**EDITORIAL**

BONUS started already twelve years ago, first as a loose cooperation between several Baltic Sea research programmes, then as an ERANET programme (2004–2008), followed by the pilot BONUS+ call and projects (2007–2011), and now more recently the strategic phase (2010–2012) and the current article 185 programme that is being implemented in years 2012–2017. The landscape of the Baltic Sea research and funding, and – as I think – the role of research supporting better sustainability policy, has changed remarkably. BONUS has been a pioneer in this process.

The destiny and fortune of a pioneer is to face challenges, adventures, opportunities, and risks. During the past ten years and more BONUS has experienced them all - almost. It has been a challenge to bring together actors across sectoral borders. BONUS collaboration has brought – not only scientists – but more importantly the science policy makers to discuss and plan jointly how to find science based sustainable solutions for preserving both the Baltic Sea ecosystem and the economy of the region. It has been a challenge to influence the existing ways of thinking about the role of science in society and convince that there is change happening although the progress may seem slow. In more concrete terms, BONUS opened a multinational call for proposals, the BONUS call 2012, which included both research and innovation parts. Seven research projects already started and 13 innovation projects that are commencing their implementation in the coming month(s) are introduced on pages 4–10. The kick off conference in August will bring all 20 projects together to start mutual communication and create innovative ways of cooperation.

Working within BONUS has been an adventure for the whole community involved, the Steering Committee, the Secretariat, the Advisory Board and the European Commission. It has been learning by doing when building up a new research governance structure, with some unforeseen surprises on the way. It has demanded creativity to find ways to merge eight countries’ and EU’s research money and also a lot of patience in the middle of complicated negotiations. Most rewarding adventure has been to discover the multitude of actors and networks with their own histories, visions, mandates and ways of operation in the Baltic Sea region. In particular, the dialogues of BONUS with HELCOM, EUSSR, BDF, ICES, CBSS, BSSR, BSRP, OSPARCOM, WWF, and many others are extremely fruitful. There is a common understanding that while acknowledging and respecting the differences, finding new ways to collaborate is the way forward and the strength of the Baltic Sea region. In the guest column on page 3, the synergies of ICES and BONUS are further explored by the ICES General Secretary, Ms. Anne Christine Brussendorff.

Most importantly, BONUS is an opportunity. Science-driven joint research programme of all countries surrounding a sea is an opportunity to respond to the need for integration of science into institutional decision making, including policy creation, regulatory enforcement, and adoption of new knowledge as called by the RIO+20 conference on sustainable development. BONUS collaboration has demonstrated that the regional seas approach is the most efficient one for linking science and policy and tackling the grand challenges and threats directed towards our seas. BONUS is open to share its experiences with other regional seas actors and the JPI Healthy and Productive Seas and Oceans.

There always exist risks in pioneering work. For BONUS such risks could be poor performance of the actors involved or loss of interest, vision and commitment. Fortunately these risks have not materialised. All involved actors – the Secretariat, the BONUS Steering Committee and the Call Task Force members representing the participating funding agencies, as well as external Advisory Board members and researchers have been highly committed and worked truly professionally. All this is at the moment assessed by an international BONUS interim assessment panel appointed by the European Commission. The report of this group will be presented to the European Parliament and the European Council in the beginning of next year. We wait to learn about the outcome!
A total of EUR 99.6 million requested by the proposals submitted to the BONUS call 2014: Sustainable ecosystem services

by Meelis Sirendi, Programme Officer, BONUS

A total of EUR 99.6 million was requested by the proposals for future funding of 15 million available for the BONUS call 2014: Sustainable ecosystem services. The total funding committed by the proposals submitted for consideration totalled just over EUR 101 million. By the submission deadline on 16 April 2014, BONUS received 48 proposals with a total of 328 potential partners listed. Two of the BONUS participating states have a total of over sixty partners listed in the proposals submitted. Sweden tops the list (63) and is followed by Finland (61). Also all the other BONUS participating states are well represented: Germany (49), Poland (43), Estonia (32), Denmark (29), Latvia (18), Lithuania (19) as well as Russia which features in total of 5 proposals and participants in BONUS through a bilateral agreement. A total of 6 partners are listed in the proposals submitted from other EU member states and associated countries, including France, Italy, Portugal, Serbia and Slovakia. Finnish partners are coordinating 14 proposals, followed by Sweden and Germany (both 10), Denmark and Poland (both 4), Latvia (3), Estonia (2) and Lithuania (1). All proposals are coordinated by research organisations. The most popular key theme open for this call among the submitted proposals was the theme number 4.2. Linking ecosystem goods and services to human lifestyles and wellbeing (11), followed by 3.2. Effects of air and water pollution by shipping and 4.1. Governance structures, performance and policy instruments (both 10 proposals). Only one proposal was submitted under the theme 3.1. Maritime risk analysis and management. The independent expert evaluators will now commence their work and rank the submitted proposals according to one common ranking list which will be the basis for the funding decision. The outcome of the evaluation of the final proposals will be announced by BONUS in July 2014. The national research funding institutions in the eight EU member states around the Baltic Sea provide half of the funds and the EU Research Framework Programme the other half of the funds of the call.

Towards closer collaboration between the Baltic Sea Region Programme and BONUS

by Andris Andrusaitis, Programme Manager, BONUS

On 19 March representatives of the Secretariats of BONUS and the Baltic Sea Region Programme met to discuss opportunities for closer collaboration in the future. Both programmes see their mission in building prosperity of the Baltic Sea region through better cooperation and more efficient use of new knowledge. While BONUS highlights excellence in research and innovation, its typical beneficiaries are academia and innovative enterprises, the Baltic Sea Region Programme puts more weight on the equally important issue of building the knowledge-up-take capacity and the region wide networking among the actors of knowledge-based development. Besides scientists and innovators, knowledge brokers as well as end-users at different levels of public governance and management are implementers of the Baltic Sea Region Programme’s projects. Nevertheless, many topics addressed by both programmes are similar and hence have room for synergies and adding value to both while reducing the risk of duplication.

Several past and present BONUS projects, such as AMBER, COCOA, ECOSSUPPORT, HYPER, PROBAULT, RECOCA and SOILS-SEA explore the immense challenge of reducing nutrient loads to the Baltic Sea in the context of changing climate. Similar range of issues is addressed by such Baltic Sea Region Programme’s projects as e.g. BALTADAPT, Baltic COMPASS, Baltic Compact, Baltic DEAL, Baltic MANURE, PURE, WATERPRAXIS. The current BONUS call for research projects include themes related to integrated coastal management, maritime spatial planning as well as clean and safe maritime transportation. No doubt, the projects that address these themes will benefit from the achievements and experiences of projects such as e.g. BalticSeaPlan and ParrSEA Pate (maritime spatial planning) or BRISK, Baltic Master II, BSR InnoShip and EfficientSEA (maritime transportation). Moreover, the complexity of the issues of sustainable aquaculture in the Baltic Sea region revealed by the Baltic Sea Region Programme’s projects AQUABEST, AQUAFIMA and SUBMARINER is earmarked for inclusion in the BONUS research and innovation call in the end of 2014. Finally, for the BSR Stars, the close partner in the BONUS innovation call (see BONUS in Brief, November 2012 article by Karin Nygård Skalman), achieved its first stage of the long term goal set from the realisation of the Baltic Sea Region Programme’s project “StartDust”. During the meeting of the two Secretariats, considerations were made of the possibility of requesting applicants of the future BONUS calls to demonstrate complementarity with the relevant Baltic Sea Region Programme’s projects, and equally that the Baltic Sea Region Programme application form and assessment criteria would contain a reference to BONUS. Furthermore, opportunities will be sought for creating joint clusters from the ongoing projects. The topic of cross-programme clustering will be included already in the agenda of the nearest BONUS ‘triple meeting’ of the Steering Committee, Advisory Board and Forum of Project Coordinators, in August 2014. BONUS looks forward to even more opportunities to work together with the Baltic Sea Region Programme 2014-2020 outlined in the new Baltic Sea Region Programme Operational Plan.

BONUS in Brief is published by the BONUS Secretariat to keep the BONUS community, including partners and supporters, informed about current views and news about BONUS activities and accomplishments. BONUS EEG is the legal management organisation of BONUS. © 2014 BONUS Baltic Organisations’ Network for Funding Science EEIG
Teaming up Joint efforts for the Baltic

As well as being BONUS’ eponymous body of water, the Baltic Sea – and its encircling coastal regions – has been a key constituent of the International Council for the Exploration of the Sea’s (ICES) work since the intergovernmental organisation’s inception in 1902, with many of our Expert Groups counting fish stocks there amongst their scientific and advisory dispatches. Whilst the traditional focus on fisheries assessments remains strong, however, much of our recent effort has come to reflect calculated objectives stipulated in ICES Strategic Plan 2014–2018.

Strides are being made beyond traditional territories of marine research and advice, especially those which pave the way towards Integrated Ecosystem Assessments (IEAs) and Understanding. That is, knowing the ocean as the sum of its parts as well as each individual element.

In terms of this integrated approach, ICES and BONUS share a similar outlook for the Baltic ecoregion. Contemporary mutual fields of interest and collaboration on current projects like INSPIRE represent the latest chapter in what we see as the re-establishment of bonds that stretch back as far as the BONUS ERA-NET project following its naissance under the EU’s 6th Framework Programme 2003-2008 and the consequential integration of research initiatives under the Global Environmental Facility’s (GEF) Baltic Sea Regional Project. Then, ICES was charged with managing the Large Marine Ecosystem component as well as building capacity and strengthening institutionally.

History aside, the symbiosis between ICES and BONUS is set for a new era, as exemplified by our respective missions and the corresponding strategic documents in which they are laid down. Moreover, ICES role in recent BONUS’ proposals and cultivation of scientific knowledge, and the criteria behind both our continued drive in the direction of landmark directives like the Marine Strategy Framework Directive (MSFD) – and reaching Good Environmental Status (GES) – align significantly. In short, we are partners set up to face a new frontier of sustainability in the Baltic, which demands studious research across multiple disciplines.

ICES Strategic Plan 2014–2018, developed over two years and adopted by ICES Council last October, charts our course for the half a decade ahead. Tailored in harmony with a rapidly fluctuating marine science policy environment, it pledges to construct a foundation of science around one central challenge: Integrated Ecosystem Understanding.

Comprising four pillars – formulating science, producing advice for decisionmakers, data service reinforcement, and Secretariat support – it is goal 1 of the first pillar that echoes the First Strategic Objective of BONUS’ strategic research agenda 2011–2017 by stating the quest to understand the complexity, structure, and functioning of the Baltic Sea ecosystem. In extension, goal 2 of our plan dictates the need to comprehend the relationship between human activity and the ecosystem, evoking both the nature of integrated research and advice that runs through the plan and also BONUS’ second strategic objective – part of which includes research on the effects of natural and man-induced changes in the catchment land-cover patterns and the reactions of coastal systems to such changes.

This latter objective is also relevant because it relates to producing knowledge on Marine Spatial Planning (MSP) and integrated coastal management. The BONUS project INSPIRE (2014–2018), in a similar vein, will consider spatial elements in order to feed into the ecosystem-based management of the major Baltic fisheries.

In a notable example of the interface between us and BONUS, recently set-up ICES Expert Groups such as the Working Group on Marine Planning and Coastal Zone Management (WGMPCZM), which involves people from social and natural disciplines, can act as a scientific home base for BONUS and its scientists.

The expertise of other Expert Groups may also be enlisted during the most recent BONUS call for proposals (see page 2). ICES Working Group on Resilience and Marine Ecosystem Services (WGRMS) group deals with ecosystem services, its remit having direct ties to BONUS’ ecosystem services call. Importantly also, ICES collaborates with the Helsinki Commission (HELCOM) for Baltic integrated assessment working groups like the ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea (WGIAB). HELCOM brings the bridging of science and policy on board, and our relationship is manifest in stakeholder conferences and applied research. The ICES-BONUS-HELCOM triangle was notably evident during work on the BEAST project (2009–2011).

ICES can also bring its extensive marine databases to the table, and plans to submit data to a common database, one of which is ICES’, should be expressed as part of each BONUS project.

The notion of integration takes on several meanings for ICES. On top of striving to integrate aspects of the same ecosystem, we foster combined assessments between different seas and ecoregions (WGCOMEDa Expert Group, focusing on European Atlantic and European Mediterranean waters, is a prime example).

Meanwhile, founding strategic working alliances to broaden our geographical map – The North Pacific Marine Science Organization (PICES) in the North Pacific, and The Mediterranean Science Commission (CIESM) and The General Fisheries Commission for the Mediterranean (GFCM) in the Mediterranean and Black Sea – help us weave a network of technology and innovation platforms, industry associations, and NGOs to keep us in touch with those who receive our advice and the general public. We are also increasingly involved with projects rooted in academia – an area that can be augmented through the work of BONUS.

With further future participation in stakeholder communications and workshops, including my role on BONUS’ Advisory Board, we hope our organisations can continue cross-pollinating science and strategy, bringing benefits to ICES community as both organisations shape up to support a prosperous future for the Baltic Sea region.
In collaboration with BSR Stars

BONUS call 2012: Innovation

Thirteen innovation projects selected from the BONUS call 2012: Innovation start in spring and summer 2014

by Markku Ranta, Innovation Call Manager, BONUS

The consortia funded from the Innovation part of the BONUS call 2012 are ready to start. In the next few pages the coordinators introduce the projects they will be steering for the next 2 to 3 years. This marks a historical moment for BONUS since this was the first call for proposals focusing on innovation and not only on basic research. This means that the scientific knowledge will be applied to a real world application and typically tested in a live environment using a prototype or pilot installation. As intended, the introduction of the innovation track into the BONUS project portfolio brought number of enterprises taking part in the projects beside scientific community. Typically an industrial partner brings into the consortium competence from the application domain and an insight from the markets and customer’s need whereas the participating research organisations ensure the leading edge scientific level of the project.

The selection process followed rigorously the evaluation guidelines of the EU Research Framework Programme as is stated in the BONUS policies. Independent evaluators from various countries made the ranking list based on the published criteria in the call guidelines and finally 13 projects out of the 33 applications were decided to be invited for project negotiations. There are a total of 32 participants from all BONUS member states and one participant from France. Compared to the projects in the Viable ecosystem part of the call, the innovation projects are relatively small. There are typically 3-4 participants per consortium. The total BONUS funding of this call for the 13 projects now commencing totals seven million euros.

Three themes from the BONUS strategic research agenda were covered in the call as the key themes: eco-technological approaches, in-situ remote sensing and laboratory techniques and information and communication technology for environment, safety and security. The selected projects cover well the key themes and accordingly, we can expect to see results from the projects that address the most critical needs for the health of the Baltic Sea.

Finally, from the experience of this call, a good advice to the applicants of the coming calls is that one good formula for being successful in the BONUS calls is to concentrate on the outcomes of the proposal and demonstrate clearly that these are well in line with the outcomes defined in the BONUS strategic research agenda.

AFISMON

Development of the current Automatic Flow Injection Sampler to monitor microbially driven biogeochemical processes in the Baltic Sea water

by Matthias Labrenz, The Leibniz Institute for Baltic Sea Research Warnemünde

Microorganisms are the driving catalysts of virtually all relevant biogeochemical cycles sustaining life in the ocean, and they respond rapidly also to environmental changes. Thus, microbes and their functional traits may serve as sensitive indicators of environmental conditions. Moreover, determination of microbial metabolic processes is fundamental for the understanding and monitoring of marine ecosystems. Nevertheless, microbes are practically absent from the current monitoring programmes.

Today modern molecular techniques allow monitoring of microbial activities and functions in the environment through the analysis of genes and their transcripts contained in natural microbial assemblages (metagenomes and metatranscriptomes). However, gene transcripts can degrade in less than 30 seconds and it is known that their abundance patterns detected in nature are a challenge to sample because they are subject to considerable modification simply due to sampling procedures. Consequently, already earlier the Leibniz Institute for Baltic Sea Research Warnemünde and HydroBios GmbH developed an instrument called Automatic Flow Injection Sampler (AFIS). The AFIS samples and preserves water directly in the environment, and by this instantaneously conserves the gene expression profile in situ, allowing a reliable evaluation of microbially driven processes based on metatranscriptomics. AFIS is a ship-dependent system designed for use with common conductivity, temperature, and depth (CTD) rosettes.

AFISMON project will now develop the existing AFIS instrument further into an autonomous in situ fixation multisampler for monitoring microbially driven biogeochemical processes in the Baltic Sea water. This system will be able to take, preserve, and store water samples independent of shore at high temporal resolution. The messenger RNA will be conserved directly in the environment, for later reconstruction of metatranscriptomes in the laboratory. In addition to strictly time dependent sampling strategies, the instrument can be connected to sensors (e.g. oxygen, salinity) in situ, enabling an event triggered sampling depending on the scientific question.

Themes covered from the BONUS strategic research agenda

Key theme
5.2 Developing and testing innovative in situ, remote sensing and laboratory techniques

Supplementary themes
1.1 Ecosystem resilience and dynamics of biogeochemical processes, including cumulative impacts of human pressures
1.2 Causes and consequences of changing biodiversity
1.3 Food web structure and dynamics
5.1 Developing and improving scientific basis for integrated monitoring programmes for continuous assessment of ecological status and human pressures

Further information: www.bonusportal.org/afismon

Funders of the BONUS call 2012: Innovation

Coordinator of AFISMON: Matthias Labrenz, HydroBios

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HydroBios GmbH, Kiel

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University of Copenhagen, Helsingør

Sweden
Royal Institute of Technology, Stockholm

Partners in AFISMON:

Academy of Finland
Baltic Marine Environment Research Centre (BASE)
Baltic Marine Biological Centre (Marine BioCenter)
Baltic Marine Environment Research Centre (BALTMAR)
Baltic Sea States Marine Research Institute (BSSMRI)
European Marine Board (EMB)
Environmental Research Institute of Finland (SYKE)
Finnish Institute of Marine Research (FIMR)
German Centre for Marine Biodiversity (GKMB)
German Institute of Maritime Research (GfM)
German Oceanographic Data Centre (GODC)
Helmholtz Centre for Ocean Research Kiel (IFM-GEOMAR)
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The Leibniz Institute for Baltic Sea Research Warnemünde (IOW)
National Institute of Marine Research (NIMR)
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Royal Institute of Technology (RIT)
Swedish National Oceanography Centre (SNOC)
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University of Turku (Turku)
University of Uppsala (Uppsala)
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University of York (York)
Vinnova
Xylomet AB
**ANCHOR**

The captain assistant system for navigation and routing during operations in harbour

By Karol Brzostowski, Astri Polska sp. z o. o. company

**PROJECT PARTNERS**

Poland
Astri Polska sp. z o. o. company (coordinating partner)
Akademia Marynarki Wojennej, Gdynia

Germany
Automotive & Rail Innovation Center, Aachen
RWTH Aachen University, Aachen

France
University of Montpellier 2, Nimes

**Themes covered from the BONUS strategic research agenda**

**Key theme**

5.3 User-driven new information and communication services for marine environment, safety and security in the Baltic Sea area

**Supplementary themes**

2.3 Integrated approaches to coastal management
4.3 Maritime spatial planning from local to Baltic Sea region scale

Further information: www.bonuxportal.org/anchor

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**ESABALT**

Enhanced situational awareness to improve maritime safety in the Baltic

by Robert E. Guinness, Research Scientist, Finnish Geodetic Institute

**PROJECT PARTNERS**

Finland
Finnish Geodetic Institute, Kirkkonummi (coordinating partner)
Furuno Finland Oy, Espoo

Poland
Maritime University of Szczecin

Sweden
SSPA, Gothenburg

**Themes covered from the BONUS strategic research agenda**

**Key theme**

5.3 User-driven new information and communication services for marine environment, safety and security in the Baltic Sea area

**Supplementary themes**

2.3 Integrated approaches to coastal management
3.1 Enhanced, holistic cross-sector and cross-border maritime risk analysis and management
4.3 Maritime spatial planning from local to Baltic Sea region scale

Further information: www.bonuxportal.org/esabalt

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ANCHOR's aims are to deliver a tool « Captain Assistant for Navigation and Routing during Operations in Harbour » in order to analyse the influence of the cargo vessels’ traffic on the coastal area of the Baltic harbours and to increase the safety of ships movement inside the harbour.

The system is directed to the professionals responsible for supervising the safety (both people and environment) in the coastal area of harbours. The system will improve the safety of people working in harbours and on incoming (docking) ships, while providing also a possibility to monitor the influence of traffic, the mass and dimensions of the ship and the coastal environment. All the data will be stored and merged with Copernicus’, GIS data and made accessible through the internet. In order to fulfil the potential end-users needs the ANCHOR system will deliver a network of precise local environment measurements as well as an innovative observation and traffic management system. It aims to assure access to the environment monitoring data, increase port efficiency and safety in harbour areas while also developing reliable positioning and navigation system.

In essence, ANCHOR will comprise a system that includes an Internet platform for GIS, GMES and local measurements data sharing and exchange, guidance module based on detailed maps of reliable, safe and environment efficient routing to the destination pier (or to the open sea), harbour server for analysing and graphical visualisation of the data, an environment measurements network to assure accurate data on weather and water conditions, ship module for precise localisation and orientation solution and pilot software for visualisation and analysis of all the data needed. Finally, a wireless communication link for reliable and fast data transmission between all these different stations will be established.

This system will be the innovative combination of its different parts. By guiding the quickest and most effective track to the pier, time and fuel will be saved significantly, which translates to major reductions in cost and CO₂ emissions. Finally, due to the tracking and evaluation of environmental sensors-data, the environmental footprint of each ship can be followed, analysed and assessed.

1 GMES finished in October 2013. Its successor is Copernicus.
FERRYSCOPE

Bridging the divide between satellite and shipborne sensing for Baltic Sea water quality assessment

by Martin Böttcher, Brockmann Consult GmbH

The FERRYSCOPE project aims at strengthening the link between in-situ and remote observations for regionally valid optical monitoring in the Baltic Sea as a technique for cost-effective monitoring as required by the EU’s Water Framework Directive and Marine Strategy Framework Directive. FERRYSCOPE uses optical measurements from ships of opportunity, notably ferries, to improve the accuracy of Earth Observation products. Automation of measurement technology, a major driver of cost reduction, can be achieved for a number of indicators of ecosystem health. The sensor systems behind such methods are preferably based on optics due to low maintenance costs, and should combine both space borne Earth Observation and in-situ platforms for optimal spatial coverage. The data processing of both in situ and Earth Observation data require expert knowledge. When their results are not in agreement, both platforms are at risk of losing the trust of their user base. To address uncertainties inherent to either observation strategy, we need to readjust how the data are accessed and used, and allow straightforward identification of respective data to improve product confidence. Modern data processing techniques allow on-the-fly data assimilation from whole archives of voluminous observation data, and can enable users at all levels of expertise to use the available archived and near-real time observation to their full potential. Such systems still need to be designed for water quality monitoring systems. Due to its optical complexity and the presence of an extensive ship-based observation network the Baltic Sea is a perfect candidate for testing this approach.

FERRYSCOPE addresses the in-situ data framework, development of methods and algorithms, system development, and service deployment. The in-situ data framework will develop automated acquisition, processing, quality flagging, and near-real time transfer of the optical data. The methods and algorithms for retrieval and assimilation will be implemented as data processors of a processing system. Service deployment includes interaction with users and stakeholders that are interested in the results of the project, as well as the provision of the service for a defined time.

PROJECT PARTNERS

Germany
Brockmann Consult GmbH, Geesthacht (coordinating partner)

Finland
Finnish Environment Institute, Helsinki

Estonia
Estonian Marine Institute, Tartu

Further information: www.bonusportal.org/ferryoscope

FISHVIEW

Assessing fish passages by the use of a robotic fish sensor and enhanced digital imaging

by Maarja Kruusmaa, Tallinn University of Technology

The life-cycle of the migrating fish, e.g. sea trout and salmon, depends on environmental conditions in the Baltic Sea and its connecting rivers. Migrating fish swim up to the rivers to their spawning grounds and their life-cycle depends heavily on the passage from the sea to the river and back to the sea again. At the same time, rivers are also key areas of intense human activity and establishing favourable environmental conditions for migrating fish has proven to be a challenging task. Particularly complex are the areas around hydropower plants where especially constructed passes provide a route for fish to reach the spawning grounds. However, currently majority of fish passes are non-functional or at best only partially accessible for a limited number of fish species. Non-functional fish passes are both an economical and ecological problem. Money spent on non-functional fish passes by hydropower companies and government agencies is a direct economic loss in addition to fines paid for violating the EU regulations or non-compliance. Naturally, it also has profound effects to the sustainability of the migrating fish species and therefore the whole ecosystem.

Designing a fish pass is often a trial and error process and there are currently no accurate methods for measuring, modelling, and predicting the effectiveness of a wide variety of hydraulic structures used to improve fish passage. Therefore, the main goal of this work is to provide a robust methodology to improve fish passage in the river basin of the Baltic Sea.

FISHVIEW uses a novel approach to give researchers the “inside view” of a river pass. We design a device which detects water flow similarly to the lateral line sensing organ of fish. This device will be immersed in river passes and records the signals in the flow. The signals will be then analysed with methods of image analysis. When we compare the flow patterns of both functional and non-functional fish passes, we are hoping to tell the difference between them and, from a fish’s point of view, learn why functional fish passes are perceived differently from non-functional ones. This method will then be used to design new fish passes by using the flow information in computer simulations. Ultimately, we hope to learn more about how to build fish passes in the future that migrating fish will use.

PROJECT PARTNERS

Estonia
Tallinn University of Technology (coordinating partner)

Finland
Tampere University of Technology

Germany
Ecohydraulic Engineering GmbH, Stuttgart

Further information: www.bonusportal.org/fishview

Themes covered from the BONUS strategic research agenda

Key theme
5.2 Innovative measurement techniques

Supplementary themes
1.2 Causes and consequences of changing biodiversity
2.1 Natural and human-induced changes in catchment land cover patterns, including the role of e.g. agriculture, forestry and urbanisation

Further information: www.bonusportal.org/fishview
Harvesting coastal radars for environmental monitoring purposes

By Mikko Lensu, Finnish Meteorological Institute

Coastal radars are used to maritime surveillance but can also provide a cost-effective way to monitor coastal sea environment. This can be realised with an independent radar server that captures the radar signal and rasterises an image suitable for environmental purposes. This is done once per radar revolution, generating one thousand images per hour, and does not interfere with the normal use of the radar in any way. The Finnish Meteorological Institute (FMI) has presently radar servers at three locations: at Tankar and Haibuo-to in the Bay of Bothnia, and at Uto in the southern archipelago. About thirty preprocessed images per hour are sent to the FMI and presented as real-time animations on a website. The images have been optimised for the detection of ice cover features that can be seen to 20 km distance from the radar. The main end-users have been icebreakers that can follow the opening and closing of coastal leads and avoid difficult ice areas. The images are also used for various research purposes and combined with other monitoring data.

The HARDCORE project develops the capabilities of the radar servers further and seeks to expand the monitoring network. New servers are installed to three coastal radars in Finland, Estonia, and Poland. The new server software allows the rastering of several images at the same time, each with its own parameters. The images target different ice types and also open water phenomena, especially the determination of wave parameters and the detection of oil slicks. The servers will be able to also store large amounts of unprocessed radar data from which the images are rasterised. The development work is based on campaigns combining field measurements with the collecting of unprocessed radar data. The unprocessed data can then be replayed in laboratory when the new rasterising algorithms are developed and tested.

The development phase lasts two years. During the third year stakeholders, customers, and end-users are actively contacted. There are about sixty coastal radars in Finland only and an almost complete real-time monitoring of coastal and archipelagic waters would be possible with moderate investment costs. There is also a large potential market for the developed system, which can also be used on board ships especially in Arctic waters.

Further information: www.bonuportal.org/hardcore

PROJECT PARTNERS

Finland
Finnish Meteorological Institute, Helsinki (coordinating partner)
Image Soft Oy, Helsinki
Finnish Transport Agency, Helsinki
Estonia
Marine Systems Institute at Tallinn University of Technology
Poland
Institute of Meteorology and Water Management – National Research Institute, Warsaw

Themes covered from the BONUS strategic research agenda
Key theme
5.2 Innovative measurement techniques
Supplementary themes
2.2 The role of the coastal systems in the dynamics of the Baltic Sea
3.1 Maritime risk analysis and management
5.1 Developing and improving scientific basis for integrated monitoring programmes for continuous assessment of ecological status and human pressures

Further information: www.bonuportal.org/hardcore
**MICROALGAE**

Cost efficient algal cultivation systems – a source of emission control and industrial development

By Arvo Iital, Tallinn University of Technology

The MICROALGAE project sets out to provide innovative solutions for the use of microalgae cultivation systems for nutrients’ and micro pollutants’ removal in wastewater treatment coupled with biogas production. Differently to previous studies, MICROALGAE research aims to identify a number of potential wastewaters to be treated by an optimal microalgae composition against them in order to define cost efficiency conditions for an industrial process. Several policies and management measures have been in force to reduce nutrient and pollution runoff from diffuse and point sources in the Baltic Sea region. Many of the measures have shown positive impacts on recipient water bodies including the Baltic Sea and biodiversity recovering, however, at a cost of commercial and socioeconomic efficiency.

The production of clean water and biogas by using nutrients as inputs through a novel biotechnological process not only promises a reduction of private industrial costs but also environmental and social net benefits. The implementation of microalgae cultivation systems will have large positive impacts on the improvement of aquatic ecosystems allowing a market solution to optimal emission control on both diffuse and point pollutant sources. Allocating abatement measures by an economic incentive and simultaneously allowing industrial development in the Baltic Sea region may significantly reduce the cost of emission control and eutrophication while increasing the supply of renewable energy.

MICROALGAE will take into account the spatial distribution of nutrients arising from intensive agricultural, industrial and municipal wastewaters and screen the selected wastewaters against a number of microalgal species and consortia, in order to determine the best species/wastewater combinations. The screening will be performed using an innovative method based on microplates that allows testing of hundreds of different conditions at the same time, minimising the time of the analysis. The capacity of nutrient and micro pollutant uptake of the microalgae composition is subsequently used in the production of biogas. The most advantageous microalgae cultivation systems for wastewater treatment and biogas production will be chosen for the scaling up of an industrial process.

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**OPTITREAT**

Optimisation of small wastewater treatment facilities

By Heléne Ejhed, IVL Swedish Environmental Research Institute

Onsite wastewater treatment is of great concern due to the load of phosphorous and nitrogen contributing to the eutrophication of the Baltic Sea. According to the HELCOM’s Fifth Baltic Sea Pollution Load Compilation, scattered dwellings contribute to about 15% of the anthropogenic nitrogen and phosphorous load to the Baltic Proper. To inland water bodies the contributions may locally be even larger. The load of hazardous substances is of further concern. Although there are numerous facility alternatives on the market, reduction of hazardous substances has been sparsely investigated. However, onsite wastewater treatment facilities are relatively cheap constructions and when optimised to mitigate wastewater pollution could offer cost-efficient wastewater treatment. In remote areas, onsite wastewater treatment is the only alternative. Sanitation is a world-wide issue of high priority due to increasing lack of water of good quality with growing health problems as a consequence.

In order to avoid new emerging problems of micropollutants, such as pharmaceuticals and antibiotic resistant bacteria due to insufficient wastewater treatment, OPTITREAT aims at holistic optimisation of treatment of macro- and micropollutants of the techniques for small wastewater treatment facilities. OPTITREAT promotes development and optimises the efficiency of small wastewater treatment systems techniques already available on the market in the Baltic Sea region. Tests for holistic assessment of reduction efficiencies of nutrients, pathogens, pharmaceuticals, personal care products and antibiotic resistant bacteria will be performed in laboratory batch experiments and on three types of techniques applied in small wastewater treatment facilities. Testing parameters, e.g. pH, redox, temperature, adsorption capacity and texture in filter bed, will be chosen together with manufacturing SMEs - associated partners of the project. In addition, over 200 earlier facility test results will be included in a benchmarking synthesis of optimisation of reduction efficiencies. Policy tools and examples of good practice of the maintenance of the facilities will be explored. The project will transfer the knowledge to SMEs and governmental stakeholders at a dialogue forum.

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**PROJECT PARTNERS**

**MICROALGAE**, Arvo Iital

- **Estonia**
  - Tallinn University of Technology (coordinating partner)

- **Denmark**
  - Technical University of Denmark, Kgs. Lyngby

- **Sweden**
  - SocEco Analysis & Education, Helsingborg

**OPTITREAT**, Heléne Ejhed

- **Sweden**
  - VIVI Swedish Environmental Research Institute, Stockholm (coordinating partner)
  - Association of the Swedish Municipal Wastewater Authorities
  - The Swedish National Test Centre for Waste Water Technology

- **Germany**
  - Development and Assessment Institute in Waste Water Technology, RWTH Aachen University

- **Poland**
  - The Institute for Ecology of Industrial areas, Katowice

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**Fifth Baltic Sea Pollution Load Compilation**

The contributions to Baltic Sea pollution runoff from diffuse and point sources have been sparsely investigated. However, onsite wastewater treatment facilities are relatively cheap constructions and when optimised to mitigate wastewater pollution could offer cost-efficient wastewater treatment.

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**Further information**

- www.bonusportal.org/microalgae
- www.bonusportal.org/optitreat
PROMISE
Phosphorus recycling of mixed substances
by Ella Turtola, MTT Agrifood Research Finland

In the project PROMISE, differently treated organic and recycled phosphorus fertilizers will be studied for their beneficial as well as for their harmful properties. PROMISE will convey backbone data on potentially hazardous contaminants and thereby further assess strategies for phosphorus fertilization that can acknowledge food safety and food security in future.

Phosphorus is essential for all living organisms, but its global reserves are finite and expected to diminish severely in the next 50 to 100 years. Neglecting this, losing large quantities of phosphorus is a common practice as anthropogenic wastes are co-incinerated, dumped and rejected from recycling, and animal manures are excessively applied to arable land in areas of concentrat-ed livestock production. Current-ly mining of primary phosphorus reserves adds further pressure to the agricultural phosphorus cycle as inorganic fertilizers are used to substitute the poorly functioning re-use of organic materials containing phosphorus.

Consequently phosphorus is leached from soils, and agriculture has become the largest contributor to the non-point phosphorus load in the Baltic Sea region. This controversial situ-ation with present phosphorus-induced eutrophication against its future scarcity can be resolved only by better recycling from urban and agricultural organic wastes. The valuable phosphorus must be conserved, instead of dumping, by processing the materials further and making them suitable for recycling. In order to produce safe, recycled fertilizers, handling and treatment proce-dures of waste need to be im-proved and implemented as the current phosphorus-rich material may still contain significant amounts of organic contami-nants, heavy metals and patho-gens. Unless proper research of the possible risks these contami-nants may constitute a major ob-stacle for the agricultural use of recycled fertilizer products.

In PROMISE, mono-incinera-tion together with successive pro-cessing is taken as one example of a possible way to ensure a full recovery of phosphorus in a safe fertilizer product. PROMISE proj-ect thus paves the way for a funda-mental adoption of advanced fertilizer practices in the Baltic Sea region that allows phospho-rus recycling, cuts its dumping and excessive use, and ultimately lead to marked reduction in the non-point phosphorus load to the Baltic Sea region.

Further information: www.bonusportal.org/pinbal

PINBAL
Development of a spectrophotometric pH-measurement system for monitoring in the Baltic Sea
by Gregor Rehder, Leibniz Institute for Baltic Sea Research Warnemünde

The overarching scientific objective scope of PINBAL is the development of a technology for high quality, low maintenance, long-term traceable measurements of pH on various platforms, which are, or could be, integrated into the Baltic Sea monitoring for the next decades. This will be realised in an environmental range of operation covering mostly all water bodies of the Baltic Sea. PINBAL is a direct response to requirements formu-lated within the EU Marine Strategy Framework Directive, where pH is explicitly mentioned as a mean to quantify marine acidification.

The pH of seawater is a key variable of the marine acid/base system. High precision meas-urements of pH in combina-tion with other parameters are invaluable to fully describe the marine CO2 system, to study biogeochemical processes, and to trace ocean acidification. De-spite the recognised importance of pH, a standard procedure for long-term and comparable pH-measurements with high acu-racy and precision has not been established, as this has been ham-pered by the use of different pH-standards and problems with probe calibration. Furthermore, assessing pH in brackish water systems like the Baltic faces particular methodological challenges due to e.g. the large salinity and pH range encountered, the occurrence of hydrogen sulphide in an-oxic waters, and varying content of terrigenous organic material.

The standard lab technology, i.e. potentiometric pH-detection with electrodes, does not meet most of the scientific requirements. Alter-native spectrophotometric meth-ods using pH-sensitive dyes have shown promise in an open ocean environment, but are not proven to be applicable in the Baltic Sea with its large range of environmental conditions and perturbations en countered.

PINBAL will fulfil the funda-mental chemical work, system/software design and field testing to realise a prototype of a spectrophotometric pH-measurement system for underway measure-ments from research vessels and ships of opportunity, as well as for the pH-determination of discrete seawater samples. The empha-sis is placed on the identification of the measurable pH-range and the determination of the effects of potential perturbations typical for the Baltic and other brackish water systems.

Further information: www.bonusportal.org/pinbal

PROJECT PARTNERS
Finland
MTT Agrifood Research Finland, Jokioinen (coordinating partner)

Germany
Julius Kühn-Institut, Quedlinburg
Outotec GmbH, Oberursel

Sweden
National Veterinary Institute, Uppsala

Themes covered from the BONUS strategic research agenda

Key theme
2.4. Eco-technological approaches

Supplementary themes
2.1. Natural and human-induced changes in catchment land cover patterns, including the role of agriculture, forestry and urbanization
2.2. The role of the coastal systems in the dynamics of the Baltic Sea
**SWERA**

**Sunken wreck environmental risk assessment**

By Jorma Rytkönen, Finnish Environment Institute

SWERA provides a new approach towards better understanding of the pollution threat by sunken ships. The innovative approach combines the theoretical risk assessment method with an oil removal risk tool. The novel salvage support tool will further advice technicians and salvage operators to design a safe and economically feasible way to work close to the sunken wreck, and to execute successful operations.

There are more than 8 500 sunken wrecks around the world with some amount of oil onboard. Also Baltic Sea waters hide numerous wrecks and alone off the Finnish coastline there are hundreds of wrecks with oil onboard. Similarly in Swedish waters significant amount of wrecks are known with oil onboard. In addition, sunken ships pose environmental risks close to the Estonian coastline. Many of these ships are already in such age, where corroded steel plates will let oil penetrate through the hull, thus causing a continuous source of pollution. Moreover, each wreck is a subject to specific environmental characteristics, which jointly with the wreck’s own condition, will complicate evaluating the risk of pollution.

SWERA will study and combine the existing national wreck statistics and validate the model against measured data including both environmental parameters and ship wreck data parameters from the case studies. It will also extend the model work to include the risk assessment of different salvage operation alternatives and develop novel risk approach to give an understanding whether the wreck should and could be salvaged or not. Finally SWERA sets out to develop also innovative technological solutions for wreck monitoring, oil removal operations with principal design drawings to manufacture and test the novel tools in field operations.

A sunken wreck identified by side scan sonar (Finnish Border Guard)

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**ZEB**

**Zero emissions in the Baltic Sea**

By Fredrik Norén, IVL Swedish Environmental Institute

ZEB proposes a concept of zero emission for oily water discharge from ships in the ecologically sensitive Baltic Sea. The goal is that ships, ideally, will clean the oily water that is produced in the ship and reuse it as far as possible. The harmful waste material will be sent to ordinary treatment at land. The project focuses on separation of oily water and development of existing technologies. Can oily water be used on-board after efficient treatment instead of discharging to the sea? The project will also study occupational safety for the crew when working with reused oily water. Zero emission term has been coined for zero tail-pipe emissions from land vehicles but is also used for the total reduction of harmful waste fluids from ships.

The Baltic Sea is known to be an extra sensitive area for pollution with shipping as one contributor, among several others, to environmental pollutants in the Baltic Sea with SO₂, NOₓ and oil emissions. The shipping industry has done large improvements in the last 30 years in minimising oil pollution from ships by the regulations of the International Maritime Organization which regulates pollution by oil in the International Convention for the Prevention of Pollution from Ships that entered into force in 1983. Today ships are prevented to discharge bilge water with an oil content exceeding 15 ppm (parts per million).

The other goal of the project is to find out how environmentally harmful a discharge of 15 ppm oil is. Only a few studies have followed up the International Maritime Organization’s regulation after its implementation in the 1980’s – could it be that 15 ppm oil is too harmful for the fragile ecosystem of the Baltic Sea? ZEB sets out to assess the ecological risk related based on field and laboratory measurements.

The zero emission concept was initially proposed by the company Wärtsilä which wanted to take their existing bilge water treatment systems one step further and investigate the possibility of re-using the treated bilge water. This is a natural step forward for Wärtsilä in their development of environmental products. And it is also a natural step for the work of reaching a cleaner Baltic Sea.

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**PROJECT PARTNERS**

**SWERA**

Finland
- Finnish Environment Institute, Helsinki (coordinating partner)
- Affons Håkans Ltd, Turku

Estonia
- Marine Systems Institute, Tallinn University of Technology

Sweden
- Chalmers University, Gothenburg
- IVL Swedish Environmental Institute, Stockholm (coordinating partner)
- Wärtsilä AB, Gothenburg
- University of Klaipeda, Marine science and technology centre

**Themes covered from the BONUS strategic research agenda**

**Key theme**
2.4 Eco-technological approaches to achieve good ecological status in the Baltic Sea

**Supplementary themes**
1.4 Multilevel impacts of hazardous substances
3.1 Maritime risk analyses and management
3.2 Effects of air and water pollution by shipping
5.1 Developing and improving scientific basis for integrated monitoring programmes for continuous assessment of ecological status and human pressures

Further information: www.bonusportal.org/swera

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**ZEB**

Sweden
- IVL Swedish Environmental Institute, Stockholm (coordinating partner)
- Wärtsilä AB, Gothenburg
- Finnish Border Guard

Finland
- Wärtsilä Oy, Helsinki

Lithuania
- University of Klaipeda, Marine science and technology centre

**Themes covered from the BONUS strategic research agenda**

**Key theme**
2.4 Eco-technological approaches

**Supplementary themes**
1.4 Multilevel impacts of hazardous substances
3.1 Enhanced, holistic cross-sector and cross-border maritime risk analysis and management
3.2 Assessing the effects of air and water pollution and introduction of energy by shipping activities on the marine environment and integrated water management in harbours

Further information: www.bonusportal.org/zeb
Dead zones have increased in the Baltic Sea by more than 10 times in the last century

Based to a considerable extent on the work and results of the BONUS+ project HYPER (implemented 2009-2011, www.bonusportal.org/hyper), an international team of scientists report that the low oxygen zone has increased by a factor of 10 times over the last 115 years. It has grown from about 5,000 km² in 1900 to more than 60,000 km² in recent years. The Baltic Sea has the largest human induced low oxygen zone (dead zone) in the world. But how did it develop and what are the causes?

Scientists have developed a new method to use sparse data on oxygen concentrations to determine oxygen trends in the Baltic Sea over the last century. An international team of scientists report that the low oxygen zone has increased by a factor of 10 times over the last 115 years. It has grown from about 5,000 km² in 1900 to more than 60,000 km² in recent years.

Professor Daniel Conley at Lund University, together with other researchers examined historical oxygen levels in the deep waters of the Baltic Sea. The study is published in the latest issue of the journal Proceedings of the National Academy of Sciences, and analyzes the different processes that affect oxygen concentrations in bottom water.

“While we have known that deeper parts of the Baltic Sea have a lack of oxygen, with our new approach we were able to separate the effects of climate, saltwater inflows and nutrients” said Dr. Daniel Conley. “We show that nutrient inputs are the primary cause of the severe hypoxia situation we have today. We also see indications of higher deep water temperatures in recent years that may have had an additional effect.”

Sufficient oxygen in bottom waters is necessary for a well-functioning healthy ecosystem with less algal blooms in the water. Scientists attribute the increase in hypoxic areas to elevated nutrient levels from the use of fertilizers, large animal farms, the burning of fossil fuels, and effluents from municipal wastewater treatment plants. The lack of oxygen leads to the death of organisms that live on the bottom.

“Politicians from around the Baltic Sea must immediately implement the national reductions for nutrients that have been agreed upon in the Baltic Sea Action Plan. If actions are postponed further, the situation in the Baltic Sea will continue to worsen,” he adds.

Link to the article in Proceedings of the National Academy of Sciences: www.pnas.org/content/early/recent

Daniel Conley is a Professor at the Department of Geology (Geologiska institutionen) at Lund University. He is also the Vice-coordinator of the BONUS project BACC. (dead zone) in the world. But how did it develop and what are the causes?

The BONUS+ project HYPER (2009–2011) scientists collecting marine sediment samples.

From the members of the BONUS Advisory Board:

Baltic Earth is up and running

Baltic Earth, the new research and outreach network in the Baltic Sea region and successor to BALTEx, was launched at the last BALTEx Conference in Öland, Sweden in June 2013. The Baltic Earth Interim Science Steering Group (chaired by Markus Meier of SMHI and Stockholm University) consists of young scientists from the various disciplines relevant for Baltic Sea Earth system science, and from various institutions around the Baltic Sea. A permanent group will be installed in June 2014. Specific interdisciplinary research challenges have been formulated to be approached by the new programme in the coming years, spanning from salinity dynamics, sea level change, water and energy fluxes and extreme events to biogeochemistry. The human impact shall be a special focus of the programme, and scientific assessments of particular research topics shall identify knowledge gaps and research needs in the future. In this respect, Baltic Earth could be complementary to the BONUS programme. Education and outreach activities shall play a strong role in the new programme. For more information, see www.baltic-earth.eu.

BACC Initiator Hans von Storch receives Baltic Sea Award 2014

The Baltic Sea Fund (www.oestersjofonden.org) has awarded this year’s award to Professor Hans von Storch of Helmholtz-Zentrum Geesthacht, Germany. The award was granted for “… an exemplary contribution to compilation of fragmentary information and knowledge into a comprehensive picture of the impact of climate change in the region”. As such, the prize indirectly also acknowledges the efforts of the BACC community of almost two hundred scientists from various disciplines and institutions around the Baltic Sea who have contributed in compiling the scattered information on regional climate change in 2008 and 2014 (to be published later this year).
Later, the first seven research projects worth EUR 26 million were announced for funding. Also during the period, the first thirteen innovation projects worth a total of EUR 7 million were invited for negotiations (introduced on pages 4–10), and the first review and update of the BONUS strategic research agenda was carried out. Published in early days of January 2014, it now underpins the BONUS calls opening in 2014, the sustainable ecosystem services which closed on 16 April and the combined research and innovation call planned to open in the latter part of this year.

All publications can be viewed at www.bonusportal.org/ publications and hard copies ordered by emailing to bonus@bonuseeig.fi

### New BONUS publications

- **AMBIO Special Issue: BONUS+ in Support of the Ecosystem Approach to Management in the Baltic Sea** provides a synopsis of the results of the policy-driven and multidisciplinary BONUS+ programme 2009–2013. BONUS+ provides the current top research about the state of the Baltic Sea system for the policymakers and other end users with a stake in the ecosystem approach to management in the Baltic Sea. Published in OPEN ACCESS, downloadable from Springer, AMBIO Volume 43, Issue 1, February 2014.

- **BONUS review 2012–13** summarises key activities and achievements of the first 15 months of implementation of the BONUS programme. During the period, the first call based on the BONUS strategic research agenda was opened and a year later, the first seven research projects worth EUR 26 million were announced for funding. Also during the period, the first thirteen innovation projects worth a total of EUR 7 million were invited for negotiations (introduced on pages 4–10), and the first review and update of the BONUS strategic research agenda was carried out. Published in early days of January 2014, it now underpins the BONUS calls opening in 2014, the sustainable ecosystem services which closed on 16 April and the combined research and innovation call planned to open in the latter part of this year.

### Calendar of events

- **12–16 May 2014**
  - Baltic Sea journalist week, Helsinki and Turku, Finland
  - BONUS session, Friday 16 May, 9:00-11:00 during the Ministry for Foreign Affairs of Finland hosted international, Baltic Sea themed week for journalists invited from the Baltic Sea coastal countries.

- **19–20 May 2014**
  - European Maritime Day 2014, Bremerhaven, Germany
  - BONUS exhibition stand number A04 on the innovation call organised jointly with the EUSBSR flagship project BSR Stars, including the announcement of 13 new innovation projects, stand number A04, open until 15:00, Tuesday 20 May. Let’s make it really blue – Sustainability, capabilities and business opportunities in the Northern European seas workshop by BONUS and City of Turku, Venue: Kaisani Saal, Tuesday 20 May, 9:00-10:30.

- **3–4 June 2014**
  - Annual Forum of the EU Strategy for the Baltic Sea Region and Baltic Development Forum, Turku, Finland
  - BONUS co-organised parallel work stream: Successful cooperation: research, development and innovation as a follow-on from the Plenary 5: The Soft Power of the Baltic Sea Region – Foundation for Smart Growth, Wednesday 4 June 2014, 14:00–17:00.

- **26–27 August 2014**
  - Kick-off conference of the BONUS projects starting in 2014, Riga, Latvia
  - A joint conference for the twenty BONUS research and innovation projects commencing their implementation during 2014 that have been funded from the BONUS call 2012 and Annual ‘triple meeting’ of the BONUS Steering Committee, Advisory Board and Forum of Project Coordinators, Riga, Latvia (27 August)

### BONUS members

**Denmark**
- Danish Agency for Science, Technology and Innovation
- Danish Council for Strategic Research

**Estonia**
- Estonian Research Council

**Finland**
- FROI Coop & Academy of Finland

**Germany**
- Forschungszentrum Jülich Beteiligungsgesellschaft mbH & Federal Ministry of Education and Research
- Latvian Academy of Sciences & Ministry of Education and Science of the Republic of Latvia

**Lithuania**
- Research Council of Lithuania & Ministry of Education and Science of the Republic of Lithuania

**Poland**
- Foundation for the Development of Gdańsk University
- National Centre for Research and Development & Ministry for Science and Higher Education

**Sweden**
- Swedish Agency for Marine and Water Management
- Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning FORMAS
- Swedish Environmental Protection Agency

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