

Chapter 2

HELCOM Baltic Sea Action Plan: An Ecosystem Approach to the Management of Human Activities

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Abbreviations

BSAP	HELCOM Baltic Sea Action Plan
EC	European Community
EQR	Ecological Quality Ratio
EU	European Union
HELCOM	Helsinki Commission
IMO	International Maritime Organization
MSFD	Marine Strategy Framework Directive
NECD	EU National Emission Ceiling Directive
NEFCO	Nordic Environmental Finance Corporation
NIB	Nordic Investment Bank
OSPAR	Commission for the Protection of the Marine Environment of the North-East Atlantic
WFD	EU Water Framework Directive

2.1 Introduction

The Helsinki Commission (or HELCOM for short) is an intergovernmental organization comprising the Baltic Sea coastal states and the European Union (EU). HELCOM has been working since the early 1970s to improve the status of the

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Baltic Sea marine environment. After several decades of addressing threats to the marine environment on a sector-by-sector basis, in the early 2000s HELCOM began working towards adopting a more holistic approach to protecting the Baltic Sea environment. This work began with the adoption of a common vision of the application of the ecosystem approach to managing human activities together with the Commission for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) at a joint ministerial meeting in 2003 (JMM 2003) and culminated in the adoption, in 2007, of the HELCOM Baltic Sea Action Plan (BSAP, HELCOM 2007a).

This chapter gives an introduction to the work of HELCOM, focusing mainly on the BSAP and how it makes use of scientific information to support decision-making and the adoption of cost-effective measures to reduce pressures to the Baltic Sea marine environment.

Eutrophication is one of the most significant environmental problems faced by the Baltic Sea. Because a substantial amount of eutrophication related data (including long time-series) exist, Baltic Sea scientists have been able to develop indicator based assessment tools that support decision-making and allow for monitoring progress towards reaching jointly agreed environmental targets. The case of eutrophication is thus used here as an example to illustrate a full management cycle based on the ecosystem approach.

Climate-related ecosystem changes are already taking place in the Baltic Sea (HELCOM 2007b). In addition to new threats to the marine environment, many existing problems, such as eutrophication, are likely to be exacerbated by the added stress of climate change. It is important to consider the marine ecosystem as a whole and modify anthropogenic activities to reduce their impacts as further information becomes available. To ensure appropriate measures are put into place, in addition to political will and financial resources, it is important to improve the linkages between science and policy.

2.2 The Helsinki Convention: Protecting the Baltic Sea Marine Environment

The Convention for the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention) was signed in 1974 by the Ministers of Environment from the (then) seven Baltic Sea coastal states¹ (HELCOM 1974). The Convention was developed during an era of increasing environmental awareness and as a

¹ The contracting parties of the 1974 Helsinki Convention were Denmark, Finland, German Democratic Republic, Federal Republic of Germany, Polish Peoples Republic, Union of Soviet Socialist Republics and Sweden. In 1992, after the fall of communism in the region, the Helsinki Convention was revised and signed by Denmark, Estonia, European Economic Community (now European Union), Finland, Germany, Latvia, Lithuania, Poland, Russian Federation and Sweden.

reaction to concerns about the worsening state of the Baltic Sea marine environment. The unique and sensitive nature of the Baltic Sea (HELCOM 2009a), coupled with the fact that the sea is a valuable resource for the coastal countries, resulted in the Baltic coastal states acknowledging that the sustainability and well-being of the Baltic Sea depends on coordinated efforts and joint regional environmental standards. This initiative originated from the 1972 United Nations Conference on the Human Environment (UN 1972) which opted for regional cooperation in areas such as the Baltic where, for geographical and ecological reasons, regional cooperation could be carried out for a natural entity.

A revised Helsinki Convention was adopted in 1992 (HELCOM 1992) in order to take into account the further strengthening of environmental awareness which had paved the way for developments in international environmental law²; as well as in the region's political environment.³ The 1992 Convention was signed by the environment ministers of the nine Baltic coastal states as well as by the Czech and Slovak Federal Republic, Norway and the European Economic Community and entered into force in 2000.

For three and a half decades HELCOM,⁴ the governing body of the Helsinki Convention, has been working to protect the marine environment of the Baltic Sea. This work has been driven by the specific environmental, economic and social situation in the Baltic region and the special sensitivity of the Baltic Sea.

2.3 HELCOM: Over Three Decades of Work for the Baltic Sea

The Baltic Sea is the world's largest body of brackish water and ecologically unique. Due to its special geographical, climatological, and oceanographic characteristics, the Baltic Sea is highly sensitive to external impacts (Leppäranta and Myrberg 2009). Human activities, both in the sea itself and throughout its catchment area, have over the last centuries put considerable pressure on its marine ecosystem (see e.g. HELCOM 2002, 2009a, b).

² The 1992 Helsinki Convention included, amongst other things, the expansion of the 'Convention Area' to cover also inland waters within the catchment area of the Baltic Sea, rather than only the marine areas of the Baltic Sea. In addition, the revised Convention included new environmental principles such as the precautionary principle, polluter pays principle and the application of Best Environmental Practices (BEP) and Best Available Technology (BAT). The revised Conventions also took on board issues of biodiversity and nature conservation, as well as the sustainable use of the natural resources of the Baltic Sea area.

³ With the fall of the Soviet Union, Estonia, Latvia and Lithuania became contracting parties to the Helsinki Convention (see also supra note 1).

⁴ The Helsinki Commission, or HELCOM, works to protect the marine environment of the Baltic Sea from all sources of pollution through intergovernmental cooperation between the countries bordering the sea – Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden; as well as, the European Community.

2.3.1 *The Work of HELCOM*

In working towards the restoration and protection of the Baltic Sea marine environment, HELCOM has been using the best available scientific information to make informed regional policy recommendations. Since its establishment, HELCOM has cooperated closely with the scientific community in the coastal countries and elaborated joint guidelines for monitoring and reporting on the status of the Baltic Sea marine environment. This has made it possible for HELCOM to compile harmonized, region-wide environmental data which are the basis for regular thematic and holistic reports and assessments addressing the pressures to, and the status of, the Baltic marine environment. These assessments in turn make it possible to evaluate the effectiveness of existing management measures and to provide recommendations to decision makers on the need for further actions to reduce the impacts of human activities on the environment. In doing so, HELCOM acts as a bridge between science and policy.

In addition to implementing regional measures based on requirements imposed by other international organizations and agreements, HELCOM also supplements these by developing Recommendations⁵ of its own according to the specific needs of the Baltic Sea. Furthermore, HELCOM works to ensure that commonly agreed upon environmental standards are fully implemented by all its contracting parties throughout the Baltic Sea and its catchment area.

In creating links between science and policy-making in the Baltic region, HELCOM has contributed to the development of measures that specifically take into account the unique environmental conditions and sensitivity of the Baltic Sea. The main priority areas of work carried out by HELCOM are based on the major environmental problems affecting the Baltic Sea, as defined by Baltic scientists and agreed upon by the contracting parties. At present, these are eutrophication, hazardous substances, biodiversity and nature conservation and maritime activities.

Despite that the focus of HELCOM activities is on regionally specific needs, much of the work carried out is linked to activities under other international forums, be these at a European or global level. Actions by HELCOM are carried out in three main ways: (1) Baltic Sea states may take joint initiatives to raise certain issues within international organizations – the International Maritime Organization (IMO) and the EU being good examples; (2) HELCOM also works towards harmonization and, where possible and needed, the strictest implementation of international environmental regulations in the region; and (3) HELCOM devises specific regional actions which either result in quicker actions than would be possible if acting on the global level or which are needed to ensure that regional interests are

⁵ HELCOM Recommendations can be characterized as soft law instruments in that they are not legally binding as such. However, the fact that the Recommendations are adopted unanimously, and that countries are required to report on their national implementation, diminishes concerns about the lacking legal nature. Furthermore, the Recommendations support the implementation of the Helsinki Convention, which in turn is a legally binding instrument.

taken into account. This is done through development of relevant measures or joint initiatives, such as projects, seminars, awareness raising campaigns, etc.

2.3.2 *Success Stories*

Joint efforts by the HELCOM contracting parties have had some positive results, such as reductions in the pollution loads reaching the Baltic Sea and encouraging signs of improvements in the state of the environment. Examples include significant reductions in waterborne phosphorus loads, especially from point sources in the catchment area (Knuuttila 2009), such that almost all HELCOM countries have achieved the 50% reduction target as set by environment ministers in 1988 (HELCOM 1988). Emissions of heavy metals such as lead, cadmium and mercury to the air have dropped significantly, resulting in a reduction in atmospheric depositions of these metals on to the Baltic Sea of 71%, 44% and 26%, respectively (Gusev 2010a). Deposition of chlorinated dibenzo-*p*-dioxins/polychlorinated dibenzofurans (PCDD/Fs) on to the Baltic Sea has also decreased by 50% during the period 1990–2008 (Gusev 2010b).

Although the reductions in nutrient inputs have not reversed the serious eutrophication problem in the Baltic Sea, a positive observation is an increase in water transparency during the last 20 years detected in the Bornholm Sea and Arkona Sea (Fleming-Lehtinen and Kaartokallio 2009). The reductions in inputs of selected hazardous substances have resulted in decreasing concentrations of certain substances in some Baltic living organisms (Bignert et al. 2010a, b) and improvements have been observed in the status of populations of white-tailed eagle and seals (in the northern areas of the Baltic) (e.g. Helander et al. 2009; Bäcklin et al. 2009).

2.3.3 *Further Needs*

Regardless of the efforts already made and the successes achieved; anthropogenic pressures on the marine environment continue and there is still a clear need for further actions. Inputs of nutrients, especially from diffuse sources such as agriculture, are still excessive and the Baltic Sea continues to suffer from the effects of eutrophication (HELCOM 2009b). The extent of the loads and biological effects of persistent organic pollutants⁶ and other hazardous substances are not well known and the entire Baltic Sea has a high contamination level (HELCOM 2010a).

⁶ Persistent organic pollutants (POPs) bioconcentrate in organisms directly from the water via body surfaces, bioaccumulate from food, and biomagnify along the trophic chain from bacteria to predators.

In addition to eutrophication and hazardous substances, physical alteration of habitats, fishing, alien species, maritime traffic, climate warming and other anthropogenic pressures are threatening the biodiversity of the Baltic Sea (HELCOM 2009a).

Even though necessary further measures have been identified by HELCOM, work is challenged by various factors. Firstly, it can take a long time before the beneficial effects of selected measures are seen in the environment. Secondly, in the face of competitive interests between different sectors and limited resources, environmental needs often do not receive the resources and attention they deserve and need. Thirdly, the enlargement of the EU has meant that most HELCOM contracting parties are prioritizing EU legislation and that many decision-making tasks have shifted from national level to EU level, such as in the case of the EU Common Agricultural Policy⁷ and the EU Common Fisheries Policy.⁸ Despite this, HELCOM still sees its role in the agricultural and fisheries fields as very important, especially as HELCOM holds information on the status of the marine environment, which should be the basis on which management decisions are made.

2.4 The HELCOM Baltic Sea Action Plan (BSAP): A New Environmental Strategy

In November 2007, the environment ministers of the HELCOM countries adopted an ambitious strategy, the HELCOM BSAP, which aims to reduce pollution to the Baltic Sea and reverse its degradation by 2021 (HELCOM 2007a). The BSAP is the first attempt by a regional seas convention to incorporate the ecosystem-based approach to the management of human activities⁹ into the protection of the marine environment. The novelty of the approach used in the HELCOM action plan is that it puts the ecosystem at the centre, by defining the status of the sea as we want it to be in the future, and focusing management decisions on this goal as opposed to the more traditional approach of addressing the sources of pollution on a sector by sector basis, without directly linking the measures to the status of the Baltic Sea.¹⁰

⁷ For more information about the EU Common Agricultural Policy (CAP), see: http://europa.eu/pol/agr/index_en.htm. Accessed 24.02.2011.

⁸ For more information about the EU Common Fisheries Policy (CFP), see http://ec.europa.eu/fisheries/cfp/index_en.htm. Accessed 24.02.2011.

⁹ The ecosystem approach to the management of human activities was officially accepted in the 1992 Rio Declaration on Environment and Development (UN 1992) and reiterated in the Plan of Implementation of the 2002 World Summit on Sustainable Development (UN 2002).

¹⁰ Examples of the historical HELCOM approach are the 1988 and 1998 HELCOM Ministerial decisions on a flat 50% reduction target for discharges of nutrients and hazardous substances (HELCOM 1988, 1998).

The holistic plan contains concrete actions to solve the major problems affecting the Baltic Sea, including measures to curb eutrophication; prevent pollution involving hazardous substances; improve maritime safety and accident response capacity; and halt habitat destruction and the decline in biodiversity. The fourth priority, biodiversity, is especially interlinked to the other issues, because without improvement in curbing inputs of pollutants, the state of biodiversity will not improve. In fact the status of Baltic Sea biodiversity can also be viewed as a measure of the progress made towards successfully implementing the action plan.

2.4.1 Cornerstones of the BSAP

The BSAP aims to be an overarching instrument which has as its *vision* and main target the achievement, by 2021, of a Baltic Sea in good ecological status – a sea with diverse biological components functioning in balance and supporting a wide range of sustainable economic and social activities. This vision is supported by four main strategic *goals* addressing issues of particular concern for the Baltic marine environment, namely eutrophication, hazardous substances, maritime activities and biodiversity.

Each of the main goals of the action plan is further defined by *ecological objectives* which describe the characteristics of the sea which we aspire towards. These ecological objectives define good ecological status and aim to be easily understandable. Example ecological objectives include clear water, an end to excessive algal blooms, and viable populations of species.

The complete framework of vision, goals and ecological objectives used in the BSAP is demonstrated in Fig. 2.1. As the action plan follows adaptive management principles, the objectives and targets will be periodically reviewed and revised using a harmonized approach and latest available scientific information.

2.4.2 Assessing the Progress Toward the BSAP Objectives

In order to determine whether management measures for protecting the Baltic Sea are achieving our commonly agreed goals for the marine environment, the ecological objectives need to be made operational. For each ecological objective, indicators, based on easily and accurately measureable parameters, need to be developed. It is important that the data are comparable over time and between countries in order to ensure Baltic-wide, harmonized datasets.

Reference values for the different indicators are defined by an understanding of what “pristine conditions” have been and these are determined either by historic data or by modeling. According to the EU Water Framework Directive (WFD, EC 2000), the reference condition for a given indicator is a description of the chemical and biological quality elements that exist, or would exist, at high status, that is, with no or only very minor disturbance from human activities.

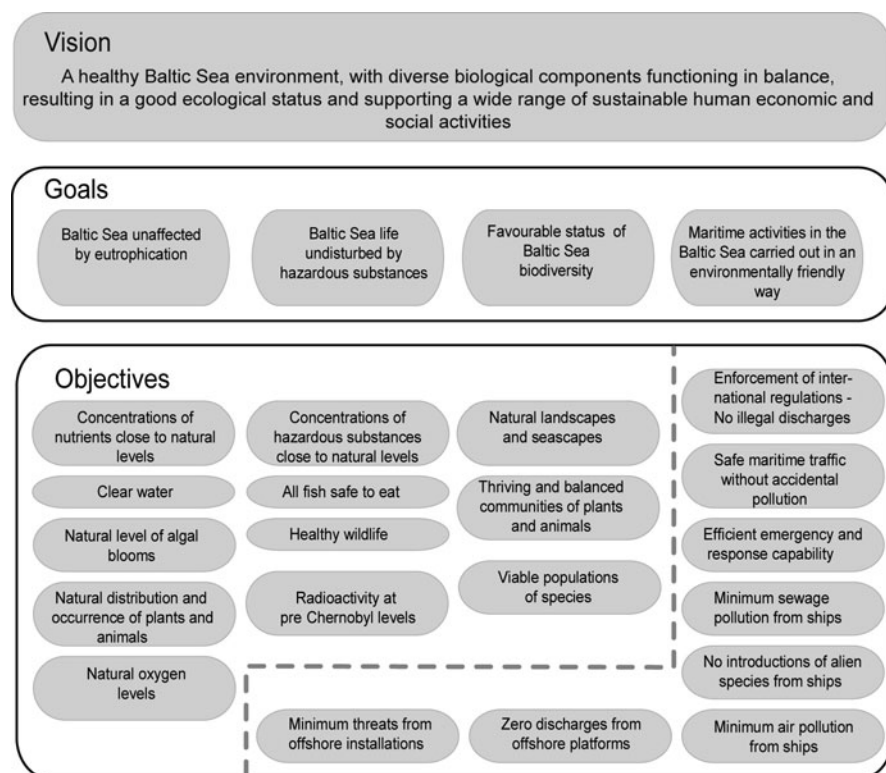


Fig. 2.1 Vision, goals and ecological objectives of the HELCOM Baltic Sea Action Plan

An *acceptable deviation* from the reference condition (usually defined by expert judgment) is used to calculate specific *target values* for each indicator. An acceptable deviation is considered to be synonymous with the border between good and moderate ecological status (for more information, see Andersen et al. 2010 and HELCOM 2006). It should be noted that because environmental conditions naturally differ greatly in different areas around the Baltic Sea, the reference values, acceptable deviations and target values also need to be adjusted accordingly.

The progress towards achieving the agreed ecological objectives can be assessed by calculating the Ecological Quality Ratio (EQR) which represents the relationship between the observed value (current status) of an ecological parameter and the value for that parameter in reference conditions.¹¹ The EQR is then used to determine the ecological status of an area as shown in Fig. 2.2.

¹¹ The EQR approach has been used in the HELCOM integrated thematic assessments on biodiversity and eutrophication (HELCOM 2009a, b). The HELCOM integrated thematic assessment on hazardous substance (HELCOM 2010a), however, is based on a different approach. For most persistent organic pollutants the reference concentration is zero, or close to zero, and therefore it

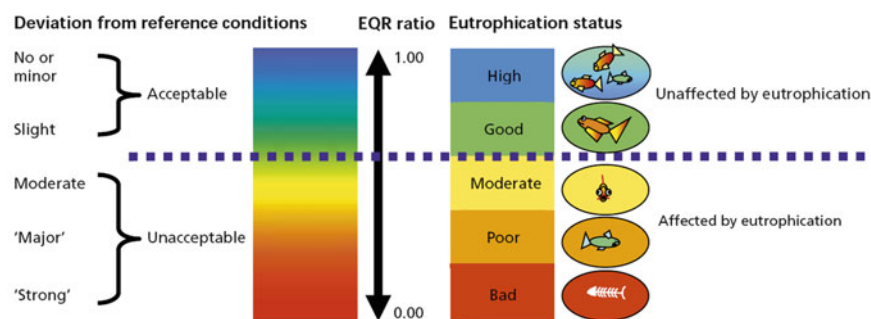


Fig. 2.2 Overview of the EQR concept and its use for classifying water bodies affected by eutrophication (Source: HELCOM 2009b)

An example of regional variations in reference conditions, acceptable deviations and targets is illustrated in Fig. 2.3 where these values are given for water transparency (Secchi depth) in different sub-basins of the Baltic Sea.

In May 2010, the ministers of the environment of the HELCOM parties adopted a demonstration set of core eutrophication indicators which allow for assessing the progress towards reaching the ecological objectives defined in the BSAP. So far, core indicators have been developed for concentrations of nitrogen and phosphorus, water clarity, chlorophyll-*a* concentrations and the status of benthic invertebrate communities.¹² These have further been combined to produce an integrated indicator describing the eutrophication status. For more information about indicators and the methodologies used to calculate targets, status etc., see HELCOM (2009b, 2010b) and Andersen et al. (2010).

2.4.3 Actions for Achieving a Healthy Baltic Sea

The development of the actions and measures agreed upon in the BSAP was coordinated by a task force group including all HELCOM members, as well as representatives from nongovernmental and governmental organisations. International financial institutions, e.g. Nordic Investment Bank (NIB) and Nordic Environmental Finance Corporation (NEFCO), also participated in the work by giving input on how to ensure future funding of concrete projects aimed at implementing

makes sense to instead of the EQR, use a threshold value as the target (the threshold level being the level above which the substance is known to cause adverse effects). By comparing the measured value (status) with the threshold value we get a Contamination Ratio (CR). If status is above the threshold, then CR is above one and we move from an acceptable status to an unacceptable status.

¹² The core set of eutrophication indicators can be viewed on the HELCOM website http://www.helcom.fi/BSAP_assessment/en_GB/main/. Accessed 24.02.2011.

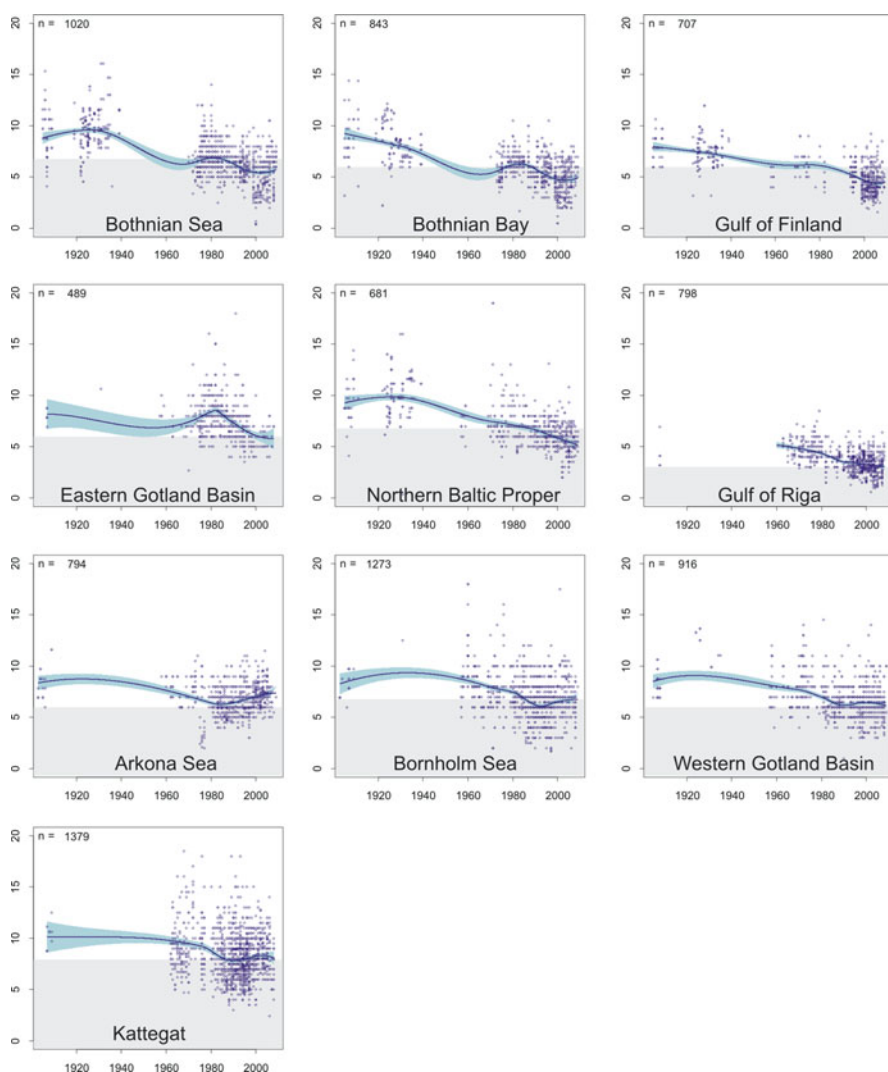


Fig. 2.3 Water transparency in June-September measured as Secchi depth (m) between years 1903 and 2009 in the open-sea sub-regions of the Baltic Sea. Secchi depth observations (m) are plotted against the year of observation and the curves fitted with non-linear smoothing (blue line) and shown with 95% confidence intervals (light blue area). The level below the target value set by the HELCOM thematic assessment on eutrophication (HELCOM 2009b) is coloured light gray. The number of observations (n) is shown on each figure. (Source: Fleming-Lehtinen and Laamanen, in press)

the action plan (e.g. improving wastewater treatment). The final phases of the development comprised political discussions between coastal countries and the European Commission, with other stakeholders participating as observers. Parallel HELCOM assessment activities (e.g. HELCOM 2006) provided the necessary scientific consensus for exact targets to be reached by the actions (Backer et al. 2010).

The BSAP actions include deadlines for achieving the agreed targets for each of the main environmental priorities. In addition to defining common actions to be carried out by all HELCOM contracting parties, the BSAP also requires the countries to develop their own tailor-made national implementation programmes which outline the most cost-effective measures for achieving the environmental targets in each country. The action plan also distinguishes between measures that can be implemented at regional or national level, and measures that can only be implemented at EU level (e.g. Common Fisheries Policy, Common Agricultural Policy, and controls over the marketing and use of chemicals) or globally (e.g. the shipping controls defined by the IMO).

One of the major highlights of the action plan is that it opens a new era in marine environmental protection by including the concept of maximum allowable nutrient input, which still makes it possible for the Baltic Sea to reach a good ecological status (see Table 2.1). The Baltic Sea coastal countries acknowledged in the plan that ‘there is a need to reduce the nutrient inputs and that the needed reductions shall be fairly shared by all Baltic Sea countries’. Initial estimates of the quantities of nutrient reductions needed to reach the environmental targets as concerns eutrophication were calculated using a model developed by the Swedish MARE programme (Wulff et al. 2007). In addition, scenarios were elaborated on how far the full implementation of existing HELCOM Recommendations, as well as EU legislation and programmes, would bring the Baltic Sea towards the agreed ecological objectives for eutrophication, using the target *clear water* as a basis. These results

Table 2.1 The maximum allowable nutrient inputs (in tonnes per year) to each Baltic Sea sub-region if good environmental status is to be reached and the corresponding necessary nutrient reductions as agreed upon in the HELCOM Baltic Sea Action Plan

Sub-region	Maximum allowable input		Inputs in 1997–2003		Needed reductions	
	P	N	P	N	P	N
Bothnian bay	2,580	51,440	2,580	51,440	0	0
Bothnian sea	2,460	56,790	2,460	56,790	0	0
Gulf of Finland	4,860	106,680	6,860	112,680	2,000	6,000
Baltic proper	6,750	233,250	19,250	327,260	12,500	94,000
Gulf of Riga	1,430	78,400	2,180	78,400	750	0
Danish straits	1,410	30,890	1,410	45,890	0	15,000
Kattegat	1,570	44,260	1,570	64,260	0	20,000
Total	21,060	601,720	36,310	736,720	15,250	135,000

Note: *P* phosphorus, *N* nitrogen (units: tonnes)

Source: HELCOM (2007a)

Table 2.2 Country-wise provisional nutrient reduction requirements^a as agreed upon in the HELCOM Baltic Sea Action Plan

Country	Phosphorus (t)	Nitrogen (t)
Denmark	16	17,210
Estonia	220	900
Finland	150	1,200
Germany	240	5,620
Latvia	300	2,560
Lithuania	880	11,750
Poland	8,760	62,400
Russia	2,500	6,970
Sweden	290	20,780
Transboundary common pool ^b	1,660	3,780

^aThis refers to the reduction requirement from the average annual pollution load from the country during the period 1997–2003

^bIn the BSAP, the HELCOM contracting parties agreed that “transboundary pollution originating in the non-contracting states Belarus and Ukraine should be addressed by initiating joint activities e.g. by bi- and/or multilateral projects and through other existing funding mechanisms as well as by international agreements such as the 1992 UNECE Convention on Transboundary Waters and Lakes, and the River Basin Management Plans of the EU Water Framework Directive for HELCOM Contracting States being also EU Member States

Source: HELCOM (2007a)

were then used to calculate specific nutrient reduction targets and to identify actions related to reducing nutrient loading to the Baltic Sea.¹³

The MARE model calculated that of the average annual loads to the whole Baltic Sea, reductions of an estimated 15,250 t of phosphorus and 135,000 t of nitrogen would be necessary to achieve agreed targets. Similarly, quantitative reduction requirements were calculated for each of the sub-basins (see Table 2.1) and provisional allocations of nutrient reduction requirements were given to each HELCOM country and to transboundary loads (see Table 2.2). These figures are all contained in the BSAP, with the idea of allowing the contracting states more flexibility in choosing the management actions that are nationally most suitable and cost-effective to reach the agreed targets.

At the time of the adoption of the BSAP, it was recognized that the calculated maximum allowable nutrient loads and the country-wise allocations were based on the best knowledge available at the time and that reviewing and revising of the figures would be necessary as soon as more updated data, information and more advanced models would be available. At the time of writing this chapter, HELCOM is working on further developing the environmental targets for eutrophication

¹³ In the BSAP, the HELCOM contracting parties noted that the calculated figures were based on the best available scientific information, and thus stressed the provisional character of the data and that all the figures related to targets and maximum allowable nutrient inputs should be periodically reviewed and revised using a harmonized approach using updated information.

indicators as well as refining the procedure for assessing annual nutrient loads and thus the progress of the HELCOM countries towards reaching their provisional nutrient reduction allocations. This work will provide input to the reviewing, and if necessary revision, of the maximum allowable nutrient inputs agreed upon in the BSAP as well as the country-wise nutrient reduction allocation schemes which are necessary for achieving the environmental targets, which in turn may result in the need to identify further measures and actions. This continuous assessment and revision process is one example of the application of adaptive management under the BSAP.

2.4.4 Implementation and Financing of the BSAP

Since the adoption of the BSAP, the HELCOM countries have been working towards implementation of the actions agreed upon in the plan. One of the first tasks for the HELCOM countries has been to prepare national implementation programmes which were to be presented at the HELCOM Moscow Ministerial Meeting in May 2010 (HELCOM 2010c).¹⁴ In these national implementation programmes, the countries should define what measures they are applying (or planning to apply) at a national level, in order to fulfill the objectives of the BSAP. Furthermore, countries should present what magnitude of reductions in nutrient inputs are expected to follow the implemented measures as well as the cost-effectiveness of the different measures.

Due to the transboundary nature of pollution, the BSAP also addresses pollution loads to the Baltic Sea that originate from non-HELCOM countries. A significant portion of waterborne pollution loads originate from non-coastal states within the Baltic Sea drainage area and to address these sources, HELCOM is working to support the establishment of bi- and multi-lateral projects, involving also private initiatives funded by private foundations and international financial institutions.

Distant sources and Baltic Sea shipping contribute about 40% of airborne nitrogen deposited onto the Baltic Sea, thus significantly adding to the existing eutrophication problem (HELCOM 2009b). Because emissions from shipping and some non-HELCOM European countries are the source of a notable amount of the nitrogen input to the Baltic Sea, HELCOM is working to influence emission policies under IMO, the EU National Emission Ceiling Directive (NECD, EC 2001) and the Gothenburg Protocol of the United Nations Economic Commission for Europe Convention of Long-Range Transboundary Air Pollution (UNECE 1999).

¹⁴ Information about the status of implementation of the BSAP by the HELCOM countries can be viewed on the HELCOM website: http://www.helcom.fi/BSAP/Implementation/en_GB/Implementation/. Accessed 24.02.2011.

The main sources of funding for implementing the BSAP actions include national budgets and EU structural funds, including the EU Cohesion Fund which aims to help new member states to implement EU Directives.¹⁵ Russia, as a non-EU HELCOM contracting party, will benefit from funding provided for high priority environmental projects through e.g. bilateral agreements and the Northern Dimension Environmental Partnership fund.¹⁶ In 2009, in an effort to speed up implementation of the BSAP actions, NIB and NEFCO set up a BSAP Fund that aims to provide grants for technical assistance to projects that support the implementation of the BSAP.¹⁷

Despite all the identified objectives, measures and actions in the BSAP, there is still much work to be done to further elaborate on them, especially as concerns issues which are not so well understood yet. In comparison to eutrophication, much less is known about the loads and the biological effects of different hazardous substance. Also there is a large knowledge gap as concerns Baltic Sea biodiversity, as a great deal still needs to be learned about the distribution and status of species, communities and habitats. Information which is essential for developing operational indicators of environmental status and without a good understanding of all the pressures and their effects on the ecosystem, it is not possible to define clear and efficient management objectives.

In an effort to reduce information and management gaps, HELCOM is presently working on developing core indicators related to hazardous substances and biodiversity. The main aim of these quantitative indicators is to allow for the assessing of the progress (and effectiveness of measures) towards reaching the BSAP ecological objectives, strategic goals and overall vision. In the progress of developing the core set indicators, HELCOM will review existing monitoring programmes and propose revisions to the programmes so that national monitoring activities will produce the data necessary for regular assessments.

To solve the environmental problems of the Baltic Sea, commitment by the HELCOM contracting parties to the implementation of the BSAP is of utmost importance. There are numerous challenges which complicate the implementation of the action plan and much remains to be done to further develop actions addressing the problems of hazardous substances and threats to biodiversity. Cooperation needs to be increased between different sectors (such as between the environmental, agricultural, fisheries and maritime authorities as well as between public and private sectors) in order to find joint solutions to the pressures affecting the Baltic Sea. Applying the concept of sustainable use of resources is not easy when economic interests often compromise the well-being of the environment.

¹⁵ For more information on the EU Cohesion Fund, see: http://ec.europa.eu/regional_policy/funds/procf/cf_en.htm. Accessed 24.02.2011.

¹⁶ For more information about the Northern Dimension Environmental Partnership fund, see: <http://www.ndep.org/home.asp?type=nh&pageid=6#support>. Accessed 24.02.2011.

¹⁷ For more information, see: http://www.nefco.org/files/48521_BSAPfactsheet.pdf. Accessed 24.02.2011.

And it is no surprise that, especially during financially challenging times, other concerns are likely to be prioritized over environmental protection activities. On a positive note, however, many governments and private organizations are beginning to see the economic benefits of protecting the environment, not only by recognizing the value of ecosystem services, but also by applying the concept of green growth and investing in the development of green jobs and technology.

Adaptive management needs to be employed by ensuring that appropriate measures are identified and implemented and new and improved information becomes available. This is not always easy, however, in the face of scientific uncertainty and the cost and effort of transposing new measures into national laws.

For the BSAP to be successful, strong political will, financial and human resources, as well as involvement by all relevant stakeholders is necessary. Also, as many activities affecting the Baltic Sea marine environment are managed from outside the Baltic Sea region, it is very important that regional environmental needs are taken into account when developing measures within other international fora. This should be done by further enhancing cooperation with relevant international institutions and other regional agreements.¹⁸

2.4.5 Links Between the BSAP and Other Multilateral Environmental Agreements

HELCOM generally complements and contributes to the harmonized implementation of various international legislative frameworks. This is also the case with the BSAP; as the implementation of the plan by HELCOM contracting parties is both a fulfillment of the obligations under the Helsinki Convention and an essential contribution to the fulfillment of the obligations of the contracting parties under various other international legal frameworks.

In developing the BSAP, HELCOM took into account the environmental provisions of the Maritime Doctrine of the Russian Federation. Close co-operation with Russia, which is the only non-EU member country in HELCOM, is crucial for further progress to be made in rescuing the Baltic marine environment. The action plan is also instrumental for the implementation of the renewed Northern Dimension policy,¹⁹ the Baltic Sea regional aspects of the EU-Russian

¹⁸ Examples are the management of shipping activities under the International Maritime Organization, the management of fisheries and agriculture under the EU framework and the addressing of transboundary air pollution under the UNECE Convention on Long Range Transboundary Air Pollution.

¹⁹ For more information, see: http://ec.europa.eu/external_relations/north_dim/index_en.htm. Accessed 24.02.2011.

Environmental Dialogue,²⁰ the Nordic Environmental Action Plan,²¹ and EU policies such as the European Maritime Policy,²² the WFD and the Marine Strategy Framework Directive (MSFD, EC 2008).

The BSAP has been widely supported by politicians at various forums and the European Union has described the plan as a cornerstone for further action in the Baltic Sea region, taking on board much of the BSAP in the environment and security pillars of the recently adopted EU Strategy for the Baltic Sea (EC 2009a). The MSFD foresees an action plan for each eco-region, including the Baltic Sea; and the BSAP is currently being considered as a possible pilot project for the regional implementation of the directive. HELCOM is in a unique position to both deliver this, given its embracing of all the countries in the Baltic Sea catchment area, and also to ensure that the special characteristics of the Baltic Sea are fully accounted for in European policies.

At the 2010 HELCOM Moscow Ministerial Meeting, the Ministers of Environment of the HELCOM countries decided “to establish, for those HELCOM Contracting States being also EU Member States, the role of HELCOM as the coordinating platform for regional implementation of the EU MSFD in the Baltic Sea including striving for harmonized national marine strategies for achieving good environmental status according to the HELCOM Baltic Sea Action Plan and the EU MSFD.” This decision is an affirmation that different international agreements need to be streamlined in order to avoid duplication of work and is in line with Articles 5²³ and 6²⁴ of the EU MSFD. Examples of regional coordination include the ongoing HELCOM work to develop core indicators and to revise HELCOM monitoring programmes in such a way that they also fulfil the requirements under the EU WFD²⁵ and MSFD.²⁶

²⁰ For more information, see: http://ec.europa.eu/environment/enlarg/russianis_en.htm. Accessed 24.02.2011.

²¹ For more information, see: Nordic Council of Ministers’ Nordic Environment Action Plan 2009–2012. <http://www.norden.org/en/publications/publications/2008-733>. Accessed 24.02.2011.

²² For more information about the Integrated Maritime Policy for the European Union, see: http://ec.europa.eu/maritimeaffairs/subpage_en.html. Accessed 24.02.2011.

²³ Article 5§2 of the MSFD states that: Member States sharing a marine region or subregion shall cooperate to ensure that, within each marine region or subregion, the measures required to achieve the objectives of this Directive [...] are coherent and coordinated across the marine region or subregion concerned.

²⁴ Article 6§1 of the MSFD states that: In order to achieve the coordination referred to in Article 5§ 2, Member States shall, where practical and appropriate, use existing regional institutional cooperation structures, including those under Regional Sea Conventions, covering that marine region or subregion.

²⁵ Especially Article 5 of the WFD on the determination of the characteristics of the river basin district, review of the environmental impact of human activity and economic analysis of water use, as well as, Article 8 of the WFD on the establishment of programmes for the monitoring of water status.

²⁶ Specifically Articles 5§2(a) concerning (1) the preparation of an initial assessment, (2) a determination of good environmental status for the waters concerned, (3) establishment of a series

As a front-runner in the application of the ecosystem approach, the HELCOM action plan could also serve as a model example to be followed by the Regional Seas Conventions and Action Plans under the auspices of the United Nations Environmental Programme's Regional Seas Programme.²⁷

2.5 Discussion and Conclusions

2.5.1 *Importance of Improving the Link Between Science and Policy*

Science is the foundation of the work of HELCOM and has also had a central role in the elaboration of the BSAP. Interaction between science and policy is central not only to developing new policies, but more importantly, should support the application of adaptive management. Adaptive management is an iterative process of refining management practices over time as new information becomes available and is central also to the implementation of the ecosystem approach (Mee 2005).

An example of the interface between science and policy in the HELCOM framework, in particular as concerns tackling the serious eutrophication problem being faced by the Baltic Sea, is illustrated in Fig. 2.4. The ongoing revision process for updating the provisionally adopted *maximum allowable nutrient input* values and *country-wise nutrient reduction targets* which were adopted with the BSAP in 2007 is a good example of how adaptive management is being put into practice under the HELCOM umbrella. These figures are being reviewed and corrected using more recent data on the magnitude and sources of pollution loads, better defined environmental targets as well as improved models. A similar application of adaptive management is expected in the future for also other components of the action plan (e.g. biodiversity and hazardous substance) after evaluation of whether agreed measures are sufficient to reach good environmental status in the Baltic Sea.

Without sound scientific knowledge, informed policy making would not be possible. Monitoring activities allow scientists to examine status and trends and to assess the effectiveness of actions and measures taken – information which in turn is used to elaborate strategic goals, management options and policy recommendations.

of environmental targets and associated indicators and (4) establishment and implementation of a monitoring programme for ongoing assessment and regular updating of targets and Article 8 on the specifics of the initial assessment of national marine waters.

²⁷ The UNEP Regional Seas Programme was launched in 1974 in the wake of the 1972 United Nations Conference on the Human Environment held in Stockholm (UN 1972). For more information, see <http://www.unep.org/regionalseas/about/default.asp>. Accessed 08.01.2010.

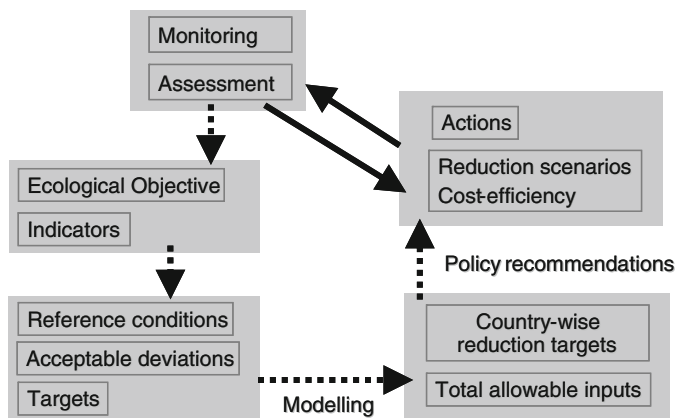


Fig. 2.4 Eutrophication management cycle of the Baltic Sea Action Plan

A sound scientific basis for such assessments requires harmonized monitoring methods as well as long-term data series which allow for integration of comparable datasets.

Fortunately, there has been joint regional monitoring of the Baltic Sea for several decades (see for example the HELCOM COMBINE Manual²⁸) meaning that there exists a great deal of comparable data for the region. Nevertheless, there are gaps in data, especially regarding historic data that is necessary for defining reference conditions, and subsequently environmental targets, for indicators describing the status of the Baltic Sea. Also, not all parameters have been (or are being) monitored, e.g. in the case of many chemicals which are new and occur in very small, but potentially highly toxic, doses for which toxicological responses, especially when combined with other substances, are not well understood.

As already mentioned earlier in this chapter, HELCOM is presently working on further developing core indicators and reviewing the current monitoring activities in the region. An outcome of this work will be proposals for revising the monitoring activities in the region so that they are cost efficient and support reporting and assessment requirements for HELCOM, EU directives as well as other international agreements. This work, which involves both scientists and decision-makers, can be seen as a move towards further improving the links between science and policy.

²⁸ The Manual for Marine Monitoring in the COMBINE Programme of HELCOM is available on the HELCOM website at: http://www.helcom.fi/groups/monas/CombineManual/en_GB/main/. Accessed 24.02.2011.

2.5.2 *Linking Climate Change to Baltic Sea Protection*

2.5.2.1 The Effects of Climate Change on the Baltic Marine Environment

Climate related ecosystem changes are already taking place in the Baltic Sea region.²⁹ Recent regional climate projections suggest that near-surface air temperatures will further increase by 3–5°C in the Baltic Sea area during this century and that precipitation in the northern Baltic Sea drainage basin will increase (Graham et al. 2008). Shorter and wetter winters are likely to also result in decreased snow and ice cover, leading to greater run-off from the drainage area and increased inflow of water (and nutrients) to the sea. Expected consequences in the marine environment include decreased salinity as well as increases in sea surface temperature,³⁰ sea level, and acidification of sea water (Belkin 2009; Graham et al. 2008; Sabine et al. 2004).

The projected changes in climate as a consequence of global warming may have profound implications for Baltic biodiversity (Dippner et al. 2008; Granskog et al. 2006; HELCOM 2009a; Laine 2008; Nielsen and Kvaavik 2007). In particular, the predicted decrease in salinity, as a result of increased precipitation, is expected to shift the distribution limits of several important habitat-structuring species and key species in the Baltic ecosystem, such as bladder wrack, eelgrass, blue mussel and cod. The projected increase in temperature and decrease in ice cover is also likely to impact the ranges of species. For example, decreasing ice cover is likely to directly impact ringed seals that breed on ice and, with increasing temperatures, alien species of southern origins may establish viable populations in the Baltic Sea.

The effects of global climate change are not only expected to result in additional pressures to the Baltic ecosystem, but also to exacerbate the effects of other anthropogenic pressures on the environment (HELCOM 2007b). For instance, the recently published HELCOM thematic assessment on biodiversity points out that climate-driven changes in the marine ecosystem (including changes in salinity and sea surface temperature, as well as deep-bottom oxygen depletion) have enhanced the negative impacts of eutrophication and fisheries on the marine environment (HELCOM 2009a; Sherman et al. 2009).

There are also likely to be other indirect impacts to the marine environment caused not only by climate change but also by policies designed to combat it. The HELCOM biodiversity assessment suggests that actions, such as the requirements adopted by the EU to, by 2020, cut CO₂ emissions by 20% from 1990 levels and to achieve the level of 20% of renewable energy of all consumed energy in the EU

²⁹ It is not the aim of this chapter to go into details about the effects of climate change on the Baltic Sea and therefore the reader is encouraged to explore the other relevant chapters of this book for more specific information.

³⁰ According to Belkin (2009) compared to other large marine ecosystems around the world, the Baltic Sea has shown the highest rate of increase in water temperature during the past half a century.

(EC 2009b), may have indirect negative effects on Baltic Sea biodiversity. It is highly likely that such a target will result in an increased number of offshore wind farms in the Baltic Sea, putting further pressure on the use of the marine space in some areas. Growing demand for carbon capture and sequestration technologies and sites, being proposed by EU institutions, may mean that potential seafloor sites will be explored with yet unknown effects on benthic ecosystems. The energy targets will also likely be linked to installations of new underwater cables and pipelines. An increase in bioenergy production, such as increased cultivation of energy-producing crops, may result in an increase in use of currently set aside land and also of chemical fertilizers and thus contribute to increased eutrophication.

2.5.2.2 The Impacts of Climate Warming on Baltic Sea Protection Measures

The effects of climate warming will no doubt require addition management and protection measures if we are to achieve our agreed goals and objectives for a healthy Baltic Sea. The BSAP acknowledges the significance of climate change and the possible need for more stringent measures to protect the Baltic Sea in the future³¹ but the specific measures and actions currently identified in the plan do not take into account the impacts of climate change as such.

Tackling the eutrophication problem of the Baltic Sea will be especially challenging if the predicted climate warming and increased precipitation become a reality as increased agricultural activities (resulting from e.g. an extended growing season and greater demands for food and energy crops) and run-off are likely to lead to an increase in nutrient loading to the sea. In addressing eutrophication, the Baltic Sea countries have already taken numerous measures to reduce the loading of nutrients to the sea, particularly from point sources. This means that the proportion of nutrient inputs originating from diffuse sources such as agriculture has increased (Knuuttila 2009). If nutrient inputs increase, then the present measures will not suffice for reaching the objectives and goals of the action plan.

The necessary adjustment of management measures (adaptive management) will require effective and continuous feedback between different activities such as monitoring programmes and management measures, and importantly, the results and recommendations of assessments and analyses need to be turned into appropriate decisions and properly implemented.

³¹ The preamble of the BSAP states: **FULLY AWARE** that climate change will have a significant impact on the Baltic Sea ecosystem requiring even more stringent actions in the future and of the efforts made by the Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change.

2.5.2.3 How Can HELCOM Work Help in Adaptation to the Effects of Climate Change?

Climate change and protection of the Baltic Sea marine environment go hand in hand. On the one hand, climate change will challenge the work to restore the Baltic marine environment, and on the other hand, protecting the marine ecosystems may help to reduce the impacts and facilitate adaptation to the changes resulting from climate change. Climate change therefore increases the importance of working towards also reducing other human induced pressures on the Baltic Sea marine environment. Box 1 outlines some examples of why HELCOM's work is important in the face of climate change.

The Helsinki Convention (the implementation of which the BSAP is facilitating) has as one of its fundamental principles the *precautionary principle*³² which requires that action should be taken at source if an adverse effect on the environment is likely, even if a clear cause-and-effect relationship cannot be established.³³ Because the effects of measures may take decades before becoming apparent in the marine environment – due, for example, to the slow exchange rate of water in the Baltic Sea – the importance of taking early action cannot be over-emphasized. It is therefore crucial to identify ways of minimizing the gap between science and policy, especially as concerns making decisions based on uncertain information.

On a more positive note, despite it seeming that the incorporation of climate change into HELCOM work is still in its infancy, in actual fact one could argue that much of the work already carried out under the umbrella of HELCOM supports the mitigation of the effects of climate change. In other words, by working towards achieving a healthy marine environment, we are also working towards having an ecosystem that is more resilient to different pressures and better able to adapt to climatic changes.

Why Is HELCOM's Work Important in the Face of Climate Change?

- Biodiversity provides insurance against external pressures. The Baltic Sea is species poor and each species has an important role in buffering the ecosystem against extreme and potentially long-lasting changes. Reducing eutrophication, diminishing harmful impacts from fisheries and hazardous substances, eliminating pollution from maritime activities as well as establishing an ecologically coherent network of protected areas will help to safeguard biodiversity also in a changing climate.
 - Achieving and maintaining the natural functions of the Baltic Sea ecosystem is crucial. Biogeochemical cycling of nutrients has already been altered by humans as the overdose of nutrients from external (e.g. land-
- (continued)*

³² Article 3§2 of the 1992 Helsinki Convention.

³³ For an in depth discussion about the application of the precautionary principle in the work of HELCOM, see Pyhälä et al. (2007).

based and atmospheric) sources has contributed to extensive anoxia and dead zones at the bottom of the sea. Climate change threatens to aggravate the situation, hence it is even more crucial to decrease nutrient loads to the sea.

- Hazardous substances cause extra stress to organisms which are already living close to their low-salinity tolerance limit in the Baltic Sea. Climate change induced higher temperatures and further decreased salinity may affect the ability of these species to cope with toxic substances. Reduction of the inputs of hazardous substances to the Baltic Sea is essential for improving the resilience of organisms to the effects of climate change.
- The suite of actions and measures outlined in the BSAP has been tailored to achieve a healthy Baltic Sea in terms of biodiversity, eutrophication and hazardous substances, as well as environmentally sound maritime activities. Ultimately such a sea is also better prepared for the extra challenges caused by climate change.

2.6 Food for Thought

During the BALTEX summer school course *Climate impacts on the Baltic Sea: from science to policy*, one of the student tasks was to identify whether and how the objectives of the BSAP might be affected by expected climate change, and to suggest ways that the action plan could be modified to accommodate these impacts.

When considering how to better integrate the issue of climate change with the BSAP, some questions to take into account might be:

- What are the goals and objectives for responding to the threat of climate change in the Baltic Sea region?
- What parameters could be used as measureable indicators?
- What stakeholders should be involved; also from outside the Baltic Sea region?
- How to enhance links between science and policy?
- Which are the key policy instruments and frameworks that need to be integrated to avoid duplication of work?

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