MARBENA

# Electronic conference on 'Newly Associated States and Marine Biodiversity Research'

## 2 to 12 June 2003

## Summary of discussions

An activity of: MARS

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# General introduction to the MARBENA project

# General introduction to the project

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## Context

Ten years ago, in 1992, the Earth Summit was held in Rio de Janeiro. Rio produced the Convention on Biological Diversity that has now been signed by nearly all European countries and the European Union. Since 1992 many initiatives for research on biodiversity issues have been launched, the majority of them local, short term and terrestrial. Marine biodiversity research was long considered less urgent because the main problems were thought to occur on land. Long-term biodiversity research, i.e. for more than 3 years, is very difficult to implement, even at the national level. Some of the major obstacles are the national and European funding systems and also the lack of an internationally agreed methodology for the measurement of marine biodiversity and the choice of indicators for biodiversity.

In 1994, the European Network of Marine Stations (MARS, http://www.marsnetwork.org), a non-profit foundation incorporated in the Netherlands, was founded to cope with these obstacles. In 2000, the MARS-related initiative BIOMARE (Implementation and Networking of large-scale long-term Marine Biodiversity research in Europe, http://www.biomareweb.org), started. This concerted action, supported by the Fifth Framework Programme, aims at achieving a European consensus on the selection and implementation of a network of reference sites as the basis for long-term and large-scale marine biodiversity research in Europe, internationally agreed standardized and normalized measures and indicators for biodiversity, and facilities for capacity building, dissemination and networking of marine biodiversity research. Twenty-one institutes co-operate in the concerted action.

The BIOMARE concerted action is an important first step and will provide a framework for the implementation of marine biodiversity research on spatial and temporal scales that cannot be covered by traditional funding schemes. The next steps are of course the research itself and the subsequent transfer of its results to society. The rapidly growing interest in biodiversity, with Rio +10 (the Johannesburg UN meeting) and the next framework programme approaching, require a directed effort from the scientific community. What is needed as well is a broadening of the discussion to a wider range of subjects and to a wider audience by not only including more scientists of other disciplines (e.g. terrestrial biodiversity and biogeochemistry), but science managers and end users as well.

To define the issues at stake an electronic conference on marine biodiversity in Europe (M@RBLE, http://www.vliz.be/marble) was organized in October 2001. The objectives of the M@RBLE e-conference were to discuss the bottlenecks and their solutions in producing relevant knowledge and the implementation of this knowledge in policy, management and conservation; therefore contributing to the development of a network for (marine) biodiversity research in Europe. The results of the e-conference were presented at the meeting of the European Platform for Biodiversity Research Strategy EPBRS in Brussels, December 2-4 2001, and published as Vanden Berghe, E.; van Avesaath, P.H.; Heip, C.H.R.; Mees, J. (2001): Electronic conference on MARine biodiversity in Europe (M@rble): summary of discussions, 8-26 October 2001. Flanders Marine Institute (VLIZ): Oostende, Belgium. iii, 43 pp.

We believe that the present efforts, BIOMARE and M@RBLE, are an important start. However, more will be needed to support development and application of marine biodiversity research over a sufficient period of time to make the field mature and active on a truly European scale. The discussion on the issues at stake should not stop with the presentation of the results at one single meeting. Instead, the discussion should become a continuous process for at least as long as the EPBRS meetings are held, so that each EPBRS meeting receives a specific input from the field responding to the specific topic of that meeting. Starting from BIOMARE - that will produce a recommendation for a network of flagship and reference sites and a review of indicators - and M@RBLE - that produced through the e-conference and the link to EPBRS the first appearance of marine biodiversity on the EU policy scene - the next series of activities should be used to create a lasting network for marine biodiversity research in Europe. Such a network must adequately prepare and exploit the possibilities of the next framework programme and the European Research Area, must improve the infrastructure for marine (biodiversity) research and its accessibility and utilization by European scientists, and must increase the visibility of marine biodiversity issues for science managers, politicians and other end users, including the public at large.

**Objectives of MARBENA**

The objectives of the MARBENA project are:

- To create the infrastructure for marine biodiversity research in Europe by creating a pan-European network of marine scientists, with strong links to the different stakeholders in Marine Biodiversity Issues, from the EU-EEA and the Newly Associated Nations, and that covers the European seas from the Arctic to the Atlantic, the Mediterranean and the Black Sea. This network must improve the science by cataloguing the existing expertise and infrastructure, by defining and prioritizing the issues at stake in terms of scientific knowledge, technological requirements and application to societal problems. It must provide an intellectually attractive environment for young scientists and a discussion forum for all. It must promote the European presence and the organization of international research programmes, and promote the discussion of their results and their application. It must provide the links between scientists and industrial companies willing to aid in technological development, between scientists and science managers and politicians and lead to better integration of research and a better insight in the 'market' of supply and demand of marine biodiversity information.

- To create awareness on the issues at stake and enlarge the visibility of marine biodiversity research in Europe, the network must make the issues – the scientific questions and the relevance of the outcome of the scientific research – clear to a non-scientific audience, it must communicate with EU policy makers and politicians (presentation of marine biodiversity issues at the European Platform for Biodiversity Research Strategy meetings, presentation to the European Commission and European Parliament when requested), with global organizations and programmes such as several IGBP programmes (GLOBEC, LOICZ, perhaps SOLAS), DIVERSITAS and the Census of Marine Life initiative, national and other EU biodiversity platforms (e.g. the BioPlatform thematic network) and dissemination of information to the public at large.

Hereby, the project contributes to the European Research Area (ERA) initiative. Special effort will be undertaken to involve the stakeholders from the Newly Associated States (NAS) in the network.

For more information on the project and for the partners involved see http://www.vliz.be/marbena.

**Overview of planned project activities**

To achieve these objectives, MARBENA performs the following main activities:

A. To create a long-term infrastructure for marine biodiversity research

1. To develop a European Marine Biodiversity Network.

- § MARBENA will start by using existing information (e.g. the ESF and Diversitas Science Plan and the results from BIOMARE and M@RBLE amongst others) and by cooperating with existing European organizations, including the European Marine Research Stations Network MARS that through its member institutes has already played an active role in the development of marine biodiversity science.
- § MARBENA will open its activities and actively engage cooperation with any interested partner, including museums of natural history, universities and government laboratories.
- § MARBENA will establish a structural link with the BioPlatform.
- § One of the most important tasks will be integration with scientists of the Newly Associated States and a sufficient coverage of the marine areas at the periphery: the Arctic Sea, the Black Sea and – when possible – the Southern Mediterranean Sea.

2. To build a long term research infrastructure for the network MARBENA will provide the information and mechanisms for creating a solid basis on which the network can build:

- § By discussing research priorities and their implementation and coordination for the next five (or even ten) years and the ways of financing European-level research where needed, taking advantage of the new possibilities of the 6th framework programme and the European Research Area e.g. through complementation of national research.
- § By describing the market of 'supply and demand' of marine biodiversity information: who are the stakeholders and what is the information available and needed? Where are the gaps and what can we do about them?
- § By describing and publishing a catalogue of the research infrastructure existing and required (vessels, instrumentation, experimental facilities) and of taxonomic literature (floras and faunas, keys for identification), studying their accessibility to European researchers and prioritizing their development where necessary.
- § By promoting regional cooperation between different EEA and NAS countries focusing on regional problems and involving the regional end-users.
- § By promoting the possibilities for discussion between scientists, management and policy makers.

B. To create visibility for marine biodiversity issues in Europe

To enlarge the visibility of the marine biodiversity issues and therefore marine biodiversity research in Europe, MARBENA will work on publicizing these issues with the stakeholders and the public. This will be done by maintaining an active web site, by regular press releases, and by the publication of a newsletter, CD-ROM's and folders. MARBENA will link to other programmes of interest (DIVERSITAS, relevant IGBP-programmes, Census of Marine Life CoML etc.), to EU policy makers requiring information and support for implementation of e.g. the Water and Habitat Directives, the European Environment Agency and to the ESF Marine Board as a representative of the national funding agencies.

1. To develop and maintain a web site where information and issues produced by the Marine Biodiversity Network will be easily accessible to stakeholders involved in marine biodiversity as well as the public at large. The website will be the main communication structure for the

network of marine biodiversity stakeholder. The web site will have links to the MARS Web Site and to other web sites (BioPlatform, ESF Marine Board, EU Directorate of Research)

2. To organize Electronic conferences on selected themes

- § To provide relevant information on the Marine Biodiversity issue for use in the meetings of the "European Platform for Biodiversity Research Strategy" (EPBRS) connected with the EU presidencies. For this a close cooperation will be established with BioPlatform.
- § To discuss issues important for the establishment and maintenance of the Marine Biodiversity Network and the long term infrastructure for marine biodiversity research and the communication between researchers, management and policy makers.

3. To organize workshops, conferences and case studies

MARBENA will organize together with other partners a series of workshops on selected topics, discussion of four case studies on selected priority issues for four regions in Europe involving scientists, policy makers, industry and the public (including the press) and a major conference to finalize the project and create the conditions for the future existence of the network.

C. Involving the Newly Associated States

In this project special effort will be undertaken to include the scientists and through them the other stakeholders of the marine biodiversity research from the Newly Associated States in the network. For this we propose the concept of MARBENA Ambassadors, well known and respected scientists who are residents of the NAS, who will actively extend the network in these countries. Furthermore the 'Ambassadors' will discuss relevant biodiversity issues at the Electronic conferences.

**The MARBENA electronic conferences**

The MARBENA-project will organize a series of at least five e-conferences on selected themes.

Four electronic conferences will be held before each of four European Platform for Biodiversity Research Strategy (EPBRS - see the BioPlatform website at http://www.bioplatform.info) meetings with the following objectives:

- § To raise a dialogue on the themes selected for the EPBRS meetings, involving a wide range of participants. These themes will be determined ad hoc in relation to the EU Minister Conference.
- § To prepare for the EPBRS meetings through this dialogue, involving both the scientific community and policy makers, specifically:
  - A. To identify current understanding on the selected themes.
  - B. To identify areas of uncertainty ('biodiversity information needs') on the selected themes.
- § To make provisional recommendations on research ('biodiversity research needs') on the selected themes for subsequent discussion at the EPBRS meetings.
- § To provide background papers for the Platform meetings summarizing current understanding, areas of uncertainty and recommendations on research on the selected themes.

E-conference chairs are coupled with the EU presidency and organization of the EPBRS meeting: in order to reach participants from the nations that host the coming EPBRS meetings

(Spain, Denmark, Greece, Italy), the chair of the respective e-conferences is conveyed to a scientist resident of these countries.

The fourth of these conferences ran for eleven days, from 2 to 12 June 2003. The theme was “Newly Associated States and Marine Biodiversity Research”. This electronic conference is held in preparation of the Bioplatform meeting in Belovesha, Poland 5-8 July to discuss: "Biodiversity research strategy and structure in the NAS: preparing for FP 6".

One additional e-conference on “The Future of Marine Biodiversity Research in Europe” will be organized independently of the platform meetings.

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# Executive summary

# Executive summary – Newly Associated States and Marine Biodiversity Research

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The theme of the fourth MARBENA e-conference was directed to a specific and unique European sea – the Baltic Sea – with a focus on the contribution from specific countries: the Newly Associated States (NAS). This summary will cover the most important issues making marine biodiversity science in the Baltic region, and especially in the NAS countries, particular and at the same time different from many other regional seas in Europe.

The 'cutting-edge science' is very often evaluated only by the number of papers published in high-ranking journals, such as Nature and Science. As the situation in the Baltic region can be considered as not very appealing, the amount of papers published on the Baltic Sea during the period 1996-2002 is just seven (which is less than 1% of the papers dealing with marine issues) as compared to 13 papers on the Black Sea and 45 papers on the Mediterranean area. This raises the following questions: is the Baltic Sea scientifically not interesting enough? Are the Baltic scientists or more specifically the marine scientists not very active in publishing their results?

The Baltic Sea is currently bordered by nine (in the period of the 1940s-1980s by six) countries. It is very likely that scientists at the Baltic shores, especially those dealing with marine biodiversity, are merely from NAS countries. Thus before the nineties, a substantial number of marine scientists in the Baltic Sea have been educated in very different circumstances. Mostly due to political reasons, the possibilities for information exchange and scientists visits were very limited at these times. English, the common language now used by the scientific community, was also a major barrier, and only recently, a relative number of NAS scientists is able to communicate in English. As a consequence, the marine science of the Baltic Sea remained largely isolated. However, the research, quantitatively as well as qualitatively, is high and is making an important contribution to the knowledge of biodiversity in the Baltic Sea. At present, almost every scientific journal of NAS is published in English and more and more are results from studies in 'older times' made available through this way. For now, scientists are very often facing financial rather than linguistic problems for attending workshops, meetings and conferences. Another important difference between the 'current' and 'older' time lies in the way of employment. Until relatively recently, all positions, even for junior scientists, were permanent, and the system for evaluation of the scientific level was non-existent. In fact, it was generally regarded as very unusual and a largely non-acceptable behaviour to 'draw attention' by keeping records of citations, impact factors etc. Traditionally, the scientist leads a carefree, easy life in terms of no need to answer questions such as 'Where does the money come from?' 'Why are you doing this?' or 'Who needs your results?' However, this old-fashioned system was at least to the advantage of marine biodiversity research by promoting long time experience and a strong devotion to a relatively narrowed subject. This is an ideal combination for taxonomy studies (the famous 'sitzfleish'), which, in parallel, supports the creation of long-term datasets, being of essential importance in understanding the processes at sea. This is why NAS countries now play the leading role in sample processing and taxon identification, whereas in the USA and in many European institutes, scientists are no longer identifying specimens from numerous samples collected in the field. All this kind of material goes to specialised sorting centres in Poland,

Russia, etc. This kind of system is working well, but invokes a risk for future research. Not only will colleagues from richer countries have good publication records, there will also be a major gap in competence. One will be able to publish new biodiversity paradigms without ever having identified any faunal or floral component in her or his lifetime. Another person will have a rather narrow knowledge on a specific taxon, but will never use it in a scientific way. In this way we are going to create a 'scientific proletariat' and a 'scientific nobility'.

Considering all the above, we must keep in mind that in the NAS countries there are lots and several types of unknown additional information sources (publications, reports, original datasets), in part due to the language barrier, and as such are not available for the international scientific community. Especially in the field of biodiversity, taxonomy and zoogeography, the old data are of extreme value and undoubtedly contribute substantially to our present knowledge. And there is a way to make it work (funds for translations, dissemination, exchange are available), but the feeling that it is the responsibility and obligation of NAS countries to join the common standards is necessary. And there is a high potential for good marine biodiversity science to be done in the Baltic Sea.

Studying the Baltic will add a completely different dimension to European marine science: relatively young and at evolutionary time-scale still developing sea, brackish water-body with changeable salinity, existence of autonomous subsystems with gradients at several scales and types. What is certainly needed is research beyond the borders of a single country, careful planning that involves the hypothesis-driven and process-oriented research, field work supported by manipulated field and controlled mesocosm-laboratory experiments. There is a great potential to secure funds for international projects through the already funded BIOMARE and MARBENA projects, and though other EU projects that have been submitted. Furthermore, we must keep in mind that taxonomy is the backbone of biodiversity research. It is an analytical tool (just like HPLC for chemists), but it has to be used in the context of life cycles of organisms, with a functional approach and with historical perspectives.

The Baltic Sea provides us with one more scientific opportunity – there are mainly physical driving forces that control the ecosystem. Low salinity, geochemistry of sediments, water dynamics circulation are key players in our area where the importance of biotic interactions are different from those in full saline and old seas.

The humans who settled the Baltic shores soon after the end of the last ice age (ca 10,000 years ago), witnessed the evolution of the sea from a sub-arctic basin, throughout the warm lake to the current temperate brackish water sea. However, present-day decision makers want to preserve the Baltic Sea as they are seeing it in a scale of their own lifetime. It is the responsibility of scientists to show the difference between natural and man-induced changes, and tell what is unavoidable and what can be restored. This involves the very important point of communication, and common understanding of the value of nature, ethics and aesthetics. The Baltic region is an ideal test-bed for this type of discussion, by virtue of the rather well functioning regional organizations and wide international collaborations.

We want to thank all the participants for their contributions to the e-conference and thanks go to the MARBENA organizing team for this enjoyable experience.

Jan Marcin Weslawski & Henn Ojaveer

Messages posted under topic six (general discussion):

| **Message** | **Date** | **Posted by** |
|---|---|---|
| Some comments to various messages. | 06 Jun 03 | Krzysztof Jazdzewski |
| some conclusions | 11 Jun 03 | Jolanta Koszteyn |

# Introductions and summaries of the sessions, conclusions and message titles

# Introduction to topic one “What is the Baltic contribution to the European marine Biodiversity? What is the knowledge of marine biodiversity in NAS countries” (I)

Krzysztof Jazdzewski

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Because of its young age, low salinity, small depth, harsh thermal regime and pollution, the biological diversity of organisms living in the Baltic is low. It decreases in the direction from south-west to north-east, presenting an interesting gradient of marine species richness. The level of this impoverishment is different in various groups of organisms. For instance the species richness in marine fishes decreases from some 120 species in the North Sea to some 40 species at Polish shores (central Baltic) - here we have a threefold decrease. Much higher decrease is observed in many invertebrate groups; it is estimated as being on the average of the order of magnitude (10-fold). For instance for Amphipoda the recent checklists prepared for North-East Atlantic and for the Baltic Sea gave the following species count: 741 versus 68, respectively (in the Baltic Sea along Polish coast only some 30 amphipod species were hitherto recorded). Also some highest taxa (phyla, classes) of marine animals are totally or nearly absent in the Baltic Sea (cephalopods, echinoderms). Numerous marine species do enter as adults even in the Bothnian Bay, but due to the low salinity they cannot reproduce there (a case of cod, *Gadus morrhua*). A crab *Carcinus maenas* reaches only the Gulf of Gdansk in the Baltic and also here we have to do only with not reproducing, wandering adults. Some species are recorded only as pelagic larvae entering the Baltic in a haphazard way with irregular inflow of saline water masses (for instance *Pagurus bernhardus*). Low temperature prevailing in northern and eastern parts of the Baltic can also be the reason why some genuine brackish water species of Lusitanian-boreal or Mediterranean-boreal occurrence range have their distribution limits in the Baltic more or less at the entrance to the Vistula Lagoon (for instance the isopods *Cyathura carinata, Sphaeroma rugicauda, S. hookeri* or an amphipod *Melita palmata*).

Marine boreal, euryhaline organisms are the natural main source of the present Baltic flora and fauna. This "core" is supplemented by several (?) glacial/postglacial relicts of Arctic / subarctic origin that have entered this basin probably during the Yoldia Sea period (*Myoxocephalus quadricornis, Saduria entomon, Monoporeia affinis, Limnocalanus grimaldii* and some others) as well as by numerous freshwater euryhaline taxa, whose contribution decreases from north-east to south-west and which can dominate in the fauna of lagoons (examples of such elements are fishes *Esox lucius, Perca fluviatilis, Rutilus rutilus* or an isopod *Asellus aquaticus*). Baltic Sea is probably devoid of endemic species, being a too recent basin to have unique species evolved. On the other hand Baltic Sea, with its peculiar salinity fitting well to the Remane's curve minimum, is especially rich in genuine brackish water species. As examples one can mention here the polychaetes *Alkmaria romijni, Manayunkia aestuarina, amphipods Gammarus duebeni, Apocorophium lacustre* or a prawn *Palaemonetes varians*. This faunistically (and floristically) impoverished basin is recently enriched by several alien taxa of different biogeographic origin. Ponto-Caspian region appeared to be a very important donor of these aliens, that become locally an important element of fauna (for instance a cladoceran *Cercopagis pengoi* and a fish *Neogobius melanostomus*). Also North-American hydrobionts were successful in conquering Baltic waters. One of them - a polychaete *Marenzelleria viridis* - became a dominant element of

zoobenthos in many Baltic areas. Another American invader is the amphipod *Gammarus tigrinus* quickly extending its range in the Baltic.

It is worth to mention that some alien species have established their rich populations in the Baltic or in its lagoons and estuaries long ago. Examples are a hydrozoan, *Cordylophora caspia*, a bivalve *Dreissena polymorpha* (both) of Ponto-Caspian origin), another bivalve *Mya arenaria* (an especially old immigrant brought probably by Vikings) and a much younger invader - American crayfish *Orconectes limosus* (in lagoons). Other Ponto-Caspian immigrants already conquered at least three southern Baltic lagoons - Kuronian, Vistula and Szczecin ones; they are amphipods *Pontogammarus robustoides* and *Obesogammarus crassus.*

At the moment these aliens increase the species richness of the Baltic, however we can expect that some of them really may be a threat to the native fauna - some species can be exterminated by competition with successful invaders. For instance the negative influence of *Marenzelleria viridis* on *Corophium volutator* has been already observed, whereas in the shallowest part of the Gulf of Gdansk - in the Bay of Puck - the Ponto-Caspian fish *Neogobius melanostomus* in very short time dominated the local fish fauna and American *Gammarus tigrinus* outcompetes six native Gammarus species. Some invaders can be a pest for human activity - a case of *Cercopagis pengoi* clogging the nets.

Despite the relative poverty of the Baltic Sea when studying its biodiversity one should bear in mind that proper recognition of plants and animals is a primordial, but also time-consuming task. To identify species one should check sometimes tiny morphological details with due patience ("Sitzfleisch"!) ; simply one should become a specialist in a particular group(s). Such a specialist should also know the species variability related to age and season, sexual dimorphism etc. At the same time we are facing a true "extinction" of taxonomists. Their efforts are neglected, their papers are held cheap and application for grants are pushed down - the winners are often biologists practising something that can be called "applied approximatology". Let me recall that some 50 years ago, before the fundamental papers by Otto Kinne and Sven Segerstrale Gammarus collected in the Baltic Sea was usually named simply *Gammarus locusta* and now we know that in the Baltic there are 6 species in question, each of different life cycle, ecological requirements, sensitivity to pollution etc. And before scientific effort of Bror Forsman and Charles Bocquet all Jaera was named *Jaera marina* (= *Jaera albifrons*) - now we know that this is a complex of 5(6?) species, 3 of them occurring in the Baltic. Of course we need modern taxonomists who understand molecular methods to verify taxa when necessary (the case of *Mysis relicta*-group), and who can show the differences in ethology and autoecology of species. It was really promising to learn from the program of MARBEF (Marine Biodiversity and Ecosystem Functioning) that one of its scientific objectives will be: "To understand how marine biodiversity varies across spatial and temporal scales ..." and then to read in this project that : "Taxonomy is essential in biodiversity studies and species inventories are basic tools ....", and then : "Accurate identification and recognition of species remains a fundamental underpinning of biodiversity research, both basic and applied."

Baltic Sea with its history, physico-chemical parameters and a special mixture of organisms (marine, brackish water and freshwater) is an ideal "laboratory" to study the ecosystem functioning, the patterns of energy flow and quickly occurring serious changes of this ecosystem. And answering to the original question that would be the Baltic contribution to the European marine biodiversity.

The second question suggested for discussion - what is the marine biodiversity knowledge in NAS countries - is a somewhat provocative one. Yes, we, the scientists from these countries, have been cut by the iron-curtain for a long time, having difficult access to the "western" scientific literature. However we have not stopped studies on the Baltic Sea; sometimes,

knowing both Russian and English (or other congress language) we were even more aware of what is published in different languages and alphabets. Contemporary with such Baltic knowledge luminaries as Adolf Remane, Sven Segerstrale or Erik Dahl, Baltic Sea was studied here by Kazimierz Demel, Arvi Jarvekulg or Wladyslaw Mankowski, among others. Their numerous successors were or are working in such well known institutions as Sea Fisheries Institute in Gdynia (82 years of activity!), Institute of Oceanography of Gdansk University, Institute of Oceanology PAS in Sopot, Agriculture Academy and University in Szczecin, Laboratory of Polar Biology and Oceanobiology-University of Lodz, Estonian Marine Institute, Coastal Research and Planning Institute-University of Klajpeda (name others, please!). That the papers by NAS scientists are (were) overlooked or neglected - yes , that was first of all the effect of publishing the results mostly in native languages, not in English. The second reason was evidently the very difficult contacts (till 1989) between scientists of two political "blocks", hindering the participation in international symposia. These obstacles were both political and financial ones. But even after breaking that barrier the NAS scientific production is comparatively poorly noticed - we need time to recover. (By the way - it is a good fortune of the NAS scientists to often be the first in recording these recent Ponto-Caspian invaders in the Baltic Sea and its lagoons - simply these species appear first in south-eastern Baltic area).

# Introduction to topic one “What is the Baltic contribution to the European marine Biodiversity? What is the knowledge of marine biodiversity in NAS countries” (II)

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In the list of European seas, the Baltic Sea stands side by side with the North Sea, Norwegian Sea etc. However, concerning ecosystems (below biodiversity has been considered in the ecosystem's framework), the shallow brackish Baltic Sea is a sea like no other. The Baltic ecosystems have developed only for 10-12,000 years, in very variable conditions, incl. the Ancylus Lake stage. The species richness of the Baltic ecosystems cannot be compared with other seas, even not with the Mediterranean, another semi-enclosed sea in Europe, the ecosystem of which has formed for 70 million years in much more stable conditions. The ecosystems of the Baltic Sea are unique brackish water systems in the stage of rapid development and differentiation.

The largely differing salinity by areas of the sea (in the Kattegat the salinity varies from 12-34 ‰ but decreases to 2-3 ‰ in the easternmost part of the Gulf of Finland and the northernmost Bothnian Bay), create very specific osmotic conditions for aquatic organisms in the Baltic Sea. Considerable variations in temperature induced by the wide N-S range of the sea, and in the oxygen concentration because of the existence of two principal water layers separated by halocline, sophisticate the adaptations. Only a limited number of species have been able to adapt to a wide range of salinity and rather severe temperature conditions in winter. Therefore, the number of species in the Baltic Sea is rather moderate. Many of them occur in the border zone of its area. The relatively small number of species and their harsh living conditions limit the possible links in food chains increasing the risk for disruptions. During the adaptation to the stressful environmental conditions, the features of a number of species have changed, e.g. their metabolism has slowed down and the body size decreased.

The long estuary-like Baltic Sea involves largely differing habitats. The SW part of the sea receiving the North Sea water is the most acceptable habitat for marine organisms in the Baltic. There the number of marine species is the highest (in Kattegat the number of marine fish species is approximately 80). In this area *Laminaria, Calanus, Oithona, Sagitta, Scoloplos, Abra, Astarte*, cod, plaice and other marine species have started their adaptations to the Baltic conditions. In the northern and NW parts of the sea with severe/arctic climate, rather marginal influence of the modified marine waters and large freshwater input, only a few marine species have permanently established and can produce their offspring (in the Bothnian Sea the number of marine fish species is about 15). In the coastal zone with numerous archipelagoes and skerries mainly the organisms with freshwater background are abundant. Because of the mechanical influence of ice, harsh conditions in shallow areas favour species with short life cycle, influencing biodiversity and the related phenomena.

The bottom relief divides the Baltic Sea into a number of basins with separate circulation systems and the continuously renewing hydrological borders. The heterogeneity in biotopes is much larger than in eumarine seas. As a result the Baltic ecosystem consists of a number of ecological subsystems notably differing in basic parameters (salinity, temperature, oxygen conditions, the pattern of energy flow in the ecosystem, etc.). Formation of infraspecific groups in species by means of adaptation to the conditions of the local subsystems is intense.

However, owing to the short history of the sea in general, the differentiation of the endemic groups has not yet reached the species level.

In the contemporary Baltic Sea the most ancient component of the biota consisting of very euryhaline species immigrated into the Baltic during its initial stages of development (the glacial relicts), is distributed mainly in the gulfs of Bothnia, of Finland and of Riga. There the temperature and oxygen conditions are acceptable for them. A continuous natural immigration occurs mainly from two sources: 1) marine boreal and migratory species penetrating into the Baltic via Danish straits; 2) freshwater species which occupy mainly coastal areas, especially in the northern Baltic with lower salinity. In addition, certain exotic species, recently favoured by man in crossing their distribution borders (with ships, mainly in the ballast water) have colonized large areas of the Baltic Sea. Historically, the success of the colonization is connected with the developmental stages of the sea and oscillations of climatic periods. Also, in the contemporary stage of the sea, the dependence of the biota on the temperature regime and the type of circulation of air masses over the Baltic Sea is obvious. In the periods of good water exchange between the Baltic and the North Sea marine species have had better possibilities for the increase of their abundance. In the periods of freshening of the Baltic Sea, marine species retreated and freshwater species widened their area. Studies on the formation of fauna and flora in the Baltic Sea (including introduction of alien species) during different climatic periods are very important and they should be encouraged.

In the subsystems of the Baltic Sea the biological productivity is highly variable both in time and space. The most productive areas are confined to the archipelagoes and estuaries and the zones of violent vertical mixing of water layers on the coastal slope and banks in the open sea where mixing-up of nutrients from below the halocline takes place year round. Such areas accommodate diverse flora and fauna. Also, ecosystems of the Baltic Sea (incl. their biodiversity) readily react to the anthropogenic impacts of which the importance in concrete areas during different climatic periods needs better be quantified
The items to be commented:

1. A reasonable scheme for the studies of the Baltic ecosystems. Is it justified to make conclusions on the whole Baltic Sea based on materials collected in a limited area, e. g. in the Gulf of Finland or SW Baltic?
2. What is the importance of infraspecific groups and higher taxonomic units in marine biodiversity assessments?
3. How should the assessments of living resources and their sustainable management be organized in the Baltic?
4. Biodiversity assessments in the Baltic.
5. The possible areas of estimation of the biodiversity and habitat variation in the Baltic.
6. The periodic nature of development of the Baltic ecosystems (incl. the dynamics in their components: phytoplankton, macro-vegetation, bacteria, zooplankton, zoobenthos, fish, alien species, etc.).
7. Define the term *alien* (*non-indigenous*, *exotic*) species for the Baltic ecosystems.

In the Baltic Sea countries the history of marine science has developed well over a century. In the second half of the 20$^{th}$ century, the contacts between the east-coast and west-coast countries in marine science were weak and the corresponding developments differed. In the east-coast countries a large part of the studies was aimed at practical goals (e.g. the creation of scientific basis for the exploitation of living resources). The studies resulted in rather detailed knowledge of some ecological subsystems and the understanding that in the Baltic Sea certain fish species have local populations that should be assessed and managed separately. The majority of the results were published in Russian, Polish, Estonian, German, and other languages not understood by all scientists.
Today a rather rich literature is available on a number of ecological subsystems (incl. biodiversity), on the assessment and management of some living resources in the Baltic Sea,

etc. However, because of language problems, the access to all of these materials by some scientists may be somewhat complicated.
Comments expected:

1. Is the problem concerning the availability of a part of the literature on the Baltic ecosystems important?
2. Suggestions.

# Summary to topic one "What is the Baltic contribution to the European marine Biodiversity? What is the knowledge of marine biodiversity in NAS countries"

Evald Ojaveer

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Altogether 18 scientists participated in the discussions concerning Topic No 1: L. Ignatiades, J. M. Weslawski, S. Cornell, I. Sousa Pinto, M. A. Kendall, T. Radziejewska, V. Panov, H. Ojaveer, E. Karasiova, F. Boero, M. Szymelfenig, L. Stempniewicz,E. Wlodarczyk, E. Bonsdorff, D. Uzars, L. Postel, K. Jadzewski, J. Morozinska-Gogol

As described in the opening statements, the participants addressed the ecosystem of the Baltic Sea as an unique young brackish-water species-poor system, which involves a number of subsystems. To improve the biodiversity assessments and include all habitats of different ecosystem components, it was proposed to carry out studies on transects starting from the shallow coastal zone to the deep parts of every subsystem (H. Ojaveer, K. Jadzewski). The leading role of taxonomy in the biodiversity research was strongly stressed (K. Jadzewski, L. Ignatiades, M. Szymelfenig, L. Stempniewicz, F. Boero). The importance of continuation and improvement of the quality of the long-term data sets for the investigation of the Baltic ecosystem was indicated by L. Postel. The influence of ecological factors (functional aspects of biodiversity) were suggested to be taken into consideration in the biodiversity assessments (D. Uzars, E. Bonsdorff).

The second part of the topic provoked an animated discussion that lasted up to the final comments. L. Ignatiades, J. M. Weslawski, S. Cornell, K. Jadzewski, I. Sousa Pinto, M. A. Kendall, T. Radziejewska, V. Panov, and F. Boero contributed to the discussions. It was confirmed that important data on the Baltic Sea systems exist published in languages other than English, or unpublished. The problem could be divided into two parts:

1. The data on the biota in the Baltic Sea have been published for more than one and a half centuries. A number of works by S. Segerstrale, K. Demel, W. Mankowski and other well-known scientists contain basic information on the ecosystems. They were mainly written in the so-called non-Congressional languages. Also, e.g. a very important monograph by the late A. Jarvekulg, published in Russian, and a number of similar other works belong to such literature, as during the Soviet occupation publication in other languages was almost out of question. In certain fields serious scientific work is not possible without using earlier publications. Correct evaluation of changes in the Baltic ecosystems needs expertise in the usage of historical data for comparison. As up to now this expertise has included knowledge in some languages, then not all scientists have been in the position for drawing valid conclusions in this very important section of science.

2. Therefore, a more balanced attitude towards the literature sources, published in the languages other than English, would be justified. The sources should not be evaluated on the basis of the languages they are published in, but by the value of their scientific content. It would be beneficial if the most important publications of the past could be made available for a wide scientific community. The involvement into the general databases of scientific data from the unpublished or recently published sources of the

Baltic east-coast countries is of substantial importance. In this process plagiarism should be avoided.
The main practical suggestions:

a. the publication (in English) of the data by the data-owners should be encouraged;
b. the data should be exploited and published in the framework of scientific collaboration.

Messages posted on the forum under topic one:

| Message | Date | Posted by |
|---|---|---|
| Opening statement by Prof. Krzysztof Jazdzewski | 01 Jun 03 | Krzysztof Jazdzewski |
| Answer to Prof. Jazdzewski | 03 Jun 03 | LYDIA IGNATIADES |
| Opening statement by Dr Evald Ojaveer | 01 Jun 03 | Evald Ojaveer |
| Answer to Dr Ojaveer | 03 Jun 03 | LYDIA IGNATIADES |
| strategy for biodiversity research | 03 Jun 03 | Henn Ojaveer |
| NAS countries marine biologist problems as seen by Jan Mar | 02 Jun 03 | Jan Marcin Weslawski |
| The paleontologist's solution | 02 Jun 03 | Sarah Cornell |
| Translations library | 02 Jun 03 | Isabel Sousa Pinto |
| reaction to Jan-Marcin's statements | 02 Jun 03 | Mike Kendall |
| blishing/translations | 03 Jun 03 | Teresa Radziejewska |
| Regarding the opinion of Marcin. | 03 Jun 03 | Andrzej Witkowski |
| Reaction to Jan Marcin | 03 Jun 03 | Vadim Panov |
| hocked | 03 Jun 03 | Karasiova Elena |
| unpleasant truths | 03 Jun 03 | Ferdinando Boero |
| in response to Jan MArcinWeslawski comment to topic 1 | 03 Jun 03 | Maria Szymelfenig |
| some reactions | 03 Jun 03 | Lech Stempniewicz |
| Message to Dr Ojaveer | 06 Jun 03 | Dana Uzars |
| Biotic interactions in the Baltic | 06 Jun 03 | Erik Bonsdorff |
| Fish parasites biodiversity | 11 Jun 03 | Jolanta Morozinska-Gogol |

# Introduction to topic two "Change of Baltic biodiversity over various time and spatial scales- What are the controlling factors? Can we predict the dynamics?" (I)

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The Baltic Sea is a young, geologically and hydrographically unstable sea whose origin is related to global climatic changes within the past 20,000 years. The Baltic Sea basin in its Late Glacial and Early Holocene history was subject to transformations. The major factors responsible for environmental changes were:

- isostatic rebound
- eustatic sea level rise

The earliest stage of the Baltic Sea history, the Baltic Ice Lake, began after the recession of the Fennoscandian Ice Sheet at circa 13,000 years BP and lasted until circa 10,250 years BP. At that time it was connected with the North Sea through south-central Sweden. This created the weakly saline Yoldia Sea, which lasted until 9,500 years BP and was followed by a freshwater basin called the Ancylus Lake. Finally, further eustatic sea level rise resulted in a new transgression in the southern Baltic and at 8,500 years BP the Littorina Sea stage began. A gradual salinity increase lasted until ca. 6,800 years BP. The recent Baltic Sea, also called the Post-Littorina Sea, developed as a result of climatic changes, which occurred within the period of 4,000 - 3,000 years BP. Increased freshwater discharge resulted in a distinct decrease of salinity, whilst the climate deterioration led to cooling of the Baltic Sea waters.

Environmental changes related to these Baltic Sea developmental stages resulted in drastic shifts of the fauna and flora inhabiting this sea. After each disturbance, the succession had to start from almost the very beginning and the species composition altered from almost completely freshwater to predominantly marine. Some of the taxa - e.g. the glacial relics isopod *Saduria entomon*, amphipod *Monoporea affinis*, mysid shrimp *Mysis relicta* and priapulid *Halicryptus spinulosus* - survived since the earliest stages, while other marine, brackish and freshwater appeared some millennia, centuries or even years later. Therefore the Baltic Sea can be regarded as a sea of invaders.

The semi-enclosed Baltic represents the world's largest brackish-water sea area. It is isolated from the North Sea and NE Atlantic Ocean by both geographic (sill depth) and ecological barriers (low temperatures and low salinities). The flora and fauna of the Baltic consist mainly of euryhaline species that have extended their natural range from the North Atlantic, relics from former stages of the geological development, brackish and freshwater species and taxa recently introduced by humans. Both temperature and salinity, crucial for organisms inhabiting the Baltic Sea, show strong horizontal and vertical gradients along the longitudinal transect from the Kattegat (close to the North Sea) to the Sea of Bothnia (under the strongest impact of freshwater). Salinity and temperature gradients strongly affect the distribution of native biotic communities and simultaneously they enable the survival of the non-indigenous species with a broad range of ecological tolerance from stenotopic to eurytopic.
The most important features of the Baltic biota are the following:

- absence of fully marine groups beginning from the Danish Sounds
- distinct decrease in number of marine species (fauna and flora) along the gradient
- increase in number of freshwater species with decreasing salinity

- absence of truly deep-water taxa in the Baltic
- presence of non-indigenous species

An interesting phenomenon in the Baltic Sea is the occurrence and appearance of new non-indigenous taxa. Within the last 200 years circa 100 alien taxa have been found in the Baltic. Most derive from uncontrolled release into the Baltic Sea from ships' ballast waters, from hull fouling or by riverine networks that include artificial navigation channels. The alien species are recognised as major threats to the native species and ecosystems. Introduction of alien species results in perturbations often observed as immense major and irreversible changes in the structure of communities (predation, competition, disturbance, diseases and parasites) and is sometimes regarded as a "biological pollution".

However, the most dramatic threat to the functioning and biodiversity of the Baltic Sea biota is human impact, which results in eutrophication and pollution by harmful substances. As a result of its isolation from the oceanic waters, specific topography and slow water exchange, the Baltic Sea ecosystem is very sensitive and reacts to all kinds of disturbance caused by external factors. From the sedimentary record and archaeological excavations it is recognised that the first traces of human impact date back to historic times (a few thousands years). This negative phenomenon was distinctly accelerated in the XVIIIth and XIXth centuries reaching its maximum in the XXth century. The inflow of municipal and industrial wastes reached its critical level in some geographic regions of the Baltic Sea (Gulf of Gdańsk) in the Seventies and Eighties of the XX century. The above processes led to increasing eutrophication of the Baltic. Although there is agreement about the causes of the increasing human-induced eutrophication of the Baltic, in the sedimentary record there is also evidence of natural eutrophication. This process may have been especially effective pronounced during the transgressive events when nutrient-rich oceanic waters were flowing into the Baltic. Therefore the question arises whether the recent eutrophication may not also be partly caused by natural factors instead of only by human impact. Another result of the increasing eutrophication is an irregular appearance of hypoxia or anoxia and the presence of hydrogen sulphide in waters below the halocline. As a result decreasing biodiversity in macro- and meiofauna is observed and this in turn has an impact on codfish stock.

Problems:

- Is the problem of "biological pollution" resolvable? What methods should be implemented to protect the Baltic against introduction of alien taxa?
- Is the recent eutrophication process solely caused by anthropogenic factors or to a certain extent also by natural processes?
- Causes of the algal/cyanobacterial blooms in the Baltic Sea. The role of the water dynamics and of bottom sediment resuspension.
- Can we predict the dynamics of the Baltic Sea biodiversity changes from the global climatic change?
- The biodiversity in the Baltic sea is controlled by historical and abiotic factors, that man can do very little about!

# Introduction to topic two "Change of Baltic biodiversity over various time and spatial scales- What are the controlling factors? Can we predict the dynamics?" (II)

Jonne Kotta

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How big is the role of physical factors in controlling the biota of the Baltic Sea? It is well known that low salinity supports lower diversity as compared to fresh- or marine waters. Besides, the marked salinity gradients and complex bottom topography make the sea hydrophysically more dynamic than many other systems. The alternating periods of stagnation and renewal of deep waters from the North Sea result in decade-scale fluctuations in the Baltic Sea ecosystem. During the past 10,000 years the significant natural environmental alterations between more saline and fresher periods have shaped the characteristic mixture of marine, brackish water and freshwater species of the Baltic Sea.

On the other hand, the Baltic Sea receives a strong load of human induced waste and eutrophication is considered as a prime factor for the development of its biota. Eutrophication increases, for example, the production of pelagic and benthic algae, favours filter-feeders in the benthic system and affects the dynamics of fish stock. Since the 1960s cyanobacterial blooms have become commonplace in the whole Baltic Sea. However, the relationship between the nutrient load and the state of biota is not straightforward. As seen recently the mass development of the benthic filamentous macroalgae and the formation of the drift algal mats were associated with the improvement of the water quality.

Since the late $20^{th}$ century the global scale of biological invasions have been "McDonaldizing" (i.e. uniforming) the previously isolated biotas. Many natural barriers to dispersal have been weakened and consequently the rates of invasions have significantly increased in the past 50 years. To this date more than 100 species of non-native animals and plants have been recorded in the Baltic Sea. Of these species less than 70 have been able to establish reproducing populations. Recently, it is believed that so called biological pollution affects the diversity of the Baltic in the same magnitude as does chemical pollution.

Some evidence exist that the Baltic populations are genetically differentiated from their origin populations with an improved ability to grow and breed in brackish water. Hence, besides conserving the biodiversity at the species level it becomes essential to protect the genetic integrity of locally adapted stocks.

Fish are the main product harvested by man in the Baltic Sea. Because of their socio-economic importance, the fish stocks have been historically investigated more than other structures of the marine food web. However, recent efforts to cope with the decline of fish stock due to the overexploitation and increased pollution have produced the moderate results. It is stressed the possible side effects of climate warming and the establishment of non-indigeneous species.

To conclude it has been often stated that the Baltic Sea is the most studied sea area in the world. To date, however, the majority of evidence about various processes is circumstantial. This is due to the fact that the researchers have primarily concentrated on the issues of spatial distribution or temporal trends of the biota whereas the experimental studies are in minority.

- In fact do we know about the prevalence of the key environmental factors in moulding the biodiversity of the sea?

§ Do we know how does biodiversity affect the magnitude of ecosystem processes and how does biodiversity contribute to the stability and maintenance of ecosystem in the face of perturbations?

# Summary to topic two "Change of Baltic biodiversity over various time and spatial scales- What are the controlling factors? Can we predict the dynamics?"

Jonne Kotta

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Jonne Kotta, Andrzej Witkowski and Brygida Wawrzyniak-Wydrowska opened the topic with an introduction discussing the role of physical and biological factors on the dynamics of the Baltic Sea ecosystem at various temporal and spatial scales. It was pointed out that besides eutrophication, biological pollution significantly affects the diversity of the Baltic Sea. It was concluded that although the Baltic Sea is considered the most studied sea area in the world, the majority of evidence about various processes is circumstantial. Our knowledge is based on the spatial distribution or temporal trends of the biota whereas the experimental studies are in minority.

Main topics of the discussion were as follows:

- Physically controlled biodiversity in Baltic as contrast to biologically controlled in full saline seas
- Sea of change (more saline and fresher periods) – consequences to biodiversity
- Availability of results from archival and paleo-oceanography research
- What is the role of alien and invasive species?
- How much the Baltic biodiversity depends from external driving forces – the role of global dimensions?
- Long-lasting eutrophication and its consequences to biodiversity.
- What is the role of other uses of the sea?

Lydia Ignatiades argued that species biodiversity in the sea varies in ways of multi-factor explanation. There might be key environmental factors affecting it such as changes in temperature and the chemical composition of sea water due to pollution but the inter- and intra-species relationships are also very important ecological factors to be taken into consideration. Thus the status, trend and magnitude of biodiversity in an area is the result of interaction among the numerous environmental and ecological factors and we really need a lot of scientific knowledge to approach the explanation of these questions.

Erik Bonsdorff pointed out that the Baltic Sea is under the continuous change and therefore it is not possible to describe the typical biota of the Baltic. Nevertheless the rationale of protecting the biota of the Baltic Sea is due to the following considerations: uncertainly of the future, ethic obligations towards our surrounding environment, including its inhabitants, and we do not know how a completely altered food web will function, i.e. we run the risk of loosing our own food source by disrupting the ecosystem.

Jonne Kotta provided the example that the relationship between the nutrient load and the state of biota is not necessarily straightforward. As an example, prior to the 1990s the Gulf of Riga was strongly influenced by municipal and agricultural discharge. Following the economic recession of the Baltic States in the 1990s the intensity of agriculture and consequently the nutrient content in the basin have substantially reduced (Suursaar, 1995). Following the improvement of the water quality in the Gulf of Riga, the mass development of the benthic filamentous macroalgae and the formation of the drift algal mats were observed (Kotta et al., 2000). Despite of the signs of improvement in terms of nutrient load we are fully aware that

the Gulf of Riga is still more polluted basin than the Baltic Sea on average. Hence, the changes are likely reflecting the instability of ecosystems due to the abrupt changes in the nutrient levels.

Henn Ojaveer stressed that alien species are an important component of the Baltic food-web at various trophic levels (e.g., phytoplankton, zooplankton, zoobenthos, fish). It means that human activities continuously play very important role in evolution of the Baltic biota. Hence, it is difficult to agree with the statement that 'the biodiversity in the Baltic Sea is primarily controlled by historical and abiotic factors, that man can do very little about!'. Alien species have caused biodiversity increase in the Baltic Sea. There are many examples showing how alien species have changed composition of the Baltic biota (e.g., Leppäkoski et al. 2002; Ojaveer et al. 2002).

Erik Bonsdorff argued that the discussion about the effect of alien species on the structural or functional biodiversity of the Baltic Sea bases on no scientific knowledge. That was also noted by Jonne Kotta who stressed that the majority of evidence about various processes in the Baltic Sea (including the effect of aliens) is circumstantial and despite of that much is talked about the significant effects of alien species on the ecosystem functioning. There exist only a few exceptions where the impacts of aliens on the native communities were experimentally studied (e.g. Kotta et al., 2001; Panov et al., 2002; Kotta & Òlafsson, 2003).

Henn Ojaveer argued that several case studies confirm that some species (e.g., *Marenzelleria viridis*, *Cercopagis pengoi*, *Neogobius melanostomus*) continue to increase in population size and by colonising new areas continue to cause declines in distribution area and population size of native species. As more alien species are expected to be transported into the Baltic, more profound impacts are to be predicted. However, which species is the next to come is almost impossible to say as such predictions (made in other regions) have generally failed. The same is valid for the potential ecological impacts caused by alien species - these are often unpredictable both in magnitude and direction. But what should be agreed with the above statement by Andrzej Witkowski in terms of alien species is that abiotic factors certainly also control the Baltic xenodiversity (=alien species diversity) allowing successful establishment of species tolerating changeable brackish-water environment.

Ewa Wlodarczyk was concerned about the increased diversity of the Baltic Sea caused by the successful invasion of non-indigenous species. In this respect the Baltic again confirmed its uniqueness by using to its advantage what is considered a world wide threat to biodiversity, i.e. non-native species. Nowadays, an increased (or at least conserved) biodiversity seems to be one of the major aims of an ecosystem-based approach to the management of human activities. Hence, there is a need to weigh the financial burden of ballast water treatment against the “slight” danger (or even benefit?) of invasion by alien species. Vadim Panov reported the negative effects of alien species in the Baltic Sea coastal waters, including replacement of native species (i.e. the decline of the native diversity) (Panov et al., 2002).

Finally Ferdinando Boero suggested that comparing the Baltic and the Mediterranean is a very profitable exercise as a low-diversity basin and a high-diversity basin should respond differently to biological invasions? He believes that it is time to synthesise all this knowledge and start to make comparisons.

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Messages posted on the forum under topic two:

| **Message** | **Date** | **Posted by** |
|---|---|---|
| Opening statement one by Prof. Andrzej Witkowski | 02 Jun 03 | Andrzej Witkowski |
| alien species | 03 Jun 03 | Henn Ojaveer |
| Opening statement two by Dr Jonne Kotta | 02 Jun 03 | Jonne Kotta |
| a voice from the Mediterranean | 03 Jun 03 | Ferdinando Boero |
| controlling factors | 04 Jun 03 | LYDIA IGNATIADES |
| message from Erik Bonsdorf | 03 Jun 03 | Erik Bonsdorff |
| Reaction to summary | 04 Jun 03 | Ewa Wlodarczyk |
| reference on effects of alien species in Baltic Sea | 04 Jun 03 | Vadim Panov |

# Introduction to topic three “Where is the "cutting edge science" in the Baltic marine biodiversity?” (I)

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Biodiversity (biological diversity) is usually considered at three different levels:

1. genetic diversity
2. species diversity
3. ecosystem diversity

But it seems that the problem of *biodiversity* is much deeper than that. It is - *de facto* –an old and still unanswered[1] question concerning the *life*, i.e. *biological dynamism*. It is not possible to answer it, without examining some essential properties of concrete *living forms*. An oak, a cat, a frog, a sea-gull, a shrimp, a herring, a bacterium, is a *concrete living form*[2].

**Living form**

The expression *concrete living form* does not imply something “frozen in time”, a segment isolated from its environment, an *organic structure*, which we see *here and now*.
Let us take into consideration a very illustrative (although non-marine) example – a frog. When we stand on the bank of a pond in springtime, we can see the frogspawn. A few days later, we can see swimming briskly tadpoles, equipped with gills and a long tail. Then we can notice frogs jumping around in the grass. They have a no tail nor gills, but which now have long hind legs and lungs. Even when the frog reaches maturity, its heart will not be the same as a few days earlier. It will be converted into a “new one”, owing to the ceaseless *metabolic turn-over*. The same we can say about herring, *Pseudocalanus*, *Aurelia*, *Pygospio*, *Balanus*, *Fucus*, etc.

The frog’s (herring’s, Aurelia’s ...) complex chemical structure changes every minute, but the frog (herring, Aurelia ...) keeps its identity as its developmental dynamism goes on. This dynamism “marks out” the non-arbitrary boundaries of the actual and fundamental object of biologist’s research. The “boundaries” of a living form are not delineated by its structure, nor by its envelope of skin, nor by its cellular walls, but by its *developmental cycle*.

However, this does not mean that the living form is just a *developmental dynamism*. Nevertheless, *this* fundamental, integrated biological dynamism determines the proper idea of the living form *as a true dynamic whole* besides which there is no life.

It does not mean that we can “narrow down” the study of the dynamics of life to a single specimen. The fact that organisms reproduce themselves, directs our attention to the dynamics of *transmitting life* “down” a lineage. The behavior of a concrete specimen is essentially subordinated to the process of reproduction - the perpetuation of life of the given living form.
The *developing* and *reproducing* living forms are the fundamental, “material” subjects of biological and ecological investigations.

[1] Daniel Koshland’s article *“The seven pillars of life”* (*Science*, March 22, 2002) bears witness to this. The author’s inspiration to write this article was a symposium, dedicated to an attempt to define *life*.
[2] To focus our attention on the issue of “object” in the debate about *life*, may seem trivial, even ridiculous. However, in the light of some biologists’ questions (in discussing the definition of life), such as: *Is an enzyme or DNA alive? Is a virus alive?* (cf Koshland 2002), the issue is not as trivial as it would seem on the surface.

Morphology, anatomy, physiology, DNA or biochemistry of particular organisms are the "formal" (but fragmentary) subject of biological study, and these investigations have a proper meaning only in the context of a living whole.

**Behavior**

In the study of biodiversity it seems necessary to pay greater attention to the behavior of living form. I propose to look at the organisms not as structural components ("particles") of ecosystem, nor as components of energy or matter flow through ecosystem, but first of all as the *behaving being*. It means, that living entity:

1. possess biological tools (organs) - from molecular (e.g. different enzymes, ribosomes or DNA structure containing enciphered and passive information) up to anatomical level of body organization (e.g. legs, gills, or eyes),
2. possess an ability to utilize these tools,
3. possess an aptitude to reach an orientation in some properties or states of surroundings and in the structures of one's own body.

Almost all the biological tools are created in the course of embryogenesis. Only relatively few are received like a "dowry" from the parental organism within the structures of the gamete. Due to orientation in abiotic and biotic factors of an environment the living form may modify and improve its own actions, as well as repair and adapt the shape, size, constructional or functional details of its own tools. Expression of these abilities amounts - among others – to phenotypic (and genotypic) plasticity of individuals of given living form.

On the top of the structural (anatomical, cytological, organellar, biomolecular) level of the living entity we observe, we do always observe the *behaviour of the (whole) living entity*. The structure and size of the *instrument* has no primary significance here.

It is important to realize that *behaviour lies at the basis of the fundamental, developmental dynamism of living forms* - i.e. the construction, reconstruction and repair of the body's structures.

**Orientation**

*Orientation* can be recognized when the living form, in an obvious way, *choose* (*select*) his actions (their character, moment of a partucular activity, its direction, etc.) as well as the object of its manipulation. Vertical and horizontal migration, selection of mating time, food capture, selection of the material for nest or shell construction, selection of the overwintering water layer, etc., are the examples of actions of living forms „steered" by orientation. It seems that orientation may play an important role in the formation of a complex web of dependencies between living forms within their communities or assemblages.

**Biological and abiotic dynamism**

Though biologists are first and foremost interested in the biological dynamism, they cannot loose sight of different types of abiotic dynamism (water mass movement, heating, freezing, river water inflow, light penetration into the water, etc.). It is necessary to discuss the dynamism of living forms in the context of the abiotic (nonliving) dynamics. But it is wrong to mix up these two kinds of dynamism (and talk e.g. about "sand-beach respiration") or melt them together into one kind of "ecosystem dynamism" (appearing in different forms). Ecosystem is not a true whole (like organism), but it is a set of objects and dynamics objectively different in their nature. The biological dynamism remains in a clear, though specific, relation with the abiotic dynamics. Physico-chemical factors can *provoke* living forms to different types of behavior (e.g. to search the environmental conditions which are optimal to developmental processes), can *shift* organisms from one place to another (conditioning, for example, colonization of a new place), or can *eliminate* (kill) them.

**Biology and ecology**

Biology is the study of life. Ecology – in my opinion - is just a division of biology. I propose to define ecology as the study of organisms in their environment of life in aim of understanding the nature, origin and consequences of formation of different types of the behavioural and physical link between living forms, as well as between organisms and abiotic environment. Marine ecologists must seriously take into consideration the results of physical and chemical investigation of the sea, but their main effort should be focused on living forms (species identification, life cycles, behaviour, etc.).

# Introduction to topic three “Where is the "cutting edge science" in the Baltic marine biodiversity?” (II)

Erik Bonsdorff

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"Marine Biodiversity" has been given many definitions, fitting the purposes of a variety of prerequisites for research and/or understanding of the problem. For the scientific scene around the Baltic Sea, this is a critical issue, as this non-tidal, low-saline brackish water basin in so many ways differs significantly from most other marine systems in the world. In fact, referees for international journals still tend to question the justification in publishing results from the Baltic Sea in the top ranked journals, as they claim these "lack generality within marine research" (quotation from referee statement in May 2003). Scientists within the Baltic Sea system have traditionally responded to the outside scientific world in two ways: (i) keeping to themselves, and presenting their data and knowledge within the Baltic marine science community at specially dedicated symposia and workshops published as separate proceedings-volumes, and (ii) by primarily testing general hypotheses utilizing the specific (species-poor) characteristics of the Baltic biota to validate or develop our (marine) ecological thinking, thus gradually increasing the awareness and knowledge of the Baltic Sea, as a valuable model for general (global) marine ecology and biology. The first approach was vital in the strive to encompass the (former) eastern Baltic countries into the family of (western) research, and also in the work to map, monitor and ultimately improve the ecological state of the heavily impacted Baltic Sea ecosystem. For this purpose the Helsinki Commission for the Protection of the Baltic Sea (HELCOM) was started already some 30 years ago (see: http://www.helcom.fi). Subsequently HELCOM has published a large number of assessment reports of the environmental state, and this effort has been of paramount importance for our current knowledge and understanding of the Baltic Sea as an ecosystem, also form a biodiversity-point of view. Similarly, the (sometimes small-scale) experimental approaches by individual scientists (or groups of scientists) working with both planktonic and benthic ecosystems has gained international recognition of the species-poor Baltic Sea as a perfect natural laboratory for the developing marine biodiversity paradigms, and it is my conviction that both these approaches have been equally important for our currently broad and detailed knowledge. Today much of our efforts are pooled through EU-financed projects, involving partners from all around Europe, and it is self-evident that we compare our marine ecosystem to any other on equal terms (perhaps at the cost of loosing individual creativity?).

This relatively simple system (low species numbers, few species per ecological function) offers ample opportunities to study and analyse functional aspects of biodiversity, linking population-, community- and systems-ecology. Further, numerical modelling including also biological effect parameters can be done at a reasonably accurate level. Thus, there is every reason for us to promote and conduct marine biodiversity research in the Baltic Sea.

There are to my mind some factors that should be kept in mind when tackling the biodiversity of the Baltic Sea, and I hope these issues will be discussed during this MARBENA e-conference on marine biodiversity: 1) the post-glacial history of the Baltic Sea: the system is young on geological, evolutionary and ecological time scales, and natural succession has not yet reached a level of "dynamic equilibrium" with immigration and extinction rates balancing each other, 2) the extremely steep environmental gradients from south (fully marine, no ice cover in winter etc) to north (almost limnic, arctic ice conditions annually, etc) reduce the number of potential natural immigrants, keeping numerical diversity low, 3) the enclosed

status of the sea, with marine inflow (and hence species recruitment) only through the Danish straits: The distance from the potential species pool (currently the North Sea and Skagerrak) with its specific conditions to the inner Baltic Sea, is long and hazardous, including problems with salinity-and hypoxia-gradients. The potential glacial immigration corridor(s) from NE (the White Sea) could be considered in terms of genetic similarity and geological history. Also, potential historic "ecological refugia" offer an interesting approach (why are some populations "Baltic"; why are some genetically close to the White Sea biota, etc), 4) current inflow of "alien" species aided by man breaking down the structures and functions evolved during the past 8,500 years: some 100 introductions (ranging from unicellular planktonic species to coastal mammals) have been recorded, but perhaps only 30% of these have actually established themselves with self-sustaining populations, and little is known on actual effects on biodiversity (increasing species composition and ecosystem functioning; no known extinctions caused by these "invaders"), with the possible exceptions of highly pre-stressed environments, such as harbours and some semi-enclosed embayments or lagoons, 5) the anthropogenic environmental stress on the system, where climate change and eutrophication are the overshadowing factors, with over-fishing, transport of hazardous substances, traffic, physical modifications of (primarily coastal) habitats and habitat fragmentation, toxic substances in the environment and in the organisms etc, as very important additional stressors.

Against these aspects, it is evident that the successive patterns that during the past millennia have lead to the ecosystem structure and function described around the mid 20th century, have been radically interfered with, causing problems for the biota of such a magnitude that it is safe to say that the marine biodiversity (species composition and their functioning) is changing at a far higher ratio than could be anticipated purely based on the successive history of the Baltic Sea ecosystem.

In this respect it is vital that scientists from all countries and political systems bordering our common Baltic Sea are given the same premises and platforms to work from in order to further increase our knowledge of this delicate ecosystem.

# Summary to topic three “Where is the "cutting edge science" in the Baltic marine biodiversity?”

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Below you can find a few general remarks/conclusions referring to some plots of discussion on topic three.

[1] “All men by nature desire to know.” (Aristotle, Metaphysics, Book I, Part 1) The man desires to understand the biotic and abiotic nature, i.e. not just to know “how it is” but also “why it is”. He desires to know it not necessary for some utilitarian ends or any other advantages. The man wants to know truth.

[2] In order to develop properly (in the biological, psychological, intellectual, and spiritual sense) we - human beings - need “diversity”: the different living forms in our surroundings, the differentiated landscapes, the starry sky, .....
We need the Baltic Sea with its lower number of species and biota, and the Mediterranean Sea with its higher number of species and biota.

[3] We cannot judge a priori or arbitrarily on the importance of a given living form for biocenosis (i.e. for community of organisms) or ecosystem.
Before we undertake decision “to protect” or “leave unprotected”, “to introduce” or “reintroduce” a given species, “to change” or “not to change” its habitat, we must learn this living form – its niche, its adaptive potential, its relation to other organisms, etc.

[4] We are trying to know and to protect concrete living forms and their habitats. Actually we do not observe, monitor and protect the so called “functional groups” – but we do observe living forms. The so called “primary producers”, “consumers”, “decomposers”, “semi terrestrial detriphagous”, etc. are just mental abstracts, i.e. a kind of intellectual “tools”. They are quite useful in conceptualization and arrangement of our knowledge. But the primary object of our study is life - in its various, fascinating forms.

[5] We have to study biodiversity, i.e. diversity of living forms, inhabiting different environments. In our research we should not ignore the developmental and adaptive potential of a particular living forms. In our work we should not become discouraged because our publications, our papers are not always impressive in terms of impact factor or because our investigations are not “fitting” to the currently trendy topics. I repeat - we are pursuing science in order to know, and not necessary for any utilitarian end. We do not seek knowledge only for the sake of any other advantage, but the joy of knowing the truth, the beauty and the goodness of nature.

Messages posted on the forum under topic three:

| Message | Date | Posted by |
|---|---|---|
| Opening statement one by Jolanta Koszteyn | 03 Jun 03 | Jolanta Koszteyn |
| to Jolanta | 05 Jun 03 | Felicita Scapini |
| so many parameters | 05 Jun 03 | LYDIA IGNATIADES |
| Opening statement two by Erik Bonsdorf | 03 Jun 03 | Erik Bonsdorff |
| some comments | 04 Jun 03 | Friedrich Buchholz |
| Focal sites & the Baltic | 04 Jun 03 | Erik Bonsdorff |

| | | |
|---|---|---|
| food for thought | 04 Jun 03 | Henn Ojaveer |
| 1) Responding to “food for thought” | 04 Jun 03 | Ewa Wlodarczyk |
| Biodiversity, comparisons and statistics | 04 Jun 03 | Erik Bonsdorff |
| mixing oranges and apples, North Sea and the Baltic | 05 Jun 03 | Jan Marcin Weslawski |
| oranges & apples? | 05 Jun 03 | Erik Bonsdorff |
| Close the theme? | 05 Jun 03 | Teresa Radziejewska |

# Introduction to topic four "Socioeconomic/cultural dimension and conservation status of marine biodiversity in the Baltic Sea" (I)

Eugeniusz Andrulewicz

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Biodiversity was defined at the Rio Convention, 1992 as: "The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems"

The general objective of the BD Convention is to preserve all types of diversity by applying the guidelines of the Rio Convention as well developing and implementing international and national Action Plans for Conservation and Management Biological Diversity. An Action Plan should contain baseline information about existing biological diversity, propose actions to control and restore biodiversity and a biological diversity monitoring program.

A number of practical questions are to be answered in relation to the preservation of biological diversity in the Baltic Sea and in fulfilling the BD Convention. They should be considered within the context of existing international organizations and ongoing monitoring and research programs.

Following (challenging) questions should be answered:

*What is the present status of Baltic marine and coastal diversity?*
This should be assessed in the light of historical reference points from the period when Baltic Sea biological diversity was in a good status. Nevertheless, we can't go to deep into history, as our reference period must be based on data, therefore the question is: Which period could be selected as a Reference Point for assessing the present status of biological diversity?

*How can monitoring Baltic biodiversity be conducted by utilizing ongoing monitoring and research programs?*
The scope of the HELCOM Monitoring Program traditionally includes phytoplankton, zooplankton and zoobenthos. It will also cover macrophytes and marine avifauna. Data on fish and mammals can be obtained from ICES and on the harbour porpoise from ASCOBANS. The following question must be answered: Is the HELCOM Cooperative Monitoring Program of the Baltic Sea (COMBINE) together with the above mentioned activities of the ICES and ASCOBANS sufficient for assessing Baltic Sea biodiversity? Should one or more of the existing COMBINE components be strengthened and/or measured more intensively? Should it be the subject of separate measurements and/or observation during COMBINE monitoring cruises? Should biodiversity be an additional core component of COMBINE?

*How should periodical assessment of biodiversity status in the Baltic Sea be conducted?*
Biodiversity issues have been considered in the "HELCOM Periodical Assessments", the Third Periodic Assessment of the State of the Marine Environment of the Baltic Sea, 1989-1993 and the Environment of the Baltic Sea Area, 1994-1998. These contain descriptive chapters on nature conservation and biodiversity with regard to Baltic biotopes and different taxonomic groups such as plankton, phytobenthos, fish, marine mammals, sea birds and alien species. This type of assessment will be discontinued. How should the assessment of

biological diversity in the Baltic Sea be continued and developed? Should biodiversity be the subject of a special "Thematic Assessment"?

*How should decision makers be advised on the status of biodiversity?*
Research results and scientific papers are not suitable material for decision makers. Most often this material is not accessible to laymen and decision makers. Likewise, lengthy, descriptive reports will not be read by managers! Thus, it is the duty of scientists to develop appropriate science-based tools for the assessment of biodiversity and to offer them to managers.

*What scientific tools for managing biodiversity can be offered to decision makers?*
A great deal of relevant data on marine species are collected by monitoring and research programs, but in many cases these data are not synthesized into forms which are legible to management. To date, very little data integration or processing into more applicable forms has been undertaken. One such tool, originally proposed by economists, are indicators.

An illustrative example of a P-S-R *(Pressure-State-Response)* framework of indicators (Andrulewicz 2002, ECSA 34) is offered for you to consider its usefulness to management. You are invited to comment and propose other indicators of a general nature to this list, but please keep in mind that only a limited number of indicators can be used by decision makers.

| Anthropogenic Pressure (P) Indicators |
|---|
| Discharges of nutrients |
| Discharges of toxic substances |
| Exploitation of fish |
| Physical habitat destruction or fragmentation of habitats (e.g. heavy trawling, marine aggregate extraction, large-scale engineering projects) |
| Anthropogenic transfer of non-native species |

| Environmental State (S) Indicators |
|---|
| Overall number of species |
| Overall number of biotopes |
| Overall number of landscape types |
| Genetic diversity (number of genotypes) |
| Status of keystone species |
| Status of endangered species |
| Biological diversity indicators (e.g. Shanon-Wiener, etc.) |

| Governmental/ Societal Response (R) Indicators |
|---|
| Reduction of nutrient loads |
| Reduction of harmful substances loads |
| Regulations of catches of fishery target and non-target species |
| Legal protection of habitats |
| Legal protection of endangered species |
| Establishment of protected areas |
| Restoration of degraded habitats |

Efficient management requires achieving the full D-P-S-I-R *(Driving force-Pressure-State-Impact-Response)* framework of indicators. This has already been adopted by the EU. What are your suggestions for "D" *(Driving force)* indicators ?

*How do we separate anthropogenic impacst on biological diversity of the Baltic Sea from natural impacts (e.g. climate change)?*

Bearing in mind that only anthropogenic factors can be managed, we should aim to have a clear picture on anthropogenic influence on biodiversity. Such questions as what is the reason for disappearance of *Fucus vesiculosus* along the Southern (Polish) Baltic Coast – anthropogenic or climatic? This questions should be answered prior to actions on restoration of *Fucus* beds.

*What about diversity of Baltic biotopes?*
HELCOM has published the "Red List of Marine and Coastal Biotopes and Biotope Complexes of the Baltic Sea, Belt Sea and Kattegat" (HELCOM BSEP No. 75). Is this list sufficient in its description of Baltic biotopes, or should this activity be conducted and developed further? Is EU EUNIS habitat classification relevant to classification of Baltic biotopes ?

*To what extent is HELCOM BSPA helpful for biodiversity conservation?*
One of the primary reasons to establish BSPA was the conservation of biological diversity. This has been more a political wish rather than an action supported by scientific consideration. Until now, no scientific support (papers) about the role of BSPA in preserving Baltic biological diversity is noticed. Perhaps they do not play any role in preserving diversity?

*Why, until now, didn't we have a Baltic Sea list of endangered species?*
Surprisingly, until now we do not have a Baltic Red List (Endangered) of Species, even if it is badly needed for the ecosystem-based assessment and management, and assessment of biodiversity status.

*How should Baltic biodiversity be restored?*
A number of species have disappeared in some Baltic sub-regions (particularly some macroalgae and some fish), and the occurrence of a number of other species has diminished. Is there a need for action on reintroduction of these species? Are environmental conditions already sufficient for such reintroduction?

# Introduction to topic four "Socioeconomic/cultural dimension and conservation status of marine biodiversity in the Baltic Sea" (II)

Georg Martin

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In the Baltic Sea we are talking about the water body of estuarine character, low biodiversity, high vulnerability, complicated mixture of pressures and responses in the ecosystem. Baltic Sea has been treated as simple (ecological models) and on the other hand extremely complicated and unpredictable (recent environmental overviews) system. At present, scientific knowledge has reached the level that we have more loose ends than fixed explanations about the behaviour of the Baltic Sea ecosystem including its biological component. Newly introduced species, changes in the community structure due to overexploitation and pollution are few examples of processes affecting biodiversity in the Baltic Sea.

On the other hand – general public interest of biodiversity issues in the Baltic Sea has remained at the same level already for ages. Most of the concerns have been concentrated to fisheries related problems and recreational matters. Public awareness of biodiversity problems has been generally very low all around the Baltic Sea. Reasons for that are the lack of scientific information and too few efforts to translate complicated scientific knowledge to the language understandable for general public.

Until present, no large scale changes in marine biodiversity having socioeconomic implication in coastal states took place, but at the same time possibilities of those have been poorly investigated. Changes in biological community structure may cause processes towards decrease in commercial fish stocks or other biological resources. In few cases public opinion seems to be ahead of scientific knowledge to blame certain species to cause damage to local fish stocks (e.g. cormorants and seals responsible for decrease in commercial fish catches) while scientists are not in a hurry to prove or deny these statements.

Development of biodiversity conservation in the Baltic Sea has been relatively slow compared to terrestrial ecosystem. Establishment of network of BSPAs (Baltic Sea Protected Area) is still in the process. In most cases where marine areas have legal nature protection status, the reasons of putting these areas under protection have nothing to do with marine biodiversity. New developments e.g. establishment of Natura 2000 network have forced to seek for more biology orientated information for marine areas and in most cases we find out that the existing information is not sufficient to describe the real situation. Detailed mapping of biodiversity is possible only for a limited number of areas in the Baltic Sea.

So it is time to formulate our strong opinions and to show up with statements as:

- Is there a conflict between process of biodiversity conservation and economic development in coastal areas?
- How to expand our general knowledge of coastal biodiversity in a way that we will be able to contribute to proper conservation activities that are now taking place?
- Is there anything that we can do for rising the public awareness about marine biodiversity in the Baltic Sea?

# Summary to topic four "Socioeconomic/cultural dimension and conservation status of marine biodiversity in the Baltic Sea"

Eugeniusz Andrulewicz

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I wish to apologize for not having played an active role in the MARBENA e-Conference. During the conference I was travelling along the Baltic coast aboard the M/S Ocean Monarch taking part in a symposium entitled *The Baltic Sea - Common Heritage, Shared Responsibility*, which was organized under the auspices of the *Religion, Science and Environment* program of the of Metropolitan of Constantinople, HAH Bartholomew. This initiative was related to the protection of *God's creation - the Baltic Sea*. The message from this symposium to MARBENA can be paraphrased by the symposium title *BIODIVERSTY - Common Heritage, Shared Responsibility*.

Just by chance, this symposium coincides well with Topic 4 of our e-Conference *(The socioeconomic and cultural dimension and conservation status of marine biodiversity in the Baltic Sea*). The public, as well as decision makers, should be thinking about why biodiversity is our common heritage. What does shared responsibility mean in practice? Decision makers should be advised on how to protect and manage biodiversity, if, indeed, biodiversity can be managed at all. Let me raise some issues in the form of questions (even if we know the answers). Who, if not scientists, should teach the public and decision makers about biodiversity and what humankind's relationship with it should be ? Who, if not scientists, should provide scientific advice to managers on how to conserve and manage biodiversity? We all know the answers: scientists have other duties than just research. Biodiversity has many other dimensions than just scientific (Oksanen 1997), and it is the responsibility of scientists to bring these to the attention of the public and decision makers.

From my experience with HELCOM EC NATURE (presently HELCOM HABITAT) and HELCOM BMP (presently HELCOM MONAS), it appears that scientists are not really capable of, or perhaps even interested in providing adequate advice to managers on how to protect biodiversity. Questions such as how to monitor and asses biodiversity remain essentially unanswered, and they must be answered by scientists. It must also be borne in mind that only limited financial resources are available for research and monitoring and that decision makers have limited time available for reading scientific advice. No manager has the time to read scientific papers and reports, and this is why they keep requesting simple, indicative reports.

Therefore, I will repeat what I said in the opening statement: "A number of practical questions are to be answered in relation to the preservation of biological diversity in the Baltic Sea and in fulfilling the BD Convention. They should be considered within the context of existing international organizations and ongoing monitoring and research programs. Thus, it is the duty of scientists to develop appropriate science-based tools for the assessment of biodiversity and to offer them to managers".

Finally, in view of the establishment of a new ICES Study Group on the Ecosystem Health of the Baltic Sea, I am personally interested on how to use biodiversity as an indicator of ecosystem health, and I offer my assistance to those scientists who would like to participate in this ICES Study Group.

I would like to extend my thanks to all those who participated in the discussion under Topic 4.

References

Oksanen M. “The Moral Value of Biodiversity”. Ambio Vol. 26 No. 8, Dec. 1997.

Messages posted on the forum under topic four:

| Message | Date | Posted by |
|---|---|---|
| Opening statement one by Dr Andrulewicz | 04 Jun 03 | Forum Admin |
| Baltic Sea list of endangered species? | 09 Jun 03 | Krzysztof Jazdzewski |
| what kind of "red book" we need for Baltic species ? | 10 Jun 03 | Jan Marcin Weslawski |
| Opening statement two by Dr Martin | 04 Jun 03 | Georg Martin |
| communication … | 05 Jun 03 | Aleksander Drgas |
| naturally and anthropogenic influences | 05 Jun 03 | Lutz Postel |
| a major query | 05 Jun 03 | Michal Gruszczynski |
| one more word about communication and the public awareness | 06 Jun 03 | Joanna Maria Drazek |
| scientists awareness | 06 Jun 03 | Ferdinando Boero |
| Drs Y. Samyn, Vrije Universiteit Brussel, Unit for Ecology & | 10 Jun 03 | Yves Samyn |
| impact factors | 11 Jun 03 | Ferdinando Boero |
| use and abuse of impact factors | 11 Jun 03 | Farid Dahdouh-Guebas |

# Introduction to topic five "Is there a need for further human intervention on the Baltic ecosystems?" (I)

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**The EU village's pond – the Baltic Sea**

The natural ecological patterns of today's Baltic Sea were formed when man first settled on its shores. This is a unique temporal coincidence. This sea has fed and sustained the development of regional civilization until recent times, when we realized that our development was being achieved at the expense of the natural values of the Baltic. How could it have happened that one of the world's centers of civilization caused such severe destruction of its local environment? The region, which is regarded as having long been intellectually mature with a concerned and rational public, has failed so badly in the field of sustainable use of natural resources. Is the Soviet-influenced political system to be blamed? Or should the general hypocrisy of international agreements and conventions which have been so poorly implemented be blamed?

The nineteenth century's village pond used to be a good indicator of the level of local agriculture and waste disposal, but today's Baltic is testament of the incompetence of the population which inhabits its watershed. The lack of knowledge may result from the ignorance of laymen and their representatives, or from the poor quality of scientific endeavor. It would be difficult to find anybody who is not in support of Baltic conservation efforts. Still, we are unable to cope with the disappearance of special habitats in the coastal zone (e.g. brown and red algae, sea grass, cane) and we cannot stop the overfishing of commercial biological resources such as cod. We cannot deal with the by-catch of protected (!) seabird and marine mammal species, neither stop eutrophication, nor take care of the spawning grounds of migrating species (salmon, eel), nor stop the inflow of invasive species nor remove chemical munitions deposits.

In this civilized part of the world initiatives and organizations like HELCOM, IBCFS, ASCOBANS, BALTIC 21, ICES are highly inefficient. How can we expect better treatment of nature in less privileged parts of the world? The human impact on the Baltic ecosystem is as old as this sea itself. Our civilization has evolved with this very sea. We are twins - the result of the evolution of the biosphere in this part of the world. Since the second half of the twentieth century, man has acquired a better understanding of the functioning of marine ecosystems and has striven to cope better with the environmental carrying capacity of the Baltic ecosystem (in terms of fish resources, coastal zone development, merchant shipping). In this context, the word "intervention" takes on another meaning – we want to behave better and be less destructive.

The present-day intellectual capacity of Europe and know-how regarding the sea is amazing, but poor success in the practical implementation of conservation measures leaves no place for optimism, regardless of whether we refer to "old" or "new" Europe. This shows how little can be done effectively. Still, I am deeply convinced that human intervention is needed. We have to improve the management of rivers and watersheds and be more efficient in the protection of threatened species, habitats and processes.

I am afraid that dispute among specialists regarding the necessity of conservation and intervention in the Baltic Sea will not be efficient in social or ecological terms. We may

consider ecological knowledge as a tool - “the rope on the ship” – which might be helpful for Baltic communities in their future sustainable development. For this we have to make sure that society knows how to use the tool. The rope on the ship will serve you when you pull, but not when you push. Ecology may easily serve as decoration - what is commonly the case today is that it is fashionable knowledge. From this point of view, intervention is needed, and we want better marine perception for the occasionally nektonic *Homo sapiens*.

At the moment, the state of the European village’s pond does not meet aesthetic expectations. Its natural values are decreasing, as are its economic values. The only beneficiaries of this situation are ecologists. There are more jobs for the researchers of our precious, degraded European Sea. The question remains - do WE need human intervention in this ecosystem?

# Introduction to topic five “Is there a need for further human intervention on the Baltic ecosystems?” (II)

Sergej Olenin

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The Baltic Sea is changing. Yet, anthropogenic changes which have happened within less than one hundred years can not be compared with major natural environmental perturbations which took place during the past 10,000 years of its post-glacial history. Nevertheless, the alterations are evident, especially in the coastal areas of the Sea. Theoretically (in ideal situation), the Baltic Sea ecosystem may return to its pre-eutrophication and pre-contamination condition. However, it will never go back to a “*Marenzelleria-*“, “*Cercopagis-*“ or “*Neogobius*-free” stage. Biological invasions associated with human activities are becoming the major element of the global change. In this context, is the problem of bioinvasions an important scientific issue *per se*, or is that interest driven only by practical needs? What aspects of bioinvasions (e.g. biogeographical, genetic, functional, ecological-economic, technological, etc.) are the most interesting from the scientific point of view?

In one of the previous MARBENA e-conferences, the conclusion was made that the effects of invasive species on native ecosystems remain largely unknown. It should be noted that the number of documented impacts of aquatic bioinvasions, both ecological and economic, in the Baltic Sea (and in Europe, in general) is significantly smaller than in North America and in Australia. Is it because the European coastal marine and inland aquatic systems are naturally “more resistant” to species introductions (if so, what are the reasons for this?) or because the European researchers are less concerned about bioinvasions and do not pay sufficient attention to that problem? If the later is the case, to what extend may the situation be changed?

The Baltic Sea is deservingly recognized as a region with a well developed international environmental cooperation. The system of marine biological monitoring conducted by HELCOM since the late 1970s is one of the good examples of such collaboration. In relation to bioinvasions, however, it should be noted that no one of the 25 alien species first recorded in the Baltic Sea in the recent two decades (for more data see the Baltic Sea Alien Species Database htpp://www.ku.lt/nemo/mainnemo.htm), was revealed at the HELCOM monitoring stations. Should the HELCOM (and national) marine biological monitoring strategies be reconsidered in that respect? Should they be focused on an early detection of non-native species? Is there a need for an early warning system on bioinvasions in the Baltic? If “yes”, what elements should it include?

At present, ship traffic is the most important vector for the spread of aquatic organisms into the Baltic Sea. Should we advise our governments to take precautionary measures and to join voluntary IMO "Guidelines for the Control and Management of Ship’s Ballast Water to Minimise the Transfer of Harmful Aquatic Organisms and Pathogens" as several countries around the globe already did?

There are opinions that the terms and notions widely used in invasion biology (e.g., “aliens”, “non-native”, “exotics”, “non-indigenous”, “xeno-diversity”) remind the phraseology of the notorious racist theories and provoke xenophobic feelings. Does this ethical concern have anything to do with the scientific problem of bioinvasions? Are such parallels between the human world and natural life permissible?

# Summary to topic five "Is there a need for further human intervention on the Baltic ecosystems?"

Krzysztof Skora

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Altogether 6 scientists participated in the discussions concerning Topic No 5: S. Olenin, V. Panov, K. Skóra, JM Węsławski, E. Karasiova, Z. Piesik.

The Baltic Sea has been described as EU "village pond", internal water body, with concerned citizens living at its shores. Great level of collaboration and coordinated monitoring runs through HELCOM system, regular international contacts and highly integrated scientific community makes almost ideal framework for the best use of knowledge for the good of the region. However it turns out, that we are still having problems with communication to the end users and general public. Decision makers want to have simple indicators of the state of the environment (and the biodiversity), furthermore they are used to have the static concept of the Nature: "when I was young there was a pike in this bay, and that it should be forever". Because of this static concept, number of regulations and actions are undertaken – like fight against erosion, attempts to stop the immigrating species, attempts to restore the species locally extinct etc. Besides this "maintenance of the village pond" there are also actions to reshape the environment for the current interest. Here belong ideas and attempts of creating artificial reefs, digging out the new lagoons, manipulations with river mouths and coastal marshes. Our problem is to understand the natural evolution of the system from the man-induced, and consequently differentiate actions taken in areas which has been severely disturbed (e.g. harbours) from areas which are undergoing natural changes (e.g. invasions of pontocaspian crustaceans via riverine system). Most of scientists believe that we have the good reason to manipulate the disturbed environments, while we shall keep hands off the areas with no acute environmental problems. The biodiversity is an important issue in planned and current human interventions in the Baltic. Those who want to intervene shall keep in mind that this temperate, brackish sea has very limited potential to accept new species (euryhaline, resistant species are not very numerous in the North Atlantic species pool).

Messages posted under topic five:

| Message | Date | Posted by |
|---|---|---|
| Opening statement one by Prof. Olenin | 04 Jun 03 | Sergej Olenin |
| urgent intervention is needed to human activities, not to th | 05 Jun 03 | Vadim Panov |
| Opening statement two by Dr Skóra | 04 Jun 03 | Krzysztof Skora |
| playing God in the Baltic | 05 Jun 03 | Jan Marcin Weslawski |
| message from Elena | 05 Jun 03 | Karasiova Elena |
| example of planned human intervention to the Baltic | 05 Jun 03 | Zbigniew Piesik |

# Organisation and statistics

Edward Vanden Berghe

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The conference was organized as a moderated bulletin board. Both the introduction to the themes and topics, and summaries of the discussions, were available on the Internet, (www.vliz.be/marbena). Contributions to the conference were posted through a form on the web site. Contributions by non-moderators were flagged as 'non-moderated', until the forum administrator or moderator released them. For this purpose, they had access to a separate form, which allowed editing or deletion of messages.

Discussions were guided by two chairmen, Jan Marcin Weslawski and Henn Ojaveer. Five separate themes were discussed in consecutive days (table 1). For each of these themes, two moderators were appointed. These co-chairs were responsible to open the discussion by making their opening statements, and to provide summaries of the discussions at regular intervals. They were also responsible to provide a general summary and synthesis of the discussion at the end of the week. These were posted on the web and a final report is reproduced here. The moderators were responsible to keep the discussion lively, and the discussions on all issues have extended until the last day of the conference.

An additional topic was raised for those who wanted to add messages of general issues on marine biodiversity, general aspects to the discussions held during this e-conference and to finalize the e-conference with a synthesis.

The basic flow of information of the conference was through the WWW. This was done to stimulate 'external' parties to participate in the discussion. To make sure the conference was widely known, mailing lists of several organizations and activities were used to invite all interested parties to register. Access to the general pages of the conference, and to the summaries, is open to everyone. To be able to post messages and also to view posted messages, registration through a form on the web site was necessary. The requests for registration were handled individually; applicants were informed of successful registration in an e-mail. On the registration form, participants could choose to receive the summaries of the discussions, as drafted by the chairpeople and opponents, by e-mail. This was done by the vast majority of the participants. Once registered, access to the forum was possible by logging-in with user-defined username. The obliged login username aids in referring to the authors' details by linking to IMIS (Integrated Marine Information System), and in addition enables us to score participation during the course of the conference.

*Statistics*

Registered participants (includes 'marble' participants): 755
Registered participants to 'marble': 336
Number of countries: 59
Participants requesting summaries through e-mail: 475
Numbers of addresses on the circulation list: 1694
Number of messages: 65
Number of contributors: 37

Hits on marbena web site: 12,343 (from 1/6/2003 to 18/6/2003)

Hits on /cgi-bin/marbena.exe: 5833
Hits on /marbena: 6510, or approximately 820 html pages
Total number of pages requested: 6653

| | **Newly Associated States and Marine Biodiversity Research - Are marine biodiversity problems different for NAS as compared to other EU countries?** | |
|---|---|---|
| **Topic 1** | "What is the Baltic contribution to the European marine biodiversity? " | K. Jazdzewski and E. Ojaveer |
| **Topic 2** | "Change of Baltic biodiversity over various time and spatial scales " | A. Witkowski and J. Kotta |
| **Topic 3** | "Where is the "cutting edge science" in the Baltic marine biodiversity?" | J. Koszteyn and E. Bonsdorff |
| **Topic 4** | "Socioeconomic/cultural dimension and conservation status of marine biodiversity in the Baltic Sea" | E. Andrulewicz and G. Martin |
| **Topic 5** | "Is there a need for further human intervention on the Baltic ecosystems? " | K. Skóra and S. Olenin |
| **Topic 6** | General discussion and synthesis | |

Table: 1. Time table: topic, themes and opponents respectively.

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