Transatlantic Arctic and Marine Research Initiative

Stakeholder Workshop

Brussels, 20 March 2013

Summary report
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**Introduction**

In the context of the EU’s Integrated Maritime Policy (IMP) and in order to fully tap into the potential offered by the Atlantic Ocean and the Arctic to our economies and citizens, the establishment of a joint transatlantic approach was identified as a priority in the EU’s Joint Coordination Committees with the US and Canada in the spring of 2013.

In the process of defining joint activities, a three-phased approach was proposed:

1. defining an over-arching vision for co-operation on Ocean observing and forecasting including seabed and habitat mapping in the North Atlantic, taking stock of on-going best practice, existing facilities and initiatives, engaging key players;

2. recommending priorities for future co-operation areas and agreeing on necessary standards and data collection techniques; defining strategic pilot projects;

3. aligning the planning and programming of research activities: mobilise existing and/or planned co-funded programmes (e.g. on EU side: Horizon 2020, etc.) and other relevant programmes managed by different agencies on both sides of the Atlantic to support a suite of strategic pilot projects to take this initiative forward and actively engage the various stakeholders.

As part of the first phase of this approach, a Stakeholder Workshop on Transatlantic Marine and Arctic Cooperation was held on 20 March 2013, bringing together some of the main actors already active in the area of marine and arctic research at European level. The Workshop addressed five (interlinked) major areas:

- Observing systems
- Ecosystem Approach / Ocean Acidification / other Stressors
- Marine microbial ecology
- Arctic Research Infrastructure
- Ocean Literacy

This report summarises the main elements that were raised during the workshop, together with priorities identified for action. These will be further developed in a High Level Meeting ‘The Atlantic – a Shared Resource’, organised by the Irish Presidency of the Council of the European Union, in association with the European Commission, on 23 and 24 May 2013 in Galway, Ireland.

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The Task Force working on the Transatlantic Arctic and Marine Research Initiative would like to thank all participants for their active participation and valuable input.
**Participants**

Antje Boetius (AWI), Jean Claude Gascard (UPMC), Gelsomina Pappalardo (CNR), David Vaughan (NERC-BAS),  
EC: Franz Immler (RTD, I4, Lead), Galle le Bouler (RTD H.2), Agnès Robin (RTD B.3), Wolfgang Wittke (RTD D.2), Anne-Mette Jensen (JRC), Natalie Hockham (DG MARE)

**Infrastructure**

Europe has an excellent infrastructure in both the Arctic and the Antarctic region, with permanent Stations, polar class icebreakers, satellites, aircrafts and ocean/ice and permafrost observatories. However, in order to increase the efficiency when it comes to the access to and logistics in the Polar Regions, a strategic plan for the renewal and support of European infrastructures in the Arctic is needed. The Arctic region is still rather unexplored, and increasing the observational capacities remains a challenge (and is also rather costly). A proposal for a cabled observatory infrastructure in the Fram Strait project (potential contribution to SIOS) is currently under evaluation.

(Antje Boetius)

EuroFleets2 - the new infrastructure project for supporting access to European research vessels - will include a strategy for improving access to icebreakers. The projects SIOS, EMSO and InterAct are making a significant contribution to improve the infrastructure and cooperation in the Arctic. In addition, an ESFRI update due in 2015 may provide future opportunities for Arctic RI.

(Agnès Robin and Gelsomina Pappalardo)

The US is very keen to use European and Canadian vessels operating in the Arctic at the same time as Europe finds several of the US satellites highly interesting. The JRC is planning another conference on Arctic infrastructures later this year (Anne-Mette Jensen).

The high quality but rather limited quantity of RI operating in the Arctic from US, Canada and Europe calls for a higher degree of cooperation and open access in order to make the most efficient use of what is available.
Key on-going international cooperation and research projects

The project ACCESS is a cooperation amongst partners from the US and Canada, but also from Russia, China and South Korea. It aims at increasing the understanding of climate change in the Arctic region and its impact on socio-economic activities such as marine transportation and tourism, fisheries and aquaculture, and oil and gas extraction. In order to understand the environmental change in the Arctic a combination of infrastructures is required, which includes ground stations and remote sensing. A network of autonomous stations was set up and maintained mainly through project funding, and thus lacks sustainability.

The DAMOCLES project has cooperated with the US project SEARCH for observing, understanding and quantifying climate changes in the Arctic, in particular regarding changes in sea-ice. The cooperation resulted in a close partnership ("Search for Damocles") funded by the EU and NSF. This project has resulted in an operational sea ice outlook.

Institutes from the US and Europe, as well as from Canada and Russia cooperate in the international Arctic Buoy Programme (IABP). This programme provides meteorological and oceanographic data for real-time operational requirements and research purposes, including support to the World Climate Research Programme (WCRP) and the World Weather Watch (WWW) Programme. Cooperation would however benefit from a more coherent approach in funding, operation of networks and data exchanges. (Jean Claude Gascard)

The Ice2sea project has triggered the funding of a similar project in the US called SEARISE. While there are benefits of such competition between institutes from the US and Europe, in the long run a more cooperative approach would be desirable, which also would reduce costs. Cooperation is in particular important for better observations and modelling of Greenland’s ice sheets and for the common use of infrastructure for logistics (e.g. aircraft). While considerable progress has been made in understanding the nature of continental ice, its melting and contribution to global sea level rise needs further attention. Further efforts are in particular needed when it comes to glaciers in near-polar regions (Svalbard, Patagonia, the Canadian Archipelago, Alaska ...)
(David Vaughan)

Priorities for future research in the Arctic:

Sea-ice. The unexpectedly strong decline in summer sea-ice during the last decade has demonstrated that this sensitive ecosystem is by far not yet fully understood, and climate models need to be further explored. The dynamics of the ice itself, its interaction with the ocean beneath and with the atmosphere (in particular the wind) requires increased research in order to improve the models and the forecasts of the ice development. The loss of sea-ice has important effects on global climate, Arctic ecosystems, and coastal areas and, as a consequence, on socio-economic structures, in particular on local communities, shipping and fishing. The Arctic change in general and sea-ice retreat in particular is expected to have a strong influence in particular on the European climate and occurrence of extreme weather.

Potential means of advancing knowledge on Arctic sea ice and related issues could involve a larger scale field campaign such as the drifting station MOSAIC, which is needed in particular for studies of the ocean ice atmosphere system. Such a campaign needs to be complemented by long term
observations carried out by (autonomous) stations, which are also needed for satellite missions. In order to make the best use of such stations they need to be set up in a coherent way across the Arctic, which requires enhanced international cooperation.

**Ecosystems.** In order to study changes in the Arctic ecosystem, the base line needs to be established from historical data. A first bottom-up scientific network project towards this end is carried out by partners in countries such as Germany, Norway, Canada, the US and Russia.

**Permafrost monitoring.** On-going, PAGE21 -> SAON. This focus area also needs to consider coastal erosion and socio-economic impacts.

**Modelling and prediction.** -> WWRP Polar prediction project

**Greenland ice sheet loss and interaction with the ocean.** A strong cooperation with the US and Canada is required in order to study Greenland ice sheets as it requires rather expensive logistics.

**Summary:**

An overarching objective in European and international research is to improve the predictability related to the changes of the Arctic eco-system and the impact on society.

Europe possesses excellent research capabilities in the Arctic (and Antarctic) region both at a national and EU level. National polar research institutes such as AWI, NERC-BAS and others support world-class and often very costly infrastructures such as ice breakers, permanent research stations (e.g. AWIPEV Ny Alesund Svalbard, Neumeyer, Mc Murdo, ...) etc. An overarching strategy for the renewal, support and evolution of Arctic infrastructure is urgently needed in order to better assess and predict future changes in the Arctic region, and their impact on European society. This strategy should address the entire system of infrastructures needed for observations, data gathering and simulations of future scenarios, including satellite missions, vessels, aircrafts, land and sea observatories (autonomous, cabled), drilling, seafloor mapping, field stations, data infrastructure, models, stakeholder-competence networks etc.

European infrastructure projects such as SIOS, ICOS, InterAct and EMSO need to further enhance their capabilities. Research projects such as ACCESS, ice2sea, ATP and PAGE21 have already established strong links and cooperation with researchers in the US and Canada as well as with other countries, in particular Russia.

However, there are a number of issues that still need to be addressed for Arctic research on both sides of the Atlantic: the access, logistics and deployment of instruments in the field; a better coordinated data collection; exchanges between all interested parties; and support for coordinated transnational research efforts. A high degree of international collaboration and coordination is needed in order to make the most efficient use of existing infrastructure and to leverage all possible synergies.
The recent record loss in Arctic sea ice has demonstrated the important need for increased efforts in improving observation, modelling and prediction of the interlinked ocean-ice-atmosphere system, and to continue addressing local and global effects on ecosystems, global climate, including socio-economic aspects.

**Next steps:**

- ERA-CAN will organise a workshop in Rome in September this year where also US partners will participate. During this workshop co-operation in the field of Arctic RI will be coordinated.

- A trilateral working group - US-Canada-Europe - is working towards common projects in Arctic research: Simone Stephensen (NSF), Nick Xenos (Canadian government), Franz Immler (EU). This group will meet during the AOS in Vancouver (see below).

- The Belmont forum has defined a Collaborative Research Action (CRA) on interdisciplinary Arctic sciences. A scoping workshop for this CRA is held in Vancouver in April.

- Basically all transatlantic players will be present during the Arctic Observing Summit in Vancouver, 30/4 - 2/5 2013 to discuss further cooperation regarding Arctic RI and Observations.
(2) - Ecosystem Approach/Ocean Acidification/Stressors

Participants: Nina Hedlund (Norwegian Research Council, Norway), Mike St John (DTU-Aqua, Denmark), Phillip Williamson (University of East Anglia, UK), James Orr (Lsce-IPSL, France), Christian Wexels Riser (Norwegian Research Council, Norway), Teodoro Ramirez (Scar Fish),

EC: Paola Agostini (DG Research & Innovation), Ana Teresa Caetano (DG Research & Innovation); Paola Reale (JRC)

Excused: Beatriz Morales Nin (CSIC Spain), Geoffrey O'Sullivan (Marine Institute, Ireland).

General Comments

Marine ecosystems, their biogeochemistry and related services are influenced by many stressors. Whilst some of these stressors are directly linked to human activities (e.g. fishing), for others the linkage may be more indirect via climate change (e.g. temperature) or biogeochemical processes (e.g. ocean acidification, eutrophication). Studying stressors individually in terms of their impacts on a species or system response is necessary as a starting point (e.g., studies of effects of ocean warming) but it is also crucial to assess complex effects of multiple stressors. To manage these systems following an ecosystem approach requires quantification of the influence of those multiple stressors and a systems vision of their interactions with natural processes.

Funding coordinated actions from both sides of the Atlantic basin are critical for the successful management and preservation of its ecosystems and the good and services they provide. The North Atlantic ecosystem (like other large ecosystems) is interconnected by transport of heat, nutrients, and carbon as well as the migration and transport of key organisms around the system. To improve our understanding of the Atlantic Ocean as a system and monitor the changes in it requires an international concerted effort and long term planning of activities and alignment of priorities, which calls for a joint programming between North America and the EU. Without implementation of joint programming between North Atlantic neighbouring states, research activities will be piecemeal and disjoint in both space and time. Hence the results will be of limited value due far field (e.g. transport effects) and temporal effects (e.g. seasonal) on the dynamics of regional systems.

With this as the background there would seem considerable merit in developing collaborative research programmes with the USA, Canada and others at the basin scale, to develop:

i. an Atlantic-wide ecosystem approach for the sustainable use of marine resources, taking full account of multiple stressors; and

ii. the equivalent for the Arctic.

Joint priority setting for potential cooperation areas in the field of the Ecosystem based approach with emphasis on multiple stressors (including ocean acidification).

There is scope for enhanced trans-Atlantic collaboration with regard to:

- Standardized methods and protocols for long term monitoring of the Atlantic Oceans and its ecosystems in order to improve our basic understanding of their functioning and to assess
the effects of ocean acidification and other stressors on the ecosystems, their food webs, biodiversity and biogeochemical processes, from the sea surface to the seabed.

- Increased sharing of experimental marine research infrastructures/platforms (e.g. mesocosms; aquaculture facilities, molecular biology facilities, etc) and other research facilities (e.g. computing)
- Harmonization, standardization and sharing of data and integrated data management arrangements
- Joint experimental and modelling studies
- Development of transatlantic networks of marine research institutions
- Exchange visits and workshops to maximize information exchange
- Joint dissemination and knowledge exchange activities

Some Potential Science activities

- **Modelling Ecosystem Stressors for the development of predictions**
  - Extension, comparison and evaluation of high-resolution physical-biogeochemical-ecosystem models to accelerate advances in modelling and prediction.
  - Development of models capable of the Darwinian processes of evolution and adaptation enabling to capture system evolution under global change.

- **Open Ocean Ecosystem Stressors**
  - Effect of ocean acidification and other stressors on biogeochemical processes in open ocean (e.g. new and regenerated primary production, nitrogen fixation, nitrification, denitrification, etc).
  - Changes in mesopelagic higher trophic levels as consequence of multiple stressors and their effects on the vertical flux of C and its sequestration.
  - Effects of multiple pressures, including ocean acidification, on pelagic and deep sea ecosystems (e.g. deep sea vulnerable marine ecosystems such as deep-water corals), food webs and key species ecology, physiology and dynamics
  - Combined effect of climate change, and fisheries on pelagic food webs dynamics, key ecosystem species and biodiversity

- **Shelf Sea ecosystem Stressors**
  - Effect of multiple stressors on the dynamic of biogeochemical and biological processes in the continental margins and shelf/BASIN exchange of nutrients, carbon and their importance for regional ecosystem dynamics, including benthic living resources, biodiversity and carbon sequestration
  - Effects of ocean acidification and climate change on the dynamic of food webs in continental shelves, ecosystems biodiversity, key ecosystems species ecology and dynamics and effects on species of interest for aquaculture.
  - Climatic and fisheries controls on food webs, key species and pelagic and benthic biodiversity
• Development and Integration of Observation Systems

  o Ocean observation systems are critical for the monitoring of key ecosystem indicators of Good Environmental Status (e.g. marine biodiversity, physical, hydrological and chemical conditions of habitats, distribution and abundance of species, non-indigenous species, food webs, etc), in support of the MARINE STRATEGY FRAMEWORK DIRECTIVE. Clearly, enhanced collaboration/coordination is necessary to ensure the long-term sustainability of marine observations through the coordinated use of large marine research infrastructures for ocean observation and monitoring (e.g. research vessels, ROVs, etc) in order to plan jointly oceanographic surveys and time series studies, as well as the development of common programmes for the improvement of existing monitoring fixed and mobile monitoring stations/platforms (e.g. moorings, ARGO-floats, gliders, deep sea observatories, etc) and the deployment of new observatories to monitor the changes in the ocean caused by multiple stressors.

  o Development of transatlantic networks of marine research institutions to promote the common use of research infrastructures, sharing of data, exchange of knowledge, development of training activities and exchange of researchers to improve our knowledge on the Atlantic Ocean system and monitor the changes in the ecosystems in response to changes in climate change, ocean acidification and human pressures.

Aligning the planning and programming of research activities

There needs to be a high level agreement on major areas of common interest. Both ‘top down’ and ‘bottom up’ support are critical for success of a transatlantic collaboration: thus there needs to be a matching of policy drivers and science issues recognized by national research communities.

Actions

• Programme Management: Revisit existing documents on joint programmes Belmont forum, JPI Oceans, SEAS-ERA, other marine ERA-Nets, EURO-BASIN to develop an agreed upon strategy for joint programme implementation, funding and programme management plan.

• Research Priorities: Convene a workshop of leaders of key funding agencies to develop a joint programming strategy and identify funding to be further discussed in a workshop between EU and North American researchers with the aim of evaluating their interest for developing a joint programming strategy

• Scientific Response: Convene a workshop of key researchers to update existing vision documents (e.g. the BASIN research and implementation plan; OA-ICC priorities plan) and identify research priorities in the context of priorities highlighted by the funding agencies.

Other considerations

To foster targeted joint programme research management agencies should

  a) agree on research priorities
b) create the funding environment to ensure targeted research priorities are supported and to maintain and develop the necessary scientific expertise and infrastructure (e.g. research infrastructures, including ocean observatories). Continuity in funding is necessary (particularly for ocean observatories) to secure the performance of long term programmes (20-30 years) required to monitor long-term changes in the ocean, its ecosystems, processes and biodiversity as consequence of climate change, ocean acidification and human pressures. In particular special attention needs to be paid to sustain marine research infrastructures (e.g. research vessels) and ocean observatories due to the high running cost of these facilities.

Appendix 1 Information on existing activities, and complementarities

1. Recent and on-going EU funded research.

The following represents a preliminary list (not exhaustive) of funded and completed EU funded programmes relevant for developing the scientific understanding and collaborations necessary for buttressing the management of European Marine environments. Many national programmes are also relevant but to remain brief, we do not list these here.

Note: North American collaboration known by the present group is highlighted.

Programme Focus: Ecosystem ECO, Ocean Acidification OA; Biodiversity BD; Ecosystem Based Management EM; Climate/carbon, CC.

a) EU ERA-Nets:

There are several marine ERA-Nets highlighting Joint programming and Joint calls in the EU with activities focused on establishing links with North American funding agencies.

• **Marin-ERA** Joint call: Regional Drivers of Ecosystem Change, Description, Modelling and Prediction – five projects funded by the EU member states

• **SEAS-ERA** Joint programming: SEAS-ERA: Strategic Analyses for the Atlantic region. The project has as one of its goals to develop collaborations with the US and Canada. Activities:
  - *Workshop* on Climate Change in the North Atlantic Ocean
  - *SEAS-ERA joint calls*:
    - Ecosystem approach and ecosystem models for North Atlantic Ocean
    - Risk assessment of invasive alien species - changes in marine biodiversity.

  Note: Three projects on the abovementioned topics have been funded by the partners.

• **BiodivERsA**: An ERA-Net promoting pan-European research that offers innovative opportunities for the conservation and sustainable management of biodiversity

• **MARINE-BIOTECH** (CSA-Support Action) The main goal of the CSA MarineBiotech is to prepare the foundation for a future ERA-NET in the area of marine biotechnology.

• **COFASP** (ERANET) Cooperation in Fisheries, Aquaculture and Sea food Processing. The objective of COFASP is to strengthen cooperation and synergies between major European funding agencies that
support research on sustainable exploitation of marine renewable resources.

**b) Joint Programming, JPI Oceans:**

The Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans) is a long term initiative driven by 18 MS/AC aiming at coordinating the marine and maritime research activities of participating countries by aligning national priorities and investments. The objective is to tackle the grand challenges that oceans and seas are facing and make a more efficient use of the available funding and resources. JPI Oceans follows a cross-cutting approach focussing on issues lying in the intersections of three major areas; 1) marine environment, 2) climate change and 3) maritime economy/human activities. JPI Oceans also addresses marine research infrastructures, monitoring, observations, data-collection and human capacity building, which are essential to facilitate the development of knowledge to address major marine and maritime societal issues of cross-cutting nature to support the implementation of EU policies. JPI Oceans has also an international dimension, and links to the US and Canada are anticipated.

c) Funded and completed EU funded projects upon which to develop collaborations.

- **ATP:** Arctic tipping points. *Links with US and Canada (unclear but high potential) Focus: ECO*
- **CarboChange:** Changes in carbon uptake and emissions by oceans in a changing climate. *Includes US (Princeton) and Canadian (Dalhousie) partners. Focus: CC.*
- **CLAMER:** *Climate change and European Marine Ecosystems Research. Focus: ECO and CC*
- **CLEANSEA:** Towards a Clean, Litter-Free European Marine Environment through Scientific Evidence, Innovative tools and Good Governance. *Links with US and Canada (unclear but high potential) Focus: EM*
- **CoralFISH:** Interactions between corals, fish and fisheries. *Focus: ECO;BD*
- **DEVOTE:** Development of innovative Tools for understanding marine biodiversity and assessing good environmental status. *Links with US and Canada (unclear but high potential) Focus: BD,EM*
- **DS3F:** The Deep Sea and Sub-Sea floor Frontier. *Focus: ECO*
- **ECO2:** Sub-Seabed CO2 Storage: Impact on Marine Ecosystems. *Links with US and Canada (unclear but high potential) Focus: EM; ECO*
- **EPOCA:** European Project on Ocean Acidification. *Focus: OA*
- **EURO-ARGO:** Global ocean observing infrastructure. *Links with US and Canada. Focus: CC*
- **EUROBASIN:** EU Basin scale analysis, synthesis and integration *component of BASIN programme. Links with US/Canadian partners. Focus: ECO; CC*
- **EUROSITES:** European Deep ocean observatories. (Links with US and Canada) *Focus: CC*
- **FACTS:** Forage Fish Interactions. *Links with Canada. Focus: ECO*
- **FORCE:** Future of reefs in a Changing Environment: An ecosystem approach to managing Caribbean coral reefs in the face of climate change. *Links with US and Canada (unclear but high potential) Focus: EM, ECO*
- **GREENSEAS:** Development of Global plankton database and model system for eco-climate early warning. *Links with US and Canada (unclear but high potential) Focus: EM, ECO*
<table>
<thead>
<tr>
<th>Programme</th>
<th>Description</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>HERMIONE</td>
<td>Hotspot Ecosystem Research and Man’s Impact on European Seas</td>
<td>ECO</td>
</tr>
<tr>
<td>HYDRONET</td>
<td>Floating Sensorised Networked Robots for Water Monitoring</td>
<td>EM</td>
</tr>
<tr>
<td>HYPOX</td>
<td>In situ monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and land-locked water bodies</td>
<td>EM</td>
</tr>
<tr>
<td>KnowSeas</td>
<td>Knowledge based Sustainable Management for Europe’s Seas</td>
<td>EM (unclear but high potential)</td>
</tr>
<tr>
<td>MedSeA</td>
<td>Mediterranean Sea acidification in a changing climate</td>
<td>OA</td>
</tr>
<tr>
<td>MEECE</td>
<td>Marine ecosystem evolution in a changing environment</td>
<td>ECO; OA; EM</td>
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<tr>
<td>MEFEO</td>
<td>Making the European Fisheries Ecosystem Operational</td>
<td>EM</td>
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<tr>
<td>MIDTAL</td>
<td>Microarrays for the detection of toxic algae</td>
<td>EM (unclear but high potential)</td>
</tr>
<tr>
<td>ODEMM</td>
<td>Options for Delivering Ecosystem-Based Marine Management</td>
<td>EM (unclear but high potential)</td>
</tr>
<tr>
<td>PAST4FUTURE</td>
<td>Climate Change: Learning from the past climate</td>
<td>CC</td>
</tr>
<tr>
<td>PEGASO</td>
<td>People for Ecosystem based Governance in assessing the sustainable development of Ocean and coast</td>
<td>EM (unclear but high potential)</td>
</tr>
<tr>
<td>PERSEUS</td>
<td>Policy oriented marine Environmental research in Southern European Seas</td>
<td>EM; ECO</td>
</tr>
<tr>
<td>THOR</td>
<td>Thermohaline Overturning – at Risk</td>
<td>CC</td>
</tr>
<tr>
<td>TRACES</td>
<td>The Trans-Atlantic Coral Ecosystem Study investigates the biodiversity, connectivity and climate records associated with cold-water coral habitats along the continental shelf break and slope and with seamounts in the North Atlantic Ocean</td>
<td>BD</td>
</tr>
<tr>
<td>WISER</td>
<td>Water bodies in Europe: Integrative Systems to assess Ecological status and recovery</td>
<td>EM (unclear but high potential)</td>
</tr>
</tbody>
</table>

2. International global change programmes and initiatives (preliminary list - not exhaustive)

- **The SOLAS** (Surface Ocean-Lower Atmosphere Study) an IGBP international research initiative aiming to understand the key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere.
- **IMBER** (Integrated Marine Biogeochemistry and Ecosystem Research), another IGBP initiative that has stimulated ocean research in Europe, North America and the rest of the world, combining chemical, biogeochemical, biological and ecological aspects of marine systems.
- **SOLAS-IMBER Working Group on Ocean Acidification** played a major role in establishing the OA-ICC. European hosting of SOLAS IPO (Kiel) and IMBER IPO (Bergen).
(3) - Observing Systems

Participants: Detlef Quadfasel (University of Hamburg, Germany), Trevor Platt (Plymouth Marine Laboratory, United Kingdom), Christoph Waldmann (MARUM – Centre for Marine Environmental Sciences, Germany), Elisabeth Remy (MERCATOR-OCEAN, France), Berit Johne (JPI-Oceans and The Research Council of Norway)

EC: Sigi Gruber (DG-RTD), Iain Sheperd (DG-MARE), Isabela Freytag (DG-RTD), Liliana Pasecinic (DG-JRC) Massimo Craglia (DG-JRC), Michael Berger (DG-RTD)

Summary:

The discussions were triggered through a series of short presentations on on-going European and international initiatives such as COOPEUS, Copernicus MyOcean, GEOWOW, the Blue Planet Initiative of the Group of Earth Observation (GEO), EMSO and EMODNet. In addition, ideas provided by the Irish Marine (viewgraphs) and an overview of the activities of JPI Ocean were presented. The aim was to screen the landscape and gaps, and to identify potential cooperation areas including their priorities to align relevant research activities.

In the discussion it was emphasised that ocean observations is becoming a crowded field with many on-going international and (multi-) national activities. This was also demonstrated by the other breakout sessions who all covered observing systems in their discussions. It is obvious that only a snapshot of the manifold activities could be addressed. Therefore a thorough review is considered important for which the recent expert group report on marine infrastructure is considered a good starting point. Further, many observing systems are only loosely connected. In addition, the outcome of the "Marine Knowledge 2020" consultation suggests interest from the private sector in participating in these activities, both in improving access to observations that they already make and in increasing their monitoring.

Of particular concern are the different data standards and metadata descriptions used by the different communities. Although it was noted that within Europe coordination and harmonisation activities are in place, it will remain a challenge to impose these standards on communities from other disciplines (e.g. atmosphere and land interactions) and at the global level. Whilst from a technical point of view, the GEO Discovery and Access Broker provides a useful framework to connect infrastructures from different disciplines, it is necessary to frame this process by key players of major programmes, initiatives and observation infrastructure. To this end, governance structures in place should be utilized as much as possible.

The benefit of coordinating activities on both sides of the Atlantic was emphasized, which e.g. would allow filling observation gaps, e.g. coast to coast mapping of the seabed or through the coordinated deployment of observational infrastructure such as moored buoys, placed at different locations for a certain time period. This would lead to a more complete dataset and improvement of the modelling database and economies of scale. It could be the first stage of a longer-term process that starts with the North Atlantic and then extends north to the Arctic and south towards the Southern Ocean. Furthermore, it was stressed that although the cooperation would be focussed on the Atlantic and the Arctic regions only, the global context should be kept in mind ("act regionally but think globally").
In summary the discussions led to the following recommendations:

- Extend the survey of programmes and initiatives;
- Explore connecting EU initiatives, especially EMODnet and Copernicus, to their American counterparts;
- Start connecting existing capacities and infrastructures in Europe and across the Atlantic with the global framework of GEO (the Blue Planet) in mind; and
- Identify focus projects on which to develop partnerships for dedicated topics such as e.g. transatlantic seabed mapping.

It was felt that dedicated working groups of the possible Transatlantic Research Alliance would be best suited to address these issues.
Ocean Literacy – Engaging with Society

Participants:  
Philippe Vallette (PV) – NAUSICAA/World Ocean Network,  
Manuel Cira (MC) – NAUSICAA/World Ocean Network,  
Fiona Crouch (FC) – MBA/European Marine Science Educators Association (EMSEA),  
Géraldine Fauville (GF) – University of Gothenburg/MBCP/EMSEA,  
Jan Seys (JS) – VLIZ/Marine Board Communication Panel (MBCP),  
Evy Copejans (EC) – VLIZ/EMSEA

EC:  
Waddah Saab (WS) – DG RTD, Marine and Maritime Research (Chair),  
Dionysia Lagiou (DL) – DG RTD, Science in Society - Mutual Mobilisation and Learning

I. Overview of actions in the field of ocean literacy / engaging with the public.

1. Different sorts of actions

Actions can be very diverse, and exist as a physical and digital activity

- Field work
- Hands-on activities
- Interaction scientists – students
- Collaboration with science centres
- Analyses of scientific data in the classroom
- Citizen science
- Outreach media (podcast, movies)
- ...

Ocean literacy (OL) should be considered as an open concept. We need a global vision where we do not separate education from the rest. All the tools are important and should be used. It is necessary to imbed education in all domains, and do not treat it as a separate process.

2. Review and evaluation of actions

It is difficult to get an exhaustive overview of OL activities in Europe:

- Fragmented landscapes with several languages
- No directory of all the OL actions exists (just started by EMSEA recently)
- Not all reported online and even though extremely time consuming to search for them online.

It is not easy to evaluate and compare OL actions.

- Most of the educational resources designed by scientists are not evaluated in a relevant pedagogical way.
- Evaluations cover different competencies (awareness, literacy, critical thinking, etc)
- Pedagogical evaluations are based on different methods (quantitative, qualitative) and different theories (socio-cultural, cognitive, etc).
The costs and benefits of the actions should also be taken into account.

Evaluations based on quantitative indicators (e.g. how many people saw or used this material?) might miss some important non-quantified impact.

We have so far the following reviews:

- Fauville et al. 2012 paper reviewing the different OA educational actions, discussing challenges of such a review and suggesting how to look at the cost/benefits of actions.
- CLAMER research of best practices in climate outreach (2011)
- A list of about 130 OL actions in Europe of EMSEA (without evaluation - not available online) and a wide network to find out as many missing actions as possible.
- Marine education research articles on one specific type of action (personal database of Dr Athanasios E. Mogias, Democritus University of Thrace and http://www.emsea.eu/marine-education/publications)
- Articles from the American the Journal of Marine Education of NMEA called ‘CURRENT’
- Possible surveys from The Ocean Project (mainly US but with European partners) that provide marine education research data, analyses and resources

3. Instruments used in the research framework programme for outreach

There are broadly 3 big instruments:

1) Dissemination of knowledge generated in research projects. This is usually done as a work package of the project focusing on communication and dissemination. The quality of the work done and the budget spent on it varies considerably according to the project.

2) Projects like CLAMER, which synthesize relevant knowledge on a given issue (e.g. ocean and climate change), define key messages and disseminate them through appropriate actions / tools.

3) Projects that involve a more interactive approach with societal stakeholders, in particular the Mutual Mobilisation and Learning projects (MML), which gather all societal stakeholders, including scientists, to generate social innovation in the definition and management of a given societal issue.

3) Transatlantic cooperation on ocean literacy

Regarding to the transatlantic cooperation in Ocean Literacy, there has been exchanges of information between Waddah Saab and Paula Keener-Chavis of NOOA (former chair of NMEA) and a videoconference between Fiona Crouch/Jon Parr and Peter Tuddenham

Existing cooperation:

EMSEA and NMEA

EMSEA is Europe’s network of marine educators, a network that is closely affiliated with the American network of marine educators (NMEA), and the international ocean community. After attending different conferences of NMEA, the founders of EMSEA were inspired to establish a similar platform for ocean education within Europe. EMSEA can be characterized as a sister organization of NMEA. (websites: http://www.emsea.eu/ and http://www.marine-ed.org/).
International meetings of the World Ocean Network (WON)

The World Ocean Network (http://www.worldoceannetwork.org) is an international association working to raise public awareness about the importance of the ocean. The association brings together organizations (like aquariums and marine science museums) involved in and committed to taking action in public outreach. In that context, there is established cooperation between European and US members of WON. For instance, NAUSICAA provides outreach component of a WON outreach project on **High Seas** (areas beyond national jurisdiction).

A **partnership between 2 film festivals** is being built: the world underwater festival in Marseille and the blue ocean festival in Monterey – to become Blue Society film festival (http://www.underwater-festival.com and http://www.blueoceanfilmfestival.org/).

**Ocean Literacy Principles**

There has been a request from Craig Strang from the US NMEA for a transatlantic cooperation on defining the Ocean literacy principles (http://oceanliteracy.wp2.coexploration.org/). The ministry of science education in Portugal, Ciencia Viva, already adapted these principles (http://www.cienciaviva.pt/oceano), giving ground for such cooperation.

**Public campaign about MPA’s** is a joint NOAA, IUCN, NAuSICAA and WON project.

There are **formal education initiatives** involving bilateral cooperation between some European countries and US organizations, such as Inquiry-to-insight: Acid Ocean lab and the international student carbon footprint challenge. The project has now been translated in French (funded EPOCA), German (funded POLMAR), Spanish (funded MEDSEA), Portuguese (funding Ciencia Viva), in Dutch (funding VLIZ) (http://i2i.loven.gu.se, http://i2i.loven.gu.se/AcidOcean.htm). There is also cooperation between Stanford University and University of Gothenburg.

Finding funds for joint initiatives is difficult, as each part has its own separate funding bodies, which do not cooperate (the problem is similar for cross-border cooperation in Europe).

**4) Possible structured European and transatlantic cooperation actions in Horizon 2020**

As regards instruments used in the research framework programme, the three kinds of actions identified should be continued:

1) dissemination within research projects of their results. There should be stronger requirements from research projects in that regard.

2) Projects synthesizing knowledge in a given area and disseminating it to selected targets (scientific community, policy makers, industrial stakeholders, students and school children...).

3) MML type of projects, which involve pro-active participation of societal stakeholders and social innovation.

In terms of content (topics and issues), projects of the second and third category should be guided by policy and societal drivers (e.g. the Marine Strategy Framework Directive and the Good
Environmental Status of the seas, climate change and ocean interactions, Blue Growth and new maritime activities / resources...).

There is a need of a critical qualitative review of existing actions, analysing the knowledge source, the knowledge target and the likelihood that a given action can achieve an expected impact.

All these projects offer potential for transatlantic cooperation, the Atlantic being a shared ocean and resource. Transatlantic cooperation can also possibly prepare the ground for actions with global reach (e.g. ocean literacy principles, or transatlantic alliances to disseminate key messages on crucial issues like ocean and climate change, ocean environmental status...).

The way forward

A working group should be set up firstly within the European marine science community to develop a strategic agenda for next financing period (key issues / topics, instruments...). The Marine Board Communication Panel provides a good basis to organize a working group involving main marine research organizations; it should be enlarged to include aquariums, marine science museums and possibly experts of science dissemination not necessarily from the marine field.

After exchanging this report with US counterparts, start discussions with them to prepare a transatlantic session in the 2nd EMSEA conference at Plymouth in September 2013.

The transatlantic session at the Plymouth conference should define a transatlantic agenda for ocean literacy / engaging with society and propose joint actions to be supported for the coming period. The Commission can finance 10-15 experts (transport, accommodation) against the delivery of a report on the strategic agenda for ocean literacy / engaging with society (European and transatlantic).
Participants: Garbine Guiu (chair), Frank Oliver Glöckner (rapporteur), Dawn Field, Matthias Obst, Loic Blanchard, Pilar Aguar

1. Starting point: Meeting with Americans/ongoing collaboration
   a. Develop standardized sample and data protocols
   b. Develop metagenomics/bioinformatic capabilities and capacities

Both topics were suggested in previous discussions with NOAA (esp. Kelly Goodwin) and are fully supported by the EU experts.

On-going joint collaborations in this respect are the Genomics Standards Consortium (www.gensc.org) headed by Dawn Field currently consisting of around 100 scientists with a majority from the US and EU side. The next joint workshop will take place at NIH, Bethesda, Maryland, USA from April 22 to 24, 2013.

Bioinformatic/Metagenomic Capacity building is a major goal in the EU FP7 project Micro B3 (www.microb3.eu) which has a strong leg in the US via the Ocean Sampling Day (see below). Furthermore with respect to capacity building Micro B3 is joining forces with BioVel (Biodiversity Virtual e-Laboratory, www.biovel.eu) to develop bioinformatics workflows, Euromarine (www.euromarineconsortium.eu) to discuss data integration at the time of sampling and data collection, as well as the ESFRI projects EMBRC (www.embrc.eu), MIRRI (www.mirri.org) and ELIXIR (www.elixir-europe.org) to develop common strategies for IT, data storage, processing, analysis and visualisation.

Bioinformatic capabilities are built by training events of Micro B3 and MG4U (www.mg4u.eu) (e.g. fixed courses in Bremen, Germany, May 27-31, 2013, June 16-21, 2013) as well as the two EU US marine genomics courses in Bremen (June 17-30, 2012) and Delaware (June 16-29, 2013).

   c. Instrument and sensor development for microbial detection
      i. US pathogen tracking and forecasting
      ii. US early warning system
      iii. EU's understanding of the contribution of microbes to global cycling of energy and matters

The experts agree with the US that sensor development for microbial detection is important. Nevertheless, the EU likes to broaden the topic by not only developing sensors for pathogen tracking and forecasting and building up an early warning system, as it seems the main goals of the US, but also by developing and deploying sensors to gain a better understanding of the contribution of microbes to the global cycling of energy and matters. Automatic sensor systems to detect and analyse microbes like the Environmental Sample Processor (ESP) developed by MBARI (http://www.mbari.org/esp/) (see picture) could help in building a dense network of standardised data about the presence/absence as
well as successions of microorganisms. This could lay the foundation for modelling and prediction of microbial communities as well as the processes and environmental functions they provide.

d. **Inclusion of microbial and geochemical measurements into observing platforms**
   i. Bringing the biological dimension into the observing systems
EU experts agree that observing platforms like the marine Long Term Ecological Research (LTER) sites ([www.lternet.edu](http://www.lternet.edu)), but also oceanographic observing systems should include the investigation of microbial diversity. This could be supported by semi-automatic systems like the ESP as described above and would add to get a global perspective of microbial diversity and function and their contribution and role in global climate change.

e. **Understanding the role of microbes in monitoring, predicting, and mitigating change**
   (ecosystems, habitat, food stocks, climate...)
   i. Agree on symbiosis between ecology, diversity understanding and bioeconomy/biotechnological applications
As elaborated above, EU experts agree on the importance of understanding the role of microbes in monitoring, predicting and mitigating change. Furthermore, EU experts want to stress that there is a symbiosis between understanding the ecology and especially the diversity of microbes and supporting bioeconomy and biotechnological applications. Still a huge amount (up to 50%) of the protein coding genes that are found in environmental studies are hypothetical or conserved hypothetical genes and consequently nearly nothing can be said about their functions. Nailing down at least some of their functions by biotechnological approaches (e.g. by functional screening, colony screening, functional assays) will not only deliver new enzymes for biotechnological approaches, but also help to gain a better understanding of the functions the microbes provide to the ecosystem. Therefore we see no strict separation between basic ecosystem research and application driven research.

2. **Identified complementarities EU/US**
   a. **Ocean Sampling Day**
      i. Orchestrated, standardised sampling event fixed in time vs spatial/circumnavigations (Tara, Venter)
      ii. Global
      iii. Reference dataset
Background: Recent developments in sequencing technology make sequencing of whole microbial communities from the environments a widely used and affordable routine task. Consequently, large scale sampling and sequencing efforts such as the Global Ocean Sampling (GOS) campaign, the Malaspina cruise and the Tara Oceans expeditions are now exploring marine ecosystems in space and time.
In contrast to these circumnavigations, no orchestrated site-based and fixed in time sampling effort has been initiated so far. The Micro B3 project is now taking action to implement the Ocean Sampling Day (OSD). The OSD is open to any interested lab across Europe and beyond. The resulting cumulative samples, fixed in time and space supplemented with a broad set of geo-referenced environmental parameters, will contribute to determine a baseline of marine biodiversity and functions on the molecular level. To ensure maximum usefulness of these samples, sampling and data analysis will be done across all sites using agreed upon best practices developed within Micro B3. Herewith, a high level of consistency between data points across Europe and beyond is ensured. In particular all sites will be expected to comply with the MIxS minimum information checklists of the
Genomic Standards Consortium (GSC, http://www.gensc.org). We expect that the combined data will provide a reference data set for generations of experimentalists to come. It should also function as starting point for site-based monitoring of microbial communities as proposed by the Genomic Observatories (www.genomicobservatories.org) initiative - see below.

By its nature, OSD is a collaborative transatlantic effort. Currently around 28 sites have already signed up or have shown interest for OSD of which six are from US and one from Canada.

![World map with current OSD sites indicated by red stars](image)

iv. Action points

1. EU/Atlantic cluster collaboration NOAA offers platforms e.g. ships
2. Planning meeting GSC 15 OSD in April in Washington

This collaboration needs now to be fostered by e.g. building an OSD Atlantic cluster together with NOAA. In previous discussions with the EU, NOAA has offered to provide access to platforms and ships. The GSC 15 meeting in Bethesda (see above) and especially the OSD-Genomic Observatories Network workshop (April 25/26, 2013 at Smithsonian, Washington D.C., USA) will be a perfect platform for further interactions.

b. Genomic Observatories

i. Crystallized in Europe – extend to US in April 2013 at Smithsonian (more sites and technology)
ii. LTER – history of data
iii. Injecting the genomic component into observatories
iv. consistent and long-term

Background: The Genomic Observatories (GOs) Network (http://genomicobservatories.org) was officially launched 2012 in Oxford, UK to bring together a premier set of geographic sites with rich histories of environmental/ ecological data collection and a long-term commitment to future genomic studies. GOs are leading sites where biodiversity is digitized into its most fundamental layer for streaming to global repositories and major analytical centres. Studies of genomic biodiversity - at both the landscape and organismal scales of biological organization - are likely to have important applications in maintaining system health and productivity.
The first international meeting dedicated to the development of the GOs Network (GOs1) was organized by the GSC and took place at Oxford in September 2012. Strong support for the GOs Network concept was expressed by a range of candidate genomic observatories and partners, and Ocean Sampling Day (OSD) built further momentum as the first “GOs Action”. The Oxford meeting established a GOs core group with an overarching focus on biodiversity genomics, and at least one working group was set up in areas of key importance to the GOs: science, informatics, technologies, and policy.

The second GOs meeting (GOs2) being held in Washington DC will help reach out to more potential participants in North America. While the agenda and talks reflect a specific focus on Ocean Sampling Day as the GOs Network’s first co-ordinated action, the overall goal is to seed other collaborative projects and work on defining how the Network should develop.

v. Action points
   1. strong EU-US commitments
   2. new dimension on the existing observing system

Launching the GOs network has shown to be a perfect starting point to further develop the transatlantic cooperation with a long-term perspective. GOs2 meeting in Washington will help in injecting the microbial component into the observatories, but what is needed are top-level commitments on the EU and US side. In summary we imagine that GOs can bring a new dimension on the existing observing system.

c. Developing the sensors for microbial detection
   i. Monitoring
   ii. Food security
   iii. Health
   iv. Biodiscovery/exploration
   v. Feed into Marine Strategic Framework Directive on EU
   vi. Early warning system on the US

As pointed out above semi-automatic biological sensors have already been developed especially in the US (Mbari, ESP). Their field of application is manifold ranging from monitoring diversity and even functions on a (meta)genomic level up to food security (aquaculture), health in terms of pathogen detecting and tracking up to the discovery of new processes and even enzymes for biotechnology. Such a network of biological sensors, once established, could become part of the fulfilments of the Marine Strategic Framework Directive to monitor and maintain good environmental status (EU) as well as the early warning system on the US side.

vii. Action point
   1. Follow up on the on-going collaboration between EU, NOAA and National Science Foundation (workshops)

To further develop this, a follow up of the on-going collaboration and workshops between EU and NOAA/NSF is recommended. The Marine Genomics Working Group as part of the EU-US Task Force on Biotechnology Research has already organised four successful joint workshops since 2005. The provided recommendations have been picked up on both sides and the joint short courses on marine genomics and bioinformatics might lead as implemented examples. Further workshops are now needed to follow up on the development of sensors across the Atlantic.
ANNEX - Minutes of the discussion on priority for fisheries and aquaculture during the Stakeholder WORKSHOP ON TRANSATLANTIC MARINE AND ARCTIC COOPERATION – 20/03/2013

Participants
Andrew D. Brown (Marine Scotland), Teodoro Ramírez (Instituto Español de Oceanografía, IEO (MINECO), Representative in Brussels
EC: Jacques Fuchs (RTD, E4, lead)
JRC: Anne-Mette Jensen, Paola Reale

Background
Fisheries and aquaculture is a key priority for the EU and also for US and Canada. The ocean's bio-resources provide 15% of the animal protein consumed globally and are a significant source of business opportunities. The EU seafood market (2010) is worth more than 120 billion Euro/year (Fisheries 90, Aquaculture 25, algae 5).

Challenges
Regarding Aquaculture, US and EU face similar problems for the development of aquaculture with a general trend to stagnation. The development of competitive and environmentally friendly aquaculture requires continuing research in particular on health, disease, nutrition, and breeding as well as on new technologies and innovative engineering to progressively move aquaculture offshore, sharing the space with other infrastructures.

Regarding Fisheries, policy makers on both sides of the Atlantic have a long expertise in managing fisheries in close collaboration with the fishing industry. The implementation of an ecosystem approach to fisheries management in order to achieve maximum sustainable yield whilst preserving goods and services for present and future generations is a high priority in both the US and Canada and is a key element of the proposed EU Common Fisheries Policy reform. It is also important to underline that ICES (International Council of the Exploitation of Seas) plays a key role in coordinating research in that area which US, Canada and main EU countries and Associated countries (NO, Iceland) participating.

Key on-going transatlantic cooperation and research projects

RTD
1/ Aquaculture species are included in the Working Group on Animal Genomics of the US/EU Task Force on Biotechnology
2/ Experts from US and Canada are regularly invited to evaluate FP7 proposals (KBBE calls, OCEAN calls).
3/ Cooperation actions have recently been launched under the KBBE forum on Mollusc disease and on Ecosystem Approach to Fisheries management with Australia and NZ (Canada expressed interest but is not participating in the activities for the moment)
JRC
JRC and NOAA in 2012 signed an implementing agreement which also includes cooperation in the field of fisheries. The latest meeting of the JRC-NOAA Steering Committee took place in March 2013 with the aim to update the work programme and agree on priorities, see below for details.

Member States and Academia
International cooperation exists with a large number of partners but it is difficult at this stage to have a full picture due to the large dispersion of efforts.

Priorities for future research on fisheries and aquaculture:

Aquaculture:
RTD
NOAA and RTD experience big differences in terms of scale and funding of projects. Preliminary exchange of view with US (video conference with NOAA 18/03/2013) has shown a particular interest in further discussing the following domains of possible cooperation:

1. Monitoring potential environmental impacts of aquaculture, including potential genetic impact of escapees on native populations (RTD FP7: Aquatrace project, in which JRC is participating)
2. Impact of ocean acidification on mollusc farming
3. Improving the image of aquaculture products
4. Understanding and mitigating the impact of diseases on aquatic farmed species including climate change effects e.g. oyster disease addressed in the KBBE forum (EU, Canada, NZ, AU
5. Skills and education

JRC
In connection with the Implementing Arrangement between NOAA and the JRC, signed in 2012 it has been identified that joint activities on aquaculture could include joint research in the following areas: Shellfish aquaculture; culture of sea bass and sea bream and related species; Sustainable finfish culture; technology development (e.g., engineering, alternative feeds).

Fisheries:
RTD: Fisheries research has not been mentioned by NOAA as a priority area for cooperation with RTD. Fishing activities have however been identified by the group on Ecosystem Approach / Ocean Acidification / other Stressors as one of the key stressors which need to be considered for Trans-Atlantic (see detailed report).

During the discussion, it has been pointed out that ICES plays a key role in coordinating research in North Atlantic with more than 100 Working Groups including researchers from both size of the Atlantic. IEO and Marine Scotland wonder about the benefit of adding fisheries in the Trans-Atlantic marine cooperation? If specific cooperation is envisaged, it would be desirable to further discuss this issue with ICES in order to avoid duplication of efforts.
JRC:
In connection with the Implementing Arrangement between NOAA and the JRC from 2012, the following subtopics have been identified as joint priorities for scientific cooperation:

- joint coordination/ participation in international events,
- technologies to combat illegal fishing and technologies for fish and fish product traceability,
- essential habitat of highly migratory species, as well as
- regional climate impacts on Bluefin Tuna spawning habitat.

Next steps

Aquaculture
- RTD and JRC to further discuss with USA potential areas of cooperation (draft fiche in preparation by RTD based on feedback from EU/US video conference)
- Plan a bilateral meeting during an international event in 2013 (ICES Annual Science Conference, Iceland, September 2013, other?)

Fisheries
- JRC to pursue activities agreed with NOAA.
- RTD to contact the new ERANET (COFASP) for mapping international cooperation with US and Canada in the field of fisheries/aquaculture/seafood quality.
- RTD to further discuss with ICES possible areas of cooperation.