Agenda Item 2 **Recent MSP developments**

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OUTCOME OF THE REGIONAL WORKSHOP ON THE EVALUATION OF MARINE AND COASTAL ECOSYSTEM SERVICES IN THE BALTIC SEA

The regional workshop on the evaluation of marine and coastal ecosystem services in the Baltic Sea was held on 7-8 November 2014 in Stockholm, Sweden. The purpose of the workshop was to exchange knowledge, share the results of existing studies and discuss how valuation of ecosystem services in the Baltic Sea can support ecosystem-based marine management.

The workshop was co-organized by HELCOM, Nordic Council of Ministers, the Swedish Agency for Marine and Water Management, Stockholm Resilience Centre, the Swedish Ministry of the Environment and UNEP, and funded by the Nordic Council of Ministers.

The latest version of the report of the workshop can be found attached to this document. Annex 5 of the report contains a summary of the presentations made during the workshop. The presentation by Mr. Holger Janssen, Germany, on the use of ecosystem valuation in marine spatial planning can be found on pages 40-42 of the Annex. The agenda of the workshop can be found in Attachment 5 of Annex 5 and the List of participants as Attachment 2 of Annex 5. The final report will be published by UNEP shortly.

HELCOM is currently considering follow up activities in relation to the workshop.

The Meeting is invited to consider the usefulness of the outcome of the workshop in relation to MSP and propose further actions to make the knowledge useful for planners.

Note by Secretariat: **FOR REASONS OF ECONOMY, THE DELEGATES ARE KINDLY REQUESTED TO BRING THEIR OWN COPIES OF THE DOCUMENTS TO THE MEETING**

Nordic Council of Ministers

UNEP Regional Seas

REGERINGSKANSLIET Ministry of the Environment Sweden

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Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea

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Authors:
Heini Ahtiainen, HELCOM, Baltic Marine Environment Protection Commission, Katajanokanlaituri 6 B, FI-00160 Helsinki, Finland
Marcus C. Öhman, Stockholm Resilience Centre, Stockholm University, SE-10691, Stockholm, Sweden

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This report was prepared as an outcome of the Regional Workshop on the Economic Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea (Regional workshop om värdering av kustnära och marina ekosystemtjänster), been held on 7-8 November, 2013, in Stockholm, Sweden. This work on the project was coordinated by the Stockholm Resilience Centre (SRC) in a partnership with the UNEP Regional Seas Programme, Baltic Marine Environment Protection Commission – Helsinki Commission (HELCOM) and the Ministry of the Environment of Sweden with financial support provided from the Nordic Council of Ministers and the Swedish Presidency of the Nordic Council of Ministers within 2013.

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Contents

List of acronyms

BSAP	Baltic Sea Action Plan (HELCOM)
BSRAC	Baltic Sea Regional Advisory Council
CAP	Common Agricultural Polucy (EU)
CICES	Common International Classification of Ecosystem Services
CFP	Common Fisheries Polucy (EU)
DDT	DichloroDiphenylTrichloroethane
EC	European Commission
EIA	Environmental Impact Assessement
EPA	Environmental Protection Agency
ESE	Ecosystem Services Economics (UNEP)
EU	European Union
EUSBSR	EU Strategy for the Baltic Sea Region
GES	Good Environmenmtal Status
GHG	Greenhouse gases
HELCOM	Baltic Marine Environment Protection Commission (Helsinki Commission)
IUU	Illegal Unregulated and Unreported (fishing/fisheries)
MA	Millenium Assessment
MSFD	Marine Strategy Framework Directive (EU), Directive 2008/56/EC
N	Nitrogen
NCM	Nordic Council of Ministers
P	Phosphorus
PCBs	Poluchlorinated Biphenyls
RP	Revealed Preference (methods)
SEA	Strategic Environmental Assessment
SP	Stated preference (methods)
SRC	Stockholm Resilience Centre
TBT	TriButyl Tin
TEEB	The Economics of Ecosystems and Biodiversity
UK NEA	United Kingdom National Ecosystem Assessment
UNEP	United Nations Environment Programme
WFD	Water Framework Directive (EU), Directive 2000/60/EC
WG ESA	Working Group on Economic and Social Analysis (EU)

Summary

The Baltic Sea provides many ecosystem services that contribute to human well-being, such as nutrient cycling, fish stocks, water quality, biodiversity, raw materials, and climate regulation. However, the understanding of the function of the Baltic Sea ecosystems that provide the services and the resulting benefits to human societies is still limited, and the value of the natural environment is not appropriately incorporated into marine decision-making. Valuation of the benefits provided by ecosystem services can aid in designing more efficient policies for the protection of the Baltic Sea and in reaching the environmental objectives for the sea. Well-covered information on the benefits provided by marine and coastal ecosystems is essential to reach the objectives of the HELCOM Baltic Sea Action Plan and the European Union Marine Strategy Framework Directive, as well as the EU Biodiversity Strategy 2020. There are some existing studies on the value of improved marine environment, which can be used to assess the importance and value of marine ecosystem services. However, further work is still needed on identifying and describing Baltic Sea ecosystem services and their interactions, evaluating how policy changes affect these ecosystem services and assessing the effect of changes in ecosystem services to human welfare. With this report an overview of ecosystem services and associated benefits provided by the Baltic Sea is provided. Information on basic approaches being applied in the Baltic Sea region on how to assess and value ecosystem services is brought forward. The way forward in applying such tools in regional and national policies is outlined.

This report has been prepared as an outcome of the Regional Workshop on the Economic Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea that was held on 7-8 November, 2013, in Stockholm, Sweden. The project was coordinated by the Stockholm Resilience Centre (SRC) in a partnership with the UNEP Regional Seas Programme, Baltic Marine Environment Protection Commission – Helsinki Commission (HELCOM) and the Ministry of the Environment of Sweden with financial support provided from the Nordic Council of Ministers and its Swedish Presidency within 2013.

Main challenges in assessing the ecosystem services in the Baltic Sea :

- Accurately describing ecosystem services and how they are linked with the ecosystem structures.
- Trade-offs and interactions of ecosystem services.
- Finding relevant indicators for the assessment of ecosystem services and ecosystem improvement.
- Evaluating how measures to improve the marine environment impact the provision and trade-offs of ecosystem services and further their value.
- Assessing the effects of changes in ecosystem services to human well-being, taking into account possible future developments.
- Taking ecological thresholds and non-linearities into account in valuation.
- Providing internationally comparable information on the value of ecosystem services.
- Incorporating uncertainty about ecosystem services into value estimates.
- Translating ecosystem services information so it becomes relevant to policy and decision-making.

Case study: Benefits from reduced eutrophication in the Baltic Sea (Ahtiainen et al 2012, 2013b,

The purpose of the study was to estimate the benefits of reducing eutrophication in the Baltic Sea to the general public. The change in eutrophication was based on the existing policy targets set by the HELCOM Baltic Sea Action Plan. Contingent valuation was chosen as the valuation method, as it is able to capture values related both to the recreational use of the sea and the existence of a healthy marine environment. Contingent valuation is a survey-based method that elicits individuals´ willingness to pay for a well-defined environmental change, with willingness to pay representing the benefits of the change in monetary terms.

The valuation survey was designed in international cooperation and implemented in 2011 in all nine coastal countries of the Baltic Sea. Altogether, 10 500 responses were collected. In addition to the valuation questions, the survey collected information on respondents' attitudes, experiences of eutrophication, level of knowledge, and background (e.g. income and age).

In the survey, the state of the Baltic Sea was described with five ecosystem characteristics: water clarity, blue-green algal blooms, underwater meadows, fish species and state of deep sea bottoms. Thus, the study examined mainly recreation and existence benefits from water quality and marine habitats (see Figure E1). Change in eutrophication was presented to respondents with colour maps illustrating the improvement in the condition of the Baltic Sea.

Figure E1. Ecosystem services and benefits addressed in the study

The results showed that people attach a great value to improving the state of the Baltic Sea. The majority of the citizens in the Baltic Sea countries were willing to pay for reduced eutrophication, and the total willingness to pay was around 3800 million euros per year. The findings also indicated that people value having the entire Baltic Sea in a healthier state, that recreation on Baltic Sea shores and waters is popular in all coastal countries, and that many are worried about the marine environment.

The estimates are useful in assessing the benefits from reducing eutrophication according to the HELCOM Baltic Sea Action Plan targets and achieving the Good Environmental Status in the Marine Strategy Framework Directive with regard to eutrophication. In addition, benefits can be compared with the costs of nutrient abatement to assess the economic efficiency and social desirability of nutrient abatement programs.

1. Introduction

The Baltic Sea provides many goods and services that contribute to human well-being. These include, for example, fish stocks, biodiversity, water quality and climate regulation, which in turn create human welfare in terms of food, tourism, recreation opportunities and inspiration. *Ecosystem services* are ecosystem functions and processes that are beneficial to humans, either directly or indirectly. The concept of ecosystem services can be used to analyze the interaction between nature and humans, and assess the significance of ecosystems and biodiversity.

Many benefits provided by nature are not recognized by markets and market prices, thus being ignored in decision-making. This leads to undervaluation of nature and ecosystem services, and loss of biodiversity (TEEB 2008). The purpose of valuation is to capture the numerous values people derive from nature, which can be integrated into decision-making.

Better understanding of the value of ecosystem services increases the awareness of the benefits provided by nature, and makes the trade-offs between the protection of the marine environment and other economic actions visible. Ecosystem valuation can thus assist in designing more efficient policies. Benefit estimates can be compared with the costs of environmental protection measures in cost-benefit analyses to assess the economic efficiency of nature conservation projects or programs. Such analyses can also be useful in setting environmental targets and in deciding how to allocate public spending. In addition, valuation is one of the ways to take into account public values and encourage public participation.

Despite recent initiatives and efforts to study ecosystem services, the understanding of the function of the Baltic Sea ecosystems that provide the services and the resulting benefits to human societies is still limited. There is a need to improve the knowledge of ecosystem services to produce comparable information for the Baltic Sea region. The knowledge of ecosystem services and their value to society can aid in achieving the regional and national environmental objectives set for the Baltic Sea. Information on the benefits provided by marine and coastal ecosystems can support reaching the objectives of the HELCOM Baltic Sea Action Plan. Such information is also needed for the implementation of the EU Marine Strategy Framework Directive (Directive 2008/56/EC).

This document provides information on ecosystem services in the Baltic Sea, the valuation of ecosystem services and the links between the management of the marine environment and ecosystem services.

1.1 Regional Workshop on the Valuation of Marine and Coastal Ecosystem Services

The Regional Workshop on the Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea was organized in Stockholm, Sweden, 7-8 November 2013 with the purpose of exchanging information, discussing how economic valuation of the Baltic Sea can be used for ecosystem-based marine management, and allowing experts and policymakers to meet. Participants of the workshop included representatives of the scientific community and academia, administration, non-governmental organizations (NGOs) and the private sector. This report follows topic-wise arrangement of the workshop with chapters (presentations) addressing ecosystem services with relation to defining the concept, global and regional perspectives and marine management and complemented by discussions on state-of-play and future of ecosystem valuation in the region. This report presents some of the discussed issues and outcomes of the workshop at the end of each relevant section. Some of the questions posed in the discussion boxes were used as the basis for the group discussions. Additional information on the workshop and its outputs can be found in Annex 4.

2. Ecosystem services – defining the concept

Working with ecosystem services requires a clear and consistent understanding of their definition and typology. Several different definitions and classification schemes of ecosystem services have been suggested (Daily 1997, Costanza et al. 1997, MA 2005, Fisher et al. 2009). One of the most widely used definitions is the one developed by the Millennium Ecosystem Assessment (MA 2005) which has been applied in analyzing the situation in the Baltic Sea (Garpe 2008, Söderqvist et al. 2012).

Millennium Ecosystem Assessment (MA) classification of ecosystem services:

- *Regulating*, e.g., pollination and the regulation of climate and erosion.
- *Provisioning*, products from the ecosystems, e.g. food, genetic resources and energy sources.
- *Cultural*, e.g. recreation, inspiration, aesthetic and educational values.
- *Supporting*, maintain other services, e.g. primary production and nutrient cycling.

Since the MA, the classification of ecosystem services has been developed to be applicable to different decision contexts (e.g. Boyd & Banzhaf 2007, Wallace 2007, Fisher et al. 2009, UK NEA 2011). It has been noted that some ecosystem services contribute to the provision of others, and that double-counting needs to be avoided in the valuation of ecosystem services. Therefore, ecosystem services are often divided into intermediate and final services, and also separated from the goods or benefits they provide (Fisher et al. 2009, Turner et al. 2010, UK NEA 2011).

Figure 2 presents a classification for the valuation of ecosystem services. It is based on the key idea that ecosystem services provide goods and benefits to humans that can be valued (Fisher & Turner 2008, Fisher et al. 2009). In the definition, ecosystem services are considered to be ecological in nature, and they do not have to be utilized directly. Intermediate services support final services but are not directly linked to human welfare, and final services directly deliver welfare gains to people. UK NEA (2011) also separates between goods that include all outputs from ecosystems that are valued by people, and benefits that represent the value of welfare improvements.

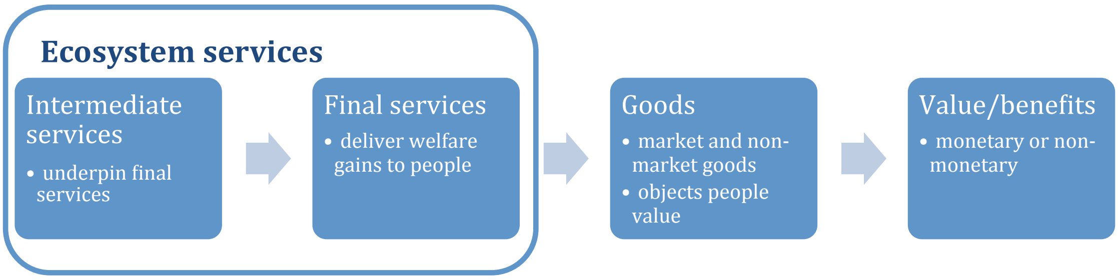

Figure 1. Classification of ecosystem services for valuation

This division of ecosystem services aids in considering all significant services to human well-being (European Commission 2010), and it also helps avoiding the problem of double-counting (Fisher et al. 2009, UK NEA 2011). Double-counting occurs when underlying ecosystem services that contribute to final service benefits are valued separately and the values are aggregated to obtain estimates of ecosystem value (Turner et al. 2010). For example, valuing nutrient cycling and recreation in marine areas separately and summing the values up leads to double-counting, as nutrient cycling contributes to having usable water for the purposes of recreation. Thus, the value of nutrient cycling is already embodied in the recreation benefits. The double-counting problem can be avoided by having a clear understanding of the interactions of ecosystem services and valuing only goods provided by final ecosystem services.

The MA classification and the division of ecosystem services into intermediate and final services and benefits can be used together (see Figure 3). In that case, provisioning and cultural services are always final ecosystem services, regulating services may be either final or intermediate services and supporting services are always intermediate services (UK NEA 2011). Also, some ecosystem services can be either intermediate or final depending on the context.

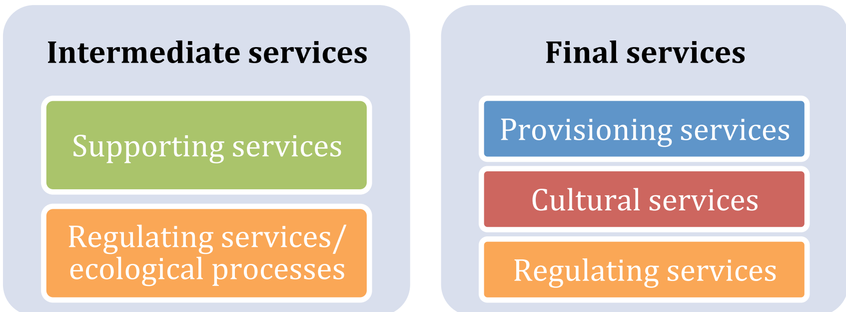

Figure 2. Classification of ecosystem services (adapted from UK NEA 2011, p. 17)

As the existence of multiple classification schemes of ecosystem services complicates comparisons between studies, a standard classification that is consistent with other classification schemes has been proposed (Haines-Young & Potschin 2011, 2013). The Common International Classification of Ecosystem Services (CICES) has been developed to facilitate comparisons between different definitions. The starting point of the CICES classification is the MA (2005) typology of ecosystem services, but it has been developed further to make a distinction between final ecosystem services, goods and benefits, with similarity to the UK NEA (2011) definition.

The classification of ecosystem services is a challenge concerning the Baltic Sea. The existing classification schemes for ecosystem services do not necessarily take into account the special characteristics of the Baltic Sea, and therefore it is important to adapt these to the conditions of the area.

3. Valuing ecosystem services

Ecosystem services are valued to assess the socio-economic benefits (or losses) resulting from changes in the market and non-market goods provided by ecosystem services. This view is essentially anthropocentric and focuses on human well-being. In addition to human benefits, nature is often considered to have intrinsic value, i.e. value in itself (e.g. Ehrenfeld 1972).

Valuation of ecosystem services is inherently interdisciplinary, and it entails combining the approaches of natural and social sciences to characterize the relationships between ecosystems, the provision of ecosystem services and human well-being. Steps in the valuation of ecosystem services include assessing how the policy change affects the ecosystem and the provision ecosystem services, how the changes in ecosystem services impact human welfare, and what is the value of the changes in ecosystem services (Defra 2007).

The effects of biodiversity conservation on ecosystem services and further on human well-being can also be assessed in relation to human well-being targets (Conservation Measures Partnership 2012). According to MA (2005), these targets include necessary material for good life (such as income, food and shelter), health, good social relations, security, and freedom and choice. Conservation projects can provide direct benefits to humans while achieving conservations goals, or provide ecosystem services that contribute to human well-being (Conservation Measures Partnership 2012). It is also possible to set goals for human well-being targets in conservation projects.

According to White et al. (2011), valuation of ecosystem services can be done at three levels: qualitative, quantitative and monetary. Qualitative valuation means identifying the effects of changes in the provision of ecosystem services on human well-being, e.g. qualitatively describing the changes in the recreational use of a certain nature area after a policy change. Quantitative valuation involves estimating the changes in ecosystem benefits in numbers, e.g. determining the increase in the yearly number of visitors to the area. Monetary valuation entails expressing the values in monetary terms, e.g. estimating the change in the annual value of the recreational visits to the area.

In addition to double-counting (see section 2), economic valuation of ecosystem services should consider marginal valuations, spatial explicitness and threshold effects (Turner et al. 2010). Marginal valuation entails that marginal changes in value are estimated instead of total values. Estimating the total economic value of ecosystem services is considered neither useful nor advisable for several reasons (Brouwer et al. 2013). First, marginal value reflects the value of an additional unit of ecosystem services, and it changes with the level of provision of ecosystem services. Therefore, multiplying marginal values with quantities may lead to biased estimates of total value. Second, for ecosystem services that are fundamental to human well-being, total value is argued to be infinite. Third, policy decisions rarely consider total losses of ecosystem services, and therefore valuing marginal changes is more useful.

Spatial explicitness means that it is important to take into account the spatial heterogeneity of ecosystem services provision and benefits (Turner et al. 2010). Provision of ecosystem services is affected, for example, by the ecosystem area, quality and the scale of delivery (Brouwer et al. 2013). Benefits depend on the number of affected people, distance to the ecosystem and availability of substitutes, among others (Brouwer et al. 2013). Interdisciplinary work is needed to account for spatial variability.

Nonlinearities are often present in ecosystem services, meaning that there are certain thresholds after which the system changes dramatically into another steady state. Possible thresholds should also be considered in valuation to produce appropriate benefit estimates. In situations with high ecological uncertainty or irreversible changes in ecosystems, other policy guiding principles, such as the precautionary principle, can be more useful (TEEB 2010).

3.1 Valuation methods

Preference-based valuation methods are currently most commonly used to assess the economic value of ecosystem services (Kettunen et al. 2012). These include stated preference and revealed preference methods, and also direct market valuation. Stated preference methods (SP) are based on carefully constructed surveys that ask people's willingness to pay for a well-defined change in the provision of ecosystem services. They are widely applicable to different kinds of ecosystem services, and are the only methods that are able to capture values that are not related to the use of ecosystem services. However, they have been criticized on the grounds of relying on survey responses and not on actual behavior. Revealed preference methods (RP) are based on observing people's behavior in markets. They rely on the assumption that people's expenditure on travelling or housing reflects also environmental values. They can be used for estimating recreation and aesthetic values, based on statistics or survey data. When time and resource constraints preclude conducting new studies, e.g. collecting survey data, methods using existing valuation studies (benefit transfer and meta-analysis) can be considered.

Besides monetary value estimates, preference-based valuation studies typically collect information on public knowledge, attitudes and opinions on ecosystem services and the environment. This information can be used to complement the benefit estimates in ecosystem service assessments.

In addition to the above-mentioned methods, economic values are sometimes based directly on market prices or costs, which is less resource-intensive. Market prices are only applicable when such data are available, and even then prices need to be adjusted for distortions such as taxes and subsidies (UK NEA 2011). It is also possible that the market price does not capture wholly the social costs and benefits, giving an underestimation of the value of the good. Cost-based methods rely on the availability of cost data, and they typically tend to either overestimate (replacement cost) or underestimate (avoidance costs) the value of ecosystem services (Turner et al 2010).

Qualitative and quantitative approaches can be used to complement monetary valuations and when monetary valuation of ecosystem goods is difficult or even not possible, e.g., in the case of some cultural ecosystem services (inspiration, spiritual values).

Methods to value ecosystems services are listed in Table 1 with examples of applications in the Baltic Sea area, and more detailed information of each method can be found in Annex 1.

Table 1. Methods to value ecosystem services

Method	Data source	Applicability and examples
Stated preference methods Contingent valuation, choice experiment	surveys	recreation, aesthetic benefits, non-use/ existence values, e.g. recreation and existence benefits from reduced eutrophication[1]
Revealed preference methods Travel cost method, hedonic pricing	surveys, statistics	recreation, aesthetic benefits, e.g. recreation benefits from increased fish catch[2], benefits of residential properties from improved water quality[3]
Methods using existing studies Benefit transfer, meta-analysis	existing valuation studies	based on primary studies, recreation, aesthetic benefits, non-use/existence values, e.g. the benefits from reduced eutrophication[4]
Cost-based methods	cost data	data on replacement or avoidance costs available, e.g. value of coastal zones as nutrient filters[5]
Market prices	market data	goods traded in markets, e.g. the value of fish landings[6]
Non-monetary methods Qualitative, quantitative	statistics, focus groups, interviews, workshops	when obtaining monetary estimates not appropriate/ possible, e.g. describing the recreational use of marine areas[7], shared values for reducing eutrophication[8]
[1] Ahtiainen et al. (2013b); [2] Håkansson (2008); [3] Artell (2013); [4] Turner et al. (1999); [5] Gren (2013); [6] Kulmala et al. (2012); [7] Ahtiainen et al. (2013a); [8] BalticSTERN (2013).		

The choice of valuation approach depends on the context and the ecosystem benefits in question and the level of ambition of the examination. Ecosystem service assessments can begin with qualitative and quantitative descriptions followed by monetary valuation in later phases. Monetary valuation makes sense especially for major issues or large-scale projects, when large benefits or costs are at stake. More information on the suitability of valuation methods to different ecosystem services can be found in Table 3 in Brouwer et al. (2013).

Box 1

Input from the workshop on valuing ecosystem services

- The concept of ecosystem services is sometimes difficult to understand, and therefore improving the knowledge and understandability of ecosystem services and the associated values is considered important. This can be achieved by making ecosystem services as concrete, personal and relevant as possible.
- Human wellbeing depends on ecosystem services. Ecosystem services that are linked to familiar issues, such as recreation, health, livelihoods and value of coastal homes, help understand and relate to them.
- It is worth explaining how policies on ecosystem services affect people's life and work.
- Case studies and local examples are useful in bringing ecosystem services closer to people. Visualizing the state of ecosystem services, what affects them and how they affect human well-being, for example, by showing them on maps can be used as a tool.
- Both monetary and non-monetary values can help people understand ecosystem services, but they need to be explained using good examples.
- For businesses, the use of valuation of ecosystem services can be an incentive for the development of new business chances and opportunities, such as innovations, are important. Likewise economic gains or long term costs, reflected through ecosystem valuation may help bringing the concept into daily business activities/routines.
- Raising the level of awareness amongst the public and politicians makes it easier to show that marine and coastal ecosystem services are valuable and that they are societal goods benefitting all.
- As ecosystem valuation mainly is calculated on the basis of present values there is a need to develop forecasting models to secure that the valuation can consider upcoming future needs for goods and services.
- Calculating the monetary value of ecosystem services facilitate the visibility, but the monetary valuation is not always possible and even less appropriate if relevant knowledge is lacking. A lot of the economic valuations tend to be on the provisioning ecosystem services – fish, fuel and wood have a market value. The cultural values are difficult to evaluate..
- Using economic valuation of ecosystem services is very important for decision makers to get the message across.

- Interdisciplinary studies are needed for valuation. There is an urging need to bring together biologist, economist and social sciences both on the research level as well as on the management level. Also, the existing data and results should be made more readily available.

4. Ecosystem services as a global priority

A major initiative taken by the United Nations (UN) to highlight the important role ecosystems play for the well-being of humanity was the Millennium Ecosystem Assessment (MA) (MA 2005). It compiled information on what the consequences may be when ecosystems change and provided recommendations for the future on how to deal with these changes. It was concluded that over the past 50 years, humanity have changed ecosystem services more than ever before. These changes correlate with the economic development of the world, but they come with a cost most notable in environmental degradation and biodiversity loss and with that the impoverishment of ecosystem services. The MA noted that ecosystem services will most likely continue to degrade, making it difficult to achieve the Millennium Development Goals, which also concerns the Sustainable Development Goals of the future (Griggs et al 2013, Rockström et al 2013, Schultz et al 2013).

The Economics of Ecosystems and Biodiversity (TEEB) initiative takes a global perspective on the valuation of ecosystem services by studying the economics of biodiversity loss. The aim is to incorporate the value of ecosystems services into decision-making. TEEB is organized in three phases, of which the third one is ongoing. The findings of the first phase were summarized in an interim report in 2008, highlighting the continuing decline in biodiversity and related losses of ecosystem services, discussing the economic valuation of biodiversity and ecosystem services, and describing how policies could be improved to better conserve biodiversity (TEEB 2008). The second phase of TEEB produced several reports directed to policy-makers (e.g. TEEB 2009), and the ongoing third phase focuses on communication, maintaining the TEEB network and supporting national TEEB studies (TEEB 2013). Several countries in Europe, such as Germany, the Netherlands and Poland have initiated national TEEB studies, and Nordic countries (Finland, Sweden, Norway, Denmark and Iceland) have published a synthesis on the socio-economic role and significance of biodiversity and ecosystem services (TEEB Nordic, Kettunen et al. 2012). TEEB Nordic compiled information on ecosystem services in the Nordic countries, including marine areas, and assessed the status and socio-economic value of marine fisheries. According to TEEB Nordic, there are considerable knowledge gaps related to marine ecosystem services, with the exception of fisheries. Another initiative related to the marine environment is TEEB for Oceans and Coasts, which draws attention to the economic benefits of ocean and coastal ecosystems and aims to provide examples and guidance on incorporating ecosystem values into policy decisions (TEEB for Oceans and Coasts 2013).

United Nations Environment Programme (UNEP) has developed several global background studies and reports for economic valuation of ecosystem services, including Guidance Manual for the Valuation of Regulating Services (2010).

Importantly, UNEP's activities *inter alia* covered coastal and marine ecosystems (e.g. wetlands in Sri Lanka, reefs in St. Lucia, Tobago, Belize, Jamaica, and the Dominican Republic). Ecosystem valuation is a priority for UNEP. With their Ecosystem Services Economics (ESE) program they aim at building stakeholder capacity to make scientifically based information to integrate an ecosystem-service based approach into national administration. According to UNEP there is a need to develop the understanding of how ecosystem services influence and relate to the well-being of humanity. They have three focus areas including (1) Economic Valuation and Natural Wealth, (2) Equity in Ecosystem Management and (3) Disaster Risk Management. The ESE program also relates to Millennium Ecosystem Assessment (MA 2005). There is great interest to apply the concept of ecosystem services into UNEPs Regional Seas Programme. This programme that was launched in 1974 aims at improving the environmental status of the worlds' seas and coastal areas by facilitating collaboration among neighboring coastal countries.

Box 2

Input from the workshop on ecosystem services as a global priority

- International experience and collaboration is important and the research community is at frontline utilizing it.
- It would be useful to develop a common understanding and methodology of ecosystem services with neighboring countries in the Baltic Sea area.
- International experiences should be utilized by finding good examples and policy instruments of ecosystem services based management. Also bad examples are useful to learn important lessons.

5. Baltic Sea environment and human impact

The marine environment is under pressure by anthropogenic inputs of nitrogen, phosphorus, organic matter and hazardous substances originating from land-based sources and activities at sea. Commercial fishing is also a strong and widespread pressure affecting the marine ecosystem. The sea bed is further under pressure by constructions, dredging and disposal of dredged materials which can have large impacts locally. Releases of oil not only cause pollution effects but may also directly threaten biodiversity such as marine birds and mammals.

The Baltic marine environment represents a unique brackish water ecosystem which is highly fragile and sensitive to anthropogenic impacts. More specific background information about it is presented in Annex 2.

According to a HELCOM assessment of ecosystem health of the Baltic Sea marine environment, the entire sea area is generally impaired (HELCOM 2010). None of the open basins of the Baltic Sea has an acceptable environmental status and only very few coastal areas along the Gulf of Bothnia can be considered healthy.

Eutrophication, caused by nutrient pollution, is a major concern in most areas of the Baltic Sea. According to a recent HELCOM assessment (HELCOM 2013a), it was noted that almost the entire open Baltic Sea was eutrophied with the exception of the open sea areas of the Bothnian Bay. Coastal areas in Orther Bucht (Germany) and the outer coastal Quark (Finland) were the only coastal areas assessed by national authorities as being in good ecological status in terms of eutrophication.

Currently, the level of nutrient inputs equals the levels of loads in the early 1960s (Gustafsson et al. 2012). Inputs of nutrients to the Baltic Sea have decreased since the late 1980s. Especially inputs from direct point source such as municipalities, industries and fish farms have decreased markedly from 1994 to 2010; by 43% for nitrogen and 63% for phosphorus. For the whole Baltic Sea, flow-normalized inputs of total nitrogen and phosphorus to the Baltic Sea have decreased by 16% and 18%, respectively, from 1994 to 2010 (HELCOM in prep).

Although some improvements can be noted in some specific areas the concentrations of nutrients at sea have in general not declined accordingly. The long residence time of water in the open Baltic Sea, as well as feedback mechanisms such as internal loading of phosphorus from sediments and the prevalence of blooms of nitrogen-fixing cyanobacteria in the main sub-basins of the Baltic Sea, are processes that slow down the recovery from an eutrophied state (HELCOM 2013b).

Living organisms and bottom sediments are affected by hazardous substances in all parts of the Baltic Sea (HELCOM 2010). Despite significant reductions of inputs of hazardous substances, only few coastal sites are undisturbed by them. However, several management actions have proved to be successful such as the reduction of atmospheric inputs of mercury, lead, and cadmium, and inputs of persistent organic pollutants including DDT, PCBs and TBT. Concentrations of radioactive substances originating from the Chernobyl fallout are still high in the northern, eastern, and central parts of the Baltic Sea, but the concentrations of the radionuclide cesium-137 are decreasing in all areas of the Baltic Sea.

The status of biodiversity appears to be unsatisfactory in most parts of the Baltic Sea. Alarming changes in many habitats and at all levels of the food chain have been reported (HELCOM 2010). Promising signs of successful remediation include an improvement in the status of top predators such as grey seals and white-tailed eagles in recent decades.

In the past ten years good progress has been made in enlarging the network of protected areas: between 2004 and 2013 the protected marine area has increased from 3.9 to 11.7% (HELCOM 2013c). The number of Baltic Sea Protected Areas (BSPAs) is also increasing with 163 sites listed at present.

In addition to anthropogenic pressures such as over-fishing and eutrophication, climate-related changes in precipitation, run-off patterns and biogeochemical cycles of the Baltic Sea may erode the resilience of the ecosystem. At present, it is not clear how climate change will influence eutrophication conditions and productivity in the Baltic Sea (HELCOM 2013d).

Box 3

Input from the workshop on Baltic Sea environment and human impact

- Despite numerous data on environmental impacts of human activities, there is insufficient information on their impacts on ecosystem services, as well as how ecosystem services affect human behavior and welfare.
- There still is a lack of mapping of different ecosystem services.
- Ecosystem services can be seen as a means of describing the full picture more appropriately, including social, economic and environmental aspects.
- It is important to consider the land and the sea as an integrated whole.
- Spatially-specific ecosystem services valuation was called for. For example, basin-specific analysis is needed in the Baltic Sea area.
- Both studies that improve understanding at the local level and international studies are important.
- More comparisons among countries would be useful but there is a need to develop common indicators.

6. Ecosystem services provided by the Baltic Sea

Figure 3 lists some examples of intermediate and final ecosystems services provided by the Baltic Sea environment and the resulting goods or benefits. It is useful to note that some of the ecosystem services can be intermediate or final depending on the context.

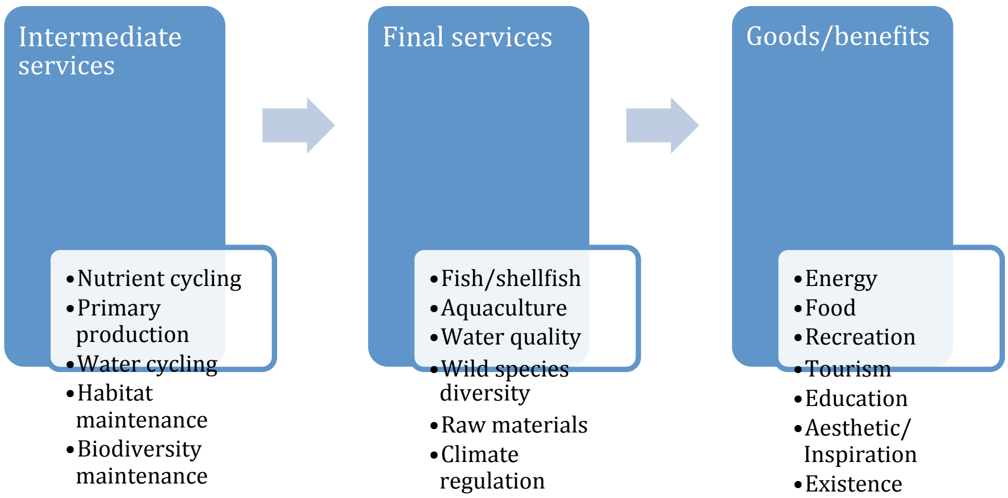

Figure 3. Examples of coastal and marine ecosystem services in the Baltic Sea

6.1 Provisioning Ecosystem Services

Fish is a major provisioning ecosystem service of the Baltic Sea used for consumption (Garpe 2008). It provides people not only with food but also with employment opportunities. Fish is also used as fish meal for fodder for farmed fish, pigs and poultry. The main species caught on a commercial basis are cod, sprat, herring and salmon. Although it is an important resource that raises a lot of political attention, it is a fairly small activity in comparison to other industries. As an example, in Sweden there were around 1600 professional fishermen in

2012, and the catch was approximately 160 000 tons with the value of 110 million euros (Kettunen et al. 2012, p. 142). If the fishery is related to other values, the net benefits from the fishery has been questioned (Waldo et al 2010).

Another provisioning ecosystem service used for human consumption, as well as for resource enhancement, is aquaculture. Fish farming is carried out in the Baltic Sea and has the potential to increase (Aquabest 2012). A common species used is rainbow trout.

Genes and genetic resources are important aspects of ecosystem services (Bailey 2011). The Baltic Sea is estimated to host more than six thousand species (Ojaveer et al. 2010). As stated above, loss of biodiversity and genetic resources is a problem also in the Baltic Sea. For example, a majority of the original wild Baltic salmon populations have become extinct, and much of the original genetic variation in Baltic salmon has already been lost due to extinction of individual populations and reduction in population sizes (Palmé et al. 2012).

Further provisioning ecosystem services of the Baltic Sea are energy, as well as space and waterways. Here especially space for various anthropogenic activities on and in the Baltic Sea has become more important over the last years. For example, the Baltic Sea is becoming increasingly interesting for offshore wind power (Lumbreras and Ramos 2013), which may support other ecosystem services such as providing habitats for fish and mussels (Andersson and Öhman 2010). Notably, competition for marine space in parts of the Baltic (Janßen et al. 2013) is one of the drivers for the implementation of Marine Spatial Planning.

6.2 Cultural Ecosystem Services

The Baltic Sea is an important recreation area for the people living in the surrounding countries. According to a survey conducted in the coastal states in 2010, over 80% of people have spent leisure time at the sea in all countries except Russia (Swedish EPA 2010). In Denmark, Estonia, Finland, Latvia and Sweden, the majority of people have visited the Baltic Sea during the last 12 months. The most common activities at the Baltic Sea in all countries are swimming and spending time at the beach. Sport fishing is also common in Baltic Sea countries. In Sweden, the number of recreational fishermen is estimated to be one million (Swedish EPA 2009).

In terms of revenue, tourism is of vast importance in the Baltic Sea region. The tourism industry is estimated to have an annual turnover of 90 billion euros, and it provides employment for some 2 million people (Swedish EPA 2009). In Germany, there were more than 33 million overnight stays along the Baltic coast in 2009, with the majority having the beach as the main reason for choosing the destination (Haller et al. 2011).

The value of the Baltic Sea for education and research is difficult to estimate, but given the large number of educational institutions in the region, it clearly plays an important role. Indeed, as there are almost 5000 scientific publications listed in the “ISI Web of Science” database, with the word “Baltic Sea” in the title, it is very important for research.

6.3 Supporting Ecosystem Services

The various ecosystem services in themselves depend on supporting ecosystem services. As they are not used by humans in a direct manner they are usually not given sufficient attention. The living nature depends on the flow of materials including nitrogen, phosphorus, carbon, water and oxygen. The cycling of these materials is necessary for marine life. If they are disturbed it may come with a cost such as eutrophication (enhanced levels of N and P), climate change (raised levels of carbon dioxide), changes in salinity (freshwater inflow) and anoxic conditions in the deeps of the sea (oxygen depletion due to decomposition of high levels of organic matter).

Primary production, i.e. the production of plant material through photosynthesis, is a basic ecosystem function in the Baltic Sea. It is the basis for the food chain. Primary production also regulates oxygen levels in the sea and in the atmosphere.

Habitat maintenance is a supporting ecosystem service. It is defined as the place where living organisms occur and the Baltic Sea provides a great variety of habitats. Important habitats are for example the beds of mussels, areas of macro-algae such as *Fucus*, and sea-grass beds.

Another supporting ecosystem service of profound importance is biodiversity maintenance. Higher levels of biodiversity usually support a larger variety of ecosystem services. It not only opens up a larger choice of interactions within an ecosystem it may also have a buffering function protecting against disturbance.

6.4 Regulating Ecosystem Services

The Baltic Sea is also a provider of a range of regulating ecosystem services. One is the sink function for carbon dioxide (CO_2). Indeed, the oceans of the world store approximately half of the carbon dioxide humans have produced (Sabine et al. 2004). However, it should be noted that CO_2 sequestration also increases ocean acidity which can have a negative impact on marine life (Hoegh-Goldberg et al. 2007). Another ecosystem service of significance is sediment retention. This is clearly illustrated in the presence of beaches (well-known cultural ecosystem service used by many people (Klein et al 2004)). However, beach erosion is a problem (European Commission 2004).

As stated above, eutrophication is one of the most critical threats to the Baltic Sea. In that context an ecosystem service of vast importance is the mitigation of eutrophication. Organism and sediment may store nutrients. For example, sea grass beds have multiple functions: they provide important nursery habitats for commercial species, may serve as a sediment trap stabilizing coastal erosion and are important in the sequestration of carbon (Duarte et al. 2005). The effects of hazardous substance may also be buffered.

6.5 Economic valuation studies of ecosystem services in the Baltic Sea

At present, there are a few dozen studies that have been conducted on the benefits of ecosystems services and improvement of the environment in the Baltic Sea. These studies have mainly focused on recreation, aesthetic values, existence values and food (fisheries). The report by Söderqvist and Hasselström

(2008) present a comprehensive review of the available literature on the economic value of ecosystem services provided by the Baltic Sea. In addition, they discuss the knowledge gaps related to different ecosystem services and environmental problems and made suggestions for future research.

The review included some 40 studies on the value of the Baltic Sea environment (see Annex 3). Most of the studies were local or regional, with only few international studies. Of environmental issues, eutrophication and fisheries were studied the most. Detailed information of each study can be found in Söderqvist & Hasselström (2008). Based on existing knowledge, the review assessed ecosystem services coverage in the Baltic Sea area and the need for future studies (see Table 5 in Söderqvist and Hasselström 2008). Previous research had focused on habitats, diversity, food, recreation and aesthetic value, and these were seen as most important for future studies as well. In addition, the report suggested studying the benefits of decreased nutrient loads to the Baltic Sea, assessing the gains of a cod-stock recovery program, valuing recreational fishing and valuing the risk of oil spills.

Since the review in 2008, further research on the value of the marine environment has been conducted in the Baltic Sea area, in part addressing the gaps identified in the report by Söderqvist & Hasselström (2008). In a report by Söderqvist et al (2012) ecosystem services were linked to global environmental-status descriptors which gives indications of the costs of degradation.

Focus of most studies has mainly been on eutrophication (Kosenius 2010, Ahtiainen et al. 2013b) and oil spills (Tegeback & Hasselström 2012, Depellegrin & Blažauskas 2013). In the ecosystem services framework, Kulmala et al. (2012) have studied the economic value of provisioning and recreational services of Baltic salmon, and Kosenius & Ollikainen (2012) the benefits from habitats and species, recreation, and food and raw materials. The importance of cultural ecosystem services, mainly recreation, has been studied by Ahtiainen et al. (2013a) and Lewis et al. (2013). Some of these studies have been conducted in all Baltic Sea coastal countries (Ahtiainen et al. 2013a, 2013b), providing comparable information for the whole region. More information on these studies can be found in Annex 3.

The benefit estimates from Ahtiainen et al. (2013b) have been utilized further in a cost-benefit analysis studying the economic efficiency of reducing eutrophication in the Baltic Sea according to the HELCOM Baltic Sea Action Plan (2007) targets (BalticSTERN 2013, Hyytiäinen et al. 2013). The findings indicated that the benefits of reducing eutrophication exceed the costs by 1-1.5 billion euros annually. The study is an example of how the value of ecosystem services can be compared to the costs of taking actions to improve the environment and how valuation can support marine decision-making.

Box 4

Input from the workshop on economic valuation studies of ecosystem services in the Baltic Sea

- There is a need to increase our understanding of the interactions between ecological and socio-economic aspects.
- More information is needed on the linkages between ecosystem services, their natural fluctuations and how they are affected as well as how they influence human behavior and well-being.
- Forecasts that extends over a long time including scenarios to assess future development are needed.
- Studies could be particularly useful where the links between pressures and ecosystem services are quite complex or unclear. One consideration is to focus on those ecosystem services that are easy to communicate.
- Concrete regional case studies and studying those ecosystem services that are closely linked to human welfare would be beneficial.
- Topics that should be addressed in this context include EU polices, such as the Common Agricultural Policy and Common Fisheries Policy, and also Marine Spatial Planning, eutrophication, oil spills, dioxin issues, transport, tourism, recreation, fishing, energy production, agriculture and new uses of the sea.
- Ecosystem services assessment that relate to spatial planning, both on the local, national and regional scale, are needed. These could, for example, identify hotspot areas for different ecosystem services.
- Also benefits from the ecosystem services to the private sector and businesses should be evaluated more.

7. Baltic Sea governance and ecosystem services

The following issues identified as being relevant for further discussion in relation to the use of ecosystem services valuation in the Baltic Sea context:

- Ecosystem services measurements and indicators and systems for ecosystem accounting.
- Internalization of environmental costs and examples how it could be applied in solving regional environmental problems in the Baltic Sea Area.
- Identifying important and crucial knowledge gaps to enable to sufficient economic valuation of marine and coastal ecosystem services in the Baltic and other regional seas.
- Economic valuation of marine and coastal ecosystem services in the implementation of the HELCOM BSAP, in particular in the policy making processes.
- Valuation of ecosystem services in the context of reaching Good Environmental Status in the MSFD.

- Application of ecosystem valuation in Marine Spatial Planning.
- Global, regional and national experiences from UNEP and TEEB that can be applied in the Baltic Sea.

These issues are addressed partly through the existing governance structures/frameworks, as described below.

The Baltic Sea and its ecosystem services are administrated by national governments, governmental agencies, the European Union. In addition, a range of international agreements influence Baltic Sea management.

The Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention) is governed by the Helsinki Commission (HELCOM)., consisting of all Baltic Sea littoral countries and the EU. Within its almost 40 years, HELCOM developed into a regional environmental policy maker and focal point for the Baltic Sea covering various issues relating to the protection of marine environment and its natural resources. The HELCOM Baltic Sea Action Plan (BSAP) adopted in 2007 is implementing an ecosystem approach in managing the Baltic Sea environment based on ecological objectives and guided by relevant indicators and targets (Backer et al 2010). With its ecosystem approach, the BSAP directly links to issues related to ecosystem services. Valuation of ecosystem services could involve assessing the changes in the provision of ecosystem services and the associated benefits of reaching the BSAP targets to demonstrate the welfare effects of the Action Plan. It should also be noted that the BSAP has a close link to the EU Marine Strategy Framework Directive (MSFD, 2008/56/EC), as both frameworks are striving to reach the Baltic Sea in good environmental status by 2021/2020 respectively.

Another organization of importance in this context is the Council for Baltic Sea States (CBSS). Following the geopolitical changes in the Baltic Sea regions after the cold war the CBSS was established in 1992. It is an organization that facilitates regional intergovernmental cooperation. There are 12 members including the Baltic Sea states and the European Commission. It has different expert groups with some relating to marine issues such as the expert group on maritime policy and Baltic 21 considering sustainable development.

Nordic Council of Ministers (NCM) also plays an important role in the management of the Baltic Sea. The committee of senior officials for fisheries and aquaculture shows an interest in a major provisioning ecosystem service. NCM also have a program to fund NGOs in the area which is instrumental in the cooperation with Baltic Sea states and with North-western Russia.

There are also various EU directives and policies that influence Baltic Sea management, the most important being the Marine Strategy Framework Directive (MSFD), adopted in 2008 (European Parliament 2008, EC 2012). The aim of the MSFD is reaching a Good Environmental Status (GES) by 2021, which is interpreted in terms of ecosystem functioning and services provision. The MSFD lists several descriptors that should be considered when establishing the environmental targets for the GES, including biological diversity, alien species, fisheries, food webs, eutrophication, contaminants and litter . The MSFD requires an ecosystem-based approach to the management of marine waters (Art. 1.3), although it does not specify how the analyses should be undertaken in practice (WG ESA 2010). Therefore, also other approaches are possible, e.g. in the Initial Assessment. For example, the ecosystem approach in the analysis of marine uses entails identifying ecosystem services of marine areas, identifying and possibly valuing the welfare derived from these services and also identifying the drivers and pressures affecting ecosystem services (WG ESA 2010). In the analysis of cost of degradation, the ecosystem approach involves identifying the ecosystem services and associated benefits of achieving GES, where the benefits can be interpreted as the losses if GES is not reached (WG ESA 2010). The estimated benefits can later be compared to the costs of reaching GES and by that support the prioritizations needed in the Programme of Measures to be developed by the end of 2015.

Also the EU Water Framework Directive (Directive 2000/60/EC) (WFD) is of great importance as the majority of nutrients and hazardous substances to the marine environment comes via the river mouths. The aim of the Directive was that all surface water should reach good ecological and chemical status. The implementation of WFD is in it second cycle and updated programs of measures should be adopted by 2015. For the management of the Baltic it is important with an integrated approach between the implementation of the MSFD and the WFD. The identification and valuation of ecosystem services should be an effective support tool for this integration in the planning and prioritization in the program of measures as i.a. measures for eutrophication.

The Common Fisheries Policy (CFP) is a clear example of how the EU regulates one of the most important ecosystem services: fish. As all countries surrounding the Baltic Sea, except Russia, are part of the European Union fishery management, commercial fish species are mainly regulated through the Common Fisheries Policy. Decisions on how fishery resources are allocated are taken by the EU Council of Ministers every year. Before the decision is taken the scientific community through ICES, and the fishery industry and NGOs through the Baltic Sea Regional Advisory Council (BSRAC), give their recommendations (Stohr and Chabay 2010). The CFP is decisive as it, in a direct manner, influence national law. What is agreed within the CFP has to be followed by all member states. . The revised CFP that entered into force 2014 is aiming to end overfishing and make fishing environmentally, economically and socially sustainable. Some of the most important changes is the CFP is the discard ban and that quotas shall be defined according to Maximum Sustainable Yield. Implementation of ecosystem-based management in fisheries, e.g. long-term multi-species management plan for major Baltic stocks is one of the examples of related challenges. The new CFP will bring decisions on technical and conservation measures closer to the fishing grounds, in particular to national administrations, fishermen and other interest groups, called the regionalization. In this term the use of valuation of ecosystem services on a regional scale within the Baltic can develop as an important tool for the communication between the fisheries sector and i.a. the implementation of the MSFD.

There are also other EU initiatives that influence Baltic Sea management. The most overarching initiative is the EU Strategy for the Baltic Sea Region (EUSBSR). It is the first strategy within EU in which a macro-region with several countries is defined with the specific objective to enhance collaboration within that certain region (Metzger and Schmitt 2012). With the strategy initiatives from different sectors are brought together and cooperation is promoted. Sectors that relates to ecosystem services include both increased prosperity and improved environmental management.

Box 5

Input from the workshop on Baltic Sea governance and ecosystem services

- Ecosystem services approach is useful in fulfilling the requirements of the current policy targets, such as the Marine Strategy Framework Directive (MSFD), the Water Framework Directive and the HELCOM Baltic Sea Action Plan (BSAP) as well as within Marine Spatial Planning..
- Ecosystem services valuation is a tool for the implementation and assessment of existing policies, for example, in cost-benefit analyses and analyzing the costs of inaction.
- For policy support, evaluation of policy scenarios is important.
- Ecosystem services valuation can provide better incentives and justification for the implementation of new measures, targets and policies, such as the MSFD or the BSAP.
- Ecosystem services assessments and valuation is a tool of convincing the public about the need for the EU directives. Showing the socio-economic value and the implications to the people of reaching the good environmental status might increase the support for the policy.
- Valuation for policy purposes should be as transparent and clear as possible. The cross-sectorial approach involving all stakeholders is necessary.

8. Future perspectives

We are far from having the complete picture on the value of ecosystem services in the Baltic Sea. However, several studies have addressed the value of environmental improvements in marine and coastal areas, so there is some knowledge on the potential value of ecosystem services in the Baltic Sea, especially related to recreation, fisheries and non-use or existence values of the marine environment. To date, most studies have not utilized the ecosystem services framework, and therefore it is not necessarily straightforward to link these studies to specific ecosystem services. Despite this, the existing results are useful in ecosystem service assessments and valuations.

For the purposes of valuation, further work is needed on identifying and describing Baltic Sea ecosystem services and their interactions, evaluating how policy changes affect these ecosystem services and assessing the effect of changes in ecosystem services to human welfare. This is required in order to conduct high-quality cost-benefit analysis of programmes of measures for the EU Marine Strategy Framework Directive. It is important to relate the economic values to specific ecological indicators and descriptors that can be measured. Linking values to ecological indicators makes it possible to estimate marginal benefits, e.g. in the context of eutrophication, benefits per reduced kilogram of nitrogen or phosphorus.

Valuation of ecosystem services can support the achievement of current policy targets in the Baltic Sea area, such as those set by the Marine Strategy Framework Directive, the Water Framework Directive and the HELCOM Baltic Sea Action Plan. Usefulness for policy support requires that the value estimates can be connected to the policy objectives, i.e. valuation studies are designed in accordance with current targets. In addition, close cooperation between researchers and policy-makers can increase the relevance of value estimates to marine policies. It should be underlined that *ex ante* valuation of ecosystem services within the scope of e.g. Strategic Environmental Assessment (SEA) or EIA of potential impacts of new policies would sufficiently reduce risks of adopting inefficient/harmful policy instruments. Even though *ex post* valuation may still help in re-designing implementation of specific policies/decisions to improve cost-effectiveness.

International cooperation is important also in the valuation of marine ecosystem services, as the Baltic Sea is shared by nine countries, and most of the environmental issues in the sea are transboundary. The current knowledge mainly originates from studies that are restricted to certain areas of the Baltic Sea and focus on a specific ecosystem service. More attention should be drawn to international studies, especially as international cooperation is required by the EU Marine Strategy Framework Directive. Cooperation could be in the form of exchanging ideas and experiences and implementing joint studies. As in other geographical areas, the ecosystem services provision and the benefits to humans in the Baltic Sea are spatially heterogeneous. There is, however, little knowledge of the spatial variation in ecosystem services and benefits in the area, requiring further work. More detailed and site-specific mapping, e.g. of underwater habitats, as well as other local amenities would be needed, to complement existing knowledge.

An important question is to identify which ecosystem services should be a priority for future research. In the review by Söderqvist and Hasselström (2008), habitats, biodiversity, food, recreation and aesthetic values were considered to be the most important, and more studies on eutrophication, cod-stocks (e.g. predator-prey interactions, feeding migrations etc.) and impacts of recreational fishing in general as well as oil spills on shoreline were needed. Policy-relevance of the values for ecosystem services should be one of the crucial factors in choosing the focus of future research, and descriptors and issues brought forward within coherent implementation of the HELCOM BSAP and EU MSFD should receive the most emphasis; priority should be given to the largest environmental threats of the Baltic Sea.

Main challenges in assessing the ecosystem services in the Baltic Sea area and integrating them into policy and decision-making include:

- Accurately describing ecosystem services and how they are linked with the ecosystem structures.
- Trade-offs and interactions of ecosystem services.

- Finding relevant indicators for the assessment of ecosystem services and ecosystem improvement.
- Evaluating how measures to improve the marine environment impact the provision and trade-offs of ecosystem services and further their value.
- Assessing the effects of changes in ecosystem services to human well-being, taking into account possible future developments.
- Taking ecological thresholds and non-linearities into account in valuation.
- Providing internationally comparable information on the value of ecosystem services.
- Incorporating uncertainty about ecosystem services into value estimates.
- Translating ecosystem services information so it becomes relevant to policy and decision-making.

Box 6

Input from the workshop on future perspectives

- A challenge in ecosystem services valuation is the link from study results to policy-making. For example, values of ecosystem services and how it affects funding of environmental projects is not clear.
- Economic values of ecosystem services should be used to highlight their importance to policy-makers and the general public.
- Important aspect of using the concept of ecosystem services is increasing awareness and understanding, and communicating the linkages between ecosystems and human welfare. The concept can be seen as a marketing tool that can help people realize how dependent we are on ecosystem services.
- Valuation of ecosystem services is useful in prioritizing between measures, fulfilling the requirements of EU directives, setting targets, cost-benefit analyses, developing more sustainable economies and balancing between the short-term and long-term targets.
- It is important to describe the connection between sea and land.
- It should be clear what taxes are contributing to in terms of ecosystem services.
- The ecosystem services concept can be used to balance the cost of implementing action against inaction (i.e. the loss of benefits of not improving the state of the marine environment).
- Ecosystem service assessments and valuation should be developed further among policy-makers, ecologists, social scientists and economists.

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Annex 1. Background on valuation methods

Many environmental or ecosystem goods do not have a market price or the price does not represent the total value, and therefore specific valuation methods have been developed to estimate their monetary value. Two concepts that are used are willingness to pay (WTP) and willingness to accept compensation (WTA), with the former being more commonly used. WTP measures the amount of money a person is willing to pay to obtain the ecosystem good. Hence, it is a measure of the economic benefits from the good. WTA is the amount of money a person is willing to accept to give up ecosystem goods, i.e. it measures the economic losses of forgoing the good.

Values are typically categorized into use values and non-use (or passive use) values. Use values refer to the direct and indirect benefits from the actual use of the ecosystem service, whereas non-use values are not related to the use of the service. For example, people may value the existence of a healthy marine ecosystem although they do not visit the sea. The following present the basics of the most widely used economic valuation methods. Good reviews can be found e.g. in Turner et al. (2010) and Champ et al. (2003).

Stated preference methods

In stated preference methods, people are asked to express their willingness to pay for a change in the state of the environment. This is done using surveys that can be implemented via mail, interviews or the internet. The advantage of these methods is that they are able to capture also values that are not related to the use of the good (so called non-use or passive use values). However, there is controversy on the reliability of the benefit estimates as they are not based on actual behavior. These methods are also resource-intensive.

Most common stated preference methods are contingent valuation (CV) and choice experiment (CE). Contingent valuation can be used measure the benefits of a change in the provision of ecosystem services (see e.g. Hanemann & Carson 2007). It entails describing the current status and the after-change status of the ecosystem. Contingent valuation is widely used, and it is applicable to many ecosystem goods.

Choice experiment, in turn, asks respondents to make choices between goods that are described in terms of their attributes (see e.g. Hensher et al. 2005). Choice experiment provides more information than contingent valuation, as it captures the value of the good as well as its attributes. However, designing the survey and analyzing the data can be more complicated.

Revealed preference methods

Revealed preference methods are well-established, and their greatest advantage is that they are based on observing people's actual behavior in the markets. However, these methods can only be used to estimate use values, and they are less flexible as they have to be based on actual environmental conditions and behavior.

Most widely used revealed preference methods are the travel cost method (TC) and hedonic pricing (HP) (see e.g. Bockstael & McConnell 2007). The travel cost method is used to estimate the value of recreation based on the costs incurred from traveling to recreation sites. The travel costs are considered to represent the recreational value of visiting a particular site. The limitation of the travel cost method is that it is resource-intensive and only applicable to specific sites.

Hedonic pricing is typically applied to housing markets. It can be used to analyze how e.g. air quality, noise, landscape or water quality affect property prices and thus estimate the price people are willing to pay for these environmental characteristics. The method is only applicable to those environmental attributes that affect housing prices and it may be difficult to obtain the appropriate data.

Methods based on existing studies

Benefit transfer (BT) uses an existing valuation study or studies to estimate the value of ecosystem goods in a previously unstudied site (see e.g. Navrud & Ready 2007). The prerequisite is that the sites and the ecosystems goods are similar enough. Recently, the use of benefit transfer has increased due to increasing demand for benefit estimates and limited possibilities to conduct resource-intensive primary studies. Benefit transfer is quick and inexpensive to implement, but empirical studies have found substantial transfer errors in the benefit estimates.

Meta-analysis (MA) takes stock of and summarizes existing studies on a specific ecosystem good, for example, air quality or forest recreation (see e.g. Nelson & Kennedy 2009). Dozens or even hundreds primary valuation studies are analyzed to find which factors affect observed value estimates. Meta-analysis can also be used for benefit transfer. The limitations include the availability of primary studies and the complexities in the statistical modeling.

Methods based on costs and prices

Values are sometimes inferred based on costs or market prices. These methods are typically less resource-intensive to use and data is sometimes more readily available.

Cost-based methods include damage costs avoided and replacements cost methods. They estimate values based on the cost of avoiding damages due to lost ecosystem services, or the cost of replacing services or providing substitute services. These costs are considered to provide useful estimates of the value of ecosystem goods, as the value of the services must be at least the incurred costs. However, they are not considered to produce strict measures of economic values as they are not based on willingness to pay.

Some ecosystem values can be based on data on market prices. These include values for e.g. fish, shellfish and timber. Goods with market prices are relatively simple to value, but the prices may represent only a partial value of the good or the prices may be distorted by subsidies or taxes.

Non-monetary methods

Non-monetary valuation can be used when monetary valuation is not considered appropriate or possible. This entails different kinds of qualitative and quantitative approaches, including the examination of statistics or using techniques such as focus groups, citizen's juries, participatory modeling and multi-criteria analysis. The aim can be on identifying relevant ecosystem services and possible values attached to them, the prioritization of ecosystem services, or assessing the importance of ecosystem benefits by examining their magnitude. It is also possible to study the existence of shared values, focusing on what individuals or groups think the society should pay for ecosystem services.

Annex 2. Background information on Baltic environment and human impacts

The Baltic Sea is a unique sea with little comparison to any other sea in the world. Its uniqueness is mainly the result of a salt concentration that is neither marine nor freshwater; it is an intermediate between the both and hence defined as a brackish sea. However, the salinity follows a gradient with almost freshwater in the northernmost part of the sea close to the Torne river, at the border between Sweden and Finland. In the south-western area, in the coastal waters of Denmark, it is approaching marine conditions. The average salt concentration is approximately 7 per mille which is one-fifth of what is typical for oceans. The lower salinity is the result of 200 rivers flowing into to the Baltic Sea in combination with a low salt water intrusion from the Atlantic (ICES 2003). The Baltic Sea is divided into seven sub-areas. The Belt Sea is situated in the south-western area, the Baltic Proper is the largest area found in the south, Gulf of Riga to the east is encased by Estonia and Latvia and the Gulf of Finland further to the east is surrounded by Estonia, Russia and Finland. The Archipelago Sea, Bothnian Sea and Bothnian Bay stretch out between Sweden and Finland.

As a result of the intermediate salt concentrations the Baltic Sea sustain both marine and freshwater species. As the Baltic Sea in geological terms is a young sea, the time span for more profound evolutionary adaptations is to short. Hence the organisms in the sea proliferate under a certain level of physiological stress that may affect growth and reproduction (Zettler et al 2007). This is also one of the main reasons the Baltic Sea is seen as a vulnerable ecosystem in which human stressors can cause large scale changes. Another reason for making it sensible to stress is that it is a fairly shallow sea with an average depth of 55 m. Given the large catchment area compared to the sea surface there is a limited volume of water that receives an inflow of water from a huge area influenced by human activities.

The catchment area of the Baltic Sea covers 1.7 million km^2 (compared to for example the area of Denmark which is approximately 43 000 km^2). There are almost 90 million people living in this area with around 50 million having a distance of 150 km or less to the sea. The Baltic Sea coast line stretches along nine countries including Russia, Estonia, Latvia, Lithuania, Poland, Germany, Denmark, Sweden and Finland with eight of them being part of the European Union. In addition to the nine littoral countries Ukraine, Belarus, Czech Republic, Slovakia and Norway are also part of the catchment area. The geography of the land area of the Baltic Sea region varies greatly. The northern part is sparsely populated dominated by coniferous forests. In the south human presence is much more pronounced with a dominance of farmland and urban developments. Hence, the largest inputs in terms of nutrients are found in the south.

Eutrophication is a major problem in the Baltic Sea (HELCOM 2009). It is caused by increased levels of nutrients and affects a broad range of ecosystem services. With large nutrient inputs enhanced growth of algae and cyanobacteria may follow. Before the Second World War, the Baltic Sea water was nutrient poor and much clearer. After the war the nutrient inputs to the Baltic Sea increased due to the increase of agricultural and industrial developments and overall population growth. Today large-scale algal blooms are common. The main substances causing the eutrophication of the Baltic Sea are nitrogen and phosphorus (Larsson 1985). Important sources are agriculture and urban dwellings as well as air emissions (Archambault 2004). For example, in the eastern Gulf of Finland poultry plants and animal husbandry are major contributors to eutrophication (Kondratyev and Trumbull 2012). Untreated sewage is still a problem in some areas while some countries have a well-developed sewage treatment.

Hazardous substances are anthropogenic substances that are harmful to the environment and/or to humans. Effluents from rivers and seashores as well as from shipping and air emissions may contain such contaminants. In addition, there are also diffuse sources such as long range transport originating from outside the region. Substances include different metals such as cadmium, mercury, lead and zinc as well as persistent organic pollutants (POP) including PCB and DDT. There are large proportions that have been assimilated in organisms such as invertebrates (Hendozko 2010) and fish (Voigt 2007) as well as sediments (Roots et al 2010); they will persist in the system in decades to come. The input from some substances has decreased but the problem remains. Some substances are still found in high levels and there are new contaminants.

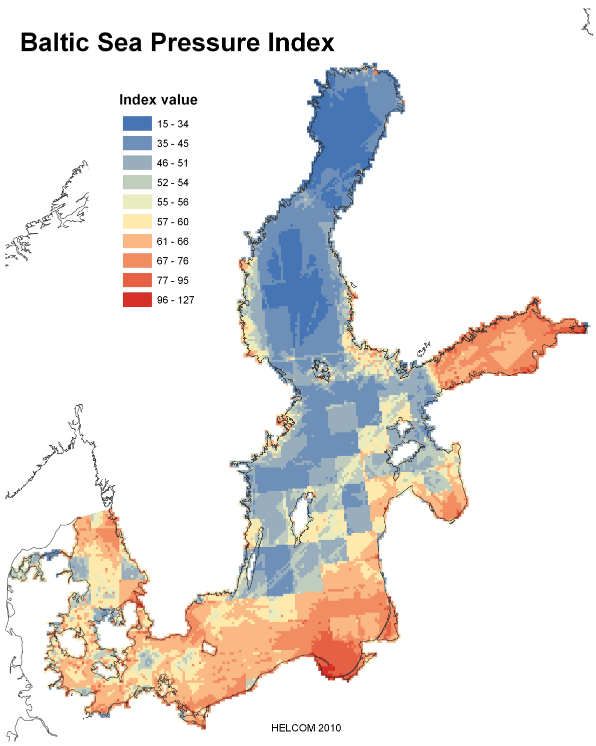


Figure 4. Baltic Sea Pressure Index (BSPI) showing the sum of anthropogenic pressures present in areas of 5 km × 5 km (52 pressure data layers included). (HELCOM, 2010)

A human activity that has a profound effect is fishing given the large number of key species that are removed from the Baltic Sea ecosystem (Österblom et al 2007, Zeller et al 2010). All countries around the Baltic Sea are actively harvesting fishery resources. The complexity that characterizes fishery management is in general poorly understood. The biggest problem to achieve a long-term sustainable fishery in the Baltic Sea is over capacity with an oversized fishing fleet (Eggert and Tveteras 2007). Another problem is the illegal, unregulated and unreported fishing (IUU). Even though fishery is an activity that has such a major effect on the Baltic Sea ecosystem it is also an activity that can be regulated and adequate management schemes can have a fairly quick effect.

Aquaculture is also a provider of fish. It is an activity that has potential for future developments in the Baltic Sea. However, there are also environmental effects to consider such as increased nutrient loads (Saikku and Asmala 2010).

In terms of maritime activities such as shipping the Baltic Sea has a comparable high occupancy of ships; 15% of the world's cargo ships are found in the area (Swedish EPA 2008). Oil spills, emissions of nitrogen oxides and the introduction of alien species from ballast waters are some environmental issues of concern related to shipping. Oil pollution is largely caused by intentional discharges (Hassler 2011). Notably, chronic oil pollution from intended spills can be a bigger problem than smaller single accidents. However, a larger spill could lead to a major catastrophe given the sensitive ecosystem that characterizes the Baltic Sea.

The Baltic Sea is also a provider of energy. The number of offshore windmills are increasing (Lumbreras and Ramos 2013). This may have environmental effects where wind parks are constructed including reef effects (Andersson and Öhman 2010), sound effects (Andersson et al 2007, 2012) and impacts from magnetic fields (Öhman et al 2007).

Climate change is expected to have a major impact on the Baltic Sea. The temperature has increased by 0.7°C during the past century and with the foreseen climate alteration it will continue to increase. In addition precipitation is predicted to intensify. A higher nutrient load is further expected. This will all affect various components of the ecosystem including algal blooms (e.g. Hense et al 2013). Another issue that relates to climate change is ocean acidification. Increased levels of carbon dioxide can change the level of acidity in seas around the world including the Baltic Sea. How it may affect the Baltic Sea is difficult to predict (Havenhand 2012).

Annex 3. Valuation studies of ecosystem services in the Baltic Sea area

This Annex lists the valuation studies mentioned in the summary report by Söderqvist & Hasselström (2008) and describes the recent valuation studies in the Baltic Sea region (see below the table).

Table A1. Valuation studies in Söderqvist & Hasselström (2008)

Issue	Country	Studies
Eutrophication	international	Markowska & Zylicz 1999, Turner et al. 1999
	Denmark	Atkins & Burdon 2006, Atkins et al. 2007
	Estonia	Gren 1996
	Finland	Siitonen et al. 1992, Kiirikki et al. 2003, Kosenius 2004
	Sweden	Frykblom 1998, Hasselström et al. 2006, Soutukorva 2001, Sandström 1996, Söderqvist & Scharin 2000
Fisheries	international	Toivonen et al. 2000
	Denmark	Roth & Jensen 2003
	Estonia	Vetmaa et al. 2003
	Finland	NAO 2007, Olkio 2005, Parkkila 2005, Valkeajärvi & Salo 2000
	Germany	Bundesforschungsanstalt für Fischerei 2007, Döring et al. 2005
	Sweden	Fiskeriverket 2008, Olsson 2004, Paulrud 2004, Soutukorva & Söderqvist 2005
Oil and marine debris	international	Hall 2000, Sanctuary and Fejes 2006
	Denmark	Storstroms amt 2002
	Estonia	Etkin 2000
	Finland	Ahtiainen 2007
	Sweden	Forsman 2003, 2006, 2007
Windmill parks	Denmark	Ladenburg 2007, Ladenburg & Dubgaard 2007, Ladenburg 2008
	Germany	Benkenstein et al. 2003, Scharlau et al. 2004
	Sweden	Ek 2002, Liljestam & Söderqvist 2004
Other/several topics	Denmark	COWI 2007, Visitdenmark 2007
	Estonia	Vetemaa et al. 2003
	Finland	HELCOM and NEFCO 2007, Siitonen et al. 1992
	Lithuania	Lithuania Environmental Financing Strategy 2001. Povilankas et al. 1998. Sceponaviciute et al. 2007
	Russia	Bodrov 2005, EBRD 2003, Kaliningrad Regional Public Fund 2002, Nordstream 2007
	Sweden	Eggert & Olsson 2003, Franzen et al. 2006, Paulsen 2007

Several studies have been carried out under the international research network BalticSTERN (BalticSTERN 2012). The network includes partners from all nine coastal countries, making international studies covering the whole Baltic Sea region possible. BalticSurvey examined the recreational use of and public perceptions towards the Baltic Sea marine environment with a coordinated survey across all coastal countries, collecting 9000 responses (Ahtiainen et al. 2013a, Swedish EPA 2010). The findings revealed that the Baltic Sea is an important recreation site in all surrounding countries. Most respondents had visited the sea at some point and the average number of recreation days spent at the sea ranged from 3 (coastal Russia) to 35 days (Sweden) per year. The survey also brought forward the concern people have about the state of the sea, especially regarding marine litter, damage to flora and fauna, hazardous substances and oil spills. Surveys such as this are useful in investigating the general public's views and also recreation behavior when statistics are not available. Also, international coordination ensures that results are comparable across countries.

Following the survey on recreation and public perceptions in the Baltic Sea countries, a coordinated study was implemented on the monetary benefits of reducing marine eutrophication (Ahtiainen et al. 2012, 2013b). Contingent valuation studies were carried out with identical questionnaires in all nine Baltic Sea countries in 2011. With over 10000 respondents, the study examined public willingness to pay for reduced eutrophication according to the Baltic Sea Action Plan (BSAP) targets from 2007 (HELCOM 2007). The results reveal the monetary benefits of reaching the BSAP targets for eutrophication. The benefit estimates were also compared to the costs of reducing nutrient loads in a subsequent cost-benefit analysis (see e.g. BalticSTERN 2013), making it possible to analyze the economic efficiency of reducing eutrophication. The results also allow for estimating the marginal benefits of reducing nutrient loads, i.e. the benefits per kilogram of reduced nitrogen/phosphorus.

In addition to the above-mentioned Baltic-wide efforts, there are some recent regional studies. Kosenius (2010) estimated the Finns' willingness to pay for improving water quality in the Gulf of Finland using the choice experiment method. The results can be used flexibly to estimate the benefits of different water quality improvements in the Gulf of Finland and perhaps also other parts of the Baltic Sea. The study provided value estimates separately for changes in water clarity, abundance of coarse fish, status of bladder wrack and occurrence of blue-green algal blooms, and estimated the value of various water quality improvement scenarios.

Kulmala et al. (2012) examined the ecosystem services provided by Baltic salmon and also presented estimates of the economic value of provisioning and recreational services of salmon. Based on data from the Finnish Game and Fisheries Research Institute (2009), the economic value of commercial salmon landings in Denmark, Finland, Poland and Sweden was estimated at 0.9-3.6 million euros per year. The value of recreational fishing was based on several studies on anglers' willingness to pay for improved quality of recreational fishing and for preserving wild salmon stock (e.g. Håkansson 2008, Parkkila et al. 2011), ranging from 8 to 19 euros per fishing day. The study utilized the ecosystem service framework, so the results are directly applicable to estimating the value of ecosystem benefits provided by Baltic salmon.

Another study using the ecosystem services framework in the Baltic Sea analyzed the ecosystem benefits from coastal habitats in two areas: the Finnish-Swedish archipelago and Lithuanian coast (Kosenius & Ollikainen 2012). The choice experiment valuation study was implemented in Finland, Sweden and Lithuania in 2011. The state of coastal habitats was described in term of the amount of healthy vegetation, the preservation of currently pristine environments and the size of fish stocks. The results are useful in assessing the value of marine ecosystem benefits provided by habitats and species, recreation, and food and raw materials.

Tegeback & Hasselström (2012) estimated the costs associated with a major oil spill in the Baltic Sea, including the direct (cleaning beaches), market (tourism, fisheries) and nonmarket costs (environmental costs). They conducted three different case studies of potential spills: two close to the Swedish coast and one in the Polish coast. Depending on the location, the costs ranged from approximately 100 to 400 million euros. These cost estimates can help decide the level of preparedness for future oil spills, assess the effects from oil spills on fishing and tourism industries and also to the general public In the Baltic Sea.

Lewis et al. (2013) studied the monetary value of cultural ecosystem services related to Baltic Sea food webs. With a choice experiment conducted in Poland in 2012, they elicited willingness to pay for four ecological features: algal bloom intensity and timing, local species visibility, regional species population and local fisheries catch consistency and profitability. The findings increase the information on the value of cultural ecosystem services provided by the Baltic Sea in Poland. According to Lewis et al. (2013), a similar case study was also conducted in Finland, but the results have not been published yet.

Depellegrin & Blažauskas (2013) used existing studies and value estimates to assess the losses from oil spills in the Lithuanian coast. The total losses were based on the value of recreational services, marine ecosystem services, commercial fisheries and seabirds, amounting to 524 million €/year. The aggregate estimates included the value of both intermediate and final ecosystem services and goods, and therefore double-counting is possible. Also, the study estimated the total economic value of the Lithuanian coastal zone and not marginal values. Therefore, the applicability of the value estimates is questionable. However, the analysis was spatially explicit, which enables evaluating the spatial distribution of values.

Annex 4. Discussions in the Regional Workshop on the Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea

The Regional Workshop on the Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea was organized in Stockholm, Sweden, in 7-8 November 2013. Participants of the workshop included representatives of the scientific community, administration, non-governmental organizations (NGOs) and the private sector.

Group discussions took place on both days of the workshop. Each group was given a role from which the members should view the questions to get a wide perspective on the issues. The roles were: researchers, managers, non-governmental organizations (NGOs), finance/business, politicians and the public. Altogether, about 70 people participated in the discussions in seven groups. The following summary is based on the discussions in the workshop and opinions of individual participants (this does not necessary represent the views of the organizers).

Opening discussion

Only eight of the twenty-four ecosystem services in the Baltic Sea are functioning properly with seven under severe threat. The four main challenges for the Baltic Sea are: eutrophication, fisheries, hazardous substances and maritime activities. These challenges call for substantial management efforts with a cross-sectorial approach. Politicians, businesses, scientists and society must all take part. There is a great need for a common language and understanding of ecosystem services and their value. Already, there is support for an integrated, holistic and ecosystem services based management strategy for the Baltic Sea, and many measures to improve its state has been identified.

The ecosystem services concept is difficult for many to understand. Using economic valuation of ecosystem services is important for the decision makers to get the message across. Designing sectorial policies and management strategies that are compatible with environmental goals and human activities is important. It is necessary to link what is happening on land with what is happening in the sea and to see them as an integrated whole

The HELCOM Baltic Sea Action Plan was the first attempt, at a regional level, to manage the Baltic Sea. HELCOM has recognized the importance of valuing ecosystem services and also agreed to intensify the valuation of marine and coastal ecosystem services in planning and accounting policies. The major task for HELCOM is to promote a healthy marine environment and to bridge the science-political-public interaction.

There are limitations to what governments can do so linking businesses to government is called for, as is international collaboration. Also educating government and businesses is important; media can play an important role here. Supplying politicians with numbers without them knowing the context or the background will not help the Baltic Sea. The planetary boundaries concept can be used as a communication tool together with the ecosystem services concept to describe how the Baltic Sea system functions.

Human wellbeing depends on ecosystem services. Identifying ecosystem services and its users, makes it easier to understand how they are affected and how human beings depend upon them. Valuing ecosystem services has an effect on human wellbeing and is important for improving the policymaking processes. The value of ecosystem services becomes clearer once they have been identified. Calculating the monetary value of ecosystem services can also facilitate visibility, but the monetary valuation is not always possible and may not be appropriate if relevant knowledge is lacking. A lot of the economic valuations tend to be on the provisioning ecosystem services – fish has a market value. The cultural values are difficult to evaluate.

When it comes to the Baltic Sea, further work is needed to identify and describe the ecosystem services found there, including their interactions. It is also important to evaluate how policy changes affect ecosystem services and assess how changes in ecosystem services relate to human wellbeing.

Group discussions

Photo: Mikhail Durkin

Q1: Which are the most important topics/fields where ecosystem services valuation could be applied in the Baltic Sea region?

- work several disciplines, chain from ecosystem services to human well-being
- define links between ecosystem services
- to make the links between ecosystem services, impacts and human behavior easier to understand
- have common indicators for the purpose of assessments and valuation
- forecasting, scenarios and "taking high" form future needs for goods and services
- land-sea connection
- concrete regional case studies
- fisheries, recreation, beauty, water quality, value of summer houses, transport, tourism, agriculture, food
- implementation of EU directives (MSFD, WFD, CFP, CAP)
- marine spatial planning (including MPA´s)
- permitting (conservation vs. exploitation)
- conflict areas given priority
- raising awareness and communicating

Q2: What kind of ecosystem valuation is most useful to decision-makers and policy- support? What kind of policies would benefit from ecosystem services information?

- international studies that help integration of policies
- related to the requirements of directives, e.g. assessing the cost of inaction
- prioritization of measures
- studies that help setting targets for ecosystem services
- valuation of conservation vs. exploitation
- concrete and clear messages, raising awareness
- more sustainable policies
- private/industry focused valuation (businesses, jobs)
- spatial planning (hotspots for ecosystem services)
- introducing new sea activities, e.g. wind power
- integrated policies linking different sectors
- transparent and clear valuation studies
- studies with clear purposes
- practical studies (what is the eelgrass worth, what is the nutrient reduction vs fish farming in open cages worth etc.)

Q3: How can the value of ecosystem services become visible and easy to understand?

- personal and concrete examples
- case studies
- local examples (e.g. algal blooms)

- using human welfare targets/indicators to improve the understanding of the links from ecosystem services to human welfare (e.g. health, jobs, pollution and dioxin in fish)
- bringing forward the idea of several ecosystem services and their interactions
- visualizations and graphical tools, e.g. maps
- target-group specific information (e.g. the public, businesses, politics)
- showing new business chances and opportunities

Q4: How can international experiences and approaches be utilized in the Baltic Sea region?

- international experiences and collaboration important
- identifying knowledge gaps
- synthesis what´s missing between disciplines
- good (and bad) examples that can be learnt from
- co-operation at different levels
- HELCOM can facilitate collaboration
- optimizing financing ex. BONUS

Q5: What are the most crucial challenges in the ecosystem services valuation in the Baltic Sea Region?

- how to turn valuation results into real policies and actions
- call for high-quality valuation studies while also using value transfers/results from other studies
- are the results reliable if value/benefit transfer used
- important to show uncertainties and confidence intervals
- bringing different stakeholders together and using a common language
- developing models for forecasting
- can be more relevant to look at marginal changes than total value

Q6: How can economic valuation of marine and coastal ecosystem services support the further implementation of the current policy targets (e.g. HELCOM Baltic Sea Action Plan and the EU Marine Strategy Framework Directive)?

- better and more correctly describe the full picture of cost and benefits – social, economic and environmental.
- tool for cost-benefit analyses
- justifying new measures and implementing certain targets
- assessing the cost of inaction
- designing better and more coherent policies and incentives
- showing the benefits of obtaining good environmental status
- describing the connection between sea and land
- increasing public awareness and understanding of the directives and their targets
- tool for integrating sectors at the local level
- consulting the public
- transparency important
- basin-specific analysis needed

- developing a common understanding and methodology with neighboring countries

Q7: How could ecosystem services valuation be utilized for implementing the programs of measures in the EU MSFD?

- help to proactively ensure GES with regards to balancing short term gains with long term prosperity
- interdisciplinary studies with social and natural sciences
- spatial prioritization
- evaluation tool (ex post/ex ante)
- work needs to be planned from the ecosystem services perspective from the beginning
- international studies and comparisons between countries
- a challenge is to make it practical

Q8: What is needed to apply such valuation methods for ecosystem services in the management of the Baltic Sea?

- integrating and connecting sciences (e.g. fish and eutrophication)
- sharing the available data
- common terminology and broader communication
- defining the carrying capacity of the ecosystem
- mapping of ecosystem services

Q8: How can ecosystem services be addressed and studied in a useful way for the future governance of the Baltic Sea?

- spatial planning as a concrete framework
- supporting strategies bottom-up
- spatially and temporally specific information
- scenario analysis
- international studies for some issues


Photo: Jorid Hammersland

Panel discussion

The valuation of ecosystem services can serve as a communication tool to help the Baltic Sea countries consider the environment and conservation. The management of the oceans needs to be improved and a cross-sectorial approach involving all stakeholders is necessary.

Integration is necessary and all involved need to speak a common language – understanding the terminology and the very basic functioning of nature. The role of the valuation at the moment is to use it for communication and to create a political will.

Keeping valuation of ecosystem services on the agenda is important. This entails raising awareness of ecosystem services among the public and policy-makers.

The issue of governance must be addressed at both local and global level. Being able to compare results, taking a multidisciplinary approach and using other perspectives than purely the environmental one is important too. Using marketing tools to promote the valuation of ecosystem services is needed, for instance connecting ecosystem services to health and food.

A lot of society's values are measured in monetary terms, but it is not possible to put a monetary value on the intrinsic value of nature. We must deal with both of those values. Because of that there is a need for a common language. Also the participation, understanding and cooperation between different stakeholders - natural scientists, governments and municipalities – is important. That gets into the aspect of communication. Media has a central part but also governments have a large role communicating the ecosystem services. When it comes to valuation, it is also an issue to raise awareness: this is actually worth keeping or restoring for future generations. A lot is being done in different areas and a lot of research is going on. A scientific basis for understanding ecosystem services is necessary.

Technical Annex 5. Summary of presentations in the workshop

See separate document.

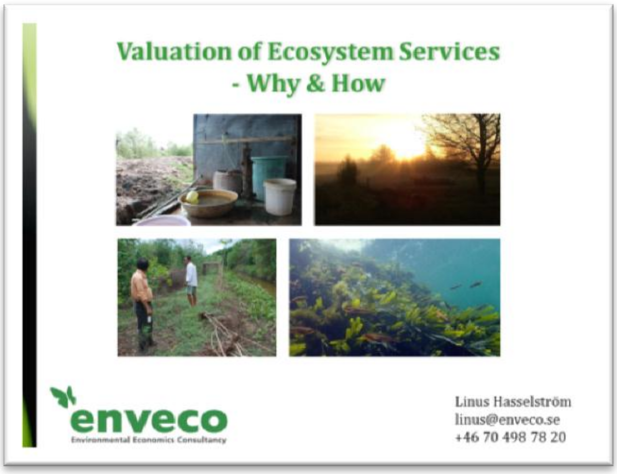
Technical Annex 5. Summary of presentations

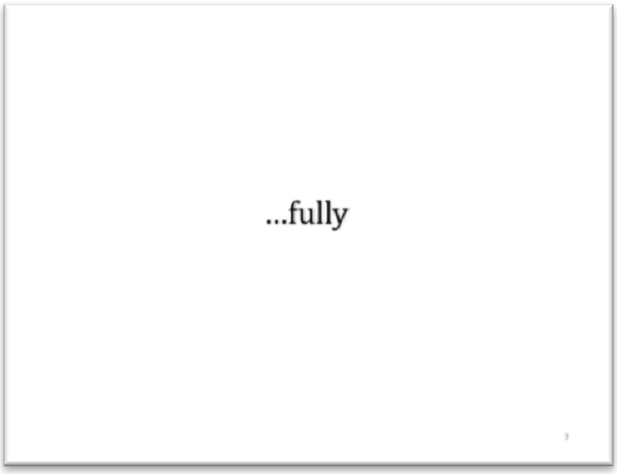
Regional Workshop on the Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea, 7-8 November 2013, Stockholm, Sweden

This Technical Annex contains brief summary of the presentations at the regional workshop as specified in the Final Agenda of the Workshop (Attachment 1). The Final list of participants of the Workshop is presented in Attachment 2.

Linus Hasselström, Enveco Environmental Economics Consulting, Sweden "Valuation of ecosystem services: terminology, methodologies and approaches"

Valuation focuses on changes in human wellbeing and tradeoffs between different goods. Substitutability is assumed but not everything is possible to substitute. Is it right or wrong to value the environment**?** It is necessary to include the environment in economic decision-making. However, it is not possible to estimate the intrinsic value of nature, but only the value to humans. Thus, the tradeoffs that people do or are willing to do are measured. Raising the level of awareness is necessary when setting a goal. People need to understand why they should care. There are different approaches for valuation. Valuation is needed and possible but has to be interpreted carefully. Policymakers need to include also environmental values. Ecological research is the key to valuation, as ecological information forms the basis for valuation studies.





- Substitutability

Starting points

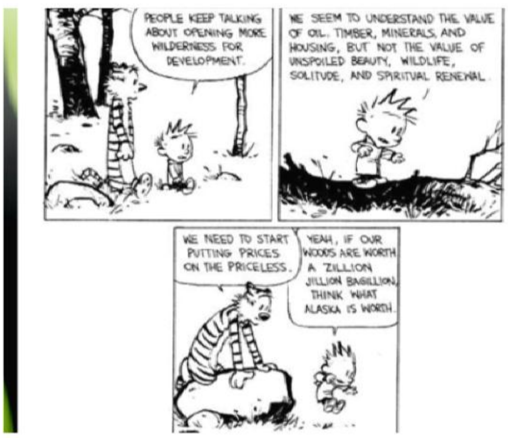
- Substitutability
- focus on human wellbeing
- focus on humans' own opinions on their wellbeing
- Utilitarianism →
  - aggregation of wellbeing over individuals is acceptable
  - focus on consequences, not on actions in themselves.

Why valuation?

1) Env. Ambitiousness — what to aim for?
2) Externalities — how big?
3) Env. Attributes — what to prioritize?
4) Opinion mapping — who wins/loses?
5) National accounts — how adjust for environment?

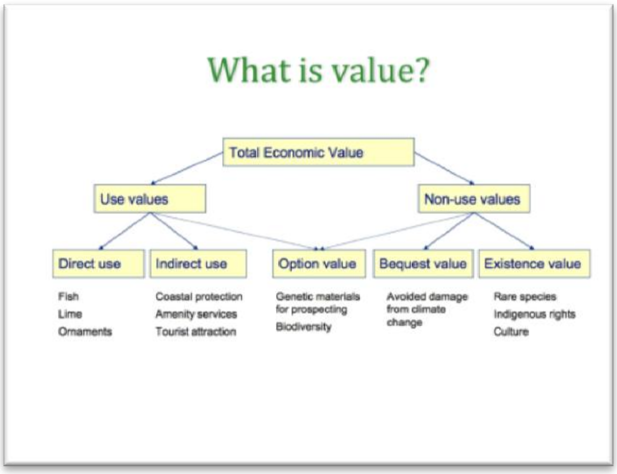
$GDP = C + Inv + G + (eX - i)$

6) **Awareness raising**



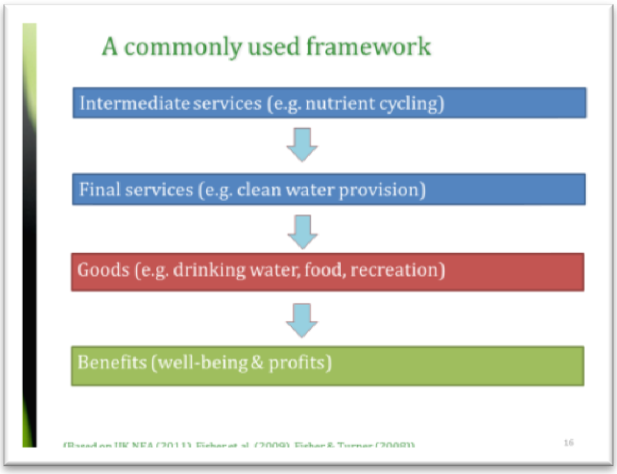
What is value?

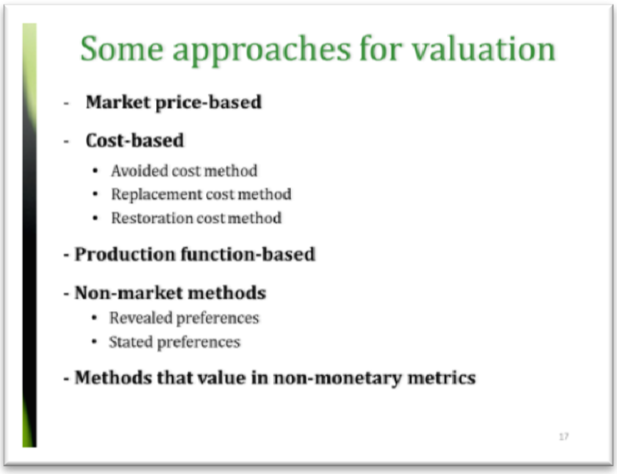
- **Instrumental** values
  - Ecosystem services as a source of human wellbeing
- **Intrinsic** values
  - Values of nature independent of humans

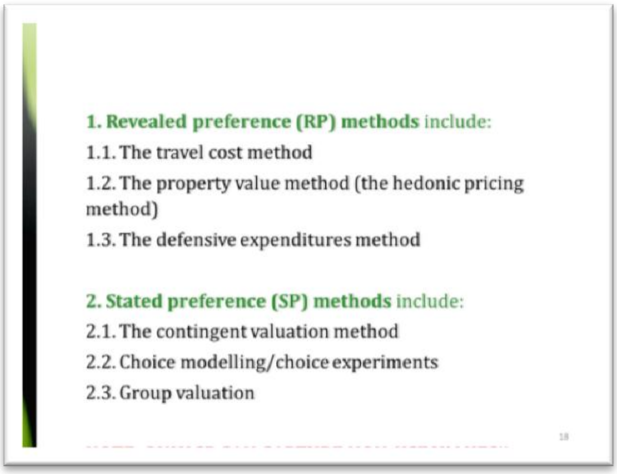

What is value?
Total Economic Value
Use values
Non-use values
Direct use
Indirect use
Option value
Bequest value
Existence value
Fish
Lime
Ornaments
Coastal protection
Amenity services
Tourist attraction
Genetic materials for prospecting
Biodiversity
Avoided damage from climate change
Rare species
Indigenous rights
Culture

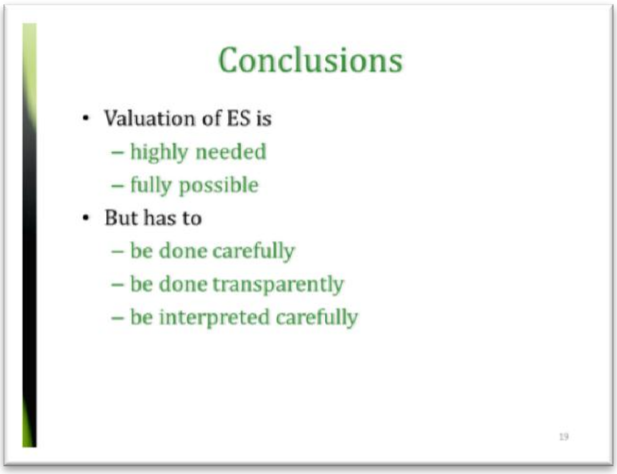

Ecosystem services:
• When humans derive wellbeing through something in nature
– directly (e.g. own experience)
– indirectly (e.g. production)


Typologies for ecosystem services: many suggestions
ECOSYSTEM SERVICES
Supporting
Provisioning
Regulating
Cultural
LIFE ON EARTH – BIODIVERSITY
– diversity in species, genes, interactions, etc.
Millennium Ecosystem Assessment
www.maweb.org
The Economics of Ecosystems and Biodiversity
www.teebweb.org
ECOSYSTEMS & HUMAN WELL-BEING


A commonly used framework
Intermediate services (e.g. nutrient cycling)
Final services (e.g. clean water provision)
Goods (e.g. drinking water, food, recreation)
Benefits (well-being & profits)


Some approaches for valuation
- Market price-based
- Cost-based
• Avoided cost method
• Replacement cost method
• Restoration cost method
- Production function-based
- Non-market methods
• Revealed preferences
• Stated preferences
- Methods that value in non-monetary metrics
17

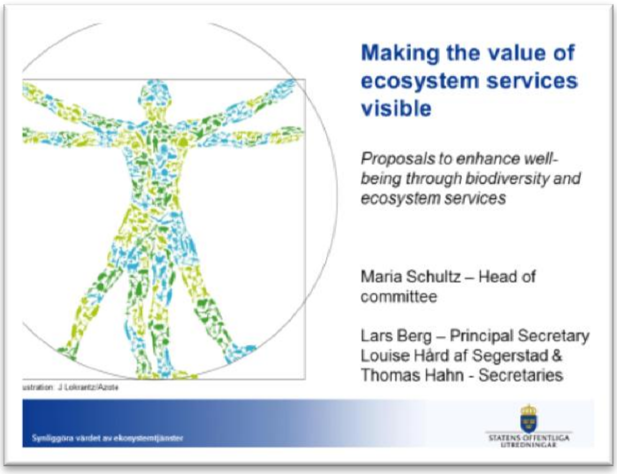

1. Revealed preference (RP) methods include:
1.1. The travel cost method
1.2. The property value method (the hedonic pricing method)
1.3. The defensive expenditures method
2. Stated preference (SP) methods include:
2.1. The contingent valuation method
2.2. Choice modelling/choice experiments
2.3. Group valuation
18

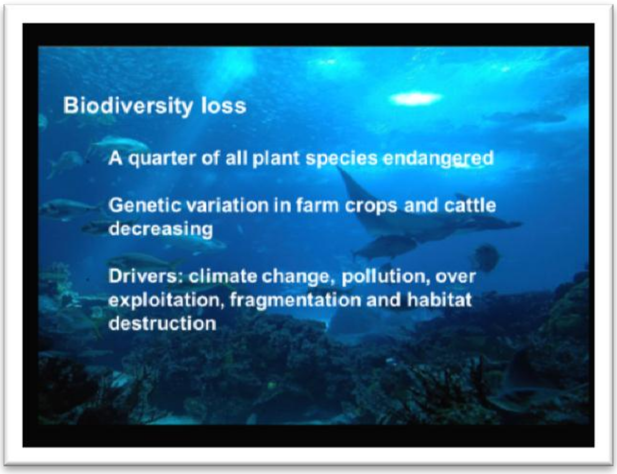

Conclusions
• Valuation of ES is
– highly needed
– fully possible
• But has to
– be done carefully
– be done transparently
– be interpreted carefully
19

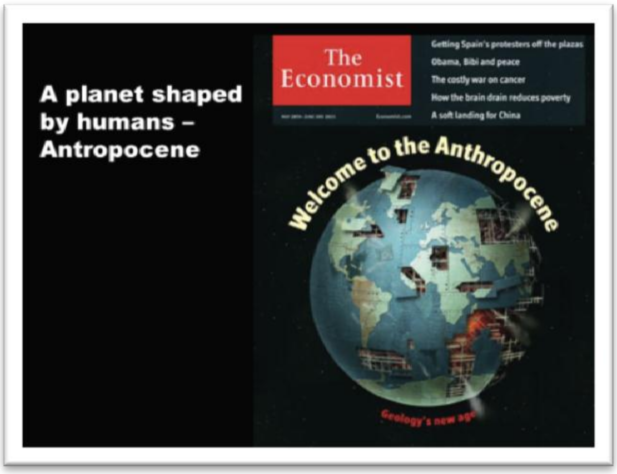

Thank you!
Find us online: enveco.se
enveco
Environmental Economics Consultancy
Linus Hasselström
linus@enveco.se
+46 70 498 78 20

Maria Schultz, Stockholm Resilience Centre, Stockholm University, Sweden
"Making the value of ecosystem services visible"

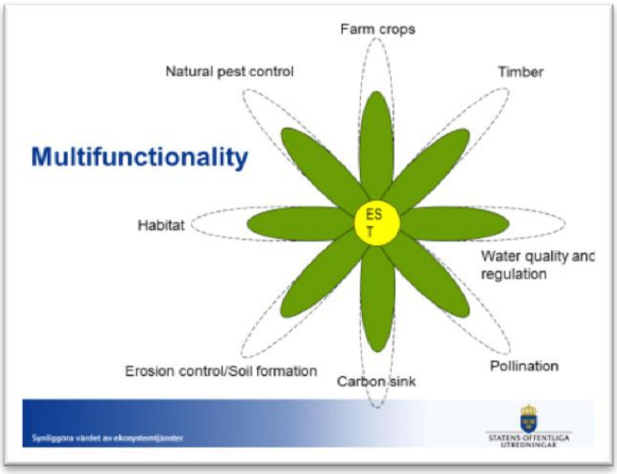
The Vitruvian man describes humans' relationship with nature and the union of art and science. It shows that biodiversity is important as insurance for our home – this planet. A Swedish government inquiry that suggests methods and measures to better evaluate ecosystem services and improves the knowledge base of the societal value of ecosystem services has recently been presented. The inquiry proposes ways to increase the level of importance of biodiversity and seeks to clarify the values of ecosystem services so that they become well-known and thus can be integrated in economic and other decisions in the community where this is relevant and reasonable. There is degradation of ecosystems all over. The loss of biodiversity affects people's possibilities to create innovative solutions. By conducting interviews with municipalities, private sectors, politicians and civil society it is possible to identify the obstacles and opportunities for integrating ecosystem services in decision-making. There is a need for interdisciplinary collaboration between researchers, and also between researchers and municipalities. It is not always necessary to value the ecosystem services - just talking about them makes them visible and that is important too.






A planet shaped by humans – Antropocene
The Economist
Getting Spain's protesters off the plazas
Obama, Bibi and peace
The costly war on cancer
How the brain drain reduces poverty
A soft landing for China
Welcome to the Anthropocene
Geology's new age


Innovative solutions
Synliggöra värdet av ekosystemtjänster
STATENS OFFENTLIGA UTREDNINGAR


Multifunctionality
Farm crops
Natural pest control
Timber
Habitat
EST
Water quality and regulation
Erosion control/Soil formation
Carbon sink
Pollination
Synliggöra värdet av ekosystemtjänster
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Goals for ecosystem services
• Nagoya plan 2010 + EU strategy on biodiversity 2011-2020
• The Swedish Parliament's Generational Goal 2010
• Milestone targets and clarifications in the environmental objectives system 2012
• Directive:
- Integration in decision making
- Better knowledge base
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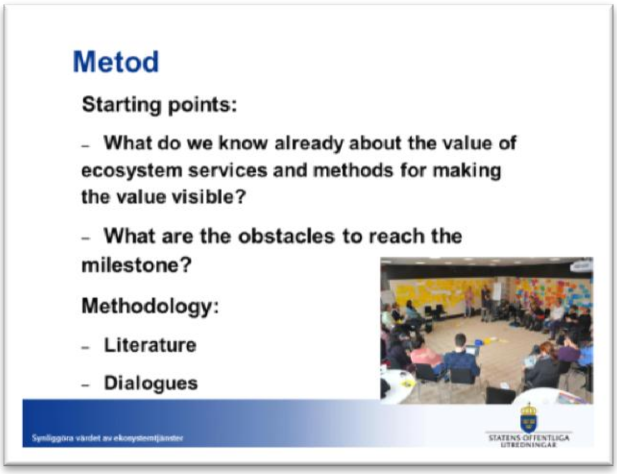
Metod
Starting points:
– What do we know already about the value of ecosystem services and methods for making the value visible?
– What are the obstacles to reach the milestone?
Methodology:
– Literature
– Dialogues
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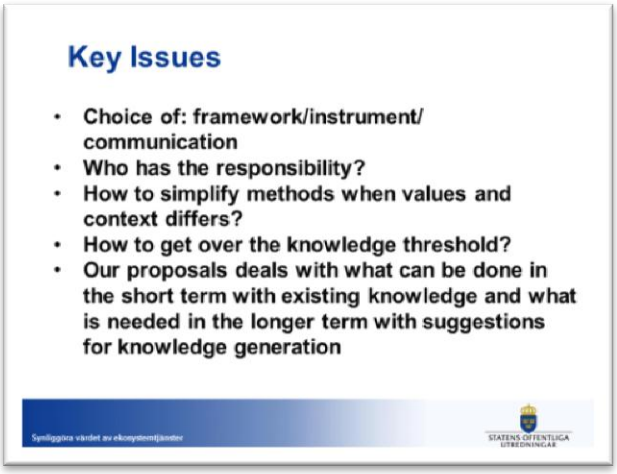
Key Issues
• Choice of: framework/instrument/ communication
• Who has the responsibility?
• How to simplify methods when values and context differs?
• How to get over the knowledge threshold?
• Our proposals deals with what can be done in the short term with existing knowledge and what is needed in the longer term with suggestions for knowledge generation
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Ecosystem services - Assessment
General strategy, ecosystem services integrated in planning, with actors:
- Problem scoping
- Identification
- Mapping
- Valuation/prioritisation
- Decision/Policy option
Framing of key policy issues
Identify ecosystem services and users
Mapping and assessing status
Valuation
Assess policy options including distributional impacts
Learning and feedback
Ecosystem Services Assessment
Actors participation
Scale
Time
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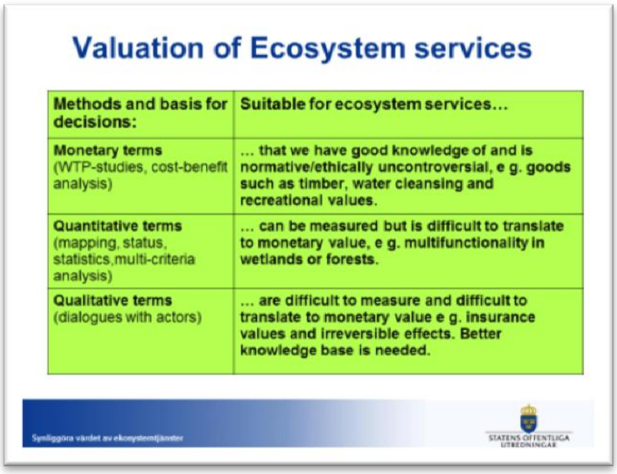
Valuation of Ecosystem services
Methods and basis for decisions:
Suitable for ecosystem services…
Monetary terms (WTP-studies, cost-benefit analysis)
… that we have good knowledge of and is normative/ethically uncontroversial, e g. goods such as timber, water cleansing and recreational values.
Quantitative terms (mapping, status, statistics,multi-criteria analysis)
… can be measured but is difficult to translate to monetary value, e g. multifunctionality in wetlands or forests.
Qualitative terms (dialogues with actors)
… are difficult to measure and difficult to translate to monetary value e g. insurance values and irreversible effects. Better knowledge base is needed.
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WTP-study

BalticSTERN show that inhabitants around the Baltic Sea are willing to pay approx. 35 billion sek per annum for a healthier sea - ready to pay more to decrease eutrophication than the proposed actions would cost

Havs- och vattenmyndigheten 2013.

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Three categories of proposed action

Integration in decision making
- Economic instruments/incentives
- Review of regulatory frameworks land/water
- Committee for development and innovation

Better knowledge base
- Ecosystem service assessments
- Guidelines
- Statistics/Indicators

Learning processes
- Reserach
- Funding at municipality level
- Evaluation after 2018

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Indicators

- Sustainability indicators should be reported along with data on economic development
- Official statistics that measure ecosystems and society's capacity to generate ecosystem services need to be developed

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Planning of land and water use

- Ecosystem Service Assessments in agencies practice
- Integration in sectors regulations
- Guidance to local authorities on land and water planning
- Guide to the County Administrative Boards in their work/guidance towards municipalities
- LONA support for ecosystem service assessments

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Economic instruments

- Review of taxes, fees and reduce harmful subsidies
- Review of the agricultural environmental support
- Inquiery to analyse ecological compensation in the everyday landscape

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Capacity building and innovation

- Committee for ecosystem services
- Information portal
- Support for innovations and business development
- Investigate bond investments impact on ecosystem services
- Tools for green procurement

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Pollination – ecosystem service
BeeUrban/Biman – innovation bees for rent

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Research

- Strategy for Research on
  - Ecological context and how humans shape these
  - Effects of economic instruments
  - Valuation of Ecosystem Services
  - Learning processes in management

Incl. analysis of participation by scientists in planning and evaluation of management.

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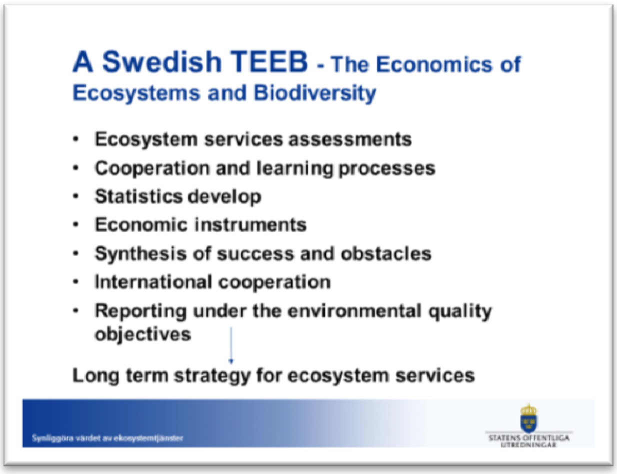
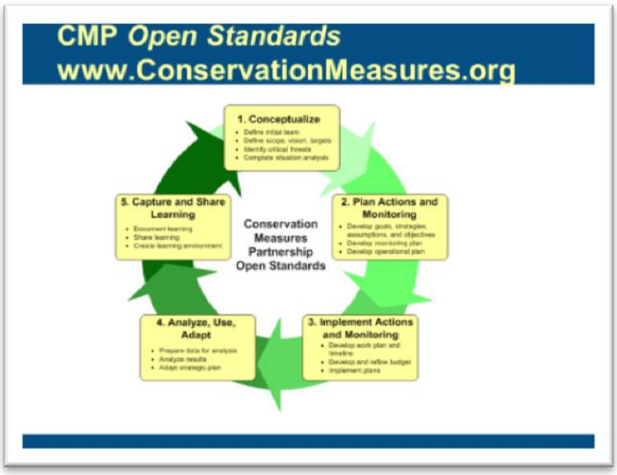
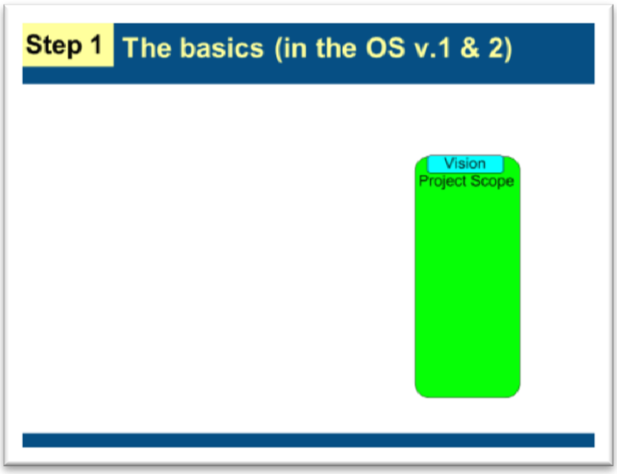
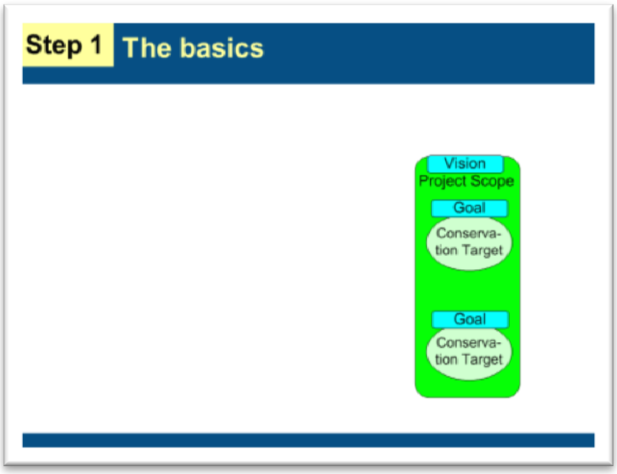


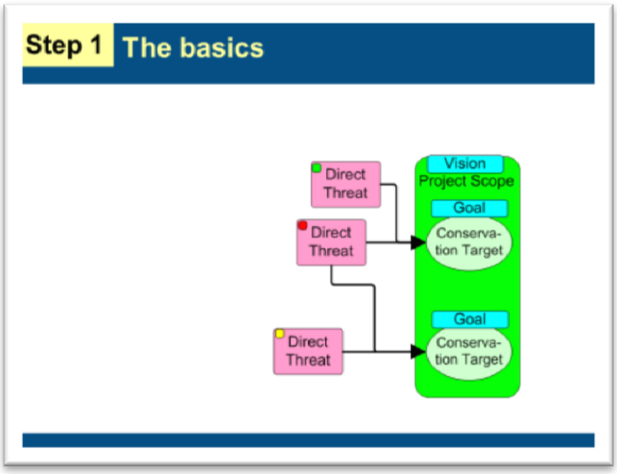
Ilke Tilders, FOS Europe, the Netherlands
"Human Welfare Targets"

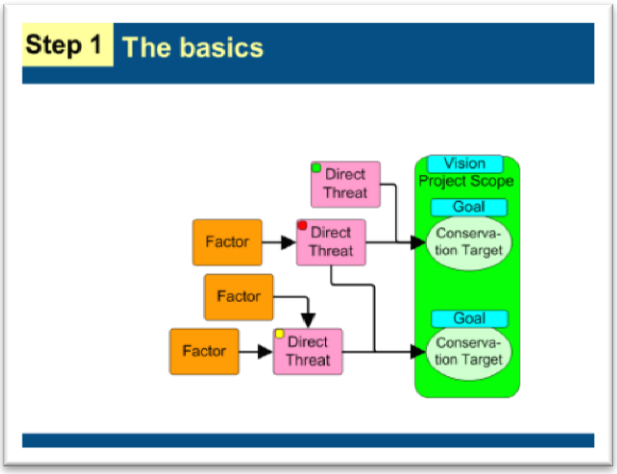
FOS Europe supports conservation through different methods. Roots of the Conservation Measure Partnership (CMP) lie in the conservation community. Traditionally, CMP open standards showed diagrams to visualize what biodiversity looks like. Threats were identified and analyzed, trying to find the indicators. The problem with this method was that is did not invite or empower non-conservation oriented stakeholders to participate in the debate, causing growing discontent with this methodology. It is important to include human wellbeing in integrated management. The method eroded, leading the CMP to start a task force to develop new methods for linking conservation and development of human well-being. It turned out to be ecosystem services. The CMP uses the MA definition and its categories.

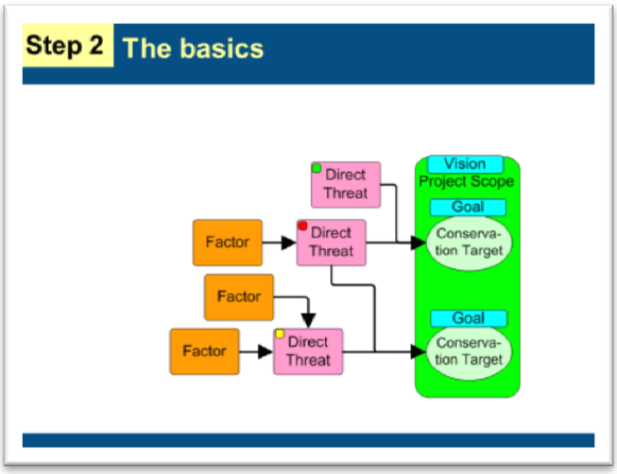


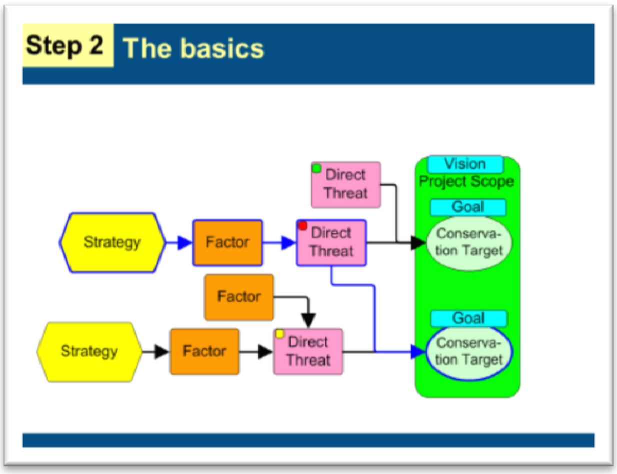

Step 1
The basics (in the OS v.1 & 2)
Vision
Project Scope

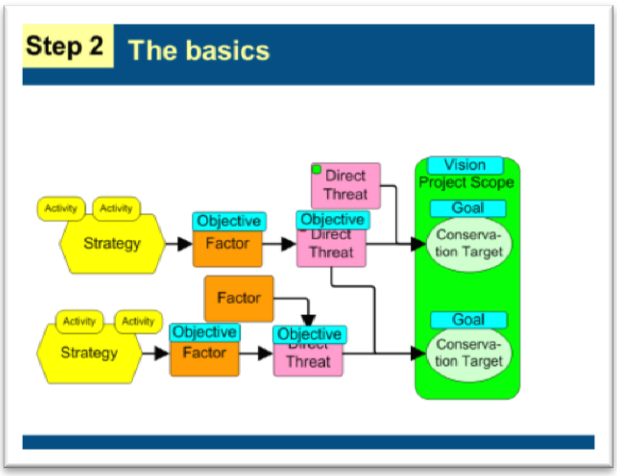

Step 1
The basics
Vision
Project Scope
Goal
Conserva-tion Target
Goal
Conserva-tion Target

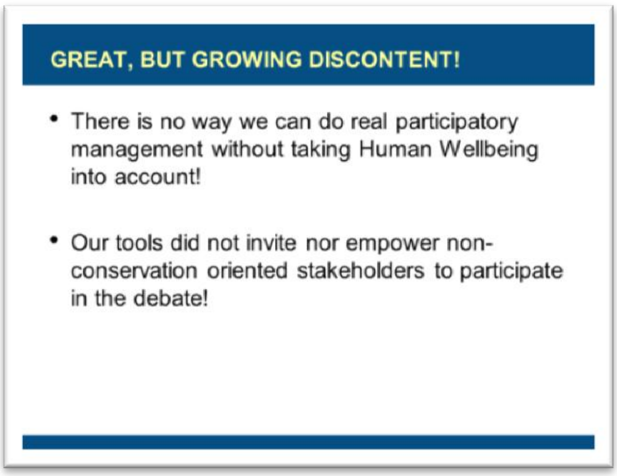

Step 1
The basics
Direct Threat
Direct Threat
Direct Threat
Vision
Project Scope
Goal
Conserva-tion Target
Goal
Conserva-tion Target


Step 1
The basics
Factor
Factor
Factor
Direct Threat
Direct Threat
Direct Threat
Vision
Project Scope
Goal
Conserva-tion Target
Goal
Conserva-tion Target


Step 2
The basics
Factor
Factor
Factor
Direct Threat
Direct Threat
Direct Threat
Vision
Project Scope
Goal
Conserva-tion Target
Goal
Conserva-tion Target


Step 2
The basics
Strategy
Strategy
Factor
Factor
Factor
Direct Threat
Direct Threat
Direct Threat
Vision
Project Scope
Goal
Conserva-tion Target
Goal
Conserva-tion Target


Step 2
The basics
Activity
Activity
Strategy
Activity
Activity
Strategy
Objective
Factor
Factor
Objective
Factor
Objective
Direct Threat
Objective
Threat
Direct Threat
Vision
Project Scope
Goal
Conserva-tion Target
Goal
Conserva-tion Target


GREAT, BUT GROWING DISCONTENT!
• There is no way we can do real participatory management without taking Human Wellbeing into account!
• Our tools did not invite nor empower non-conservation oriented stakeholders to participate in the debate!

So people started to experiment

- A mess…inconsitencies…erosion of method, language, concepts…
- Time for action: cmp working group

Version 3.0 Define ecosystem services & human wellbeing targets

To clarify links between conservation & human wellbeing targets via ecosystem services

Definition Human Wellbeing within OS

Human wellbeing target <u>definition:</u> In the context of a conservation project, human wellbeing targets focus on those aspects of human wellbeing* affected by the status of conservation targets.

**Millennium Ecosystem Assessment defines human wellbeing as including: 1) necessary material for a good life, 2) health, 3) good social relations, 4) security, and 5) freedom and choice*

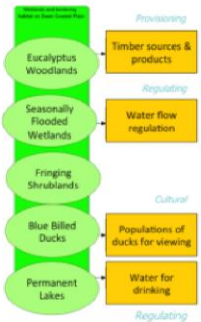
Definition Ecosystem Service

Ecosystem services <u>definition</u>: the services that functioning ecosystems, species, and habitats provide and that can benefit people.

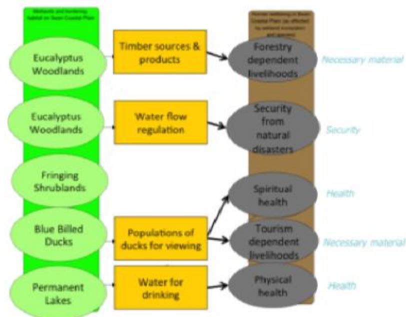
**Millennium Ecosystem Assessment offers various categories: 1) provisioning, 2) regulating, 3) supporting , and 5) cultural*

Identify Ecosystem Services

Our Example : Swan Coastal Plain Wetlands



3. Identify Human Wellbeing Targets

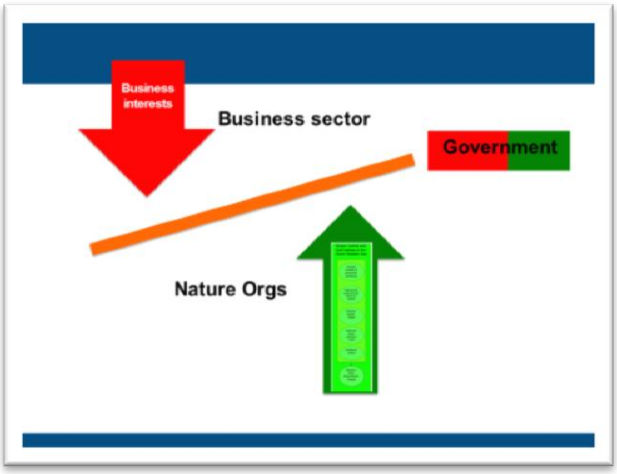


Most complex: Defining social scope

- Whose wellbeing are we actually discussing and why?
- Thematic / Geographic
- What about future generations?

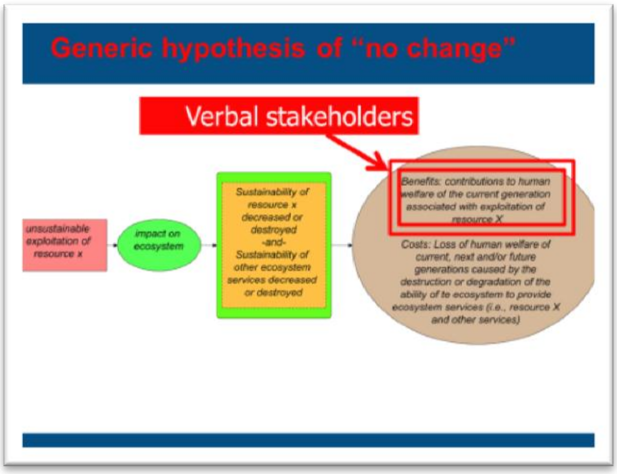

The Wadden Sea
• UNESCO "…largest unbroken system of tidal sand and mud flats worldwide …"

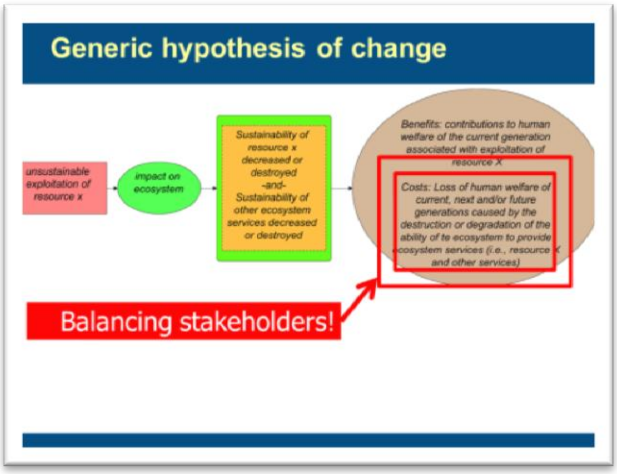

20 Direct Threats
tidal habitats in the Dutch Wadden Sea


Business interests
Business sector
Government
Nature Orgs

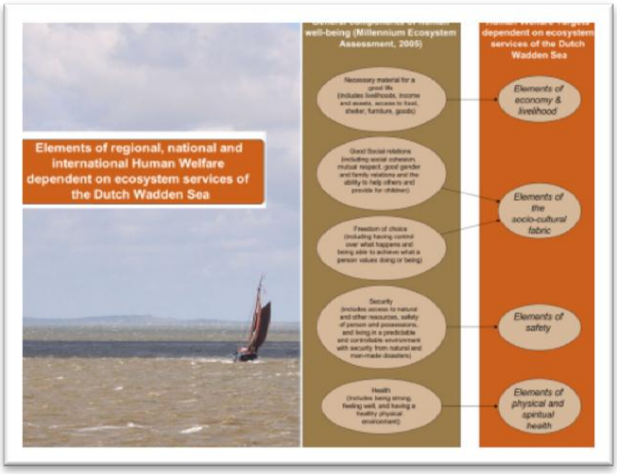

Court ruling inline with trends ….
• From legal instruments….to…..collaboration
• From centralized …..to…..decentralized
• From "post-hoc integrated" ……to…..fully integrated
• From "biodiversity oriented" …..to ecosystem functions

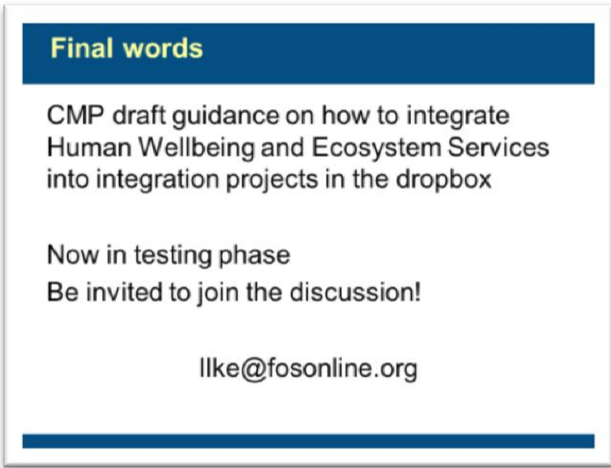

COURT RULING:
FORM A COALITION AND ENSURE:
A rich WaddenSea
Nature & Use
Now & Future


Generic hypothesis of "no change"
Verbal stakeholders
unsustainable exploitation of resource x
impact on ecosystem
Sustainability of resource x decreased or destroyed -and- Sustainability of other ecosystem services decreased or destroyed
Benefits: contributions to human welfare of the current generation associated with exploitation of resource X
Costs: Loss of human welfare of current, next and/or future generations caused by the destruction or degradation of the ability of te ecosystem to provide ecosystem services (i.e., resource X and other services)


Generic hypothesis of change
unsustainable exploitation of resource x
impact on ecosystem
Sustainability of resource x decreased or destroyed -and- Sustainability of other ecosystem services decreased or destroyed
Benefits: contributions to human welfare of the current generation associated with exploitation of resource X
Costs: Loss of human welfare of current, next and/or future generations caused by the destruction or degradation of the ability of te ecosystem to provide ecosystem services (i.e., resource X and other services)
Balancing stakeholders!


Ecosystem services (benefits to humans) provided by the Dutch Wadden Sea
Cultural & information services
Carrier services
Regulating and supporting services
provisioning services





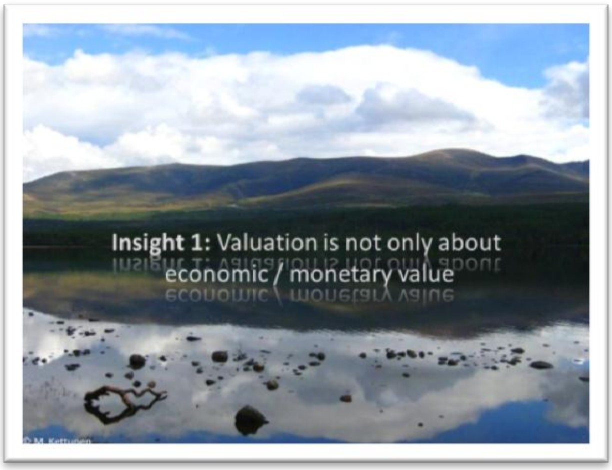
Marianne Kettunen, TEEB Nordic, IEEP, Finland.

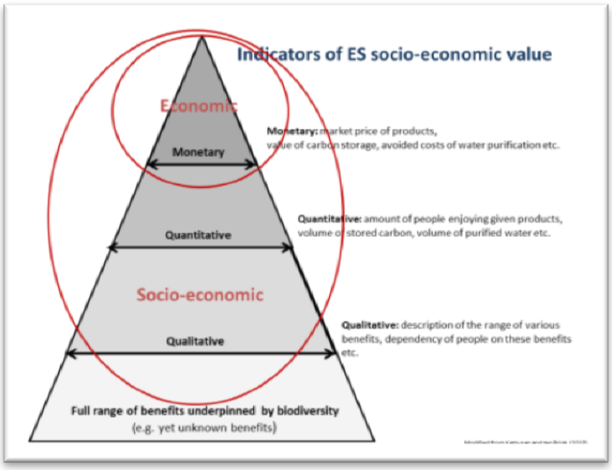
"Global perspectives on valuation of coastal and marine ecosystem services – key insights from TEEB Nordic"

TEEB started in 2007 to give an economic voice to ecosystem services and their value at the global level. The first report was published in 2008. Since then a number of local initiatives have been conducted, and TEEB Nordic was published in 2012. Key insights from TEEB Nordic are: (1) The socioeconomic values of ecosystem services are needed to capture a broader set of values related to ecosystem services and nature. Valuation is broader than just economic valuation based on market prices. The value of fish and fishing in Nordic countries can be expressed in number of fishermen and the value of commercial fisheries. In addition to this, there is a great importance of recreational fishermen in Baltic Sea, and the monetary value of recreational fishing has been evaluated In Sweden. Another case is that of the Baltic Sea salmon. Its commercial value is 0.9-3.6 million €/year, but the recreational value is 1.4 million €. The Baltic Sea recreation survey 2010 showed that there is definitely a broader value than just the market value: One third of the people are willing to pay for an improved Baltic Sea environment. (2) Have a clear purpose! (3) Understand the "why". Understanding the values of ecosystem services even without market-based values is the basis for a green economy.


Institute for European Environmental Policy
Perspectives on the valuation of coastal and marine ecosystem services
inc. key insights from TEEB Nordic
Marianne Kettunen
Institute for European Environmental Policy (IEEP) / Guest Researcher Fin Env Inst (SYKE)
7 – 8 Nov 2013
Regional Workshop Valuation of marine and coastal ecosystem services in the Baltic Sea
Stockholm, Sweden
www.ieep.eu
@IEEP_eu

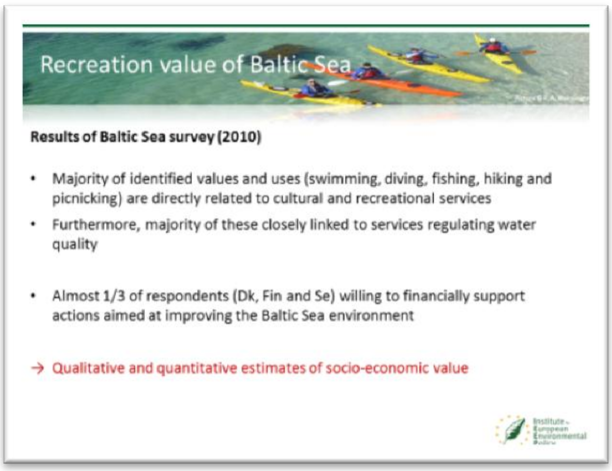

TEEB and TEEB Nordic – the context
Kick-off 2007 / 2008 - Global Assessment 2010 - Country studies 2011 onwards - inc. TEEB Nordic 2012
RIO+20
XI Conference of Parties
HYDERABAD INDIA 2012


Insight 1: Valuation is not only about economic / monetary value


Indicators of ES socio-economic value
Economic
Monetary
Quantitative
Socio-economic
Qualitative
Full range of benefits underpinned by biodiversity
(e.g. yet unknown benefits)
Monetary: market price of products, value of carbon storage, avoided costs of water purification etc.
Quantitative: amount of people enjoying given products, volume of stored carbon, volume of purified water etc.
Qualitative: description of the range of various benefits, dependency of people on these benefits etc.

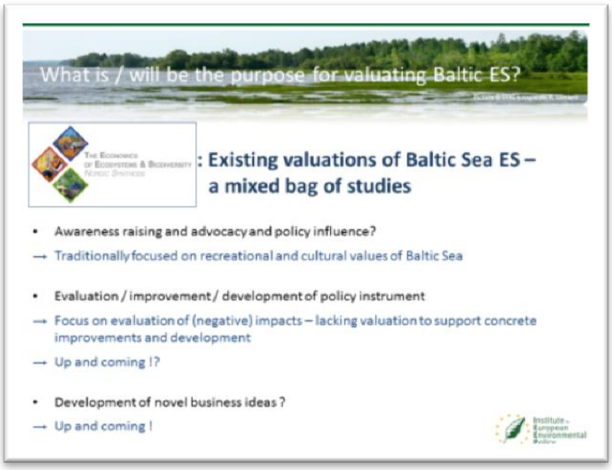

Value of fish(ing) in the Nordic countries
Commercial fishing (marine)
Economic
Number of professional fishermen: 1,600 (Se), 2,088 (Dk), 2,195 (Fin) and 12,280 (No)
Market value of commercial fisheries: EUR 27 mil. (Fin), EUR 110 mil. (Se), EUR 460 mil. (Dk) and EUR 2 bil. (No) / year
Recreational fishing
Socio-economic
Estimated over 6 mil. recreational fishermen in the Nordic countries (European Anglers Alliance
30 - 50% of population / country / year engages with fishing (Fin, Se, No)
Estimated economic value of recreational fishing in Sweden around EUR 80 mil (Garpe 2008)


Value of fish(ing) in the Nordic countries
The case of Baltic Sea salmon
Commercial
Economic
Value (NPV) of commercial landings EUR 0.9 - 3.6 mil. / year (Dk, Fin, Pl and Se in 2009-2015)
Recreational / cultural
Socio-economic
Fin state budget allocated nearly EUR 1.4 mil. for annual stockings (2000-2004) and over EUR 9 mil. were spent for habitat restoration (1997-2005)
In addition, Baltic salmon plays an important role in
– reducing sedimentation
– regulating food webs and maintaining the general ecological balance of ecosystems
→ No monetary / quantitative estimates of value exist

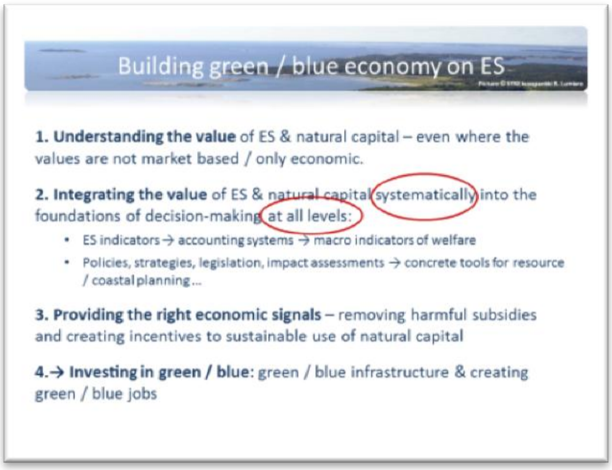

Recreation value of Baltic Sea
Results of Baltic Sea survey (2010)
Majority of identified values and uses (swimming, diving, fishing, hiking and picnicking) are directly related to cultural and recreational services
Furthermore, majority of these closely linked to services regulating water quality
Almost 1/3 of respondents (Dk, Fin and Se) willing to financially support actions aimed at improving the Baltic Sea environment
→ Qualitative and quantitative estimates of socio-economic value

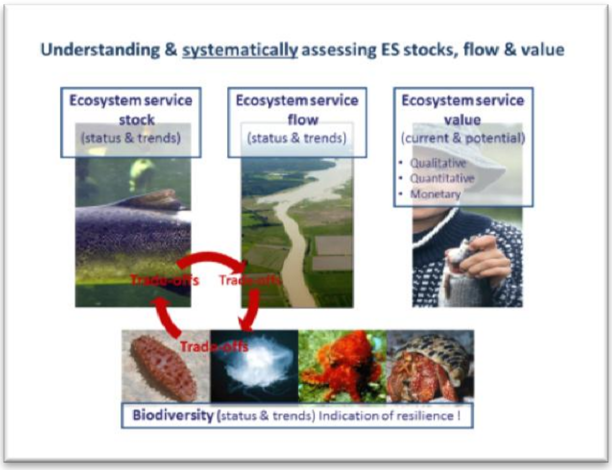

Insight 2: (Economic) valuation should be carried out with a clear purpose

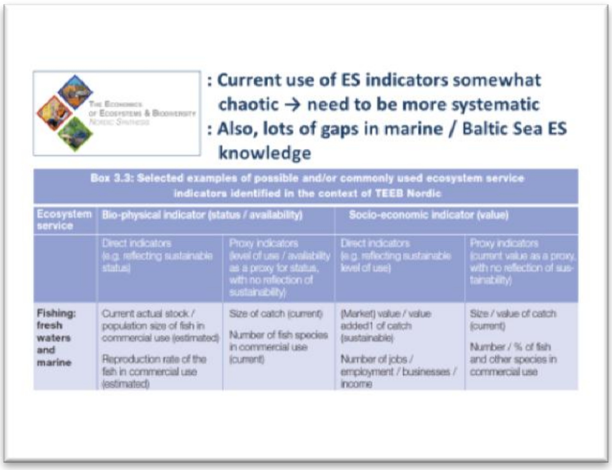

What is / will be the purpose for valuating Baltic ES?
• Awareness raising ?
• Advocacy and policy influence?
→ Qualitative and quantitative info can suffice
→ Broad (but robust) monetary valuations, to indicate scale
• Evaluation / improvement of existing policy instrument (fishing quotas, ag env payments)?
• Development of new policy instruments (Payment for Ecosystem Services - PES)
→ Quantitative and monetary information
→ Cost-benefit considerations
• Development of novel business ideas ?
→ Market-based valuations


What is / will be the purpose for valuating Baltic ES?
: Existing valuations of Baltic Sea ES – a mixed bag of studies
• Awareness raising and advocacy and policy influence?
→ Traditionally focused on recreational and cultural values of Baltic Sea
• Evaluation / improvement / development of policy instrument
→ Focus on evaluation of (negative) impacts – lacking valuation to support concrete improvements and development
→ Up and coming !?
• Development of novel business ideas ?
→ Up and coming !

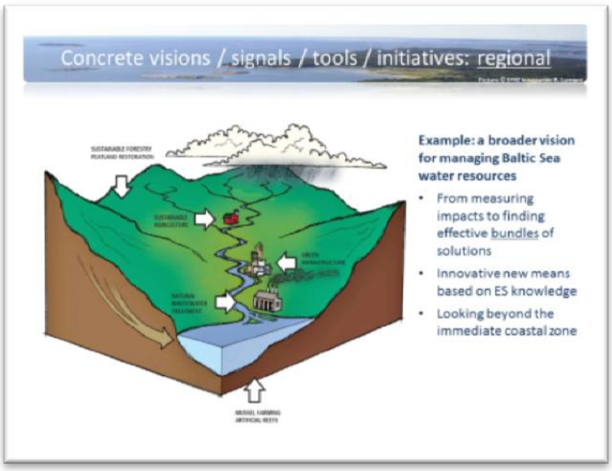

Insight 3: ES based 'green / blue' economy

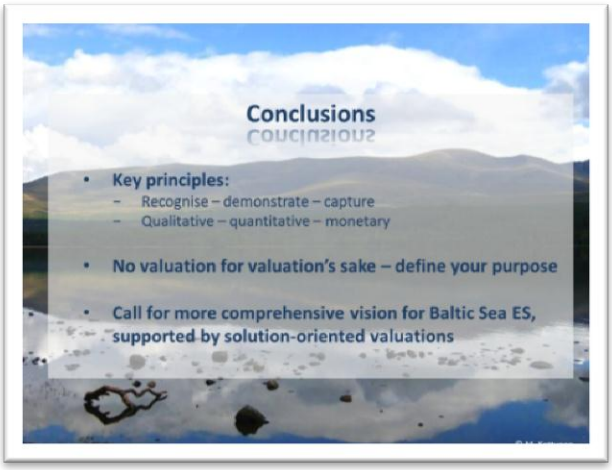

Building green / blue economy on ES
1. Understanding the value of ES & natural capital – even where the values are not market based / only economic.
2. Integrating the value of ES & natural capital systematically into the foundations of decision-making at all levels:
• ES indicators → accounting systems → macro indicators of welfare
• Policies, strategies, legislation, impact assessments → concrete tools for resource / coastal planning…
3. Providing the right economic signals – removing harmful subsidies and creating incentives to sustainable use of natural capital
4.→ Investing in green / blue: green / blue infrastructure & creating green / blue jobs


Understanding & systematically assessing ES stocks, flow & value
Ecosystem service stock (status & trends)
Ecosystem service flow (status & trends)
Ecosystem service value (current & potential)
• Qualitative
• Quantitative
• Monetary
Trade-offs
Trade-offs
Trade-offs
Biodiversity (status & trends) Indication of resilience !


: Current use of ES indicators somewhat chaotic → need to be more systematic
: Also, lots of gaps in marine / Baltic Sea ES knowledge
Box 3.3: Selected examples of possible and/or commonly used ecosystem service indicators identified in the context of TEEB Nordic
Ecosystem service
Bio-physical indicator (status / availability)
Socio-economic indicator (value)
Direct indicators (e.g. reflecting sustainable status)
Proxy indicators (level of use / availability as a proxy for status, with no reflection of sustainability)
Direct indicators (e.g. reflecting sustainable level of use)
Proxy indicators (current value as a proxy, with no reflection of sustainability)
Fishing: fresh waters and marine
Current actual stock / population size of fish in commercial use (estimated)
Reproduction rate of the fish in commercial use (estimated)
Size of catch (current)
Number of fish species in commercial use (current)
(Market) value / value added1 of catch (sustainable)
Number of jobs / employment / businesses / income
Size / value of catch (current)
Number / % of fish and other species in commercial use


Concrete visions / signals / tools / initiatives: national
Beyond GDP
European Environment Agency
UNEP
OECD
ES Stock – Flow – Value
Biodiversity
Natural Capital Accounting (NCA):
Ecosystem accounts (EA) & System of Integrated Environmental and Economic Accounting (SEEA)
A bundle of greener macroeconomic & societal indicators

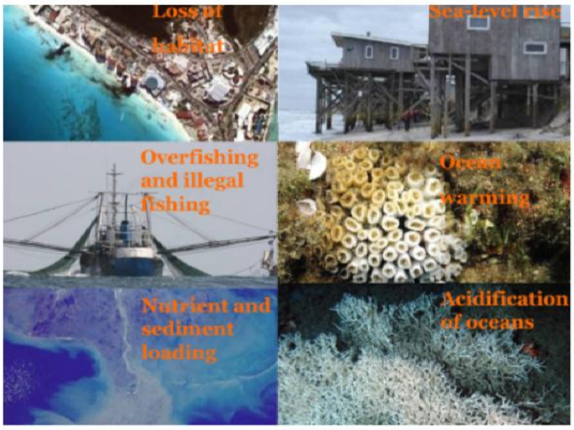

Concrete visions / signals / tools / initiatives: regional
Example: a broader vision for managing Baltic Sea water resources
• From measuring impacts to finding effective bundles of solutions
• Innovative new means based on ES knowledge
• Looking beyond the immediate coastal zone



Alberto Pacheco Capella, UNEP Regional Seas Programme, UNEP HQ, Kenya
"UNEP Regional Seas; examples from other areas"

Economic valuation is a tool and it is meaningful only if it has a purpose that is clearly understood before valuation. There are 18 regional seas, and cooperation between the different regions shows that many have the same kind of problems. However, there is great fragmentation of our seas and very poor governance, if any. Multiple challenges require integrated solutions at the national level. There are so many challenges – climate change and mineral mining to name just two. The problem is that a sectorial approach is still being used, but each sector influences the ecosystem services in the other sectors as well. Case: Mediterranean "Plan Bleu": It is estimated that the Mediterranean provides ecosystem services worth 26 billion € per year. The European countries that benefit the most from the Mediterranean are also the countries that have the largest impact on the sea. This is an important message to the policy makers: they need to protect the environment as there is a cost associated with the pollution going into the sea. There should not be a discussion between development and conservation because one will influence the other according to a study by Barbier et al. (2008). The benefits derived from ecosystem services are nonlinear. It is possible to find an optimal value between conservation and development. It is very difficult for policy makers to know what to do with just numbers. Data is very limited and is biased towards market goods and services. It is the actual provisioning of the ecosystem services and the marginal values that need to be looked at. Economic valuation can be used to support decision making processes as tools of policy advice. A movement from a sectorial approach to a more ecosystem services based approach is needed, becoming cross-sectorial. For example, in Colombia 187 valuations have been done but so far no policies have been linked to any of them.

**Economic valuation –
a tool for decision making processes
Lessons from the Regional Seas
Conventions and Action Plans**



Regional Seas Conventions and Action Plans

- Established in 1974; 143 countries; 18 Regional Seas Conventions and Action Plans, 6 administered by UNEP
- Provide the only legally binding framework to protect the marine environment at the regional level
- Governed by member states
- Main objectives are to address the degradation of oceans and seas through the sustainable use and management of marine and coastal resources

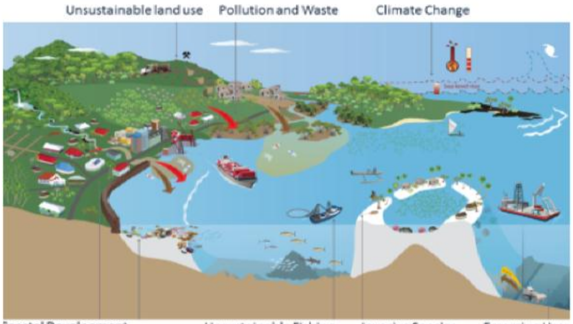
Main Activities

- Addressing land-based sources of pollution (nutrients, wastewater, marine litter, heavy metals, amongst others)
- Ecosystem Based Management (EBM) – guidelines tailored for member states
- Marine protected areas networks
- Integrated coastal zone management
- Economic valuation of marine and coastal ecosystem servcices
- Green economy for oceans
- Regional funds for wastewater management
- Monitoring and evaluation on the state of the marine environment (every 3-5 years)

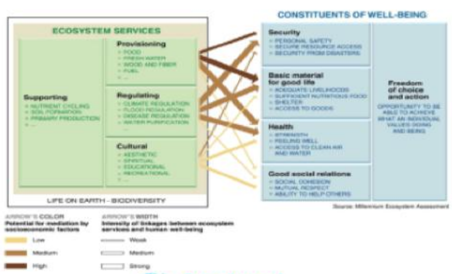
Regional Seas Strategic Directions (2013-2016)

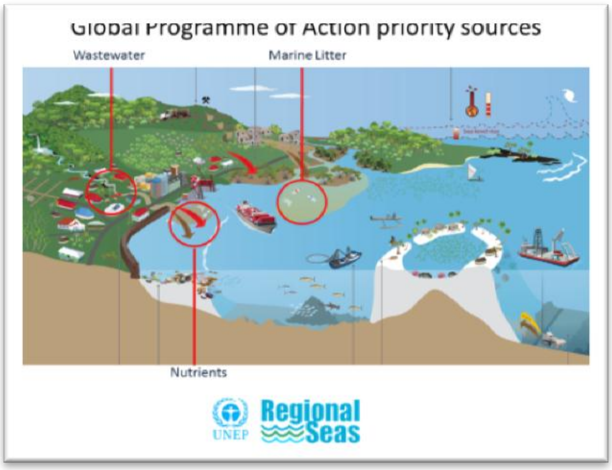
- Effectively apply Ecosystem Based Management
- GPA: Protection from Land Based Activities
- Strengthen capacity for coastal and marine governance
- Promote resource efficiency and productivity
- Strengthen coordination and capacity for state of marine environment reporting, in particular the World Oceans Assessment
- Strengthen mechanisms for MEA, UN and IFI collaboration

Multiple challenges require an integrated solution

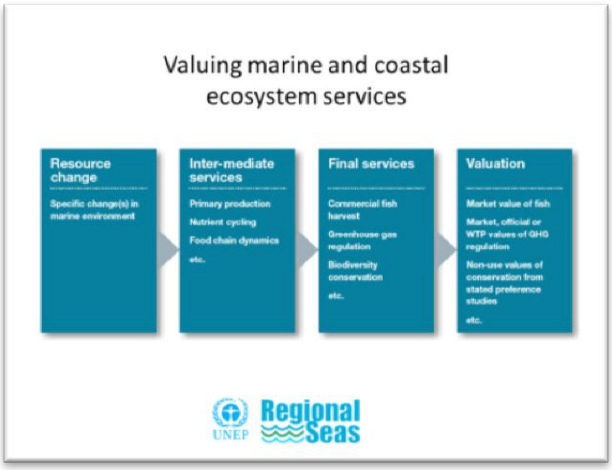


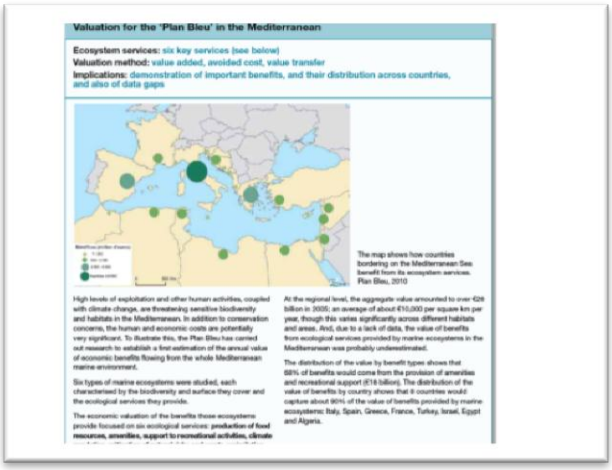
Valuing marine and coastal ecosystem services



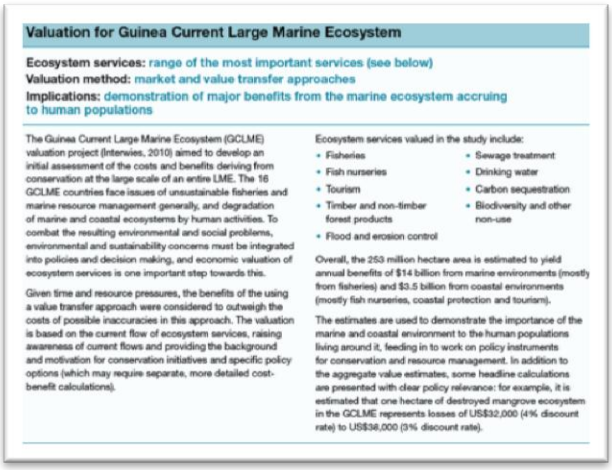

Global Programme of Action priority sources
Wastewater
Marine Litter
Nutrients
UNEP
Regional Seas


Why value marine services?
• The ultimate aims of defining and measuring the value of the natural environment are to better inform management choices, and/or influence human behaviour.
• There are two main types of reason for valuing ecosystem services:
– To assess the costs and benefits of an action/inaction or policy, as an aid to decision making;
– To improve understanding of the value of benefits to society from an ecosystem or series of linked ecosystems.
UNEP
Regional Seas


Valuing marine and coastal ecosystem services
Resource change
Specific change(s) in marine environment
Inter-mediate services
Primary production
Nutrient cycling
Food chain dynamics
etc.
Final services
Commercial fish harvest
Greenhouse gas regulation
Biodiversity conservation
etc.
Valuation
Market value of fish
Market, official or WTP values of GHG regulation
Non-use values of conservation from stated preference studies
etc.
UNEP
Regional Seas


Valuation for the 'Plan Bleu' in the Mediterranean
Ecosystem services: six key services (see below)
Valuation method: value added, avoided cost, value transfer
Implications: demonstration of important benefits, and their distribution across countries, and also of data gaps
The map shows how countries bordering on the Mediterranean Sea benefit from its ecosystem services. Plan Bleu, 2010
High levels of exploitation and other human activities, coupled with climate change, are threatening sensitive biodiversity and habitats in the Mediterranean. In addition to conservation concerns, the human and economic costs are potentially very significant. To illustrate this, the Plan Bleu has carried out research to establish a first estimation of the annual value of economic benefits flowing from the whole Mediterranean marine environment.
Six types of marine ecosystems were studied, each characterised by the biodiversity and surface they cover and the ecological services they provide.
The economic valuation of the benefits those ecosystems provide focused on six ecological services: production of food resources, amenities, support to recreational activities, climate
At the regional level, the aggregate value amounted to over €26 billion in 2005; an average of about €10,000 per square km per year, though this varies significantly across different habitats and areas. And, due to a lack of data, the value of benefits from ecological services provided by marine ecosystems in the Mediterranean was probably underestimated.
The distribution of the value by benefit types shows that 68% of benefits would come from the provision of amenities and recreational support (€18 billion). The distribution of the value of benefits by country shows that 8 countries would capture about 90% of the value of benefits provided by marine ecosystems: Italy, Spain, Greece, France, Turkey, Israel, Egypt and Algeria.


Values from mangroves in Thailand (expressed in $ at 1996 prices)
Ecosystem services: food production, wood products, coastal protection and fish nurseries
Valuation method: market and production function approaches
Implications: mangrove conservation is more beneficial than conversion for shrimp farms, but if non-linearities are taken into account, limited conversion for shrimp farming has relatively little impact on coastal protection
Barbier et al. (2008) demonstrate the practical importance of taking into account non-linear relationships between value and area. They show that using an average value for the storm protection value of mangroves in an area of Thailand ($1879 per ha), mangrove conservation clearly dominates conversion for shrimp farms. However, using the marginal values, and therefore taking into account that small reductions in mangrove area have relatively limited impact on flood protection values, this result is nuanced: the highest values overall occur if there is, in this case, 20% mangrove conversion for shrimp farms, and 80% conservation.
Of course there is a strong spatial component to the value – the flood defence value of any given hectare depends strongly on where it is and what people and infrastructure it protects, as well as on the extent of mangrove nearby: the 20% earmarked for conversion should be carefully chosen to incur the smallest reduction in coastal protection values.
Taking non-linear values into account is also very important in determining the appropriate level of mangrove restoration where they have already been destroyed. Barbier (2009) reports restoration costs with a present value of around $9000 per ha. Considering the average value of flood protection (present value around $11000 per ha) would suggest that restoration is profitable. Looking at marginal values would reveal the more accurate conclusion that it is profitable up to a point. This reasoning can help ensure that scarce resources for restoration and conservation activities are optimally allocated.
UNEP
Regional Seas


Valuation for Guinea Current Large Marine Ecosystem
Ecosystem services: range of the most important services (see below)
Valuation method: market and value transfer approaches
Implications: demonstration of major benefits from the marine ecosystem accruing to human populations
The Guinea Current Large Marine Ecosystem (GCLME) valuation project (Interwies, 2010) aimed to develop an initial assessment of the costs and benefits deriving from conservation at the large scale of an entire LME. The 16 GCLME countries face issues of unsustainable fisheries and marine resource management generally, and degradation of marine and coastal ecosystems by human activities. To combat the resulting environmental and social problems, environmental and sustainability concerns must be integrated into policies and decision making, and economic valuation of ecosystem services is one important step towards this.
Given time and resource pressures, the benefits of the using a value transfer approach were considered to outweigh the costs of possible inaccuracies in this approach. The valuation is based on the current flow of ecosystem services, raising awareness of current flows and providing the background and motivation for conservation initiatives and specific policy options (which may require separate, more detailed cost-benefit calculations).
Ecosystem services valued in the study include:
• Fisheries
• Fish nurseries
• Tourism
• Timber and non-timber forest products
• Flood and erosion control
• Sewage treatment
• Drinking water
• Carbon sequestration
• Biodiversity and other non-use
Overall, the 253 million hectare area is estimated to yield annual benefits of $14 billion from marine environments (mostly from fisheries) and $3.5 billion from coastal environments (mostly fish nurseries, coastal protection and tourism).
The estimates are used to demonstrate the importance of the marine and coastal environment to the human populations living around it, feeding in to work on policy instruments for conservation and resource management. In addition to the aggregate value estimates, some headline calculations are presented with clear policy relevance: for example, it is estimated that one hectare of destroyed mangrove ecosystem in the GCLME represents losses of US$32,000 (4% discount rate) to US$36,000 (3% discount rate).


"The perfect spill": economic value of Deepwater Horizon damage
Ecosystem services: 'all 'ecosystem services from the Mississippi River Delta
Valuation method: value transfer based on several methods
Implications: rapid assessment demonstrating the significant, but highly uncertain, losses of ecosystem service values following the oil spill
Costanza et al. (2010) provided quick, approximate estimates of the damage that could arise through the recent Deepwater Horizon oil spill in the Gulf of Mexico. They based their calculations on Batker et al. (2010) who estimated the total value of marine ecosystem services for the Mississippi River Delta to be in the range of $12-47 billion per year. Summing the flow of these services into the indefinite future, at a 3.5% discount rate, gives an estimated value of the Delta as a natural asset in the range of $330 billion to $1.3 trillion – which, Costanza et al. note, is far more than the total market value of BP ($189 billion) before the spill.
For an approximate calculation, they assume that the Mississippi River Delta will be the most affected region and that there will be a 10 to 50 percent reduction in the ecosystem services provided by the Delta. This amounts to a loss of $1.2 – $23.5 billion per year into the indefinite future until ecological recovery. This is clearly a "rough and ready" estimate, developed rapidly in order to inform debate and awareness over the consequences of the spill. The figures can be seen as fit for that particular purpose. For the different purpose of estimating compensation payments, more refined methods would be necessary.
UNEP
Regional Seas


Lessons learnt so far from Regional Workshops
• Economic valuation studies of ES can be used to support the decision process as tools of policy advice
• Based on efficiency- saving money
• Based on social welfare- improving social conditions
• Valuation for policy and decision-making
• From economic values to economic incentives
• Policy instruments for managing marine and coastal resources
UNEP
Regional Seas

National and sub-national policies and plans	Development & planning Environment Treasury Physical planning, emergency planning, and response	Poverty reduction strategies, land-use planning, water supply, and sanitation Protected area creation, climate adaptation strategies National budgets, public expenditure reviews, audits Integrated ecosystem management of coasts, river basins, forest landscapes, and watersheds
Economic and fiscal incentives	Finance Budget office	Subsidies, tax credits, payments for ecosystem services, import duties, and tariffs Tax policies to support easements or promote alternative energy technology, pricing regulations for water
Sector policies and plans	Commerce and industry Science and technology Agriculture Forestry Environment/ Natural resources	Corporate codes of conduct/standards, assessment of new technologies Applied research, technology transfer, business capacity building Extension services, best management practices Forest sector action programs, mapping initiatives, concession management State of the environment reports, strategic environmental assessments, environmental impact assessments, information/tools, legal instruments
Governance	Prime minister's or mayor's office, justice ministries, legislature, local government bodies	Decentralization policies, free press, civil society, accountability of government through elections, access to information and decisions, judicial review, performance indicators

UNEP Regional Seas

Lessons learnt so far from Regional Workshops

- Marginal value
  - *Understand trade-offs between development paths*
  - *Understand tipping points of ecosystem services delivery*
- Human well-being
  - *Understand the contribution of ES in material terms for subsistence economies*

UNEP Regional Seas

Lessons learnt so far from Regional Workshops

- Human well-being
  - *Understand the contribution of ES in monetary terms for market economies*
- Policy making
  - *Successfully meet our needs taking into account biophysical limits*

UNEP Regional Seas

Challenges and opportunities

- Conceptual
  - *From total economic values to marginal values*
  - *Tipping points and trade offs*
- Methodological
  - *From singular (economic) to plural values (ecological- social – economic)*
- Data
  - *Limited*
  - *Biased towards marketed goods and services*

UNEP Regional Seas

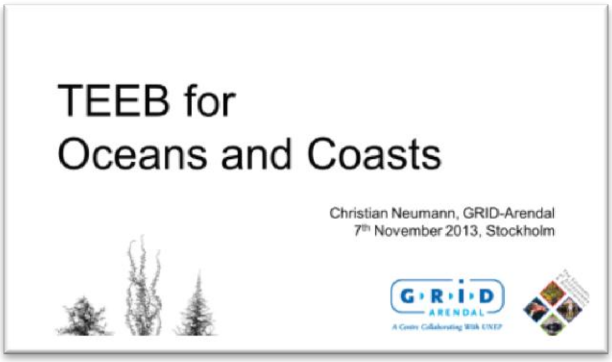
UNEP Regional Seas

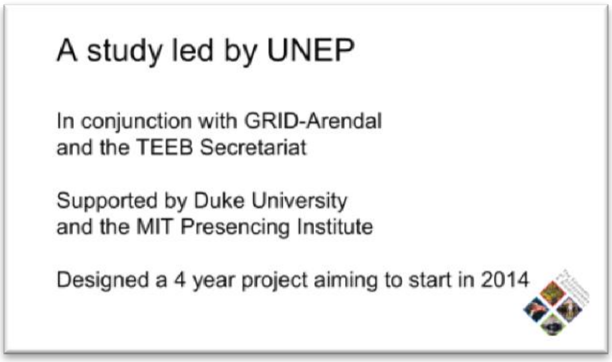
Alberto Pacheco Capella
Coordinator
Regional Seas Programme
UNEP

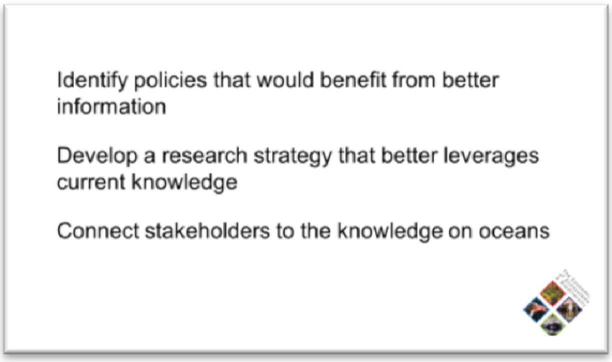
alberto.pacheco@unep.org

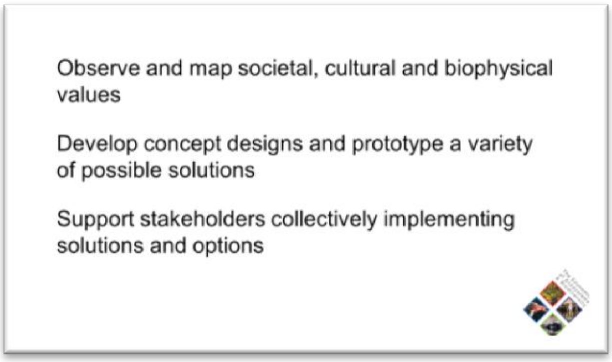
Christian Neumann, GRID-Arendal, Norway.
"TEEB for Oceans and Coasts"

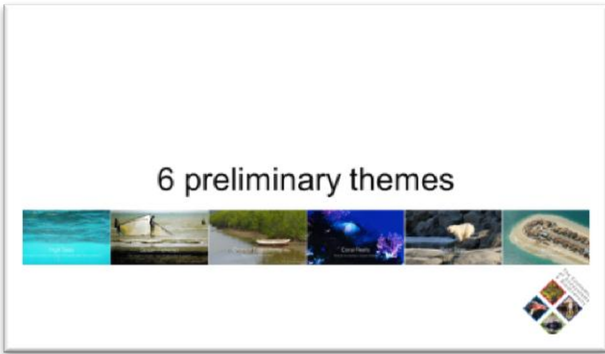
"TEEB for Oceans and Coasts" is a study led by UNEP in conjunction with GRID-Arendal and the TEEB Secretariat. It is a 4 year project aiming to start in 2014. The project is supported by Duke University and the MIT Presencing Institute. The key study objectives are to identify policies that would benefit from better information, developing integrated policy frameworks, such as economic incentives for tourism. Second, the aim is to develop a research strategy that better leverages current knowledge – for instance, there is less science in the developing world - and how does one package this information for the politicians? The aim is also to observe and map societal, cultural and biophysical values, develop concept designs and prototype a variety of possible solutions. Another goal is supporting stakeholders collectively to implement solutions and options. What is the actual value of an ecosystem for a coastal country today? The biggest business today is the high seas fisheries, but what is the value of the fish that remains in the sea? Coastal ecosystems are valued at 193,845 international dollars per hectare and year. We risk losing many coastal ecosystems and coral reefs, so how do we make coastal communities resilient to this loss? Can we replace them? It is very important to recognize, demonstrate and capture the full picture. Investing in natural capital is not just about conservation, it is about investing in infrastructure.



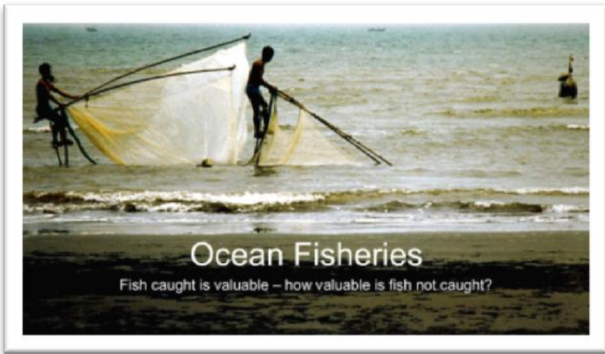




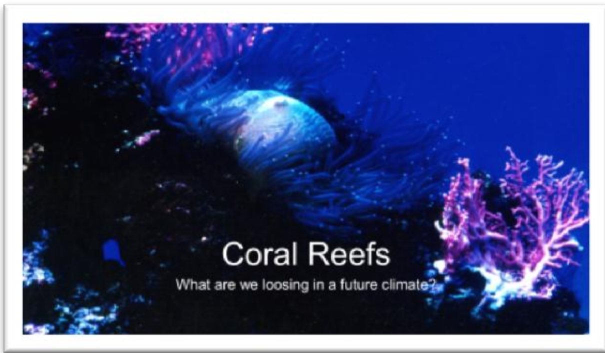



6 preliminary themes

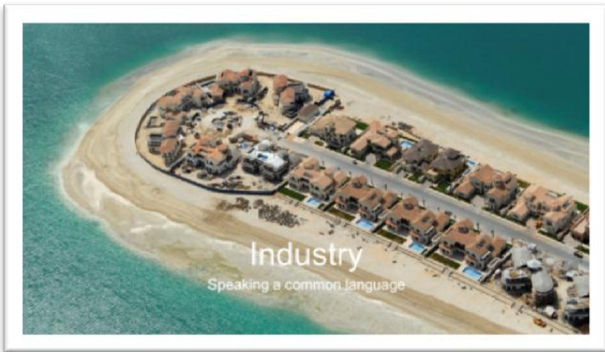

High Seas
Does the global economy and society need healthy High Seas ecosystems?


Ocean Fisheries
Fish caught is valuable – how valuable is fish not caught?

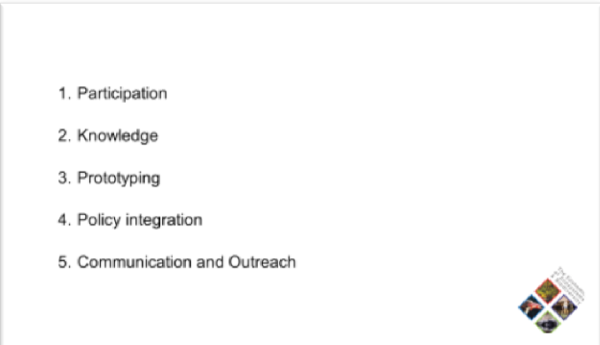

Coastal Ecosystems
Worth 193,845 Int$ /ha /year?


Coral Reefs
What are we loosing in a future climate?

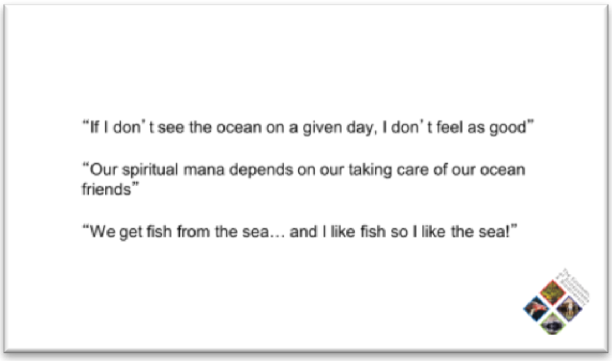

Polar Seas
Race to the bottom?

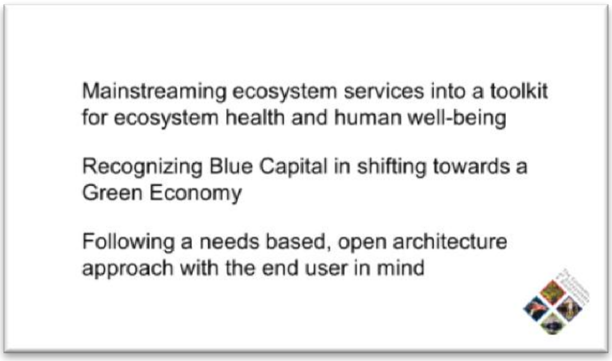

Industry
Speaking a common language

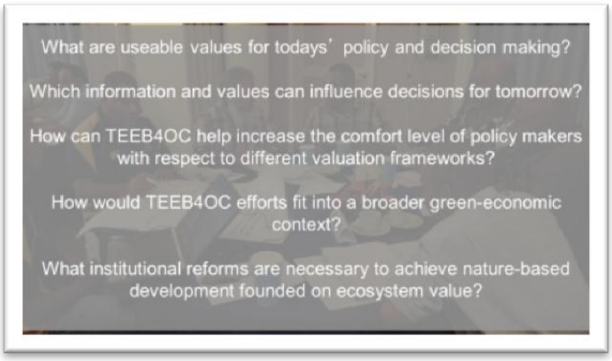

5 Components


1. Participation
2. Knowledge
3. Prototyping
4. Policy integration
5. Communication and Outreach


Painting the full picture

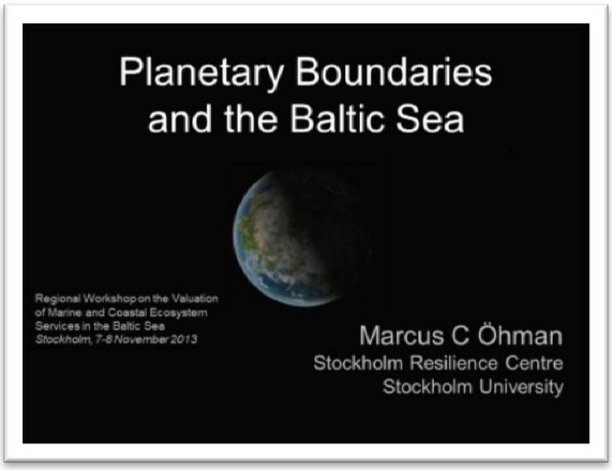






Marcus C Öhman, Stockholm Resilience Centre, Stockholm University, Sweden
"The Baltic Sea and Planetary Boundaries"

In 2009 the concept of nine Planetary Boundaries was presented. The scientists behind the Planetary Boundaries tried to find the safe operating space for mankind. One of the boundaries is climate change. It has been estimated that by the end of the century, the water temperature in the Baltic Sea is expected to increase by 2-3 degrees and Gulf of Bothnia to increase by 4 degrees in the summer. This will influence many things such as the stratification and mixing of water. Plankton will be affected; an effect that will ripple through the ecosystem. Other effects could be altered species composition, more frequent algal blooms, shorter seasons with ice coverage (seals prefer to give birth on the ice), the distribution of birds northwards, habitat changes, food availability etc. Why is biodiversity important? It is the control panel and the natural capital for Earth. The rate of extinction has increased by 100-1000 times. The Planetary Boundary concept calls for the necessity to stay below 10 extinctions per one million species. The number of species is important but also the shift in composition should be considered. Much data is still lacking for the Baltic Sea. The Baltic Sea biodiversity is affected by climate change, fisheries, eutrophication, hazardous substances, and alien species. Nitrogen is fixed by humans into reactive compounds - more than what happens in Nature. Nitrogen is one of the main environmental problems with the Baltic Sea. Relatively small portions of fertilisers are taken up by plants. Nitrogen and phosphorus are a concern because they contribute to the eutrophication in the Baltic Sea. Other Planetary Boundaries that relate to the Baltic Sea and the surrounding areas are global fresh water use and land system change. Also ocean acidification could be a problem. It has increased by 30% since pre-industrial times. Two problems that have no set boundaries yet: chemical pollution (hazardous substances such as POPs and metals are of concern for the Baltic Sea) and aerosol loading, particles in the air.


Planetary Boundaries
and the Baltic Sea
Regional Workshop on the Valuation of Marine and Coastal Ecosystem Services in the Baltic Sea
Stockholm, 7-8 November 2013
Marcus C Öhman
Stockholm Resilience Centre
Stockholm University

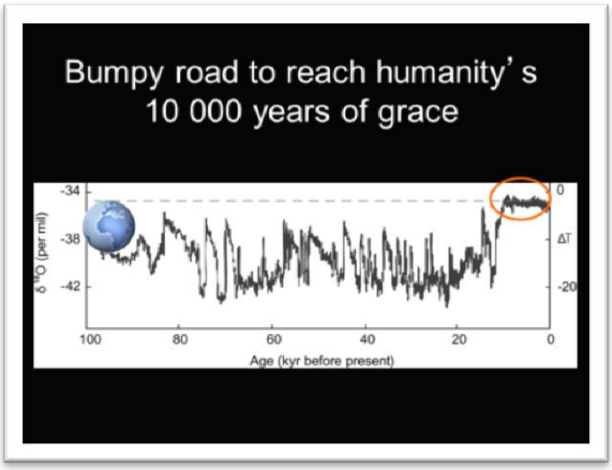
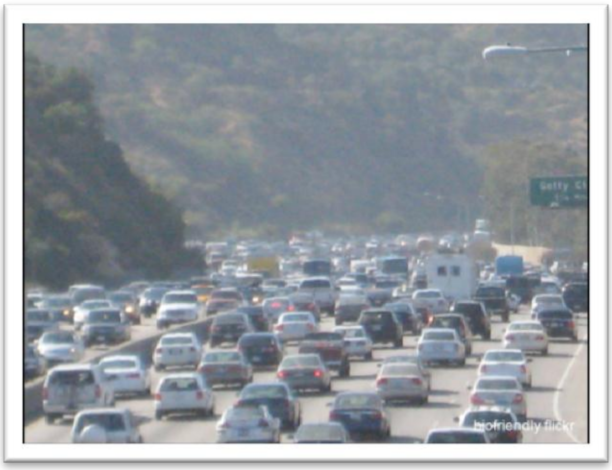

Bumpy road to reach humanity' s
10 000 years of grace
δ ¹⁸O (per mil)
-34
-38
-42
0
ΔT
-20
100
80
60
40
20
0
Age (kyr before present)


Photo: Mattias Klu


biofriendly flickr

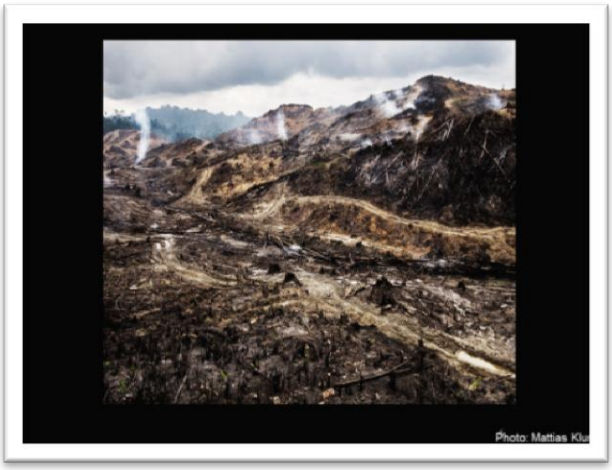
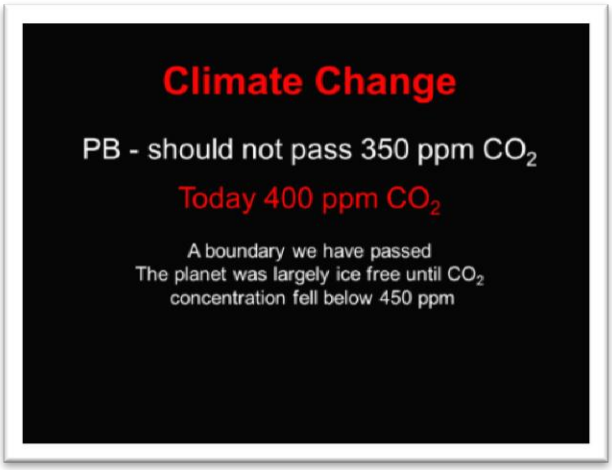


Photo: Mattias Klu

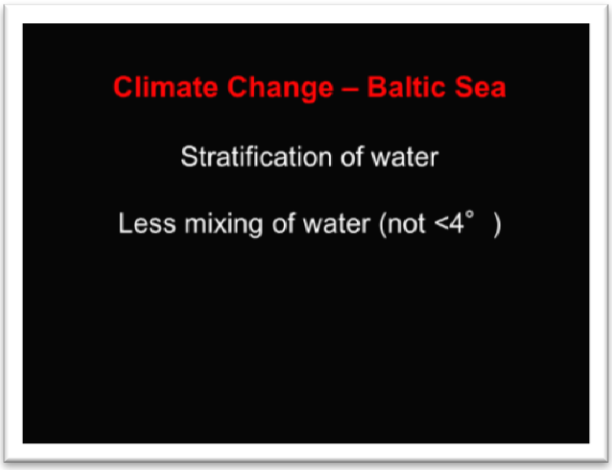

Nine planetary boundaries
FEATURE
A safe operating space for humanity
Climate change
Ocean acidification
Stratospheric ozone depletion
Phosphorus cycle
Global freshwater use
Change in land use
Biodiversity loss
Atmospheric aerosol loading (not yet quantified)
Chemical pollution (not yet quantified)
Rockström et al. 2009 Nature, 461 (24): 472-475

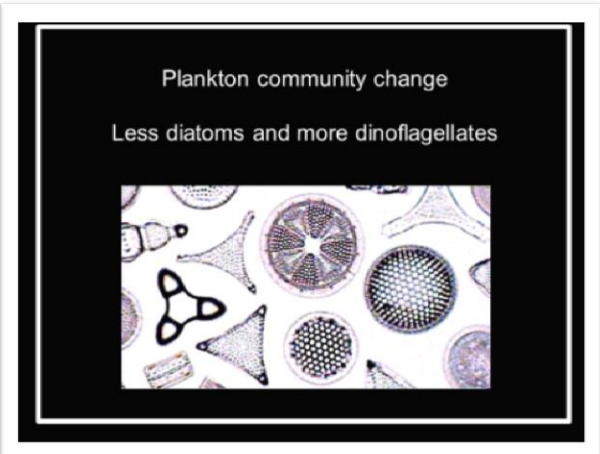

What is the safe operating space?
There are thresholds that we don't want to pass

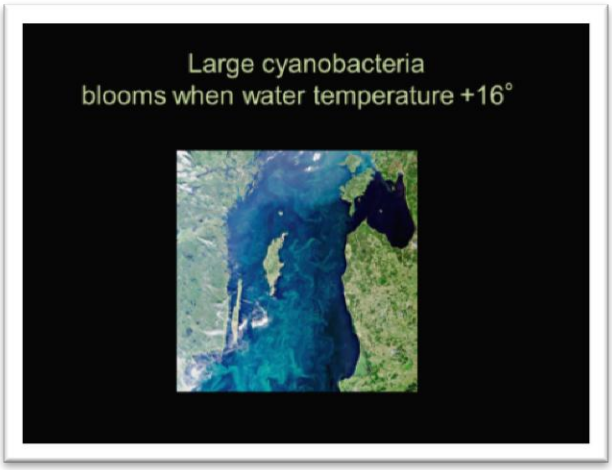

- Climate Change -


Climate Change
PB - should not pass 350 ppm CO_2
Today 400 ppm CO_2
A boundary we have passed
The planet was largely ice free until CO_2 concentration fell below 450 ppm


Climate Change – Baltic Sea
In the end of this century:
Baltic Proper +2-3°
Gulf of Bothnia in summer +4°
Scenario – end of this centure
BACC (2008) - BALTEX Assessment of Climate Change for the Baltic Sea Basin
Swedish Commission on Climate and Vulnerability (2007)
Swedish Environmental Protection Agency


Climate Change – Baltic Sea
Stratification of water
Less mixing of water (not <4°)


Plankton community change
Less diatoms and more dinoflagellates

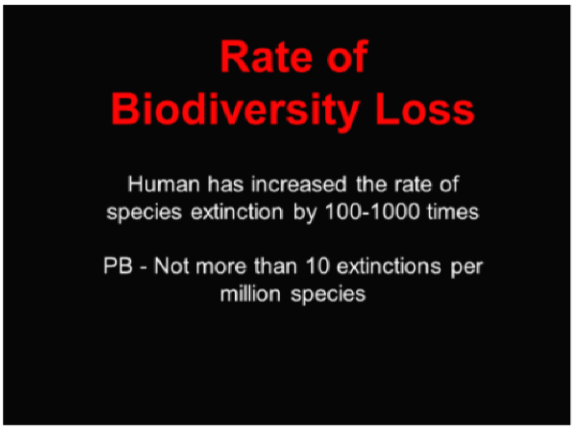

Large cyanobacteria
blooms when water temperature +16°


Ice coverage
Smaller area
Shorter season
Two month shorter in central Baltic Sea

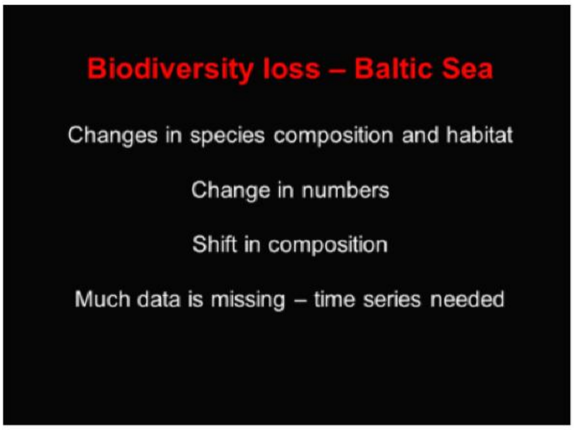

Wintering coastal birds
moving north

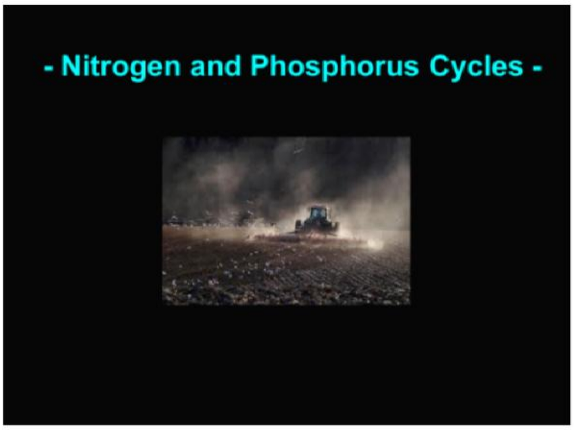

- Biodiversity Loss -

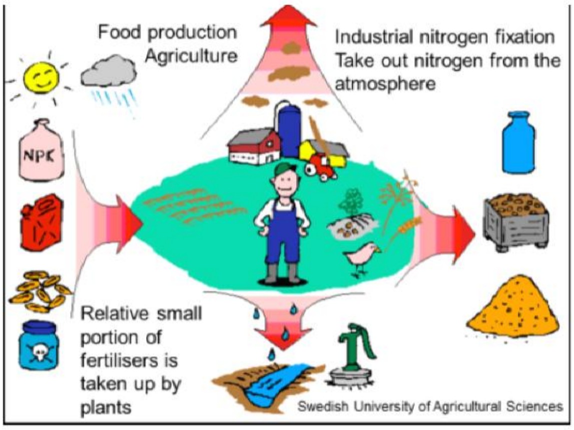

Why is biodiversity important?
Control panel for the
living on earth
Natural capital

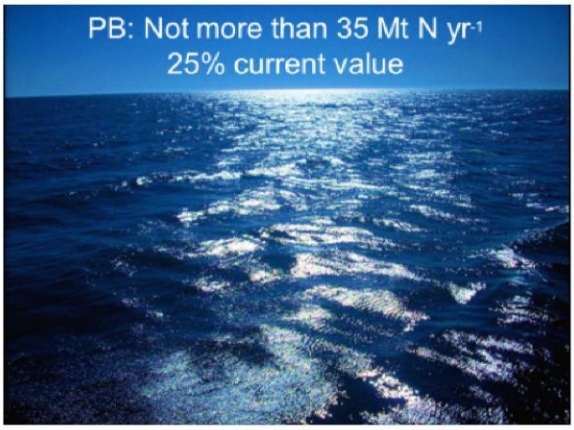

Rate of
Biodiversity Loss
Human has increased the rate of
species extinction by 100-1000 times
PB - Not more than 10 extinctions per
million species

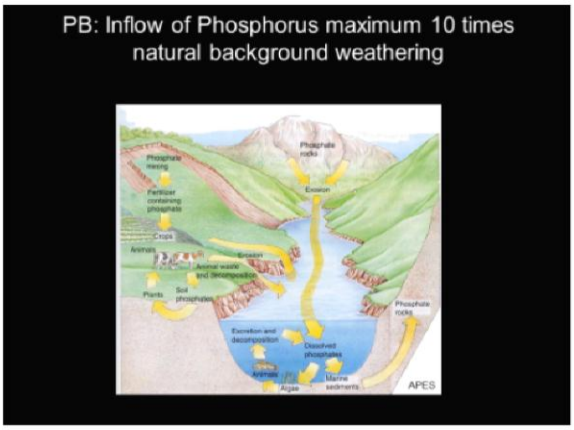

Biodiversity loss – Baltic Sea
Climate change, fisheries,
eutrophication, hazardous substances,
alien species…will affect biodiversity

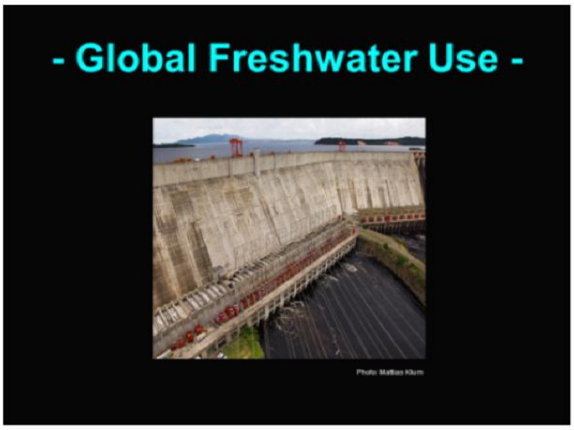

Biodiversity loss – Baltic Sea
Changes in species composition and habitat
Change in numbers
Shift in composition
Much data is missing – time series needed

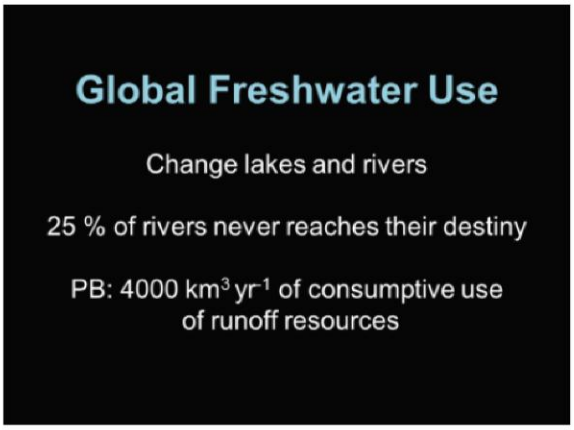

- Nitrogen and Phosphorus Cycles -


Food production
Agriculture
Industrial nitrogen fixation
Take out nitrogen from the atmosphere
NPK
Relative small portion of fertilisers is taken up by plants
Swedish University of Agricultural Sciences


PB: Not more than 35 Mt N yr-1
25% current value

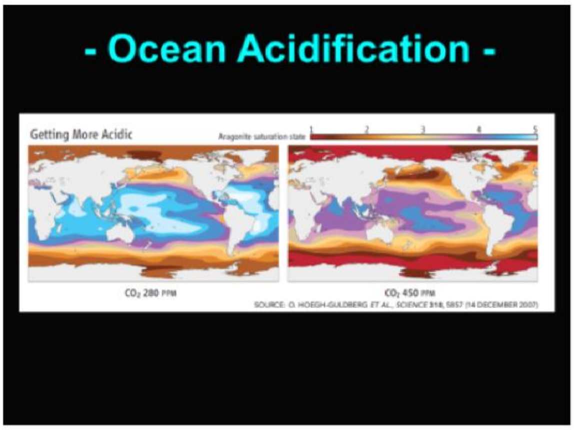

PB: Inflow of Phosphorus maximum 10 times natural background weathering
APES


- Global Freshwater Use -

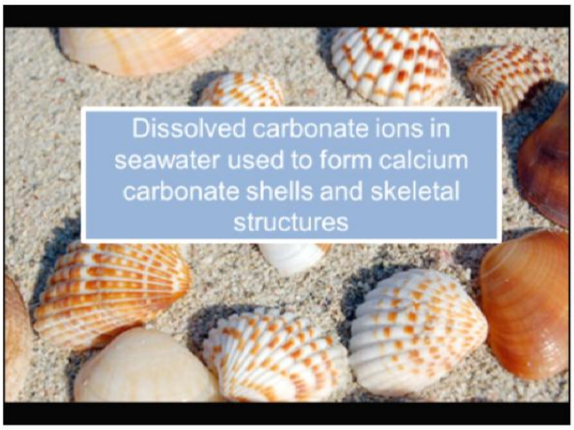

Global Freshwater Use
Change lakes and rivers
25 % of rivers never reaches their destiny
PB: 4000 km3 yr-1 of consumptive use of runoff resources

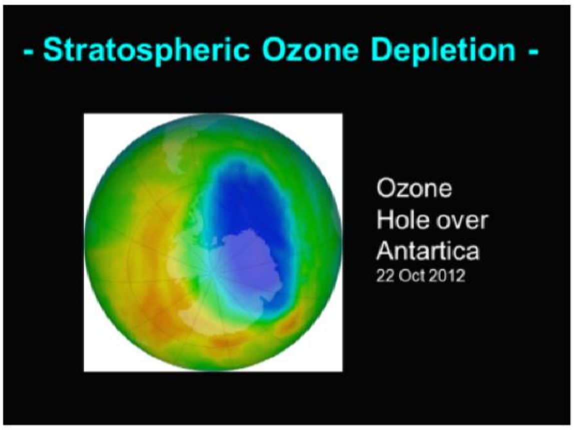

- Land System Change -
Photo: Mattias Klum

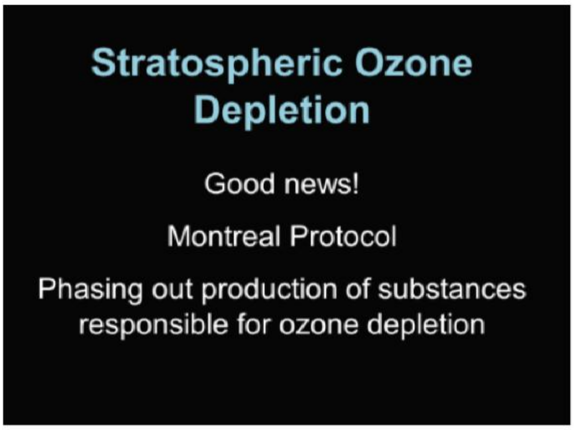

Land System Change
Today about 12 %
of ice-free land
is crop land
PB: Should not be more than 15%


- Ocean Acidification -
Getting More Acidic
Aragonite saturation state
CO2 280 PPM
CO2 450 PPM


Ocean Acidification
Comes from CO2
Increased 30% since pre-industry
PB: Mean surface seawater saturation state with respect to aragonite -
not less than 80% of pre-industrial levels

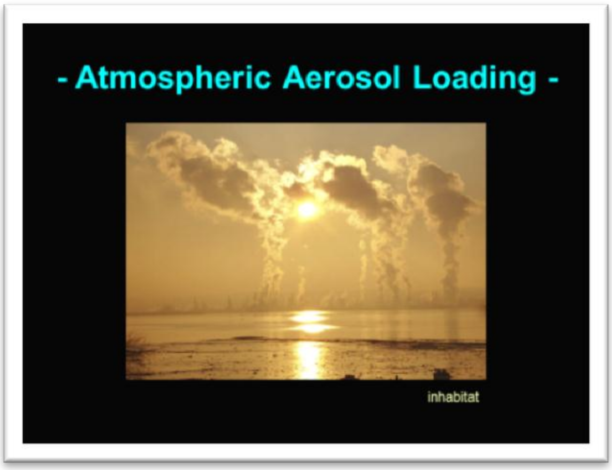

Dissolved carbonate ions in seawater used to form calcium carbonate shells and skeletal structures

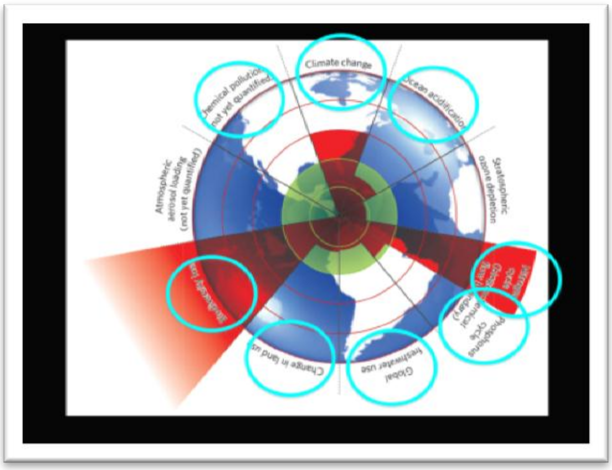

- Stratospheric Ozone Depletion -
Ozone
Hole over
Antartica
22 Oct 2012

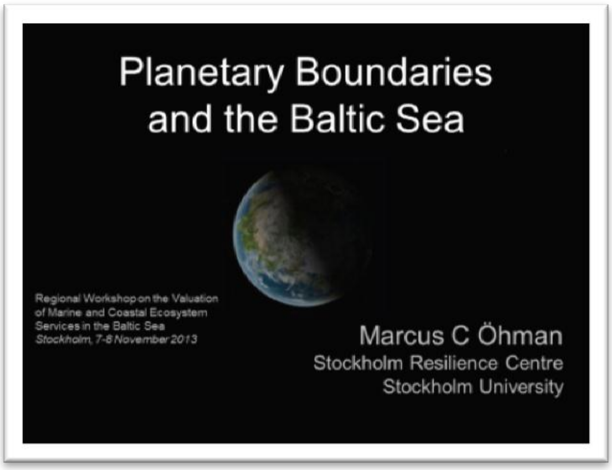

Stratospheric Ozone Depletion
Good news!
Montreal Protocol
Phasing out production of substances responsible for ozone depletion


- Chemical Pollution -


Chemical Pollution in the Baltic Sea
Persistent Organic Pollutants
PCB, DDT, Dioxins, Brominated flame retardants, TBT etc
Metals
Mercury, Lead, Cadmium etc







Fredrik Wulff, Baltic Sea Center, Sweden
"Challenges for Reaching a Clean Baltic Sea"

The 4 main challenges for the Baltic Sea are: eutrophication, fisheries, toxic substances and shipping. This poses challenges for scientists, managers and society as a whole. Scientists must describe the environment and what causes the changes. Society needs to figure out what is a good environment and how is it reached? What does it cost in socio-economic terms? It is necessary to develop scenarios for future development. Reductions so far are not enough! Recent reevaluation of the BSAP for P says that 10,000 tons of P should be reduced, but so far the reduction has only been by 2000 tons. Half of the P load comes from agriculture through leakage. It is necessary to include the external cost which means that food must cost more. If the BSAP is implemented, how long will it be before any effect is seen? The BSAP estimates 30 years for N and 60 years for P to reach half their levels! So the chance to see a clean Baltic by 2021 is not possible. With cost-minimization it is possible to reduce the costs of nutrient load abatement. Nutrient trading might work. The costs are estimated to be 4.65 billion euro per year. Most measures should be done in Poland because the measures are less expensive there. At the same time it is necessary to value the ecosystem services. It is very important that society decides what is good enough. So far the scientists have set the targets, but society should say when the marine environment is good enough. What kind of agreements are needed in order to reach a good environment? Hopefully the BSAP will be converted to be legally binding. Drastic changes in agriculture practice are needed to save the Baltic Sea. An understanding of the socioeconomic consequences of various actions is missing. Very few studies have been conducted on the legal and economic measures that could make it successful.

Challenges of reaching a clean Baltic Sea

Fredrik Wulff
Bo Gustafsson, Christoph Humborg & Tina Elfwing
Baltic Sea Center, Stockholm University

Regional Workshop on the valuation of marine and coastal ecosystem services in the Baltic Sea - 7-8 November 2013

Four main challenges

- Eutrophication
- Fisheries
- Toxic substances
- Shipping

+ All of these together

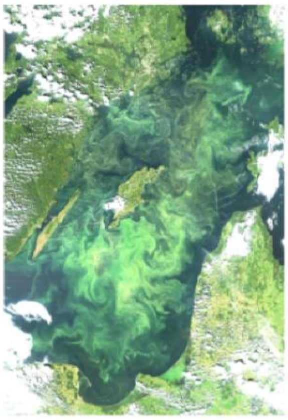
Challenges

- For scientists
- Managers
- Politicians - society

For scientists

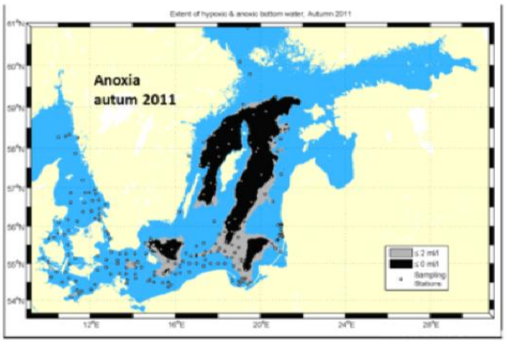
- Describe the environment - and what causes changes
- What is needed to reach a good environment
- What does it cost- in socioeconomic terms
- Scenarios of future development

Eutrophication - effects

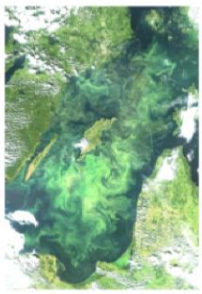


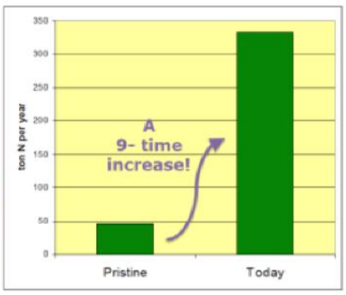
Cyano-
bacterial
Bloom July
05

Deep basins without oxygen



Cyanobacterial blooms

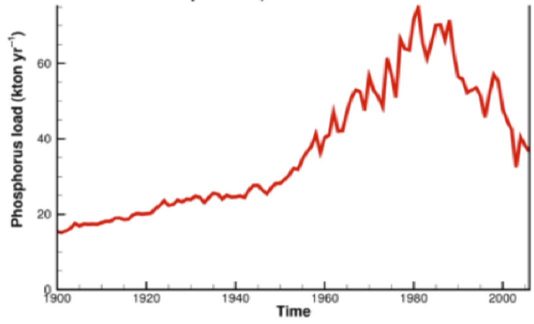




Eutrophication - Causes

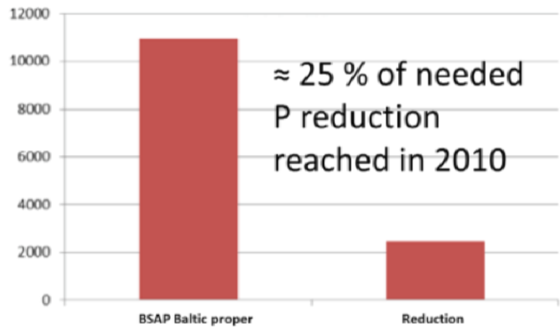
- Excessive nutrient load
- Limited water exchange
- Stratified water body
- Non tidal

Total phosphorus load (from land and atmosphere) to the Baltic Sea

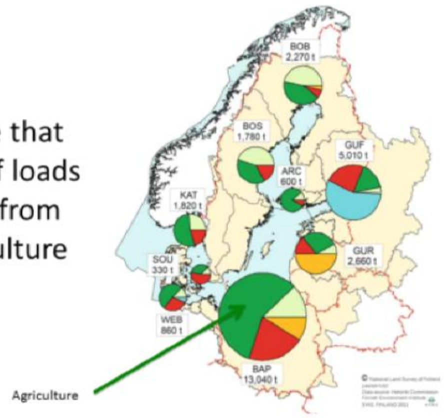


Reductions so far - are not enough

HELCOM PSAP reduction of phosphorus



More that 50% of loads now from agriculture

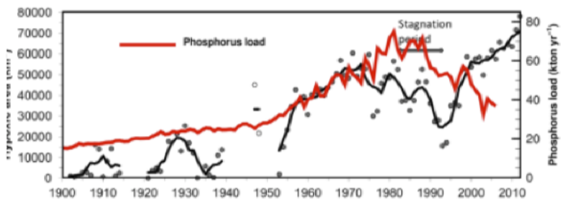


Can we reach nutrient reduction targets?

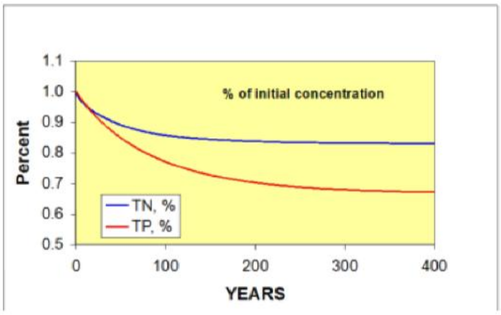
- It is not enough to build sewage treatment plants
- Leakage from agriculture must be reduced
  - If agriculture include costs for the environment.
  - Food prices will be higher

How long should we wait?

No effects of nutrient reductions for bottoms without oxygen



When BSAP is implemented: About 30 (N) and 60 (P) years to reach 50% of final concentrations



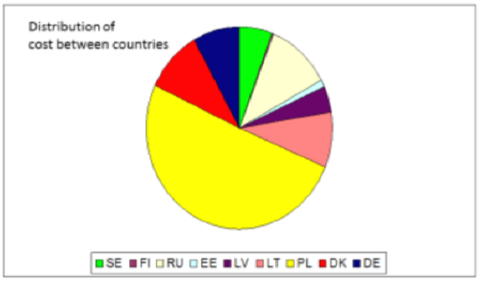
Large scale Eutrophication – science remedies

- BSAP Baltic Sea Action
  - Decrease nutrient load
- Ecological engineering
  - Mussel farming
  - Speed up recover by decreasing P pool
    - Oxygenation
    - Chemical precipitation
  - Better fishery management

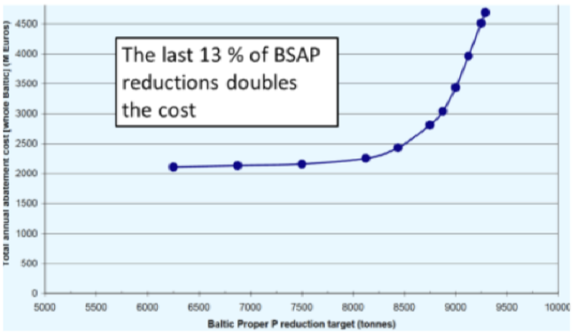
Money

- Cost minimization would reduce total cost considerably
  - Needs rules for nutrient trading
  - Works in the US
  - Failure in Baltic region – so far
- Valuation of ecosystem services

Minimum cost for BSAP 4.65 billion € per year



Baltic proper: cost for reduction of P load



Challenges for society

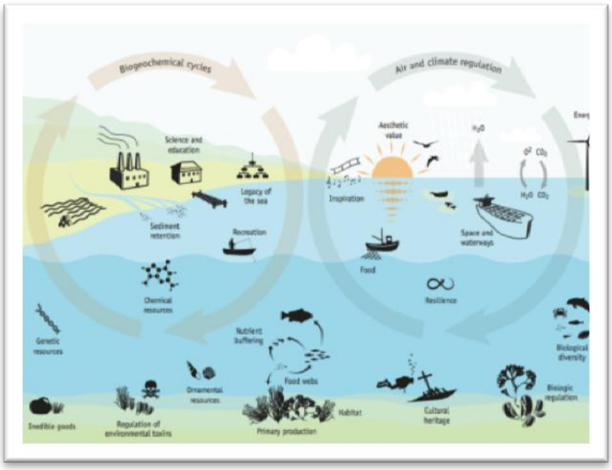
- What is a good environment?
- What kind of agreements are needed for reaching a good environment?
  - What legal and economic regulations are effective
  - BSAP worthless?
  - BSAP converted to EU directives
- Is it worth it – considering the economic and social costs?
- How long should we wait?

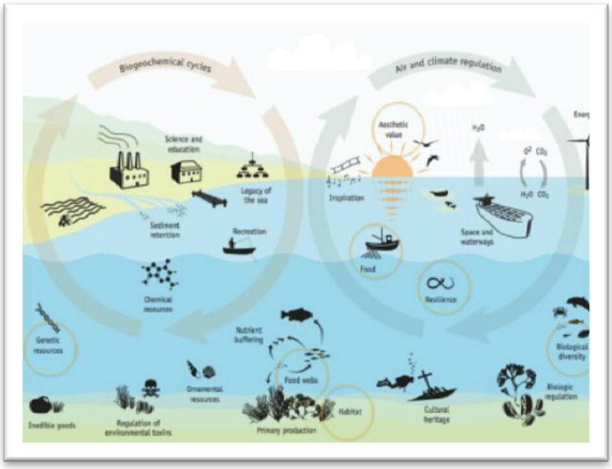
Conclusions

- (Natural) marine science good enough for actions on eutrophication but – *we don't know how to do it!*
- An understanding of the socio-economic consequences of various actions is missing!
- What legal and economic measures will make actions successful?
- Better dialogues needed

Siv Ericsdotter and Kerstin Blyh, Stockholm Resilience Centre and SU, Sweden "BalticSTERN: Ecosystem services and the Baltic Sea"

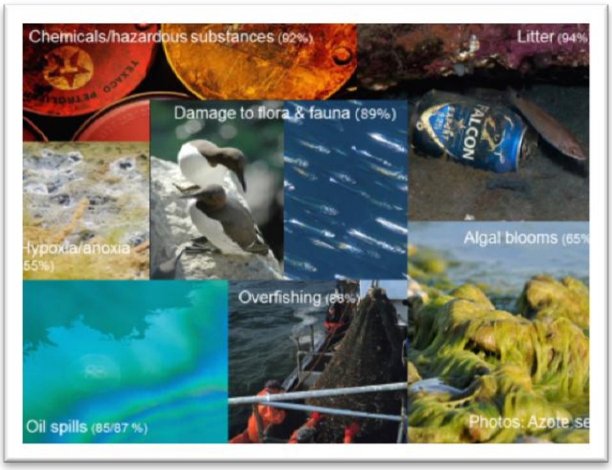
The BalticSTERN study was done in international cooperation and the report "BalticSTERN – Our common treasure" was published in 2013. Evaluation of ecosystem services identified 24 ecosystem services for the Baltic Sea in 2008, out of which only 8 are functioning properly and 7 are under severe threat. The survey on the use and attitudes of the Baltic Sea showed that 80% of the people living in the coastal countries have spent leisure time around the sea. Other common activities are boat cruises, fishing and swimming. At the same time many are worried about the Baltic Sea, for example about marine litter, chemical hazards, invasive species, oil spills, overfishing and eutrophication. The study also found out policy instruments and cost-effective measures, and whether people would be willing to pay. According to surveys, the potential benefits per year could be around 3.6 billion €. The study determined the most cost-effective measures to reduce nutrient loads. The costs were estimated to be 1.4-2.8 billion € per year, depending on the allocation of measures and models used. The total welfare gain would then be 0.8-2-3 billion € per year and it could be even larger. The benefits are probably even larger due to not including possible benefits from improved water quality in inland waters. The more direct services are dependent on the underlying ecosystem services, e.g. healthy food webs and nutrient buffering, so if these are severely threatened focus must be on management of these. There is support for an integrated, holistic and ecosystem services based management strategy for the Baltic Sea. Many measures have been identified but policies are lacking.

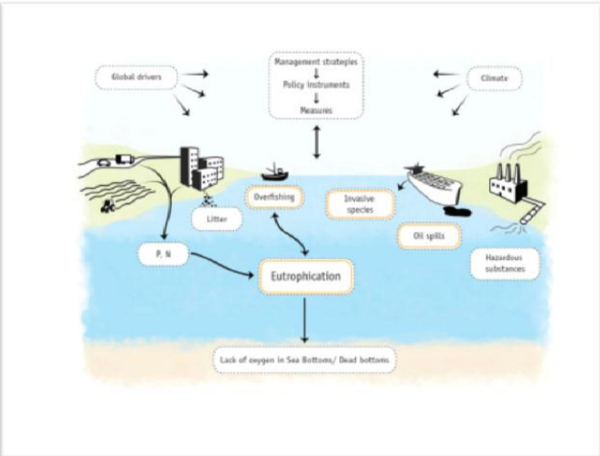



Biogeochemical cycles
Air and climate regulation
Science and education
Legacy of the sea
Sediment retention
Recreation
Chemical resources
Genetic resources
Nutrient buffering
Ornamental resources
Food webs
Habitat
Primary production
Inedible goods
Regulation of environmental toxins
Aesthetic value
Inspiration
Food
Resilience
Space and waterways
Cultural heritage
Biological diversity
Biologic regulation

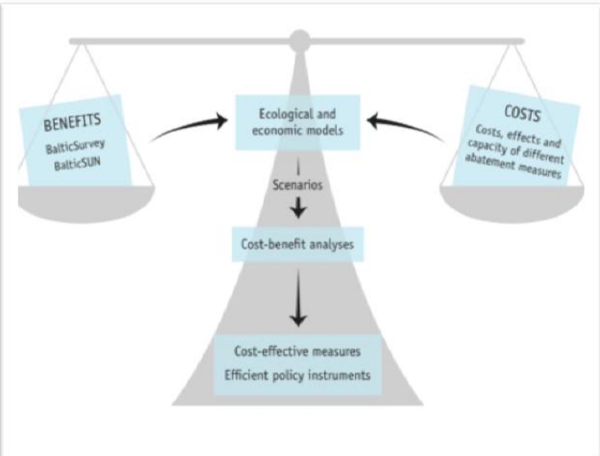

BalticSurvey
use and attitudes


80 % of Baltic Sea
citizens spent leisure
time at the Sea

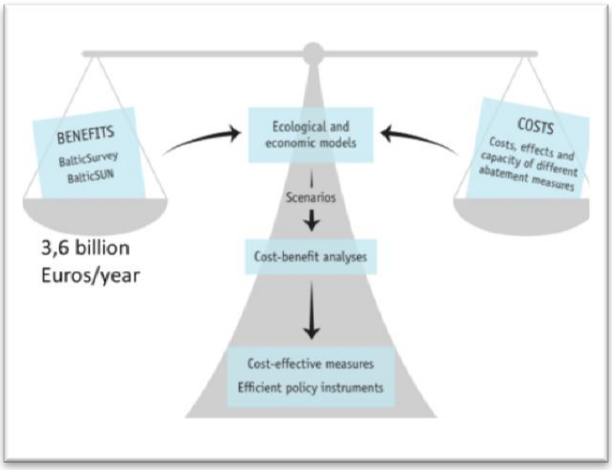

Chemicals/hazardous substances (92%)
Litter (94%
Damage to flora & fauna (89%)
Hypoxia/anoxia
55%)
Algal blooms (65%
Overfishing (88%)
Oil spills (85/87 %)
Photos: Azote.se


Global drivers
Management strategies
Policy instruments
Measures
Climate
Overfishing
Invasive species
Litter
Oil spills
P, N
Eutrophication
Hazardous substances
Lack of oxygen in Sea Bottoms/ Dead bottoms


Baltic Sea Action Plan


BENEFITS
BalticSurvey
BalticSUN
Ecological and economic models
COSTS
Costs, effects and capacity of different abatement measures
Scenarios
Cost-benefit analyses
Cost-effective measures
Efficient policy instruments

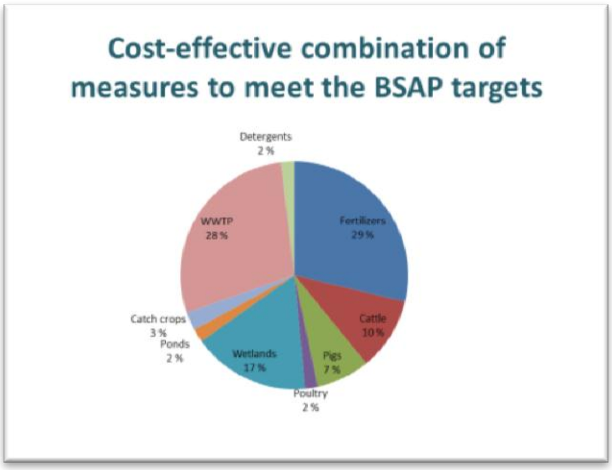

80 % of Baltic Sea
citizens spent leisure
time at the Sea....
.... but are they willing to pay for ESS ?

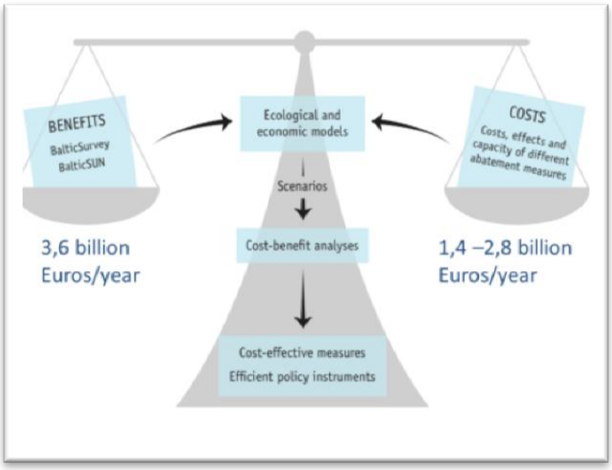


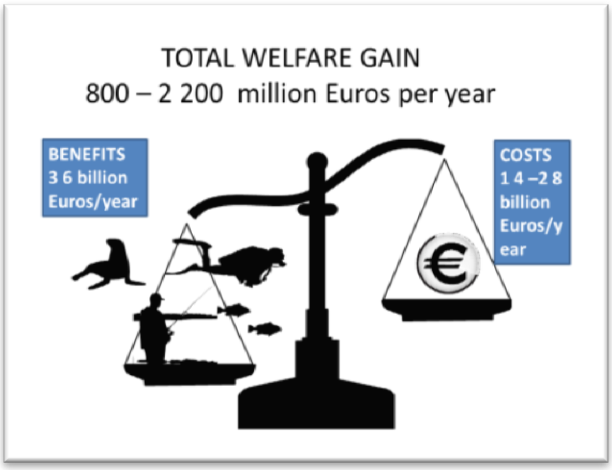
Costs of nutrient abatement

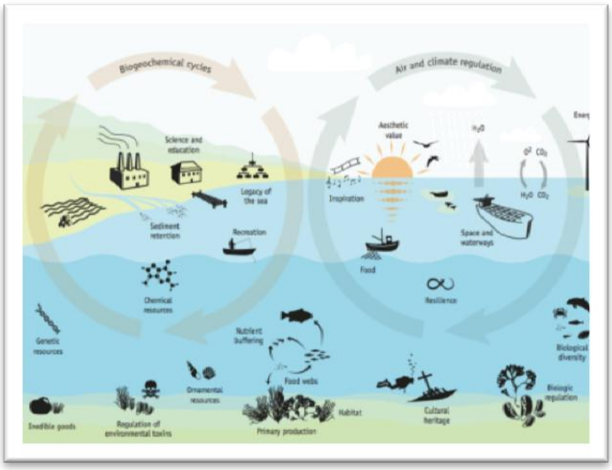
- Two models used
- Two cost estimates (country quotas, Sea basin targets)
- Retention considered

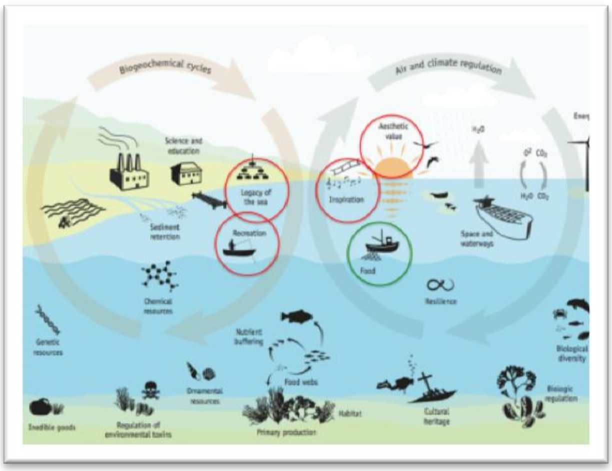
14

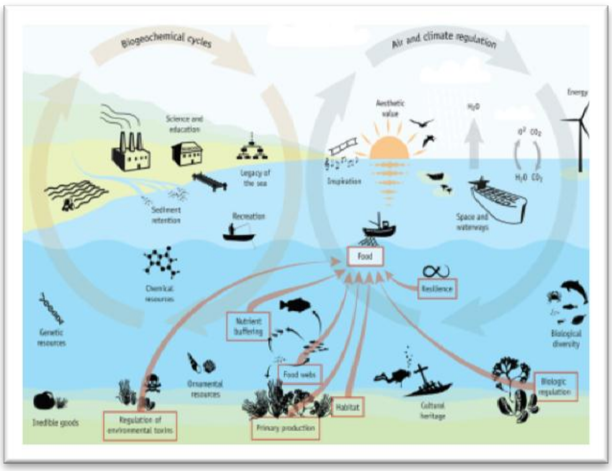












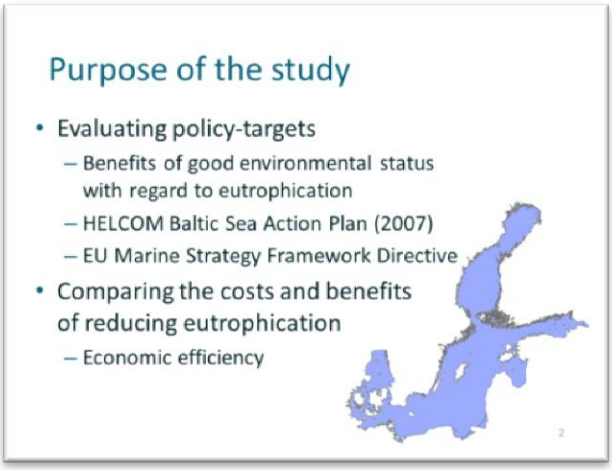
- First large scale international CBA involving all Baltic Sea countries
- Call for ecosystem based, holistic and integrated management strategies
- Public awareness and support for action, political framework there, measures identified but lack of enabling policy instruments

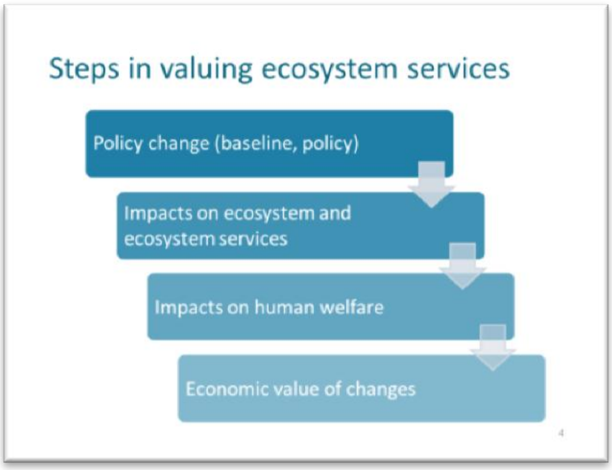
Heini Ahtiainen, MTT Agrifood Research/HELCOM, Finland
"Recreation and Existence Benefits of Reducing eutrophication in the Baltic Sea"

The study is an example of how ecosystem services can be valued in the Baltic Sea. Basic features of the study include finding the monetary benefits of improved recreation and existence values from reducing eutrophication. The study was interdisciplinary from the beginning, including ecologists and economists. The steps in valuation were to assess:

- How will the state of the Baltic develop if we keep to the current situation and if we change the policy?
- How does this impact the ecosystem and ecosystem services?
- What are the impacts to human welfare?
- What is the monetary value of these impacts to humans?

The results of the study show that there are substantial benefits from reducing eutrophication, which are lost if nothing is done (costs of inaction).



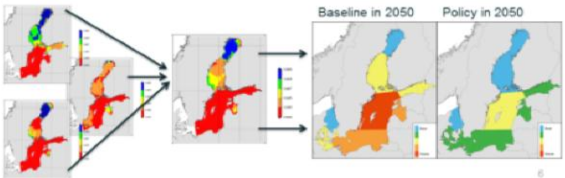


Policy change: What to value?

- Baseline: present water protection measures
- Policy: implementing the Baltic Sea Action Plan (HELCOM 2007)
- Time frame: 40 years

Impacts on ecosystem: Future state of the Baltic Sea

- Eutrophication in different basins
- Nutrient concentrations and chlorophyll-a
- Marine modelling and expert judgement



Impacts on human welfare: describing eutrophication

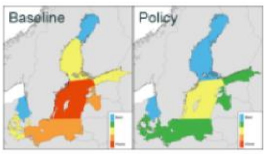
- Effect of reducing eutrophication on recreation and habitats
  - Recreation: blue-green algal blooms, water clarity, fish species composition
  - Habitats: state of underwater meadows, lack of oxygen in the sea bottom
- Who will be affected: citizens of coastal countries

Economic value of changes: Monetary benefits of reducing eutrophication

- Valuation method: contingent valuation
  - Survey-based
  - Captures also non-use values
  - Willingness to pay (WTP) for reducing eutrophication
- Implemented in 2011
- Identical questionnaires
- 10500 respondents

Economic value of changes: Describing eutrophication in the survey

- Understandable, meaningful and clear
- Five levels of eutrophication
- Verbal description and color-coded maps



Willingness to pay results

Country	Share willing to pay (%)	Mean WTP per year (€)	Adult population (in millions)	National WTP per year (M€)
Denmark	52	32	3.96	126
Estonia	52	24	0.99	24
Finland	63	42	3.62	151
Germany	54	25	68.32	1706
Latvia	48	5	1.69	9
Lithuania	50	9	2.52	22
Poland	53	12	24.62	299
Russia	31	8	81.47	693
Sweden	67	76	7.56	573
Total			194.75	3603

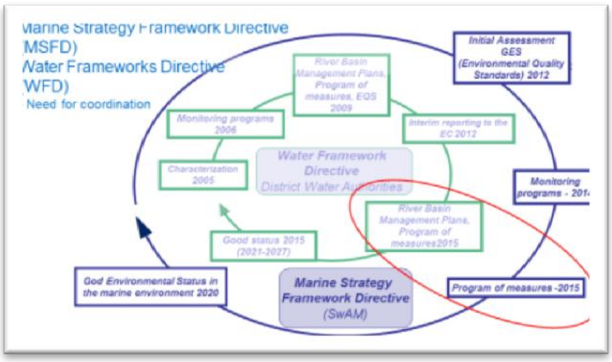
WTP = willingness to pay

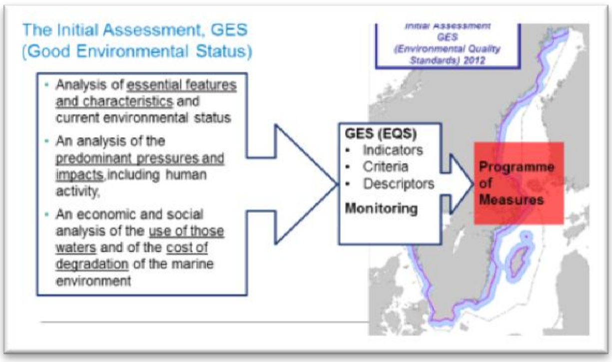
Conclusions

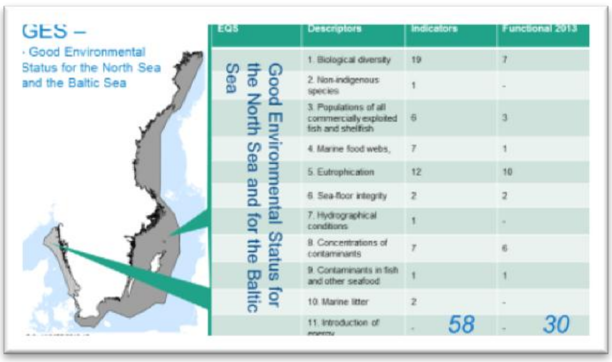
- Results useful in evaluating the economic efficiency of reducing eutrophication
  - Baltic Sea Action Plan
  - Marine Strategy Framework Directive
- Substantial benefits from reducing eutrophication → losses if nothing is done (costs of inaction)
- Benefits unevenly distributed between countries

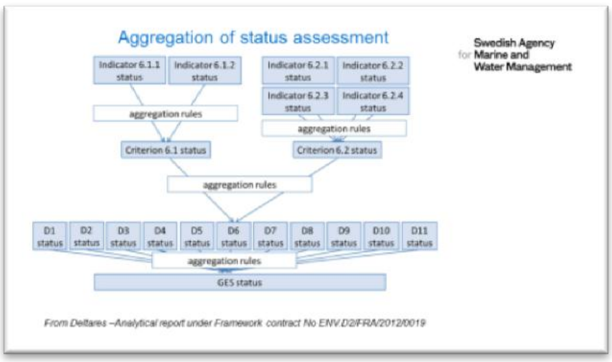
Mats Ivarsson, Swedish Agency for Marine and Water Management, Sweden
"Applying an ecosystem Services Approach on the EU Marine Strategy Framework Directive in Sweden"

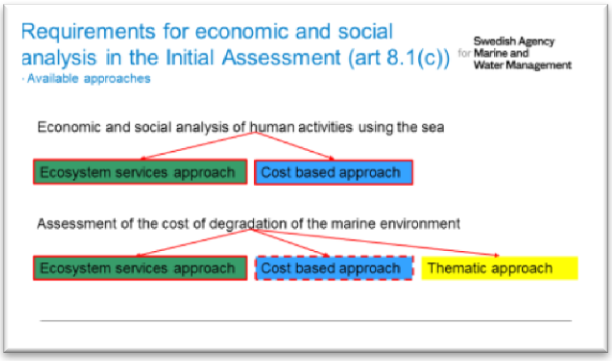
The EU Marine Strategy Framework runs in cycles of 6 years and starts out with an initial assessment. Monitoring programs and measures are under development and will be finalized in 2015. The objective is to reach a good environmental status by 2020. The initial assessment contains the following basic elements: the analysis of the current environmental status, the pressures, the use of the waters and the cost of degradation. There are different standards for "good environmental status". For each of these, there are descriptors, such as biodiversity and eutrophication. Requirements for the economic and social analysis: human activities using the sea (the ecosystem services approach and marine water accounts used) and the cost of degradation of the marine environment (ecosystem services approach, marine water accounts, and thematic approach used). When using the water accounts approach we look at human activities using the sea: employment, turnover, manufacturing, transports, and fisheries. The ecosystem services approach is done according to the MA, activities are listed into groups that represent the same dependencies and pressures, such as fisheries and aquaculture. Looking at the impacts is more difficult. The activity can impact supporting, regulating, provisioning and cultural services, and at the end the picture is very complex. For the in-depth study of the cost of degradation, three ecosystem services are chosen: biodiversity, eutrophication and scenery.

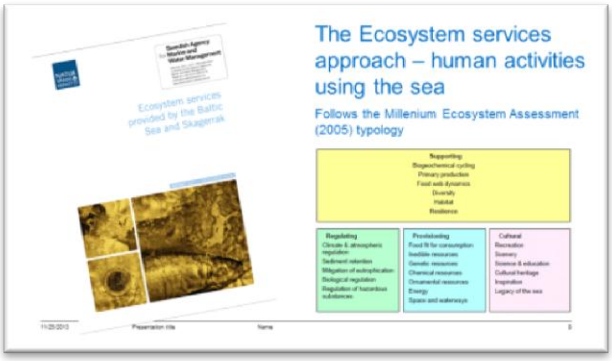


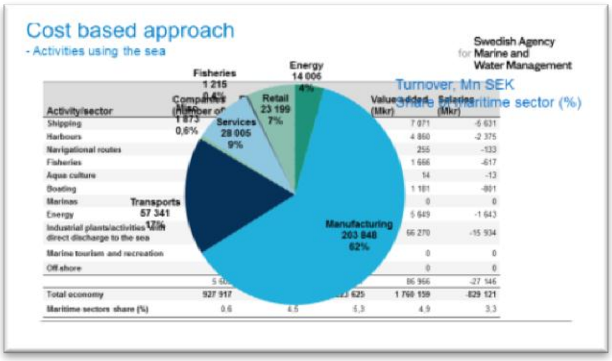


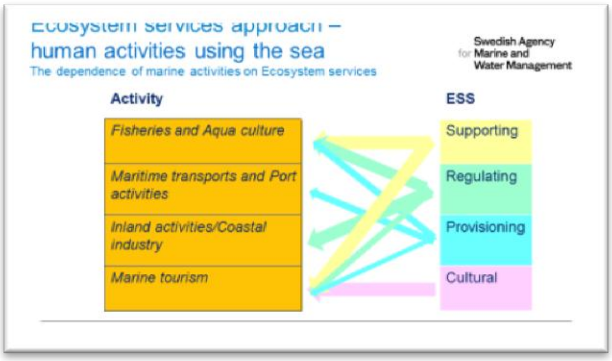


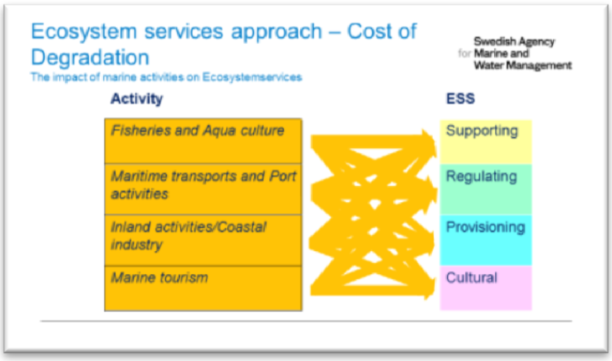


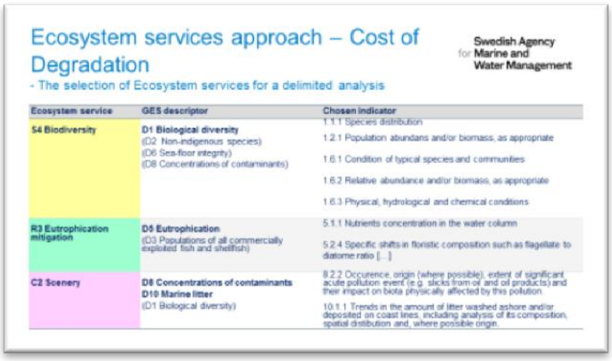

Requirements for economic and social analysis in the Initial Assessment (art 8.1(c))
- Available approaches
Swedish Agency for Marine and Water Management
Economic and social analysis of human activities using the sea
Ecosystem services approach
Cost based approach
Assessment of the cost of degradation of the marine environment
Ecosystem services approach
Cost based approach
Thematic approach

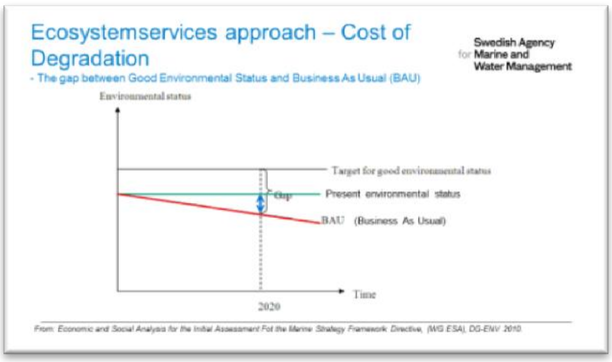

The Ecosystem services approach – human activities using the sea
Follows the Millenium Ecosystem Assessment (2005) typology
Supporting
Regulating
Provisioning
Cultural

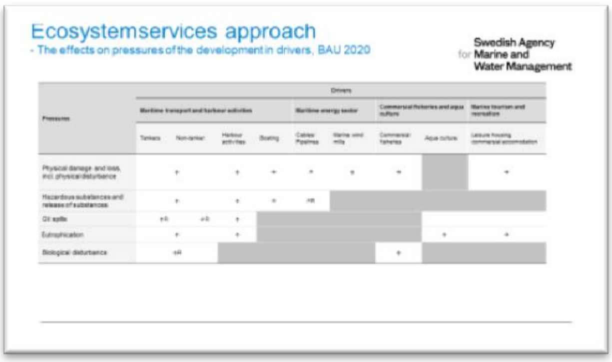

Cost based approach
- Activities using the sea
Swedish Agency for Marine and Water Management
Turnover, Mn SEK
Fisheries 1 215
Energy 14 006 4%
Retail 23 199 7%
Services 28 005 9%
Transports 57 341
Manufacturing 203 848 62%
Activity/sector
Shipping
Harbours
Navigational routes
Fisheries
Aqua culture
Boating
Marinas
Energy
Industrial plants/activities with direct discharge to the sea
Marine tourism and recreation
Off shore
Total economy
Maritime sectors share (%)

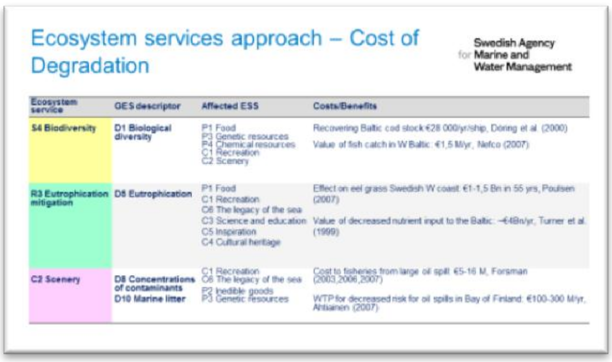

Ecosystem services approach – human activities using the sea
The dependence of marine activities on Ecosystem services
Swedish Agency for Marine and Water Management
Activity
ESS
Fisheries and Aqua culture
Maritime transports and Port activities
Inland activities/Coastal industry
Marine tourism
Supporting
Regulating
Provisioning
Cultural


Ecosystem services approach – Cost of Degradation
The impact of marine activities on Ecosystemservices
Swedish Agency for Marine and Water Management
Activity
ESS
Fisheries and Aqua culture
Maritime transports and Port activities
Inland activities/Coastal industry
Marine tourism
Supporting
Regulating
Provisioning
Cultural


Ecosystem services approach – Cost of Degradation
- The selection of Ecosystem services for a delimited analysis
Swedish Agency for Marine and Water Management
Ecosystem service
GES descriptor
Chosen indicator
S4 Biodiversity
D1 Biological diversity
(D2 Non-indigenous species)
(D6 Sea-floor integrity)
(D8 Concentrations of contaminants)
1.1.1 Species distribution
1.2.1 Population abundans and/or biomass, as appropriate
1.6.1 Condition of typical species and communities
1.6.2 Relative abundance and/or biomass, as appropriate
1.6.3 Physical, hydrological and chemical conditions
R3 Eutrophication mitigation
D5 Eutrophication
(D3 Populations of all commercially exploited fish and shellfish)
5.1.1 Nutrients concentration in the water column
5.2.4 Specific shifts in floristic composition such as flagellate to diatome ratio [...]
C2 Scenery
D8 Concentrations of contaminants
D10 Marine litter
(D1 Biological diversity)
8.2.2 Occurence, origin (where possible), extent of significant acute pollution event (e.g. slicks from oil and oil products) and their impact on biota physically affected by this pollution
10.1.1 Trends in the amount of litter washed ashore and/or deposited on coast lines, including analysis of its composition, spatial distibution and, where possible origin


Ecosystemservices approach – Cost of Degradation
- The gap between Good Environmental Status and Business As Usual (BAU)
Swedish Agency for Marine and Water Management
Environmental status
Target for good environmental status
Gap
Present environmental status
BAU (Business As Usual)
Time
2020
From: Economic and Social Analysis for the Initial Assessment For the Marine Strategy Framework Directive, (WG ESA), DG-ENV 2010

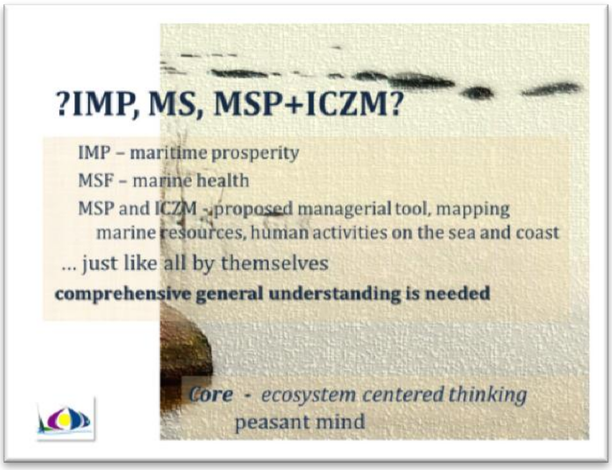

Ecosystemservices approach
- The effects on pressures of the development in drivers, BAU 2020
Swedish Agency for Marine and Water Management

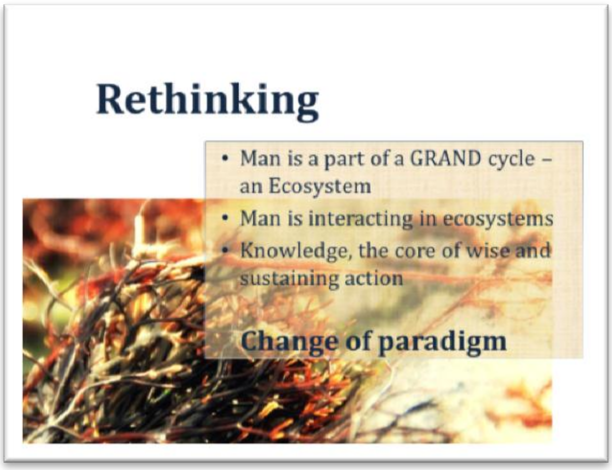

Ecosystem services approach – Cost of Degradation
Swedish Agency for Marine and Water Management
Ecosystem service
GES descriptor
Affected ESS
Costs/Benefits
S4 Biodiversity
D1 Biological diversity
P1 Food
P3 Genetic resources
P4 Chemical resources
C1 Recreation
C2 Scenery
Recovering Baltic cod stock €28 000/yr/ship, Döring et al. (2000)
Value of fish catch in W Baltic: €1,5 M/yr, Nefco (2007)
R3 Eutrophication mitigation
D5 Eutrophication
P1 Food
C1 Recreation
C6 The legacy of the sea
C3 Science and education
C5 Inspiration
C4 Cultural heritage
Effect on eel grass Swedish W coast: €1-1,5 Bn in 55 yrs, Poulsen (2007)
Value of decreased nutrient input to the Baltic: ~€4Bn/yr, Turner et al. (1999)
C2 Scenery
D8 Concentrations of contaminants
D10 Marine litter
C1 Recreation
C6 The legacy of the sea
P2 Inedible goods
P3 Genetic resources
Cost to fisheries from large oil spill: €5-16 M, Forsman (2003,2006,2007)
WTP for decreased risk for oil spills in Bay of Finland: €100-300 M/yr, Ahtiainen (2007)

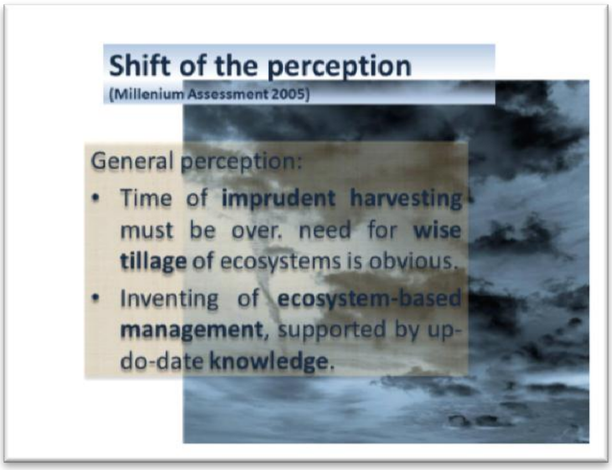

Swedish Agency for Marine and Water Management
Thanks for your attention!
Mats Ivarsson
mats.ivarsson@havochvatten.se

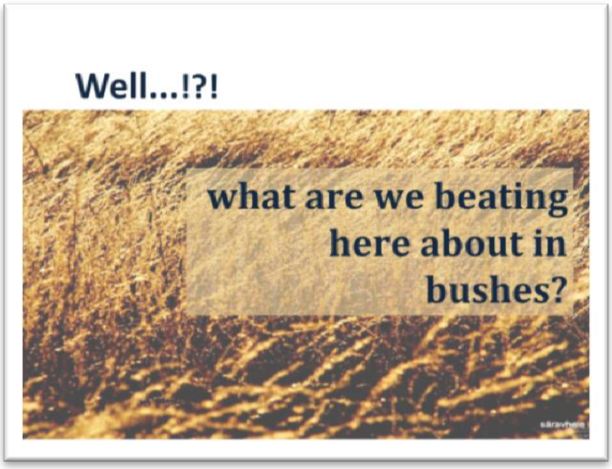
Silver Vahtra, Ministry of Environment, Estonia
"Ecosystem services valuation in context of the HELCOM BSAP implementation"

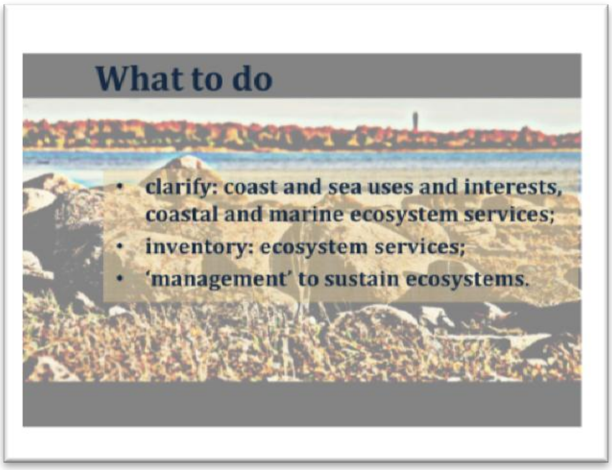
Today's situation in the Baltic Sea area is a mess because different authorities are dealing with the same environment but they are completely separate from each other. There is some knowledge that land ecosystems provide benefits but the same insights are needed for the sea. Nature and the benefits humans receive have been taken for granted. Comprehensive general understanding is needed. Different authorities are dealing with the environment but in different ways. The time has come for ecosystem services management. There is a need to clarify the interests and uses of coastal and marine ecosystem services. Marine ecosystem services need to be inventoried before they can be managed. There is a need for a common understanding and common language. Knowing which values to manage is also important. Valuing ecosystem services provides a tool for smart management.








Well...!?!
what are we beating here about in bushes?

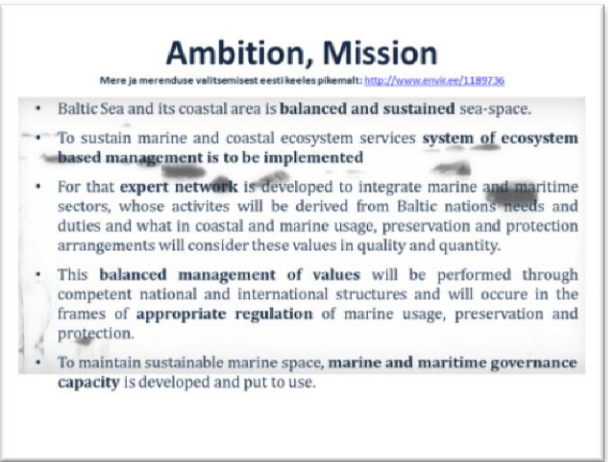

What to do
clarify: coast and sea uses and interests, coastal and marine ecosystem services;
inventory: ecosystem services;
'management' to sustain ecosystems.


Accounting of (marine) ecosystem services
Target is: preserving sustainability and health of ecosystems ……. happy life of a Man

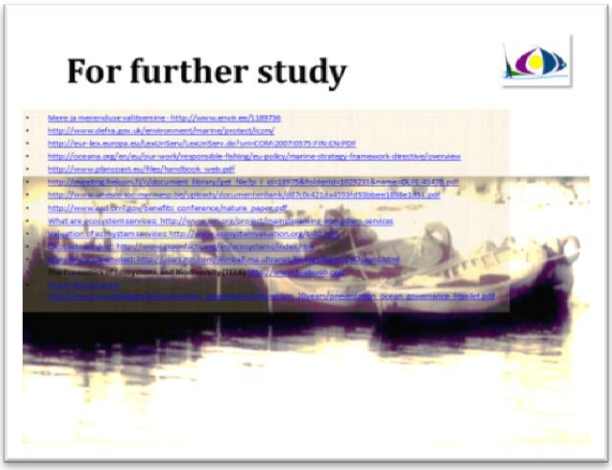

Ecosystems (incl. Marine ecosystems) offer
Provisioning service like food – fishstock, shrimps, algae, etc;
Regulation services as climate that seas are directly forming;
Cultural service – vacation, aestetic influence, etc;
Supporting services – as foodchain performance through ecosystem, etc.


inherent
inventing services valuation demand for an agreement and 'common language'
use of services provide assets for preservation and protection
for balanced management purposes, ecosystem services need valuation


inherent 2
ecosystem services have qualitative and quantitative meaning/value
valuation provide traceability
valuation enable/require a management
management enable/require system

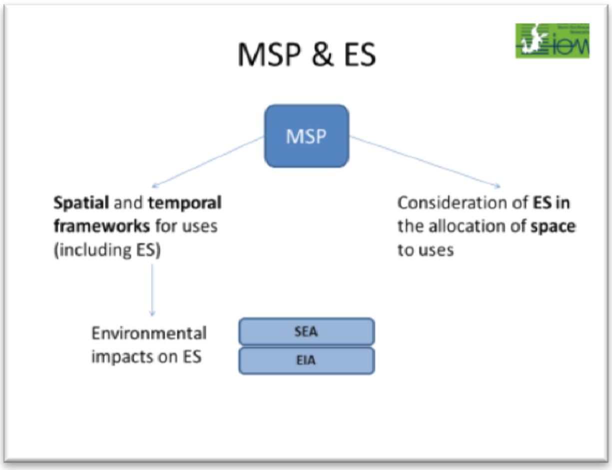

Ambition, Mission
Mere ja merenduse valitsemisest eesti keeles pikemalt: http://www.envir.ee/1189736
Baltic Sea and its coastal area is balanced and sustained sea-space.
To sustain marine and coastal ecosystem services system of ecosystem based management is to be implemented
For that expert network is developed to integrate marine and maritime sectors, whose activites will be derived from Baltic nations needs and duties and what in coastal and marine usage, preservation and protection arrangements will consider these values in quality and quantity.
This balanced management of values will be performed through competent national and international structures and will occure in the frames of appropriate regulation of marine usage, preservation and protection.
To maintain sustainable marine space, marine and maritime governance capacity is developed and put to use.


For what, for whom!

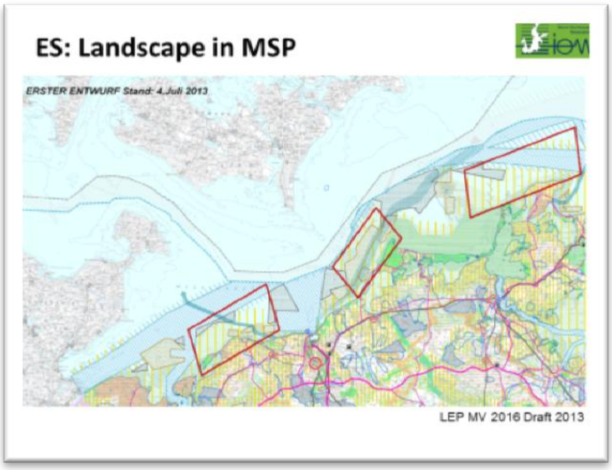


Holger Janssen, HELCOM/VASAB MSP, Germany
"Use of ecosystem valuation in marine spatial planning"

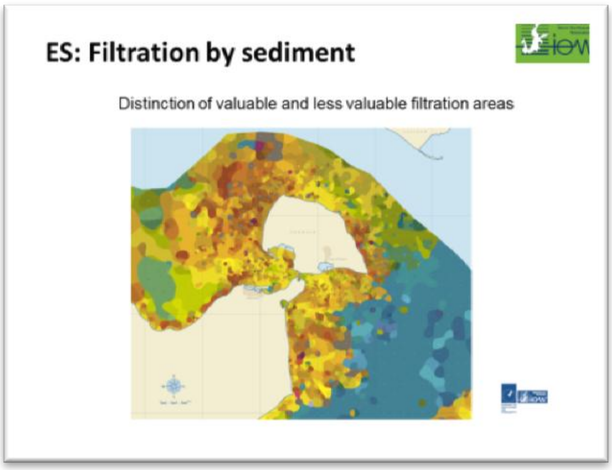
Spatial planning is a mechanism that helps allocate space. By applying good marine spatial planning (MSP) the impact from different activities on the ecosystem services can be limited. To do this, high quality data is needed. It is relatively easy to use spatial planning for things such as wind farms – people do not want wind farms to disturb their view. It is important to consider what is in the background, balancing users against ecosystem services and being specific with what one is dealing with. What does marine spatial planning (MSP) have to do with ecosystem services? It's a compromise between the use and the status of the ecosystem services. There are tools that can be used to limit the impact on the marine environment (e.g. EIA, SEA), but they are not perfect. It is necessary to balance the users against the ecosystem services. HELCOM and VASAB have agreed on MSP principles that are all related to ecosystem services in some way. Complex examples for MSP include filtration by sediment and spawning. Sedimentation can be valuable for coastal protection. Spawning areas are not part of the common fisheries policy. MSP can be used to limit activity during the spring when these areas are very sensitive. It is important to find the most valuable areas, and also ecosystem services that move around can be an element of MSAP. Information about ecosystem services and the quality of them in both time and place is important in order to integrate ecosystem services into MSP. Monetary values can be important but they are not necessary for MSP. It is important to have good arguments for court. Everything is not about the exact monetary values, but more broadly about human wellbeing.

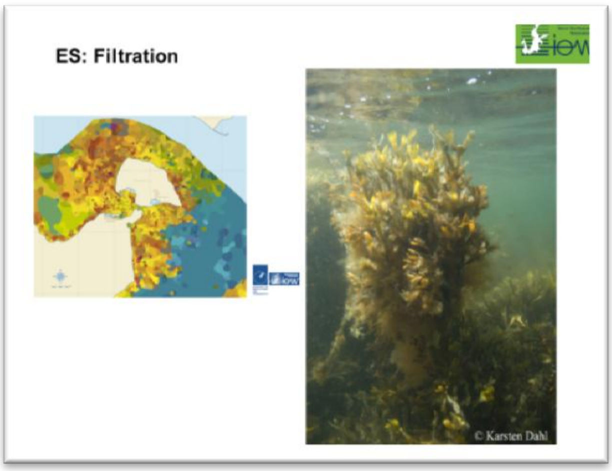

MSP & ES
MSP
Spatial and temporal frameworks for uses (including ES)
Consideration of ES in the allocation of space to uses
Environmental impacts on ES
SEA
EIA

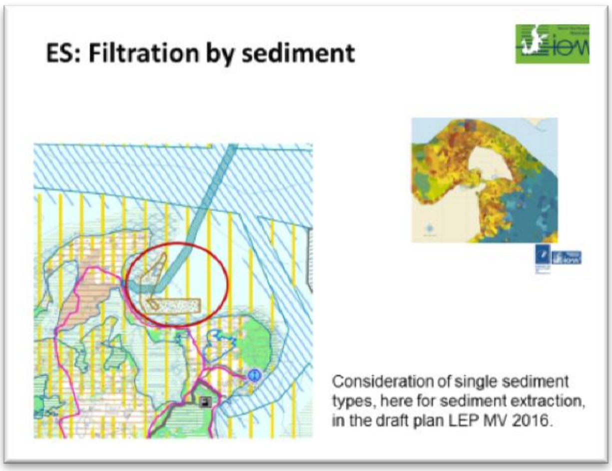

Baltic broad scale MSP principles
VASAB
1. Sustainable management
2. Ecosystem approach
3. Long term perspective and objectives
4. Precautionary Principle
5. Participation and Transparency
6. High quality data and information basis
7. Transnational coordination and consultation
8. Coherent terrestrial and maritime spatial planning
9. Planning adapted to characteristics and special conditions at different areas
10. Continuous planning

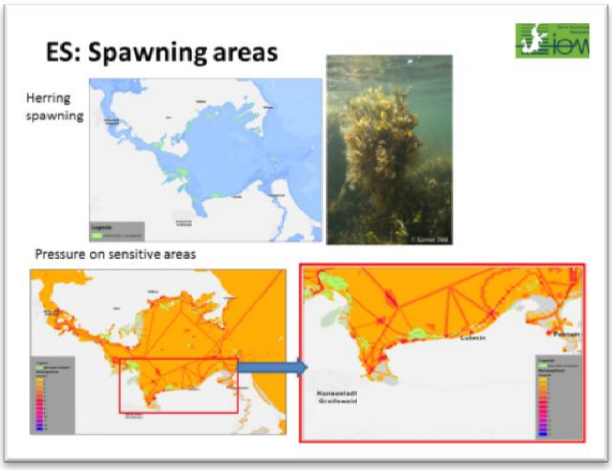

ES: Landscape in MSP
ERSTER ENTWURF Stand: 4.Juli 2013
LEP MV 2016 Draft 2013

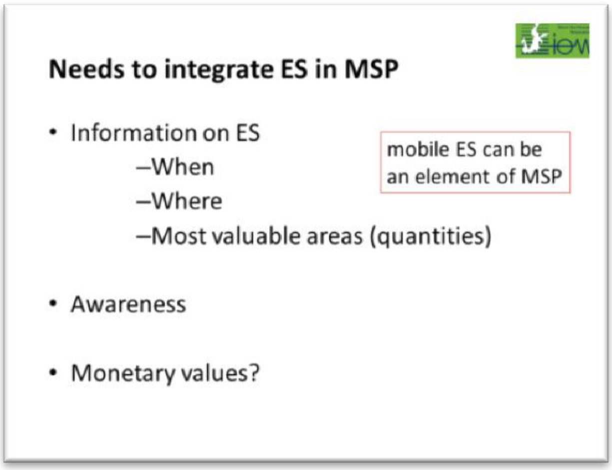

ES: Filtration by sediment
Sediment as water treatment

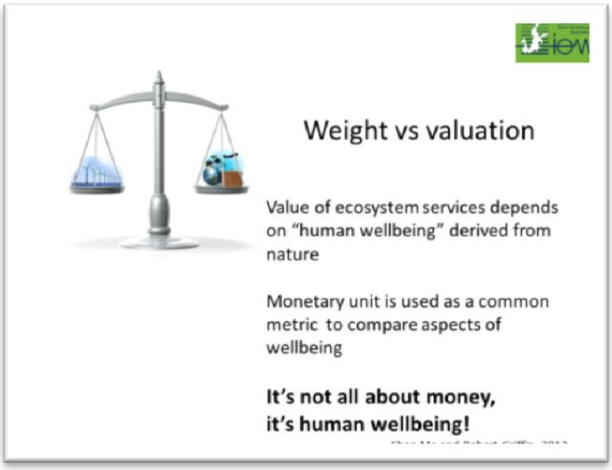

ES: Filtration by sediment
Distinction of valuable and less valuable filtration areas

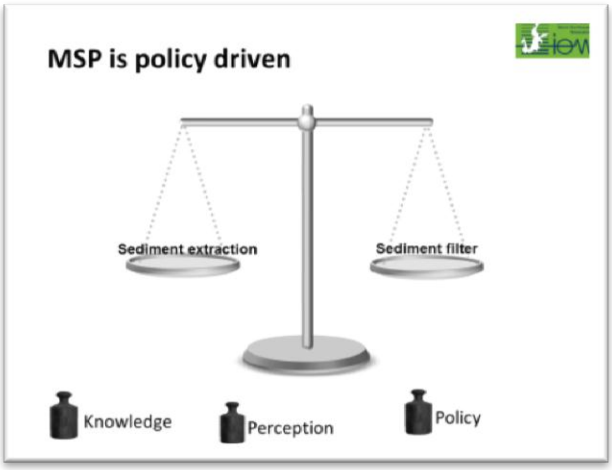

ES: Filtration
© Karsten Dahl


ES: Filtration by sediment
Consideration of single sediment types, here for sediment extraction, in the draft plan LEP MV 2016.


ES: Spawning areas
Herring spawning
Pressure on sensitive areas


Needs to integrate ES in MSP
• Information on ES
–When
–Where
–Most valuable areas (quantities)
mobile ES can be an element of MSP
• Awareness
• Monetary values?

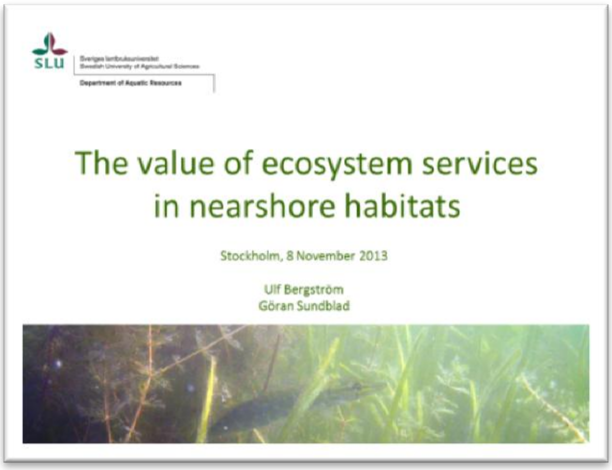

Weight vs valuation
Value of ecosystem services depends on "human wellbeing" derived from nature
Monetary unit is used as a common metric to compare aspects of wellbeing
It's not all about money, it's human wellbeing!

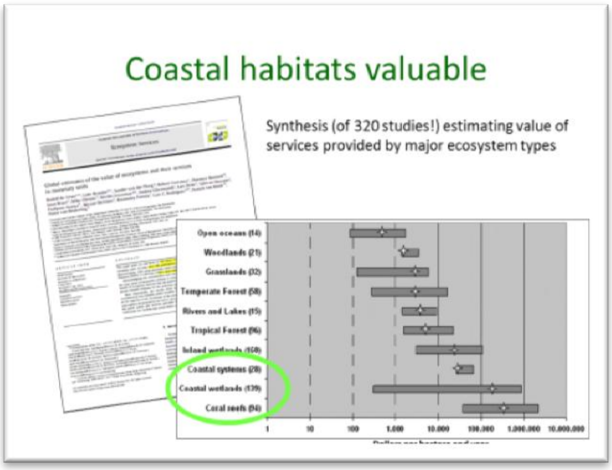

MSP is policy driven
Sediment extraction
Sediment filter
Knowledge
Perception
Policy

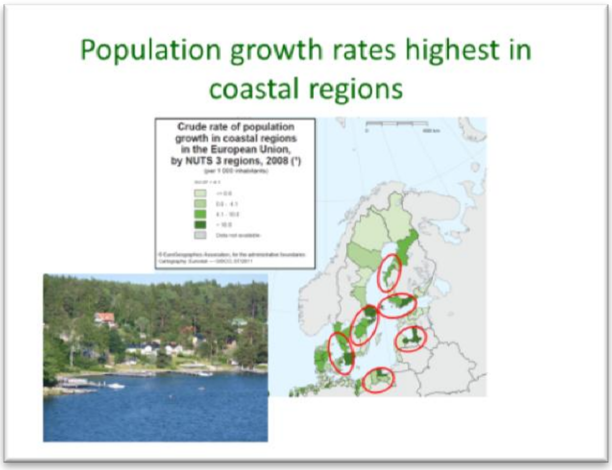

Holger Janßen
Leibniz Institute for Baltic Sea Research (IOW)
holger.janssen@io-warnemuende.de
Phone: +49 381 5197 469
Fax: +49 381 5197 211

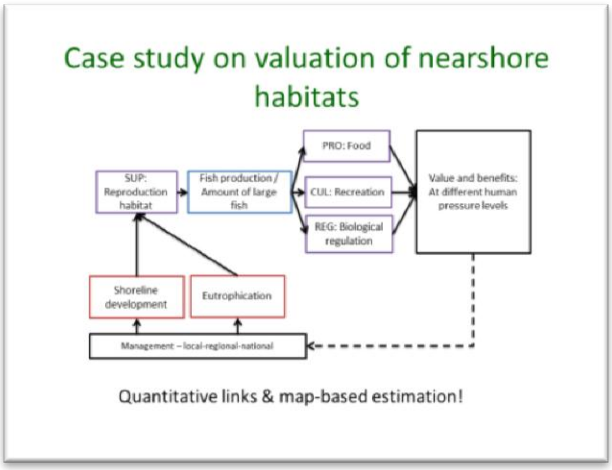
Ulf Bergström, SLU Sweden
"The value of ecosystem services in nearshore habitats"

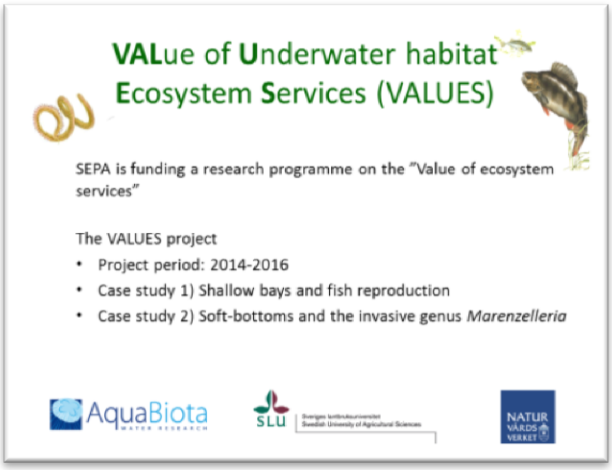
A synthesis based on 320 studies estimating the value of services provided by major ecosystem types showed that coastal systems, coastal wetlands and coral reefs provide the most value. There is a huge population growth in coastal areas also in the Baltic Sea. Coastal development comes at a cost: harbor and dredging lead to habitat degradation. Today 40-50% of the coastal habitats have developments. The rate of construction is 0.5-1% exploitation of habitat each year. There are maps of these habitats but the effects that human activities have on these habitats need to be quantified. A Swedish EPA funded research programme on the value of ecosystem services tries to evaluate the monetary costs when ecosystem services are lost. The focus lies on eutrophication and shoreline development aiming to find quantitative links and producing maps that later can be used in spatial planning. The correlation between habitats and fish production is clear – lots of habitats means lots of fish. There are also studies showing how human pressure affects the habitat of these fishes, some species gain from clear water such as perch, but pike prefers murky waters. The control of algae is very important in the Baltic Sea.



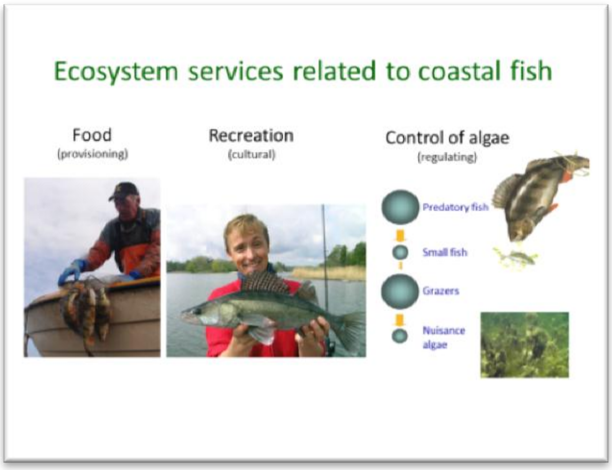


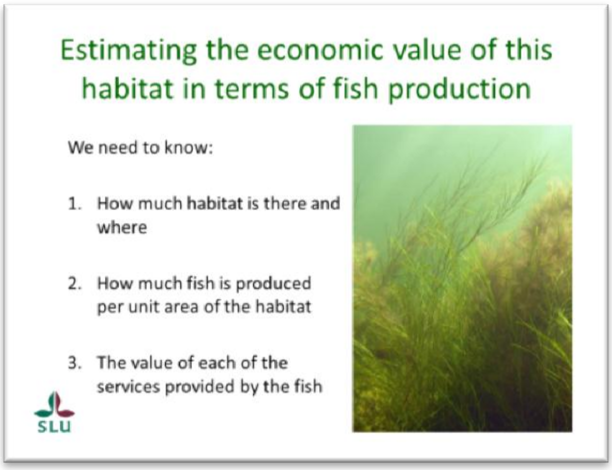


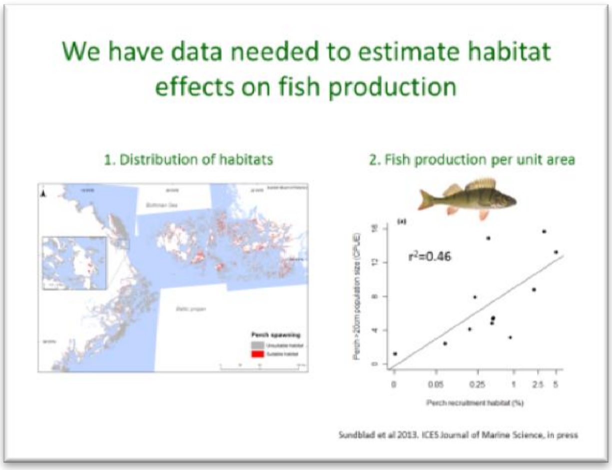

Case study on valuation of nearshore habitats
PRO: Food
SUP: Reproduction habitat
Fish production / Amount of large fish
CUL: Recreation
Value and benefits: At different human pressure levels
REG: Biological regulation
Shoreline development
Eutrophication
Management – local-regional-national
Quantitative links & map-based estimation!

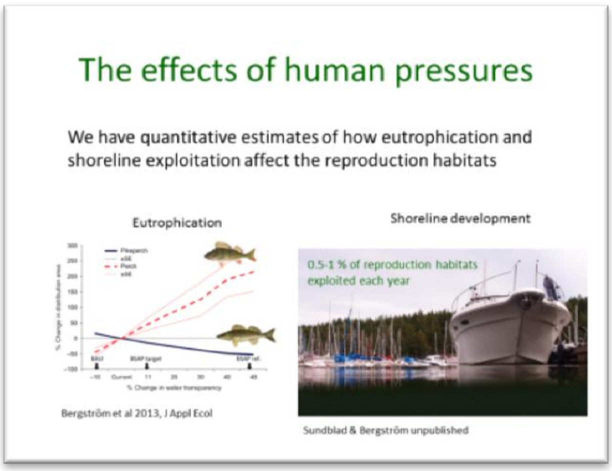

VALue of Underwater habitat Ecosystem Services (VALUES)
SEPA is funding a research programme on the "Value of ecosystem services"
The VALUES project
• Project period: 2014-2016
• Case study 1) Shallow bays and fish reproduction
• Case study 2) Soft-bottoms and the invasive genus Marenzelleria
AquaBiota
SLU
NATUR VÅRDS VERKET

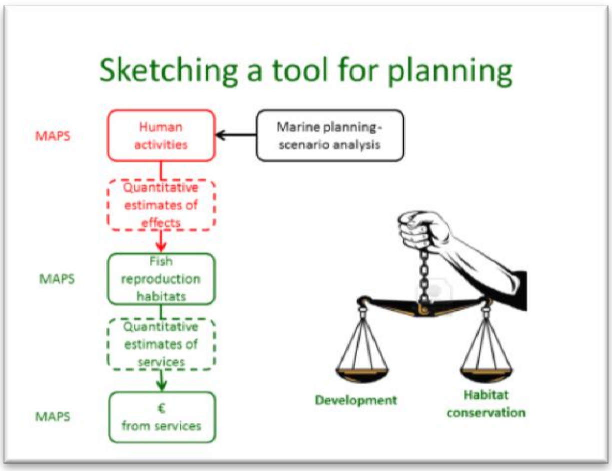

The nearshore habitat
Photo: Lena Bergström


Ecosystem services related to coastal fish
Food
(provisioning)
Recreation
(cultural)
Control of algae
(regulating)
Predatory fish
Small fish
Grazers
Nuisance algae


Estimating the economic value of this habitat in terms of fish production
We need to know:
1. How much habitat is there and where
2. How much fish is produced per unit area of the habitat
3. The value of each of the services provided by the fish
SLU


We have data needed to estimate habitat effects on fish production
1. Distribution of habitats
2. Fish production per unit area
r²=0.46
Sundblad et al 2013, ICES Journal of Marine Science, in press


The effects of human pressures
We have quantitative estimates of how eutrophication and shoreline exploitation affect the reproduction habitats
Eutrophication
Shoreline development
0.5-1 % of reproduction habitats exploited each year
Bergström et al 2013, J Appl Ecol
Sundblad & Bergström unpublished


Sketching a tool for planning
MAPS
Human activities
Marine planning - scenario analysis
Quantitative estimates of effects
MAPS
Fish reproduction habitats
Quantitative estimates of services
MAPS
€ from services
Development
Habitat conservation


Thank you!
SLU

Attachment 1. Final Agenda of the Regional Workshop on the valuation of marine and coastal ecosystem services in the Baltic Sea, 7-8 November 2013

Venue: Hallvarsson & Halvarsson, Sveavägen 20, Stockholm, Sweden

7 November 2013, Thursday	
09.30-10.00	• ***Coffee and sandwich***
10.00-10.25	***Opening and welcome***
	Ecosystem services and ecosystem-based management of the Baltic Sea – *Monika Stankiewicz, Executive Secretary, Helsinki Commission - HELCOM* – *Lisa Emelia Svensson, Ambassador for Ocean, Seas and Fresh water, Ministry of the Environment, Sweden* – *Marcus C Öhman, Associate Professor, Stockholm Resilience Centre, Sweden*
10.25-11.30	***Defining the concept*** *(Marcus C Öhman, SRC)*
10.25-10.40	**Valuation of ecosystem services: terminology, methodologies and approaches** – *Linus Hasselström, Enveco Environmental Economics Consultancy, Sweden*
10.40-10.55	**Making the value of ecosystem services visible** – *Maria Schultz, Stockholm Resilience Centre, Sweden*
10.55-11.10	**Human welfare targets** – *Ilke Tilders, FOS Europe, Netherlands*
11.10-11.30	**Questions and discussion**
11.30-12.30	• ***Lunch***
12.30-13.30	***The global perspective on ecosystem services*** *(Mikhail Durkin, HELCOM)*
12.30-12.45	**Global perspectives on valuation of coastal and marine ecosystem services - key insights from TEEB Nordic** – *Marianne Kettunen, TEEB Nordic, IEEP, Finland*
12.45-13.00	**UNEP Regional Seas; examples from other areas** – *Alberto Pacheco Capella, UNEP Regional Seas Programme, UNEP HQ, Kenya*
13.00-13.15	**TEEB Oceans and Coasts** – *Christian Neumann, GRID-Arendal, Norway*
13.15-13.30	**Questions and discussion**
13.30-15.30	***The Baltic Sea region and ecosystem services*** *(Mikhail Durkin, HELCOM)*
13.30-13.45	**The Baltic Sea and planetary boundaries** – *Marcus C Öhman, Stockholm Resilience Centre, SU, Sweden*
13.45-14.00	**Challenges of reaching a clean Baltic Sea** – *Fredrik Wulff, Baltic Sea Center, Sweden*
14.00-14.30	• ***Coffee-break***

14.30-14.45	**BalticSTERN: Ecosystem services and the Baltic Sea** – *Siv Ericsdotter and Kerstin Blyh, Stockholm Resilience Centre, SU, Sweden*
14.45-15.00	**Baltic Sea: Recreational and existence values** – *Heini Ahtiainen, MTT/HELCOM, Finland*
15.00-15.30	**Questions and discussion**
15.30-17.00	***Group discussion*** *(Jorid Hammersland, Ministry of the Environment, Sweden)*
15.30-16.30	**Monetary and non-monetary valuation of ecosystem services**
16.30-17.00	Presentation of group work outcomes
17.00-20.00	***Get together***

8 November 2013, Friday (09.00-14.00)	
09.00-10.20	***Ecosystem services and marine management*** *(Fredrik Moberg, SRC)*
09.00-09.15	**Applying an ecosystem services approach on the EU Marine Strategy Framework Directive in Sweden** – *Mats Ivarsson, Swedish Agency for Marine and Water Management, Sweden*
09.15-09.30	**Ecosystem services valuation in the context of the HELCOM-BSAP implementation** – *Silver Vahtra, Ministry of Environment, Estonia*
09.30-09.45	**Use of ecosystem valuation in Marine Spatial Planning** – *Holger Janßen, HELCOM/VASAB MSP, Germany*
09.45-10.00	**The value of ecosystem services in nearshore habitats** – *Ulf Bergström, Swedish University of Agricultural Science, Sweden*
10.00-10.20	**Questions and discussion**
10.20-10.40	• ***Coffee-break***
10.40-12.00	***Group discussion*** *(Jorid Hammersland, Ministry of the Environment, Sweden)*
10.40-11.40	**Valuation of ecosystem services in the Baltic Sea: way forward – what is needed?**
11.40-12.00	Quick presentation of group work outcomes
12.00-13.00	• ***Lunch***
13.00-14.00	***Panel discussion*** *(Ottilia Thoreson, WWF Baltic Programme)*
	Where do we go from here? – *Andris Andrusaitis, BONUS Joint Baltic Sea research and development programme* – *Alberto Pacheco Capella, UNEP Regional Seas Programme* – *Mathias Bergman, Baltic Sea Action Group* – *Monika Stankiewicz, HELCOM* – *Sulev Nômmann, SEI Tallinn*
14.00-14.15	***Concluding remarks*** *Stefan Berggren, Marine and Water Director, Ministry of the Environment, Sweden*

Attachment 2. List of Participants

PARTICIPANTS		
Name	**Institution**	**Email**
1. Jesper Adolfsson	County Administrative Board of Västra Götaland	jesper.adolfsson@lansstyrelsen.se
2. Heini Ahtiainen	HELCOM/MTT Agrifood Research Finland	heini.ahtiainen@helcom.fi
3. Gustaf Almqvist	Coalition Clean Baltic	gustaf.almqvist@ccb.se
4. Magnus Andersson	Nordic Investment Bank	magnus.andersson@nib.int
5. Andris Andrusaitis	BONUS Joint Baltic Sea research and development programme	andris.andrusaitis@bonuseeig.fi
6. Mathias Bergman	Baltic Sea Action Group	mathias.bergman@bsag.fi
7. Ulf Bergström	Swedish University of Agricultural Science	ulf.bergstrom@slu.se
8. Paula Biveson	Baltic Sea Action Group	paula.biveson@bsag.fi
9. Kerstin Blyh	Stockholm Resilience Centre	kerstin.blyh@stockholmresilience.su.se
10. Ellen Bruno	Swedish Society for Nature Conservation	ellen.bruno@naturskyddsforeningen.se
11. Alberto Pacheco Capella	UNEP Regional Seas Programme	alberto.pacheco@unep.org
12. Jonas Dahl	Kristianstads Vattenrike Biosphere Reserve	jonas.dahl@kristianstad.se
13. Mikhail Durkin	HELCOM	mikhail.durkin@helcom.fi
14. Anna Ehn	Skärgårdsstiftelsen	anna.ehn@skargardsstiftelsen.se
15. Tina Elfwing	Baltic Sea Centre	tina.elfwing@su.se
16. Beate Ellingsen	Norwegian Ministry of the Environment	bel@md.dep.no
17. Ylva Engwall	Swedish Agency Marine and Water Management	ylva.engwall@havochvatten.se
18. Siv Ericsdotter	Stockholm Resilience Centre	siv.ericsdotter@stockholmresilience.su.se
19. Bengt Fjällborg	Swedish Agency Marine and Water Management	bengt.fjallborg@havochvatten.se
20. Peter Funegård	Swedish Agency Marine and Water Management	peter.funegard@havochvatten.se
21. Alice Guittard	University of Montpellier	al.guittard@gmail.com
22. Bo Gustafsson	Baltic Nest Institute	bo.gustafsson@su.se
23. Jacob Hagberg	Baltic Sea 2020	jacob.hagberg@balticsea2020.org
24. Åke Hagström	Swedish Institute for the Marine Environment (SIME)	ake.hagstrom@havsmiljoinstitutet.se

25. Jorid Hammersland	Ministry of Environment - Sweden	jorid.hammersland@regeringskansliet.se
26. Joakim Hansen	Baltic Sea Centre	joakim.hansen@su.se
27. Linus Hasselström	Enveco	linus@enveco.se
28. Jon Havenhand	University of Gothenburg	jon.havenhand@marecol.gu.se
29. Mats Ivarsson	Swedish Agency Marine and Water Management	mats.ivarsson@havochvatten.se
30. Barbara Jackson	Zennstrom Philanthropies	barbara@raceforthebaltic.com
31. Holger Janßen	Leibniz-Institut für Ostseeforschung Warnemünde	holger.janssen@io-warnemuende.de
32. Joacim Johannesson	Swedish Agency for Marine and Water Management	Joacim.johannesson@havochvatten.se
33. Sif Johansson	MISTRA	sif.johansson@eviem.se
34. Stanislovas Jonusas	European Commission	stanislovas.jonusas@ec.europa.eu
35. Gunnar Karltorp	Ministry of Environment - Sweden	gunnar.karltorp@regeringskansliet.se
36. Marianne Kettunen	TEEB Nordic	mkettunen@ieep.eu
37. Nada Krstulovic	Institute of Oceanography and Fisheries	Krstulovic@izor.hr
38. Linda Kumblad	Baltic Sea 2020	linda.kumblad@balticsea2020.org
39. Andrey Lappo	Research and Design Institute of Urban Development	niipgrad@niipgrad.spb.ru
40. Allan Larsson	Forum Östersjön	allanlarsson@telia.com
41. Sebastian Linke	University of Gothenburg	sebastian.linke@sts.gu.se
42. Pauli Merriman	WWF Baltic Ecoregion Programme	pauli.merriman@wwf.se
43. Anja Müller	Universität zu Kiel	amueller@ecology.uni-kiel.de>
44. Andrea Morf	Swedish Institute of the Marine Environment	andrea.morf@havsmiljoinstitutet.se
45. Christian Neumann	Grid Arendal	christian.neumann@grida.no
46. Sulev Nômmann	SEI Tallinn	sulev.nommann@seit.ee
47. Tea Nõmmann	SEI Tallinn	tea.nommann@seit.ee
48. Alf Norkko	University of Helsinki	alf.norkko@helsinki.fi
49. Joanna Norkko	University of Helsinki	joanna.norkko@helsinki.fi

50. Lotta Nygård	County Administrative Board of Västernorrland	lotta.nygard@lansstyrelsen.se
51. Anja Nysten	NEFCO	anja.nysten@nefco.fi
52. Antonia Nyström Sandman	AquaBiota Water Research	antonia.sandman@aquabiota.se
53. Kristine Pakalniete	AKTiiVS	kristinepa@apollo.lv
54. Dean Pearson	DEFRA	dean.pearson@defra.gsi.gov.uk
55. Peter Pierrou	Oceana	ppierrou@oceana.org
56. Liisa Pietola	Central Union Agricult. Prod. and Forest Owners (MTK)	liisa.pietola@mtk.fi
57. Marjukka Porvari	John Nurminen Foundation - Clean Baltic	marjukka.porvari@jnfoundation.fi
58. Caroline von Post	Albaeco	caroline@stormiepoodle.se
59. Soile Oinonen	Finnish Environment Institute	soile.m.oinonen@ymparisto.fi
60. Marko Reinikainen	Tvärminne Zoologiska Station	marko.j.reinikainen@helsinki.fi
61. Ida Reuterswärd	Ministry of Environment - Sweden	ida_reutersward@yahoo.se
62. Isabelle Romedahl	Swedish Society for Nature Conservation	isabelle.romedahl@hotmail.com
63. Mattias Rust	WWF	mattias.rust@wwf.se
64. Jan Schmidtbauer Crona	Swedish Agency for Marine and Water Management	jan.schmidtbauer.crona@havochvatten.se
65. Henrik Scharin	Swedish Environmental Protection Agency	henrik.scharin@naturvardsverket.se
66. Maria Schultz	Stockholm Resilience Centre	maria.schultz@stockholmresilience.su.se
67. Angela Schultz-Zehden	Informus	asz@sustainable-projects.eu
68. Pavel Spirin	Research and Design Institute of Urban Development	niipgrad@niipgrad.spb.ru
69. Monika Stankiewicz	HELCOM	monika.stankiewicz@helcom.fi
70. Göran Sundblad	AquaBiota Water Research	goran.sundblad@aquabiota.se
71. Lisa Emelia Svensson	Ministry of Environment - Sweden	lisa.svensson@regeringskansliet.se
72. Ottilia Thoreson	WWF Baltic Ecoregion Programme	ottilia.thoreson@wwf.se
73. Liene Tiesnese	Ministry of Environmental Protection and Regional Development - Latvia	liene.tiesnese@varam.gov.lv
74. Ilke Tilders	Foundations of Success - Europe	ilke@fosonline.org

75. Silver Vahtra	Ministry of Environment - Estonia	silver.vahtra@envir.ee
76. Wojciech Wawrzynski	International Council for the Exploration of the Sea	wojciech@ices.dk
77. John-Olof Vinterhav	Sida	john-olof.vinterhav@sida.se
78. Fredrik Wulff	Baltic Sea Centre	fredrik.wulff@su.se
79. Jacek Zaucha	Maritime Institute in Gdansk	jacek.zaucha@im.gda.pl
80. Tomasz Zarzycki	Uniwersytet Gdanski	ocetz@ug.edu.pl
81. Maria Åslund	Östergötland County Administrative Board	maria.aslund@lansstyrelsen.se
82. Marcus C Öhman	Stockholm Resilience Centre	marcus.ohman@stockholmresilience.su.se