer water means faster growth of plankton, smaller individual size and less fat deposited. Change in climate, means not only the change in physical properties of the Nordic Seas – it means the change of ecosystem functioning. Climate, biogeochemical cycles, hydrology and marine organisms are closely coupled in European Nordic seas.

➤ **National Marine Aquarium, Plymouth, United Kingdom:**

Dr Roger Harris, Plymouth Marine Laboratory (r.harris@pml.ac.uk), tel (+44) 1752 633400

North Atlantic Ocean

Why is the North Atlantic Ocean important for Europe?

This ocean basin contains some of the most productive marine pelagic ecosystems in the world. Important fish stocks of the North Atlantic rim (for example, cod, herring, and mackerel) depend on these food webs.

Processes occurring in and over the North Atlantic influence ocean conditions and biological productivity in all of the European seas. The role of the North Atlantic in global change processes is not yet fully understood, but the consequences of any large scale circulation changes are likely to be dramatic. For example, temperature change and ice melt may, potentially, alter the direction and/or strength of major current systems.

We already have evidence for convincing climate change effects on North Atlantic and shelf seas plankton and fish distributions. Long term monitoring of the planktonic ecosystem has shown that warm-water species have extended their distribution northward by more than 10° of latitude. Cold-water species have decreased in number and extension.

As yet we do not understand the mechanisms by which the North Atlantic influences biological processes closer to and in continental Europe. A primary aim of EUR-OCEANS will be to examine these mechanisms of interaction.

Over the last decade, nationally-funded programs have been conducted to understand the effects of climate variability on ocean ecosystems. One outcome of these studies is the realization that the spatial scale of biological events is often larger than national or regional waters.

The North Atlantic provides the link between the marine research communities of Europe and North America, so EUR-OCEANS is building scientific co-operation in ocean basin scale studies.

The immediate challenge is to co-ordinate trans-Atlantic research, assemble appropriate data sets, and develop basin-scale physical and biological models which include the adjacent shelf seas. EUR-OCEANS is working actively with the North American research community to reach a new level of ecosystem understanding and predictive capability for the North Atlantic.

➤ **Ocenario, Lisbon, Portugal:**

Dr Miguel Santos, Portuguese Fisheries and Sea Research Institute (amsantos@ipimar.pt), tel (+351) 213027193

Upwelling Systems

Upwelling ecosystems are characterised by an upward movement to the surface of deeper cold and nutrient-rich waters. Thus upwelling ecosystems located at the eastern boundaries of the Pacific and Atlantic oceans are among the most productive regions of the world. They account

for more than 20% of the total worldwide catches of marine species, while representing only 3% of the ocean surface.

The four major upwelling ecosystems are located in the eastern boundary current systems of the oceans and include the Canary (including the Iberian Peninsula and NW Africa), the Benguela (SW Africa), the Humboldt (SW America), and the California (NW America).

Upwelling ecosystems are particularly relevant for the study of the impact of climate and anthropogenic forcing on pelagic ecosystems, because they support important fishing activities and display important inter-annual and inter-decadal fluctuations of the biomass corresponding to small pelagic fishes (sardines, anchovies). Moreover their different geographical locations and ecosystem structure makes it possible and promising to use a comparative approach – a major tool in disciplines such as fisheries science in which experiments are hard to perform.

EUR-OCEANS will focus mainly on three upwelling ecosystems (Canary, Benguela and Humboldt). However, the California ecosystem will be dealt with through co-operation with US scientists, and comparative studies.

Recent developments in modelling and computer sciences make it possible to couple physical and biological process models, which will lead to a better understanding of how ecosystems function and respond to climate and anthropogenic forcing. This should lead to the development of new (ecosystem-oriented) tools for a better management of marine resources.

In the Upwelling Systems we will couple physical, biogeochemical and ecological generic models to study the functioning of upwelling ecosystems. The modelling approach will include the use of:

- Productivity models, such as 3D NPDZ (Nutrient-Phytoplankton-Detritus-Zooplankton models);
- Early life history models, such as IBM (individual-based models);
- Ecosystem trophic models or dynamic and size-structured models, such as ECOPATH, ECOSYM and OSMOSE

The NPDZ will be coupled with the hydrodynamical ROMS model (Regional Ocean Modeling System) to produce distributions of temperature, salinity, currents and food.

IBM and ecosystem models will make use of the output of NPZD models under present, past and – as far as possible – predicted forcing to study the functioning of pelagic ecosystems (e.g., types of production control – bottom-up, top-down, wasp-waist; fish distributions).

In situ and/or *in vitro* experiments will be conducted to validate models outputs, fulfil missing information and verify new hypotheses arriving from modelling studies. Some examples of these experiments are:

- Release of Lagrangian markers in spawning areas to validate the 3D hydrodynamical model simulations.
- Mesocosms experiments on phyto- and zooplankton growth and survival rates according to environmental conditions in order to improve the parameterisation of NPDZ models

This System involves about 26 Principal Investigators (PIs) belonging to 17 Member Organisations from 13 European and non-European countries, such as Chile, Morocco, Peru and South Africa, which will contribute with local expertise and unique databases.

Memoranda of Understanding were already signed with USA in the context of GLOBEC regional programme on Small Pelagics and Climate Change (SPACC) and with Namibia in the frame of the Benguela Environment Fisheries Interaction and Training Programme (BENEFIT). A general Agreement with the Scripps Institution of Oceanography (USA) was also celebrated.

Finally, from a total of 19 PhD fellowships already selected in the frame of EUR-OCEANS, 3 of them will focus specifically on upwelling ecosystems.

➤ **Hellenic Centre for Marine Research, Heraklion, Greece (Crete):**

Dr Ioanna Siokou, Hellenic Centre for Marine Research (isiokou@ath.hcmr.gr), tel (+30) 22910 76368

Mediterranean Sea

The Mediterranean Sea presents some particularities within European seas: this small basin is driven by the same physical, chemical and biological processes as the oceans but on smaller scale. It is characterized by a complex food web with a great variety of organisms (in terms of size and trophic relationships). It is an area of low productivity at all trophic levels (e.g. fisheries) and therefore the sustainable use of its limited resources requires a very good knowledge of the pelagic system dynamics.

The semi-enclosed nature of this sea, in combination with the increasing trend of population growth and human activities in coastal regions make this basin very sensitive; it is sensitive to climate variability, both from the North Atlantic Oscillation and from the Indian Monsoon variability; it is sensitive also to human effects due to river and atmospheric inputs from many European, north-African and Asiatic countries. In addition, the ecosystem of the neighbouring Black sea has already revealed considerable catastrophic changes in the food web and collapse of fisheries, mainly due to anthropogenic activities.

Our major goal is to understand the vulnerability of all components of the Mediterranean and Black Sea pelagic ecosystems (from small unicellular organisms to large fish) to the global change and to produce models predicting the impact of these changes. National projects carried out in the recent past or currently running by Mediterranean and Black Sea countries will provide a considerable amount of conceptual ideas as well as data to be networked for the achievement of this goal.

A key element in this strategy is the observational sites driven by these national programs. On a national basis it would be difficult to understand the reaction and the feedback of the Mediterranean ecosystem to the process of global change. However, taken together the set of sites networked within EUR-OCEANS, these sites are treated as indicative 'sensors' since they are positioned in a) areas of variable productivity (from the Levantine Sea, an area of very low production, to the productive waters of the Alboran Sea), b) areas where climatic changes can affect water mass formation and thus productivity, c) strategic locations such as the Gibraltar strait, Sicily strait, Dardanelles strait etc. In a few of these sites time-series of meteorological and oceanographic data are provided e.g. the DYFAMED site in the Ligurian Sea, the POSEIDON buoys system in the Aegean and Ionian Seas.

The 'basin perspective' of the Mediterranean Team of EUR-OCEANS is precisely working to diagnose gaps in our knowledge of this complex ecosystem and motivate research aimed at the understanding of the Mediterranean and Black Seas ecosystems.

➤ **Aquarium of Genova, Italy:**

Dr Marco Zavatarelli, University of Bologna (marco.zavatarelli@unibo.it), tel (+39) 051 20 9 5213

Mediterranean Sea (2)

1) The Mediterranean Sea is often described as a “miniature ocean” because of the many similarities in processes with the global ocean. However, the Mediterranean Sea characteristics are subjected to changes at temporal scales much larger than the seasonal variability.

1a) As an example it can be mentioned the long term changes in the Mediterranean Sea global temperature occurred in the last 50 years:

1b) But the long term interannual/interdecadal variability goes beyond the warming trend and can involve changes in the thermohaline circulation and consequent re-arrangement of the Mediterranean Sea water masses, as demonstrated by the occurrence of the so-called “eastern Mediterranean transient”, that is to say a change in the source area of the eastern Mediterranean deep water, that in the nineties shifted from the Adriatic to the Aegean Sea.

2) The long term variability of the physical characteristic of the basin has a profound impact on the structure and functioning of its ecosystems:

2a) Sometimes the impact of the physical characteristic could be regarded as “catastrophic” as the massive gorgonian and coral mortality occurred in 1999 at many coastal sites in the Mediterranean Sea that was ascribed to a strong and sudden summer warming of coastal waters:

2b) In other cases the influence of physical characteristics on the dynamics of the marine ecosystems can be linked to the long term variability of meteorological and hydrological pattern as could be the case of the occurrence of the “Mucilage events” in the northern Adriatic Sea.

3) EUROCEANS is actively supporting the investigation on the links between physical variability and marine ecosystems functioning trough the establishment and the analysis of long time series of oceanographical properties (as stated by Ioanna Siokou) but also trough the development and the use of coupled numerical models simulating the general circulation of the ocean and the dynamics of the marine ecosystem and its variability

➤ **Universeum, Göteborg, Sweden:**

Prof. David Turner, University of Göteborg (davidt@chem.gu.se), tel (+46) 31-7722295
Prof. Anders Omstedt, University of Göteborg (Anders.Omstedt@gvc.gu.se), tel (+46) 31-773 2881

Baltic Sea

A key concept behind the EUR-OCEANS network is the holistic approach to marine systems expressed in the phrase “Ecosystems end to end”. Looking at the Baltic Sea from this perspective, we can see that research efforts are fragmented, with questions such as climate,

eutrophication and fisheries being the subject of separate research programmes. The vision of the Baltic Sea activity within EUR-OCEANS is a holistic approach to Baltic Sea science covering climate, oceanography, biogeochemistry and fisheries. To this end, a joint leadership has been established between oceanographers at Göteborg University and fisheries scientists at the Danish Institute for Fisheries Research. We are now developing a long-term research framework involving scientists from different disciplines and from the different countries around the Baltic Sea.

The research effort at Göteborg University has been strengthened by the decision of the Swedish Research Council to establish a Baltic Sea professorship at the University. Anders Omstedt is the holder of this chair, and a member of the Baltic Sea planning group within EUR-OCEANS.

The Baltic Sea, including its drainage area, constitutes a key region for the fundamental understanding of the climate of the northern Europe. At the same time the Baltic Sea waters and sediments, to a great extent, are the final recipients for anthropogenic and naturally induced material. These materials affect the Baltic Sea, and living conditions in the surrounding countries, through the interactions between environment, climate, and human activities such as eutrophication, land use change, shipping, river regulations and fishing. Understanding of these problems can only be reached through basic studies of how atmospheric, climatological, biogeochemical, and hydrological systems interact. The challenge is both to understand how the Baltic Sea functions as a system, and also to predict how future changes in climate and other forcing functions will affect the Baltic Sea. In addition to EUR-OCEANS, the research group contributes to national and international programmes such as MUSCAD and BALTEX.

➤ **Ocenario, Lisbon, Portugal**

Paul van den Sande, Executive Director of the European Union of Aquarium Curators
(paul.van.den.sande@euac.org), tel (+32) (0)332 410 08

(not available – please contact eur-oceans@oceanopolis.com for more details about this presentation)

➤ **National Space Agency (Centre National d'Études Spatiales), Paris, France:**

Danielle De Staerke, Education Programme, National Space Agency (Centre National d'Études Spatiales), (danielle.destaerke@cnes.fr), tel (+33) (0)5 61 27 46 84

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