ISTOCK

BONUS 10 years
For the Baltic Sea and beyond

BONUS
SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

briefing
number 27
MAY 2017

CONTENTS

Insights into BONUS successes: 10 cases from a 10-year journey

1. BONUS seeks for societally acceptable solutions

The importance of including socio-economic sciences into the Baltic Sea research ensemble has been understood only recently - the number of socio-economists in the Baltic Sea research groups is still relatively small, but collaboration amongst those involved is increasing and intensifying. BONUS, the policy-driven Baltic Sea research and development programme, has an instrumental role in this development.

The comparison of developments of scientific publications in different research subjects before BONUS (2002–2008, PRE-BONUS) and BONUS (2009–2016) shows that the relative increase is highest in multidisciplinary sciences (increase 1654 %) and, in particular, social sciences (increase 512 %). Comparison between published articles outside (NON-BONUS) and within BONUS during the equal period (2009–2016) confirms that the positive development is mainly attributable to BONUS (difference 339 %)(see BONUS briefing 26).

The underlying reason for such a surge of including socio-economic sciences across the Baltic Sea research stems from the necessary focus on stakeholders' - ultimately the taxpayers' and voters' - awareness, perceptions and priorities. In research, it is no longer just about marine ecosystems structure, functioning and vulnerability. Instead, it is only by adopting multi- and interdisciplinary research approach that enables the understanding of complex interactions and interdependencies of the environmental conditions and processes,

multiple uses of marine resources and the economic causalities.

Monika Stankiewicz, General Secretary of the Baltic Marine Environment Protection Commission, HELCOM noted recently that *"Environmental management action must be accepted broadly in the society. Only then it is possible to improve the governance and the stewardship of the Baltic Sea issues. Sustainability of the goods and services provided by the sea and its good environmental status is for every citizen's benefit"*.

As the very reason of establishing BONUS was to respond effectively to the major environmental and key societal challenges in the Baltic Sea region, the supportive role of BONUS in the region's ecosystem-based management action will continue to stress interdisciplinarity of the research it funds. This way BONUS can create the scientific basis for well-informed decision making, and support reaching of the sustainable development goals determined by the United Nations.

2. BONUS process is a strong model of European integrated approaches

Today, BONUS, the policy-driven joint Baltic Sea research and development programme, is the first and only funding and programming initiative encompassing both marine and maritime research. The eight BONUS member states have aligned their national marine strategies with BONUS and are funneling their programmatic research funding through the BONUS programme. The basis for this strong integration, the dynamic BONUS strategic research agenda process, dates back over a decade. It sets the backbone for the BONUS programme's aim of ensuring that the knowledge produced is at all times fit-for-purpose and well communicated to those who really need it.

It is also the intensity in which the agenda takes into account future demands that sets it apart from many other agendas. Through regular, transparent updates that have involved hundreds of policymakers and other stakeholders across the entire macro-region, the current version of the agenda dates to January 2014. The five strategic objectives deal with ecosystem, coast and catchment area, marine goods and services, societal responses, and observation and data management in the Baltic Sea region. Based on a total of 19 themes corresponding with these objectives, BONUS has opened 4 competitive calls and funded (by mid-2017) a total of 40 top science and innovation projects worth close to EUR 100 million.

The BONUS strategic research agenda *process* is above all systemic: a decade ago it focussed on the Baltic Sea ecosystem, and then it expanded to cover the land-coast-sea continuum and brought in the innovation element. In 2013, a comprehensive policy framework analysis mapped over 80 EU and international policy developments sharpening the policy relevance of the BONUS programme further prior the agenda's 2014 update was completed and published.

Now when facing the future, the programme is focusing on the challenge of sustainable development when responding to the EU growth strategy: BONUS is underpinning national and EU policies, but also increasingly contributing to sustainable blue growth and related EU strategies. A proposal "Towards sustainable blue growth" was put forward to the Commission, and it outlines the formulation of a joint northern European regional seas programme for years to come.

At the start of BONUS, Lena Ek of the European Parliament noted: "*BONUS deserves special attention as a valuable, forward-looking model for other forms of future regional research cooperation with common European value, such as those of the Danube, the Mediterranean Sea and the North Sea*". Through the agenda *process* that BONUS has developed, its journey on this forward-looking path a decade later continues.

3. Solid scientific evidence help politicians to make smart decisions

More than 300 researchers from the 28 ongoing (or recently completed, and excluding the 12 'BONUS call 2015: Blue Baltic' projects starting in April-July 2017) BONUS projects are participating in different policy-related committees, amongst other in 24 HELCOM, 75 ICES and 18 European Commission led working groups. These and other channels enable BONUS scientists to actively communicate projects' results directly to end-users and other stakeholders with a vested interest in the protection action of the Baltic Sea.

While BONUS projects stress the importance of active participation in different working groups and/or projects, opportunities for optimal and timely uptake of relevant project results by the decision makers are manyfold:

Results of BONUS BAMBI, BIO-C3, BLUEPRINT and COCOA projects are contributing to the development of indicators and associated definitions of good environmental status (GES) for eutrophication, biodiversity and hazardous substances in the **HELCOM State and conservation working group.** This group works across the monitoring-indicators-assessment chain in order to provide a stronger basis for coordinated development of the HELCOM thematic assessment tools and a coherent holistic assessment of the ecosystems health, including Baltic Sea Pressure Index and Impact Index.

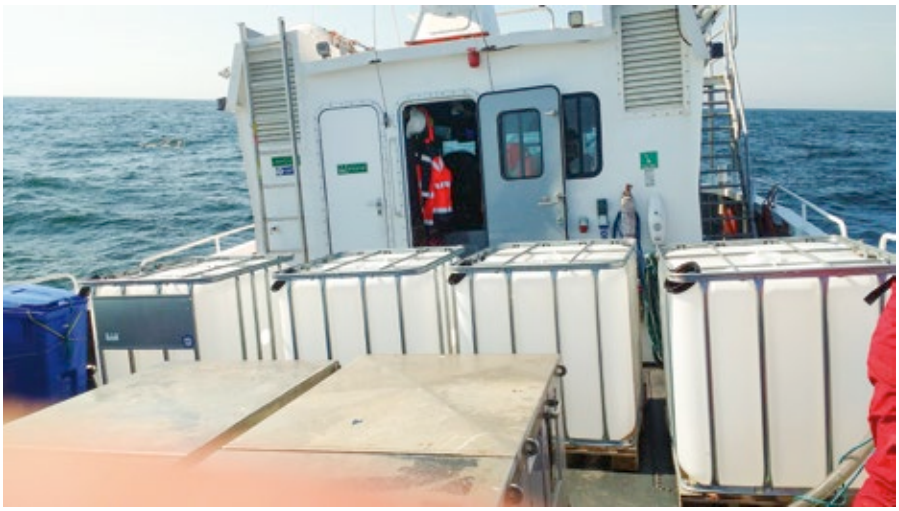
BONUS BALTICAPP, COCOA and SHEBA projects are contributing to HELCOM PRESSURE - **Working Group on Reduction of Pressures from the Baltic Sea Catchment Area.** Among other, BONUS SHEBA's approach for assessing GES for underwater noise in low density areas is considered as official methodology for the (HELCOM) Member States.

HELCOM RESPONSE working group is benefitting from BONUS results (for example BONUS GEOILWATCH, STORMWINDS, SWERA projects). HELCOM RESPONSE has established a special environmental **SUBMERGED working group** where the main focus is paid to dumped munitions and wrecks with risk for environmental pollution. The main aim is to collect wreck register data from each of the Baltic Sea countries and to use BONUS SWERA analyses to create a fresh view over the possible "Hot Spots" in the Baltic Sea area.

BONUS BALTCOAST, BALTSPACE and BAMBI projects are active contributors to the joint **HELCOM – VASAB Maritime Spatial Planning working group** and when the second Baltic Sea maritime spatial planning forum convened in autumn 2016 by VASAB – each within remits of their specific scope contributed greatly to the deliberations of the meeting (respectively: systems-approach in coastal management, comprehensive issues of MSP and spatial measures for biodiversity protection).

BONUS BIO-C3, COCOA and SOILS2SEA projects have already in their first years contributed significantly to implementation of the **EU Water Framework Directive** and the **EU Marine Strategy Framework Directive** at the EU level as well as national level.

Furthermore, BONUS INSPIRE has been particularly active in generating and disseminating to the policy level new knowledge needed for securing ecosystem approach to fisheries management. BONUS INSPIRE scientists have contributed more than 100 times as members of various stakeholder committees – mostly in relation to fisheries management. Their data on spatial ecology of fish stocks initiated a critical revision of the existing management for cod, herring and sprat in the Baltic.



BONUS BLUEPRINT

Work carried out by BONUS BLUEPRINT is contributing, among other, towards development of 'good environmental status' indicators in the HELCOM 'State and conservation working group'. Mesocosm experiment at Linneaus University (LNU) in Sweden, testing the effects of environmental perturbations on the microbial genetic information. (l.) Empty tanks to be filled with seawater, (r.) experiments "ready to roll" after adding nutrients and setting up several different perturbation treatments.

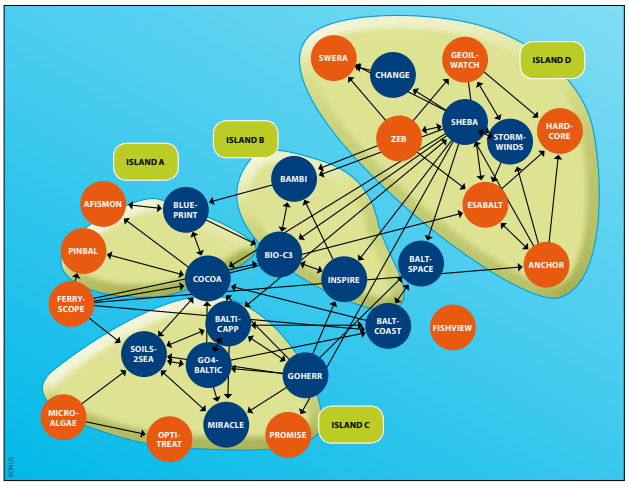
4. BONUS clustering activities intensify: Why does it pay off to collaborate?

When BONUS project coordinators were asked in late 2014 what added value collaboration with other projects can bring to their projects, 'integrating project outputs into more impactful results' was a clear winner of the views expressed. From there on, coordinated and supported by the Secretariat, BONUS projects have taken leaps forward in forming 'bottom-up' clusters originating from the needs of projects and initiated by motivated project partners themselves, both having underlined added value to the clustering and cross-project collaboration.

Other guiding principles in BONUS clustering have been a well-identified specific purpose and objective that goes beyond the tasks of individual projects, which can work towards strengthening the overall programme-level impact, and the need of maintaining flexibility in forming clusters depending on importance and relevance to individual projects.

As interactions have intensified between BONUS projects in recent months and years, it has become apparent that the support and encouragement by BONUS has been instrumental in forging opportunities for diverse groups of experts from different fields to come together and add great value to the joint work; this will eventually result into synthesis papers in key, international journals in the coming months and years.

There is also a clear need for systematic cooperation in project clusters beyond funding programmes for the good of the Baltic Sea future as noted recently by Ms. Eeva Rantama of Interreg Baltic Sea Region Programme: *"Interreg Baltic Sea Region Programme looks forward to exploring further ways of collaboration with BONUS also in project clusters around our shared sea"*. Now steps are being taken by Interreg Baltic Sea Region Programme and BONUS who together encourage their projects to increase cooperation in order to broaden and deepen the knowledge in common fields of work.



On left, the 'BONUS archipelago of project clusters' (blue research and orange innovation projects, excluding the 'Blue Baltic' projects commencing from April 2017 onwards).

Island A: 'Coastal biogeochemistry processes and indicators'.
Island B: 'Spatial patterns of marine biological diversity'
Island C: 'Combating nutrient loads from the drainage'
Island D: 'Clean and safe shipping'.

BONUS in Brief May 2016 contains further information on BONUS clusters www.bonusportal.org/inbrief

5. Realising potential of young scientists – the leaders of tomorrow

Incepted first in 2009, the BONUS Young Scientist Club have been met to date with enthusiastic and inspired participation of hundreds of PhD students and early career Postdocs. BONUS trainings and networking events of 'leaders of tomorrow' have included hugely popular transferable skills' sessions on how to become an extremely successful researcher, improve one's public engagement skills, and other.

In addition, other young scientists' activities have been organised by BONUS. For instance, the PE2020 Public Engagement Innovations for Horizon 2020 project (https://pe2020.eu) chose the BONUS young scientists blogging activity on the BONUS projects' website* as one of its innovative, bottom-up, real-time case studies. This provided an online social media and blogging 'clinic' opportunity for interested BONUS young scientist bloggers in spring 2016 to further develop their social media skills. BONUS joined forces recently also with ICES for a popular workshop on the topic of 'getting published' and developed together with young scientists a BONUS-HELCOM-VASAB-Baltic Earth

session at the EUSBSR Annual Forum 2016 'Hot Seat: Which way is up? Young scientists take on key regional actors about desired future options for the Baltic Sea'.

Now in the pipeline is the 11th Baltic Sea Science Congress (2017) taking place in Rostock in June 2017 where the 6th BONUS Young Scientist Club will convene. This time it will be in a form of yet another, 'well in advance fully booked' session by the professional researcher-trainer Hugh Kearns, who will run a session titled 'Turbo-charge your writing and communicate the impact of your research!'. Find out more at www.bonusportal.org/ys

The importance of investing efforts in young scientists' community in the Baltic Sea region continues to be in the core of the BONUS programme also in the future; as will be the ambition of the BONUS sponsored young scientist activities that promote the creation of networks of tomorrow's leading Baltic Sea scientists across disciplines.

"I think everyone will say that we spent a great time listening and discussing among us the difficult life of early career scientist struggling between science, supervisors, distractions and sense of guilt. It was a mind opening seminar that will help for sure all of us attending it to give a new boost to our studies and research."

Participant of the BONUS workshop
'Seven secrets of extremely successful researchers'
by Hugh Kearns, 15 June 2015, Riga

*The website www.bonusprojects.org was launched first in late 2014 to act as a first stop of information related to all BONUS projects in a bottom-up fashion managed by the projects themselves. Already from its first year of existence onwards, a steady flow of ca. 28 000 visits (close to 20 000 unique page views) per year have been recorded. Half of these visits are to the young scientists' blog section www.bonusprojects.org/blogs on experiences while working in BONUS projects.

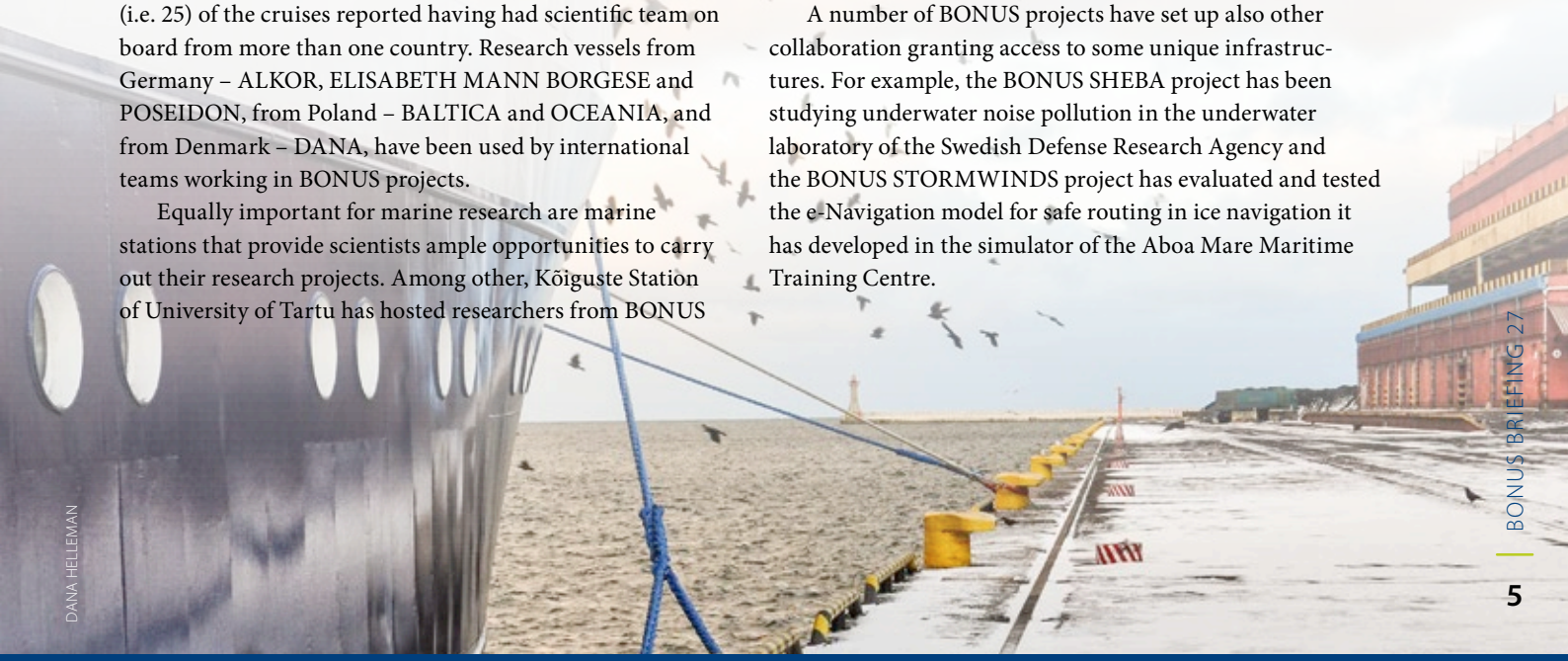
6. Boosting shared use of infrastructures in the Baltic Sea region

"12 scientists from 5 institutes and 4 countries, highly motivated and well equipped with samplers, corers and grabs, as well as empty bottles, boxes and bags to be filled with water, filters and sediments. While the first day started off bumpy, the weather calmed down when arriving in the Bay of Gdansk and sampling started off well under cold winter sunshine." So starts Dana Hellemann (University of Helsinki) her blog post in February 2015 that tells about a research cruise of the BONUS COCOA project on board of ALKOR.

Access to research vessels, field stations, data acquisitions systems, special equipment and laboratories, gliders and other infrastructures is critically important for marine research. Facilitation of joint use of such infrastructures is well-fitted to the BONUS programme and its multinational nature. In addition, BONUS also encourages national infrastructure providers to award 'free of charge' access to various major infrastructures for the ongoing BONUS projects. From the 41 'free of charge' research cruises attended by BONUS projects in the years 2014–2016, almost two thirds (i.e. 25) of the cruises reported having had scientific team on board from more than one country. Research vessels from Germany – ALKOR, ELISABETH MANN BORGESE and POSEIDON, from Poland – BALTICA and OCEANIA, and from Denmark – DANA, have been used by international teams working in BONUS projects.

Equally important for marine research are marine stations that provide scientists ample opportunities to carry out their research projects. Among other, Kõiguste Station of University of Tartu has hosted researchers from BONUS BAMBI project for sampling and transplant experiments related to the distribution of bladder wrack, Roskilde Fjord learning site of Aarhus University has hosted sampling campaigns of BONUS BLUEPRINT and COCOA projects. Furthermore, BONUS INSPIRE experiments on flounder eggs have been carried out in the År Research Station, University of Uppsala on the island of Gotland and the Tvärminne Zoological Station, University of Helsinki has hosted field experiments of BONUS BALTICAPP, BLUEPRINT, COCOA and SHEBA projects.

A number of BONUS projects have set up also other collaboration granting access to some unique infrastructures. For example, the BONUS SHEBA project has been studying underwater noise pollution in the underwater laboratory of the Swedish Defense Research Agency and the BONUS STORMWINDS project has evaluated and tested the e-Navigation model for safe routing in ice navigation it has developed in the simulator of the Aboa Mare Maritime Training Centre.



DANA HELLEMAN

7. Citizens can help to enhance safety in the Baltic Sea

Ordinary citizens can be of a great help in improving maritime safety. A new, innovative solution by the BONUS ESABALT project enables leisure boaters to report about human activity and interactions with nature and brings their observations into a common database. The project is an important first step in crowdsourcing applications in the Baltic Sea setting.

The BONUS ESABALT project allows ordinary citizens to become both collectors and users of valuable data while at sea. The data collected can also help in preventing accidents and other dangerous situations. As overall situational awareness increases, also the maritime safety, intelligent navigation and environmental reporting improve.

Conventionally, each information source has its own ecosystem and should be monitored independently. The novel BONUS ESABALT system, however, integrates various information sources into a common platform: satellites, buoys, commercial and pleasure vessels, autonomous sensor stations and land-based monitoring systems. After testing in real environment, the platform is now ready to be deployed and free-to-use by anyone. E.g. marine electronics manufacturer can integrate the BONUS ESABALT capability into their navigational plotters. This means that the new information platform offers a huge innovation and commercialisation potential to any European commercial manufacturer of maritime products and services.

The BONUS ESABALT project (2014–2016) is among the four BONUS projects* selected as flagship projects of the EU Strategy of the Baltic Sea Region, and has received many international recognitions for its outstanding work and collaboration, among other an ION GNSS+ 2015 award for the best presentation In Tampa, Florida, and the best student paper at the 2015 European Navigation Conference in Bordeaux, France.

www.bonusportal.org/esabalt

*Four BONUS projects from the BONUS 'safer and cleaner shipping and boating cluster' have flagship project statuses in the EU Strategy for the Baltic Sea Region programme: BONUS CHANGE, (Policy Area HAZARDS), BONUS ESABALT (Policy Area SAFE), BONUS SHEBA (Policy Area SHIP) and BONUS STORMWINDS (Policy Area SAFE).

8. Find the fish!

At a very first glance, the BONUS strategic agenda's theme 3.4 'Evaluation framework for fisheries management' appears poorly covered by the BONUS-funded projects: no project addresses this as its key theme and only one of the projects identifies it as the project's supplementary theme in its description of work. This seemingly insufficient coverage of the fisheries management theme has been noticed also in the independent assessment of the BONUS impact on relevant policies, innovative industries and structuring of the macro-regional research area. But is it really so?

One of the most severe knowledge deficiencies hampering any attempt to come closer to fit-for-purpose "ecosystem approach to fisheries management" is related to our insufficient knowledge on, so called, spatial ecology of fishes. This is the case in spite of decades of systematic fish stocks' surveying. Exactly this body of scientific knowledge, urgently needed to underpin any further progress in the Baltic Sea fisheries management, is addressed by the BONUS INSPIRE project focusing on spatial ecology of four commercially most important Baltic fish stocks – cod, herring, sprat and flounder. Although only two out of four implementation years have passed to date, the BONUS INSPIRE scientists have obtained key information on the spatial ecology of early life stages of sprat and expressed the first suggestions of possible hybridisation between the coastal- and deep sea-spawning ecotypes of flounder. They confirmed that adult cod in general does not perform long-distance migrations, while dispersion of cod eggs in the Baltic Sea is limited by the sills separating different Baltic Sea sub-basins. They have analysed and unveiled also the knowledge gaps leading to presently unclear Eastern Baltic cod stock status, and suggested ways of future improvement.

So the question is, shall we wait patiently while these new scientific insights inform practical fisheries management? Certainly not! Project performance statistics collected by the Secretariat tells that BONUS INSPIRE scientists are among the most active in terms of significant contribution to development of 'fit-for-purpose' regulations, policies and management practices, and in terms of the number of times they have been serving in stakeholder committees and different working groups, most often within the framework of the EU common fisheries policy and the ICES.

9. Genes tell the truth

A species of plants or animals might look like thriving in a local habitat while in reality it is on a track towards demise. Something wrong is happening to the genetic structure of the population – this because of irresponsibly unbalanced exploitation, or because of severing the natural paths of connection among the sub-populations, or because of fragmentation of the habitat into inappropriately small patches, or, too often, because of any combination of these factors. This phenomenon is well known to the terrestrial ecologists – scientists call it a loss of intra-specific diversity. The BONUS+ BALTGENE team embarked to study the magnitude of issue in several key species of the Baltic Sea. Continuing to employ the powerful tools of modern genomic research BONUS BAMBI (involving the BALTGENE core team) took the study to the next level, enquiring how much the issues of genetic diversity is taken onboard the existing marine biodiversity protection measures by the Baltic Sea states. Actually – very little!

Genomics has well established reputation as a more and more accessible approach to understanding the mechanisms governing marine biological diversity, but may it have more applications in our pursuit towards sustainability of marine ecosystems? Apparently – yes! Man-made eutrophication - overfeeding with plant nutrients - is the top threat in the Baltic. Nutrients pass through a complex network of biogeochemical transformations that are run by bacteria.


ISTOCK

The potential to perform one or another of these transformations can be linked to specific enzymes and transporters coded in specific bacterial genes. Can we imagine a map of genes matching the network of biogeochemical pathways?

And further on: can we employ such gene 'blueprints' for monitoring the ecosystem status and eventually protect it from eutrophication? This might sound as a far-fetching idea, but BONUS BLUEPRINT suggests exactly this: development of a new generation environmental monitoring approach based on genomics. The maps of the 'first suspect' genes are already developed and the necessary bio-informatics basis built. The current research focuses on testing the new application in real-life circumstances. Not the least, one might need a very specific sampling gear to recover and store undamaged genetic material from sometimes significant sea depths – a device being designed and tested by innovators of the BONUS AFISMON project in close collaboration with BONUS BLUEPRINT.


BONUS+ BALTGENE

10. Orchestrating the ecosystem models

Nine years ago the BONUS+ ECOSUPPORT project suggested something never tried before – creation of an ensemble of the Baltic Sea ecosystem models. Using an ensemble of coupled physical-biogeochemical models driven with regionalised data from global climate simulations, a team of scientists was able to quantify the influence of changing climate upon oxygen conditions in the sea and to show that under the impact of warming climate the oxygen-poor areas will very likely increase or at best only slightly decrease (in case of optimistic nutrient load reductions) compared to present conditions.*

The approach itself is not entirely new as the whole body of our insight into the impacts of climate change, both globally and regionally, is based upon an 'ensambled' output of several climate models.

We all agree, however, that the future of the Baltic Sea critically depends on various human pressures on the natural system, such as loads of pollution, exploitation of biological resources or claiming certain tracts of sea space for various economic activities. These, in turn, depend on the development scenarios of different industries, demography, growth and connectivity of cities and many other socio-economic factors.

Ultimately, in order to improve our 'projecting capacity', modelers need something like a family of regional socio-economic pathways applied in the Fifth Assessment Report (AR5) of the Intergovernmental Panel of Climate Change (IPCC). Thus, the BONUS BALTICAPP project (2015–2018) involves both the natural scientists and modelers (the core ECOSUPPORT team) as well as a team of environmental socio-economists to establish a set of agreed socio-economic development scenarios for the Baltic Sea region and subsequently suggest the optimal ways of achieving true sustainability of the Baltic Sea ecosystem services.

Besides demonstrating the value of successive scientific effort, this development provides for the entire BONUS programme the most compelling example of the impressive results that might be achieved applying genuine interdisciplinarity in research.

* Meier et al., 2011, doi:10.1029/2011GL049929; Meier et al., 2011, doi:10.1088/1748-9326/7/3/034005

For more information, contact BONUS:

BONUS
Hakaniemenranta 6
00530 Helsinki
Tel. **+358 40 040 4011**
Email: **bonus@bonuseeig.fi**
Web: **www.bonusportal.org | www.bonusprojects.org**
Facebook | Twitter: **BONUSBaltic**

BONUS is funded jointly from the national research funding institutions in the eight EU member states around the Baltic Sea and the European Union by a total of EUR 100 million for the years 2011–2017. Russia participates in BONUS through bilateral agreements.

BONUS
SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

© 2017 BONUS Baltic Organisations' Network for Funding Science EEIG