Havs
och Vatten
myndigheten

Marine tourism and recreation in Sweden

A study for the Economic and Social Analysis of the Initial Assessment of the Marine Strategy Framework Directive

Havs- och vattenmyndighetens rapport 2012:2

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Foreword

The tourism sector currently accounts for a significant portion of the Swedish economy, specifically marine-related recreation and tourism. This report provides an overview of the activities that can be classified under marine recreation and tourism and how they depend upon and impact our marine ecosystems. The development of the environment in marine areas is crucial for the possibility of future generations to enjoy recreation in these areas. The report describes how various activities may be affected in the future, along with the values that represent the people and Sweden in general.

Within Europe, the efforts to implement new legislation around the marine environment have begun in earnest. In order to gather all maritime activities into a single framework, the EU has formulated a maritime strategy designed after three main directions: the Common Fisheries Policy, marine spatial planning, and common environmental legislation for the marine environment. The common environmental legislation has been formulated within the EU Marine Strategy Framework Directive (2008/56/EG) which was introduced into Swedish legislation through the Marine Environmental Regulation (SFS 2010:1341).

In Sweden, marine issues received a new home on 1 July 2011 with the creation of a new, central administrative authority, the Swedish Agency for Marine and Water Management. The new agency will use an integrated approach in working with issues pertaining to water, marine, and fisheries management. The introduction of the Marine Strategy Framework Directive (MSFD) in Sweden and the development of marine spatial planning will become central to operations in the coming years.

As a first step in Sweden's work with MSFD, an initial assessment of the marine environment's status has been conducted and assembled into "Good Environmental Status 2020 – Part 1: Initial Assessment of the State of the Environment and Socio-economic Analysis." As the name suggests, the assessment gives an overall picture of the current state of the environment. It also describes the socio-economic importance of the different activities and operations currently in progress in marine areas as well as the stresses they generate on the ecosystem.

The report "Marine Tourism and Recreation in Sweden" is an important part of the documentation produced by the Swedish Agency for Marine and Water Management for the initial assessment. The connection made in the report between tourism and recreation and related ecosystem services provides a good overview of the impact on the marine ecology while it illuminates the sea's importance to human activities such as recreation.

Mats Ivarsson, August 2012

Förord

Turistsektorn utgör idag en betydande andel av den svenska ekonomin med den rekreation och turism som sker på eller i anslutning till havet som en viktig komponent. Denna rapport ger en bild över de aktiviteter som kan sorteras in under begreppet *marin turism och rekreation* och hur de är beroende av, och samtidigt påverkar, ekosystemen i våra hav. Utvecklingen av miljön i havsområdena är avgörande för framtida generationers möjlighet till rekreation vid havet. I rapporten beskrivs hur olika aktiviteter kan komma att påverkas i framtiden tillsammans med de värden som detta representerar för människorna och Sverige i allmänhet.

I Europa har arbetet med att genomföra ny lagstiftning på havsmiljöområdet inletts på allvar. Med syfte att samla all maritim verksamhet i ett och samma ramverk har EU formulerat en maritim strategi som utformats efter tre huvudriktningar; gemensam fiskeripolitik, fysisk planering till havs samt gemensam miljölagstiftning för den marina miljön. Den gemensamma miljölagstiftningen har formulerats i Havsmiljödirektivet (2008/56/EG) som omsatts i svensk lag genom Havsmiljöförordningen (SFS 2010:1341).

I Sverige fick de marina frågorna en ny hemvist 1:e juli 2011 genom inrättandet av en ny central förvaltningsmyndighet, Havs- och vattenmyndigheten. Den nya myndigheten ska arbeta på ett integrerat sätt med vatten-, havs och fiskförvaltningsfrågor. Införandet av havsmiljödirektivet i Sverige, samt utvecklingen av den marina fysiska planeringen kommer att vara centrala delar av verksamheten under de kommande åren.

Som ett första steg i det svenska arbetet med Havsmiljödirektivet har en inledande bedömning av havsmiljöns tillstånd gjorts, God miljöstatus 2020 – Del 1: Inledande bedömning av miljötillståndet och socioekonomisk analys. Som namnet antyder ger den inledande bedömningen en bild av det nuvarande miljötillståndet. Den beskriver också den samhällsekonomiska betydelsen av olika aktiviteter och verksamheter som pågår i våra havsområden idag, samt den belastning på ekosystemen som nyttjandet ger upphov till.

Rapporten *Marine tourism and recreation in Sweden* är en viktig del i det underlag som tagits fram av Havs – och vattenmyndigheten för den inledande bedömningen. Kopplingen som görs i rapporten mellan turism och rekreation och berörda ekosystemtjänster ger en bra bild över påverkan på den marina ekologin samtidigt som den belyser havets betydelse för mänskliga aktiviteter som exempelvis rekreation.

Mats Ivarsson, augusti 2012

INNEHÅLL

0 Summary

This report provides input regarding the marine recreation and tourism components of the ecosystem service approach to the Economic and Social Analysis of the Initial Assessment of the EU Marine Strategy Framework Directive. The main content of the report is the following. See also Figure 0.1 for an illustration that also provides an interpretation of the report in terms of the Drivers-Pressure-State-Impact-Response (DPSIR) framework.

Chapter 1 presents the general methodology followed in the report. It also gives an introduction to Swedes' recreation in or at the sea.

Chapter 2 presents a number of definitions related to marine recreation and tourism. Six sectors of marine tourism are identified:

A. Cruise-ship traffic in marine waters
B. International passenger ferry traffic in marine waters
C. National passenger ferry traffic in marine waters
D. Other commercial passenger transportation in marine waters
E. Leisure boating in marine waters
F. Holiday housing associated with marine recreation
G. Commercial accommodation (e.g. hotels, camping sites, etc.) associated with marine recreation
H. Same-day visits associated with marine recreation

For sectors A-E, the connection to marine waters is unambiguous since the activities in these sectors take place *in* marine waters. Sectors F-H have a less direct connection but are still relevant to include because a substantial proportion of these sectors is likely to depend on the enjoyment of marine recreation. However, including sectors F-H requires a reasonable and objective delimitation of these sectors. It was chosen to use two alternative geographical definitions for these sectors; one (called MAX) that is likely to result in an overestimate of the sectors in relation to their association with marine recreation and one (called MIN) that is likely to result in an underestimate. The MAX definition is to include those parts of sectors F-H which are located in Swedish coastal municipalities or on islands in marine waters. The MIN definition is to include those parts of sectors F-H which are located in sub-drainage basins that drain directly into coastal or transitional water bodies (typology from the Water Framework Directive, 2000/60/EG) (*delavrinningsområden som avvattnas direkt till kustvattenförekomster eller övergångsvatten*) or on islands in marine waters.

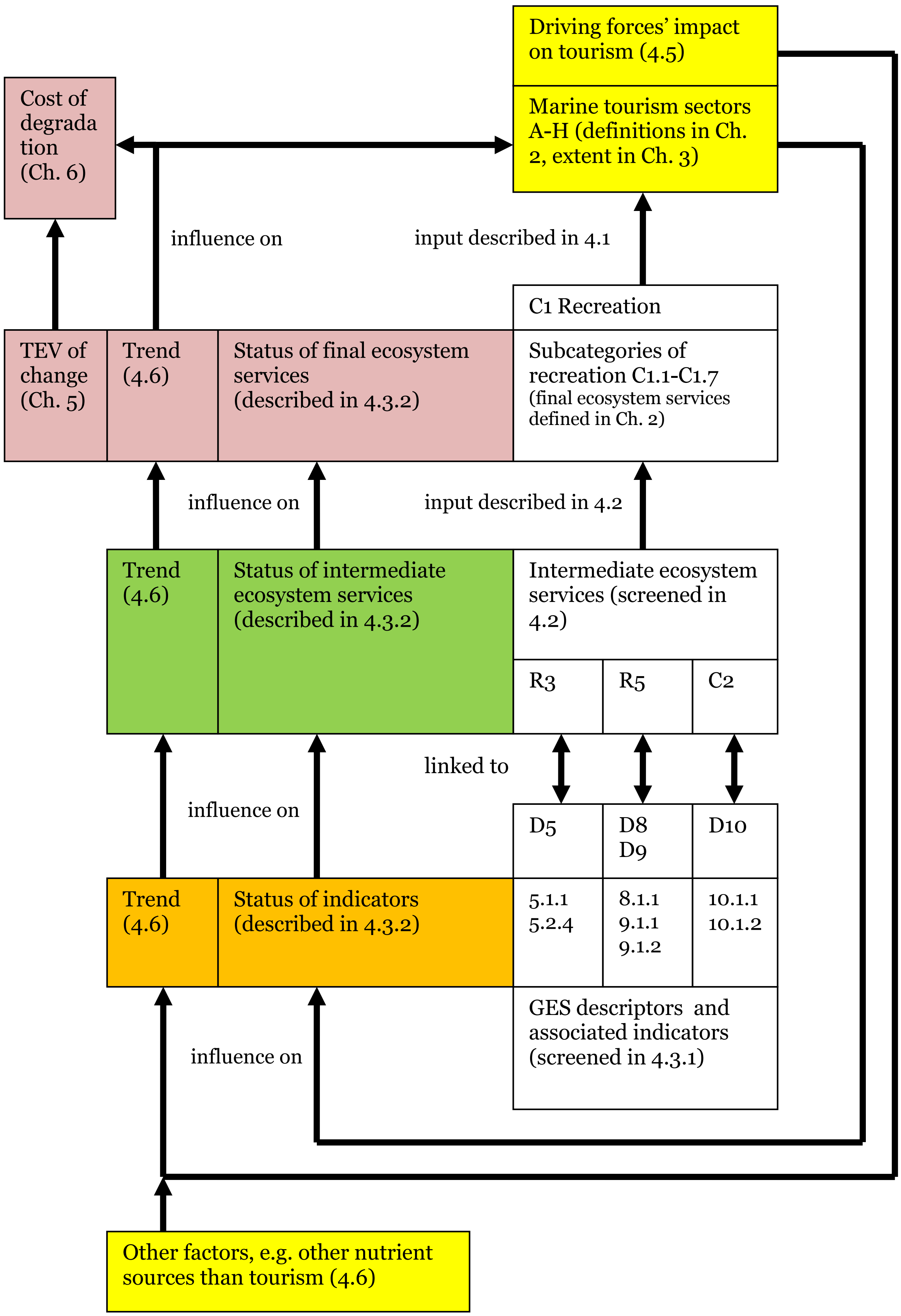

Figure 0.1. The contents of the report. Links to DPSIR are indicated by colours: yellow=drivers, orange=pressures, green=state and red=impact. Response in the sense of societal response by introducing e.g. new policy instruments is not covered in this report.

Based on the classification of marine ecosystem services in Garpe (2008) and SEPA (2009) and a survey of people's use of marine waters (SEPA, 2010a, 2010b), Chapter 2 identifies the following seven subcategories of the ecosystem service C1 Enjoyment of recreational activities:

C1.1	Swimming
C1.2	Diving
C1.3	Windsurfing, water skiing
C1.4	Boating
C1.5	Fishing
C1.6	Being at the beach or seashore for walking, picnicking, sunbathing, visiting touristic or cultural sites, etc.
C1.7	Using water-based transportation

Chapter 3 describes the extent of use of Swedish marine waters by the sectors of marine tourism. The findings are summarized in Tables 0.1 and 0.2, where the former is based on the MIN definition for sectors E-H and the latter is based on the MAX definition for these sectors. When interpreting the figures, note that turnover and employment are defined differently for the different sectors: For sector A, they are about passengers' expenditures ashore and the jobs these expenditures create; for sectors B-D, turnover and employment are for the companies found in these sectors – for employment this implies an underestimation because a substantial part of the employment is accounted for in the country where ships are registered; and for sectors E-H, turnover and employment are about tourists' spending when boating, having holiday housing, making use of commercial accommodation and making same-day visits and the jobs associated with this turnover. The tables illustrate the considerable extent of coastal and marine tourism in Sweden. For example, the estimated turnover of this part of the Swedish tourism industry is between SEK 58 578 million (MIN) and SEK 75 153 million. The turnover of the Swedish tourist industry as a whole in 2010 was SEK 255 000 million (Tillväxtverket, 2011), which means that coastal and marine tourism accounted for between 23 % (MIN) and 29 % (MAX) of the total turnover.

Table 0.1. Summary table for the extent of sectors A-H in 2010 for the Baltic Sea and the North Sea, the case of the MIN definition for sectors E-H. Source: Resurs AB (2011a).

Sector and area	Number of calls	Number of passengers (sectors A-D) Number of visits through overnight stays (sectors E-G) Number of same-day visits (sector H)	Turnover (MSEK)	Employment
Cruise-ship traffic (sector A), Baltic Sea	331	404 896	445	318
Regular international and national ship traffic (sector B and part of sector C), Baltic Sea	22 366	16 352 889	4 683	692
Vägverket Rederi (part of sector C), Baltic Sea	209 347	n.a.	223	163
Non-regular ship traffic (sector D), Baltic Sea	n.a.	n.a.	313	233
Leisure boating, holiday housing, commercial accommodation and same-day visits (sectors E-H), Baltic Sea, MIN		60 929 000	27 563	22 219
Total Baltic Sea, MIN			**33 227**	**23 625**
Cruise-ship traffic (sector A), North Sea	48	66 286	73	52
Regular international and national ship traffic (sector B and part of sector C), North Sea	36 769	12 177 842	6 155	740
Vägverket Rederi (part of sector C), North Sea	211 441	n.a.	225	165
Non-regular ship traffic (sector D), North Sea	n.a.	n.a.	367	67
Leisure boating, holiday housing, commercial accommodation and same-day visits (sectors E-H), North Sea, MIN		37 691 000	18 531	14 229
Total North Sea, MIN			**25 351**	**15 253**
Total Swedish seas, MIN			***58 578***	***38 878***

Table 0.2. Summary table for the extent of sectors A-H in 2010 for the Baltic Sea and the North Sea, the case of the MAX definition for sectors E-H. Source: Resurs AB (2011a).

Sector and area	**Number of calls**	**Number of passengers (sectors A-D)** **Number of visits through overnight stays (sectors E-G)** **Number of same-day visits (sector H)**	**Turnover (MSEK)**	**Employment**
Cruise-ship traffic (sector A), Baltic Sea	331	404 896	445	318
Regular international and national ship traffic including Vägverket Rederi (sectors B-C), Baltic Sea	22 366	16 352 889	4 683	692
Vägverket Rederi (part of sector C), Baltic Sea	209 347	n.a.	223	163
Non-regular ship traffic (sector D), Baltic Sea	n.a.	n.a.	313	233
Leisure boating, holiday housing, commercial accommodation and same-day visits (sectors E-H), Baltic Sea, MAX		78 950 000	38 558	31 928
Total Baltic Sea, MAX			**44 222**	**33 334**
Cruise-ship traffic (sector A), North Sea	48	66 286	73	52
Regular international and national ship traffic (sectors B-C), North Sea	36 769	12 177 842	6 155	740
Vägverket Rederi (part of sector C), North Sea	211 441	n.a.	225	165
Non-regular ship traffic (sector D), North Sea	n.a.	n.a.	367	67
Leisure boating, holiday housing, commercial accommodation and same-day visits (sectors E-H), North Sea, MAX		46 825 000	24 112	19 108
Total North Sea, MAX			**30 932**	**20 132**
Total Swedish seas, MAX			***75 154***	***53 466***

Chapter 4 provides an ecosystem service analysis that in principle follows the procedure of a Corporate Ecosystem Services Review (ESR) as designed by WRI (2008). Such a procedure relies heavily on a number of different screenings, e.g. to sort out the most important services in terms of the dependence and the impact of marine tourism sectors on ecosystem services. The ecosystem service analysis in Chapter 4 consists of the following parts:

- An analysis how the sectors of marine tourism are depending on the ecosystem service subcategories C1.1-C1.7.

- An identification of the following intermediate ecosystem services on whose input C1.1-C1.7 primarily depend:
    - R3 Eutrophication mitigation
    - R5 Regulation of hazardous substances
    - C2 Scenery

- An identification of the Good Environmental Status (GES) descriptors that are covering each of the identified intermediate ecosystem services and selecting those GES indicators associated with these descriptors that give the most relevant information on the status of the supply of the identified intermediate ecosystem services. This screening resulted in the following list of GES descriptors and associated indicators as defined by COM (2011):
  - D5 Eutrophicaton
    - 5.1.1 Nutrient concentration in the water column
    - 5.2.4 Bloom events of nuisance/toxic algal blooms caused by human activities
  - D8 and D9 Contaminants
    - 8.1.1 Concentration of contaminants
    - 9.1.1 Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels
  - D10 Marine litter
    - 10.1.1 Litter washed ashore or found along the coast

- A description of the status of the selected GES indicators and the associated intermediate ecosystem services. As is indicated by Table 0.3, this resulted in the assessment that the marine ecosystems are *not* providing enough input for having a sustainable supply of the subcategories C1.1-C1.6, and that the marine ecosystems are *locally* not providing enough input for having a sustainable supply of C1.7 and C1.8.

Table 0.3. Summary of status assessment for selected intermediate ecosystem services.

Intermediate marine ecosystem services		**Subcategories of marine recreation (final ecosystem services)**							
		C1.1 Swimming	C1.2 Diving	C1.3 Windsurfing, water skiing	C1.4 Boating	C1.5 Fishing	C1.6 Being at the beach or seashore	C1.7 Skating, skiing	C1.8 Using water-based transportation
R3	Eutrophication mitigation	insufficent	insufficent	insufficent	insufficent	insufficent	insufficent		
R5	Regulation of hazardous substances	insufficent	insufficent	insufficent	insufficent	insufficent	insufficent		
C2	Enjoyment of scenery	locally insufficent	locally insufficent	locally insufficent	locally insufficent	locally insufficent	locally insufficent	locally insufficent	locally insufficent

- An analysis of the impact of the sectors of marine tourism on the selected GES indicators.

- A description of driving forces influencing the sectors of marine tourism and assessing what these forces might imply for the future development of these sectors.

- A description of a business-as-usual (BAU) trend for the selected GES indicators and the associated intermediate ecosystem services to 2020 and 2050. It is concluded that the situation in 2020 is likely to be similar to the situation described by Table 0.3. For 2050, it is suggested that the implementation of the Baltic Sea Action Plan might imply improvements in terms of reduced eutrophication effects and less toxic substances in the water and fish. However, the considerable uncertainties are also emphasized. These uncertainties include what climate change would imply for the effects the proposed nutrient reductions.

- A discussion what the BAU trend might imply for the development of the sectors of marine tourism. Until 2020, the sectors that are likely to be primarily affected by a non-sustainable supply of the subcategories of marine recreation are sectors E-H. Sectors A-D are likely to be only locally affected. This is illustrated by Table 0.4. As to the development until 2050, it is concluded that the Swedish marine tourism sectors might benefit considerably from climate change, given that their competitiveness is not diminished because of reduced water quality and/or heavy algal blooms.

Chapter 5 presents findings about the total economic value (TEV) of changes in recreational opportunities. Based on a literature review, a number of valuation studies are identified that are judged to be useful for valuing recreational activities in the marine environment and their links to GES descriptors and indicators.

Chapter 6 assesses the cost of degradation based on the results of the earlier chapters. The review of valuation studies in Chapter 5 is used for indicating what GES could imply in economic terms, and conversely also what is lost if BAU is reached instead of GES. The result describes the extent to which different recreational activities is likely to bear the cost of degradation and is summarized in Table 0.5. The table shows that the marine recreation activities that will most likely have to bear a cost of degradation if GES is not reached are swimming, diving, fishing and being at the beach. The recreation activities that seem the least sensitive to a scenario where GES is not reached are boating, skating, skiing and using water-based transportation.

Table 0.4. "No" in the table denotes those subcategories of marine recreation which are not likely to have a sustainable supply in 2020 for BAU. The table also shows what sectors are dependent on each subcategory, based on Chapter 4.

Subcategory of marine recreation	**Sector**							
	A. Cruise ship traffic	B. Inter-national passenger ferry traffic	C. Natio-nal pas-senger ferry traffic	D. Other com-mer-cial pas-senger trans-porta-tion in marine waters	E. Leisure boating	F. Holiday houses	G. Com-mercial accom-moda-tion	H. Same-day visits
C1.1. Swimming						No	No	No
C1.2 Diving						No	No	No
C1.3 Wind-surfing, water skiing						No	No	No
C1.4 Boating					No	No	No	No
C1.5 Fishing					No	No	No	No
C1.6 Being at the beach or seashore						No	No	No
C1.7 Skating, skiing						No, locally	No, locally	No, locally
C1.7 Using water based transportation	No, locally	No, locally	No, locally	No, locally	No, locally			No, locally

Table 0.5. To what extent would different recreational activities bear the cost of degradation? The table indicates this for different recreation activities based on the activities' links to GES, according to findings in Chapters 4 and 5.

Descriptors and indicators of GES	**Subcategories of marine recreation**							
	C1.1 Swimming	C1.2 Diving	C1.3 Windsurfing, water skiing	C1.4 Boating	C1.5 Fishing	C1.6 Being at the beach or seashore	C1.7 Skating, skiing	C1.8 Using water-based transportation
D5 Eutrophication								
5.1.1 (nutrient concentration)	+++	+++	+	+	++	++	-	-
5.2.4 (toxic algal blooms)	+++	+++	++	++	++	++	-	+
D8 Contaminants								
8.1.1 (concentration of contaminants)	+++	+++	++	-	-	+	-	-
D9 Contaminants in fish and other seafood								
9.1.1 (actual levels of contaminants)	-	-	-	-	+++	-	-	-
D10 Marine litter								
10.1.1 (litter washed ashore)	++	+	+	+	+	+++	+	+
Legend: +++ = the activity is likely to bear the cost of degradation to a **high** degree ++ = the activity is likely to bear the cost of degradation to a **fairly high** degree + = the activity is likely to bear the cost of degradation to a **low** degree - = the activity is **not** likely to bear the cost of degradation								

Finally, *Chapter 7* contains a concluding discussion. It is emphasized that a further development of an ecosystem service analysis as that carried out in Chapter 4 would require ecological-economic studies allowing a more quantitative analysis. Such studies would preferably include, *inter alia*, more precise definitions of the various ecosystem services. In this report, a step towards this was taken by dividing the broad ecosystem service C1 Enjoyment of recreational activities to seven subcategories C1.1-C1.7. Further efforts to provide precise definitions of ecosystem services, also other than recreation, would greatly facilitate assessments of the economic (and social) consequences of programmes of measures, such as those PoMs which will be a part of the MSFD implementation. Another effort that would be of great help for such assessments is to define GES indicators that serve as useful links between environmental change and nature's provision of ecosystem services.

1 Introduction

1.1 Background and methodology

The initial assessment (IA) of the implementation of the EU Marine Strategy Framework Directive (MSFD) includes an economic and social analysis (ESA). This analysis is about two areas: (1) the use of marine waters and (2) the cost of degradation of the marine environment. COM (2010) describes two different approaches for analysing (1): the ecosystem service approach and the marine water accounts approach; and three different approaches for analysing (2): the ecosystem service approach, the thematic approach and the cost-based approach.

The Swedish ESA will be based on the ecosystem service approach associated with each of the two areas. For the use of marine waters, this approach entails the following components (COM, 2010:17):

1a. Identifying ecosystem services of marine areas in cooperation with the analysis of status, pressures and impacts
1b. Identifying and, if possible, quantifying and valuing the wellbeing derived from the ecosystem services
1c. Identifying the drivers and pressures affecting the ecosystem services

For the cost of degradation, the ecosystem service approach is about the following (COM, 2010:35):

2a. Defining good environmental status (GES) using qualitative descriptors, list of elements and list of pressures.
2b. Assessing the environmental status in a business-as-usual (BAU) scenario.
2c. Describing in qualitative and, if possible, quantitative terms the difference between the GES and the environmental status in the BAU scenario. This difference at a particular point of time defines the degradation of the marine environment at this point of time.
2d. Describing the consequences to human well-being of degradation of the marine environment, either qualitatively, quantitatively or in monetary terms. These consequences are the cost of degradation.

This report provides input regarding marine recreation and tourism components of these two ecosystem service approaches. After a general introduction to Swedes' recreation in or at the sea in Section 1.2, the report contains the following. See also Figure 1.1 for an illustration of the contents of the report that also provides an interpretation of the contents in terms of the Drivers-Pressure-State-Impact-Response (DPSIR) framework.

- Chapter 2: Definitions related to marine recreation and tourism. For example, this chapter defines sectors of marine tourism and suggests subcategories of the ecosystem service of providing recreational opportunities. These subcategories turn out to be of great importance for making an analysis of marine recreation and tourism operational.

- Chapter 3 describes the extent of use of Swedish marine waters by the sectors of marine tourism.

- Chapter 4 provides an ecosystem service analysis by:
    - Analyzing how the sectors of marine tourism are depending on subcategories of the ecosystem service to provide recreational opportunities (4.1).
    - Viewing the subcategories of the ecosystem service of providing recreational opportunities as final ecosystem services and identifying on which intermediate ecosystem services they primarily depend (4.2).
    - Identifying which GES descriptors are covering each of the identified intermediate ecosystem services and selecting those GES indicators associated with these descriptors that give the most relevant information on the status of the supply of the identified intermediate ecosystem services (4.3.1).
    - Describing the status of the selected GES indicators and the associated intermediate ecosystem services (4.3.2).
    - Analyzing the impact of the sectors of marine tourism on the selected GES indicators (4.4).
    - Describing driving forces influencing the sectors of marine tourism and assessing what these forces might imply for the future development of these sectors (4.5).
    - Describing a BAU trend for the selected GES indicators and the associated intermediate ecosystem services to 2020 and 2050 given BAU (4.6).
    - Discussing what the BAU trend might imply for the development of the sectors of marine tourism (4.7).

- Chapter 5 presents findings about the total economic value (TEV) of changes in recreational opportunities.

- Chapter 6 assesses the cost of degradation based on the results of the earlier chapters.

- Chapter 7 contains a concluding discussion.

For carrying out the ecosystem service analysis in Chapter 4, we follow in principle the procedure of a Corporate Ecosystem Services Review (ESR) as designed by WRI (2008). The purpose of an ESR is to evaluate a company's dependence of and impact on ecosystem services as a basis for identifying the resulting business risks and opportunities. ESR emphasizes the importance of both looking at dependence *and* impact, which is relevant also for the case of marine tourism because marine tourism both has an impact on marine ecosystem services and is in the same time highly dependent on a sufficient supply of those services. An ESR consists of five steps:

I. Determine the corporate boundaries related to e.g. markets, geographical area, products, customers, etc.
    - In this report, this is done by the definitions in Chapter 2 and the associated descriptions of the extent of the sectors of marine tourism in Chapter 3.

II. Identify the company's impact and dependence on ecosystem services and select those services that are the most important ones in terms of impact and dependence.

- This is done in Section 4.1 for the sectors of marine tourism and Section 4.2, in which the final ecosystem services are related to intermediate ecosystem services.

III. Analyze the status and trends in the selected ecosystem services.
- This is done in Sections 4.3-4.6.

IV. Identify business risks and opportunities based on the trends in the selected ecosystem services.
- This is done in Section 4.7 for the sectors of marine tourism.

V. Develop strategies for minimizing the risks and maximizing opportunities.
- This last step is rather a part of the future Programmes of Measures than the Initial Assessment of the MSFD.

The usefulness of an ESR hinges upon carrying out different kinds of screenings. To define the boundaries in step I is one kind of screening, but the most important one is the selection in step II of the most important ecosystem services in terms of impact and dependence. This selection must sort out relatively few ecosystem services; otherwise the analysis will be subject to the cannot-see-the-wood-for-the-trees problem. Such screenings are in this report also necessary for e.g. the selection of GES descriptors and associated indicators. Since an ecosystem service analysis of this kind still is a relatively uncharted territory, it is unavoidable that those screenings and other parts of the work are to a large extent based upon professional judgments.

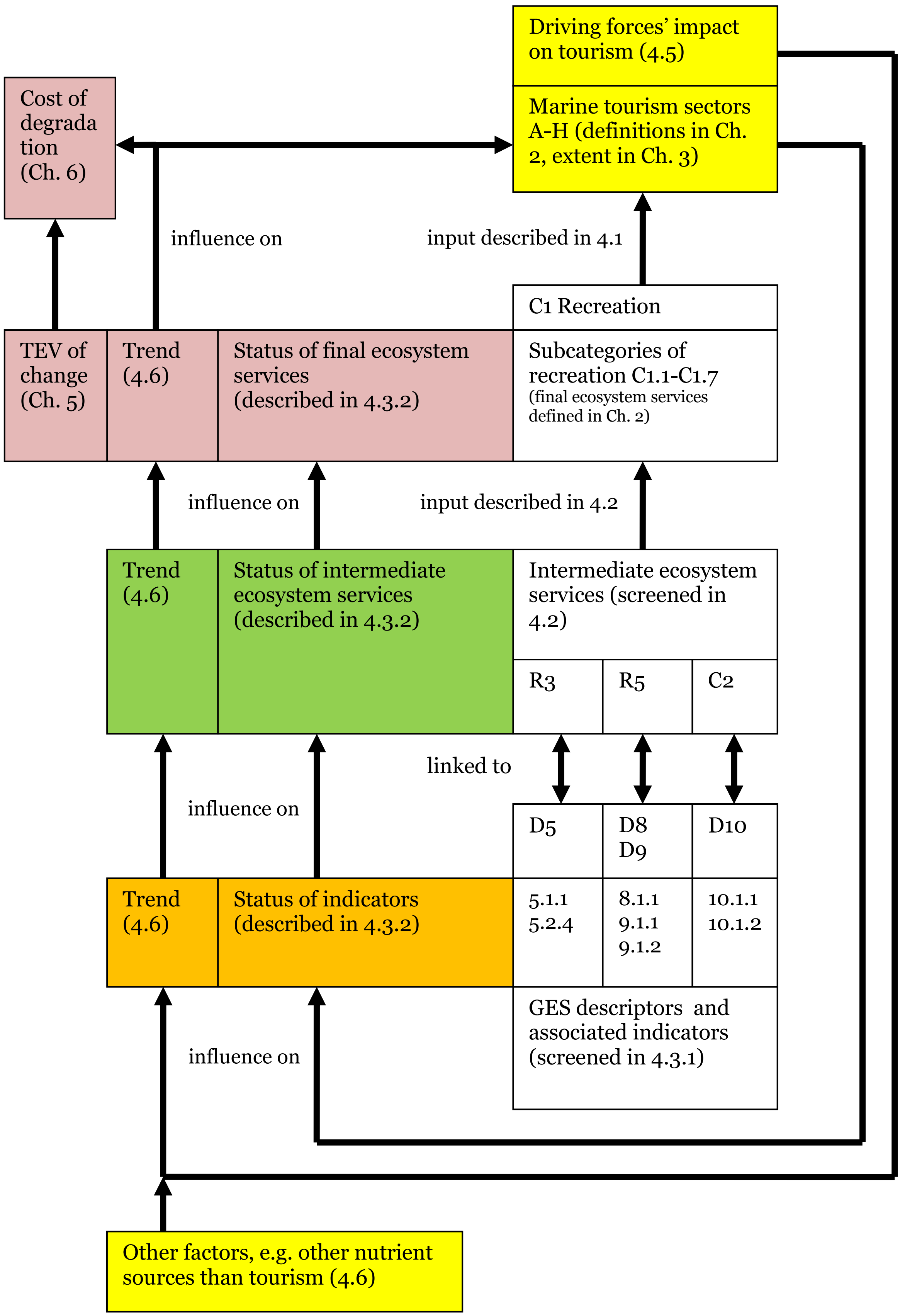

Figure 1.1. The contents of the report. Links to DPSIR are indicated by colours: yellow=drivers, orange=pressures, green=state and red=impact. Response in the sense of societal response by introducing e.g. new policy instruments is not covered in this report.

1.2 Swedes' recreation in or at the sea

There is a strong dependence between the marine environment of the Baltic Sea and the North Sea[1] and recreation and tourism in Sweden. The importance of the sea from a recreational point of view is evident from a recent survey study (*BalticSurvey*). BalticSurvey was an internationally coordinated survey study among the general public in all nine littoral Baltic Sea countries. Identical questions were posed in all countries in April-June 2010 to about 1000 respondents per country, using either telephone interviews or face-to-face interviews. See SEPA (2010a, 2010b) for details. In Sweden, a sample of Swedish residents of at least 16 years of age was used, which implies a survey population of about 7.74 million people (SCB, 2011). The questions in BalticSurvey was both about people's use of the sea and attitudes towards the marine environment. In this chapter, we employ the results of the former type of questions for introducing the importance of marine recreation among Swedes in the Baltic Sea and the North Sea.[2]

When answering the questions, the respondents were asked to perceive "the sea" as both the waters of the shores of the Baltic Sea and the North Sea. This means, for example, that activities that take place *in* the water as well as *at* the water were reported by the respondents. The focus below is on the results of the following questions:

- Q4: "Have you ever been to the sea to spend leisure time there? This could be about swimming, boating and fishing, but also for example walking along the seashore, skating and going on a cruise."

- Q5 was posed to those respondents who have visited the sea at least once: "When was your last visit to the sea to spend leisure time there? Was it 'in the last 12 months, that is in April 2009 to March 2010', 'in the last 5 years, but not in the last 12 months' or 'more than 5 years ago'"?

- Q6 and Q7 were posed to those respondents who had visited the sea in the last 12 months:
    - Q6a: "Now think about the months of April to September 2009. This means about 180 days. At about how many of these days did you spend at least some leisure time at the sea?"
    - Q6b: "Now think about the months of October 2009 to March 2010. This means about 180 days. At about how many of these days did you spend at least some leisure time at the sea?"
    - Q7: "Now think about the last 12 months, i.e. April 2009 to March 2010, and the days you spent at least some leisure time

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[1] If not otherwise stated, "the Baltic Sea" refers in this report to the Swedish marine waters of the Bothnian Bay, the Bothnian sea and Baltic Sea Proper. "The North Sea" refers to the Swedish marine waters of the Skagerrak, the Kattegat and the Sound (Öresund). The Sound is interpreted as having its southern border at the Drogden threshold, i.e. at the Öresund Bridge.

[2] In BalticSurvey, respondents were asked to also consider non-Swedish marine waters in the Baltic Sea and the North Sea. This means that the figures presented below include, for example, Swedes' visits to the German Baltic Sea coast. On the other hand, e.g. Germans' visits to the Swedish coast are not included.

at the sea. At about how many of these days did you do the following?
- Swimming (in the sea)
- Diving (in the sea)
- Windsurfing, water skiing
- Boating –e.g. sailing, power boating, rowing, canoeing/kayaking
- Jigging
- Other types of fishing than jigging
- Being at the beach or seashore for walking, picnicking, sunbathing, visiting touristic or cultural sites, etc.
- Skating, skiing
- Going on a cruise/using water-based transportation for recreation"

It is important to note that the activities listed in Q7 cannot take place if the marine environment does not provide opportunities for them. That is, the marine environment supply the ecosystem service of "recreation", or more precisely, providing opportunities to enjoy recreational activities (ecosystem service C1 in Garpe, 2008 and SEPA, 2009). Even more precisely, the list in Q7 suggests that the marine environment provide opportunities for *different* recreational opportunities. These opportunities might be of different quality or quantity. These opportunities are henceforth referred to as subcategories of the ecosystem service of "recreation". Ecosystem services are further defined in Chapter 2.

The answers to BalticSurvey indicate that 98 % of the sampled population has visited the Baltic Sea and the North Sea at least once to spend leisure time there. 78 % of this part of the population had visited the sea in the last 12 months and for 5 %, the latest visit occurred more than five years ago. For those who visited the sea in the last 12 months, the mean number of days during the period of April-September 2009 that they spent at least some leisure time at the sea was 35 days (median: 15 days). The corresponding mean number of days for the period of October 2009-March 2010 was 17 (median: 3 days). These numbers are likely to indicate that for many Swedes, leisure visits to the sea is a part of their everyday life. For example, many Swedish cities are coastal ones, offering a convenient opportunity to enjoy the sea view just by taking a walk along the seashore. The answers to Q7 indeed showed that "being at the beach or seashore for walking, picnicking, sunbathing, visiting touristic or cultural sites, etc." was the most common recreational activity.

The results from BalticSurvey suggest that about 7.74x0.98x0.78 = 5.92 million Swedes made at least one visit to the sea to spend leisure time there in the period of April 2009-March 2010. During April-September, they visited on average the sea every fifth day (35/180). The corresponding figure for October-March is every tenth day (17/180). A lower boundary for the number of Swedes' visits to the sea during April-September is 35x5.92 = 207 million visits. (This is a lower bound since some people might have visited the sea several times per day.) The corresponding lower boundary for October-March is 17x5.92 = 101 million visits. For the whole year, this means at least 308 million visits. To put this figure in perspective, it might be mentioned that the total number of nights spent by foreign tourists in the whole of Sweden was about 12.8 million in 2010 (Tillväxtverket, 2011).

2 Definitions

In this chapter, we suggest a number of definitions and categorizations of "tourism" and "recreation" on which the subsequent analysis will build.

2.1 Tourism

For *tourism*, our part of departure is the well-established and general definition established by the World Tourism Organization (UNWTO): *"The activities of persons traveling and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes."* (UNWTO, 1995:1)

Further, *visitors* are those persons engaging in tourism, a group which in turn is divided into *tourists* and *same-day visitors*. A *tourist* is an overnight visitor. Visitors are distinguished from other travellers by applying three fundamental criteria: (1) the trip should be to a place other than that of the usual environment, (2) the stay in the place visited should not last more than twelve consecutive months, and (3) the main purpose of the visit should be other than the exercise of an activity remunerated from within the place visited (Eurostat, 1998). Some examples of travellers who are not visitors are those who are regular commuters because of work or studies and those who travel to a place in which they receive a reward for labour (Turistdelegationen, 1995).

Sweden has adopted this definition of tourism (Turistdelegationen, 1995), which also involved an adaption to Swedish conditions so that tourism is defined as *the activities of persons who make an overnight stay away from their usual residence or make a same-day visit outside their municipality of residence*. This definition is the basis for the data collection to the Travel and Turist Database (*Rese- och Turistdatabasen*, TDB®), which is the most extensive source of travel and tourist data in Sweden. The data collection for TDB began in 1989 and is based on telephone interviews in which about 2 000 randomly selected Swedish residents per month are asked about their travelling behaviour.

2.2 Tourism sectors of economic activity

For the analysis, we are interested in those visitors who enjoy the opportunities for recreation that the marine environment in Swedish marine waters offers, i.e. those visitors who consume the ecosystem service of "marine recreation" provided by Swedish marine waters. Those visitors can be associated with different sectors of economic activity, with the main sectors being:

A. Cruise-ship traffic in marine waters
B. International passenger ferry traffic in marine waters
C. National passenger ferry traffic in marine waters
D. Other commercial passenger transportation in marine waters
E. Leisure boating in marine waters
F. Holiday housing associated with marine recreation
G. Commercial accommodation (e.g. hotels, camping sites, etc.) associated with marine recreation
H. Same-day visits associated with marine recreation

For sectors A-E, the connection to marine waters is unambiguous since the activities in these sectors take place *in* marine waters. Sectors F-H have a less direct connection but are still relevant to include because a substantial proportion of these sectors is likely to depend on the enjoyment of marine recreation. To not account for this proportion would imply that the economic activity that is dependent on marine waters would be understated.

However, including sectors F-H requires a reasonable and objective delimitation of these sectors. To illustrate the problem, whereas some commercial accommodation situated at the coast (e.g. a camping site adjacent to a beach on the island of Gotland) is likely to be dependent to a very high degree on the opportunity to enjoy marine recreation, other accommodation facilities situated at the coast (e.g. a hotel in a coastal city such as Stockholm) might be almost independent on marine recreational opportunities.

This problem relates to a general difficulty to delimit “coastal tourism”, with the consequence that it does not exist any precise and widely accepted definition of this part of the tourism sector (Eurostat, 2009). The definitions that have in fact been used are in most cases based on a geographical delimitation, such as sorting out administrative areas situated at or close to the sea. Another approach is to use data on visits based on surveys in which visitors themselves have classified their visits as coastal ones. As noted by Eurostat (2009), these approaches are to some extent complementary and there are thus opportunities to combine them.

For sectors F-H, we have chosen the approach of making a geographical delimitation by using two alternative geographical definitions for these sectors; one (called MAX) that is likely to result in an overestimate of the sectors in relation to their association with marine recreation and one (called MIN) that is likely to result in an underestimate. When describing the extent of these sectors, an interval derived from these two definitions will be used instead of a point estimate.

The MAX definition is to include those parts of sectors F-H which are located in Swedish coastal municipalities or on islands in marine waters. The MIN definition is to include those parts of sectors F-H which are located in sub-drainage basins that drain directly into coastal or transitional water bodies (typology from the Water Framework Directive, 2000/60/EG) (*delavrinningsområden som avvattnas direkt till kustvattenförekomster eller övergångsvatten*) or on islands in marine waters.

The definitions are illustrated by Figure 2.1, showing the municipality of Karlskrona (within blue line). For this municipality, the area covered by the MAX definition is the whole municipality of Karlskrona (including the islands along the coast). The MIN definition implies a considerably smaller area, viz. the greyish green and dark green sub-drainage basins and the grey islands along the coast.

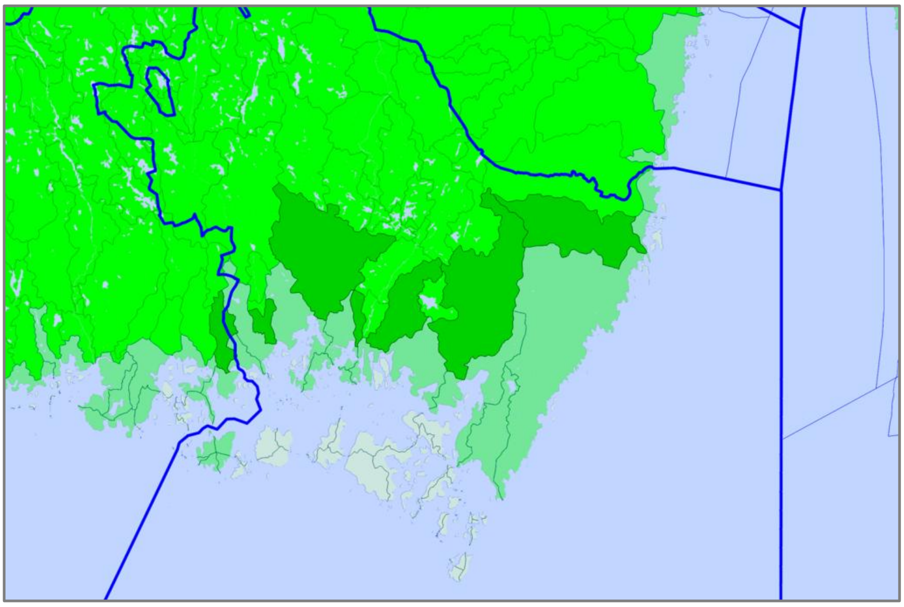

Figure 2.1. Map of the municipality of Karlskrona (SW Sweden), illustrating the MAX definition (the whole municipality) and the MIN definition (the dark green and grey green sub-drainage basins and the grey islands).

2.3 The ecosystem service of recreation

Ecosystems provide support to human life and contribute to human well-being in numerous different ways. In recent years, this fact has increasingly been conceptualized by using the terms “ecosystem goods” and “ecosystem services”, and a number of definitions and classifications are available in the literature, see TEEB (2010, p. 17) for references. The Millennium Ecosystem Assessment (MA, 2005) provided a definition and categorization that has been much employed, also by Garpe (2008) and SEPA (2009) for the case of marine ecosystems. Sometimes a distinction between “ecosystem goods” and “ecosystem services” is made, with the former referring to products that are provided by ecosystems and that usually can be traded on a market – fish is a typical example. However, we follow Garpe (2008) and SEPA (2009) and use “ecosystem services” as a general term also covering “ecosystem goods”.

The concept of ecosystem services represents an instrumental perspective on ecosystems – it is about the ways in which ecosystems are useful to humans. As noted by Garpe (2008), the concept thus views ecosystems from a utilitarian perspective. As emphasized by TEEB (2010, Figure 1.4), the concept provides a link between what is going on in an ecosystem in terms of its structures, processes and functions and human well-being. Based on the four categories of provisioning, supporting, regulating and cultural ecosystem services suggested by MA (2005) and illustrated in Figure 2.2, Garpe (2008) and SEPA (2009) identified a number of ecosystem services provided by the marine ecosystems of the Baltic Sea and the Skagerrak, see Table 2.1.

In the discussion of ecosystem services, it has been observed that some of them tend to be input in ecosystems’ production of other services. For example, the regulating service of mitigation of eutrophication might be manifested in improved opportunities for recreation, i.e. a cultural service. Ecosystem services are therefore often divided into intermediate and final ecosystem services, see e.g. Fisher et al. (2009). As emphasized by COM (2010), this division is likely to help avoiding a narrow focus on final services when making a full listing of ecosystem services and also avoiding double counting when making a monetary assessment of ecosystem services.

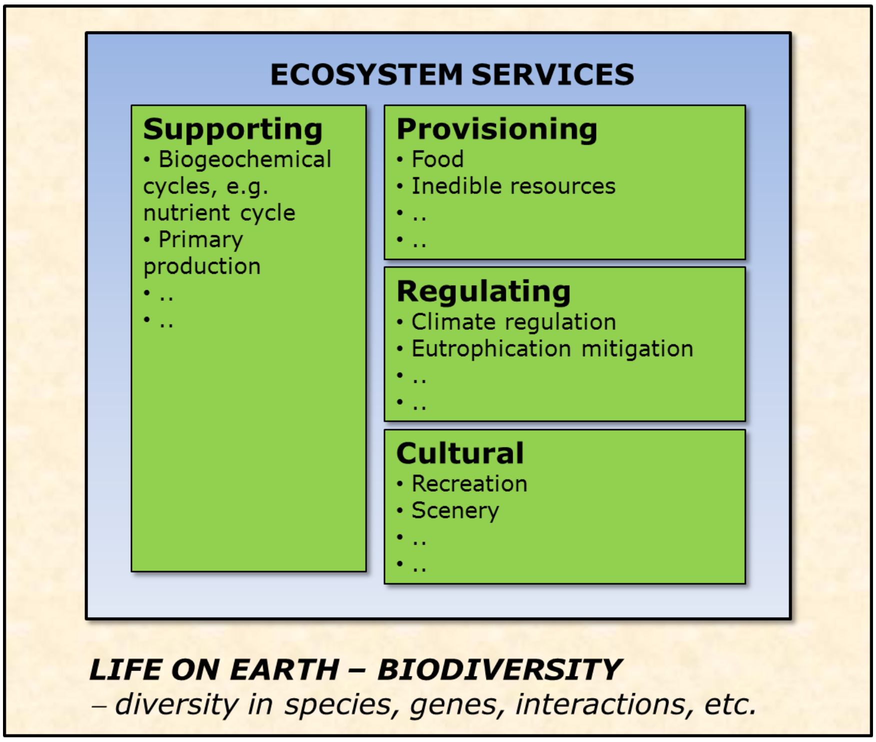

Figure 2.2. Four categories of ecosystem services, after MA (2005).

Table 2.1. List of identified marine ecosystem services provided by the Baltic Sea and the Skagerrak (S=supporting, R=regulating, P=provisioning, C=cultural). Source: Garpe (2008) and SEPA (2009).

	Ecosystem service
S1	Biogeochemical cycling
S2	Primary production
S3	Food web dynamics
S4	Diversity
S5	Habitat
S6	Resilience
R1	Climate and atmospheric regulation
R2	Sediment retention
R3	Eutrophication mitigation
R4	Biological regulation
R5	Regulation of hazardous substances
P1	Food
P2	Inedible goods
P3	Genetic resources
P4	Chemical resources
P5	Ornamental resources
P6	Energy
P7	Space and waterways
C1	Enjoyment of recreational activities
C2	Scenery
C3	Science and education
C4	Cultural heritage
C5	Inspiration
C6	The legacy of the sea

We noted above that the tourism sectors reflect economic activities of visitors that in one way or another make use of the ecosystem service of providing opportunities to enjoy recreational activities. Ecosystem service C1 is therefore in focus for this report. Garpe (2008) suggested the following definition of this ecosystem service:

> *"Enjoyment of recreational activities refers to economic and societal values of activities carried out in the marine environment such as sport fishing, boating, diving, swimming and bird watching. The service further includes the use of coastal and marine environments to promote and sustain national and international tourism"*. (Garpe, 2008:134)

This definition thus lumps together the opportunities to enjoy many different types of marine and coastal recreational activities. In order to make the definition operational for an analysis of tourism sectors, there is a need to separate these different opportunities. As was suggested in Chapter 1, we therefore divide C1 into a number of subcategories according to what specific opportunities are provided. These subcategories are defined as the opportunities to enjoy the different recreational activities listed in Q7 in

BalticSurvey, with a few minor modifications. This means that we define the following different types of opportunities to enjoy recreational activities:

C1.1	Swimming
C1.2	Diving
C1.3	Windsurfing, water skiing
C1.4	Boating
C1.5	Fishing
C1.6	Being at the beach or seashore for walking, picnicking, sunbathing, visiting touristic or cultural sites, etc.
C1.7	Using water-based transportation

Each of these subcategories might, if required for the analysis, be subject to further breakdown. For example, it might be of interest to divide "boating" in different types of boating since, for example, consuming opportunities for power boating might decrease the opportunities for canoeing/kayaking, at least as regards quality aspects of these opportunities.

2.4 Total economic value (TEV)

Finally, the concept of total economic value (TEV) should be explained, because it plays an important role in Chapter 5 when valuation studies of changes in marine recreational opportunities are reviewed. As explained in COM (2010), various valuation methods can be applied for estimating the TEV of a changed provision of an ecosystem service.[3] In general, "total" in TEV refers to that TEV is the sum of two different types of economic values: use values and non-use values. That is, TEV=use values+non-use values. Use values are due to individuals' direct or indirect use of an ecosystem service, and non-use values refer to that people might regard it as important to know that there are a sufficient supply of ecosystem services and that these services may also be available to future generations (COM, 2010). For example, people might be willing to make trade-offs (i.e. having an economic value) for saving a particular coastal habitat even if they have no intention of making use of this habitat, neither directly through diving nor indirectly through its input in the provision of final ecosystem services. As emphasized by Turner et al. (2010), TEV must not be confused with the "total value" of an ecosystem service, because potential intrinsic values of nature are typically regarded as independent of human preferences and therefore not reflected by TEV.

[3] See e.g. Hanley and Barbier (2009), Kinell and Söderqvist (2011) and SEPA (2008) for introductions to valuation methods.

3 Use of marine waters

This chapter reports how the tourism sectors defined in Chapter 2 make use of marine waters by describing the extent of sectors in terms of, for example, the number of passengers/overnight stays/same-day visits, turnover in SEK and employment in number of full-time year-round employed. All data are for 2010 and are primarily based on official statistics from Statistics Sweden and TDB (cf. Section 2.1). In addition, a model for tourism economics (*Turistekonomiska modellen*, TEM®) was used for processing data. See Resurs AB (2011a) for details. Note that "visits" are not defined in the same way as in SEPA (2010a, 2010b), which means that figures on visits below give complementary information to those presented in Section 1.2.

3.1 Sector A. Cruise-ship traffic

Cruise-ship traffic in Swedish marine water occurs during the summer months when ships are making round trips in the Baltic Sea and/or the North Sea. Norwegian fjords are common destinations included in the trips. In 2010, calls made by cruise-ships were reported at ten Swedish ports, and Stockholm accounted for almost 80 % of the total number of passengers, see Table 3.1.

Table 3.1 also includes an estimation of the turnover because of shopping etc. by the passengers when they are ashore. This estimation is based on a study carried out by Stockholms Hamnar AB. The figures on turnover are in turn used for an estimate of the employment generated ashore by the passengers, based on the average turnover per employee in the affected industries (shops, restaurants, etc.). However, turnover and employment for ports and ships are not included; these figures are reported in IVL and Enveco (2012).

Table 3.1. Description of the extent of sector A in 2010 (cruise-ship traffic in marine waters) for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Port	Number of calls	Number of passengers	Turnover ashore (MSEK)	Employment ashore
Luleå	2	1 538	1.7	1
Piteå	0	0	0	0
Sundsvall	2	1 271	1.4	1
Skärnes, Iggesund	0	0	0	0
Stockholm	242	318 327	350.2	250
Nynäshamn	15	30 664	33.7	24
Gotland	66	52 067	57.2	41
Kalmar	2	320	0.4	0.3
Karlskrona	2	709	0.8	0.6
Total Baltic Sea	**331**	**404 896**	**445.4**	**318**
Malmö	1	410	0.5	0.3
Helsingborg	6	15 635	17.2	12
Göteborg	41	50 241	55.3	40
Total North Sea	**48**	**66 286**	**72.9**	**52**
Total Swedish seas	***379***	***471 182***	***518.3***	***370***

3.2 Sectors B-D. Other passenger ship traffic

Table 3.2 reports the number of calls and passengers, turnover and employment associated with the Swedish companies carrying out international and national ship traffic (sector B-C) and non-regular ship traffic. Non-regular ship traffic refers to taxi boats and other types of on-demand traffic. The figures in Table 3.2 for turnover and employment concern those reported by the companies, i.e. in contrast to sector A, passengers' expenditures ashore are not included.

Table 3.2. Description of the extent of sectors B-D in 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Port	Number of calls	Number of passengers	Turnover (MSEK)	Employment
Regular international and national ship traffic (sector B and part of sector C), Baltic Sea	22 366	16 352 889	4 683	692
Vägverket Rederi (part of sector C), Baltic Sea	209 347	n.a.	223	163
Non-regular ship traffic (sector D), Baltic Sea	n.a.	n.a.	313	233
Total Baltic Sea			**5 219**	**1 088**
Regular international and national ship traffic (sector B and part of sector C), North Sea	36 769	12 177 842	6 155	740
Vägverket Rederi (part of sector C), North Sea	211 441	n.a.	225	165
Non-regular ship traffic (sector D), North Sea	n.a.	n.a.	367	67
Total North Sea			**6 747**	**972**
Total Swedish seas			***11 966***	***2 060***

3.3 Sector E. Leisure boating

The number of seaworthy leisure boats owned by Swedish residents are about 881 000, of which 47 % is reported to have home harbour in marine waters (Transportstyrelsen, 2011a). This suggests that there are about 414 000 leisure boats owned by Swedish residents and primarily used for boating in marine waters. There is no separate reporting in Transportstyrelsen (2011a) for the Baltic Sea and the North Sea, but a rough approximation of the number of boats in each area might be based on the proportion of overnight stays in each of the sea areas. Based on Table 3.3, this implies (762000/1164000)x414 000 = about 271 000 leisure boats in the Baltic Sea and 414 000-271 000 = 143 000 in the North Sea.

The turnover reported in Table 3.3 is the expenditures made by people in connection to their boating in 2010. Data about the size and types of expenditures are collected through TDB interviews.

Table 3.3. Description of the extent of sector E for 2010 for the Baltic Sea and the North Sea. Source for overnight stays and turnover: Resurs AB (2011a). Source for number of boats: Transportstyrelsen (2011a) and own computations.

Area	Number of boats	Number of overnight stays	Turnover (MSEK)
Baltic Sea	271 000	762 000	164.6
North Sea	143 000	402 000	125.8
Total Swedish seas	**414 000**	**1 164 000**	**290.4**

3.4 Sector F. Holiday housing

Three categories of the holiday housing sector are investigated: Holiday houses (Table 3.4), visits to relatives and friends, which might also take place in their permanent homes (Table 3.5) and other types of mainly non-commercial accommodation (Table 3.6).

The turnover reported in Table 3.4-3.6 is the expenditures made by people in connection to their holiday housing in 2010. Data about the size and types of expenditures are collected through TDB interviews.

Table 3.4 shows that the total number of holiday houses at the coast is between 214 894 and 275 655, depending on whether the MIN or MAX definition is used. This means that 38-49 % of the in total 564 700 holiday houses in Sweden are situated at the coast. To put this figure into perspective, it can be mentioned that the total number of buildings for homes (permanent and holiday) and work situated not more than 100 metres from the coastal shoreline of Sweden was about 117 000 in 2000 (SCB, 2004).

Summing figures from Tables 3.4-3.6, the total number of overnight stays for the two sea areas together for the three different parts of sector F is between 37.4 million (MIN) and 50.4 million (MAX). As to turnover, the corresponding figures are SEK 9378.3 million (MIN) and 12 696.7 million (MAX). Visits to relatives and friends account for about 50-60 % of the total number of overnight stays and the turnover.

Table 3.4. Description of the extent of the holiday house part of sector F for 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Area	Number of holiday houses	Number of overnight stays	Turnover (MSEK)
Baltic Sea, MIN	155 878	9 507 000	1 625.7
North Sea, MIN	59 016	4 585 000	866.6
Total Swedish seas, MIN	**214 894**	**14 092 000**	**2 492.3**
Baltic Sea, MAX	205 649	12 542 000	2 144.7
North Sea, MAX	70 006	5 439 000	1 028.0
Total Swedish seas, MAX	**275 655**	**17 981 000**	**3 172.7**

Table 3.5. Description of the extent of the visits to relatives and friends part of sector F for 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Area	Number of overnight stays	Turnover (MSEK)
Baltic Sea, MIN	13 325 000	3 517.7
North Sea, MIN	6 105 000	1 740.0
Total Swedish seas, MIN	**19 430 000**	**5 257.7**
Baltic Sea, MAX	19 035 000	5 025.2
North Sea, MAX	8 722 000	2 485.8
Total Swedish seas, MAX	**27 757 000**	**7 511.0**

Table 3.6. Description of the extent of the other-types-of-non-commercial-accommodation part of sector F for 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Area	Number of overnight stays	Turnover (MSEK)
Baltic Sea, MIN	2 092 000	841.1
North Sea, MIN	1 746 000	787.2
Total Swedish seas, MIN	**3 838 000**	**1 628.3**
Baltic Sea, MAX	2 676 000	1 075.8
North Sea, MAX	2 078 000	937.2
Total Swedish seas, MAX	**4 754 000**	**2 013.0**

3.5 Sector G. Commercial accommodation

Statistics for three categories of commercial accommodation are reported below: Hotels (Table 3.7), cabin villages and hostels (Table 3.8) and camping sites (Table 3.9).

The turnover reported in Table 3.7-3.9 is the expenditures made by people in connection to their use of commercial accommodation in 2010. Data about the size and types of expenditures are collected through TDB interviews.

Viewing the Baltic Sea and the North Sea as a whole, the tables show that there are altogether between 1346 (MIN) and 1792 (MAX) places for commercial accommodation. The corresponding aggregates for the number of overnight stays and turnover are 17.6-28.1 million and SEK 16 257.1-27 847.0 million. The hotel category of commercial accommodation is larger than the two other categories, especially in terms of turnover.

Table 3.7. Description of the extent of the hotel part of sector G for 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Area	Number of hotels	Number of overnight stays	Turnover (MSEK)
Baltic Sea, MIN	450	6 227 000	8 624.2
North Sea, MIN	195	3 570 000	4 491.1
Total Swedish seas, MIN	**645**	**9 797 000**	**13 115.2**
Baltic Sea, MAX	652	11 370 000	15 747.5
North Sea, MAX	277	6 213 000	7 815.8
Total Swedish seas, MAX	**929**	**17 583 000**	**23 563.3**

Table 3.8. Description of the extent of the cabin villages and hostels part of sector G for 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Area	Number of cabin villages and hostels	Number of overnight stays	Turnover (MSEK)
Baltic Sea, MIN	262	1 187 000	685.0
North Sea, MIN	95	472 000	305.7
Total Swedish seas, MIN	**357**	**1 660 000**	**990.7**
Baltic Sea, MAX	326	1 739 000	1 003.6
North Sea, MAX	112	617 000	400.1
Total Swedish seas, MAX	**438**	**2 356 000**	**1 403.7**

Table 3.9. Description of the extent of the camping sites part of sector G for 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Area	Number of camping sites	Number of overnight stays	Turnover (MSEK)
Baltic Sea, MIN	238	3 883 000	1 281.4
North Sea, MIN	106	2 271 000	869.8
Total Swedish seas, MIN	**344**	**6 154 000**	**2 151.2**
Baltic Sea, MAX	308	4 400 000	1 452.0
North Sea, MAX	117	3 728 000	1 428.0
Total Swedish seas, MAX	**425**	**8 128 000**	**2 880.0**

3.6 Sector H. Same-day visits

For TDB, interviewees are normally asked to report information about same-day visits due to one-way trips that are at least 100 km. In order to obtain a more complete picture of the number of same-day visits to the Swedish coast, a question was added about one-way trips shorter than 100 km in the TDB interviews carried out in June, July and August 2011. The figures in Table 3.10 are thus based on all one-way trips, regardless of length.

The turnover reported in Table 3.10 is the expenditures made by people in connection to their same-day visits in 2010. Data about the size and types of expenditures are collected through TDB interviews.

The total number of same-day visits for both sea areas are between 42.5 million (MIN) and 46.1 million (MAX). The corresponding interval for turnover is SEK 20 168.3-21 835.6 million.

Table 3.10. Description of the extent of sector H for 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Area	Number of same-day visits	Turnover (MSEK)
Baltic Sea, MIN	23 946 000	10 823.8
North Sea, MIN	18 541 000	9 344.5
Total Swedish seas, MIN	**42 487 000**	**20 168.3**
Baltic Sea, MAX	26 426 000	11 944.6
North Sea, MAX	19 625 000	9 891.0
Total Swedish seas, MAX	**46 051 000**	**21 835.6**

3.7 Employment effects of sectors E-H

The turnover associated with people's spending when boating, having holiday housing, making use of commercial accommodation and making same-day visits gives rise to employment in six different industries: Food stores, restaurants, transportation, shopping, various activities and accommodation. Information from TDB is used for conclusions about how people's expenditures are distributed among these different industries. This is combined in TEM with facts about turnover per employee in the different industries in each municipality. The results are shown in Table 3.11, which indicates that about 36 000 (MIN)-51 000 (MAX) jobs are associated to the turnover caused by people's visits to the Swedish coast in 2010.

Table 3.11. Employment effects of the turnover caused by people's spending in sectors E-H for 2010 for the Baltic Sea and the North Sea. Source: Resurs AB (2011a).

Area	**Employment (number of employees)**
Baltic Sea, MIN	22 219
North Sea, MIN	14 229
Total Swedish seas, MIN	**36 448**
Baltic Sea, MAX	31 928
North Sea, MAX	19 108
Total Swedish seas, MAX	**51 036**

3.8 Summary for all sectors A-H

The facts above about the extent of sectors A-H are summarized in Tables 3.12-3.13. Table 3.12 is based on the MIN definition for sectors E-H and Table 3.13 on the MAX definition. When interpreting the figures, it should be kept in mind that turnover and employment are defined differently for the different sectors: For sector A, they are about passengers' expenditures ashore and the jobs these expenditures create; for sectors B-D, turnover and employment are for the companies found in these sectors – for employment this implies an underestimation because a substantial part of the employment is accounted for in the country where ships are registered; and for sectors E-H, turnover and employment are about tourists' spending when boating, having holiday housing, making use of commercial accommodation and making same-day visits and the jobs associated with this turnover. This implies a double-counting for turnover and employment for all tourists that have paid for a trip by ship. For example, such expenditures for going to Gotland by ferry are included in sector C as well as in sectors E-H. However, the turnover and employment caused by visits by foreign tourists to relatives and friends are not included because lack of satisfactory data about such visits on municipality level. Resurs AB (2011a) judges the turnover caused by such visits to be considerably larger than the turnover that has been subject to double-counting, e.g. to Gotland.

Tables 3.12-3.13 illustrate the considerable extent of coastal and marine tourism in Sweden. For example, the estimated turnover of this part of the Swedish tourism industry is between SEK 58 578 million (MIN) and SEK 75 153 million. The turnover of the Swedish tourist industry as a whole in 2010 was SEK 255 000 million (Tillväxtverket, 2011), which means that coastal and marine tourism accounted for between 23 % (MIN) and 29 % (MAX) of the total turnover. The corresponding percentages for employment are 23 % and 33 %, since the total employment in Swedish tourist industry in 2010 was 162 100 (Tillväxtverket, 2011).

Table 3.12. Summary table for the extent of sectors A-H in 2010 for the Baltic Sea and the North Sea, the case of the MIN definition for sectors E-H. Source: Resurs AB (2011a).

Sector and area	Number of calls	Number of passengers (sectors A-D) Number of visits through overnight stays (sectors E-G) Number of same-day visits (sector H)	Turnover (MSEK)	Employment
Cruise-ship traffic (sector A), Baltic Sea	331	404 896	445	318
Regular international and national ship traffic (sector B and part of sector C), Baltic Sea	22 366	16 352 889	4 683	692
Vägverket Rederi (part of sector C), Baltic Sea	209 347	n.a.	223	163
Non-regular ship traffic (sector D), Baltic Sea	n.a.	n.a.	313	233
Leisure boating, holiday housing, commercial accommodation and same-day visits (sectors E-H), Baltic Sea, MIN		60 929 000	27 563	22 219
Total Baltic Sea, MIN			**33 227**	**23 625**
Cruise-ship traffic (sector A), North Sea	48	66 286	73	52
Regular international and national ship traffic (sector B and part of sector C), North Sea	36 769	12 177 842	6 155	740
Vägverket Rederi (part of sector C), North Sea	211 441	n.a.	225	165
Non-regular ship traffic (sector D), North Sea	n.a.	n.a.	367	67
Leisure boating, holiday housing, commercial accommodation and same-day visits (sectors E-H), North Sea, MIN		37 691 000	18 531	14 229
Total North Sea, MIN			**25 351**	**15 253**
Total Swedish seas, MIN			***58 578***	***38 878***

Table 3.13. Summary table for the extent of sectors A-H in 2010 for the Baltic Sea and the North Sea, the case of the MAX definition for sectors E-H. Source: Resurs AB (2011a).

Sector and area	Number of calls	Number of passengers (sectors A-D) Number of visits through overnight stays (sectors E-G) Number of same-day visits (sector H)	Turnover (MSEK)	Employment
Cruise-ship traffic (sector A), Baltic Sea	331	404 896	445	318
Regular international and national ship traffic including Vägverket Rederi (sectors B-C), Baltic Sea	22 366	16 352 889	4 683	692
Vägverket Rederi (part of sector C), Baltic Sea	209 347	n.a.	223	163
Non-regular ship traffic (sector D), Baltic Sea	n.a.	n.a.	313	233
Leisure boating, holiday housing, commercial accommodation and same-day visits (sectors E-H), Baltic Sea, MAX		78 950 000	38 558	31 928
Total Baltic Sea, MAX			**44 222**	**33 334**
Cruise-ship traffic (sector A), North Sea	48	66 286	73	52
Regular international and national ship traffic (sectors B-C), North Sea	36 769	12 177 842	6 155	740
Vägverket Rederi (part of sector C), North Sea	211 441	n.a.	225	165
Non-regular ship traffic (sector D), North Sea	n.a.	n.a.	367	67
Leisure boating, holiday housing, commercial accommodation and same-day visits (sectors E-H), North Sea, MAX		46 825 000	24 112	19 108
Total North Sea, MAX			**30 932**	**20 132**
Total Swedish seas, MAX			***75 154***	***53 466***

4 Ecosystem service analysis

4.1 Sectors' dependence on recreation

The sectors of marine tourism are all dependent on the marine ecosystems to provide recreational opportunities, i.e. their provision of the ecosystem service of marine recreation. However, all sectors do not depend on the same subcategory of marine recreation. This is indicated by Table 4.1, in which the main dependencies are mapped.

Table 4.1. Sectors' dependence on subcategories of the ecosystem service of marine recreation.

Subcategory of marine recreation	**Sector**							
	A. Cruise ship traffic	B. International passenger ferry traffic	C. National passenger ferry traffic	D. Other commercial passenger transportation in marine waters	E. Leisure boating	F. Holiday houses	G. Commercial accommodation	H. Same-day visits
C1.1. Swimming						X	X	X
C1.2 Diving						X	X	X
C1.3 Wind-surfing, water skiing						X	X	X
C1.4 Boating					X	X	X	X
C1.5 Fishing					X	X	X	X
C1.6 Being at the beach or seashore						X	X	X
C1.7 Skating, skiing						X	X	X
C1.7 Using water based transportation	X	X	X	X	X			X

For example, whereas the demand for going on a cruise ship trip (sector A) is likely to be largely independent of the opportunities for swimming (C1.1), the demand for holiday houses is probably quite dependent on the local conditions of the area in which the houses are situated, including the opportunities for swimming.

The mapping focuses on dependencies which can be argued to be direct ones. There are also many indirect dependencies due to people making use of passenger transportation in marine waters for travelling to, for example, holiday houses and to hotels and other types of commercial accommodation. Such indirect dependencies are not taken into account in Table 4.1.

4.2 Recreation's dependence on intermediate ecosystem services

The next step is to study what ecosystem services the subcategories of the ecosystem service of recreation are dependent on. That is, the subcategories of recreation are regarded as *final* ecosystem services whose quantity and quality are dependent on inputs of *intermediate* ecosystem services. For example, the provision of opportunities of swimming is dependent on the capacity of marine ecosystems' to mitigate eutrophication (ecosystem service R3). If this capacity is not enough for taking care of the load of nutrients, the result will be reduced opportunities for swimming in terms of quantity (e.g. because of an increased number of days with algal blooms) and/or quality (e.g. because of a decreased water transparency).

Furthermore, it can be expected that the *degree* of dependence on other ecosystem services should vary for different subcategories of recreation. Again, using swimming as an example, this is an activity that involves close contact with the sea and thereby great dependence on ecosystems' capacity to mitigate eutrophication. Figure 4.1 illustrates to which degree swimming, and other important subcategories of recreation, depend on natural eutrophication mitigation.

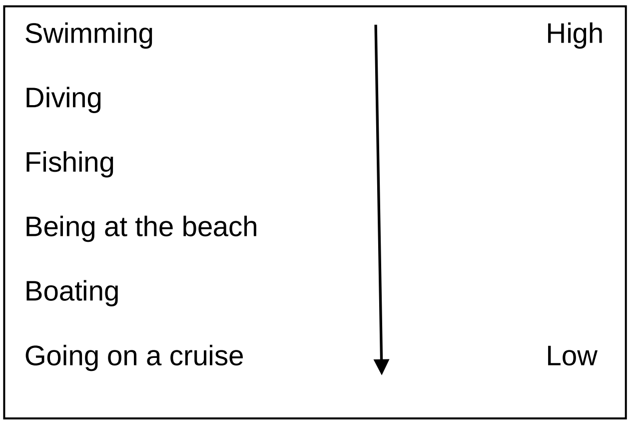

Figure 4.1. Degree of dependence on ecosystem service R3 Eutrophication mitigation.

It is necessary in this type of mapping to identify the main and crucial dependencies. The result of this identification is presented in Tables 4.2-4.5. The tables indicate that some of the intermediate ecosystem services are more crucial to marine recreation than others. The overall degree of importance of an intermediate ecosystem service should be interpreted by the number of recreation activities depending on it. The subsections below explain and motivate how each ecosystem service relates to the different subcategories of recreation.

The description of ecosystem services is primarily based on Garpe (2008). The importance of the ecosystem services for different recreation activities is in many cases supported by results from economic valuation studies of recreation opportunities. For example, the case studies presented in Söderqvist et al. (2005) (see Chapter 5) show that the demand for recreation in the Stockholm and Roslagen archipelagos is highly dependent on bathing water quality, among other factors. Bathing water quality (measured as Secchi depth) is in turn highly dependent on the marine ecosystems' capacity to mitigate eutrophication. Hence, these case studies, as well as e.g. Vesterinen et al. (2010) (see Chapter 5), show that the recreation activity "swimming" and other recreation activities are strongly dependent on the intermediate ecosystem service R3 Eutrophication mitigation. Another existing dependence, often referred to in the valuation literature, is that of recreational fishing. This recreation activity is highly dependent on a number of ecosystem services, e.g. provision of food and maintenance of habitat (see further discussion below), but also on eutrophication mitigation (see Vesterinen et al., 2010). References from the valuation literature are thus important to support Tables 4.2-4.5 but equally important are the discussions that have taken place in project B between economists and natural scientists. The concept of ecosystem services provides a tool and a language that facilitates transdisciplinary communication.

4.2.1 Supporting ecosystem services

Following Garpe (2008), the supporting ecosystem services (S1-S6) have a fundamental role for all other ecosystem services, which is illustrated by Figure 4.2. The basis of all ecosystems is photosynthesis or primary production (S1) which is dependent on the biochemical cycling of nutrients, water and carbon, and on climate regulation (R1). These two ecosystem services (S1 and R1) affect almost all other ecosystems, including each other. Primary production in turn, is the foundation of the supporting and interacting ecosystem services diversity (S4), food web dynamics (S3), and habitat (S5). These three ecosystem services (S3-S5) in turn maintain resilience (S6) which maintains an ecosystem ensuring flexibility and capacity to reorganize following disturbances. The supporting ecosystem services S1-S6 as well as the regulating ecosystem service R1 are the foundation for the regulating, provisioning and cultural ecosystem services. For example, biochemical cycling (S1) is required for primary production (S2) and the growth of phytoplankton. Phytoplankton are part of the marine food web (S3). They are grazed by either zooplankton or fish which make up the ecosystem service food (P1).

In Table 4.2 these supporting ecosystem services (S1-S6) as well as R1 in Table 4.3 (climate regulation) have not been marked as relevant to marine recreation. Not because they are unimportant, but because they are fundamental to almost all other ecosystem services (see description above). Including these ecosystem services in the analysis would distract from the ecosystem services that are more directly relevant to marine recreation and tourism.

Although most recreation activities depend indirectly on the supporting ecosystem services as fundamental and intermediate services, there is one important exception. The recreation activity C1.5 (fishing) is highly, and more directly, dependent on the supporting ecosystem services S3 Food web dynamics, S4 Maintenance of biodiversity and S5 Maintenance of habitat. Well-functioning food web dynamics, biodiversity and habitat all support fish populations, providing baseline conditions for catching fish. We also indicated a dependence of C1.2 (diving) on the maintenance of habitats providing opportunities for nature experience when diving.

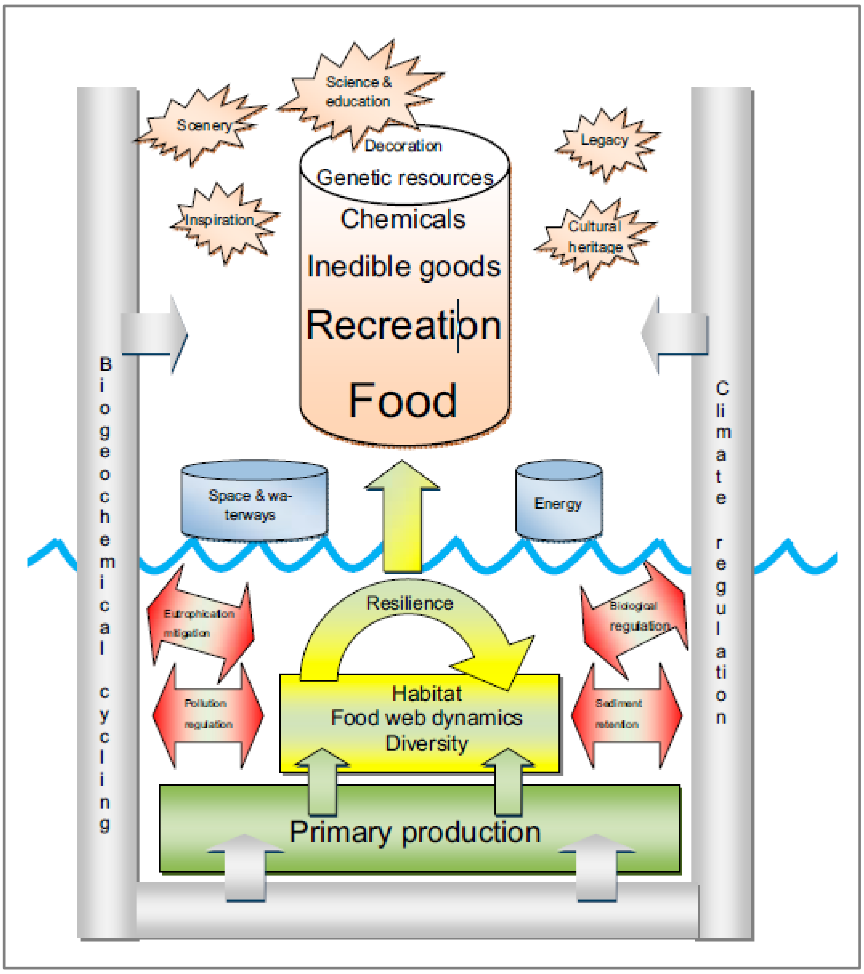

Figure 4.2. The relationship between different marine ecosystem services. From Garpe (2008).

Table 4.2. Main dependence of marine recreation on supporting ecosystem services.

<table>
<tr><th colspan="2" rowspan="2">Intermediate marine supporting ecosystem services</th><th colspan="8">Subcategories of marine recreation (final ecosystem services)</th></tr>
<tr><td>C1.1 Swimming</td><td>C1.2 Diving</td><td>C1.3 Windsurfing, water skiing</td><td>C1.4 Boating</td><td>C1.5 Fishing</td><td>C1.6 Being at the beach or seashore</td><td>C1.7 Skating, skiing</td><td>C1.8 Using water-based transportation</td></tr>
<tr><td>S1</td><td>Biogeochemical cycling</td><td colspan="8">Fundamental</td></tr>
<tr><td>S2</td><td>Primary production</td><td colspan="8">Fundamental</td></tr>
<tr><td rowspan="2">S3</td><td rowspan="2">Food web dynamics</td><td colspan="8">Fundamental</td></tr>
<tr><td></td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">S4</td><td rowspan="2">Maintenance of biodiversity</td><td colspan="8">Fundamental</td></tr>
<tr><td></td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">S5</td><td rowspan="2">Maintenance of habitat</td><td colspan="8">Fundamental</td></tr>
<tr><td></td><td>X</td><td></td><td></td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>S6</td><td>Maintenance of resilience</td><td colspan="8">Fundamental</td></tr>
</table>

4.2.2 Regulating ecosystem services

The regulating ecosystem services (R1-R5) are, compared to the supporting ecosystem services, generally of much more direct importance to marine recreation, see Table 4.3. As regards R1 Climate and atmospheric regulation, this ecosystem service is directly linked to e.g. S1 Biogeochemical cycling and S2 Primary production and hence supports most other ecosystem services. The relevance of climate and atmospheric regulation for marine recreation, however, is judged to be indirect.

The ecosystem service R2 Sediment retention helps mitigate coastal erosion by means of vegetation to stabilise and retain sediments. This ecosystem service is of direct importance for four recreation activities listed in table 3: C1.1 (swimming), C1.2 (diving), C 1.6 (being at the beach) and C1.8 (using water-based transportation) as it helps maintain sandy beaches, which are very important sites for marine recreation in the Baltic Sea and North Sea areas. However, coastal erosion may also have very severe consequences for construction, port development, maritime operators and other human activities by the shore. R2 is therefore also judged to be of importance for the recreation activity C1.8 (using water-based transportation).

The ecosystem service R3 Eutrophication mitigation is important for nearly all recreation activities listed in table 3: C1.1 (swimming), C1.2 (diving), C1.3 (wind-surfing, water skiing), C1.4 (boating), C1.5 (fishing) and C1.6 (being at the beach or seashore). The importance of clean and clear water cannot be overestimated for activities involving close contact with the sea (see Figure 4.1), but R3 is also important for production of food, and thereby for the recreation activity C1.5 (fishing).

The ecosystem service R4 Biological regulation is especially important for three recreation activities: C1.1 (swimming), C1.2 (diving) and C1.5 (fishing). The importance of biological regulation can be exemplified by blue mussels helping maintain water fit for recreation activities involving close contact with the sea (see Figure 4.1), but R4 is also important for food provisioning and thereby the recreation activity C1.5 (fishing).

The ecosystem service R5 Regulation of hazardous substances is important for the great majority of recreation activities listed in Table 4.2: C1.1 (swimming), C1.2 (diving), C1.3 (wind-surfing, water skiing), C1.5 (fishing) and C1.6 (being at the beach or seashore). Recreational users taking part in these recreation activities all depend on clean water that does not cause illness.

Table 4.3. Main dependence of marine recreation on regulating ecosystem services.

Intermediate marine regulating ecosystem services		**Subcategories of marine recreation (final ecosystem services)**							
		C1.1 Swimming	C1.2 Diving	C1.3 Windsurfing, water skiing	C1.4 Boating	C1.5 Fishing	C1.6 Being at the beach or seashore	C1.7 Skating, skiing	C1.8 Using water-based transportation
R1	Climate and atmospheric regulation	Fundamental							
R2	Sediment retention	X	X				X		X
R3	Eutrophication mitigation	X	X	X	X	X	X		
R4	Biological regulation	X	X			X			
R5	Regulation of hazardous substances	X	X	X		X	X		

4.2.3 Provisioning ecosystem services

Some of the provisioning ecosystem services (P1-P7) are of direct importance for marine recreation but they are not as crucial as the regulating ecosystem services in terms of number of recreation activities depending on them, see Table 4.4. No dependencies have been identified of marine recreation on the provisioning ecosystem services P3 Provision of genetic resources, P4 Provision of chemical resources and P6 Provision of energy.

The ecosystem service P1 Provision of food is important for the recreation activity C1.5 (fishing). The ecosystem service P2 Provision of inedible goods might have some importance for the recreation activity C1.8 (using water-based transportation) as it implies provision of material that can be used for construction work in ports etc.

The ecosystem service P5 Provision of ornamental resources is important for two recreation activities: C1.2 (diving) and C1.6 (being at the beach or seashore). The provision of marine products to be used for decoration or handicraft can be exemplified by shells, amber, driftwood and aquarium fish. All these goods can be found when diving or being at the beach. The relative importance of this ecosystem service, compared to other intermediate ecosystem services, to the recreation activities swimming and diving is probably rather low.

The ecosystem service P7 Provision of space and waterways is important for two recreation activities: C1.4 (boating) and C1.8 (using water-based transportation) as this ecosystem service refers to the use of the sea surface as a medium for transport. P7 also implies using the sea surface as site for energy provision and industrial purposes. These uses however are not of importance for the subcategories of marine recreation studied in this report.

Table 4.4. Main dependence of marine recreation on provisioning ecosystem services.

Intermediate marine provisioning ecosystem services		**Subcategories of marine recreation (final ecosystem services)**							
		C1.1 Swimming	C1.2 Diving	C1.3 Windsurfing, water skiing	C1.4 Boating	C1.5 Fishing	C1.6 Being at the beach or seashore	C1.7 Skating, skiing	C1.8 Using water-based transportation
P1	Provision of food					X			
P2	Provision of inedible goods								X
P3	Provision of genetic resources								
P4	Provision of chemical resources								
P5	Provision of ornamental resources		X				X		
P6	Provision of energy								
P7	Space and waterways				X				X

4.2.4 Cultural ecosystem services

Some of the cultural ecosystem services (C2-C6) are of direct, major importance for marine recreation whereas others are less relevant, see Table 4.5.

The ecosystem service C2 Enjoyment of scenery is judged critical for all recreation activities listed in Table 4.2. The service includes concepts such as beauty and silence, and is thus a very broad concept with relevance for all kinds of marine recreation.

The ecosystem service C3 Science and education is judged to be relevant primarily for C1.6 (being at the beach or seashore), if being at the beach involves visiting e.g. an aquarium or museum. It is however likely that the recreation activity “being at the beach or seashore” is dependent on the ecosystem service C3 only to a limited extent. The relative weight of this ecosystem service is thus probably low.

The ecosystem service C4 Maintenance of cultural heritage is of importance for the recreation activities C1.2 (diving), C1.4 (boating), C1.5 (fishing) and C1.6 (being at the beach or seashore). This ecosystem service is about use of the marine and coastal environment for spiritual, sanatory or historical purposes. The recreation activity C1.2 (diving) is one example of an activity that may depend on the underwater cultural heritage provided by the sea. The Baltic Sea has a unique underwater cultural heritage. Divers can enjoy an enormous number of wrecks (12 000 according to the Swedish National Maritime Museums) but also sunken Stone Age villages. Cultural heritage may also be maintained by recreation activities such as boating, fishing (e.g. symbolic values attached to preservation) and being at the beach (e.g. visiting maritime museums).

The ecosystem service C5 Inspiration for art and advertisement) is not linked to marine recreation and neither is C6 The legacy of the sea, at least not directly and exclusively. C6 is about the appreciation of nature for ethical reasons. Although there is no direct link between this ecosystem service and marine recreation, there are strong reasons to believe that many people may appreciate, and economically value, the existence of the sea to be used for recreation purposes by future generations. See also Chapter 5 on TEV where a selection of valuation studies is presented.

Table 4.5. Main dependence of marine recreation on other cultural ecosystem services.

Intermediate marine cultural ecosystem services (except for C1 Enjoyment of recreational opportunities)		**Subcategories of marine recreation (final ecosystem services)**							
		C1.1 Swim-ming	C1.2 Diving	C1.3 Wind-surf-ing, water skiing	C1.4 Boat-ing	C1.5 Fish-ing	C1.6 Being at the beach or sea-shore	C1.7 Ska-ting, skiing	C1.8 Using water-based trans-portation
C2	Enjoy-ment of scenery	X	X	X	X	X	X	X	X
C3	Science and edu-cation						X		
C4	Main-tenance of cultural heritage		X		X	X	X		
C5	Inspira-tion for art and adverti-sement								
C6	The legacy of the sea								

4.2.5 Conclusion

The mapping resulted in a number of main dependencies of marine recreation on other marine ecosystem services, marked by X's in Tables 4.2-4-5. This first screening is now followed by a second one in the sense that we sort out the three intermediate ecosystem services that have the greatest number of links to the subcategories of marine recreation. Counting the number of X's in each row of Tables 4.2-4.5, those intermediate services turn out to be R3 Eutrophication mitigation, R5 Regulation of hazardous substances and C2 Enjoyment of scenery. These are therefore selected as the intermediate ecosystem services that the rest of the analysis is delimited to.

4.3 Status of ecosystem services

For assessing status and later also trends, we must know what factors are influencing the availability of the selected intermediate ecosystem services. This is done by linking them to GES descriptors and associated indicators as defined in COM (2011).

4.3.1 Linking selected intermediate ecosystem services to GES descriptors and indicators

As shown in Table 4.6, we conclude that R3 Eutrophication mitigation is most closely related to descriptor D5 about eutrophication ("human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters"). Further, we find R5 Regulation of hazardous substances to be most closely connected to descriptors D8 and D9, which both are about contaminants. D8 says that "concentrations of contaminants are at levels not giving rise to pollution effects" and D9 that "contaminants in fish and other seafood for human consumption do not exceed levels established by EU legislation or other relevant standards". D8 is likely to be relevant for most recreational activities where humans come in contact with water whereas D9 is primarily connected to recreational fishing. Finally, C2 Scenery was found to only have a close connection to descriptor D10 about marine litter ("properties and quantities of marine litter do not cause harm to the coastal and marine environment"). This reflects the fact that the descriptors have an ecological focus whereas people's enjoyment of scenery is determined by many subjective factors.

Table 4.6. Linking selected intermediate ecosystem services to GES descriptors.

GES descriptor	Selected intermediate ecosystem services		
	R3: Eutrophication mitigation	R5: Regulation of hazardous substances	C2: Scenery
D1: Biological diversity			
D2: Non-indigenous species			
D3: Population of commercial fish/shell fish			
D4: Elements of marine food webs			
D5: Eutrophication	X		
D6: Sea floor integrity			
D7: Alteration of hydrographical conditions			
D8: Contaminants		X	
D9: Contaminants in fish and seafood for human consumption		X	
D10: Marine litter			X
D11: Introduction of energy, including underwater noise			

We now proceed by going through each of the GES descriptors D5, D8, D9 and D10 for discussing the associated indicators and identifying those which are influencing the status of ecosystem services.

Table 4.7. Evaluation of indicators for GES descriptor D5.

GES descriptor: D5 Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters. **Ecosystem service:** R3 Eutrophication mitigation		
Criterion	**Indicator**	**Does the indicator affect the ecosystem service?**
5.1 Nutrients level	5.1.1 Nutrients concentration in the water column	Yes
	5.1.2 Nutrient ratios (silica, nitrogen and phosphorus), where appropriate	Yes
5.2 Direct effects of nutrient enrichment	5.2.1 Chlorophyll concentration in the water column	Yes
	5.2.2 Water transparency related to increase in suspended algae, where relevant	Yes
	5.2.3 Abundance of opportunistic macroalgae	Yes
	5.2.4 Species shift in floristic composition such as diatom to flagellate ratio, benthic to pelagic shifts, as well as bloom events of nuisance/toxic algal blooms (e.g. cyanobacteria) caused by human activities	Yes
5.3 Indirect effects of nutrient enrichment	5.3.1 Abundance of perennial seaweeds and seagrasses (e.g. fucoids, eelgrass and Neptune grass) adversely impacted by decrease in water transparency	Yes
	5.3.2 Dissolved oxygen, i.e. changes due to increased organic matter decomposition and size of the area concerned	Yes

The first step is to determine what indicators are relevant for describing the ecosystem service R3 Eutrophication mitigation with regard to marine recreation. The GES eutrophication descriptor D5 includes 8 indicators. Table 4.7 shows which indicators are selected and the selection is motivated below.

An excess discharge of nutrients to the sea is the basis for eutrophication and the indicator for nutrient concentrations (5.1.1) is consequently relevant to consider. The actual nutrient concentration does not necessarily indicate if eutrophication is present or not (e.g. consider high nutrient – low chlorophyll regions). Eutrophication is the accumulation of nutrients in the water. Rather than studying actual nutrient concentrations, it is therefore more interesting to consider the deviation of the nutrient concentration from a “natural” concentration, or to look for trends in the nutrient concentration to determine if nutrients are accumulating or not.

Ratios between nitrogen, phosphorus and silica, indicator 5.1.2, give information about what nutrient is limiting. For example, the nitrogen to phosphorus ratio N/P affects cyanobacteria blooms, which are of relevance to marine recreation.

Eutrophication is often defined as an accumulation of nutrients in the water and an excessive growth of phytoplankton. Chlorophyll concentration, which is easily measured, is used as a proxy for phytoplankton biomass. The indicator chlorophyll concentration is therefore relevant to describe eutrophication. Water transparency is closely related to chlorophyll concentration and hence relevant to consider when dealing with eutrophication.

Indicator 5.2.4, shift in floristic composition, includes bloom events of nuisance/toxic algal blooms. For marine recreation activities close or in the water, algal blooms are a big nuisance. For this indicator we consider only algal blooms.

Abundance of perennial seaweeds and seagrasses adversely impacted by decrease in water transparency, indicator 5.3.1, is closely related to chlorophyll concentration in the water and to nutrient concentrations.

Dissolved oxygen is also marked as a relevant indicator. When biomass decays oxygen is consumed and low oxygen levels or hypoxia occurs. Just as for nutrient levels, the oxygen level needs to be considered relative to natural or undisturbed conditions as there are areas that are naturally low in oxygen.

The objective of this study is not to analyse eutrophication and all of its indicators but rather to use a few of them to determine the status and trend of the ecosystem service that affects marine recreation. We will therefore concentrate on nutrient levels (5.1.1), the reason that eutrophication occurs, and on toxic algal blooms (included in 5.2.4) which are the most obvious way that eutrophication affects marine recreation.

Table 4.8. Evaluation of indicators for GES descriptor D8.

<table>
<tr><td colspan="3">GES descriptor: D8 Concentrations of contaminants are at levels not giving rise to pollution effects.
Ecosystem service: R5 Regulation of hazardous substances</td></tr>
<tr><th>Criterion</th><th>Indicator</th><th>Does the indicator affect the ecosystem service?</th></tr>
<tr><td>8.1 Concentration of contaminants</td><td>8.1.1 Concentration of the contaminants mentioned above, measured in the relevant matrix (such as biota, sediment and water) in a way that ensures comparability with assessments under Directive 2000/60/EC</td><td>Yes</td></tr>
<tr><td rowspan="2">8.2 Effects of contaminants</td><td>8.2.1 Levels of pollution effects on the ecosystem components concerned, having regard to the selected biological processes and taxonomic groups where a cause/effect relationship has been established and needs to be monitored</td><td>No</td></tr>
<tr><td>8.2.2 Occurrence, origin (where possible), extent of significant acute pollution events (e.g. slicks from oil and oil products) and their impact on biota physically affected by this pollution</td><td>No</td></tr>
</table>

Descriptor D8 deals with chemical contaminants in the water. We select those indicators that are relevant for marine recreation occurring close to the water e.g. swimming, diving, and wind surfing. As indicated in Table 4.8, only indicator 8.1.1 about concentration of contaminants is considered to be relevant. Indicator 8.2.1 deals with the effect of contaminants on the ecosystem and is thus not relevant for this study. Acute pollution events (indicator 8.2.2), including oil spill, do have an effect on marine recreation. However, since the study by IVL et al. (2012) deals specifically with oil spills, this indicator is not considered here.

Although not a chemical contaminant, outbreaks of *Escherichia coli* bacteria and other pathogens may have an impact on marine recreation. *E. coli* is not a GES indicator but is included as an indicator in Bathing Water Profiles.[4]

Table 4.9. Evaluation of indicators for GES descriptor D9.

GES descriptor: D9 (Contaminants in fish and other seafood for human consumption do not exceed levels established by EU legislation or other relevant standards). **Ecosystem service:** R5 Regulation of hazardous substances		
Criterion	**Indicator**	**Does the indicator affect the ecosystem service?**
9.1 Levels, number and frequency of contaminants	9.1.1 Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels	Yes
	9.1.2 Frequency of regulatory levels being exceeded	Yes

Descriptor D9 deals with contaminants in fish and seafood for human consumption. Both indicators 9.1.1 and 9.1.2 are relevant for marine recreation when considering recreational fishing, see Table 4.9. We will focus on indicator 9.1.1 and the levels of contaminants.

[4] Under the Bathing Water Directive of the European Union (2006/7/EC), member states must report on the quality of their bathing waters, referred to as Bathing Water Profiles.

Table 4.10. Evaluation of indicators for GES descriptor D10.

GES descriptor: D10 (Properties and quantities of marine litter do not cause harm to the coastal and marine environment.) **Ecosystem service:** C2 Scenery		
Criterion	**Indicator**	**Does the indicator affect the ecosystem service?**
10.1 Characteristics of litter in the marine and coastal environment	10.1.1 Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source	Yes
	10.1.2 Trends in the amount of litter in the water column (including floating at the surface) and deposited on the sea-floor, including analysis of its composition, spatial distribution and, where possible, source	Yes
	10.1.3 Trends in the amount, distribution and, where possible, composition of micro-particles (in particular micro-plastics)	No
10.2 Impacts of marine litter on marine life	10.2.1 Trends in the amount and composition of litter ingested by marine animals (e.g. stomach analysis)	No

The GES descriptor D10 deals with marine litter. Here we select the indicators that are relevant for the ecosystem service C2 Scenery in terms of marine recreation, see Table 4.10. The selection of indicators is therefore determined by the visual aspect of marine litter. The indicators that capture this are indicators 10.1.1, marine litter washed ashore or deposited on the coastlines, and 10.1.2, amount of litter in the water column or deposited on the sea floor. Most of the marine recreation activities take place at the coast and we choose to focus the further analysis on the indicator for marine litter on land, i.e. 10.1.1. Neither of the indicators 10.1.3 (micro-particles in the water) and 10.2.1 (litter ingested by marine mammals) are judged to have a direct effect on marine recreation.

The selection above of those indicators which are judged to primarily influence the status of the ecosystem services is summarized by Table 4.11.

Table 4.11. List of selected indicators influencing the status of the ecosystem services.

GES descriptor	Ecosystem service	Selected indicator
D5	R3 Eutrophication mitigation	5.1.1 Nutrients concentration in the water column
		5.2.4 Species shift in floristic composition such as diatom to flagellate ratio, benthic to pelagic shifts, as well as bloom events of nuisance/toxic algal blooms (e.g. cyanobacteria) caused by human activities
D8	R5 Regulation of hazardous substances	8.1.1 Concentration of the contaminants mentioned above, measured in the relevant matrix (such as biota, sediment and water) in a way that ensures comparability with assessments under Directive 2000/60/EC
D9	R5 Regulation of hazardous substances	9.1.1 Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels
D10	C2 Scenery	10.1.1 Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source

4.3.2 Status of selected indicators and ecosystem services

Below we first describe the status of the indicators listed in Table 4.11, i.e. those which were judged to primarily affect the ecosystem services. We also discuss what this status imply for the selected intermediate ecosystem services, which in turn constitute the most crucial input for the subcategories of marine recreation.

4.3.2.1 D5 EUTROPHICATION

For this descriptor two indicators are selected:

- 5.1.1 Nutrient concentration in the water column
- 5.2.4 Bloom events of nuisance/toxic algal blooms caused by human activities

Nutrient levels

For the nutrient concentration indicator 5.1.1 there is a large amount of data along the coast of Sweden. Much of this data has already been analysed in terms of eutrophication. On the webpage for the “Vatten InformationsSystem Sverige” (VISS, Water Information Service for Sweden) run by the Länsstyrelsen (County Administrative Board), maps are available showing the status of nutrients levels with regard to eutrophication, as well as the ecological status along the coast of Sweden, and areas where eutrophication is considered to be an environmental problem. Figure 4.3 shows a map of the coastal regions where eutrophication is an environmental issue.

According to Figure 4.3, eutrophication is mainly an issue in southern Sweden along the coast of Skagerrak, Kattegat, and the Baltic Proper. Along the coast in the Gulf of Bothnia there are just a few spots where eutrophication is a problem. In terms of the ecosystem service R3 Eutrophication mitigation, the maps can be interpreted as showing the areas where the ecosystem service is under pressure and where marine recreation may be affected by eutrophication. Figure 4.4 shows the status of nutrient levels with regard to eutrophication.

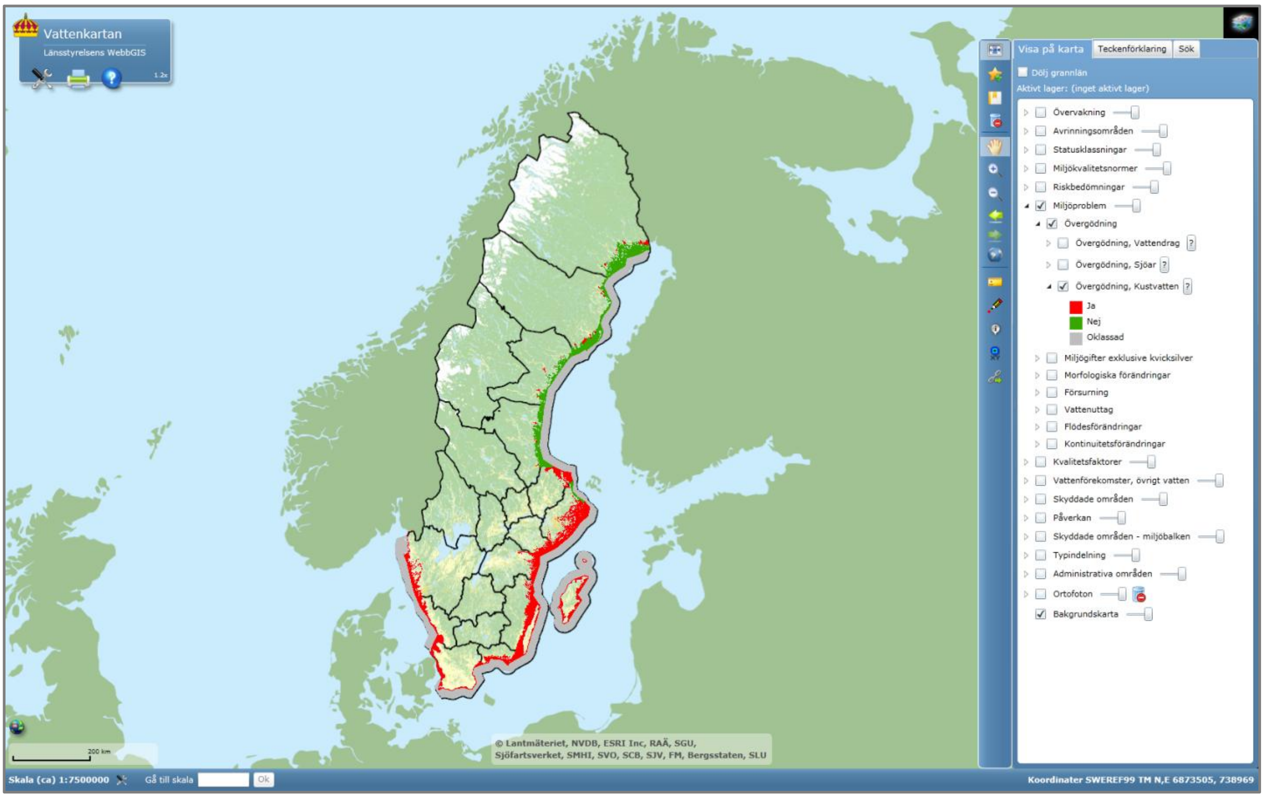

Figure 4.3. Map showing where eutrophication is a problem (red areas). Green areas indicate no problem with eutrophication. Source: VISS (2011).

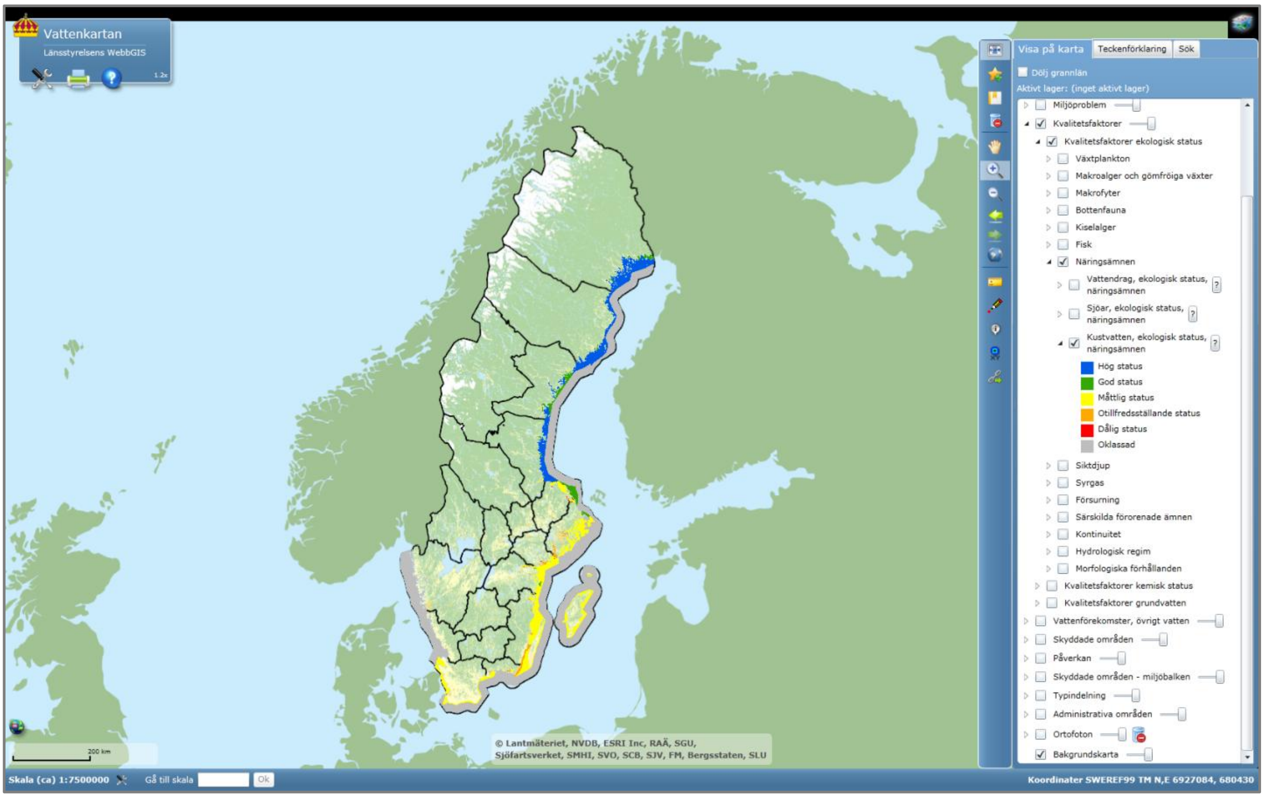

Figure 4.4. Map of status of nutrient levels with regard to ecological status. Blue = High, Green = Good, Yellow = Moderate, Orange = Poor, and Red = Bad. Source: VISS (2011).

Toxic algal blooms

Toxic algal blooms are often measured in terms of amount of cyanobacteria accumulated at the sea surface. There is plenty of large-scale information about cyanobacteria blooms at sea as they can be observed from space. Figure 4.5 shows the number of days that cyanobacteria were observed during the period 1997-2009 and Figure 4.6 for the period 2010-2011. The images show that cyanobacteria mostly occur in the Baltic Sea, and only occasionally in the Gulf of Bothnia. Furthermore, the variation from year to year is large. Compare the year of 2005 when cyanobacteria were observed for 20 days in most parts of the Baltic Sea, with 2007 when cyanobacteria were observed for much shorter periods.

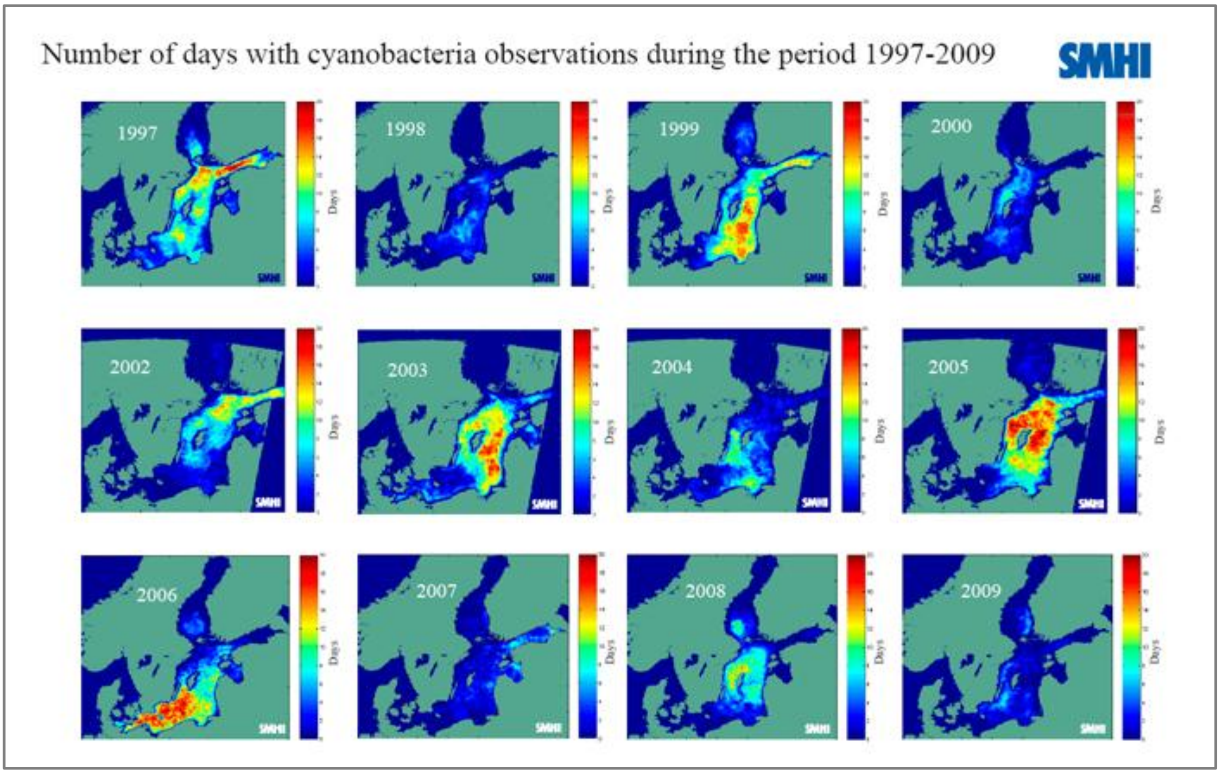

Figure 4.5. Number of days with cyanobacteria observations during the period 1997-2009. Red is 20 days, yellow 13 days and light blue 8 days. Source: HELCOM (2011a).

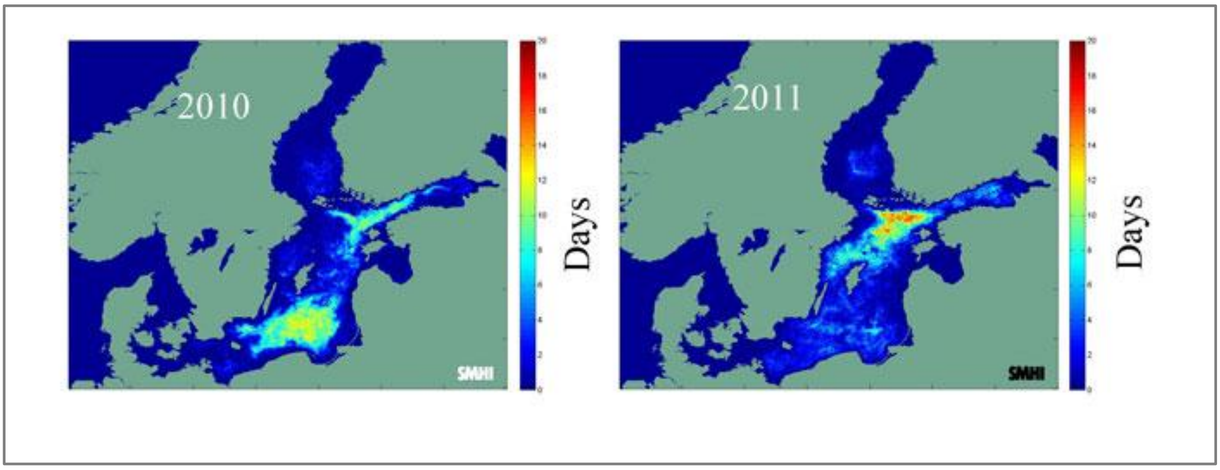

Figure 4.6. Number of days with cyanobacteria observations during the period 2010-2011. Red is 20 days, yellow 13 days and light blue 8 days. Source: HELCOM (2011a).

For marine recreation it would be even more relevant to assess the status of algal blooms that affect beaches. This cannot be accomplished with satellites as they have difficulties distinguishing between an algal bloom and vegetation on land. There is a lack of data providing a general picture of on how algal blooms have actually affected beaches.

Status of ecosystem service R3 Eutrophication mitigation

It was concluded in Section 4.3.1 that ecosystem service R3 Eutrophication mitigation is most closely linked to D5. Garpe (2008:80) assessed the status of natural eutrophication mitigation to be “good” in the Baltic Sea and the Skagerrak with the arguments that human use does not influence the provision of R3 and that the organisms responsible for taking care of excess nutrients are not threatened at present. However, the presence of substantial problems from eutrophication effects (cf. Figure 4.3) suggests that the marine ecosystems do not have a sufficient capacity of processing and removing nutrients to an extent that is enough for society. For example, the status of R3 would probably be much better if the stocks of top predators in the marine food web, e.g. cod, could be restored to considerably higher levels. For example, Österblom et al. (2007) presents indications that a clupeid-dominated Baltic Sea because of excessive loads of nutrients and overfishing of cod might exacerbate eutrophication. We therefore conclude that the marine ecosystems are at present not supplying enough eutrophication mitigation for causing a non-disturbing presence of eutrophication effects. As a consequence, the status of R3 is assessed as *insufficient* for both the Baltic Sea (except for the Gulf of Bothnia) and the North Sea.

4.3.2.2 D8 AND D9 CONTAMINANTS

The following indicators were selected above:

- 8.1.1 Concentration of contaminants
- 9.1.1 Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels

D8 Concentration of chemical contaminants

VISS gives information about chemical contaminants. Figure 4.7 shows where in Sweden chemical contaminants are an environmental problem (red areas in map). Most of these areas are on the eastern coast of Sweden. For this descriptor we are interested in areas close to the coast where recreation activities occur and where humans are in contact with water.

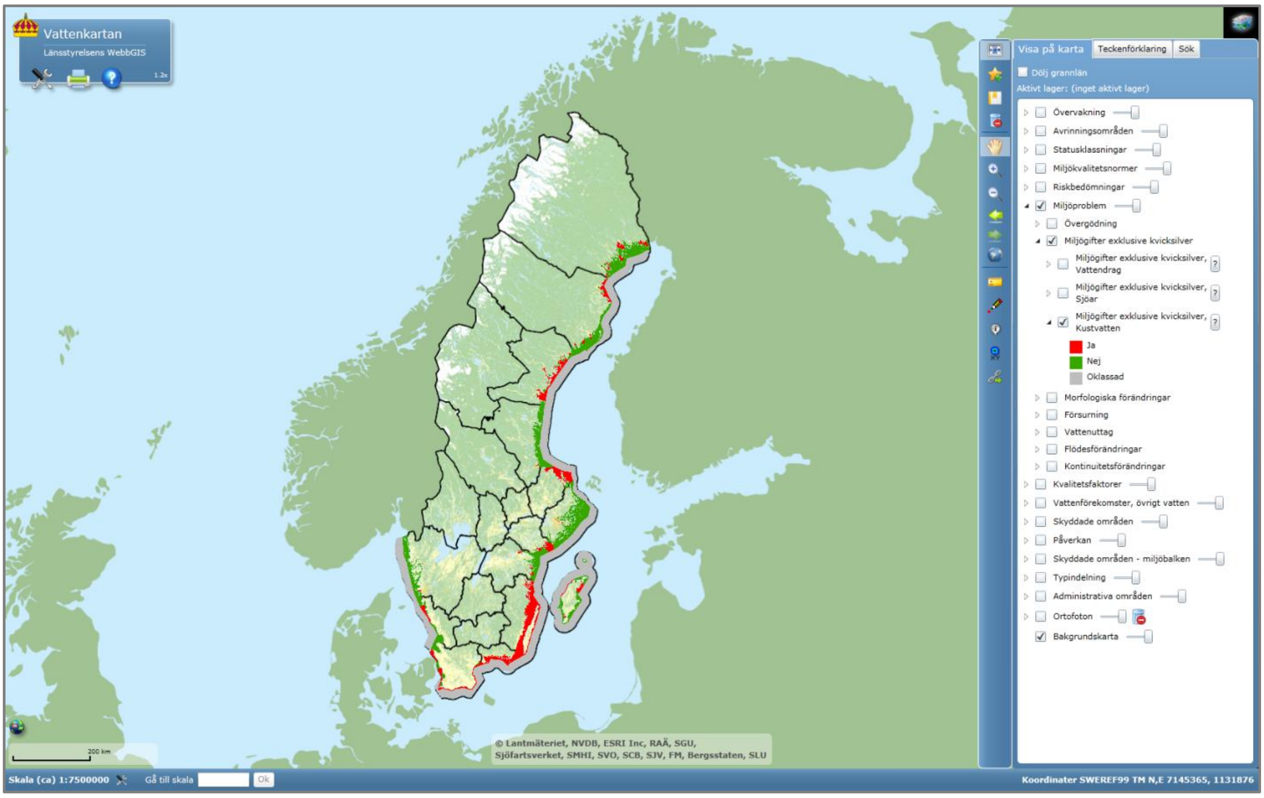

Figure 4.7. Map showing where chemical contaminants (except mercury) are an ecological problem (red areas). Green areas indicated no problem. Source: VISS (2011).

D9 Contaminants in fish and seafood intended for human consumption

For descriptor D9, contaminants in fish and seafood intended for human consumption, we look at the level of mercury and dioxins in fish and compare these values with regulatory levels specified by the European Commission (EC, 2006).

Data on the content of these contaminants in fish are available from the Swedish Environmental Protection Agency. Figures 4.8 and 4.9 show the content of these contaminants in fish along the coast of Sweden. The analysis shows that for the fish content of mercury is below safety levels and that for dioxin the values are above.

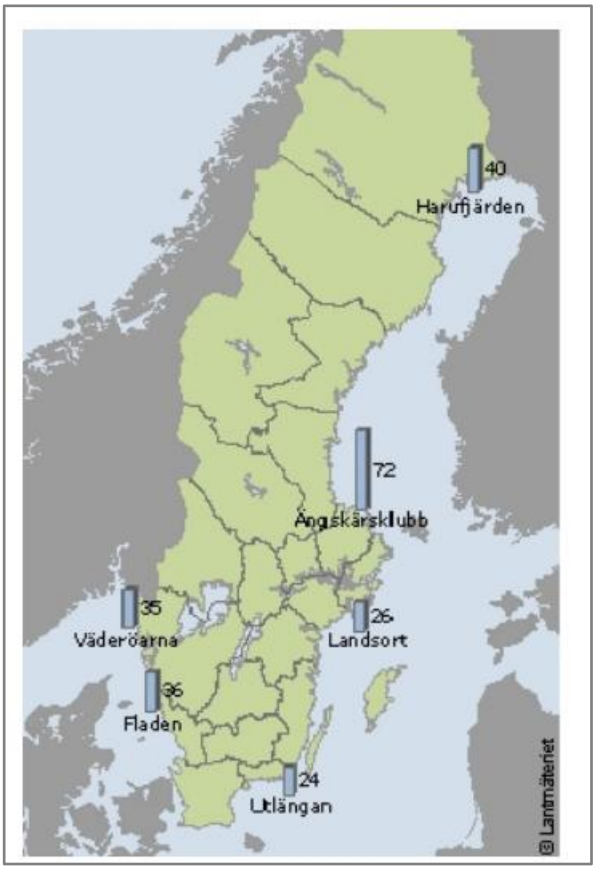

Figure 4.8. Average (2004-2006) concentration of mercury (Hg) in muscle tissue of herring in ng Hg/g wet weight. Source: SEPA (2011).

Figure 4.8 shows the 2004-2006 averge mercury concentration is herring muscle in terms of ng Hg/g wet weight (ww). The target level for mercury depends on the fish species and ranges from 0.5 mg/kg ww or 1.0 mg/kg ww depending on fish species. For herring it is 0.5 mg/kg ww, or 500 ng/g ww. The highest value found in Sweden is 72 ng/kg ww at Ängkärrsklubb which is far below the target level.

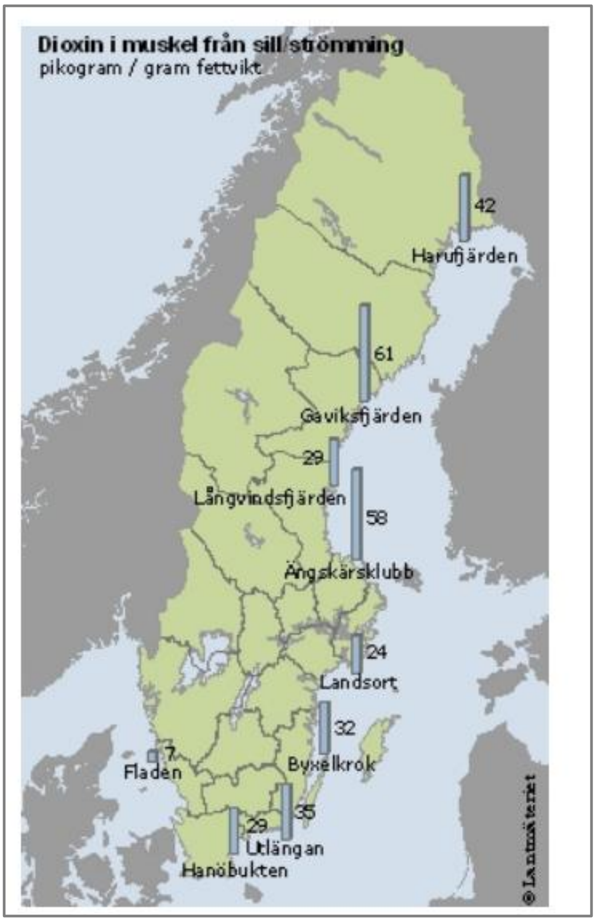

Figure 4.9. Concentrations of dioxins in muscle tissue of herring in pg dioxins/g fatty tissue. Source: SEPA (2011).

Figure 4.9 illustrates the concentration of dioxins in fish along the coast of Sweden. The values range from 7 pg/g fatty tissue at Fladen on the west coast to 61 pg/g at Gaviksfjärden in northern Sweden. The safety level for dioxins is 4 pg/g fatty tissue. In the Baltic Sea the values are several times higher than these values.

Finally, while *E. coli* is not covered by any GES descriptor, we include it here because *E. coli* is an example of pathogens whose presence in bathing water may impact marine recreation. It is included as one of the indicators of faecal contamination in the Bathing Water Profiles. Figure 4.10 shows the status of Swedish beaches during the 2010 bathing season based on the Bathing Water Profiles. Except of a few locations in southern Sweden (red dots on the map) the status is good for swimming. However, it should be noted that the Bathing Water Profiles do not give the entire picture. These profiles are based on water samples 3-4 times per bathing season. An *E. coli* outbreak can happen on much shorter scales and go undetected in the Bathing Water Profile data.

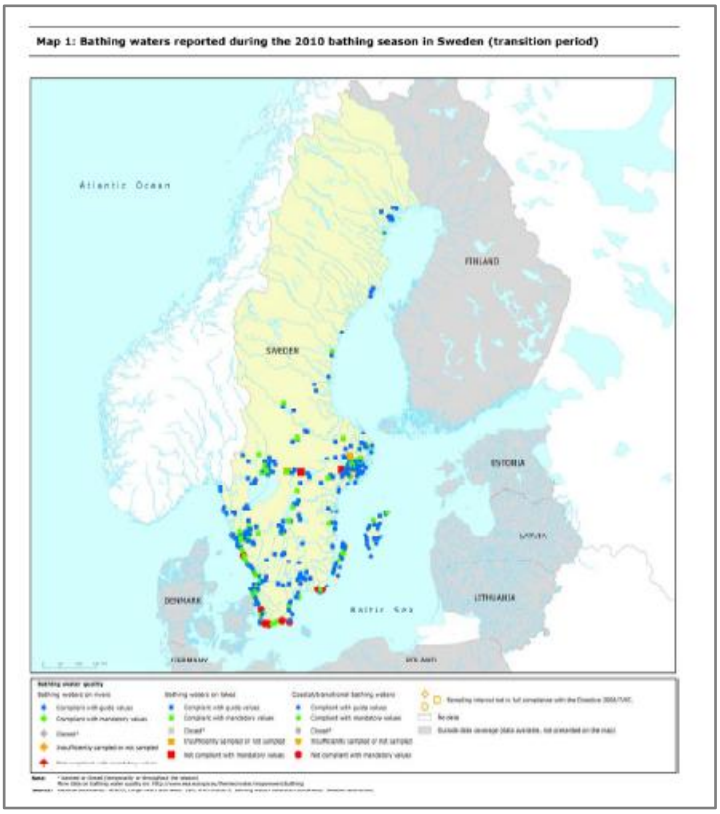

Figure 4.10. Status of Swedish beaches during the 2010 bathing season based on the Bathing Water Profiles. Source: EEA (2011).[5]

Status of ecosystem service R5 Regulation of hazardous substances

The ecosystem service R5 Regulation of hazardous substances was associated in Section 4.3.1 to D8 and D9. The marine ecosystems are providing this service thanks to the existence of three different functions: Breaking down, storing and burying. These functions imply a reduction of human exposure to hazardous substances. For example, natural sediments help binding otherwise extremely stable and harmful substances such as heavy metals and organic pollutants such as DDT, PCB and dioxins. Garpe (2008:87) assesses the status of R5 as "moderate" because the presence of anthropogenic waste and other disturbances imply a reduced capacity of the marine ecosystems to break down, store and bury hazardous substances. Considering Figures 4.7-4.9, the status of R5 is therefore assessed as *insufficient* for both the Baltic Sea and the North Sea.

4.3.2.3 D10 MARINE LITTER[6]

For the marine litter descriptor D10 we selected indicator 10.1.1 (litter washed ashore or found along the coast).

[5] See http://www.eea.europa.eu/themes/water/status-and-monitoring/state-of-bathing-water-1/country-reports-2010-bathing-season/sweden-bathing-water-results-2010/at_download/file

[6] For more details on marine litter in Sweden, see Enveco and DHI (2012).

Since the early 1990's marine litter has been collected and measured at six beaches on the Swedish west coast. The amount of litter found is shown in Table 4.12. In addition to the volume the number of day labours, bags of litter, fish boxes and oil containers found are also shown. The reason for the high volume (15 500 m^3) value in 1992 is that this was the first year the litter was collected and large amounts had accumulated. The relative low numbers in 1996, a total volume of 4000 m^3, is partly a result of extensive ice coverage during the winter season as well as long periods with easterly winds which transported the litter off-shore (Olin, 2010).

Table 4.12. Amount and composition of litter collected in the province of Bohus 1992-2006 (Olin, 2010). Also the number of day labours involved in collecting the litter is shown.

Year	Volume (m^3)	Day labour (number of)	Bags of litter (number of)	Fish boxes (number of)	Oil containers (number of)
1992	15 500	25 000	89 200	2 410	
1993	5 500	6 000	36 071	1 412	2 500
1994	6 000	7 163	36 210	1 231	733
1995	6 000	6 508	34 427	1 229	589
1996	4 000	5 840	22 607	575	1 316
1997	6 000	7 885	36 206	2 020	2 292
1998	6 000	6 480	35 825	1 620	2 290
1999	8 000	7 023	39 103	1 899	2 673
2000	7 000	8 081	48 581	3 046	4 021
2001	5 000	6 214	34 066	1 361	2 393
2002	4 000	5 880	30 119	2 186	2 937
2003	3 000	5 364	24 335	1 631	2 150
2004	3 000	5 472	24 620	1 453	2 099
2005	3 000	4 964	24 131	1 640	2 114
2006	3 000	4 156	19 944	1 072	1 553

Table 4.13. Marine litter found in Sotenäs on the Bohus Coast (Enveco and DHI, 2012).

Year	Volume (m^3)	Mass (tons)	Percentage of beaches cleaned
2007	199	19.4	25
2008	152	14.4	25
2009	364	31.9	50
2010	455	42.1	53

The local authorities in Sotenäs on the Bohus Coast have collected marine litter from beaches from 2007 to 2010, see Table 4.13. The collection is carried out between March and October each year. Among the items found are fish boxes, oil containers, medical waste, and refrigerators. The percentage of beaches cleaned is also reported. In 2007 and 2008, marine litter was collected on only 25% of the beaches while between 2009 and 2010 about half the beaches where cleaned. This shows that marine litter data based on beach clean-up efforts can underestimate the total amount of litter on a beach.

OSPAR collects data at a number of reference beaches along the coastal zones of Europe. Six beaches from the Bohus Coast are included in the OSPAR North Sea programme. Figure 4.11 illustrates the amount of litter in different OSPAR regions and shows that the North Sea is one of the areas most affected by marine litter.

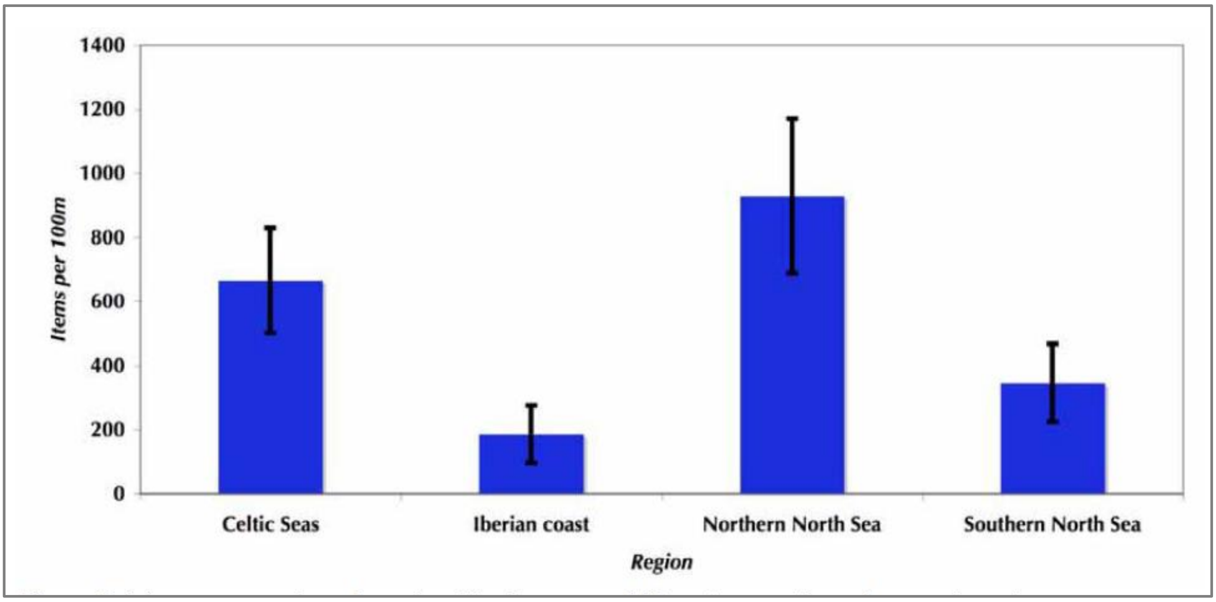

Figure 4.11. Average number of litter items per 100 meters on the reference beaches in the OSPAR regions. (Figure from OSPAR, 2009, p. 5)

For the Swedish east coast in the Baltic Sea, marine litter data is very scarce. When it comes to marine litter, the Swedish east coast receives little attention compared to the west coast, in particular the Bohus Coast. Therefore, in order to estimate the amount of litter on the Swedish Baltic Sea coast, data are used from elsewhere in the Baltic Sea..

Municipalities and NGOs (e.g. WWF and the Ocean Conservancy) gather information about the amount of litter found at beaches in the Baltic Sea. UNEP and the Ocean Conservancy collect information from beach clean-up efforts in the Baltic Sea. Although UNEP (2009) does not include data specific for Sweden we will use it to illustrate typical values for the Baltic Sea. The highest concentration of marine litter found on beaches in the Baltic Sea is 700 to 1200 items per 100 m coastline. These values are very similar to those reported by OSPAR (2009) for the northern North Sea. More typical values for the Baltic Sea are 6 to 16 pieces of litter per 100 m coastline. From these figures we conclude that marine litter on beaches is a larger issue in the North Sea than in the Baltic Sea. However, it is important to keep in mind that local variations can be substantial. Close to the source of the litter (e.g. at a public beach) the amount of litter may be higher, making marine litter to a conspicuous issue.

Status of ecosystem service C2 Scenery

In Section 4.3.1, D10 was associated to the ecosystem service C2 Scenery. The provision of this service implies aesthetic values to humans and includes beauty as well as silence, which is appreciated by tourists as well as residents and owners of holiday houses. Clear water, richness of animal and plant species, a feeling of pureness and silence are some important attributes. Besides marine litter and eutrophication effects such as algal mats and cyanobacterial blooms, offshore wind parks, beach erosion, oil spills and decrease in valuable species are examples of phenomena that are likely to have adverse effects on scenery. Garpe (2008:145) assesses the overall status of C2 as "moderate" since substantial development is taking place in many coastal regions. However, there are also great regional differences. Taking into account Garpe's view and the review of the extent of marine litter above, we assess the status of C2 as *locally insufficient* in both the Baltic Sea and the North Sea.

4.3.2.4 STATUS OF ECOSYSTEM SERVICES: SUMMARY

The status assessments for the three intermediate ecosystem services R3, R5 and C2, give an opportunity to evaluate what they imply for the status of the subcategories of marine recreation. Using the main dependencies of marine recreation on the three selected intermediate ecosystem services as identified in Tables 4.2-4.5, a summarizing picture is provided in Table 4.14. This table indicates that the marine ecosystems are *not* providing enough input for having a sustainable supply of the subcategories C1.1-C1.6. For C1.7 (skating, skiing) and C1.8 (using water-based transportation), the situation is different because they are not identified as being greatly dependent on R3 and R5. Their dependence on C2 implies that the marine ecosystems are *locally* not providing enough input for having a sustainable supply of C1.7 and C1.8.

Table 4.14. Summary of status assessment for selected intermediate ecosystem services.

Intermediate marine ecosystem services		**Subcategories of marine recreation (final ecosystem services)**							
		C1.1 Swim-ming	C1.2 Diving	C1.3 Wind-sur-fing, water skiing	C1.4 Boat-ing	C1.5 Fish-ing	C1.6 Being at the beach or sea-shore	C1.7 Ska-ting, skiing	C1.8 Using water-based trans-porta-tion
R3	Eutro-phica-tion mitiga-tion	insuf-ficent	insuf-ficent	insuf-ficent	insuf-ficent	insuf-ficent	insuf-ficent		
R5	Regula-tion of hazar-dous sub-stances	insuf-ficent	insuf-icent	insuf-ficent	insuf-ficent	insuff-icent	insuf-ficent		
C2	Enjoy-ment of scenery	locally insuf-ficent	locally insuf-ficent	locally insuf-ficent	locally insuf-ficent	locally insuf-ficent	locally insuf-ficent	locally insuf-ficent	locally insuffic ent

4.4 The impact of tourism sectors on selected indicators

Below we briefly discuss how the marine tourism sectors A-H affect the selected indicators related to the descriptors D5 Eutrophication, D8 and D9 Contaminants and D10 Marine litter in the previous section.

4.4.1 D5 Eutrophication

For the descriptor D5 Eutrophication above, we selected two indicators, nutrient levels and toxic algal blooms. To study the impact of the marine sectors on eutrophication we look at nutrient levels only, because without the accumulation of nutrients there is no eutrophication.

As is indicated by Table 4.15, all of the marine tourism sectors affect nutrient levels. Sectors A-E contribute by discharge of sewage water directly to the sea thereby increasing nutrient levels. Ships and boats with engines also contribute with nitrogen through the combustion of fuels. Same-day visits (sector H) might include trips by ferries and visits to beaches, restaurants, etc., and are therefore likely to at least partly influence nutrient levels in a similar manner as the other sectors.

The biggest contribution from ships (sectors A-D) is due to NO_x emissions from fuel combustion. These emissions enter the ocean in the form of atmospheric deposition. Stipa et al. (2007) estimated the contribution of shipping to the atmospheric deposition into the Baltic Sea. Passenger ships emit approximately 76 000 ton NO_x/year. In the Baltic Sea, atmospheric deposition corresponds to 25 % of the total nitrogen load to the Baltic Sea. The load due to ships corresponds to 10-15 % (with large variation within the Baltic Sea and time of the year) of the atmospheric deposition. Although passenger ships only make up about 6 % of the number of ships in the Baltic Sea, they emit circa 20 % of the total NO_x load from ships. The load from passenger ships corresponds to 0.5 % of the total load to the Baltic Sea. This can be compared with the nitrogen load from sewage water from ships, which is an order of magnitude smaller, 0.04 % of the total load of nitrogen to the Baltic Sea (Hänninen and Sassi, 2009). For phosphorus, Hänninen and Sassi (2009) estimated the load from sewage water from ships to 0.3 % of the total phosphorus load to the Baltic Sea.

For leisure boating (sector E), Transportstyrelsen (2009) estimated that a prohibition in Sweden against emitting sewage water from recreational crafts would result in a maximum reduction of phosphorus emissions amounting to 3.7 tonnes per year, which is about 0.001 % of the total Swedish phosphorus load to the Baltic Sea. While this is a small proportion, Transportstyrelsen (2009) emphasizes that the emissions from recreational crafts generally takes place at times and places where it contributes relatively much to algal growth and other eutrophication effects.

Holiday houses and commercial accommodation (sectors F-G) produce sewage and contribute to the discharge of nutrients (nitrogen and phosphorus) to the sea. However, to determine the actual contribution from these sectors *per se* is a complex task. Domestic marine tourists in these sectors will increase the nutrient load to the sea if the sewers connected to holiday houses/commercial accommodation have a smaller capacity to remove nutrient than the sewers connected to the tourists' residence and/or if the holiday houses/commercial accommodation are situated closer to the sea than the tourists' residence. That is, there are (1) a sewer nutrient removal factor and (2) a geographical factor determining the extent of the actual contribution of these sectors to the nutrient load to the sea.

Holiday houses (sector F) are either connected to a sewage treatment plant or have a private sewer. In general, private sewers can be expected to have a lower nutrient removal capacity than municipal sewage treatment plants. This means that both factor 1 and 2 might contribute to that sector F contributes to an extra nutrient load to the sea. As to commercial accommodation facilities (sector G), they can generally be expected to be connected to a sewage treatment plant, which means that factor (2) could be the most important factor for sector G. However, to set numbers on these potential increases and the importance of these two factors require a detailed study which was judged as being beyond the scope of this report.

Table 4.15. The impact of marine tourism sectors on nutrient levels (GES indicator 5.1.1).

Selected indicator	Sectors							
	A. Cruise ship traffic	B. Intern-ational pas-senger ferry traffic	C. Natio-nal pas-senger ferry traffic	D. Other com-mercial pas-senger trans-porta-tion in marine waters	E. Leisure boating	F. Holiday houses	G. Com-mercial accom-moda-tion	H. Same-day visits
5.1.1. Nutrient levels	X	X	X	X	X	X	X	X

4.4.2 D8 and D9 Contaminants

For contaminants two indicators are selected:

- 8.1.1 Concentration of the contaminants mentioned above, measured in the biota, sediment and water
- 9.1.1 Actual levels of contaminants that have been detected in fish and seafood

The main influence of the marine tourism sectors on contaminants in the water and potentially in fish and seafood is through toxic anti-fouling boat paints. This is reflected by the X's in Table 4.16. See IVL and Enveco (2012) for details on the emissions of synthetic compounds due to use of anti-fouling paints for maritime transports.

Table 4.16. The impact of marine tourism sectors on concentrations of contaminants and levels of contaminants in fish and seafood (GES indicators 8.1.1 and 9.1.1).

Selected indicators	Sectors							
	A. Cruise ship traffic	B. International passenger ferry traffic	C. National passenger ferry traffic	D. Other commercial passenger transportation in marine waters	E. Leisure boating	F. Holiday houses	G. Commercial accommodation	H. Same-day visits
8.1.1 Concentration of the contaminants mentioned above, measured in the biota, sediment and water	X	X	X	X	X			
9.1.1 Actual levels of contaminants that have been detected in fish and seafood	X	X	X	X	X			

4.4.3 D10 Marine litter

Marine tourism is considered to be the main source of marine litter (UNEP, 2009), especially of the litter washed ashore and deposited on the coastline (indicator 10.1.1). The source of this litter is either from trash left behind by beach-goers or litter from ships that have washed ashore. All marine tourism sectors are therefore judged to have an impact on this indicator, see Table 4.17.

Although we only look at the impact of the marine tourism sectors on the selected indicator, it should be mentioned that the sectors A-H have an impact on all the marine litter indicators. Litter found in the water column and at the sea bottom (indicator 10.1.2) originates most commonly from ships. Light and buoyant items stay on the surface and can drift long distances with the currents. Heavier items sink to the sea floor and remain there. Boats and ships also contribute to micro-particles in the sea (indicator 10.1.3) through fuel combustion and through microscopic flakes of boat paint. Litter floating on the sea or on the coast, especially plastic item (e.g. plastic bags) can be ingested by marine mammals. Although some of this litter is due to fishing, some of it is due to the marine tourism sectors.

Table 4.17. The impact of marine tourism sectors on litter washed ashore or deposited on coastline (GES indicator 10.1.1).

Selected indicator	Sectors							
	A. Cruise ship traffic	B. Inter-natio-nal pas-senger ferry traffic	C. Natio-nal pas-senger ferry traffic	D. Other com-mercial pas-senger trans-porta-tion in marine waters	E. Leisure boating	F. Holiday houses	G. Com-mercial accom-moda-tion	H. Same-day visits
10.1.1. Litter washed ashore or deposited on coastline	X	X	X	X	X	X	X	X

4.5 Driving forces influencing tourism sectors

Looking back at the development of the Swedish tourist industry in the last 25 years, it can be concluded that there are two factors that generally have had a large impact: (i) The economic development including the impact of policy instruments such as VAT and gasoline tax, and (ii) weather conditions. Marine tourism is especially sensitive to weather conditions, which can easily be seen from statistics on the number of overnight stays in leisure boats. (Resurs AB, 2011b). Related to the former factor, economic development is further investigated as a general driving force in Section 4.5.1 below. We subsequently go through a number of more specific driving forces for different sectors in Section 4.5.2, including factors related to the marine environment and the climate.

4.5.1 General driving force: Economic development

The Swedish tourist industry is in absolute numbers a growing industry. The turnover related to tourism has increased from SEK 150 000 million in 2000 to SEK 220 000 million in 2010 (2000 prices). The part of the turnover caused by foreign tourists visiting Sweden has increased from 27 % to 34 % during this period. In 2010, the total gross value added of the Swedish tourism industry was about SEK 80 000 million (2010 prices). In relative terms, the tourist industry has accounted for an almost constant proportion of GNP during the last decade: 2.7-3.0 %. (Tillväxtverket, 2011).

A growing tourist industry is an international phenomenon. International travelling has more than doubled since 1990 and acute economic crises only seem to imply temporary halts in this development. For example, in 2009 there was a 4 % decrease in global travelling in response to the exploding financial crisis in the autumn of 2008, but in 2010 the industry more than recovered with a 6.6 % increase. (Tillväxtverket, 2011).

These trends reflect that in general, the most important driving force for the tourism industry is the general economic development. This is true for both leisure and business travelling. If there is a positive general economic development, individuals are gaining an increasing disposable income and firms are given new investment opportunities, at least if the financial system is well-functioning. (Niklas Gustafsson, HUI, personal communication).

Looking into the future, the UNWTO tourism 2020 vision suggests that a continued growth until 2020, entailing a 55 % increase globally in the number of international arrivals between 2010 and 2020. For Europe, UNWTO predicts a 36 % increase. (UNWTO, 2011a). Sweden has in the last two decades experienced a greater increase in the number of international arrivals in comparison to a European average. (Tillväxtverket, 2011). If this trend is stable, an increase in arrivals greater than 36 % could be expected for Sweden between 2010 and 2020. UNWTO has also recently launched a long-term forecast to 2030. It indicates a growth in international arrivals also between 2020 and 2030, but at a more moderate pace than before. While the predicted increase in arrivals between 1980 and 2020 was 4.2 % per year, UNWTO's forecast for the period of 2010-2030 is 3.3 %. The reduction in growth is due to factors such as a lower GDP growth when economies mature, a reduced elasticity of travel to GDP and a tendency for transport costs to increase rather than diminish. (UNWTO, 2011b). This international outlook thus suggests that the Swedish tourist industry can expect that the growth in international arrivals will continue, other things being equal. This is highly important for the total growth of the Swedish tourist industry because the domestic market, i.e. Swedes being tourists in Sweden, is relatively small in comparison to the potential number of international arrivals.

4.5.2 Specific driving forces

In this section, we take a closer look at more specific driving forces. We begin by the tourist industry in general and identify factors of particular importance for the marine part of this industry. The subsequent subsections deal with specific driving forces for passenger ship traffic, leisure boating and holiday houses.

4.5.2.1 THE TOURIST INDUSTRY IN GENERAL

The important role of the general economic development for the future growth of the Swedish tourist industry is emphasized also by Svensk Turism AB[7] (2010). However, the extent to which the Swedish tourist industry can benefit from the opportunities that a globally growing tourist market depends on the competitiveness of Swedish tourism, which in turn is influenced by a large number of more specific global, national, regional and local driving forces. As to the particular case of marine tourism sectors, it can be observed that while marine tourism has increased during the last 20 years, there has been a considerably larger increase in Swedish winter tourism at ski resorts has been considerably larger. This is also reflected by a higher willingness to invest in new facilities at Swedish ski resorts than at coastal destinations. (Resurs AB, 2011b).

[7] Svensk Turism AB is a national tourist industry organization, owned by 160 companies and organizations that together represents about 10 000 enterprises (Svensk Turism AB, 2010).

The driving forces that were identified by Svensk Turism AB (2010) are listed in Table 4.18. The table illustrates the diversity of factors that are determining the development of the tourist industry. Of particular interest is the fact that environmental issues are identified at all levels; we study this in more detail below.

Rather few regulations and other policy instruments specific for the tourist industry are included in Table 4.18; the policy issues rather tend to be of a more general nature, such as investing in infrastructure and suitable education and create favourable entrepreneurial conditions. The latter is to a large extent related to whether Swedish taxes reduce the competitiveness of the Swedish tourist industry. Svensk Turism AB (2010) brings up two examples of specific importance to the tourist industry: the VAT levels on both restaurants and accommodation are at present higher in Sweden in comparison to the average EU levels, and Svensk Turism AB (2010) argues that this tax difference constitute a clear negative impact on the Swedish tourist industry. If this is correct, the suggested reduction in VAT for restaurants from 2012 is a policy instrument that will contribute to increased competitiveness of the Swedish tourist industry, also the marine part of this industry. A specific policy instrument that strongly affects marine tourism is the regulations for shoreline protection (*Miljöbalken* SFS 1998:808, chapter 7, recently changed based upon Government Bill 2008/09:119). The existence of the shoreline protection law is probably a main explanation to the relatively low willingness to invest in new tourism facilities at the Swedish coast (Resurs AB, 2011b).

Turning to environmental issues, SOU 2007:60 concludes that climate change is likely to have a significant impact on the Swedish tourism sector, partly because coastal activities are the basis for an important part of the tourism sector. This is an issue we return to in Section 4.7.

Table 4.18. Global, national, regional and local driving forces for the Swedish tourist industry as identified by Svensk Turism AB (2010).

Global level and Sweden's position relative to the rest of the world	National level	Regional/destination level	Enterprise level
Continued globalization	Political will and decisiveness	Political will and decisiveness	Profitability
Economy and prosperity	Economic development	Ability to cooperate for destination development	Ability to develop the business idea
Health and epidemics	Taxes and regulation	Cooperation between enterprises and the public sector	Innovativeness and productivity development
Political stability and security	Effective authorities	Supply of "raw material", i.e. attractive destinations and places to visit	Access to capital and financial sustainability
Environment and climate	Cooperation within the tourist industry	Innovations and ability to refine "raw material"	Cooperation with other enterprises
Natural disasters	National marketing	Marketing and selling skills	Education and training
Travel patterns	Effective education and training	Access to capital	Work environment, manpower care and salaries
Trends	Supply of labour and skills	Infrastructure and accessibility	Supply of labour
Competition globally	Technological competitiveness	Technological and IT effectiveness	Technological competence
Competition from other Nordic countries	Environment and climate	Seasons	Environment and CSR (corporate social responsibility)
General technological development	Innovations and development of products	Environment and climate	
Development of environmental technology, especially for transports	Infrastructure and accessibility	Demography and supply of labour	
Geographical location and climate	Seasons		
Supply and price of oil	Trends		
Exchange rates			

4.5.2.2 PASSENGER SHIP TRAFFIC

Maritime transports including passenger ship traffic in Swedish waters are described in IVL and Enveco (2012). The number of passenger ships is few in comparison to the total number of ships – Stipa et al. (2007) estimated that about 6 % of all ships in traffic in the Baltic Sea region as a whole is passenger ships. However, passenger ships including ferries that also are transporting cargo are dominating maritime transports in the sense that they in 2009 accounted for almost 80 % of the number of all calls to Swedish ports

(Sjöfartsverket, 2010). IVL and Enveco (2012) also present policy instruments relevant for maritime transports. Rather than repeating their findings, we will emphasize a few items that are of particular relevance to passenger ship traffic, i.e. sectors A-D:

- *IMO MARPOL 73/78 Annex IV on prevention of pollution from sewage from ships*, in force from 2003, see also TSFS 2010:96 (changed by TSFS 2011:1). All discharge of untreated sewage is prohibited closer than 12 NM from nearest land. Adequately treated discharged is prohibited closer than 4 NM from nearest land. There is a requirement that ships are to have either treatment plants or holding tanks, and the annex also specifies maximum rates of discharge.

- *IMO MARPOL 73/78 Annex V on prevention of pollution by garbage from ships*, see also TSFS 2010:96 (changed by TSFS 2011:1) in force from 1988. Annex V of MARPOL 73/78 defines designated special areas, which include the Swedish EEZ. Disposal of any waste to the sea is prohibited, with the exception of food waste, which never is to be disposed closer than 12 NM from nearest land and as far from land as practically possible. Ports are to install adequate facilities for taking care of garbage from ships as soon as possible.

- *HELCOM agreement on ban on sewage discharge*. On 15 July 2011, IMO adopted a HELCOM proposal to ban all untreated sewage discharge from passenger ships in the Baltic Sea region, and these new regulations are covered by MARPOL Annex IV. Ships are required to either use an approved sewage treatment plant or deliver sewage to a port reception facility. The ban will come into force when port reception facilities are adequate, which means that some facilities have to be upgraded. Such upgrading is agreed by the coastal countries and is expected to be completed by 2015. The upgrading is facilitated by the HELCOM Cooperation Platform on Port Reception Facilities. New passenger ships are required to comply with the ban by 2016 and existing passenger ships by 2018. (HELCOM, 2011b.)

IVL and Enveco (2012) concludes that there will be a general increase in sea traffic in the forthcoming decades in the Baltic Sea region and the NE Atlantic region, particularly because EU intends to stimulate sea traffic. IVL and Enveco (2012) also finds that this increase is not likely to be counteracted by environmental policy instruments, neither to 2020 nor to 2050. This applies also to passenger ship traffic, but it is in general more factors that influence passenger ship traffic than cargo traffic. Again, the general economic development is of importance (see above), particularly for cruise-ship traffic. However, there are also other factors influencing the competitiveness of particular cruise routes, in particular the development of attractions at or close to the ports (Resurs AB, 2011b). Lundgren (2006) identifies four such general factors:

1. Physical-geographical factors
2. Resource basis – geographic resources and their tourist utility
3. The growth process – development of modern excursion and cruise services
4. Cruise ship impacting – destination area consequences

As to other passenger ship traffic, the availability of duty-free sales has historically been an important determinant for the international traffic. In the last 20 years, the international ferry traffic has been quite stable in terms of number of passengers. New destinations such as Tallinn and Riga have appeared, but on the other hand destinations in Germany and Poland have experienced decreases. In addition, North Sea routes to the Netherlands and the UK has been closed down. (Resurs AB, 2011b). Hänninen and Sassi (2009) predict that the traffic on important routes such as Turku/Helsinki-Stockholm and Helsinki-Tallinn is expected to stay at about the current level in coming years. We therefore expect no major changes in international ferry traffic in the future. As to national ferry traffic and non-regular ship traffic, increases proportional to the general increase in tourism can be expected (Resurs AB, 2011b).

4.5.2.3 LEISURE BOATING

While leisure boating shall comply with general sea laws (such as Sjölag 1994:1009), there are some regulations that apply specifically to leisure boating in Swedish waters:

- Directive 94/25/EC (16 June 1994) on the approximation of the laws, regulations and administrative provisions of the Member States relating to recreational craft.
- Lag (1996:18) om vissa säkerhets- och miljökrav på fritidsbåtar
- SJÖFS 2005:4 Sjöfartsverkets föreskrifter om ändring i Sjöfartsverkets föreskrifter (SJÖFS 2004:16) om vissa säkerhets- och miljökrav på fritidsbåtar m.m.

SJÖFS 2005:4 mostly cover requirements regarding safety, emissions from boat motors and noise. Maximum emissions for different motor types are specified for CO, HC, NO_x and particles. For noise, maximum noise levels of 67, 72 and 75 dB are specified for one-motor effects of less than or equal to 10 kW, more than 10 but less than or equal to 40 kW and more than 40 kW, respectively.

It should also be mentioned that a prohibition against emitting sewage water from recreational crafts is suggested to be in force from 1 April 2014 for the whole Swedish coast except the Gulf of Bothnia and from 1 April 2016 also for the Gulf of Bothnia (Transportstyrelsen, 2011b).

As to other driving forces for leisure boating, the recent national survey *Båtlivsundersökningen 2010* indicates that owners of leisure boats are generally reluctant to refrain from boating: 72 % of the boat owners said that they would *probably not* or *absolutely not* be willing to refrain from boating. This indicates that considerable stability in the preferences for boating once one has become a boat owner. The corresponding figure for persons who have taken part in boating in 2010 without being owners of a boat were somewhat lower: 52 %. Boat owners were also asked to rank what types of experience are important or not important during a boat trip. The types that on average were judged to be at least rather important was *experience of freedom, experience of nature, nice weather* and *silence and calmness*. This suggests that boat owners in general would agree that noise and at least conspicuous environmental disturbance, for example, marine litter and substantial algal blooms, would reduce either the number of boat trips or the perceived quality of boating or both. Swedes who are not boat owners or have not taken part in boating in 2010 reported similar main reasons for belonging to these categories: lack of interest in boating, no access to a boat and lack of time. Among boat non-owners, financial reasons were also often mentioned as an explanation to why they do not own any boat. All respondents were also asked to report if they are interested in having holidays in Swedish archipelago areas in the next two years (2011-2012). While there is a general interest in having such holidays (43 % of the respondents said they were rather or very interested), a majority of the respondents answered that they were not interested at all in renting a canoe or small boat (51 % were not interested at all while 18 % were rather or very interested) or purchasing a new or additional boat within five years (71 % were not interested at all while 14 % were rather or very interested). This indicates the limitations of the market for leisure boats. (Transportstyrelsen, 2011a). It is also a fact that the number of overnight stays in leisure boats has been rather constant during the last 20 years, except for influence from weather conditions. However, the number of daytrips have increased, which is likely to reflect a general trend towards stronger preferences among Swedes for leisure activities that are shorter in time and involve fewer overnight stays. (Resurs AB, 2011b).

4.5.2.4 HOLIDAY HOUSING

Driving forces influencing holiday housing are related to general economic and socio-demographic conditions in society. In a nationally representative survey carried out by Synovate-Temo in 2006, 19 % of the respondents reported that they were owner of a holiday house. Among those who were not owners, 43 % said that they will probably or certainly buy or inherit a holiday house in the future, although a majority of those respondents (58 %) believed this would happen in ten years, at the earliest. However, this indicates that there is no reason to believe that there would be any substantial reduction in the demand for holiday housing in the future. This is confirmed also by looking at the plans among those who are owners of holiday houses at present. Based on a nationally representative survey carried out in 2009, Müller et al. (2010) report that a great majority (81 %) of holiday house owners believe that they will use their holiday house more in five years from now or at least keep using it at the present level. However, this does not necessarily mean that their holiday houses will start being their permanent home – 78 % of the holiday house owners did not report any plans to settle down permanently in their holiday house. In any case, at least if the general economic development allows it, it is likely that holiday housing will continue to be an important recreational activity in Sweden. This is in particular likely to be true for holiday housing by the coast, which is indicated by the survey by Synovate-Temo (2006); this survey investigated what factors respondents perceive are of importance when owning a holiday house or considering to have one. These factors are listed in Table 4.19 together with the percentage of respondents reporting the factor as being of importance.

Table 4.19. Factors of importance for Swedes when owning a holiday house or considering to have one. Source: Synovate-Temo (2006).

Factor	Percentage of respondents reporting the factor as being of importance	Factor	Percentage of respondents reporting the factor as being of importance
Close to water	59	Permanent house standard and/or winterized	28
Beautiful nature	25	Sunny site	25
Distance to home	25	Privacy	22
Woodland lot	17	Easy access with own car	15
Situated in the archipelago/on an island	15	The price	10
That the children like it	10	Close to a beach	10
Renovation necessary	10	Renovation not necessary	10
Housing costs	9	Property tax/assessed value	9
Situated in Sweden	9	Children can bring friends	9
Opportunities for different types of activities	8	Possible to build an extension of the house	7
Situated close to service (e.g. post, bank, supermarket)	6	Commuting distance to work	6
Well-functioning public transportation (e.g. bus, train)	6	Possible to relax/silence and calmness	6
Suitable lot for building a new house	6	Situated close to friends	5
Situated close to boat harbour	5	Situated abroad	3
Situated close to relatives	3	Other factors	7

The importance of the factor “close to water” is striking. Together with factors such as “situated in the archipelago/on an island” and “close to a beach”, this list confirms the considerable attractiveness of coastal areas for holiday housing.

However, there are also specific driving forces for the case of coastal holiday housing. Of particular interest for this study are the available policy instruments for private sewers and shoreline protection. The importance of the former is illustrated by the fact that holiday houses are estimated to account for 42 % of the about 523 000 private sewers in Sweden, based on survey answers from 200 of 289 Swedish municipalities (Naturvårdsverket, 2004). However, the survey also shows that there are not detailed inventories in some municipalities. Besides general regulation such as *Miljöbalken* SFS 1998:808 and *Plan- och bygglagen* SFS 2010:900, the following policy instruments are of particular relevance for private sewers of holiday houses:

- *Förordningen om miljöfarlig verksamhet och hälsoskydd* SFS 1998:899, which is e.g. about permissions and registration of private sewers.

- *Naturvårdsverkets allmänna råd om små avloppsanordningar* NFS 2006:7, which specifies requirements for private sewers connected to less than or equal to 25 persons.
- *Lagen om allmänna vattentjänster* SFS 2006:412, which is about the water supply and sewage responsibilities of municipalities.
- *Anläggningslagen* SFS 1973:1149, which stipulates the creation of jointly-owned facilities such as private sewers connected to a group of holiday houses.

The regulations for shoreline protection are found in *Miljöbalken* SFS 1998:808, chapter 7. They were recently changed based upon Government Bill 2008/09:119.

4.5.3 Summary

Based on the earlier subsections, Table 4.20 summarizes the main policy instruments that were identified for the different tourism sectors. Another summary of findings and judgements of the earlier subsections is provided by Table 4.21, which presents a rough assessment of the general trend for the tourism sectors' use of marine waters to 2020 and 2050. The table indicates that all sectors besides sector A (cruise ship traffic) are likely to remain at about the same level of use of marine waters until 2020. Cruise ship traffic is likely to show a moderate increase until 2020, at least if the world does not experience an economic crisis of long duration. Making predictions for the period between 2020 and 2050 is very difficult, but until 2050 it is probable that all sectors show a moderate increase because of general population growth and a belief that there on average will be a positive economic development until 2050. We have found no reason to discriminate between the Baltic Sea and the North Sea for these trends. As to the influence of the development of environmental conditions and marine ecosystem services, see Section 4.7.

Table 4.20. Summary of main policy instruments identified for the tourism sectors.

Marine tourism sectors	**Main policy instruments**
All sectors	Policy instruments affecting general economic development, disposable income, the functioning of the financial system, and the competitiveness of Swedish tourist industry, e.g. direct and indirect taxes. General Swedish law such as *Miljöbalken* SFS 1998:808 and *Plan- och bygglagen* SFS 2010:900. The shoreline protection law (*Miljöbalken* SFS 1998:808, chapter 7, recently changed based upon Government Bill 2008/09:119).
A-D. Passenger ship traffic	IMO MARPOL 73/78 Annex IV on prevention of pollution from sewage from ships, see also TSFS 2010:96 (changed by TSFS 2011:1). IMO MARPOL 73/78 Annex V on prevention of pollution by garbage from ships, see also TSFS 2010:96 (changed by TSFS 2011:1). HELCOM agreement on ban on sewage discharge, covered by MARPOL Annex IV. See also policy instruments for shipping in general, listed in IVL and Enveco (2012).
E. Leisure boating	Directive 94/25/EC (16 June 1994) on the approximation of the laws, regulations and administrative provisions of the Member States relating to recreational craft. Swedish law 1996:18 *om vissa säkerhets- och miljökrav på fritidsbåtar.* SJÖFS 2005:4 *Sjöfartsverkets föreskrifter om ändring i Sjöfartsverkets föreskrifter (SJÖFS 2004:16) om vissa säkerhets- och miljökrav på fritidsbåtar*. A prohibition against emitting sewage water from recreational crafts is suggested to be in force from 1 April 2014 for the whole Swedish coast except the Gulf of Bothnia and from 1 April 2016 also for the Gulf of Bothnia (Transportstyrelsen, 2011b).
F-G. Holiday housing and commercial accommodation	Focus on policy instruments regarding nutrient emissions from these sectors: SFS 1998:899, *Förordningen om miljöfarlig verksamhet och hälsoskydd.* NFS 2006:7, *Naturvårdsverkets allmänna råd om små avloppsanordningar.* SFS 2006:412, *Lagen om allmänna vattentjänster* SFS 1973:1149, *Anläggningslagen.*

Table 4.21. Trends for the marine tourism sectors' use of marine waters.

	Marine tourism sectors							
	A. Cruise ship traffic	B. International passenger ferry traffic	C. National passenger ferry traffic	D. Other commercial passenger transportation in marine waters	E. Leisure boating	F. Holiday houses	G. Commercial accommodation	H. Same-day visits
2020	↗	→	→	→	→	→	→	→
2050	↗	↗	↗	↗	↗	↗	↗	↗

4.6 Trend for selected indicators and ecosystem services to 2020 and 2050

In this section, it is considered how selected indicators and ecosystem services might develop to 2020 and 2050 in a BAU scenario.

4.6.1 Short-term trend to 2020

In order to determine the development of indicators and ecosystem services to 2020 several assumptions about the future must be made. 2020 is a relatively short time perspective and no dramatic changes in the indicators and ecosystem services can be expected to happen. We will base the prediction for the next 10 years on the past 10 years by studying how the selected indicators have been changing in the last 10 years and extrapolating forward in time assuming a continuing trend for the next 10 years. For eutrophication, i.e. the nutrient level indicator, it is hence taken into account that measures are being implemented to reduce the accumulation of nutrients in the Baltic Sea. We first look at the trends for the selected indicators and then discuss what this implies for the ecosystem services.

4.6.1.1 NUTRIENT LEVELS AND EUTROPHICATION

To determine the trends in nutrient levels and eutrophication data and analyses from HELCOM (2010a) are employed. We focus the analysis on the Baltic Proper which is one of the most affected sea basins in terms of eutrophication in Sweden. The eutrophication analysis carried out by HELCOM is based on data for 2003-2007 and focuses on the following indicators: Nutrient (nitrogen and phosphorus) concentrations, chlorophyll-*a* concentrations, water transparency and zoobenthos communities. HELCOM also provides longer time series by which trends can be determined.

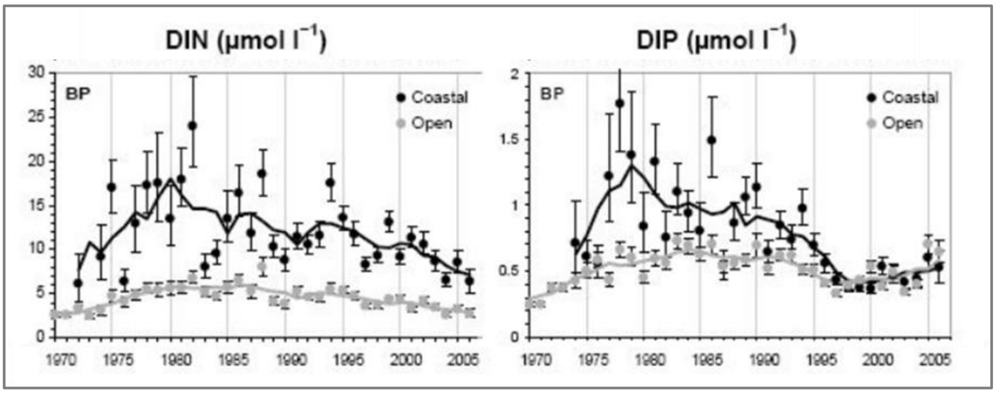

Figure 4.12. Winter means (December – March) of dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorous (DIP) in surface waters (0 – 10 m) in the Baltic Proper from 1970 to 2007. Black curve is for coastal locations and grey curve for open sea location. Source: HELCOM (2010a).

During the 1970's nutrient concentrations in the Baltic Proper increased and peaked in the early 1980's, see Figure 4.12. Since then there has been a declining trend for DIN (dissolved inorganic nitrogen), especially in coastal regions. Phosphorus also increased in the 1970's and peaked in the early 1980's. Unlike nitrogen, phosphoros has been increasing in the last decade.

An extrapolation of these trends forward in time suggests that nitrogen levels can be expected to remain fairly constant or decrease, and phosphorus levels to increase slightly. For the prediction of nutrient levels towards 2020 we take into account the results of realized and forthcoming abatement measures, especially those that are a part of the programmes of measures of the Water Framework Directive (WFD), which aims at obtaining good ecological status in most Swedish coastal waters by 2021. Combining the extrapolation and the WFD implementation suggests a slight decrease in nitrogen levels while phosphorus levels off. Thus in 2020 this would imply a small improvement in terms of reduced eutrophication effects.

For marine recreation, cyanobacteria blooms during the summer should also be considered. By looking at the ratio between nitrogen and phosphorus it is possible to assess the risk of cyanobacteria blooms. A low ratio increases the probability of a bloom happening (Aneer and Löfgren, 2007). Figure 4.13 shows the nitrogen to phosphorus ratio in the Baltic Proper at the open sea and coastal areas.

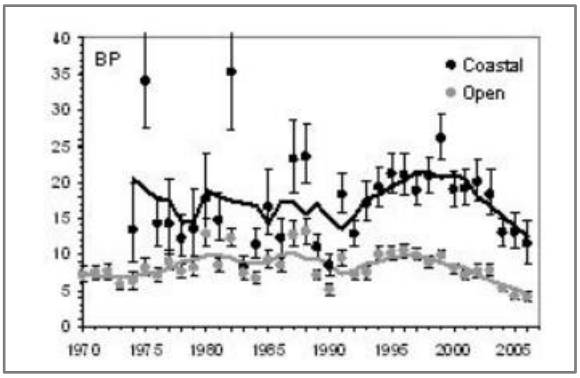

Figure 4.13. Winter DIN:DIP ratios in the Baltic Sea. Source: HELCOM (2010a).

The ratio is lower at the open sea but the coastal ratio shows a faster decrease. Thus with a decrease in nitrogen levels and constant phosphorus levels, the ratio between nitrogen and phosphorus (N/P) will be lower, favoring cyanobacteria blooms in the Baltic Sea during the summer. In the North Sea where salinity is higher, cyanobacteria are generally not a problem.

4.6.1.2 TOXIC SUBSTANCES IN FISH

The trend of the indicator related to the content of toxic chemicals in fish is based on measurements in fish along the coast of Sweden. Data on the content of lead, dioxins, cadmium, mercury and PCB:s in fish are available from the Swedish Environmental Protection Agency. This data goes back to the early 1980's and covers both the Baltic Sea and the North Sea. Here we look at the content of mercury and dioxins.

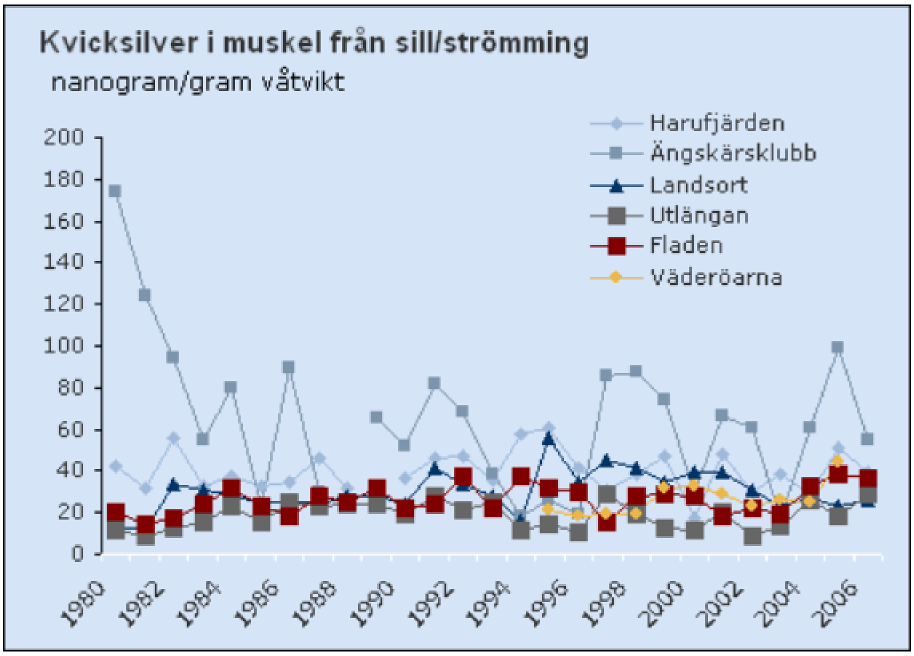

Figure 4.14. Mercury in herring muscle (ng/g wet weight) 1980-2006. Source: SEPA (2011).

Mercury in fish is a well-known problem in Sweden, especially for fish in fresh water lakes. For fish in the sea the mercury content is usually lower. Measurements along the coast show no clear increasing or decreasing trend (see Figure 4.14). At Ängskärsklubb there are large interannual variations. At Landsort the concentrations decreased from the 1990's till mid 2000's but started to increase then. On the west coast (Fladen and Väderöarna) the concentrations have been increasing in the last 5 years. Notice though that all these values are below the safety level of 500 ng/g wet weight.

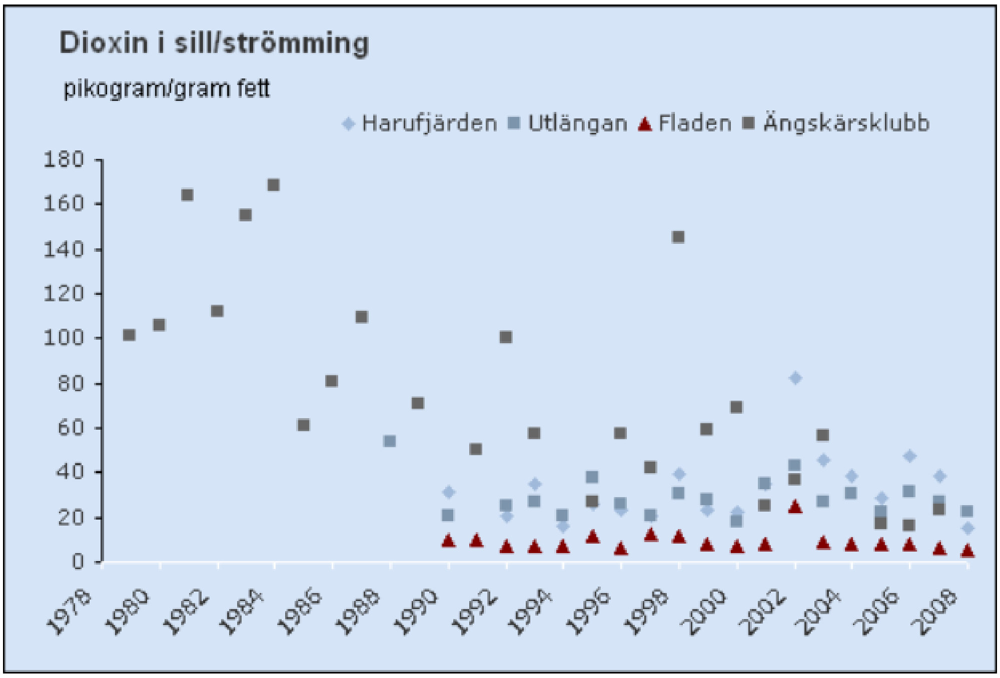

Figure 4.15. Dioxins in herring muscle (pg/g fatty tissue weight) 1980-2009.Source: SEPA (2011).

Figure 4.15 shows the concentration of dioxins in herring since the late1970's. During the last decade the values have remained fairly constant with a small decrease. Notice that at Ängskärsklubb the measurements start in the late 1970's and that the concentrations have decreased considerably since then. All these values are above the safety level of 4 pg/g.

To determine the figure trends we look at the time series and extrapolate forward in time. For mercury there is no clear trend and we assume that levels will remain similar in the next 10 years. For dioxin there is a small decreasing trend, which we assume will continue. The Baltic Sea coast differs from the North Sea coast in that it has generally higher levels of toxic chemicals in fish.

It is highly uncertain what these trends imply for the overall status of the ecosystem services until 2020, since other chemical substances than those reviewed above might introduce negative consequences. However, until 2020 we assume that it is sufficient to base the projection on the patterns represented by mercury and dioxins.

4.6.1.3 MARINE LITTER

The selected indicator for marine litter is for the litter deposited on the coast or washed ashore. There is a general lack of marine litter data in Sweden. There are very few time series available that can be used to determine trends in the GES indicators for marine litter. An exception is the time series from the beaches of the Bohus Coast where litter has been collected since 1992. This data set includes information about the volume collected, as well as number of bags, fish boxes and oil containers, see Table 4.12. This time series is used to determine the trend in the indicator 10.1.1 Marine litter found on the coast and/or washed ashore. Data from UNEP (2009) and OSPAR (2009) are used as well to illustrate similar or contrasting trends.

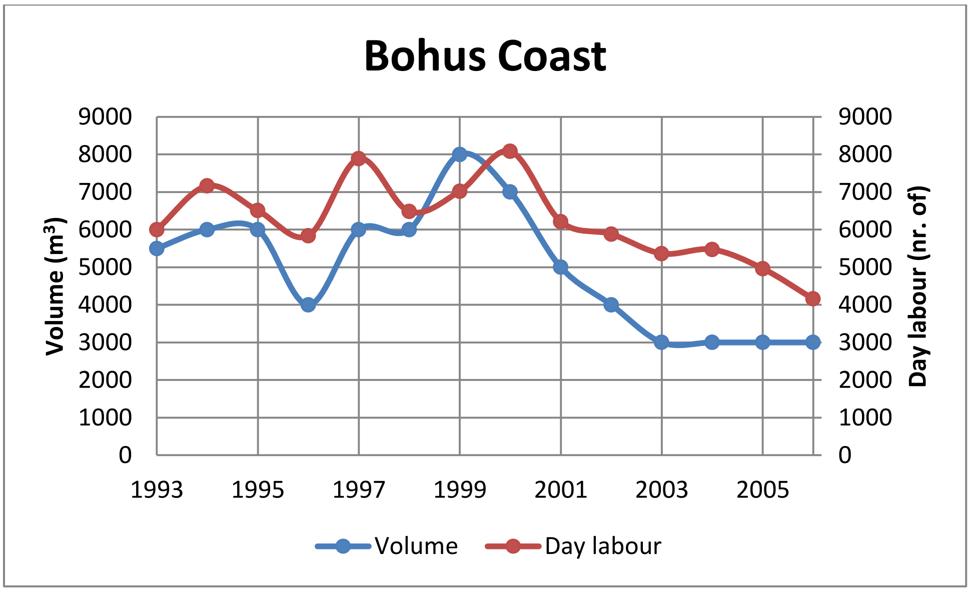

Figure 4.16. Amount of litter collected on the Bohus Coast 1993-2006 and number of day labours used to collect the litter. Data from Table 4.12. The year of 1992 has not been included in the plot as this was the first year of the beach clean-up effort and large amounts of accumulated litter were collected.

Figure 4.16 shows the amount of litter collected along the Bohus Coast in terms of volume (m^3) and the number of day labours used to collect the litter. Although the amount of litter seems to have been decreasing from 1999 to 2003 and then stagnated, it may not be that there is less litter. This data is for litter *collected* and during the early 2000's there was less money available for the clean-up programmes. The amount of litter collected at beaches depend on a number of factors, such as weather conditions, number of people that collect, etc.

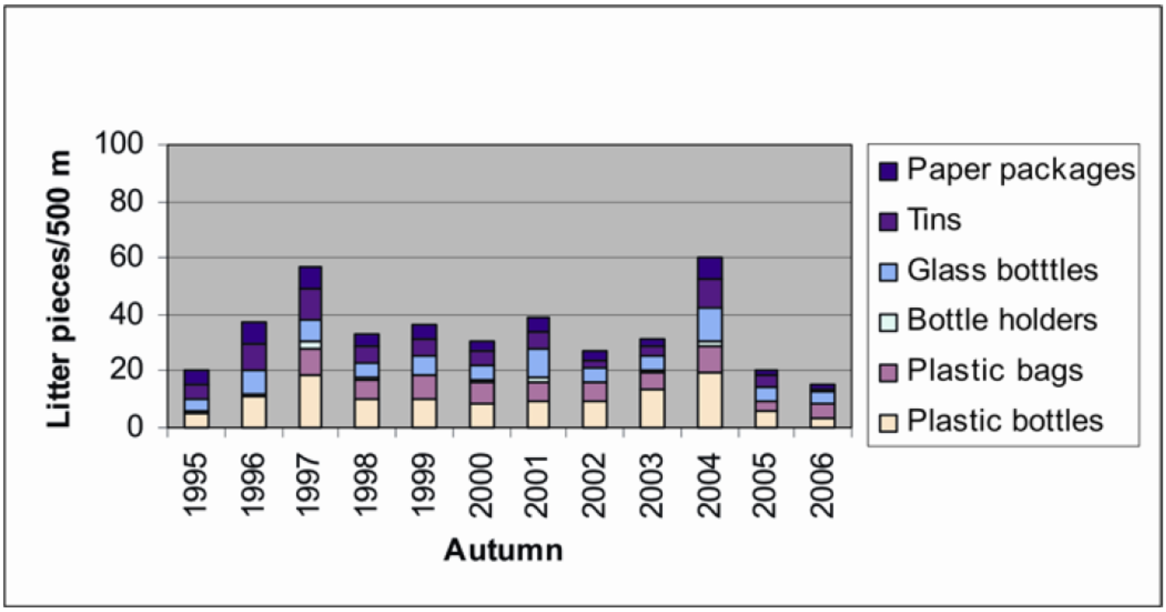

Figure 4.17. The amount of litter items per 500 m of beach found during autumn, 1995-2006. Data provided by Coastwatch Estonia. (Figure from UNEP, 2009, p. 29).

For comparison, Figure 4.17 shows the amount of litter collected by volunteers on beaches in Estonia during the autumns of 1995-2006. There is no clear trend in this data set either.

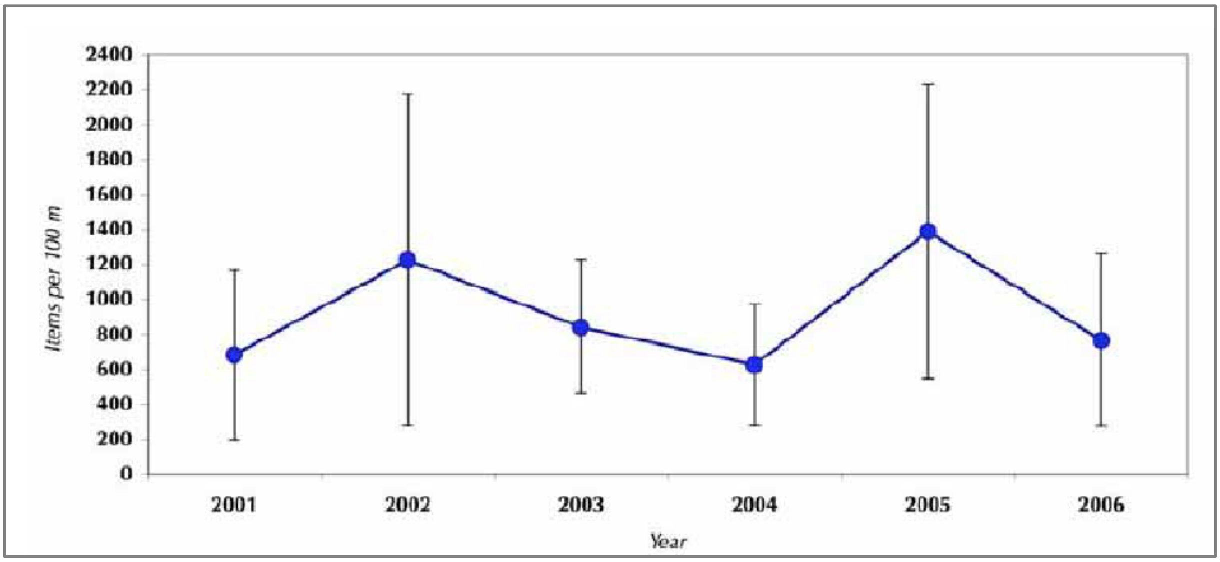

Figure 4.18. Average number of marine litter items on the Northern North Sea references beaches. This data set includes 6 beaches on the Bohus Coast. (Figure from OSPAR, 2009, p. 7).

Figure 4.18 shows the number of marine litter items on the Northern North Sea references beaches 2001-2006. This data set includes 6 beaches on the Bohus Coast. The decreasing trend in the Bohus Coast data cannot be seen here.

Based on these figures, there is no clear increasing or decreasing trend in the amount of marine litter found on beaches. Hence, if no new measures against marine littering are introduced, we can expect the amount of litter on the coast in the near future to remain at levels similar to today. There will always be inter-annual variations, but no long-term changes are expected.

4.6.1.4 LEVELS OF THREATS TO ECOSYSTEM SERVICES

This analysis can be compared with the level of threats in the near future to the ecosystem services as indicated in Garpe (2008). This analysis can be used to determine whether the ecosystem services will be sufficient or not in 2020.

Table 4.22. Level of threat for the intermediate ecosystem services for marine recreation and recreation according to own assessment and Garpe (2008).

Ecosystem service		Level of threat
R3	Eutrophication mitigation	Moderate
R5	Control of hazardous substances	Moderate
C2	Enjoyment of scenery	Moderate

The level of threat to R3 Eutrophication mitigation was considered as “low” by Garpe (2008). This is because the processes that allow for eutrophication to occur (e.g. denitrification) are not threatened *per se*. However, the supply of R3 was above assessed as being insufficient. For our analysis we therefore upgrade the threat to moderate for R3.

A moderate threat level implies that no major improvements or deteriorations in the ecosystem services are expected to happen in the next 10 years. Thus the situation in 2020 is likely to be similar to today’s situation, see Table 4.22. This suggests that the assessment in Table 4.14 would be valid also for 2020.

4.6.2 Long-term trend to 2050

4.6.2.1 EUTROPHICATION

For the long-term trend regarding eutrophication we use the Baltic Sea Action Plan as a starting point. One goal of the plan is a Baltic Sea unaffected by eutrophication by 2021. By 2050 we assume that measures to reduce eutrophication have been in place long enough to have had some effect. Thus the ecological status with regards to eutrophication can by 2050 be expected to improve. A topic of current research is what climate change would imply for the effects of the proposed nutrient reductions (ECOSUPPORT, 2011).

4.6.2.2 TOXIC SUBSTANCES IN THE WATER AND IN FISH

Another goal of the Baltic Sea Action Plan is for the Baltic Sea to be undisturbed by hazardous substances such as organic toxins (e.g. dioxin, PCB and DDT) and heavy metals. The objectives include to reach concentrations of hazardous substance close to natural levels and to ensure that all Baltic fish are safe to eat (HELCOM, 2007). By 2050 we assume that measures have been taken towards fulfilling the BSAP and that the use of toxic substances is being phased out by e.g. being substituted for less toxic substances. Thus we can expect an improvement in the Baltic Sea regarding toxic substances. However, this relies on the strong assumption that, similarly to the trend until 2020, any new chemicals introduced in industry or manufacturing would not have a substantially negative impact on the chemical status.

4.6.2.3 MARINE LITTER WASHED ASHORE OR FOUND ALONG THE COAST

To determine the long term trend of marine litter we take into account the development of the sources of litter, whether the litter can be collected or not and what the litter is made of.

Litter washed ashore or found along the coast can originate either from land (e.g. litter from beach-goers) or from the sea (e.g. litter from fishing or recreational boating). Given BAU, we expect a large fraction of the litter in the coastal environment to be due to the main land-based source, marine recreation.

A large fraction of the marine litter, including litter due to marine recreation, is made of plastic. Plastic materials decay very slowly thus any plastic item in the coastal environment can be expected to remain there for a very long time unless collected.

The litter found along the coast can be collected though as it is often found in relatively limited areas (compared to the size of the open sea). There are several beach clean-up programmes in place today, especially along the Bohus Coast. Given BAU and no change in the behaviour of people participating in marine recreation, the status of marine litter in the coastal environment will depend on the beach clean-up programmes.

4.6.3 Impact of trends in marine recreation on selected indicators

Here we briefly comment on the implications of the increasing trend for marine recreation in Sweden on the selected indicators. All marine tourism sectors are expected to increase by 2050, see Table 4.20. The most substantial impact of this increase is likely to be on the extent of marine litter, since marine recreation is responsible for a large fraction of the marine litter found on beaches, see also Enveco and DHI (2012).

4.7 What does BAU imply for the development of tourism sectors A-H?

It was concluded in Section 4.3.2.4 that the status of intermediate ecosystem services R3 Eutrophication mitigation and R5 Regulation of hazardous substances are not supplied to an extent that is sufficient for having a sustainable supply of the subcategories C1.1-C1.6 of marine recreation, see Table 4.14. The intermediate ecosystem service C2 Scenery was judged to be locally insufficient for having a sustainable supply of the subcategories C1.1-C1.8, which implies a *locally* non-sustainable provision of C1.7-C1.8.

The status described by Table 4.14 is also likely to be valid in 2020 for BAU, according to the projections in Section 4.6, see in particular Section 4.6.1.4. In order to evaluate the consequences of this status for the tourism sectors A-H, we make use of Table 4.1, which described the dependencies of the sectors on the subcategories C1.1-C1.8. The result is shown by Table 4.23, which indicates what sectors are likely to be mainly influenced by a non-sustainable supply of subcategories of marine recreation in 2020 for BAU. It turns out that the sectors that are primarily affected by a non-sustainable supply of the subcategories of marine recreation are E-H, i.e., leisure boating, holiday houses, commercial accommodation and same-day visits. Sectors A-D are likely to be only locally affected.

To evaluate the development until 2050 is much more complicated, but it was suggested in Section 4.6.2 that efforts according to the Baltic Sea Action Plan are likely to improve the marine environmental conditions. This could imply a major upswing for the Swedish marine tourism sectors because of synergy effects with climate change. SOU 2007:60 concludes that climate change is likely to have a significant impact on the Swedish tourism sector, partly because coastal activities are the basis for an important part of the tourism sector.

Climate change implies both advantages and disadvantages for marine tourism. The summer average water temperature in the Baltic Sea is estimated to increase by 2-4 degrees until the end of the 21st century. Together with a general prolongation of the summer season thanks to an increased air temperature in May and September, this would constitute an important increase in competitiveness of Swedish coastal tourist destinations, in particular since the Mediterranean region is predicted to experience an increase in inconveniently hot summer days and a decrease in the freshwater supply. In SOU 2007:60, it is emphasized that also a small transfer of the total number of tourist overnight stays in the Mediterranean region to Sweden would have large consequences for the Swedish tourist industry: A transfer of only 1 % of the overnight stays in the Mediterranean region would imply a 10 million increase in the number of overnight stays in Sweden, which correspond to a 100 % increase of the total annual number of tourist overnight stays in Sweden.

Table 4.23. "No" in the table denotes those subcategories of marine recreation which are not likely to have a sustainable supply in 2020 for BAU. The table also shows what sectors are dependent on each subcategory, based on Table 4.1.

Subcategory of marine recreation	**Sector**							
	A. Cruise ship traffic	B. International passenger ferry traffic	C. National passenger ferry traffic	D. Other commercial passenger transportation in marine waters	E. Leisure boating	F. Holiday houses	G. Commercial accommodation	H. Same-day visits
C1.1. Swimming						No	No	No
C1.2 Diving						No	No	No
C1.3 Wind-surfing, water skiing						No	No	No
C1.4 Boating					No	No	No	No
C1.5 Fishing					No	No	No	No
C1.6 Being at the beach or seashore						No	No	No
C1.7 Skating, skiing						No, locally	No, locally	No, locally
C1.7 Using water based transportation	No, locally	No, locally	No, locally	No, locally	No, locally			No, locally

Climate change is thus likely to have a positive impact on the marine tourism sectors in Sweden. There are also negative consequences such as increased erosion of beaches and changed conditions for building houses and other constructions close to the sea. However, above all SOU 2007:60 identified water quality and the presence of algal blooms as key factors for the development of summer tourism. If some destinations would experience reduced water quality and/or heavy algal blooms, this might diminish their competitiveness substantially while congestion might appear at other destinations. Locally, the tourism sector itself is able to influence water quality conditions by having appropriate sewage treatment, but large-scale algal bloom episodes are the result of a multitude of factors. Predictions of future algal blooms are thus a crucial input for evaluating whether the potentially large increase of marine tourism in Sweden because of climate change would be realized from about 2050 and thereafter.

5 TEV of changes in recreational opportunities

5.1 Objective and scope of analysis

Section 2.4 explained the concept of TEV as the sum of two different types of economic values: use values and non-use values. That is, TEV = use values + non-use values. While use values are due to individuals' direct or indirect use of an ecosystem service, non-use values refer to that people might regard it as important to know that there are a sufficient supply of ecosystem services and that these services may also be available to future generations (COM, 2010).

The objective of this chapter is to provide an updated picture of how recreation, or ideally, the subcategories of recreation has been economically valued up to know. The approach is to first carry out a wide search for literature focusing on valuation studies in Baltic Sea countries. Based on the findings from the literature review and complemented by some newer results, a small, but well-motivated, sample of already existing valuation studies of high relevance for the present study is chosen. The most important results from this small sample of studies are given a fairly thorough presentation and their links to GES is discussed.

5.2 Literature review

A literature review has been carried out primarily based on SEPA (2008) which provides a comprehensive presentation of valuation results specifically linked to ecosystem services provided by the Baltic Sea and Skagerrak. Tables 5.1 and 5.2 below summarize the findings in SEPA (2008). It can be noted that similar kinds of data mappings have also been carried out in HELCOM (2010b) and SEPA (2010c), and that ongoing valuation studies associated with the BalticSTERN initiative[8] is likely to result in useful estimates in 2012.

Table 5.1. Studies on all recreational activities except for recreational fishing. Source: IVL et al. (2012), which in turn is based on SEPA (2008). The estimates are expressed in EUR^{2007}.

Study	Measure	Valuation method	Estimate
Ahtiainen, 2007	Value of improved oil spill response capacity in the Gulf of Finland	Contingent valuation	112 MEUR total
Ek, 2002	Value of placing windmill park offshore rather than onshore in Sweden	Contingent valuation	0.39 cents per kWh
Forsman, 2003	Scenario: Large oil spill in Bohuslän - damage to tourism	Market value	170 MEUR
Forsman, 2006	Scenario: Large oil spill southern Sweden – damage to tourism	Market value	19-100 MEUR
Forsman, 2007	Scenario: Large oil spill Stockholm archipelago – damage to tourism	Market value	37 MEUR

[8] See http://www.stockholmresilience.org/balticstern.

Frykblom, 1998	Value of reduced nutrient emissions by 50 % in a study area on the Swedish west coast	Contingent valuation	10.8 MEUR
Kaliningrad regional public fund "21st century", year unknown	Total value of recreation in a coastal national park in Kaliningrad	Travel cost method	1.7 – 2.9 MEUR per year
Liljestam & Söderqvist, 2004	Value of alternative locations for windmill parks	Contingent valuation	e.g.: 12 870 – 21 560 EUR to place windmill parks 25 km rather than 5 km offshore
Kyber, 1981	Share of waterfront property value related to non-polluted water for inland properties in Finland	Property value	Polluted water might lower property values by up to 60 %
Luoto, 1998	Recreational value of one recreational day at a Finnish lake	Contingent valuation	3.1 MEUR
Markowska, 2004	Improvement of inland water quality, causing all inland waters to be suitable for swimming and fish breeding	Contingent valuation	337 MEUR per year total for Poland
Markowska & Zylicz, 1999	Value of reduced eutrophication in the Baltic Sea	Contingent valuation	6 048 MUSD
Mattila, 1995	Recreational value percent of a shore property for inland waters in Finland	Property value	Recreation value corresponds to up to 80 % of property value
Mäntymaa, 1993	Value of increasing water quality in a Finnish lake by one class, using a water quality scale, based on suitability for different types of recreational use	Contingent valuation	2.0 MEUR
Pakalniete et al., 2007	Willingness to pay for improved water quality in a Latvian river	Contingent valuation	2.38 EUR per person per year
Povilanskas et al., 1998	Willingness to preserve coastal meadows in an Estonian study area	Contingent valuation, Travel costs	EE: 71 300 – 238 000 EUR
Ready et al., 2002	Willingness to pay for improved water quality in a Latvian river	Contingent valuation	7.9 EUR per person per year
Sandström, 1996	Value of increased sight depth along the Swedish coast line	Travel cost method	29-65 MEUR
Sceponaviciute et al., 2007	Value of water quality improvement in a Lithuanian river	Contingent valuation	0.5 EUR per person per month
Soutukorva, 2005	Value of improved sight depth by one meter in the Stockholm archipelago	Travel cost method	10 – 31 MEUR
Söderqvist & Scharin, 2000	Value of improved sight depth by one meter in the Stockholm archipelago	Contingent valuation	61-101 MEUR
Turner et al., 1999	Value of a 50 % reduction in nitrogen and phosphorus effluents to the Baltic Sea	Contingent valuation	4 500 MEUR per year

VisitDenmark, 2007	Value of coastal tourism in Denmark	Turnover	1 800 MEUR
Zylicz et al., 1995	Value of reducing eutrophication, leading to an opening of all coastal beaches in Poland to swimming	Contingent valuation	137 EUR per person per year

Table 5.2. Studies on recreational fishing. Source: IVL et al. (2012), which in turn is based on SEPA (2008).The estimates are expressed in EUR^{2007}.

Study	Measure	Valuation method	Estimate
Eggert & Olsson, 2003	Willingness to pay to improve cod stock on the Swedish west coast.	Choice experiment	45 – 70 MEUR per year
Federal research centre for fisheries, Germany, 2007	Market value of total catch in recreational fishing in the Baltic Sea in Germany	Market value	2.85 – 7.65 MEUR per year
NAO, 2007	Total value of recreational fishing in a Finnish river	Travel cost method	6.8 MEUR per year
Parkkila, 2005	Value of doubled salmon catches in a Finnish river	Contingent valuation	31 000 EUR
Paulrud, 2004	Average value per fishing day in Bohuslän on the Swedish west coast	Travel cost method	7-14 EUR per person
	Marginal value per number of catches in Bohuslän	Travel cost method, Contingent valuation	0.6-1.2 EUR per catch
	Marginal value per kilo caught in Bohuslän	Travel cost method, Contingent valuation	1.1 – 1.8 EUR per kilo
Roth & Jensen, 2003	Total value of recreational fishing in Denmark	Expenditures	47.8 MEUR
Siitonen et al., 1992	Value of decreased amounts of phosphorus and nitrogen in the waste water from a pulp and paper factory in Finland	Compensations to fishermen prior to improvement	269 000 – 515 000 EUR per year during 1980-1989
Soutukorva & Söderqvist, 2005	Value of increased catches by 0,8 kg per fishing hour in Stockholm archipelago	Travel cost method	0.42 MEUR
Swedish Board of Fisheries, 2008	Consumer surplus per kilo fish caught in Sweden	Contingent valuation/expenditu res	4.2 EUR per kilo
Toivonen et al., 2004.	Swedes' total willingness to pay to preserve current fishing possibilities (including inland fishing in lakes and rivers)	Contingent valuation	298 MEUR per year

In general it can be concluded from the above mapping exercise that marine recreation is an ecosystem service that has been quite frequently studied in the Baltic Sea and North Sea, although these studies have generally not focused specifically at the different subcategories of recreation studied in this project, i.e. swimming, diving, wind surfing/water skiing, boating, being at the beach or seashore and using water based transportation. One important exception from this however is recreational fishing, which is often treated as a special category of recreation.

Recreation in valuation studies is hence usually viewed as a very broad concept, i.e. the estimated benefits due to recreational use normally cover a whole range of activities. The literature review shows that it seems difficult to find data where benefits are linked to individual recreation activities. Therefore, for practical reasons, the approach of this report is to look for studies that cover at least some aspect(s) of the ecosystem service marine recreation, keeping in mind that the results must be interpreted with care in order to avoid overstating the economic value of individual recreation activities.

Another conclusion is that studies covering also non-use values are important in order to assess the total economic value (TEV) of changes in the provision of recreational opportunities. However, since these studies aim at capturing the total economic value they usually do not focus specifically on the recreational benefits from environmental improvements. Contingent valuation and choice experiment studies seldom discuss the degree to which the estimated economic values are due to present or future recreational opportunities.

Moreover, some of the valuation studies have explicitly valued a changed provision of the ecosystem service marine recreation whereas others do not mention ecosystem services directly, even if that is what actually has been valued. The latter category of studies might still be useful if it can be judged that the link to ecosystem services is strong enough. Finding links between valuation results and ecosystem services is not always obvious, and the task gets even more complicated when it comes to valuing a change to GES conditions, mainly because GES is not yet (late autumn 2011) defined quantitatively. GES is still a crucial concept for the ESA because of its relationship to the cost of degradation, and hence there is a need to discuss to what extent economically valued environmental improvements can be linked to changes of GES conditions. This discussion is given in this chapter as well as in Chapter 6 on cost of degradation.

The choice of a small sample of relevant valuation studies has been guided by the following five important *preferred features* of valuation studies:

1. Geographical relevance (the valuation results should ideally be linked to Swedish marine waters)
2. The results should not be too old
3. Ideally dealing with individual recreation activities (in order not to overstate the economic value of individual recreation activities)
4. Discussion of the relative importance of recreation in a TEV setting (in order not to overstate the economic value accruing through recreational use)
5. Relevance for valuing GES conditions

It is unlikely that all these features will be possible to find in the same valuation study but by using this kind of criteria, the resulting choice of studies is at least well-motivated. The chosen sample of valuation studies, keeping in mind that there might also be other studies of relevance which are not covered here:

1. Östberg et al. (2010)
2. Östberg et al. (2011)
3. Söderqvist et al. (2005)
4. Vesterinen et al. (2010)

5.3 Presentation of valuation studies and their relevance for GES

This subsection presents the most important results of the chosen sample of valuation studies, with focus on their usefulness for valuing recreational activities in the marine environment and their links to descriptors and indicators of GES.

5.3.1 Östberg et al. (2010)

Title: *Non-market valuation of the coastal environment – uniting political aims, ecological and economic knowledge.*

This study uses the contingent valuation method to estimate the value of improving the water quality status according to classifications in terms of ecological indicators. A web-based survey was conducted in two study areas on the Swedish East and West coasts. The study focuses on eutrophication effects such as poor water clarity, a decrease in bladder wrack stands and algae mats. It is argued that these water quality characteristics affect recreational use of coastal areas. Also relating to recreational use are two other environmental attributes; algae blooms and protection of marine areas in terms of restrictions for boat traffic for example. The mean monthly household WTP between the years 2010-2029 is estimated to 61-108 SEK (7-12 EUR) for improved water quality, 54-84 SEK (6-9 EUR) for less algae blooms and 32-50 SEK (4-6 EUR) for less noise and littering. The authors conclude that he respondents from the East coast region express relatively high mean WTP values compared to the respondents on the West coast for all scenarios. The differences in mean WTP values between the study areas are reflected in the transfer errors Even if the two areas are similar in many ways, i.e. in terms of use, environmental problems and characteristics of the populations, the authors cannot recommend a point estimate benefit transfer due to existing transfer errors.

Relevance for valuing GES: The geographical relevance of this study is very high as it covers both the Swedish East and West coasts. The study uses a stated preferences method and thus has the potential to capture also non-use values, which is necessary for assessing the TEV of environmental improvements. However, it does not discuss individual subcategories of recreation activities. Recreational benefits are rather treated as an unspecified part of the total economic value estimated. One important advantage of the study is its clear links to policy (EU Water Framework Directive) determined classifications of water quality. Unfortunately the paper does not provide aggregated estimates for the whole populations of the Swedish East and West coasts.

The results of Östberg et al. (2010) are clearly linked to the descriptors and indicators of GES studied in the present report, i.e. more specifically to the indicators 5.1.1 (nutrient concentrations) and 5.2.4 (toxic algal blooms) linked to eutrophication (descriptor D5), and indicator 10.1.1 (litter washed ashore) linked to marine litter (descriptor D10).

5.3.2 Östberg et al. (2011)

Title: *Benefit transfer for environmental improvements in coastal areas: General vs. specific models.*

This study uses choice experiment (CE) data to analyze the accuracy of benefit transfer between two case study areas, the Swedish East and West coasts, for attributes relevant to the implementation of the EU Water Framework Directive and special consideration zones in marine areas. In the study it is concluded that the accuracy and reliability of a benefit transfer based on a model including only easily available socioeconomic information is similar to the accuracy of a benefit transfer based on a model that gives the best statistical fit, but requires time-consuming data collection. The authors also conclude that the former model has almost as god a fit as the latter. The benefit transfer error varies significantly across the attributes, regardless of which model is used.

Relevance for valuing GES: The geographical relevance of this study is very high as it covers both the Swedish East and West coasts. The study provides important insights to the discussion of benefit transfer as an alternative to carry out new valuation studies, and shows that transfer errors may be large even if the study area and policy area are similar in many ways. The relevance of the study in terms of valuing GES conditions is the same as Östberg et al. (2010) as these two studies are based on the same environmental changes and populations. Thus there is a clear linkage to descriptors and indicators of GES studied in the present report, i.e. more specifically to the indicators 5.1.1 (nutrient concentrations) and 5.2.4 (toxic algal blooms) linked to eutrophication (descriptor D5), and indicator 10.1.1 (litter washed ashore) linked to marine litter (descriptor D10).

5.3.3 Söderqvist et al. (2005)

Title: *Economic valuation for sustainable development in the Swedish coastal zone.*

This paper presents the design and results of five valuation studies on Swedish coastal zone issues. The case studies are: 1) Eggert and Olsson (2003), 2) Söderqvist and Scharin (2000), 3) Soutukorva (2005), 4) Soutukorva and Söderqvist (2005), 5) Sundberg (2004). Below are the most important results of studies 1-4 presented, as well as their links to descriptors and indicators of GES.

Case study 1.
Eggert and Olsson (2003). The economic value of water quality improvements at the Swedish westcoast.
Preferences for improved water quality are studied using a CE framework. Marine water quality can be characterized in a number of ways and there is a trade-off between the interest and relevance of the attributes on the one hand and the level of complexity for the survey respondents on the other. In the study, water quality was represented by the following attributes; level of fish stock, bathing water quality and biodiversity level. The attribute "bathing water quality" is measured in frequency of failures to meet the standards of e.g. bacteriological contamination for bathing sites along the coasts. For an

improvement in bathing water quality, resulting in the fraction of bathing sites violating the standards decreasing to 5 %, the individual WTP is on average 600 SEK (66 EUR). The aggregated estimate for improved water quality is estimated to 200-300 million SEK (22-33 MEUR). The corresponding individual and aggregated WTP for an improved cod stock to a level where the catch per trawling hour is 100 kg, is 1200 SEK (133 EUR) and 500-600 million SEK (55-66 MEUR) respectively.

Relevance for valuing GES: The geographical relevance of this study is high as it covers the Swedish West coast. One advantage is that the study presents aggregated estimates of the economic value of improved water quality. The water quality attribute (frequency of west-coast sites violating the quality standard, e.g. in terms of bacteriological contamination) is not directly linked to any of the GES indicators, although it is indeed of importance for the ecosystem service marine recreation. Improved cod stocks however is linked to underlying ecosystem support to fish populations and hence the GES indicator 5.1.1 (nutrient concentration) linked to eutrophication (descriptor D5) and 9.1.1 (actual levels of contaminants in fish) linked to contaminants in fish (descriptor D9). Most important for the support to fish populations are likely the ecosystem services food web dynamics, maintenance of biodiversity, maintenance of habitat and provision of food. These ecosystem services are however not of direct importance for *other* recreation activities (see further discussion in section 4.2.1, Table 4.2) and are therefore not analyzed further in this report.

Case study 2 and 3.
Söderqvist and Scharin (2000). The regional willingness to pay for a reduced eutrophication in the Stockholm archipelago, and *Soutukorva (2005) A random utility model of recreation in the Stockholm archipelago.*
These studies estimate the benefits from reduced eutrophication in the Stockholm archipelago. The environmental improvement was specified as a one-meter increase in the average water transparency during the summer. Recreational benefits were estimated by a travel cost study estimating people's demand for recreation in the archipelago, with water transparency as one of the explanatory variables (Soutukorva, 2005). The presence of other benefits than recreational ones, were captured by a CV study (Söderqvist and Scharin, 2000), where people's WTP for a nutrient abatement program that would give a one-meter increase in water transparency was estimated. Conservative, aggregated estimates from the studies for the benefits of a one-meter increase in water transparency were 60 million SEK (10 – 31 MEUR) per year (TCM) and 500 million SEK (61-11 MEUR) per year (CVM).

Relevance for valuing GES: The geographical relevance of these two studies is high as they cover parts of the Swedish East coast, i.e. the Stockholm archipelago. One advantage of the studies is that they present aggregated estimates of the economic value of improved water quality. The travel cost study captures recreational benefits although these are not linked to individual recreation activities. The water quality attribute valued (water transparency) is highly linked to the GES indicator 5.1.1 (nutrient concentration) linked to eutrophication (descriptor D5).

Case study 4.
Soutukorva and Söderqvist (2005). Gone fishing to the Stockholm-Roslagen archipelago – results from surveys on anglers' travels, catches and habits.

In this study the economic value of improved recreational fishing conditions in the Stockholm-Roslagen archipelago is estimated, with the purpose to link benefit estimates to the underlying ecosystem support to fish reproduction. A travel cost study on recreational fishing was thus carried out with the aim of not only valuing bigger fish catch, but eventually also the underlying increased ecosystem support necessary for accomplishing this increase. Data necessary for the TC-analysis (travel behavior, e.g. sites visited, distance travelled, travel time, travel costs, catch rates etc.) was collected in 2002 and 2003. For example is the WTP for doubling the average spring catch per hour of perch from 0.8 kg to 1.6 kg 56 SEK (6 EUR) per angler.

Relevance for valuing GES: The geographical relevance of the study is high as it covers parts of the Swedish East coast, i.e. the Stockholm-Roslagen archipelago. Improved catch of fish is linked to underlying ecosystem support to fish populations and hence the GES indicator 5.1.1 (nutrient concentration) linked to eutrophication (descriptor D5) and 9.1.1 (actual levels of contaminants in fish) linked to contaminants in fish (descriptor D9). Most important for the support to fish populations are likely the ecosystem services food web dynamics, maintenance of biodiversity, maintenance of habitat and provision of food. These ecosystem services are however not of direct importance for *other* recreation activities (see further discussion in section 4.2.1, Table 4.2) and are therefore not analyzed further in this report.

5.3.4 Vesterinen et al. (2010)

Title: *Impacts of changes in water quality on recreation behavior and benefits in Finland.*

In this paper are national recreation inventory data combined with water quality data to model recreation participation and estimate the benefits of water quality improvements. In the study is analyzed the association of water transparency in individuals' home municipalities with the three most common water recreation activities – swimming, fishing and boating. The results show no effect on boating, but improved water quality would increase the frequency of close-to-home swimming and fishing as well as the number of anglers. A policy scenario implying a 1 meter improvement in water transparency for both inland and coastal waters indicates that the consumer surplus would increase by 31-92 MEURO (6 %) per year for swimmers and 43-129 MEURO (15 %) per year for fishers.

Relevance for valuing GES: The geographical relevance is reasonably high as the study covers Finnish marine waters. As regards the method used, it is a major advantage that an attempt is made to allocate estimated benefits to recreation activities and not just recreation "as a whole". However, the study also includes inland waters (76 % of all trips included in the TC-analysis), which makes interpretation of the results to marine waters less evident. The water quality attribute valued (water clarity) is highly linked to the GES indicator 5.1.1 (nutrient concentration) linked to eutrophication (descriptor D5).

5.4 Summary of valuation findings

All four valuation studies reviewed have links to descriptors and indicators of GES, to varying degrees. Table 5.3 summarizes the studies in terms of how they perform in relation to the specified preferred features of valuation studies.

Largely based on the above sample of valuation studies are intervals of default monetary values for improved water clarity by one metre in coastal waters presented in SEPA (2010c). These intervals are based upon two CVM studies and two TCM studies (three of these belong to the studied sample of valuation studies in Table 5.3). The mean WTP in SEK and EUR:

- Per person and year: 369-923 SEK (41-102 EUR). Default value: 699 SEK (77 EUR)
- Per visit: 62-360 SEK (7-40 EUR). Default value: 178 SEK (20 EUR).

The corresponding intervals of default monetary values for recreational fishing are summarized in Table 5.4. Based on 17 recreational fishing studies, of which nine are CVM studies, four are CE studies and four are TCM studies, are intervals of default values calculated.

Table 5.3. Summary of valuation study findings.

Study	**Preferred features**				
	Geogra-phical relevance	Not too old	Discusses individual recreation activities	Discusses recreation in a TEV-setting	Relevance for valuing GES-conditions
Östberg et al. (2010)	+++	+++	-	+	+++
Östberg et al. (2011)	+++	+++	-	-	+++
Case studies in Söderqvist et al (2005):					
Case study 1	++	+	-	+	+
Case study 2	++	+	-	+	++
Case study 3	++	++	-	(n.a. since TC-study)	++
Case study 4	++	++	+	(n.a. since TC-study)	+
Vesterinen et al. (2010)	+	+++	+++	(n.a. since TC-study)	++
Legend: +++ = yes, fulfill the preferred features to a high degree ++ = yes, fulfill the preferred features to a fairly high degree + = yes, fulfill the preferred features to an acceptable degree - = no, does not fulfill the preferred features					

Table 5.4. Interval of values estimated by the travel cost method and the contingent valuation method. Based on SEPA (2010c).

Method	**One extra kg of fish (SEK)**	**One extra fish (SEK)**	**One extra fishing day (SEK)**
TCM	12-207	6-358	38-229
CVM	16-237	7-732	21-308

6 Cost of degradation

Chapter 4 presented a BAU scenario. What is the development if GES is reached instead? These two pieces of information are necessary in order to give predictions of the cost of degradation.

There are different practical approaches to analysing cost of degradation (COM, 2010). The approach of this report is to discuss in terms of what would be lost if BAU is reached instead of GES. The review of existing valuation studies in Chapter 5 indicates what GES could imply in economic terms, and conversely also what is lost if BAU is reached instead of GES. It is important to emphasize that since GES is not yet defined in quantitative terms, the actual size of the cost of degradation is consequently unknown. Based on the findings in valuation studies, with clear links to GES descriptors and indicators, it is at least possible to discuss and give indications as to whether or not there is a cost of degradation, and also give approximations of its potential monetary size.

It is evident from the findings in Chapter 5 that valuation studies dealing with ecosystem services in the Baltic Sea and Skagerrak are seldom linked to individual recreation activities. The flora of studies dealing with recreation as a whole however is not negligible. Furthermore, the review of valuation studies shows that eutrophication has been quite thoroughly studied, whereas there is a gap in the valuation literature focusing on marine litter and contaminants. Table 5.3 summarized the studied sample of valuation studies and their relevance for valuing recreation activities and the GES descriptors and indicators found to be of special importance for marine recreation, i.e. eutrophication, contaminants and marine litter.

The strongest link between the sample of valuation studies and GES seem to be through the descriptor D5 (eutrophication), especially indicator 5.1.1 (nutrient concentration). Two studies provide strong links to GES through the descriptor D10 (marine litter) but none provides a link to contaminants in general, descriptor D8. The link to descriptor D9 (contaminants in fish) is at least vaguely provided by the valuation studies focusing on recreational fishing, although this has not been valued specifically in any of the studies. The same kind of pattern of valuation results and GES descriptors and indicators seem to be present also in the large sample of studies (see Tables 5.1 and 5.2). That is, there are numerous links to eutrophication and fisheries but the links to contaminants in general are very few.

As for the scenario if BAU is reached instead of GES, it can be concluded that valuation findings from the Baltic Sea and Skagerrak certainly indicate that there would be a cost of degradation. Since GES is not yet quantitatively defined, it is merely possible to give rough approximations of its monetary size.

The results from SEPA (2010c) may be used to provide such indications for recreational fishing and water quality in Swedish marine areas. The default monetary values of Table 6.1 are presented for illustrative reasons and must be interpreted with great care since the estimates are not applicable to an arbitrary population. The default monetary values should in this context be interpreted as what would be lost if BAU is reached instead of GES.

Table 6.1. Monetary approximation of the cost of degradation, based on default monetary values for water quality and recreational fishing. in SEK. Modified from SEPA (2010c).

Method	Recreational fishing (one extra fishing day)	Water quality (default value per visit)
TCM	38-229	178*
CVM	21-308	
* = mean value for TCM-studies *and* CV-studies.		

The literature review shows that already existing valuation studies do not provide specific information on which recreation activities that would have to bear the cost of degradation, but combining the findings from Chapter 5 with findings from Chapter 4 on ecosystem services and the dependence of marine recreation on other marine ecosystem services (see Tables 4.2-4.5 and Figure 4.1), some hints are still given in Table 6.2.

Table 6.2 shows that the marine recreation activities that will most likely have to bear a cost of degradation if GES is not reached are swimming, diving, fishing and being at the beach. The recreation activities that seem the least sensitive to a scenario where GES is not reached are boating, skating, skiing and using water-based transportation. But again, Table 6.2 does not say anything about the monetary size of the cost of degradation, it merely illustrates the activities that would probably be most adversely affected.

As regards the monetary size of the cost of degradation it can be argued that although valuation studies in general have not studied individual marine recreation activities it is very likely that the estimated benefits of these studies are at least partly linked to the activities found to be sensitive to degradation of the marine environment. Swimming and being at the beach are the most important recreation activities for Swedes when they spend leisure time at the Baltic Sea (SEPA, 2010a). We therefore conclude the following:

a) Recreation is likely to constitute an important share of the total economic value of changed environmental conditions in Swedish marine areas.
b) Estimated economic values due to changed recreation opportunities are probably closely connected to the activities that are most common, i.e. swimming and being at the beach.

Table 6.2. To what extent would different recreational activities bear the cost of degradation? The table indicates this for different recreation activities based on the activities' links to GES, according to findings in Chapters 4 and 5.

Descriptors and indicators of GES	**Subcategories of marine recreation**							
	C1.1 Swim-ming	C1.2 Diving	C1.3 Wind-surfing, water skiing	C1.4 Boa-ting	C1.5 Fish-ing	C1.6 Being at the beach or sea-shore	C1.7 Skat-ing, skiing	C1.8 Using water-based trans-porta-tion
D5 Eutrophication								
5.1.1 (nutrient concentration)	+++	+++	+	+	++	++	-	-
5.2.4 (toxic algal blooms)	+++	+++	++	++	++	++	-	+
D8 Contaminants								
8.1.1 (concen-tration of contaminants)	+++	+++	++	-	-	+	-	-
D9 Contaminants in fish and other seafood								
9.1.1 (actual levels of contaminants)	-	-	-	-	+++	-	-	-
D10 Marine litter								
10.1.1 (litter washed ashore)	++	+	+	+	+	+++	+	+

Legend:
+++ = the activity is likely to bear the cost of degradation to a **high** degree
++ = the activity is likely to bear the cost of degradation to a **fairly high** degree
+ = the activity is likely to bear the cost of degradation to a **low** degree
- = the activity is **not** likely to bear the cost of degradation

The discussion so far has focused on the degree to which marine recreation activities will have to bear a cost of degradation if BAU is reached instead of GES. However, a similar discussion can also be made focusing on the commercial tourism sectors. Table 4.23 of Section 4.7 ("What does BAU imply for the development of tourism sectors A-H?") shows the subcategories of marine recreation which will likely not have a sustainable supply in 2020 for BAU. The table also indicates the dependence between the commercial tourism sectors and the subcategories of marine recreation.

Table 6.3 (modified from Table 4.23) indicates the sectors which are likely to be mainly influenced by a non-sustainable supply of subcategories of marine recreation in 2020 for BAU. These are consequently the sectors that will likely have to bear the cost of degradation. It turns out that the sectors that are primarily affected by a non-sustainable supply of the subcategories of marine recreation are E-H, i.e., leisure boating, holiday houses, commercial accommodation and same-day visits. Sectors A-D are likely to be only locally affected.

Table 6.3. "X" indicates the marine tourism sectors which would likely have to bear the cost of degradation, based on the sectors dependence on the subcategories of recreation, modified from Table 4.23.

Subcategory of marine recreation	**Sector**							
	A. Cruise ship traffic	B. International passenger ferry traffic	C. National passenger ferry traffic	D. Other commercial passenger transportation in marine waters	E. Leisure boating	F. Holiday houses	G. Commercial accommodation	H. Same-day visits
C1.1. Swimming						X	X	X
C1.2 Diving						X	X	X
C1.3 Windsurfing, water skiing						X	X	X
C1.4 Boating					X	X	X	X
C1.5 Fishing					X	X	X	X
C1.6 Being at the beach or seashore						X	X	X
C1.7 Skating, skiing						X (at least locally)	X (at least locally)	X (at least locally)
C1.7 Using water based transport-tation	X (at least locally)	X (at least locally)	X (at least locally)	X (at least locally)	X (at least locally)			X (at least locally)

7 Concluding discussion

This study has made use of a rather broad definition of “marine tourism and recreation” in the sense that it has also included tourist sectors based on *terra firma* but dependent on people’s enjoyment of marine recreation, such as hotels and camping sites situated at the coast. Since there is no widely accepted definition of these tourist sectors, two alternative geographical definitions were chosen; one which is likely to result in an overestimation of the sectors in relation to their association with marine recreation, and one which is likely to result in an underestimation. The extent of these sectors was therefore described with an interval instead of a point estimate. This approach should be compared to definitions used by other Member States in their ESAs, and it hopefully contributes to a discussion on what could be a reasonable definition. An alternative would have been to only include sectors whose activities take place *in* marine waters, such as maritime passenger transportation and leisure boating in marine waters. However, such a delimitation would have resulted in a considerable underestimation of the economic activity that can be attributed to the sea, and we therefore judged such a delimitation to be too restrictive.

The work for this report has relied on the ecosystem service approach, and the ecosystem service analysis that was carried out followed the steps of a Corporate Ecosystem Service Review (ESR) as outlined by WRI (2008). One of the most important features of the ecosystem service approach is that it provides a meeting point for environmental change and its impact on human well-being. Changes in human well-being can in turn be assessed by methods measuring TEV (or by non-economic methods). The main advantage of ESR in the context of this report is its basic idea of quickly screening out the ecosystem services of greatest importance. This is important, because otherwise the analysis will be subject to the cannot-see-the-wood-for-the-trees problem. Such screenings have also been necessary for the selection of GES descriptors and associated indicators.

While projects such as MA (2005) and TEEB (2010) have greatly improved the conceptual understanding of nature’s provision of ecosystem services, the meeting point between environmental change and its impact on human well-being is still not very crowded by studies showing how environmental change and the supply of various ecosystem services are linked in detail. Naeem (2011) suggests that this partly is because ecological research traditionally has another focus. Cole and Hasselström highlight in IVL et al. (2012) the importance of finding useful ecological endpoints, i.e. biophysical measures that can serve as a basis for valuing changes in the supply of ecosystem services. Such endpoints would serve as convenient meeting points for ecologists and economists, see also SAB (2009). All this explains why an ecosystem service analysis such as that of Chapter 4 at present tends to be qualitative and to a large extent based on professional judgments. There is thus a need for studies allowing a more quantitative analysis, which is likely to require, *inter alia*, more precise definitions of the various ecosystem services. In this report, a step towards this was taken by dividing the broad ecosystem service C1 Enjoyment of recreational activities to seven subcategories C1.1-C1.7. Further efforts to provide precise definitions of ecosystem services, also other than recreation, would greatly facilitate assessments of the economic (and social) consequences of programmes of measures, such as those PoMs which will be a part of the MSFD implementation.

A particular contribution of this report is to point at existing gaps between ecosystem services and GES descriptors and indicators. While an ecosystem service approach provides a helpful link between the environment and human well-being, the analysis in Chapter 4 indicates that the approach is not fully compatible with the present GES descriptors and indicators. For example, it was found in Section 4.3.1 that the only clear link between the intermediate ecosystem service C2 Scenery and GES was through descriptor D10 about marine litter. This reflects the fact that GES descriptors tend to have a focus on ecological factors. This makes sense, but it also entails a drawback: The selection of associated indicators might not be those which are suitable from the meeting point perspective of the preceding paragraph.

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