Economic assessment of policy measures for the implementation of the Marine Strategy Framework Directive

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Annexes

1  Annex 1: Extended text of the case studies.................................................................5
1.1 Norwegian NOx tax and NOx Fund........................................................................7
1.2 Case study Aggregates Levy in the UK.................................................................43
1.3 Case study "no special fee" system Baltic Sea.........................................................65
1.4 Case study Real Time Closures of Scottish Fisheries ............................................107
1.5 Marine Protected Areas in the Mediterranean: Medes Islands.............................133
2  Annex 2: Approach to establish interconnections between measures and MSFD-elements .................................................................163
3  Annex 3: Integration table, linking state characteristics to pressures through impacts ......................................................................................166
4  Annex 4: Description and background to the data collection process......................167
5  Annex 5: Indicators of GES......................................................................................173
6  Annex 6: Overview of Specially Protected Areas of Mediterranean Importance (SPAMIs) ((UNEP-WCMC)).................................................................177
Annex 1: Extended text of the case studies

In agreement with the European Commission, the following case studies were considered representative of the different situations in the EU (different seas, different ecological and economic situations):

- Part 1.1: NOx-tax and NOx Fund (Norway)
- Part 1.2: Aggregate tax / Levy (UK)
- Part 1.3: No-special-fee system (Baltic Sea)
- Part 1.4: Temporary / real time closures (Scotland)
- Part 1.5: MPAs (Medes Islands)
1.1 Norwegian NOx tax and NOx Fund

1.1.1 Introduction: NOx tax and Business Fund

The NOx tax (nitrogen oxides) was implemented in order to fulfil Norway’s commitment to the Gothenburg Protocol under the Convention on Long Range Transboundary Air Pollution. As of 1 January 2007, the Norwegian State introduced a tax per kilogram of emission of NOx on energy production delivery. The NOx tax covers energy producing units within a variety of sectors including the following: domestic shipping (including fisheries), aviation, railway operations, land-based activities and off-shore activities on the Norwegian Continental Shelf. The environmental tax targets NOx-emissions from larger units:

- motors, boilers and turbines with total installed capacity larger than 10 MW
- propulsion engines with a total installed capacity of over 750 kW
- flares on offshore installations and on facilities on land

The tax is calculated on the basis of actual NOx emissions. If these are not known, it is calculated on the basis of a source-specific emission factor or (if both are not known) based on standard values. In 2007, the tax was NOK 15 per kilogram (approximately 1.95 €), in 2011 it is NOK 16.43 per kilogram (2.14 €).²

Several Norwegian business organizations (15) have entered into an environmental agreement with the Ministry of the Environment to be exempted from the tax (i.e. the NOx Agreement, notified and approved by ESA³). Instead of paying the entirety of the NOx tax to the Norwegian State, undertakings that are party to the NOx Agreement will pay a smaller amount to the NOx Fund (earmarked for the implementation of emission reducing measures).⁴ In return, individual enterprises need to sign a Participant Agreement laying down rights and obligations arising from the collective commitment and the temporary tax exemption.

1.1.2 Environmental problem and objective of the measure

Nitrogen monoxide (NO) and nitrogen dioxide (NO2) are by-products of the combustion process. NOx emissions have residence times in the atmosphere of 1 to 3 days, which mean they can be transported over distances of more than 1,000 km. NOx emissions

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² 1 NOK = 0.130163 EUR (October 2011)
³ EFTA Surveillance Authority. The temporary tax exemption (and privately organised NOx Fund) is considered as state aid. As a party to the European Economic Area (agreement), Norway must notify state aid to the ESA. ESA assesses compatibility of the aid and must approve the tax exemption. The NOx scheme 2008-2010 was approved by the Authority by Decision 501/08/COL of 16 July 2008. 2011-2017 by Decision 144/11/COL of 19 May 2011.
⁴ http://www.nho.no/NOx/english
have complex impacts.\textsuperscript{5} They lead, among others, to the creation of health-hazardous ground-level ozone and to the acidification (acid rain) and eutrophication. Acid rain is a major environmental problem for Scandinavia and Northern Europe. Especially in sensitive coastal regions, emissions from fuel combustion (e.g. from shipping) contribute notably to overstepping the critical loads of acidification. The most important direct effect regarding the marine environment is eutrophication, affecting biodiversity both on land and in coastal waters. Excessive richness of nutrients causes dense plant growth (e.g. algae) and impacts on life in seas, lakes and rivers.

Eutrophication affects marine ecosystems in many ways

Eutrophication is mainly a problem in coastal areas and in areas with restricted water exchange, such as enclosed estuaries and embayments. Eutrophication causes changes in the composition of plant and animal communities and generally favours growth of rapidly reproducing opportunistic algal and animal species. Opportunistic algal species do not always pose a threat but some species can adversely affect ecosystems. Mass occurrence of phytoplankton also reduces the depth at which light is available for long-lived seagrass species. Once the nutrients have been depleted, the algal blooms associated with nutrient enrichment decay, leading to oxygen deficiency and possibly kills of fish and benthic invertebrates, and to the formation of toxic hydrogen sulphide (H2S). As well as causing impacts on the ecosystem, eutrophication can affect human activities. For example, algal blooms can clog fishing nets. Decaying blooms of some algae can create unsightly foam masses on beaches and unpleasant smells that interfere with tourism and recreation. Although some algae produce toxins that can harm humans through consumption of contaminated shellfish, the link to nutrient enrichment is uncertain.


At the end of 2007, Norway produced the highest per capita emissions of NOx in Europe with 42 kilograms NOx per capita annually. In 2010, total NOx emissions amounted up to 189,000 tonnes vis-à-vis their commitment to reduce annual NOx emissions to 156,000 tonnes (by 2010). Shipping represents a significant share of NOx emissions of maritime states. Worldwide, NOx from shipping have been estimated to about 10% to 15% of the global anthropogenic NOx emissions from fossil fuels. In Norway, coastal shipping (including fishing) and the oil and gas industry account for about 60% of Norwegian nitrogen oxides emissions.\textsuperscript{6} The objective of the environmental NOx-tax is to encourage reductions in NOx-emissions from domestic activities that are included in Norway’s

\textsuperscript{5} \url{www.zero.no/publikasjoner/biofuels-in-ships.pdf/at_download/file}
\textsuperscript{6} \url{http://www.endseurope.com/14122/norway-39worst-in-europe39-for-nitrogen-oxides}

Confirmed by the Business Sector’s NOx Fund
emission inventory estimated and reported for the purpose of compliance review of the Gothenburg Protocol obligation. The tax exemption (for emission sources encompassed by environmental agreements with the Norwegian State, e.g. the NOx scheme or NOx Fund) was introduced in order to achieve a higher reduction in national emissions of NOx than would have been achieved by the mere application of the full tax rate. Accordingly, affiliated enterprises to the first NOx-Agreement shall reduce their NOx emissions by totally 18,000 tonnes, with yearly emissions obligation as follows: 2,000 tonnes in 2008, 4,000 in 2009 and 12,000 tonnes in 2010, of which 7,000 tonnes may still be implemented in 2011. Reduction targets for the new environmental agreement 2011-2017 have been set at 16,000 tonnes.

Reduced NOx-emissions (lower nitrogen inputs) can contribute to lower human-induced eutrophication (GES 5) and biodiversity in the longer run (GES 1). The transboundary nature of these inputs and the complex process of eutrophication requires modelling to assess the effect in time and space.

1.1.3 Measure: definition and context

1.1.3.1 (Legal) Background and implementation

The Norwegian Government signed the Gothenburg Protocol in 1997, which committed Norway to reducing their NOx emissions from 215,000 tons to 156,000 tons (28.5%) by 2010. To match these requirements, a subsidy system was established for owners/operators that lasted for five years. This so-called NOXRED programme fund covered up to 100% of the cost of upgrading, and about 30 engines were converted during that period.

The NOx tax was implemented in order to fulfil Norway’s commitment to the Gothenburg Protocol under the Convention on Long Range Transboundary Air Pollution. Late 2007, Norway had only cut emissions by 8% compared to the 30% commitment (2010 versus 1990) under the Gothenburg protocol. In order to improve the level of environmental protection and reduce NOx-emission, the Norwegian Parliament endorsed a tax policy on emission of NOx to be applicable from January 1, 2007 (resolution of the Norwegian

7 EFTA Decision No: 144/11/COL.
8 See http://www.nho.no
9 Ratified by the Protocol to Abate Acidification, Eutrophication and ground-level Ozone of 30 November 1999. The Norwegian authorities have indicated that the Gothenburg Protocol and the EU Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants (“the NEC Directive”) are due to be revised which should lead to new NOx emission ceilings from 2020. In accordance with the Gothenburg Protocol and the NEC Directive, Norway’s total annual emissions of NOx shall not exceed 156 000 tons from 2010 onwards.
10 http://www.bellona.org/articles/articles_2007/NOx_EU
Parliament -“the Storting”- on NOx emissions).\textsuperscript{11} The Norwegian NOx tax is innovative for shipping as operators now for the first time pay for what they pollute.\textsuperscript{12}

As mentioned above, the legal framework of the NOx tax contains an exemption clause for sources encompassed by environmental agreements with the State concerning the implementation of measures to reduce NOx in accordance with a predetermined environmental target. According to the Storting Resolution, any undertaking or association – all sectors and sources - may at any point in time enter into negotiations with the Ministry of Environment on similar agreements with obligations to implement measures to reduce NOx-emissions. The tax exemption, based on the NOx Agreement, is an integrated part of the tax scheme\textsuperscript{13}, which provide undertakings being subject to the tax burden with three alternatives for compliance with the tax scheme, i) pay the tax\textsuperscript{14}, ii) sign the Participant Agreement and comply with obligations laid down therein and in the NOx Agreement, or iii) enter into negotiations with the Ministry of the Environment on a separate environmental agreement.

\textbf{Parties, agreements and obligations}\textsuperscript{15}

The NOx scheme 2011-2017 is very similar to the NOx scheme which covered the period 2008-2010. 14 business organisations joined the initial NOx Agreement 2008-2010, growing to 15 in the new Agreement 2011-2017.\textsuperscript{16} It is the NOx Fund that decides upon the contribution to the Fund.

The NOx scheme is based on the conclusion of two agreements: the “NOx Agreement” and the “Participant Agreement”.

The environmental \textbf{NOx agreement} is concluded between 15 business organisations representing enterprises emitting NOx (“the Business Organisations”) and the \textit{Ministry of Environment}. The Business Organisations party to the NOx Agreement have committed themselves collectively to ensure the implementation of measures that will reduce their emissions of NOx by 16,000 tonnes by the end of 2017 regardless of whether this

\begin{itemize}
\item \textsuperscript{11} See e.g. Toll Customs 2007, Circular No. 14/2007 S or Toll Customs 2011, circular No. 14/2011 S for the most recent version. Downloadable at \url{http://www.toll.no}
\item \textsuperscript{12} Opportunity NOx at \url{www.bunkerspot.com} Environmental issues August / September 2007
\item \textsuperscript{13} Norwegian Ministry of the Environment. Letter of notification of a temporary NOx tax exemption to EFTA Surveillance Authority, (May 2008)
\item \textsuperscript{14} Operators who opt not to join the fund (or who do not fulfi l the obligation if they do join) will have to pay 15 NOK/kg NOX to the Norwegian government (and the indication is that this figure will increase in the years to come) (Wartsila Journal). It is of note that this has not been confirmed by other sources.
\item \textsuperscript{15} Section has been based on EFTA Surveillance Authority Decision No: 144/11/COL. Decision of 19 May 2011
\item \textsuperscript{16} This additional entry followed from the decision of the Storting to include waste incineration in the activities potentially benefiting from the tax exemption.
\end{itemize}
contributes to an over fulfilment of current international commitments. Some key points in the NOx Agreement (2011-2017)\textsuperscript{17}:

- Prerequisite for a continued NOx tax exemption is that the Business Organisations ensure that the emission reduction effect obtained under the NOx Agreement 2008-2010 is maintained throughout the entirety of the new agreement period.

- There is no possibility to adjust the reduction obligation downward due to changes in the Norwegian emission projections. The NOx Agreement however is open for renegotiation of the commitments from 2013 if higher reduction commitments are necessary in order for Norway to fulfil current international obligations.

- Business Organisations must establish and operate the NOx Fund and carry out the tasks that follow from the NOx Agreement, the Participant Agreement and the statutes of the NOx Fund. The NOx Fund shall, inter alia, require on behalf of the Business Organisations, payment of a fixed fee per kg of emissions of NOx, and shall, on behalf of the Business Organisations, provide financial support for cost-efficient measures to reduce NOx. The NOx Fund shall be operated in accordance with the non-profit principle. The Norwegian State will have no right to control or issue instructions to the NOx Fund and will have no claim for representation on the Fund’s governing bodies.

- Any possible over / underfulfilment of the annual reduction obligations in the NOx Agreement 2008-2010 shall be deducted from / added to the reduction obligation in the NOx Agreement 2011-2017.

- Business Organisations must achieve annual reductions in emissions based upon projections. Implemented measures that are undertaken by the affiliated undertakings must be operated in a manner that maintains the emission reduction effects at least until 31 December 2018.

- Detailed reporting obligations on the Business Organisations: within 31 May of the years 2012-2017, they need to provide the Climate and Pollution Agency with an overview of the measures implemented and contracts entered into during the previous year and the first quarter of the present year as well as an overview of the NOx emissions per sector (annual report). In addition, the Business Organisations shall within 31 May of 2012, 2013, 2015, 2017 and 2018, furnish a written report to the Climate and Pollution Agency and the Ministry of Environment concerning the fulfilment of the emission reduction obligation (status

\textsuperscript{17} The NOx scheme 2011-2017 is very similar to the NOx scheme which covered the period 2008-2010. 14 business organisations joined the initial NOx Agreement 2008-2010, growing to 15 in the new Agreement 2011-2017, following the decision of the Storting to include waste incineration in the activities potentially benefiting from the tax exemption.
The Business Organisations shall provide a concluding report to the Ministry of Environment in 2018 indicating whether the total emission reductions have been achieved. Finally, they shall also provide a report in 2019 showing whether the total emission reduction obligations have been fulfilled.

The Business Organisations do not themselves produce emissions of NOx that are subject to the NOx tax. It is the undertakings which emit NOx who will join the scheme. Each individual undertaking wishing to join the scheme must therefore sign a Participant Agreement. It may either join the Participant Agreement which has already been signed or enter directly into a new specific environmental agreement with the Norwegian Ministry of Environment. Undertakings that affiliate themselves with the NOx Agreement, receive the rights (mainly – temporary - exemption from the tax) and obligations that are set forth in the NOx Agreement and the Participant Agreement:

- The Participant Agreement creates rights and obligations between the individual undertakings and the Norwegian State (issuance of a Participation Certificate by the NOx Fund).
  - An obligation to pay the NOx Fund an amount (to be determined) per kilogram of NOx emissions; The level of the fees will be determined by the NOx Fund and not the State. Undertakings pay a charge of NOK 4 (€ 0.47) per kg NOx into the Fund. The charge is set higher for the offshore sector, at NOK 11 (€ 1.29) per kg NOx.
  - Formulation of a plan/application relating to NOx reducing measures for their own undertaking;
  - Implementation of NOx reducing measures by their own undertaking;
  - Participant undertakings must ensure that implemented measures that have been granted support from the NOx Fund during the period 2008-2010 are kept in operation;
  - Reporting of reduced NOx emissions to the NOx Fund (article 7);
  - Loyalty to the NOx Fund, its statutes and its decisions that affect their operations.
  - Pursuant to Article 4, each undertaking must formulate its own measures plan for NOx reductions. The measures plan containing the implementable, permanent and cost-effective measure shall be submitted to the NOx Fund within a period of two years following the signing of this Participant Agreement. Participating undertakings are obliged to update their measure plan every other year.

- The NOx Fund shall, in turn, allocate financial support to some individual undertakings to support the implementation of emission reducing measures.
Article 5 sets forth the administrative procedure according to which the NOx Fund determines which measures are to be granted support. Permanent measures yielding the largest NOx reduction in volume shall be granted priority. The NOx Agreement does not favour a specific technological solution.

1.1.3.2 Exemptions and underlying rationale

Section 2 of the Storting resolution concerning the duty on NOx-emissions lists the emission sources exempted from the NOx tax:

- vessels travelling between Norwegian and foreign ports: for the entire voyage.
- vessels used for fishing and catching in distant waters: for the part of the voyage that takes place in distant waters.
- aircrafts travelling between Norwegian airports and foreign airports: for the entire voyage.
- preserved vessels, railway museum trains, technical and industrial cultural heritage monuments and sites and technical facilities in the museum sector.
- sources of emissions that are regulated by an environmental agreement signed with the Norwegian government for initiating measures to reduce NOx that are implemented in accordance with established national environmental goals.

The Ministry may regulate the conditions, limitations and implementation for the exemptions. It is of note that the last bullet, exemptions under environmental agreement, has already been elaborated in previous paragraphs. Exemptions are made under the condition that the Norwegian Climate and Pollution Agency has given its approval for the implementation of the contract obligations for each year in question. The basis for exemption pursuant to this provision shall be documented by means of the submission of the Certificate of Compliance from the Business Sector’s NOx Fund. A copy of the Certificate of Compliance must also be sent to the Customs Region.

Other exemptions from paying the NOx tax are in agreement with Norway’s (environmental) taxation policy in general (Ministry of Environment, letter of notification to ESA May 2008). Traffic between Norwegian and foreign port are thus exempted from the tax. This is due to rules in the Gothenburg Protocol concerning emissions covered by the agreement, meaning that this emission is not accredited to Norway’s reduction obligation in the Protocol. If these rules are changed, there might be changes in the rules concerning emission subject to NOx tax. Figure 1 below illustrates the evolution (including future projections) of NOx-emissions, the key contributors and the importance of emissions under the NOx-tax. It is estimated that the tax covers +/-55% of total Norwegian NOx-emissions. With regard to shipping, the taxation affects more than 1500

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19 P.c. Wenche Svellingen NOx Fund
Most of these emissions can also be covered by the agreement between the Business sectors and the Ministry of Environment (excluding state vessels). Emissions from enterprises that are eligible to join the Agreement constituted approximately 124,000 tonnes in 2005. More than 90% of the emissions (about 100,000 tons) that were initially subject to the tax are now instead covered by the agreement. Reasons for not joining the Fund are typically due to little traffic in Norwegian waters and/or the fear of obligations related to joining the Fund.

Figure 1: Own compilation based upon information from technical working group under the Agreement 2008-2010 (with representatives from the Climate and Pollution Agency, Ministry of Environment, Ministry of Finance, Det Norske Veritas, and the NOx Fund).

1.1.3.3 Relation to other policy initiatives
Previous paragraphs have demonstrated the origin of the NOx tax and associated NOx scheme (Fund) as a means to lowering Norwegian NOx emissions considering their commitments to the Gothenburg Protocol. EU Governments have, in recent years imposed stringent restrictions on emissions of NOx from a wide range of industrial and commercial activities including road vehicle transport, but relatively little has been done to reduce emissions from for example ships which now account for more than a quarter of total emissions of nitrogen oxides in Europe.

The Norwegian NOx tax is one of the first economic instruments to include the shipping sector (not international) in a scheme inspired by the polluter pays principle. Existing instruments or measures are usually top down (regulation) which can bring about some technological innovation for (new) installations. Existing policy NOx emission standards for international shipping are set by the International Maritime Organisation (IMO). New

20 The NOx Fund: A successful financial instrument for emission reduction. Presentation at Sustainable Shipping Miami 2010 (22-23 October 2010) by Henning Mohn, DNV Solutions.
21 http://www.nho.no/what-is-NOx/category508.html
22 Personal communication Wenche Svellingen, Business Sector’s NOx Fund
regulations were introduced by the IMO in 2008 which strengthen somewhat the NOx requirements worldwide for all new ships built after January 2011 (see Figure 2).

![Annex VI NOx requirements](image)

**Figure 2**: IMO's NOx emission standards for new ship engines

A problem in the context of the IMO NOx standards is that they only apply to new ships and the strict 2016 limits are solely for Emission Control Areas (ECAs). Ships tend to have a life of 25–35 years before being scrapped so the turnover of the fleet is slow. In addition it is feared that the new regulation could be evaded by operators only deploying older ships in ECAs (Kågeson, 2009). Thus in order to not only limit the growth in ships’ NOx emissions, but actually to reduce them, there is a need to cut emissions from existing vessels and to speed up the introduction of efficient NOx abatement technologies in new ships built before 2016. The NOx tax and Business Sector’s Fund in Norway could provide incentives in that direction.

We briefly describe a number of other instruments to reduce NOx-emissions from sectors that are not widely covered by existing regulation (road transport for example is not considered).

Economic incentives (differentiated dues) have been in use for some time in Swedish ports and fairways (due is payable to the Swedish Maritime Administration) to decrease ship-generated air pollution. The objective is to encourage the implementation of abatement technologies, such as catalytic converters to reduce nitrogen oxide emissions. It does not restrict the type of abatement technology installed in a ship. The principle in differentiating and applying the polluter pays principle is that ships that have taken environmentally protective measures are charged reduced dues. The NOx-related reduction of the fairway due is based on the emissions measured in grams per kWh. If the emissions at 75% engine load are above 10 g/kWh, no NOx discount is given. By July

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23 Air pollution from ships. Presentation by Christer Ågren, Air Pollution & Climate Secretariat. 29 November 2010

2009, 37 ships had a valid NOx certificate that allows them a NOx-related discount on the fairway due (excluding vessels owned by the Swedish Maritime Administration). For port dues, the competition aspects between autonomous ports makes the decision more complex. The challenge lies in differentiating the port due in a way that provides an incentive additional to that of the fairway due without risking a loss of customers or revenue. Such difficulties explain why the port dues are much less differentiated than the fairway dues (Kågeson, 2009).

In 1994 the Green Award Foundation was established to initiate market incentives to promote quality shipping. In collaboration with the Port of Rotterdam the Green Award programme was launched. It is designed as an incentive to large vessels to improve safety and environmental protection. Worldwide, more than 1,500 tankers and 1,500 bulk carriers are operational in the categories for which the Green Award is available. Today more than 35 ports in nine different countries offer reduced port dues for vessels that carry a Green Award Certificate. Most of them offer discounts of 5 or 6% on port dues. Around 200 ships have been certified. Most of these vessels are larger than 50,000 DWT and are not used in short-sea shipping. Criteria related to air emissions can contribute a maximum of 10% of the total number of ranking points available. Points are awarded for NOx emissions of no more than 17 g/kWh.

In 1992, Sweden introduced a nitrogen oxides charge in emissions of NOx from large stationary combustion plants. The Swedish NOx tax has been highlighted globally as an example of an innovative use of environmental taxes to spur emissions reductions and technological innovation (Skjelvik et al, 2009). The charge is very high (+/- 5.5 € per kg thus more than double of the Norwegian NOx tax). However, it is distributed back to the polluting companies in relation to the amount of energy produced by the specific plant. This means that the polluting industry as a whole does not pay anything to society – and it is presumably this fact that has made the charge politically feasible (Kelly et al, 2009).

1.1.4 Evaluation of the measure
1.1.4.1 (Environmental) Effectiveness

Goal achievement

The introduction of the NOx tax in Norway (followed by the Fund one year later) arose to better fulfil Norway’s commitment to cut NOx-emissions under the Gothenburg Protocol (see paragraph 1.1.3.1). Late 2007, at the end of the first introduction year of the tax, Norway had only cut emissions by 8% compared to the 30% commitment (2010 versus 1990) under the Gothenburg Protocol.25 The graph below (Figure 3) illustrates the trend of NOx-emissions (since base year 1990) and shows a growing trend before 2000 while

25 http://www.bellona.org/articles/articles_2007/NOx_EU The 30% commitment corresponds to a decrease in absolute terms from 215,000 tonnes of annual NOx-emissions to 156,000 tonnes (or nearly 60,000 tonnes).
remaining at a high level the years after, as opposed to e.g. emissions of NMVOC or Sulphur dioxide. 26.

![Graph of various emissions to air in Norway since 1990](image)

**Figure 3**: Evolution of various emissions to air in Norway since 1990. Preliminary figures for the last years. 2010 is the target under the Gothenburg Protocol. Source: Statistics Norway 27

From the graph, it can be read that no absolute emission reductions were achieved in 2007 (emission level in 2007 +/- 1,000 tonnes lower than the 2006 level 28), the only year where the tax has existed as a separate instrument. This short time period makes it however difficult and not relevant to evaluate whether the instrument did or did not achieve any results. Moreover, industry sectors were expecting compensating measures with the introduction of the NOx tax, leading to a climate where the implementation of abatement measures are defined for a certain period, until more information is available on potential compensation. 29

Taking a closer look at the combined effect of the tax and the fund, Figure 3 is suggesting a decrease in absolute NOx-emissions as of 2008. At the time of the creation of the NOx fund, the Environmental Agreement between the Business Organisations and the Ministry of Environment agreed on absolute emission reduction targets over the period of the first agreement 2008-2010 (with implementations still partly allowed in 2011). Undertakings that received exemption from the NOx tax committed to decrease NOx emissions –

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26 It is of note that these absolute figures also depend on evolution in the activity level in the different contributing sectors.
27 [http://www.ssb.no/agassn_en/](http://www.ssb.no/agassn_en/)
collectively - by +/- 30,000 tonnes in that period. It is important to indicate that this absolute target has been corrected downward to 18,000 tonnes based on the argument that emission factors in the inventory calculations had overestimated emissions of certain activities. The NOx Fund indicates that they can document that the emission obligations for the years 2007-2010 laid down in the Environmental Agreement on NOx (i.e. the new figure of 18,000 tonnes) have been met. The current situation is illustrated below (Figure 4). Measures implemented and verified by Det Norske Veritas (DNV) are shown in blue. Applications granted support but not yet implemented or verified are shown in green. Red shows received applications not yet granted support. The decision to grant support to applications is taken at the board meetings of the Fund.

Figure 4: Realised and projected NOx reductions under the NOx Fund (source: Business Sector’s NOx Fund, situation early September 2011)

The Norwegian Climate and Pollution Agency has confirmed that the business organisations have complied with their emission reduction commitments in both 2008 and 2010.

30 Gothenburg requirements translated to the affiliates of the Fund: NOx emissions below 98,000 tonnes, implicating reductions of +/- 31,000 tonnes at the start. 14,000 tonnes reduction comes from improved data and updated forecasts, leading to the new target of 18,000 tonnes. See “The Norwegian NOx Fund – Experiences gained so far.” Presentation by Sveinung Oftedal at 2nd Meeting of the ECCP Working Group on Reducing greenhouse gas emissions from ships, 22-23 June 2011. Downloadable at http://ec.europa.eu/clima/events/0036/NOx_fund_en.pdf

31 P.c. Wenche Svellingen and Geir Høibye of the Business Sector’s NOx Fund.

32 Det Norske Veritas (DNV) are responsible for the processing of applications for support for NOx reducing measures from ships, the mainland industries and the offshore sector. DNV will give recommendations to the Business Sector’s NOx Fund regarding the prioritisation of measures in order to ensure the most cost-effective use of the Fund’s financial means while ensuring that the individual measures with the highest effect are granted priority. DNV is also responsible of quality assurance of the documented NOx reductions. See http://www.nho.no/the-NOx-fund/category477.html
The Environmental Agreements foresee both targets for the entire period and translates these to annual targets. Under- or overfulfiment is however transferred accordingly to the next period. The (cumulative) reduction of NOx-emissions from participants to the Fund in the first four years is shown below, showing the actual decline in emissions from participants to the Fund.

Figure 5: NOx emission reductions (green) and targets (blue) for companies involved in the NOx fund (Source: annual report Business Sector’s NOx Fund 2010)

**Additionality**

The trend of NOx-emissions shown in Figure 3 indicates that past policies have not led to a significant decrease in emissions, as these are now at the level of 1990 while a 30% reduction was targeted. The main contributing sectors are road transport (20%), transport and motorised equipment (39%) and combustion in oil and gas related activities (27%).

Road transport (own emission standards) is no target group of the tax. Unlike in most sectors, emissions in two key sectors (e.g. shipping, oil and gas) have grown (2000 – 2005) and the NOx tax has been installed primarily to curb the upward trend in these sectors. Emission reductions within the target group of the NOx tax have not been motivated by other policy initiatives besides the introduction of the tax and the fund.

At the time of the installation of the tax, it was assumed that the tax in itself would probably not suffice to reach the emission ceiling under the Gothenburg Protocol. Kelly et al (2009) described that the initial tax rate (NOK 15) could only be considered as an introductory tax level only, and added that the government had stated that sufficient reductions (by the year 2010) would require a marginal cost of 5.95 €/kg (NOK 50). At that time, the Government already suggested that it would be necessary to consider the introduction of a NOx tax in the context of compensations paid to certain affected industries.

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33 EFTA Surveillance Authority Decision No: 144/11/COL, 19 May 2011.
34 Figures for 2010. Statistics Norway at http://www.ssb.no
35 Confirmed by personal communication with the Business Sector’s NOx Fund: tax rate would have to be at NOK 50-60 (€ 6.25-7.50) per kg NOx emitted to trigger implementation of sufficient NOx reducing measures.
The activity level and economic climate will also play a role in absolute emissions and influence the ambition of the targets. It is of note that the definition of the targets appears to have considered an increase in the activity level.\footnote{Personal communication Geir Høibye from the Business Sector’s NOx Fund} This appears to be a solid assumption considering the nature of the sectors included in the Fund (oil and gas, shipping). Moreover, the authorities can take the initiative for adaptation of the (absolute) targets if stricter obligations under the Gothenburg Protocol would arise. For the granting of support, the NOx fund bases on real NOx reductions and includes the activity level in the verification process. The Fund only grants support for implementation of devices or physical modification. Initiatives like speed reduction or driver training (to reduce fuel consumption and associated emissions) are not eligible for funding. The evaluation of actual emission reductions is done by an independent third party quality assurer, Det Norske Veritas (DNV).\footnote{Information on the functioning of the verification scheme has been received through personal communication with Henning Mohn, Det Norske Veritas (DNV).} DNV checks applications for funding and evaluates on an ex-ante basis the cost-effectiveness and the reduction potential of the measures plans. Reductions are considered together with the activity level, as enterprises need to report on past and projected fuel consumption as well. Actual measurements after implementation must be carried out by an accredited firm or a competent party approved by the Norwegian Maritime Directorate.\footnote{http://www.nho.no/support-from-the-fund/category479.html} Data on emission reductions (emission factor, fuel consumption) are then again sent to and verified by DNV. For certain installations where operating conditions are important, verification runs over a defined time period with partial support payments.

In its notifications to the EFTA Surveillance Authority (ESA)\footnote{For further reading, see EFTA Surveillance Authority Decision No: 144/11/COL, 19 May 2011.}, the Norwegian Ministry of Environment motivated that the tax exemption (and support for NOx-reducing measures) – NOx Fund - was introduced in order to achieve a higher reduction in national emissions of NOx than would have been achieved by the mere application of the full tax rate. One of the conditions of ESA to define the State Aid as acceptable has been that the scheme should contribute at least indirectly to an improvement of the level of environmental protection and that the tax reduction and exemption does not undermine the general objective.

It is argued by the Norwegian authorities that the tax exemption is not undermining the general objective of the NOx tax but rather pursues its general objective further. The aim of the NOx tax is, by imposing a financial contribution proportionate to the pollution made, to encourage undertakings to take concrete measures to reduce NOx emissions. The possibility to be exempted from the NOx tax goes further as it encourages the undertakings to combine their financial resources in order to enable them to implement measures which on their own they could less easily afford, thus achieving a direct and
long term reduction in NOx emissions. The NOx agreement entails a temporary exemption of the NOx tax. Individual undertakings also have an incentive to consider measures for their own situation in the longer run, in order to lower or avoid future tax payments. The Business Sector’s Fund believes that undertakings (subject to NOx tax) not affiliated to the Fund will have low to no incentives to decrease emissions the coming years. The gap between the NOx tax and the rate to the NOx Fund appears to be insufficient to finance the enterprises’ measures and most reductions come from initiatives granted support.40

Effectiveness in relation to GES (MSFD) and side-effects
Atmospheric deposition is an important pathway for nitrogen to the sea. Emissions of nitrogen oxides contribute to nitrogen inputs to the marine environment. The portion of atmospheric inputs41 (i.e. deposition) of nitrogen from land based sources, such as traffic and power plants, and sea based sources, such as shipping, into the OSPAR maritime area accounted for one third of the total nitrogen inputs in the period 1990 – 2001. Transport by land, air and sea has been growing over the past years emphasising the significance of atmospheric inputs to the sea. Models42 estimate that Region II (including the Norwegian South coast) receives most atmospheric nitrogen, as would be expected from the high levels of industry and agriculture in its coastal areas and its intense ship traffic. Models show no significant trends in atmospheric inputs between 1998 and 2006 in the OSPAR area. According to OSPAR, efforts are required to reduce emissions from agriculture, combustion processes and transport, and to tackle emissions from increasing levels of ship traffic.

Nitrogen oxides can have a residence time of a few days making it possible to transport pollutants over distances above 1000 km. This specific feature makes it difficult to assess a policy measure in terms of reduced nitrogen inputs in the (own) marine environment. Deposition of nitrogen from long-range transport of nutrients is calculated using numerical models and measurements of the concentration in precipitation.43 Deposition is usually greatest close to the source.

There is concern about the level of atmospheric nitrogen deposition to the OSPAR area from agriculture, combustion processes and road transport, and about the increasing absolute and relative contribution from shipping to airborne inputs. OSPAR wants to promote the recognition of marine eutrophication in the revision of air emission targets for nitrogen under the EU National Emission Ceilings Directive and the Gothenburg Protocol

40 Personal communication Wenche Svellingen from the Business Sector’s NOx Fund.
41 http://qsr2010.ospar.org/media/assessments/p00310_PARCOM_Rec_88_2_and_89_4.pdf
42 http://qsr2010.ospar.org/en/ch04_03.html
43 http://www.environment.no/Topics/Marine-and-inland-waters/Eutrophication/Eutrophication/Inputs-to-coastal-waters/
to the UNECE Convention on Long-range Transboundary Air Pollution. OSPAR will further evaluate the contribution of atmospheric nitrogen emissions, including those from ships, in eutrophication assessments and use this to steer revision of IMO standards for NOx. Additional policy instruments like for example nitrogen taxes will be needed to further reduce emissions to fulfil these international targets.

Next to reduced NOx emissions, it is important to note that some implemented measures supported by the NOx Fund can also result in reduced emissions from other pollutants or climate gases. The Business Sector’s NOx fund claims that the accumulated reduction of CO2 based on granted support application is +/- 340,000 tonnes, of which 260,000 tonnes are in waters subject to NOx tax.44 Around 40,000 tonnes of the reductions are due to conversion from diesel to gas. Det Norske Veritas (DNV) estimates a yearly reduction of 160,000 tonnes CO2. The highest side-benefits are achieved by conversion to gas or new building. LNG (Liquid Natural Gas) gives a 90% NOx reduction and has a beneficial effect on other emissions: reducing CO2 with 20% and low emissions of sulphur and particulates.

1.1.4.2 Information on costs and benefits

Costs and benefits of the instrument

Costs of a policy instrument must be identified for the various parties involved. Implementation costs or direct costs (usually administrative costs for authorities) are distinguished from indirect costs including the associated costs for sectors or target groups. The description of the costs is slightly different in the case of the isolated NOx tax and for NOx scheme combining the tax and the NOx Fund (temporary tax exemption).

In the case of the isolated NOx tax, two groups of actors are identified. The Government installed the tax instrument in 2007 and bears the administrative costs for the design, the operation and the control of the tax scheme. Administration and implementation costs for the Norwegian government could not be identified for the NOx tax and Fund. When the tax on NOx emissions was introduced in 2007, annual extra administrative costs for the Governmental bodies having new responsibilities were estimated at a total of 9 million NOK (about 12 full time equivalents). It is of note that these figures represent 4 government agencies (tax and customs, Pollution Control Authority, Maritime Directorate and the Petroleum Directorate), making it impossible to isolate the impact of the NOx scheme.45 The legal framework for the NOx tax is covered by existing regulations on special taxes. Moreover, reporting of emissions is based on the same methods used for the calculation of NOx pursuant to § 3-19-6 of the Regulation relating to Special Taxes. It is assumed that this existing framework limits the administrative costs in operation and control.

44 Personal communication Wenche Svillingen, Business Sector’s NOx Fund.
45 Personal communication Eli Marie Åsen, Ministry of Environment
Indirect costs for enterprises in 2007 were primarily tax payments at a rate of 15 NOK per kg NOx (+/- 1.8 € per kg NOx). This has been the main cost for companies as it is argued that only a limited number of investments in abatement technology have been triggered by this tax considering the expected but delayed setup of a compensation regime (cfr supra). It is argued that this tax cannot be passed on to final customers as most of the enterprises liable to the tax act in an international context. This taxation level would result in annual tax payments (for ships) of +/- 75,000 – 150,000 euro. In the current situation (i.e. after introduction of the NOx-scheme in 2008), less than 10% of the undertakings are solely liable to tax.

Nevertheless, enterprises still need to report emissions periodically (per trimester) to the Government. For ships, 2 hours per ship per reporting would be a rough estimate. Some companies with many ships tend to automate this reporting (IT systems) saving both time and money in the longer run. For larger companies with complex industrial structures, the NOx-reporting is usually part of their emissions report and control-system that they have to report to the Government any way, at least on a yearly basis.

After the introduction of the NOx Fund in 2008, the majority of NOx tax payers have decided to participate in the Fund and the operation and control of the NOx scheme is now controlled by the Business Sectors. Authorities have no direct implementation costs related to the Fund, except the closing of the Environmental Agreement between the Ministry of the Environment and industry organisations. The annual loss in tax revenues is estimated at about NOK 1.39 billion (180 million euro). As the Government was planning compensating measures for the tax, e.g. increasing grants for funding measures to reduce the NOx emissions of ships and fishing vessels, net impact on the State budget is reasonably lower. Kelly et al (2009) stated net tax revenue of NOK 520 million (67 million euro) accrued in 2007.

According to its statutes, the Fund shall be managed in accordance with the full cost principle (non-profit), i.e. all the financial means which the Fund receives will be utilised in accordance with its purpose of reducing NOx emissions in a cost-effective manner with the exception of necessary administrative costs. To date, in the first four years of operation of the Fund, the administrative costs have been kept a low level (<2% of total contribution payments). The Fund claims that the interest returns from having out money (annual contribution payments) in the bank outweigh the costs of running the Fund (the latter including support services from Det Norske Veritas (DNV) and other services).

46 The NOx Fund: A successful financial instrument for emission reduction. Presentation at Sustainable Shipping Miami 2010 (22-23 October 2010) by Henning Mohn, DNV Solutions.

47 Information on reporting provided by Geir Høibye from the Business Sector’s NOx Fund.

48 Specific costs have not been estimated, but can be regarded as marginal. Personal communication Eli Marie Åsen, Ministry of Environment

49 For 2011, if the affiliates of the first agreement 2008-2010 participate in the second. See EFTA Surveillance Authority Decision No: 144/11/COL, 19 May 2011
It has been an intensive work (approximately one year) to set up a practical framework for the Fund. Start up costs in preparation for the Environmental Agreement were close to 0.3 million €. Most of this was work by DNV to look into potential reductions of NOx from the shipping sector and how they could be developed over the period of the Agreement. These startup costs were pre-funded by the member organisations and later refunded from the Fund when the Agreement was in operation. Dedicated manpower in member organisations during the introduction period would be roughly estimated at 3 Full Time Equivalents in the pre-introduction year. The development and introduction has been a priority for business organisations considering the fiscal cost of the NOx-tax of roughly 2.2 million € in 2007.

Participants to the Fund pay a contribution to the fund instead of the higher NOx tax. The rates of payment to the NOx Fund are NOK 11 per kilo NOx (1.29 €) for the offshore industry, and NOK 4 (0.47 €) for the other sectors (shipping, supply-vessels, fishing, industry, aviation, district heating etc.) instead of NOK 16.43 (2.14 €). This temporary exemption results in significant savings for enterprises liable to the tax (nearly 80% for non-offshore industry). Moreover, practically all contributions are recycled back to the businesses as grants for abatement measures. Support payments can cover up to 80% of the total costs (up to a maximum per kg NOx reduced) and are differentiated according to the type of the measure. Considering that the offshore tends to have higher abatement costs (nature of its operations), cost-effective measures are first implemented in other sectors. This industry is thus financing an important share of the Fund while the potential to install cost-effective measures is low. Nevertheless, the offshore sector is paying still significantly less (40%) than when no tax exemption would exist providing an incentive to participate in the Fund.

Benefits of the policy instrument are directly connected to the reduction of NOx emissions. When benefits are looked at within the context of the Marine Strategy Framework Directive, these come as reduced nitrogen inputs into the North Sea area, with a potential positive effect on GES 5 (human-induced eutrophication). Overall benefits can also be considered in the wider context when looking at the harmful effects of nitrogen oxides pollution: health, acidification, .... From a policy perspective, it may be relevant to estimate the benefits of NOx reductions in terms of reduced external costs of NOx emissions. Miola et al (2009), based on Holland and Watkiss (2002) mention marginal external costs of emissions for countries surrounding sea areas (EU seas). For

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50 Information on the design and setup costs of the Fund have been received from Geir Høibye, the Business Sector’s NOx Fund.
51 [http://www.nho.no/support-from-the-fund/category479.html](http://www.nho.no/support-from-the-fund/category479.html)
52 External costs of activities (for example in relation to transport) are costs related to effects generated by that activity but not borne by the actor. In the context of transport, external costs usually follow from like environmental impacts, accidents or congestion. The internalisation of external costs means making such effects part of the decision-making process of the actors. See for example [http://ec.europa.eu/transport/sustainable/2008_external_costs_en.htm](http://ec.europa.eu/transport/sustainable/2008_external_costs_en.htm)
the North Sea, this value was estimated at 3,100 € per tonne NOx (year 2000 prices). Hjelle (2006) mentions a shadow price of 1.88 € per kg NOx for short sea shipping and coastal traffic. Benefits in 2011, based on estimated NOx reductions of +/- 21,000 tonnes (from implemented abatement measures, see e.g. Figure 5) then range from 40 to 65 million €. Assuming the total reductions from the two environmental agreement periods (18,000 and 16,000 tonnes), annual benefits could amount up to more than 100 million €.

Cost-effectiveness

Cost-effectiveness plays a central role in both the design and the functioning of the system. Firstly, it can be argued that the NOx tax as an economic instrument stimulates cost-effectiveness for emission abatement. By placing a direct cost on environmental damage, taxes increase the incentive for firms to reduce such damage provided that the level of the tax is sufficiently high. A tax normally encourages both the lowest cost abatement across polluters and provides incentives for abatement at each unit of pollution (OECD, 2010). The collective commitment for emission reductions within the NOx fund allows freedom in the choice and priority of abatement options, as the initiative groups multiple sectors. The instrument thus includes by definition some elements to maximise cost-effectiveness.

Moreover, the notion of cost-effectiveness has been installed as the decision criterion to grant funding for abatement measures. With assistance from Det Norske Veritas (DNV), the board of the NOx Fund selects the most cost-effective NOx reduction projects, which may receive up to 80% of the (usually) investment costs. The fund also supports operational costs, such as urea that is used in selective catalytic reduction (SCR) systems. The support rate can be differentiated by type of measure and the amount of support is limited per unit of NOx reduction (e.g. NOK 350 or 44 € per kg for conversion to natural gas engines, technology that can benefit from highest support rates).

The cost-effectiveness of the NOx reduction measures has been estimated by the Business Sector’s NOx Fund. If the lifetime of measures are taken into consideration (from 5 – 30 years), the total average weighted cost for all measures with planned implementation by the end of 2011 is at NOK 15.30 (€ 1.90) per kg NOx. Granted support from the NOx Fund for these measures is at NOK 8.80 (€ 1.10) per kg NOx. The weighted average cost is based on information from 483 applications granted support, of

53 These prices have been based on estimated costs for Norway to fulfill the obligations of the Gothenburg protocol. For further reading, see Econ (2003). Eksterne marginale kostnader ved transport. Oslo, Econ Analyse.
54 http://www.airclim.org/acidnews/2010/AN1-10.php#1
55 Personal communication Business Sector’s NOx Fund. This information is also included in the annual report of the Fund. Available for download at http://www.nho.no/getfile.php/bilder/RootNY/NOX-fondet/NOX-fondets%20arsrapport%202010.pdf
which 250 were implemented and verified at the time of estimation. The vast majority of the measures appear to have costs below the current NOx tax.

![Cost-effectiveness of emission](http://www.airclim.org/acidnews/2010/AN1-10.php#1)

**Figure 6**: Cost-effectiveness of implemented and projected abatement measures under the NOx scheme (source: Business Sector's NOx Fund)

The level of support has varied between projects. Some companies have opted not to propose measures (i.e. apply for funding) because they are not cost competitive. This may be the case for many offshore oil and gas installations where abatement measures are far more costly than for example on ships. Oil service vessels (offshore service ships) contributed to the largest reduction in NOx emissions through NOx Fund projects, followed by fisheries and short sea shipping (see Figure 7). Overall, it is estimated that approximately 80% of the reduction will come from maritime projects onboard vessels as they appear to be more cost-efficient.\(^{56}\) One reason for costs at sea being lower is that the easiest and least expensive measures have already been taken ashore, but not yet at sea. Several sources refer to the relatively low costs of NOx abatement measures in ships compared to other emitting sources, stating marginal abatement costs for ships between 0.1 and 1.8 € per kg NOx opposed to a steep marginal abatement cost curve for land-based sources (see Figure 8).

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\(^{56}\) [http://www.airclim.org/acidnews/2010/AN1-10.php#1](http://www.airclim.org/acidnews/2010/AN1-10.php#1)
The projects with the highest NOx reductions (most widely implemented) are selective catalytic reduction (SCR) (41%), followed by internal engine modifications and conversion into Liquid Natural Gas (LNG) fuel driven vessels (both +/- 18%).

Implementation of SCR systems are very effective (high abatement efficiency of up to 90% reductions), but with substantial operational costs (for urea). The new

Environmental Agreement focuses on long lasting measures, and the NOx Fund has therefore reduced the support rate to SCR systems. The share of SCR systems is assumed to be reduced towards 2017. Large reductions are already achieved to switching over to Liquid Natural gas (LNG) or dual-fuelled ships.

Financing
The combined instrument NOx tax and Fund provides a good financing mechanism for NOx abatement measures. Moreover, the costs of running the Fund are largely transferred to a (lean) non-profit business organisation creating the opportunity to implement the system without high costs for the public authority. Existing mechanisms to support investments in NOx abatement measures run by public bodies were terminated after the conclusion of the Environmental Agreement.59

The NOx Fund has about 2% administrative costs covering own expenses for administration and purchased services from mainly Det Norske Veritas (DNV). At least 98% of what the enterprises pay into the Fund goes back to NOx reducing measures in the affiliated enterprises, leading to a nearly zero sum game for industry. According to the NOx Fund, its financing possibilities have resulted in increased emission reductions at a considerably lower financial burden for the enterprises. It is also argued that the emission reductions in the Agreement are achieved with a higher degree of certainty.

Implementation of measures is conducted at the enterprises’ own risk as payment of support is based on actual NOx reduction after the realisation of the measure. If a measure does not give the anticipated NOx reduction, the support from the Fund will be reduced accordingly.

1.1.4.3 Suitability - Fit for use (context) and feasibility
The purpose of the NOx tax (and Fund) is to contribute to cost-effective reductions of NOx emissions and together with other policy measures contribute to fulfil Norway’s obligations to the Gothenburg Protocol (see earlier paragraph 1.1.2). The tax aims at emissions that are not (or partly) covered by other policy instruments (Skjelvik at al., 2011). The target sectors of the tax (e.g. oil and gas, shipping, fisheries) represent an important share in total NOx emissions of the country. Much of Norway’s economy depends on its natural resources base oil and gas, wood, fisheries and hydropower. The tax is one of the first instruments that for example addresses NOx emissions from the

59 Personal communcation with Eli Marie Åsen, Norwegian Ministry of Environment.
domestic shipping and fishing sector. The model combining the tax and the Fund is unique to Norway.\(^60\)

Awareness of national and international environmental issues has long been high in Norway, which is exposed to air and coastal water pollution influenced by emission from other countries. Its status as a net importer of transboundary pollution motivates Norway to fulfil its own obligations under the Gothenburg Protocol and this has played a role in the implementation of the instrument. Although direct regulations still play an important role, Norway has a long tradition of using economic instruments in the environmental policy. Several commissions have since the 1990s proposed shift towards more use of environmental taxes, which has gradually taken place (Skjelvik et al., 2011).

The introduction of the NOx Fund has followed from a strong emphasis on efficiency in environmental policy in Norway and a continuous concern with competitiveness. The instrument (Environmental Agreement granting tax exemption) has been developed in order to provide efficient, environmentally oriented transformation without excessively burdening Norwegian industry.

1.1.4.4 Social, legal and institutional context

Legal basis and rationale

Norway was one of the first countries to apply environmental taxes, and they continue to be important instruments of environmental policy. The environmental NOx tax is considered as a special tax and falls under the Act No. 11 of 19 May 1933 concerning Special Taxes. When (new) taxes are installed with reference to this act, the Ministry can issue further provisions relating to calculation, collection and control, preventing lengthy decision processes before implementation. Regarding the NOx Fund, it is important to indicate that the tax exemption (and replacing contributions to the Fund) represents a temporary exemption. The Storting’s resolution on taxes on emissions lays down the legal basis for the exemption from the NOx tax. The exemption is valid until the end of the period of the Environmental Agreement, i.e. the year 2017, and thus does not mean that the tax no longer exists.

It is believed that NOx reductions under the NOx scheme have only been possible because of the presence of a credible tax instrument.\(^61\) The tax has been present before the support scheme has been introduced and the support scheme is known as a temporary measure, thus will continue to affect activities after 2017.\(^62\) This framework provides incentives to choose for structural measures.


\(^61\) Personal communication Henning Mohn, Det Norske Veritas.

\(^62\) Maximum ten years according to ESA, the EFTA Surveillance Authority.
Institutional capacity to implement and control

With the introduction of the NOx tax and Fund, Norway has confirmed its status of pioneer user of economic instruments in environmental policy. The environmental performance review of the Organisation for economic cooperation and development (OECD)\(^63\) states that the country developed an impressive analytical capacity to underpin policy development. However, like in many countries, the interplay of policy analysis and the political process appears to have not always led to the selection of the most cost-effective environmental policies. The NOx tax and NOx Fund combination can be considered as an effort to further define environmental policy objectives for sectors that exert the greatest pressures on the environment.

The Norwegian State could rely on past experiences (e.g. CO\(_2\)-tax) to set up the NOx tax. The instrument has first been announced in 2005 and was introduced 1\(^{st}\) of January 2007. The competent authority (and its responsibilities) is clearly defined in the Storting Resolution. The implementation of the instrument is supported by clear documentation on the provisions and the scope of the policy instrument. It is emphasised that the aim is to achieve as accurate a tax system as possible. This applies in particular to the provisions on tax calculation and the requirements applicable to documentation of the calculation. This is for example illustrated by an interpretation document of parts of the regulations on the NOx tax where misunderstandings could exist.\(^64\) According to Moen et al (2010), the office of the Audit General of Norway (Riksrevisjonen) presented criticism of the groundwork and the lack of analysis of the consequences of the taxation scheme. Moreover, it is noted that existing documentation would not be open for external evaluation. No further information could be identified to confirm this statement.

The NOx Fund on the other hand, is the result of a negotiated agreement between business organisations and the Ministry of Environment. Through the agreement, the majority of undertakings subject to the tax are temporarily exempted from the tax. This agreement between business and the Authority has in fact transferred (a significant) part of the control the NOx Fund. Individual undertakings sign a participant agreement with the Fund stating rights and obligations between both parties. First line reporting and control is organised by the Fund, as the Fund has an obligation to meet a collective reduction target. Enterprises have to report their emission both to the NOx Fund and to the Norwegian Customs and Excise. Customs and Excise may ask the Fund to submit emission data on each individual enterprise, to ensure that the same emission has been reported.\(^65\) The annual and final reporting of the Fund towards the Norwegian authority is evaluated by the Climate and Pollution Agency.

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\(^{65}\) Personal communication, Business Sector’s NOx Fund.
Both the Environmental Agreement and the Participant Agreement provide specific provisions for control and possibilities to respond in case of possible violations, allowing effective control. The Business Sector’s NOx Fund can impose fines in order to ensure adequate pressure with regard to fulfilment of commitments from enterprises, even before violations are determined. In case of violations, the NOx Fund may revoke an enterprise’s participant certificate. The undertaking is then no longer exempted from the tax and will also have to repay all the support received from the NOx Fund if the support has not been spent on NOx reducing measures. Lack of fulfilment of the reduction obligation also leads to (partial) obligation to the tax. The Climate and Pollution Agency reviews the annual reports and status reports and checks compliance with the reduction obligations for the specified periods. If the Climate and Pollution Agency finds that the participating undertakings have fulfilled less than 90% of their annual reduction obligation before the deadline, a tax obligation will arise for the relevant calendar year. The Climate and Pollution Agency shall decide which rate is to be applied by the undertakings liable to pay the reduced tax.

The Business Sector’s NOx Fund applies a rigid control system. Effective control within the system is ensured because support to measures is only paid after implementation and documentation of the measure – based on actual NOx reductions and costs. The Fund is assisted by a third party to control real emissions, Det Norske Veritas (DNV). The verifications are done based on a self-declaration form submitted by the enterprises. These enterprises will also have to submit a measurement report, including measurement of emission both before and after implementation of the measure. The measurements must be carried out by an accredited firm or a competent party approved by the Norwegian Maritime Directorate. For more complex NOx reducing systems depending on operating conditions (e.g. SCR, EGR and HAM systems), the real reductions are measured over a longer time period and support payment is paid partly after implementation and the remainder after the first control period. The NOx Fund grants operating support to SCR systems (urea) to ensure that the systems are operated after implementation. Support is paid out after consumption over at least three months. The consumption must be documented with information regarding SCR and fuel consumption as well as a copy of documented costs.

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66 100% in the last year 2017

67 This payment obligation means that if the Business Organisations fulfil 60% of the annual reduction obligation, the taxable source shall pay 40% of the ordinary NOx tax. As an upper limit, the payment to the NOx Fund and the NOx tax to be paid shall not exceed what the undertaking would have paid in ordinary tax if the exemption did not exist.

Distributional impact and acceptance

New policy initiatives often face opposition from different angles. Acceptance generally goes together with the distribution of the cost burden. After the introduction of the NOx tax in 2007, fishing industry opposed to the isolated introduction of the tax without Environmental Agreement (fund solution for economic compensations), as was apparently formulated as a condition earlier. It was argued that the additional cost for industry had several negative consequences, such as reduced landings of fish in Norway and thereby also reduced number of jobs at the Norwegian fleet and processing plants. Year-round operating shrimp trawler fleet in Norway was claimed to face 50% reduction in 2007 due to i.a. the special Norwegian NOx-tax for the fleet.

As is the case for all environmental taxes inspired by the polluter pays principle, the main obstacle to institute the tax is often the power of polluters – and their threat of relocating or going out of business (Sterner et al, 2000). Emission payment schemes are generally efficient from a social welfare point of view, by internalising associated external costs, but political viability often depends on the distribution of the costs and the varying degrees of opposition. Revenue recycling within the group of polluters may increase the acceptance of the policy. The NOx Fund may be considered as an unconventional example of Refunding of Emission Payments (REP), as it is a combination of a tax exemption and refunding of contributions to the Fund. It is a price-type instrument where the regulator does not want to place the full cost burden on the polluters.

The introduction of the NOx Fund has been widely accepted by the different sectors affected by the NOx tax in Norway, as more than 90% of all registered enterprises subject to the tax and about 95% of taxable emissions have endorsed the Environmental Agreement. Most of the oil and gas industry's activities have endorsed the agreement. Oil and gas industry chooses to join the Fund rather than pay tax as it is their belief that cost efficiency for other emission sources is much higher compared to for example for (their) offshore installations.

1.1.4.5 Flexibility and adaptability

The combined instrument of the NOx tax and Fund has the capacity to be both flexible and adaptive, due to the very nature of the instruments (tax and collective commitment) and the setup of the NOx-scheme.

69 http://www.akerseafoods.com/text.cfm?id=3-206&path=3.61

70 Sweden has installed a NOx tax for large combustion plants where revenue is recycled back based upon useful energy production. The Swedish experience has often been used as a good example of a (successful) REP system. See e.g. Sterner et al (2009) or Kelly et al (2009).

Real NOx emissions are the basis of both the tax payments and contributions to the Fund (and support). The NOx tax can be regarded as a continuous incentive to reduce emissions provided the tax level is chosen correctly. The NOx Agreement establishes absolute emission reduction targets for the group of undertakings participating in the Fund. The State has no influence on how these reductions are achieved, as this is the sole responsibility of the Business Sector’s NOx Fund. The grouping of multiple and diverse sectors (with specific NOx abatement costs) allows businesses to opt for the most cost efficient solutions for the collective entity. The success of the cooperative effort (Fund) is however dependent on the fact whether sufficient NOx reducing measures are being implemented, ensuring that the emission obligations vis-à-vis the Environmental Agreement are being met. Flexibility is therefore likely to be higher in the short run compared to the end of the Agreement period. According to the Participant Agreement, undertakings have the obligation to implement a measure if it is cost-effective\(^{72}\).

The NOx tax and Fund do include future developments or potential changes. In the second and ongoing Agreement, it is stipulated that the emission obligations from 2013 may be adjusted if it is considered necessary in order to meet Norway’s emission obligations vis-à-vis the Gothenburg Protocol in 2020. The state can then initiate negotiations with the business organisations.

Technological developments are by definition considered as the tax base are emission units. According to the Environmental Agreement the Fund may support only new technology ready for implementation, i.e. support to full-scale new solutions. Other funds or organisations are usually granting support to research, development and pilot installations, while it is of note that the Fund now dedicates a small budget to pilots.\(^{73}\)

1.1.4.6 Broader impacts: risks and opportunities

It is fairly reasonable to assume that the NOx tax would have an impact on the competitiveness of certain Norwegian sectors subject to the tax. In their notification of the (temporary) tax exemption\(^{74}\) to the EFTA Surveillance Authority, the Norwegian authority stated that the introduction of the environmental NOx tax would lead to a substantial increase in production costs for undertakings in the majority of sectors affected by the tax. The activities coming within the scope of the potential tax exemption are typically transport by ship or by plane, heavy engineering, or energy generation at an

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\(^{72}\) In this context, a measure is cost-effective if the reduction in NOx emissions resulting from the relevant measure and the value this has in the form of reduced NOx tax calculated over a three-year period, is sufficient enough to cover the corporate costs in relation to implementing said measure, including the enterprise’s fee after it has received support from the Business Sector’s NOx Fund, including losses in cases of reduced operations or temporary shutdown of operations and other costs resulting from the measure for the enterprise or others.

\(^{73}\) Personal communication Henning Mohn, Det Norske Veritas.

\(^{74}\) Information derived from EFTA Surveillance Authority Decision No: 144/11/COL. Decision of 19 May 2011
industrial scale in addition to oil and gas production. Such activities are generally subject to strong international competition. In sectors such as fish and fish products, oil and gas and industrial products such as paper, metals, and building materials, Norwegian undertakings are not in a position to independently set the prices of their products. Due to their limited size and the presence of foreign undertakings on the various markets they would be price takers, meaning that their possibilities are very limited to carry increased costs, such as a NOx tax, over in products prices.

Further evidence that the substantial increase in costs cannot be passed on is the fact that the proposal to introduce the notified regime was instigated by the industry itself. Originally, the Norwegian Government had proposed in the 2007 Fiscal Budget to introduce the tax without any option for environmental agreements. Only after pressure from the industry did the Parliament provide for the possibility to introduce such agreements. If it had been possible for the industry to pass on the tax to the customers, it may not or to a lesser extent have asked for the possibility to enter into agreements with the State.

Next to the issue of competitiveness, technological innovation has also been a motivation for signing the NOx agreement and establishing the NOx fund\textsuperscript{75}. The Fund can create opportunities to develop new, environmentally efficient solutions within shipping, and to provide greater marketing opportunities for environmental technology solutions. The supplier industry for NOx abatement or low NOx emissions technologies is worth more than NOK 5 billion (649 million euro) in Norway and the NOx fund’s support of NOK 1.8 billion (234 million euro) will trigger measures and activity therein. The Fund’s administration estimates the overall employment effect in the supplier industry at 500 to 700 full-time equivalents for the years of the agreement period. Moen et al (2010) claim that the real winners of the NOx scheme are companies offering equipment of systems for NOx emissions abatement. They expect that more alike initiatives will be introduced in the future and assume that companies with green performance better than industrial average will be rewarded.

Innovation and the environment(al problems) can be important to address through government actions because market forces alone cannot properly address either issue. Compared to other policy instruments such as regulations that simply set emission limits or prescribe the use of certain technologies, environmental taxation encourages both the lowest cost abatement across polluters and provides incentives for abatement at each unit of pollution. OECD (2010) also underlines that environmentally related taxes can provide significant incentives for innovation, as firms and consumers seek new, cleaner solutions in response to the price put on pollution. Tax design issues (level, tax base) and credibility / certainty of the policy then have a significant effect on innovation. It is also argued however that political economy issues (lower tax rates or refunding mechanisms)

\textsuperscript{75} OLF Norwegian Oil Industry Association (2010). Environmental report. The environmental efforts of the oil and gas industry. Facts and trends.
can maintain the marginal incentive to abate but can weaken some of the incentives to innovate, especially innovation undertaken at the collective level. It is therefore likely that the combination of the tax and the Fund will most likely not spur innovations and technological development but will have a positive impact on the wider and faster deployment of existing technologies. One good example of speeding up market-ready innovations is the conversion to LNG-fuelled ships. It has already been mentioned that ship engines operating on natural gas also reduce SO₂ emissions to almost zero since there is no sulphur in LNG. Emissions of NOₓ and PM are significantly reduced, by 80% or more. CO₂-emissions are reduced by +/- 20%. In 2008, only three ships except ferries were based on LNG. The NOₓ Fund has granted support to 24 ships for conversion to gas or new builds, 14 of which will be finished in 2011. That is expected to raise the amount of LNG as maritime fuel from 3% in 2008 to 16% in 2016, and possibly as much as one third by 2020 if the NOₓ fund and its support continue, according to Det Norske Veritas and MARINTEK. The environmental demands (installation of Emission Control Areas, IMO-standards) as well as future environmental taxing make environmental measures like LNG increasingly more attractive, though still at a cost. The volume of gas consumption is increasing and the infrastructure/availability of LNG is improving, meaning that the use of LNG may be increasing, especially in new ships. LNG operated ships are mostly found in waters subject to NOₓ tax.

One potential negative side-effect often raised in relation to NOₓ abatement is the resulting higher fuel consumption and associated CO₂-emissions. Entec (2005) for example notes that internal engine modification to reduce NOₓ emission (delayed injection) might increase CO₂-emissions. Overall, for the majority of technologies it was assumed that there was no impact on fuel consumption. A recent edition of the Tanker Operator Magazine stated that the new IMO requirements (as of 2011, new engines) with 20% NOₓ emission reductions would lead to a 2% increase in CO₂ and preventing further improvements in CO₂ efficiency. The publication calls for separate legislation of each form of pollution from ship engines, promoting a rational approach considering all pollutants together and synchronising reductions.

1.1.5 Enabling and limiting factors
According to the communication with Business Sector’s NOₓ Fund, there have been no major changes when comparing the first Environmental Agreement (period 2008-2010) to the successor (2011-2017). The NOₓ Agreement 2011-2017 pursues the same principles as the previous one, suggesting that the functioning of the NOₓ scheme has not been questioned by any of the parties involved.

76 http://www.nortrade.com/index.php?cmd=show_article&id=609
77 Personal communication Business Sector’s NOₓ Fund.
The scheme has now run for a few years and first experiences have lead to some interesting thoughts on the factors that could influence the success of the instrument. Success factors and potential pitfalls are further described and discussed in the next paragraphs:

- Design of the instrument
- Stakeholder commitment and cooperation
- Timing and policy certainty
- Information and knowledge
- Control and enforcement

1.1.5.1 Strong design
The instrument has been introduced as an initiative to reduce pollution from larger NOx emission sources. When opting for a certain instrument, it is key to consider the desired behaviour of the target group and to select the measure that can steer their actions. When installing a tax, the tax rate needs to be high enough in order to justify investment in abatement technology. Where an isolated tax faces strong opposition (competitiveness, strong sector organisations …), compensation measures or refunding could be considered resulting in lower costs for polluters. The incentive effect of the NOx fund lies in both the (temporary) exemption\(^79\) from paying the fiscal NOx tax and the possibility to receive support to implement measures. Even if firms are not granted support, the temporary (and partial) exemption lowers the cost of taxation when these were normally highest (i.e. at the beginning, when no measures have been installed yet). Abatement measures will reduce the enterprise’s emissions, meaning that its expenses will be further reduced (having to pay for less NOx emitted). Some measures also reduce fuel consumption and thus reduce operating costs.

OECD (2010) recommends that tax rates should be relatively predictable to strengthen investment and abatement decisions. The NOx tax is only following the normal evolution of the price level, while the Fund has kept the contribution per unit stable over time. The level of the contribution to the Fund is set by the NOx Fund’s Board. The rates were set at a level necessary to bring in sufficient money so that the Fund could support enough NOx reducing measures to meet the Fund’s obligations. The rate of payment to the NOx Fund is NOK 4 for shipping, supply vessels, fishing, aviation, industry, district heating, railway etc. and NOK 11 for the offshore industry (oil and gas production) with more costly abatement options. Rates have been agreed within the business sector.

The experiences with the Norwegian NOx scheme have shown that it could be advisable to establish the notion of *payment post implementation* in the instrument design. Support payments for measures are only granted after implementation and full documentation in

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\(^{79}\) In other words, the presence of a credible NOx tax is a necessary condition for the success of the fund. Personal communication Henning Mohn, Det Norske Veritas.
order to ensure that the support goes to actual NOx reductions. This is an important element as the Business Sector’s NOx Fund needs accreditation of the NOx reduction in order to be able to fulfil its own commitments to the Environmental Agreement (payments per unit of NOx reduction). Support is not granted to measures which only serve to comply with IMO requirements at the time of entry into force. It is important to note that the Fund provides a letter of guarantee (for financing institutions) for applicants that have been selected for support.

A potential pitfall for the success of the system could be the risk of granting an insufficient level of support. Support to measures must be large enough so that the enterprises are willing to take the risks and additional costs of implementing the measure. Based on the current experience of the Norwegian Business Sector’s NOx Fund, it is indicated that a measure must be supported from the Fund with at least 50% of the implementation costs.

As the scheme (both the tax and the fund) is relying on actual NOx emissions and reductions, there is a continuous need for information, for both the installation of the scheme and during its operation. In the design phase and the operation, the Fund has been supported by a third party to identify and refine available information (emission factors, fuel consumption, …). Enterprises have spent longer time than first anticipated to submit documentation after the implementation of abatement measures. The NOx Business Sector’s Fund therefore advises a sufficiently long time period to document fulfilment of the emission obligation vis-à-vis the authorities. On the other hand, the Fund believes it is essential to foresee sanctions (e.g. by reducing support) for enterprises not submitting documentation.

1.1.5.2 Stakeholder commitment and cooperation

Private business organisations representing undertakings subject to the NOx tax are co-founders of the NOx Fund. The Board constitutes of representatives from several of the different business organisations. This has given the Fund a forum for dialog and discussions towards its members and the authorities. Midttun (2009) states that Industry federations are strong supporters of negotiated agreements as they believe these could be more efficient and effective means for achieving environmental and climate policy results than traditional taxation (governance efficiency). It is argued that the fact that industry has exceeded the requirements of the agreements is taken as a proof of this.

Commitments from individual undertakings are laid down in the Participant Agreement. Affiliated enterprises have to develop a measure plan\(^8\) identifying possible NOx reducing measures within two years after affiliation. The purpose of the measure plan is to identify profitable measures the enterprise can implement on its own accord, and cost-effective NOx reducing measures whose implementation are dependent on support from the NOx Fund. The NOx Fund is well aware that enterprises may not have any profitable or cost-

\(^8\) [http://www.nho.no/affiliation/category478.html](http://www.nho.no/affiliation/category478.html)
effective measures at present for their enterprise. Nevertheless, the enterprise shall undertake a review to reveal potential NOx relevant measures. If cost-effective measures are selected for support by the Fund, the enterprise has the obligation to continue with the implementation thereof. The enterprise granted support is responsible for its own risks and cost estimates.

The NOx Fund is not solely a cooperation between business organisations representing members liable to the tax. Support from a third party is considered essential in both the setup and the good functioning of the scheme. Det Norske Veritas (DNV) is important as an independent expert quality assurer for each individual application (i.e. for support to abatement measures), both in the application process and in verifying the effect of measures. The Fund has also been in dialogue with research and governmental institutions providing a broad forum for collaboration. Overall, flexible cooperation between the Fund and its partners resulted in lean NOx Fund operation. Administrative costs for the NOx-fund (including DNV and other services) have been only 2% of total income to date (first four years). The cost of running the fund can currently be covered by interest payments on contributions to the fund.

The NOx scheme requires good understanding between industry associations and the authorities. The continuation of the scheme in Norway can possibly underline the assumed advantages of the said scheme where an isolated tax is not viable (competitiveness) or other regulation is difficult (different sectors). In Norway, oil and gas industry claims that experiences from the NOx fund show that several elements of this fund model can serve as a good model for establishing a climate fund (OLF, 2010). Apparently, other countries like Sweden and the Netherlands are considering similar models. The Norwegian NOx fund has won the Green Ship Technology award in 2011 because of the international interest for the initiative relying on an agreement between industry and the authorities. The European Commission has also referred to the NOx Fund as an example to encourage industry and public sector cooperation for emission abatement in shipping.

1.1.5.3 Timing and policy certainty: introduction, anticipation of target group and eventual targets
The NOx tax was introduced to reduce Norway's emission of NOx as the national emissions were too high. According to the Fund, the tax introduction should have been better timed and communicated to the target group. Preferably, economic instruments (especially taxes and charges) should be announced well in advance and should involve consultations with stakeholders. This will enable actors to take account of the instrument

81 Personal communication Geir Høibye from the Business Sector's NOx Fund
82 http://www.nortrade.com/index.php?cmd=show_article&id=609
84 Personal communication Wenche Svellingen, Business Sector’s NOx Fund
in their decisions and to react optimally to the changed conditions, thus improving overall efficiency.

It is also argued that the NOx tax alone would not have given the amount of NOx reductions needed to meet the obligations in the Gothenburg Protocol. This has been confirmed by some voices in fishing industry, stating that the introduction of the NOx tax without economic compensation is poor environmental policy. It is argued that these compensation measures were decided in the Parliament, but not realised at the time of the tax introduction in 2007.\textsuperscript{85} Besides the impact on margins of fisheries, this delayed introduction of the Fund most likely postponed the process of investing in environmental friendly technologies. It is indeed reasonable to believe that the projected short term introduction of a fund did postpone planned investments for a certain period.

On the other hand, the effective implementation of the NOx tax did create the situation where the industry believes that the tax is a credible instrument and is there to stay. The tax exemption is as such regarded as a temporary situation and enterprises have the incentive to seek for reduction measures at the individual level as well.

\textbf{1.1.5.4 Good information and knowledge}

Target groups are usually sceptical of environmentally related taxation, believing that it may simply be a tax grab or may not fully understand why the tax is raised. Strong communication and credible proponents of the tax can help to overcome these issues. Norway’s communication is consistent on the objectives of the NOx tax (and scheme) referring to the country’s obligation to the Gothenburg Protocol. Regarding the NOx Fund, spreading of information has been a crucial factor in the initial period and is still important. The Fund has organised multiple information meetings with active participation from all stakeholders: private enterprises, suppliers and persons from the Directorate of Customs and Excise. The Fund has a lot of direct contacts with participant enterprises through e-mails, telephones and meetings and has an extensive webpage with clear and complete information in English and Norwegian. Foreign enterprises can also be subject to the tax and thus participate in the Fund.

The NOx Fund appears to have lead to a high level of transparency and openness, for example in the shipping sector. Emissions and fuel consumption are reported periodically, where little or no data has been available in the past. Enterprises that have been granted supported are published on the NOx Fund webpage and this can be viewed by competitors. The Fund’s annual report shows emission reductions for individual undertakings and the time schedule for these projects.\textsuperscript{86} The website also lists abatement technologies for all sectors participating in the Fund and their suppliers. There is a random order of the suppliers in the lists, in order to avoid favouring any particular

\textsuperscript{85} \url{http://www.akerseafoods.com/text.cfm?id=3-206&path=3,61}
\textsuperscript{86} See for example \url{http://www.nho.no/getfile.php/bilder/RootNY/NOX-fondet/NOxFondets%20arsrapport%202010.pdf}
technologies or suppliers. The document is dynamic which will be updated as new technologies reach the market. Since the market and the technologies are constantly developing, there may be additional systems in the market which we not yet have detected. Any updates from the suppliers to this memorandum are appreciated.\(^{87}\) This transparency and information sharing can contribute to a more level playing field for enterprises.

The importance of the third party Det Norske Veritas has been described in paragraph 1.1.5.1. The company offers its expertise for evaluating the reduction potential based upon the initial application of the enterprises and advises the NOx Fund Board on expected reductions and most promising proposals. After implementation, the installation needs to be checked by an accredited institution and the documentation then goes back to DNV in order to evaluate the effect of the measures. In their evaluation, they also address fuel consumption (past and projections) in order to assess real reductions.

1.1.5.5 Control and enforcement

The NOx tax and NOx fund defines strict reporting requirements for individual enterprises and the collective NOx fund. This reporting is needed in order to evaluate and monitor the different obligations and objectives. When obligations are not met, tax is still payable based on the actual emissions.

According to the NOx Fund, control of free riders in shipping from the Norwegian Customs and Excise was only in place in 2010, while it should have been there from the start. Today, ships need to present a valid NOx declaration (taxes paid or exempted) at every port call.\(^{88}\) The intensive use of ship tracking systems (AIS) and strict port control now make it impossible to refrain from NOx obligations.

1.1.6 Sources

- EFTA Surveillance Authority Decision No: 144/11/COL. Decision of 19 May 2011 on the notified scheme for the temporary NOx tax exemption for undertakings encompassed by an environmental agreement with the State on the implementation of measures to reduce emissions of NOx in accordance with a predetermined environmental target

\(^{87}\) [http://www.nho.no/technologies-and-suppliers/category515.html](http://www.nho.no/technologies-and-suppliers/category515.html)

\(^{88}\) Personal communication Henning Mohn, Det Norske Veritas


Presentations


- Air pollution from ships. Presentation by Christer Ågren, Air Pollution & Climate Secretariat. 29 November 2010

- The NOx Fund: A successful financial instrument for emission reduction. Presentation at Sustainable Shipping Miami 2010 (22-23 October 2010) by Henning Mohn, DNV Solutions.


- Status for the fulfilment of the Environmental Agreement on NOx. Presentation by Geir Høibye at Marintek, 21 January 2009.

Articles, newsletters and position papers

- Air Pollution & Climate Secretariat. Cutting NOx emissions - the Norwegian way. Newsletter Acid news n°1, March 2010. Downloadable at http://www.airclim.org/acidnews/2010/AN1-10.php#1


- WÄRTSILÄ technical journal, January 2008. NOX abatement solutions
1.2 Case study Aggregates Levy in the UK

1.2.1 Introduction: Aggregates Levy

The Aggregate Levy (or the Levy from now on) was introduced by the UK Government in 2002 as an environmental policy to reduce the impacts of aggregate extraction. The Levy was set at a fixed rate of £1.60 (€2.54\(^\text{\footnote{Note: The impact of the changes in the exchange rate is greater than the impact of the price rise. Exchange rates calculated at historic levels (eg. 2002, 2008 here). No attempt has been made to re-inflate to 2011 prices.}}\)) per tonne (rising to £1.95 (€2.19) in 2008 and £2 (€2.33) per tonne in 2009) across all aggregate types regardless of the source or extraction method (Fullerton et al, 2010). Monies raised from the Levy were originally hypothecated back to the industry in the form of reduced National Insurance payments and a Sustainability Fund (the Fund). The Levy is not a specifically marine-focussed policy but does have the potential to be used in other countries as a measure to work toward the MSFD.

Aggregates are necessary for the construction industry, as well as for projects such as beach refurbishment, amongst others. The Levy raised between €393m (£247m) in 2002/3 to €503m (£400m) in 2008/9 (Fullerton et al, 2010), with the rise in part due to a rise in the rate of the Levy. Of this, marine aggregates contribute about 20% of the total, a proportion which remains fairly constant over the time period.

The UK aggregate industry is represented by the Quarry Products Association (QPA), the British Aggregates Association (BAA), the Mineral Products Association (MPA) and British Marine Aggregate Producers’ Association (BMAPA).

1.2.2 Environmental problem and objective of the measure

Aggregate extraction from the sea bed makes up around 20% of the aggregate extraction in England and Wales, but this can vary substantially by region. Table 1 shows the tonnage of sand and gravel in England from 1970-2006. In 2006, 13.4Mt went to the UK construction sector, 6.7Mt went to export and 4.1 Mt went to beach nourishment (Highley et al 2007). In 2005 the public sector used 40% of aggregates in the UK, primarily for transport (EEA 2008). Marine extracted aggregates are mainly used for concrete (Sutton and Boyd, 2009) In the South-East of England, including London, marine-sourced aggregates are especially important as the geography of the area means there are few sites for quarries on land – and given the high cost of transporting aggregates by land, marine aggregates are key. For instance, in 2005, marine aggregates made up 80% of total aggregate use, whereas in the East and West Midlands, no marine aggregates were used (Highley et al 2007: 12). Also, in London, ships can dock along the Thames near central London and so reduce transport costs further.

Dredging the aggregates from the sea bed can cause a number of problems to the environment. Not only is the benthic ecosystem removed, causing habitat destruction and...
biodiversity loss, there can be wider issues with changes to surrounding habitats through sediment dispersion, and turbidity plumes (OSPAR 2009).

Marine extraction is controlled by the UK Government, the Crown Estate, which owns the sea bed in British waters, and the British Marine Aggregate Producers Association (BMAPA). Licences and permissions to extract are subject to environmental impact assessments which cover issues such as impacts of wave/erosion patterns, ecosystems, fisheries, water quality, navigation, archaeological sites and others (Gubbay, 2005). However, some of the oldest permissions were granted before environmental monitoring requirements (MEPF 2009: 1).

UK dredging ships are fitted with Electronic Monitoring Systems (EMS) which allow consistent monitoring of dredging activity via GPS. Records for this date back to the late 1990s and provide detailed data as well as compliance monitoring (Sutton and Boyd 2009).

In 2010 the area licensed for dredging was 1,291 km², but only 105km² were dredged and 15.95 Mt extracted, shown in Table 1. 90% of dredging took place within 37.63km², but only 6.83km² was subject to more than 1hr 15 mins dredging per year (BMAPA website). The area dredged is a tiny fraction of the UK’s sea bed.

Table 1: UK marine extraction – area and quantity (source: BMAPA website 201190)

<table>
<thead>
<tr>
<th>Year</th>
<th>Area of seabed licensed for dredging (km²)</th>
<th>Area available to be worked (km²)</th>
<th>Area dredged (km²)</th>
<th>Quantity dredged (mill tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>1,458</td>
<td>222.6</td>
<td>20.47</td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>1,455</td>
<td>220.3</td>
<td>23.68</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>1,464</td>
<td>155.4</td>
<td>20.68</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>1,408</td>
<td>972</td>
<td>150.6</td>
<td>22.76</td>
</tr>
<tr>
<td>2002</td>
<td>1,359</td>
<td>896</td>
<td>149.8</td>
<td>21.93</td>
</tr>
<tr>
<td>2003</td>
<td>1,264</td>
<td>890</td>
<td>143.8</td>
<td>22.23</td>
</tr>
<tr>
<td>2004</td>
<td>1,257</td>
<td>780</td>
<td>134.5</td>
<td>21.45</td>
</tr>
<tr>
<td>2005</td>
<td>1,179</td>
<td>596</td>
<td>137.6</td>
<td>21.09</td>
</tr>
<tr>
<td>2006</td>
<td>1,316</td>
<td>576</td>
<td>140.6</td>
<td>24.18</td>
</tr>
<tr>
<td>2007</td>
<td>1,344</td>
<td>556</td>
<td>135</td>
<td>23.09</td>
</tr>
<tr>
<td>2008</td>
<td>1,278</td>
<td>570</td>
<td>138</td>
<td>21.24</td>
</tr>
<tr>
<td>2009</td>
<td>1,286</td>
<td>536</td>
<td>124</td>
<td>20.1</td>
</tr>
<tr>
<td>2010</td>
<td>1,291</td>
<td>552</td>
<td>105</td>
<td>15.95</td>
</tr>
</tbody>
</table>

90 [http://www.bmapa.org/issues_area01.php](http://www.bmapa.org/issues_area01.php)
Areas that are suitable for aggregate extraction are likely to be those where the sea bed is mainly gravel. Depending on local currents, this habitat can be an ecosystem that is used to large natural movements of the sea bed, and where the dominant species are capable of relatively swift recolonisation, hence the direct impacts of dredging may be relatively low. However, other locations may take longer to fully recover from even low intensity dredging.

![Figure 9: Sales of land-won and marine sand and gravel in England, 1970-2006. Source: Annual Minerals Raised Inquiry, Office for national Statistics; shown in Figure 1 of Highley et al (2007) Figure 9: Sales of land-won and marine sand and gravel in England, 1970-2006. Source: Annual Minerals Raised Inquiry, Office for national Statistics; shown in Figure 1 of Highley et al (2007)](image)

Figures for the cost of marine aggregates are rare in the public domain and are likely to vary according to the quality and type of aggregate, where landed, and when, but Cooper et al (2011) use a value of €13.78 (£12) per tonne based on personal communication with the BMAPA. The Levy therefore adds around 17% to the cost of aggregates.

In 2005, 68 million tonnes out of a total of 275 million tonnes produced came from recycled and secondary sources (EEA 2008). The UK has had one of the highest levels of recycled aggregate usage in the EU since before the Levy was introduced.

**1.2.3 Measure: definition and context**

**1.2.3.1 (Legal) Background and implementation**

In July 1997, the UK Government set up a review into the possibility of raising a charge on quarrying, at the same time as developing principles for green taxes (House of Commons, 2011).

There was opposition at the time from industry groups and the Confederation of British Industry (CBI) which highlighted the likelihood of low environmental impact and the risk of too blunt an instrument to deal with what is often a very local problem. Measures such as
voluntary industry action were discussed at the time. However, in 2000 the decision was made to introduce a levy that applied to virgin sand, gravel and crushed rock but not recycled aggregates.

The Levy was introduced in 2002 at a level of €2.52 (£1.60) per tonne, applicable to all aggregates extracted in the UK or imported into the UK. For marine extracted aggregates, the Levy would be charged at the place of unloading. Any water present at the weighing would need to be measured in order so the weight of the water would not be charged to the Levy. Clay, shale and slate, as well as other materials mined and stone used for facing would be outside the scope of the Levy. Aggregates arising from dredging marine navigation channels would also be exempt. However, the by-products – that is, secondary products sold as cheap, low-grade aggregate substitutes – would be chargeable, despite the fact that the Levy could double the costs of these.

The legislation that applies is the following:

- Finance Act 2001 (sections 16 – 49 and Schedules 4 – 10) as amended;
- Aggregates Levy (Registration and Miscellaneous) Regulations 2001
- Aggregates Levy (General) Regulations 2002

(HMRC, 2011).

The revenues from the Levy were to be hypothecated back to the industry in the form of a 0.1 percentage point reduction in National Insurance payments of the employers (i.e. a fall in the cost of employment) and a Sustainability Fund.

This Fund was set up “to promote alternatives to virgin aggregate and reduce the environmental impact of aggregate extraction” (House of Commons 2011:13). At first €46.6 (£29.3) million was available each year for the first two years of the Fund, distributed through a number of quasi autonomous non-government organisations (Quangos). Towards the end of the Fund, monies were allocated on a 3-year basis, allowing for more stability in the expenditures. The Fund has since run each year up to 2011 when it was discontinued as part of wider cuts. It seems that any surplus revenues from the Levy after the National Insurance rebate will be directed back to the central treasury.

Basis for the setting of the charge

Research was commissioned into the wider social costs of quarrying. This focused on land-based extraction, and a contingent valuation survey was carried out to estimate the disamenity costs of living near quarries. The values found ranged from £0.35 per tonne for crushed rock, £2 per tonne of sand and gravel and £10 per tonne for quarries within...
National Parks. The study also found that results could vary widely between quarries (London Economics, 1999). Marine extraction was not assessed.

The Levy is applied to all aggregates including by-products, that is low grade aggregates arising from the production of high-grade aggregates. Before the Levy, these would have been sold at a very low price of around €1.52/tonne (£1/tonne) otherwise quarry operators would have the cost of these by-products. Adding the levy increases the cost greatly and the BAA reports that there is likely to have been a movement towards increased virgin extraction caused by the increased cost of by-products (Alston, 2011, pers comm.). That is, greater quantities of low-grade aggregates are needed to compensate for a given amount of high-grade aggregates (e.g. in foundations) and so the low-grade by-products are only desirable when they can be bought in larger quantities, and a small price rise per tonne therefore makes a large change in the total cost to the purchaser.

The Sustainability Fund
The Aggregate Levy Sustainability Fund (ALSF) was introduced at the same time as the Levy with the aims of reducing demand for primary aggregates extraction, promoting environmentally friendly extraction and transport, addressing the environmental impact of past extraction and compensating communities for impacts of extraction. These aims were delivered through various groups such as Local Authorities, Government Departments, Quangos91 and non-departmental public bodies (Defra 2006). In 2007, approximately €44m (£30m) was available to the ALSF, of which around 10% went to the Marine ALSF (or MALSF).

Marine focussed work has been carried out through the Centre for Environment, Fisheries and Aquaculture Science (Cefas), English Heritage, English Nature, the Office of the Deputy Prime Minister; after 2007 just the first two groups. The Marine Environmental Protection Fund (MEPF) was set up in 2004 to commission projects for the MALSF, administered by Cefas (MEPF, 2010). Research priorities were developed based on input from the main users – there was general agreement that increased knowledge in order to reduce risks and increase certainty for regulators, advisors and industry for the planning, assessment and management of marine aggregate operations was a priority for all groups’ decision making (BMAPA 2011 – pers comm. with M. Russell).

By 2007 over 50 research projects had been funded, with half of funding going towards seabed resource mapping (Defra 2006). From 2002-2007, approximately €13m (£9m)

91 Quasi-autonomous Non-Governmental Organisation
was spent through the ALSF on marine research; the largest funds to partners were €4.2m (2.9m) spent through English Heritage, €3.5m (£2.4m) allocated through the MEPF and €2.2m (£1.5m) to marine research through Natural England. (ALSF 2007). From 2008 to 2011, €14.8m (£12.9m) had been allocated to the Marine theme of the Fund, with €13.2m (£11.5m) to Cefas and €1.6m (£1.4m) to English Heritage (Daykin, 2010). The work undertaken has wider benefits than just the marine aggregate sector – for example, the increased understanding of marine habitats, impacts and pressures has helped to develop better Marine Protected Areas (MPAs) and inform the assessment and management of other marine industries’ (BMAPA 2011 – pers comm with M. Russell).

Projects funded by the ALSF can be searched for at http://alsf.defra.gov.uk/.

A 2011 study from Defra\(^2\) found that in the 2008-2011 period the Fund had met its aims – some benefits were quantified, but not marine benefits. The quantified benefits of the fund were estimated to have a present value in 2010 of €227.3m (£195.1m), compared to an expenditure (in 2010 present value terms) of €23m (£20m) (Daykin, 2010).

In 2010 it was announced that the ALSF was to be discontinued due to budget reductions\(^3\).

**Ongoing legal challenges**

The Levy is currently under challenge in the European Courts, with the industry group the British Aggregates Association (BAA) claiming that the Levy constitutes illegal state aid as the Levy is not charged on all aggregates. (some rock types are excluded based on their geological description). The BAA has won one appeal and a further judgment is pending.

### 1.2.3.2 Exemptions and amendments – actual and proposed

A number of exemptions and amendments have been proposed, some of which have been applied to the Aggregates Levy, Here we summarise both those measures enacted and the main proposals that have not been implemented.

**Exemptions for by-products of certain processes - implemented**

Certain exemptions were made for other minerals or aggregates extracted as the result of other processes such as road building or fertilizer production.

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\(^2\) Department for Environment, Food and Rural Affairs

Changes in rate of levy – implemented/suspended

The Levy rose from £1.60 (€2.54) per tonne to £1.95 (€2.19) per tonne in 2008 and £2.00 (€2.33) per tonne in 2009. Plans to raise it further have been postponed.

Tax Credits for Northern Irish quarries – implemented but discontinued

The only land border the UK shares is between the Republic of Ireland and Northern Ireland. This means that the Levy would increase competitiveness risks across the border, as well as potentially encouraging illegal cross-border trade, so a scheme to provide tax credits to Northern Irish quarries was introduced, but was discontinued in 2010 due to a legal challenge that this constituted illegal state aid. Originally, the measure had support from the European Commission but the European General Court annulled this in September 2010. (BAA, 2010)

Proposed differentiation for environmental performance

Whilst it has been suggested at various points that a lower rate could be applied to aggregates from quarries meeting environmental standard, it was felt that this would be impractical due to complexities of setting and monitoring standards (House of Commons, 2011).

Relation to other policy initiatives

Whilst the UK’s Aggregate Levy is not specifically aimed at reducing the environmental costs of marine extraction there are two ways in which the policy could have an impact. The first is that by changing the cost of extraction, the price of aggregates rises. In theory, this leads to a reduction in the demand for virgin aggregates - assuming a normal elasticity of demand and no change in other demand-side factors - either by reducing total demand or by shifting use to recycled aggregates. The second is that the Sustainability Fund can be used to develop best practices, to research the impacts of marine extraction and increase the use of recycled aggregates via industry initiatives.

The Aggregates Levy has an aim of increasing recycling of aggregates. This is shared by the Landfill Tax, currently at €64.30/tonne (£56/tonne) and rising to €91.85/tonne (£80/tonne) by 2014. This means that any aggregates arising from construction activities or similar that may in the past have been disposed of are now considerably more attractive to be used as recycled aggregates. The Aggregate Levy of €2.33/tonne (£2/tonne) is small compared to the Landfill Tax and the industry suggests that the impacts of the Levy in this regard are negligible (Alston, 2011, pers comm).

Marine aggregate extraction is subject to a system of permissions and licences from the Government and the Crown Estate, which includes a research fund and environmental impact analysis of sites as well as monitoring of dredging activity.
The Marine Mineral Guidance 1: Extraction by dredging from the English seabed (MMG1) states that dredging should aim to leave the seabed in a condition to enable recovery. In Wales, the Interim Marine Aggregates Dredging Policy (IMADP) includes consideration for repair and restoration if unanticipated harmful impacts occur (Cooper et al 2011).

From an international perspective, a number of other countries have an Aggregate Levy or similar, although not all of these countries have marine extraction. These are summarised in Table 2. It can be seen that there in each case there is a variety of options chosen, both in scale and scope. The UK has the highest level of Levy and the greatest revenues.

<table>
<thead>
<tr>
<th>Country</th>
<th>Objective of tax or charge</th>
<th>Coverage of tax or charge</th>
<th>How the tax or charge is applied</th>
<th>Tax or charge rate on aggregates</th>
<th>Tax as % of aggregate price</th>
<th>Total revenue raised from tax</th>
<th>Aggregate tax revenue as % of total tax revenue</th>
<th>Administrative cost of tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech Republic</td>
<td>1) To raise revenue 2) To encourage deep mining and preserve the landscape</td>
<td>Applied across all mining activity Only reserved deposits subject to the tax</td>
<td>Area based and charged per cubic meter</td>
<td>EUR 0.1 per tonne</td>
<td>2-3 %</td>
<td>EUR 1.4 million</td>
<td>0.6 %</td>
<td>Not available</td>
</tr>
<tr>
<td>Italy</td>
<td>1) To compensate for the environmental costs caused by quarry activity e.g. preserve natural capital 2) To preserve landscape</td>
<td>Applied to sand, gravel, ornamental stones, crushed rock</td>
<td>Charged per cubic meter</td>
<td>Varies by region EUR 0.2-0.3 per tonne</td>
<td>4 %</td>
<td>EUR 117 million</td>
<td>Not available</td>
<td>Not available</td>
</tr>
<tr>
<td>Sweden</td>
<td>1) To safeguard gravel resources and water quality 2) To preserve the landscape</td>
<td>Applied to natural gravel = sand, gravel and cobbles</td>
<td>Charged per tonne extracted</td>
<td>EUR 1.43 EUR per tonne</td>
<td>12 %</td>
<td>EUR 22 million</td>
<td>0.02 %</td>
<td>EUR 0.38 million per year</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1) To compensate for environmental externalities caused by quarry activity 2) To reduce demand for aggregates and encourage recycling</td>
<td>Applied to rock, gravel and sand</td>
<td>Charged per tonne sold</td>
<td>EUR 2.4 per tonne</td>
<td>20 %</td>
<td>EUR 454 million</td>
<td>0.1 %</td>
<td>EUR 1.5 million per year</td>
</tr>
</tbody>
</table>

1.2.4 **Evaluation of the measure**

1.2.4.1 **(Environmental) Effectiveness**

This section will focus on the Marine Environment rather than the overall impact of the Levy. The overall effectiveness of the Levy has been examined in both QPA (2003) and EEA (2008). The QPA research was funded by the industry body and covered the earliest stages of the Levy, but includes some useful evidence for assessing the extent to which other policies and trends, as well as motivations within the industry, would have
contributed to changes in aggregate extraction and recycling. EEA (2008) provides a summary for European users and while it does not cover the marine context, it again includes interesting data and analysis.

No specific targets were set for the Levy, either in terms of changes in extraction, changes in environmental quality or recycling rates.

For the marine context, there are no specific studies looking at the impact of the Aggregate Levy. There are two questions that have to be addressed:

- **Has the Levy’s impact on prices changed extraction behaviour?** Has the rise in price led to less extraction, or have there been adverse effects in order to keep costs lower? This question assumes that extraction carries environmental costs - a reasonable assumption in that there is habitat destruction and ecosystem change which can take years to recover (see section above). However, it is worth noting that the licensing regime encourages responsible behaviour.

- **Has the Sustainability Fund led to improved environmental quality?** This could be through a number of channels – Fund measures to increase the use of recycled aggregates, research carried out by the Fund leading to more environmentally beneficial behaviour, improved relationships between the industry and environmental representatives.

**Price impacts on extraction behaviour and environmental quality**

The level of the Levy is based on a Contingent Valuation study of the social costs of quarrying on land (London Economics 1999), but marine impacts were not explicitly included in either the study or the original aims of the Levy. The price of marine based aggregates would have risen by the same amount as other aggregates included under the Levy, so the main price changes would be to either reduce demand for aggregates as a whole – unlikely since the aggregate costs make up around 2% of construction project costs (EEA, 2008) and demand is more likely to be driven by the wider economic demand for construction – or to see demand shift from virgin aggregates to recycled. As QPA (2003) point out, this is hard to pinpoint since the trend was apparent before the Levy, with other legislation such as the Landfill Tax being a likely driver of this change. Also, it is worth bearing in mind high transport costs of aggregates, so in areas such as London where demand is high and supply is low there may be plenty of scope for recycled aggregate uptake even without the Levy.

The UK Government in 2005 assessed the Levy which found that “early indications suggest the aggregates levy has been effective in achieving its objectives” since primary aggregate sales were falling and production of recycled aggregate rose. (House of Commons 2011). However, this analysis did not look at wider trends and seems less precise than other studies. The Levy does seem to be a key mover in increasing recycling of aggregates and in increasing the use of exempt materials sold as aggregate.
It is therefore not clear whether the price impact of the Levy led to environmental quality change, but it is likely that it had little specific impact. Any impact would have been part of wider legislation and trends and working in the same direction as these.

There were negative impacts for land-based extraction noted by some (BAA – pers comm. with Alston, 2011) whereby low-grade by-products were being substituted for virgin extraction. This is because the by-product was charged the Levy at the same rate as high grade virgin aggregates. Before the introduction of the Levy, the byproducts were sold on as low-quality filler material which benefitted the quarry since it did not have to pay disposal or storage costs. However, the Levy could triple the price of this material and make high-grade aggregates the more cost effective option since less high-grade aggregate is required for the same purposes as a given quantity of low-grade aggregate.

Similarly, there were adverse effects if a quarry subject to the Levy was near a quarry not subject to the Levy (because it quarried shale or other exempt material). Here, there were incentives to increase the quarrying of the exempt material if it could be a substitute for the levied materials.

Again, these last two impacts probably do not apply to marine extraction.

**Sustainability Fund Impacts**

The Sustainability Fund was set up to encourage recycling and to reduce the environmental impacts of aggregate extraction. Specific marine focussed projects were introduced with the Marine Aggregate Levy Sustainability Fund (MALSF), which had the theme of “research into the marine environment relevant to marine aggregate extraction” (MALSF 2007) that is, this fund focussed on research rather than mitigation plans (such as greening old quarry sites) or recycling advocacy that the wider Fund included. Therefore specific benefits of this Fund would be through behaviour change created by the new knowledge, such as improving state-of-the-art monitoring or changing licensing criteria. Some benefits may also arise through the work of the wider Fund in promoting recycling.

In 2007 a report assessed the current state of knowledge about various aspects of marine dredging, summarised in Table 3 below. It can be seen that estimates of current understanding are low or medium in most of the identified sectors. The information shown in the table was used to identify future research projects funded by the MALSF, including a number used in this case study, such as Austen et al (2009), Tillin et al. (2011). Therefore knowledge has increased, but it is not yet apparent how much this knowledge has led to actual changes in environmental quality. Now the Sustainability Fund has been halted, no future research will be commissioned based on the Aggregate Levy’s revenues, but any benefits of the research already undertaken will carry into the future.

*Table 3: Summary of state of knowledge of marine dredging impacts in 2007 (MALSF 2007)*
<table>
<thead>
<tr>
<th>Issue</th>
<th>Current Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal Processes</td>
<td>High</td>
</tr>
<tr>
<td>Direct impacts on seabed bathymetry and sediments</td>
<td>High</td>
</tr>
<tr>
<td>Indirect effects on seabed sediments</td>
<td>High</td>
</tr>
<tr>
<td>Long term changes to seabed bathymetry</td>
<td>High</td>
</tr>
<tr>
<td>Long term changes to seabed sediments</td>
<td>Medium</td>
</tr>
<tr>
<td>Effects on resources of historic or archaeological significance</td>
<td>Low (knowledge of distribution of resources)</td>
</tr>
<tr>
<td></td>
<td>Medium (ability to protect resources)</td>
</tr>
<tr>
<td>Effects on biological resources of conservation importance</td>
<td>High (knowledge of impacts in dredged areas)</td>
</tr>
<tr>
<td></td>
<td>Low (knowledge of impacts outside dredged areas)</td>
</tr>
<tr>
<td>Recovery of biological resources</td>
<td>Medium (knowledge of species recovery)</td>
</tr>
<tr>
<td></td>
<td>Low (knowledge of community recovery)</td>
</tr>
<tr>
<td>Effects on wider ecosystem functioning</td>
<td>Low</td>
</tr>
<tr>
<td>Effects of dredging noise on fish and marine mammals</td>
<td>Low</td>
</tr>
<tr>
<td>Public awareness of issues associated with marine aggregate dredging</td>
<td>Medium</td>
</tr>
</tbody>
</table>

The Fund also supported work done by WRAP (the UK Waste and Resources Action Programme) to encourage the growth in recycled aggregates. These contributions include improving quality standards, lowering stigma of recycled products, raising awareness and delivering accessible and robust information, as well as providing access to capital for supply- and quality-infrastructure improvements (EEA 2008). The UK Government also found that many recyclable aggregate producers felt that the Levy was “the most frequent reason for growth since 2001” (House of Commons 2011). Although this would be supporting or increasing the trend that existed since the mid-1990s.

**Additionality**

The Levy does not operate alone within the sector. It can be seen to work alongside other policies and legislative frameworks. In the case of marine aggregates, it probably generates benefits in conjunction with the strong licensing and monitoring regime since...
the knowledge generated by the Fund’s research can be transferred into practice relatively directly and swiftly.

**Effectiveness in relation to GES (MSFD)**

The key indicators in terms of GES relate to the descriptor “Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.” Determining the impact of the aggregates levy on marine extraction is difficult, particularly given the existence of licensing by the Crown Estate. However, we can use a partial equilibrium approach to estimate what might have been the impact of the tax *ceteris paribus* on aggregate extraction. Taking the extraction value for 2002 of 22.76 million tonnes and applying the levy of €2.55 (£1.60) to a price of extracted resource of €19 (£12) per tonne, we can estimate the impact using different elasticities of demand. From the academic literature, we know that aggregates have a relatively inelastic demand. Hence we can surmise that the elasticity would lie between a value of 0 (perfectly inelastic – no change on demand of a change in price) to say 0.5 (indicating that a 1% increase in price leads to a 0.5% reduction in quantity demanded). Using these values for elasticity and the approximate price of aggregates given above, the values of the quantity change that may be expected due to the levy is shown in Table 4 below. The quantity change lies between 0 tonnes and 1.48 Million tonnes. Assuming a linear relationship between quantity and area dredged, this results in an 7% change in area for an elasticity of 0.5 (based on the percentage change in quantity from a 22.76 Mt baseline).

<table>
<thead>
<tr>
<th>Elasticity</th>
<th>Estimated impact on quantity of marine aggregate demanded (Mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.1</td>
<td>0.30</td>
</tr>
<tr>
<td>0.2</td>
<td>0.59</td>
</tr>
<tr>
<td>0.3</td>
<td>0.89</td>
</tr>
<tr>
<td>0.4</td>
<td>1.18</td>
</tr>
<tr>
<td>0.5</td>
<td>1.48</td>
</tr>
</tbody>
</table>

Table 4: Estimated reduction in demand for marine aggregate due to Levy introduction in 2002

Source: own calculations

Clearly the assumption of *ceteris paribus* would not apply in the real world – at the time of the introduction of the levy there was a significant increase in demand due to demands from the construction industry. This would imply a rightwards shift in the demand curve. Hence the tax impact is difficult to isolate from the market data.
1.2.4.2 Information on costs and benefits

Costs and benefits of the instrument

Costs of a policy instrument must be considered for the various parties involved.

Direct costs of the instrument include the administrative costs to the producers and to the UK’s Revenue and Custom’s Authority (HMRC), the collecting body. The costs are mainly the extra paperwork and monitoring costs, of recording the extracted levels, calculating and claiming for exemptions, and so on. Start-up costs include developing and implementing new systems for administrators and data collection in firms. These are felt to be small, with setup costs of producers around 0.5p per tonne and ongoing costs of around 0.3 pence per tonne (House of Commons, 2011).

At the time of implementation, the compliance costs were estimated to be as follows:

- Start-up costs for medium sized businesses (of which there were 10-20 companies, accounting for 1% of the market or 2.5m tonnes) €15,907-€31,814 (£10,000-£20,000). For small companies (over 350 companies producing 200,000 tonnes per year) the costs would be small, about €1193 (£750). For the few large companies the costs would be €79,535-€159,070 (£50,000-£100,000) (House of Commons 2011).

- Ongoing Costs: Approx. €2386-€15,907 (£1,500-£10,000) depending on the size of the company

- Total costs: around €1.9m (£1.2million) total set up costs and €1,193,000 (£750,000) per annum ongoing costs, at 0.8 cents (0.5 pence) per tonne and 0.5 cents (0.3 pence) per tonne respectively.

In terms of revenues from marine based aggregates it is possible to estimate these on the basis of taking the amounts extracted shown in Table 1 and multiplying by the levy applied for the various years. The results are shown in Figure 10 below.
Other economic benefits arise from the removal of distortionary taxation via the National Insurance rebates. However, they will not be explored here in detail since this focuses on environmental costs and benefits.

In terms of the distributional impact of the measure, since no real decline in extraction can be traced directly to the Levy (QPA 2003, EEA 2008), and because producers have tended to pass costs on directly to the consumers (BAA - pers comm with Alston, 2011), this would lead to an increase in construction costs. It is worth noting also that the public sector is a very large consumer of aggregates – 55% according to BDS (2009, commissioned by the BAA), so in this case monies raised have come from the public purse.

The benefits of reduced marine aggregate extraction have been evaluated in several studies. The main impacts of marine aggregate extraction are the direct impacts of the removal of a layer of the sea-bed, leaving depressions and furrows and changing the make-up of the sediments on the sea bed. Also, if the dredger implements sediment screening, sediment plumes from the ship can be damaging to a wider area (Barrio Froján et al 2011). There can also be social costs if cultural heritage is damaged (e.g. wrecks), costs to fishing activity if fish stocks are disturbed or spawning grounds disrupted, costs to tourism (if dive sites are affected) and possibly erosion patterns can

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94 Note this assumes a very inelastic demand curve for aggregates – and this is supported by Berck (2005) in analysis of demand for aggregates in California.

95 This is where the ship filters out the smaller, sandy particles and keeps the desired sized gravel. The removed sediments are washed into the sea where they can settle well outside the licenced area, changing the composition of the seabed and affecting habitats and biodiversity.
be changed. However, as noted above, the UK aggregate extraction process is governed by a licensing programme that required Environmental Impact Assessment of the above. However, it remains that aggregate extraction means removal of habitats and the flora and fauna within the dredge zone.

Austen et al (2009) researched the overall social benefits of the marine environment as a scoping study to estimate the impacts of aggregate extraction. Using the Eastern English Channel region as a case study, they found that leisure and recreation services in this region contributed over €1.1bn (£1bn) to society, with food provision and gas and climate regulation also significant. However, a number of other possible benefits were harder to value due to low levels of data. Austen et al (2009) researched the overall social benefits of the Eastern English Channel’s marine environment as a scoping study to estimate the impacts of aggregate extraction. As this study is just a scoping study, results are preliminary and subject to a high degree of uncertainty. One impact of dredging is that gas and climate regulation could be altered by between -€15,868 (-£14,139)/km² and +€9,867 (+£8,792)/km² – this is the amount of carbon sequestred by living organisms multiplied by the damage costs avoided – dredging changes the quantity of organisms in the area and so the amount of carbon sequestered. They also look at cognitive benefits (benefits to researchers, academics etc from being able to study the areas) may change by +€2.5m (+£2.2m) through the funds generated (including the Sustainability Fund). The research values research and development activities, the benefits to local higher education institutions, the public sector and education and training and the authors note that of the possible benefits, the only quantifiable benefit attributable to the aggregate industry was the research arising from the Sustainability Fund.

Tillin et al. (2011) – also funded by the Sustainability Fund – found that the direct and indirect impacts of aggregate dredging are “likely to be not significant as they are minimised through management and mitigation measures”.

Other costs include the diesel / carbon costs of the ships themselves, but this could be offset against any displaced emissions of other sources of aggregate, including recycled aggregates.

Cooper et al (2011), again funded by the Fund, looked at the costs and benefits of restoring dredged zones, looking at a study site eight years after dredging. Whilst the study is not generalisable to all dredged zones, it raises issues that are important. These include uncertainties about how long residual impacts of dredging may last, and the capacity for natural recovery, and how these may differ across sites, against the range of benefits of restoration as well as the costs.

Aside from the environmental quality changes discussed above, the benefits to society would probably be limited (in the marine case) to the increased knowledge/research – assuming this does have some intrinsic societal value. Also, better environmental quality will likely lead indirectly to greater economic returns from fishing, tourism and so on.
Cost-effectiveness

The aggregates levy is revenue generating and, as revenues are used to reduced distortionary taxation, the net social costs are likely negative (depending on assumptions on the marginal cost of public funds). The administrative costs estimated do not seem excessive compared to the revenues raised. The difficulties in assessing the environmental benefit of the measure in terms of reduced marine aggregate extraction need to be noted.

The measure was originally designed to keep implementation costs low by using a flat rate levy rather than differentiating different extraction methods or by evaluating the specific environmental impact of a quarry/dredger.

1.2.4.3 Suitability - Fit for use (context) and feasibility

The Aggregates Levy was aimed at being a national level policy applying an equal charge per tonne of aggregate extracted, regardless of its source. It was never directly aimed at being a marine policy, but in this section the suitability of the Levy as a marine policy will be explored. Conclusions reached are not therefore conclusions about the suitability of the overall UK Aggregate Levy.

The Levy was set at a level roughly based on a contingent valuation study of the nuisance costs of living near a quarry. It is therefore not set at a level based on social costs of marine extraction. However, this is not entirely suitable because (a) the government adjusted the level anyway to include other factors (not known) and to ensure the level was feasible for producers and consumers, and (b) the Levy was applied equally across all producers and almost all aggregates.

In terms of implementation, the Levy was appropriate as it was aimed at keeping administrative and monitoring costs low – which is one reason for the single rate. Lower rates for so-called “green quarries” were suggested but rejected due to compliance and assessment costs, difficulties in definitions as well as competition policy (House of Commons 2011). In particular, it would be hard to assess whether marine dredging counted as a “green quarry”.

The Levy’s Sustainability Fund developed over the years, incorporating a wider set of research projects and longer-term projects. This adaptability means that its suitability can be seen to have improved over time. The scale seems suitable, since there is little opposition to the Fund from industry and a number of in-depth research projects have been funded. However, the fact it was considered unessential in the face of budget cuts suggests that the government felt that it was not necessary to continue with.

The Levy does not seem very suitable as a means of lowering the environmental impact of dredging by encouraging less dredging since the cost is passed on in full to consumers and the evidence suggests this has not greatly changed behaviour. However, the
Sustainability Fund does seem to have been a suitable way of generating benefits from research funded by the industry which are likely to lead to environmental quality improving in the future, even if the Fund no longer exists.

The measure is not directly transferable to all other countries since many do not have a marine extraction sector, or if they do, it is small. Some lessons from the Levy may be transferable to other marine extractive industries, such as coal and gas – especially the need to have the support of the industries and the relevance of the level of the Levy to social and environmental costs, rather than set at a general level. However, it is likely that the situation in other industries is more complicated than for aggregates, for example, the energy security benefits of energy extraction.

It could be more useful to apply lessons from the Sustainability Fund, whereby users of the sea bed (e.g. oil and natural gas extraction) contribute to a fund which improves the knowledge of the marine ecosystems. Here, the factors which have led to the success of the fund such as stakeholder/user involvement in the research funding process, could be applied if such a Fund was ever generated.

1.2.4.4 Social, legal and institutional context
Legal basis and rationale

The Levy was a government policy which was raised through the budget and parliament. It was included as an environmental policy tool, and throughout the planning processes different agencies and actors were able to question, challenge and suggest changes to the policy. As such, the Levy has the legal basis of any other tax or Levy with the institutional capacity of the UK’s Revenue and Custom’s Authority behind it.

However, the legitimacy of the Levy has been challenged by the British Aggregates Association (BAA) on the grounds that it does not include all quarrying activities. The challenge is still in the European courts but an appeal has been won against the UK Government96.

Also, the BAA challenged the UK Government’s tax credit scheme for Northern Ireland. This had been implemented to counter the competition impacts of the proximity of the Republic of Ireland but the tax credits made it feasible for Northern Irish producers to sell at lower cost. The BAA’s challenge was accepted and the tax credit scheme was abolished in late 2010.

These legal challenges suggest that both the legal and social/institutional bases of the Levy are problematic in part. That is, there are sufficient legal problems for the challenges to exist, but also the industry may have been less likely to resort to legal challenges if the institutional context was stronger.

96 Details of actions can be found here: http://curia.europa.eu/jurisp/cgi-bin/form.pl?lang=EN&Submit=Rechercher&docrequire=alldocs&numaff=C-487/06%20P&datese=&datefe=&nomusuel=&domaine=&mots=&resmax=100
Institutional capacity to implement and control

The institutional context of the Levy was one of an industry with a small number of large companies and a large number of small companies under some established organisations, namely the Quarry Producers’ Association, the British Marine Aggregate Producers’ Association, and the BAA. The Levy was introduced by a government with a large Parliament majority, but the process involved negotiations with the industry and other actors. The UK’s Revenue and Custom’s Authority (HMRC) had the capacity to collect and monitor the Levy, and the Sustainability Fund was distributed through a number of governmental bodies and Quasi-Autonomous Non-Governmental Organisations (Quangos). There appear to be no gaps in the social or institutional contexts.

Distributional impact and acceptance

The Levy took time to move from a proposal to implementation, and included primary research into the valuation of environmental (social) impacts of quarrying. Measures were put in place to hypothecate the revenues back to the industry.

The main industry bodies have not accepted the Levy, as demonstrated by the legal challenges.

Flexibility and adaptability

There are two main aspects to the flexibility and adaptability: Firstly, the level of the Levy. This has changed twice since the inception in 2002, and the changes arise from budget announcements. These are then communicated via the UK’s Revenue and Custom’s Authority (HMRC) and industry bodies. The changes however do not necessarily relate to changes in the social costs of aggregate extraction. The second main aspect is the distribution of the Fund. This showed a relatively high level of flexibility in both scale and scope, in that new projects and new types of projects could be introduced over time.

The Levy is not flexible in that it remains a flat fee per tonne of aggregate regardless of the source or type of aggregate. As a marine policy tool it can be considered inflexible since the level is not set to specific marine contexts, and as marine extraction makes only 20% of total UK aggregate production, it is reasonable to expect that the Levy will never fully incorporate marine environmental costs.

Another aspect of the flexibility of the Levy is that various changes can be made in response to the wider legislative and financial contexts, such as the Northern Ireland tax credit scheme being introduced and abolished, and the Sustainability Fund being closed.

The Levy can be evaluated by how it works and responds to timing issues, such as how long it takes for implementation to change GES, or how quickly the policy can adjust to changes in the wider context. In general, it would be expected that any price signals can
be passed on to the market relatively quickly. However, if the construction industry is unable to respond quickly, for example if a lot of aggregate was being used in projects with a long planning lead-time and quantities had to be set in advance, then the difference between implementation and impact could be quite long.

The Levy is able to adjust to changing circumstances by changing the level the Levy is set at, but this can only happen through the Government's annual budget, rendering it relatively time-insensitive.

The Fund was in some ways less time-sensitive, since it is often a number of years between research being commissioned to it being delivered. However, this does depend on the particular research projects. Once research is available the licensing regime may be able to implement changes quite quickly.

1.2.4.6 Broader impacts: risks and opportunities

In the marine case, the broader impacts are more likely to be beneficial than negative since the research outcomes of the Fund will continue to support policy making and licensing into the future, and encourage more environmentally beneficial behaviour, even after the Fund’s closure. The current research will also provide opportunities for future research and other future marine environmental policies.

A possible risk would be if the court action causes the Levy to be abolished, which could then hinder future legislation in the area. The converse is also true, that it could encourage a more flexible and accurate Levy across a wider range of aggregates explicitly aimed at environmental cost reduction. But if relationships between the Government and Industry become overly antagonistic then future legislation may become hard to implement effectively.

1.2.5 Enabling and limiting factors

This section will briefly look at the following dimensions of the Levy in order to assess which factors are key to the success of the Levy and which may limit success. These will then be used to assess the applicability of the Levy to other cases. The dimensions are:

- Design of the instrument
- Stakeholder commitment and cooperation
- Timing and policy certainty
- Information and knowledge
- Control and enforcement

Success of the Levy could be defined as the reduction in environmental and social costs of aggregate extraction. This was intended to be achieved partly with a shift in aggregate
use from primary extracted aggregates to recycled aggregates – via the price rise of the Levy and the Sustainability Fund’s actions – and through better extractive practices, encouraged through the Fund. Success is therefore about how well the Levy and Fund have changed both the extraction and use of aggregates, but also the extent to which the aggregate and construction industries have responded to the policy.

1.2.5.1 Strong design of the Levy
The Levy was designed to be simple and applicable broadly, rather than to achieve specific marine outcomes. The design is a basic, flat-rate levy applied to all extraction of aggregates with a few specific exceptions. The Levy is paid by the producer and applies to by-products of extraction which may also be considered (low grade) aggregates. In addition to the Levy, the National Insurance payments of employers were reduced and a Sustainability Fund developed. The Fund had a strong and flexible design which helped it meet early objectives of encouraging recycling and later objectives of wider research. However, the Levy’s design has left it open to challenges. Firstly, the issues arising from aggregates crossing the Irish border meant that a tax credit scheme for Northern Ireland was introduced. This was later removed after court action. Other court action has challenged the Levy itself as not all quarrying is covered, thus opening the Levy to the accusation that it is not an environmental charge and so not legal. The cancelling of the Sustainability Fund also suggests that the Levy is not focussed on environmental considerations.

1.2.5.2 Stakeholder commitment and cooperation
The main quarrying and aggregate industry organizations are not committed to the Levy, as it does not treat all aggregates equally, for example shale is exempt. The BMAPA (Marine producers association) does not make such a clear opposition to the Levy and seems to appreciate the research generated by the Sustainability Fund (see http://www.bmapa.org/issues_levy01.php). However, whilst the Levy remains, cooperation is mandatory as the Levy is a legal obligation.

This opposition weakens the environmental impact of the Levy inasmuch as it raises uncertainty over the future of the Levy, thus reducing the ability to plan, and may remove the Levy altogether. However, since producers have to comply, the Levy’s impacts remain.

The Sustainability Fund was developed using input from stakeholders and users – in the marine case, research was targeted based on shared priorities, and the results of such research have been useful and relevant, and not just to the aggregates industry.
1.2.5.3 Good information and knowledge
The successes of the Levy have depended as much on the ‘soft policy’ outcomes of the Fund as the financial incentives of the Levy itself. Knowledge generation and dissemination through primary research has helped increase the understanding of the marine impacts of aggregate extraction. Information dissemination, particularly in the realm of recycled aggregate promotion, has also played a part.
These impacts are generally about information flows within the industry, and since aggregates play only a small role in wider public life, this seems reasonable.
A weakness may have been to base the Levy rate on a limited set of knowledge – the Contingent Valuation Study on which the level of the levy had been set and as a technique in general was not well received by the industry (see BAA 2001 where Contingent Valuation is considered “unscientific”).

1.2.5.4 Control and enforcement
The Levy is administered by the HMRC and so this is a very strong enforcement. As a simple per-tonne fee, this can be calculated relatively easily from other records the companies must keep. There are criminal offences related to the Levy (HMRC 2011).

1.2.6 Sources

- Austen, M.C., C. Hattam, S. Lowe, S.C. Mangi, and K. Richardson (2009), *Quantifying and Valuing the Impacts of Marine Aggregate Extraction on Ecosystem Goods and Services*. MEPF project 08/P77. Available online at [http://www.cefas.co.uk/media/462458/mepf-08-p77-final-report.pdf](http://www.cefas.co.uk/media/462458/mepf-08-p77-final-report.pdf)


1.3 Case study “no special fee” system Baltic Sea

1.3.1 Introduction: no special fee system for ship-generated waste

The “no-special-fee” system is defined as a charging system where the cost of reception, handling and disposal of ship-generated wastes, originating from the normal operation of the ship, as well as of marine litter caught in fishing nets, is included in the harbour fee or otherwise charged to the ship irrespective of whether wastes are delivered or not (HELCOM Recommendation 28E/10 superseding Recommendations 19/8, 26/1 and 28/1).

The concept of the “no-special-fee” thus means that every ship (with some exemptions) entering the port is paying a fee which is not related to whether the ship delivers the waste or not or to the quantity delivered. The fee covers the waste collecting, handling and processing including infrastructure and is distributed among ships and collected as part of or in addition to the port dues. The system is not restricted to any specific type of ship-generated waste and thus includes the most common wastes from normal operation of ships: oily wastes, sewage and garbage.98

1.3.2 Environmental problem and objective(s) of the measure

Because of the very specific hydrographical, chemical and physical conditions of the Baltic Sea area99, and its geological history, it possesses quite unusual fauna and flora. Marine and freshwater organisms live side by side, and there is a number of living relicts. The exchange of water in the Baltic Sea is very slow, and if harmful substances are introduced they will remain there for a very long time. As the fauna and flora of the Baltic Sea area are extremely sensitive to changes in their environment there should be no discharges of harmful substances, especially oil and noxious liquid substances, into this vulnerable sea.

Contrasting with the vulnerability of the Baltic Sea area, this regional sea is one of the most intensively trafficked shipping areas in the world. (Maritime) shipping may be associated with several environmental effects. The HELCOM works actively around four major areas100 regarding shipping, i.e. safety of navigation (and response to accidents), air pollution, transportation of non-indigenous organisms via ships’ ballast water and ship-generated waste or illegal pollution. The target area for the “no-special-fee”

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98 Cargo residues are not covered by the Baltic “no-special-fee” system. Personal communication with some ports has learned that minor amounts are also accepted under the same regime.
99 See for example HELCOM (2008).
system is ship-generated waste and associated pollution or related impacts from e.g. discharges (HELCOM, 2006)

Ship-generated wastes entail multiple environmental impacts
Due to the diverse nature of ship-generated waste, multiple pressures can be considered related to effects of waste from normal operation of ships. These wastes can be further grouped in 3 large categories, with own related potential impacts on the marine environment.

Oil wastes from normal shipping operations generally originate from machinery space activities and can be oil mixed with larger quantities of seawater, fuel residues or sludge. Some estimates indicate that normal shipping operations are responsible for over 70% of the oil entering the sea from marine transportation (Miola et al, 2009). The effects of operational discharges may appear less dramatic than the localised effects of accidental oil spills as oil is often spread over a large number of locations. They do, however, give rise to a number of chronic pollution problems, particularly in low energy environments such as ports and harbours. Smaller floating concentrations of oil can have several harmful direct impacts: oiled birds and mammals suffer from hypothermia or intoxication.

The nutrient pollution loads originating from waste water discharges from ships (sewage) remain rather small compared to other sources. Considering the high sensitivity of the marine environment in the Baltic Sea and existing eutrophication problem, these must however not be neglected. Moreover, the Baltic Sea region is an attractive and fast growing destination for tourists (number tripled in the last decade) representing roughly three million cruise passengers visiting the region each year. The waste-water produced in these vessels is estimated to contain 365 tonnes of nitrogen and 119 tonnes of phosphorus. The nutrient pollution loads originating from waste water discharges from ships (sewage) remain rather small compared to other sources. Considering the high sensitivity of the marine environment in the Baltic Sea and existing eutrophication problem, these must however not be neglected. Moreover, the Baltic Sea region is an attractive and fast growing destination for tourists (number tripled in the last decade) representing roughly three million cruise passengers visiting the region each year. The waste-water produced in these vessels is estimated to contain 365 tonnes of nitrogen and 119 tonnes of phosphorus. Most of this sewage is today discharged into the Baltic Sea contributing to the annual load. Sewage loading of nutrients, which are concentrated along shipping routes, are immediately available for uptake by planktonic algae adding to the severe eutrophication of the Baltic Sea. In the Gulf of Finland, where maritime traffic has increased rapidly, the annual phosphorus load from ships is now almost the same as from the four largest Finnish coastal cities along the Gulf - Espoo, Hamina, Kotka, and Porvoo (Hänninen & Sassi 2009). Phosphorus is directly responsible for the mass occurrences of blue-green algae, which form foul-smelling masses and make the water unfit for swimming in some places + biodiv pb.

Another group of ship-generated waste is garbage and all types of solid waste with diverse harmful impacts on the marine environment. The garbage generated in ships (Kalli et al, 2009) consists of household wastes such as glass and plastic bottles and containers, cardboard boxes, tins and food waste. Hazardous wastes come from maintenance of a ship: certain light bulbs, batteries, paints and empty paint containers

101 http://wwf.panda.org/what_we_do/where_we_work/baltic/?uNewsID=201056
are also often received by the ports. In the past, the waste thrown overboard was mainly food waste and other biodegradable substances or heavier substances that sank to the bottom of the sea. The composition of waste has changed along with durable materials and waste containing synthetic materials such as plastic packages, nets and fibre fishing lines. Plastic particles, whether microscopic or larger, can have a range of effects on the marine life. As an example of the effects of larger particles, various species, like fish-catching birds, are worldwide commonly found dead with plastic particles in their stomachs. Recent studies have discovered that plastic micro-particles, like those found in Baltic seawater, enter to and accumulate in animals such as blue mussels and may thus have significant food-web consequences (HELCOM, 2010). This category also includes waste from fisheries or litter caught in fishing nets. Solid wastes can lead to entanglement of birds or wildlife. Even though evidence for pollution through solid waste is often visible in the sea, it is usually very difficult to attribute it to any specific human activity as there are various possible sources of marine litter, including shipping.

The main objective of the Baltic Strategy is to substantially decrease operational and to eliminate illegal disposal of ship’s wastes and thus, prevent pollution of the Baltic Sea Area. The Strategy includes all types of wastes generated onboard ships, being it a large ship, fishing vessel, working vessel or pleasure craft. According to HELCOM Recommendation 28E/10, the “no-special-fee” system is installed with the dual purpose to i) eliminate the economical motivation to illegally discharge waste at sea and ii) to avoid undesirable waste streams between ports, thereby encouraging a sound sharing of the waste burden. The system is as such considered as a necessary complement to the existing requirements on mandatory delivery of ship-generated waste which cannot be legally discharged to the sea. The HELCOM meeting states that in order for the system to be fully effective, all ports in the Baltic Sea need to apply it.

Following the diverse nature of ship-generated waste, the measure could have a beneficial impact on multiple GES-descriptors. Reduced discharges at sea can lead to improvements in quantities of marine litter (GES 10) from sea-based sources, lower concentration of contaminants (GES 8) and reduced humand-induced eutrophication (GES 5) which can be particularly important in the Baltic. More indirectly, it is assumed that reduced discharges of all kinds of ship-originated waste could also help to halt further decrease of biological diversity (GES 1), disruption of marine food webs (GES 4) and the distribution of invasive species (GES 2) as litter is also considered as a vector for the spread of non-indigenous species.
Measure: definition and context

(Legal) background and implementation

HELCOM (1993) formulated the need to develop a more harmonised system for port reception facilities and charging. High fees charged for reception of chemical, oily or other wastes in some ports together with insufficient surveillance and sanctions had caused a situation in which some ships chose to discharge their wastes illegally into the Baltic Sea or into the North Sea. The different fee systems also caused some undesirable transportation of wastes from one country to another. The system would need to be designed in a way that the costs for reception of wastes should not differ too much between ports and should be neutral to competition.

Actions to deal with the environmental problems caused by discharges of wastes from ships have been part of the international Baltic co-operation since the first Convention on the Protection of the Marine Environment of the Baltic Sea Area (the Helsinki Convention, 1974). Discharges from ships in the Baltic Sea are regulated in the International Convention for the Prevention of Pollution from Ships (1973), widely known as MARPOL 73/78. This system of marine environmental protection based on UN recommendations has been adopted by the majority of the countries in the world, including all countries surrounding the Baltic Sea (Finland, Denmark, Estonia, Latvia, Lithuania, Russia, Germany, Poland and Sweden).

Under MARPOL, the Baltic Sea Area has been designated as a Special Area for wastes covered by annex I (oil) and V (garbage). Such status is given to sea areas which, because of their special oceanographic or ecological characteristics, are regarded as particularly sensitive to environmental disturbances. The discharges of noxious liquid substances (annex II) are also strictly regulated. In addition, regulations concerning the discharge of sewage into the sea and the prohibition of incineration of ship-generated wastes in the territorial seas of the Baltic Sea States have been adopted by the Contracting Parties to the Helsinki Convention (HELCOM, 2010). There is also a general

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102 This section has been based on Swedish Maritime Administration (1999) and HELCOM, 2006
103 The 1974 Convention was the first international agreement worldwide to take into account all aspects of marine environment protection. The Convention aims to prevent pollution from ships (including dumping), pollution from land-based sources, and pollution resulting from the exploration and exploitation of the seabed and its subsoil. The Convention also regulates the cooperation to respond to marine pollution by oil and other harmful substances. (HELCOM, 2008)
105 Special areas can exist for Annex I “Prevention of pollution by oil”, Annex II “Control of pollution by noxious liquid substances” and Annex V “Prevention of pollution by garbage” from ships. The Baltic Sea is a special area under MARPOL for annex I and annex V, prohibiting discharges into the Baltic Sea. See [http://www.imo.org/OurWork/Environment/PollutionPrevention/SpecialAreasUnderMARPOL/Pages/Default.aspx](http://www.imo.org/OurWork/Environment/PollutionPrevention/SpecialAreasUnderMARPOL/Pages/Default.aspx)
ban on dumping and incineration of other wastes, not incidental to or derived from the normal operation of ships, in the entire Baltic Sea area.

Despite 20 years of international co-operation within the Helsinki Commission (HELCOM) framework as well as in the International Maritime Organisation (IMO) to control discharges of wastes from ships, illegal discharges remained a serious environmental problem in the Baltic Sea Area. To further address the issue of pollution of the marine environment by ship-generated waste, the Helsinki Commission had elaborated and approved the Strategy\(^{106}\) for Port Reception Facilities for Ship-generated Wastes and Associated Issues, also known as the Baltic Strategy\(^ {107}\). This strategy was adopted by HELCOM in March 1996 and comprises a set of measures and regulations with the main goals to ensure ships' compliance with global and regional discharge regulations and to eliminate illegal discharges into the sea of all wastes from all ships. The cornerstones of the Baltic Strategy are adequate port reception facilities, mandatory delivery\(^ {108}\) and implementation of the “no-special-fee” system for delivery of ship-generated wastes as well as efficient law enforcement. It is of note that some countries already implemented a no-special-fee system for ship-generated waste before the year 2000 (e.g. Sweden since beginning of the 1980s).

Within the framework of the Baltic Strategy, countries around the Baltic Sea agreed to introduce a harmonised fee system for the use of port reception facilities.\(^ {109}\) The key objective of the “no-special-fee” system is to eliminate illegal discharges and encourage the delivery to shore facilities of ship-generated wastes. According to the “no-special-fee” system, a fee covering the cost of reception, handling and final disposal of ship-generated wastes is levied on the ship irrespective of whether or not ship-generated wastes are actually delivered. The fee is included in the harbour fee or otherwise charged to the ship and rates are decided by ports.\(^ {110}\) According to the Recommendation\(^ {111}\) the

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\(^{108}\) Mandatory delivery: All ships, with some exceptions, are under an obligation to deliver to a port reception facility, before leaving the port, their ship-generated wastes and cargo residues that cannot be legally discharged under the global MARPOL 73/78, or under the HELSINKI CONVENTION (HELCOM, 2008).

\(^{109}\) Which does not imply equal fee rates as these are the responsibility of ports (calculation principles for fees are discussed further in the document).

\(^{110}\) HELCOM Recommendation 28E/10 (article 4.1). The waste management fee imposed on a ship should be independent of the volume of the wastes delivered to the port reception facilities. To obtain the maximum of truth and fairness in specifying the ship’s contribution to the no-special-fee system the gross tonnage, as indicated in the vessel’s Data Sheet, could be taken as the basis of calculation by the port. Basis of calculation of oil, garbage and sewage may depend on the type and size of the ship as well as the number of crew and passengers.
waste management fee shall be fair, transparent and non-discriminatory to all ships, i.e. the size of the waste management fee shall be visible to every ship even if it is included in the harbour fee.

The application of the harmonised “no-special-fee” system for the operation of reception facilities for ship-generated wastes has gradually been expanded to include first oily waste from machinery spaces (Annex I of MARPOL) as of 1 January 2000, and sewage (Annex IV) and garbage (Annex V) as of 1 January 2006. In 2007, the concept has been broadened to marine litter caught in fishing nets. In principle, the “no-special-fee” system is not restricted to any specific type of operational waste. Separate arrangements are made for cargo residues:

- The consignor (i.e. “sender”) in the loading port is responsible for reception arrangements for cargo-related wastes covered by Annex I (oil residues from cargo tanks) to MARPOL;
- The consignee (i.e. “receiver”) in the unloading port is responsible for reception arrangements for wastes covered by Annex II (residues of noxious liquid substances) of MARPOL.

Considering the severe eutrophication status of the Baltic Sea, sewage from ships are of particular relevance. Sewage is also covered by the no special fee system, but it has become clear that the designation as a special area (MARPOL Annex IV) would be needed in order to really let it work. The no special fee system does not provide incentives in absence of legislation to make sewage discharges illegal and motivate delivery in ports. In 2009, 2010 and 2011, the Contracting Parties submitted a joint proposal to IMO to amend Annex IV of MARPOL 73/78 and to designate the Baltic Sea as a special area for sewage discharges from passenger ships. The proposal has been approved by the 61st Session of IMO Marine Environment Protection Committee and adopted in July 2011. Passenger ships operating within the Baltic Sea Special Area will be required to treat sewage onboard to remove nutrients prior to the discharge into the sea or deliver it to a port reception facility (PRF). In other words, dumping of waste water will become illegal in the Baltic Sea. The new regulations will come into effect 2016 (instead of initially announced 2013) for all new ships and from 2018 for all ships, when Baltic countries notify that sufficient port reception facilities are available. Today only a fraction of the ports around the Baltic Sea can meet the demands of the cruise industry to receive their ship waste discharges.

111 HELCOM Recommendation 28E/10 ‘Application of the no-special-fee system to ship-generated wastes and marine litter caught in fishing nets in the Baltic Sea area’
112 Personal communication Monika Stanckiewicz from HELCOM.
113 For further reading, please see http://www.helcom.fi/shipping/waste/en_GB/
114 http://wwf.panda.org/what_we_do/where_we_work/baltic/?uNewsID=201056
1.3.3.2 Exemptions and underlying rationale

The HELCOM recommendation 28E/10 regarding the no special fee system includes the possibility for competent authorities to exempt ships from the obligation to pay if engaged in (i) regular services (regular and frequent port calls) and (ii) when it is ensured that the disposal requirements will be met on the ship’s own account. A definition of the "regular services" is provided in the guidelines attached to Recommendation 28E/10. The requirements for granting exemptions are followed by all Contracting Parties, with some differences resulting from EU Directive 2000/59/EC and specific national requirements. Statistics on exemptions are not available in all countries (HELCOM Maritime 5/2006). The competent authority of the Port State should require evidence of the ship’s scheduled traffic as well as evidence of waste management practice (contract, receipts, copy of garbage record book, oil record book etc.) when a ship is applying for an exemption.

The HELCOM Recommendation regarding the no special fee system (and exemptions) supplements stipulations in the Helsinki Convention (regulation 6 of Annex IV) where ships can be exempted from mandatory delivery of ship-generated wastes when there is a need for special arrangements (for example passenger ferries engaged in short voyages). HELCOM has mapped the application of both types of exemptions and Contracting Parties were expected to report by the end of 2008 (HELCOM Maritime 8/2009). More information on how countries deal with exemptions can be read in paragraph 0. EU Directive 2000/59/EC on port reception facilities for ships-generated waste and cargo residues also provides the possibility to exempt ships engaged in scheduled traffic and the number of exempted ships must be reported to the EU.

1.3.3.3 Implementation of the no special fee system: geographical differences

In spite of efforts to set up a harmonised system for the Baltic Sea, it appears that the fee system for ship-generated waste reception in ports has been implemented differently in the countries of the Baltic. This follows from the multiplicity of regulations and

115 "Regular services" means a series of ship crossings operated so as to serve traffic between the same two or more ports, or a series of voyages from and to the same port without intermediate calls, either (i) according to a published timetable, or (ii) with crossings so regular or frequent that they constitute a recognisable schedule. A crossing should be considered as frequent if the ship visits the port once a fortnight. According to the information provided by the Contracting Parties (Helsinki Convention) the exemptions are based on this definition in five countries, while in one country there is no limitation as to the frequency of the traffic when granting exemptions. Information is missing for two countries (HELCOM Maritime 8/2009).

116 Confirmed by different parties (HELCOM – Monika Stanckiewicz, WWF – Matias Rust)

117 The (Commission) Meeting requested the Contracting Parties to provide by 31 December 2008 to the (HELCOM) Secretariat the missing information on use of exemption system within the no-special-fee system (HELCOM Recommendation 28E/10) as well as information on contact points to be addressed with information on exemptions. When doing so, the Contracting Parties were to try to differentiate (i) the number of exemptions from mandatory delivery of waste from (ii) exemptions from obligation to pay within the “no-special-fee” system.
recommendations (MARPOL requirements, binding EU Directive, the HELCOM recommendation and existing or new national legislation). In Sweden for example, the no special fee system for all types of ship generated wastes was already implemented in 1995, some time before the Baltic strategy and PRF Directive. One country has transposed the requirement for the “no-special-fee” into their national legislation making it binding towards ports (Finland). This should bring about a harmonised implementation within the country. Some other countries refer to the HELCOM Recommendation (which is not legally binding, but “soft” law) and follow the EU Directive.

Following paragraphs briefly describe how different implementations across the Baltic do not fully correspond to the harmonised system that has been targeted. Differences can occur in the number of exemptions and the exact meaning of mandatory delivery and receipt (indirectly related to the no special fee), waste types under the system and waste quantities that can be delivered. Fee rates and reductions also differ as calculation of fees are entirely within the responsibility of the ports.

Geographical differences in exemptions

A consultation with Baltic Ports identified that the percentage of individual ships under the system could range from 2 to 100%, depending on the port. The decision on exemptions is a Port State responsibility leading to important differences between countries. Finland appears to apply more exemptions than the neighbouring country Sweden. Cruise ships can for example be exempted in Finland while this is not the case in Sweden. Ljungberg (no date) for example states that about 80% of the vessels in regular traffic have been granted an exemption by the Finnish maritime administration and claims that there is no change in the situation before or after the introduction of the no special fee system. It is argued that the demand for an exemption is most likely inspired by economic elements and benefits of flexibility to choose specific ports for certain types of waste (own agreements for waste reception and handling).

Exempted ships need to document how they fulfil their waste disposal requirements to the national authority, and ports have no insights on these waste streams.

Some information on the granting of exemptions in the Baltic countries has been presented in Table 5. Four countries granted exemptions from mandatory delivery and advance notification of wastes only (Estonia, Latvia, Poland and Sweden). In three of

118 P.c. Gun Rudeberg, port of Stockholm
119 P.c. Monika Stanckiewicz of HELCOM
120 Presentation at the General Assembly of the Baltic Ports Organisation in Sopot, September 6th -8th, 2007: http://www.newhansa.net/documents/Sopot_specific_Alhosalo_Kalli.pdf. Exemptions are defined by the national authorities, though own characteristics of ports (predominating passenger traffic) can lead to extreme figures.
121 Personal communication with two Baltic ports.
these countries (Estonia, Latvia and Sweden\textsuperscript{123}) it is up to the port authorities whether to grant exemption from the obligation to pay within the no-special-fee system. In Latvia, Port Authorities appear to grant exemptions according to the HELCOM Recommendation. In two countries, Germany and Finland, ships exempted from mandatory delivery and advance notification of wastes (by governmental administration) are also exempted from the obligation to pay within the “no-special-fee” system (by port authorities).

Table 5: Summary overview of exemptions (no special fee and mandatory delivery) for ships in Baltic countries (Source: own compilation based on HELCOM Maritime 5/2006 and 8/2009)

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of ports (2005)</th>
<th>Exemptions for mandatory delivery and notification</th>
<th>Exemptions for payment within the no special fee system</th>
<th>Number of exemptions (no special fee)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>90</td>
<td>X</td>
<td>Decision up to the port</td>
<td>Many</td>
</tr>
<tr>
<td>Estonia</td>
<td>no information</td>
<td>X</td>
<td>Decision up to the port</td>
<td>20 exemptions granted within 2006-2008</td>
</tr>
</tbody>
</table>
| Finland       | 64                     | X                                                  | X                                                    | • total number of valid exemptions 115 in 2005\textsuperscript{124}  
|               |                        |                                                    |                                                      | • 186 ships with valid exemptions in 2009 |
| Germany       | 62                     | X                                                  | X                                                    | 260 exemptions at the end of 2005                                             |
| Latvia        | 10                     | X                                                  | X                                                    | • 863 in 2004  
|               |                        |                                                    |                                                      | • 693 (9 months 2005)  
|               |                        |                                                    |                                                      | • 1258 in 2007 |
| Lithuania     | 1                      | X                                                  | (X)                                                  | 159 exemptions in 2008                                                        |
| Poland        | No information          | X                                                  | No information                                       | No information                      |
| Sweden        | 148                    | X                                                  | Decision up to the port                               | 138 exemptions in 2008                                                        |
| (Russia)      |                        |                                                    |                                                      | No information                      |

HELCOM Maritime 8/2009 shows that most countries follow the HELCOM recommendation 28E/10 for exemptions and the definition of regular services, while nuancing in the definition is still possible (e.g. Germany also exempts ships with permanent berth more than 60 successive days in one year). Information is lacking for Russia and Lithuania. For Poland, it has been explicitly confirmed that national legislation does not consider frequency of traffic when granting exemptions. Most countries require

\textsuperscript{123} In Sweden, the national administration can only recommend exemption of a ship from the obligation to pay for the delivery of wastes.

\textsuperscript{124} Only 95 ships had valid exemptions. One ship can have exemptions for more than 1 port however.
evidence of the ship’s traffic and waste management practice (e.g. contracts with operators or ports) before granting exemptions. For many countries, it is not clear if and how well this is controlled in practice. Traffic pattern in Finland is apparently controlled on the PortNet, a web application registering all calls in Finnish ports. Poland only asks to document on waste management practices. No information was found on Denmark, Lithuania and Russia. Regarding the information exchange on exemptions towards other countries along the scheduled route, there appears to be room for improvement. Only Sweden states that a copy of the exemption certificate is sent to other countries (competent authorities) in order to inform calling ports. No information for Lithuania, Poland and Russia. Other countries lack information on contact points for information sharing.

**Waste types and amounts under the system**

Implementation differences between ports also exist in the waste types and amounts that can be delivered under the system. Some accept any amount of oily waste, garbage and sewage within “no-special-fee” conditions, whereas others are ready to accept only a reasonable amount of waste (often since the last port of call) under the no-special-fee and require additional payment for the rest of the waste (if any). Such differences between ports in applying the “no-special-fee” system are for example found regarding amounts of waste (on-board a ship) that can be left at the port:

- Solid waste allowed to be left at the port: from 0.4 m³ to unlimited
- Waste water allowed to be left at the port: from 2 m³ to unlimited
- Oily waste waters allowed to be left at the port: from 2 m³ to unlimited

Denmark for example confirmed that only a reasonable amount of waste / waste generated since the last port of call is accepted under the no special fee system. Germany confirmed that in some cases harbour management can restrict the amounts of waste (HELCOM Maritime 5/2006). According to national regulation in Sweden, ports have to accept all the ship-generated waste against an indirect fee. The Law foresees a possibility to charge additionally if the ship did not send notification form 24 hours before or if the required pumping - unloading capacity is not available on board. In Sweden, the no special fee system thus implies that ports need to receive everything the ship has on board, often larger quantities than what can be normally generated during the last trip. Lack of harmonisation (in acceptance) in ports can be inspired by port reception facilities (for example, few ports have the capacity to receive sewage from cruise ships) or bottlenecks in the extended waste chain, as sometimes

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126 P.c. Gun Rudeberg, port of Stockholm
municipalities are not ready or able to accept certain types of waste (quality of waste water, absence of waste incineration plant, …).

The implementation can also differ regarding the waste types covered by the system. Some ports take within the system only black water (excreta, urine and faecal sludge) as grey water (kitchen and bathing wastewater) is not regulated by MARPOL. Other ports have a less stringent policy and accept all ship-generated waste and even cargo residues under the indirect fee system, as the latter are usually limited to small amounts. Port experiences regarding the acceptance of waste confirm that the reception of oily wastes poses little problems. For solid wastes, it appears that sorting of waste on board ships and separated reception thereof is considered as a challenge which also applies to sewage from large passenger ships (odour problem, capacity of pipelines, …).128

Waste fees and reduction for good waste management onboard

Fee rates are decided by ports. The indirect fee for waste management is included in the port fee. In the port of Stockholm, as for most ports, fees are differentiated by type of ship (different waste pattern): ships carrying freight, tankers, passengers or cruise ships. The fee system is described in the waste management plan. National authority controls whether the proposed system for calculation can be accepted but does not comment on the level of the fee. The fee is calculated from a cost recovery perspective. Direct costs for waste reception and handling are the costs charged by the waste handlers (tendering procedure). Total cost is then split to different ship types according to their waste generating pattern (highest costs for cruise ships). The same principles apply for the calculation of reductions in fees, and reductions are usually granted for:

- Reduction for (solid) waste sorting: difficulties for ships arise from the differences in waste fractions between (and even within) countries (local, regional or national waste sorting practices).
- Reduction for reducing the quantity of oily waste: the use of separators can reduce the water quantity in oily wastes and as such e.g. require less tank wagons needed for reception.

Table 6: Some examples of fee rates in Baltic Ports

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127 P.c. Monika Stanckiewicz of HELCOM
128 See for example Wastewater reception facilities at the port of Helsinki. Presentation by Kaarina Vuorivirta at the seminar “Baltic Ports and Environment – new regulations and challenges” held on 7th December 2010 Malmö, Sweden
<table>
<thead>
<tr>
<th>Port</th>
<th>Fee for reception of ship generated waste</th>
<th>Potential fees / reductions for ships with waste minimisation facilities</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riga (Latvia)(^{129})</td>
<td>Sanitary fee 0.1 €/GT (Sanitary Dues shall cover costs for removal of any garbage and segregated water, except for segregated ballast water or tank cleaning waters)</td>
<td>Sanitary fee 0.06 €/GT</td>
<td>Sanitary Dues shall not be collected from passenger ships, cruise ships and fishing vessels. Direct fee for bilge, sewage and oil containing water.</td>
</tr>
<tr>
<td>Gdansk (Poland)(^{130})</td>
<td>Total tonnage due is ranging from 0.09 – 0.64 €/GT, including the “unknown” waste fee</td>
<td>Reductions not readily found</td>
<td>Specified maximum amounts included in the tonnage fee (for passenger ships, one third of the waste discharged. Specific quantities for other ship types)</td>
</tr>
<tr>
<td>Helsinki (Finland)(^{131})</td>
<td>Solid waste and oily waste: waste management fee between 2 and 25 € per vessel net tonnage. There is no charge for the emptying of wastewater (domestic sewage) into the port’s sewer system.</td>
<td>If the TraFi has exempted a vessel from obligatory disposal of oily wastes only, the vessel is charged a waste management fee discounted by 70%. The Harbour Master and operations directors may grant a discount on the waste management fee to vessels which operate equipment, methods or fuel grades that significantly reduce the amount of waste.</td>
<td>For amounts of waste that are exceptionally large in terms of the vessel’s normal use or traffic, the vessel or shipping company will be charged according to the costs that arise (collection fee).</td>
</tr>
<tr>
<td>Tallinn (Estonia)(^{132})</td>
<td>Passenger ships 0.010 EUR/GT, Cruise ships 0.022 EUR/GT, Tankers 0.020 EUR/GT</td>
<td>Reductions not readily found</td>
<td>Sewage received on account of the waste fee up to the amount of 7 m³. Higher amounts charged by the amount.</td>
</tr>
</tbody>
</table>

\(^{130}\) http://www.portgdansk.pl/shipping/types-of-waste  
\(^{132}\) www.ts.ee/?dl=161
Based upon two HELCOM evaluations on the no special fee system, an evolution regarding the granting of reductions and thus the incentives to ships to implement waste minimising practices could be identified. In the first evaluation (HELCOM Maritime 5/2006), nearly no countries were stating reductions in harbour fees due to (good) waste management practices. Finland mentioned some ports in 2005 (reducing the amount and waste sorting), but reported limited uptake by ships. Sweden mentioned rebate systems in some ports for good waste management on board (Gothenburg, Stockholm, Helsinborg and Örnsköldsvik) and for lower water content in sludge and bilge oil delivered (Stockholm, Gothenburg and Halmstad). Today, in most ports such reductions on port tariffs are present. No further evidence could be identified on the effect of these reduced tariffs. The port of Stockholm states that waste minimisation on-board ships has been most striking for cruise ships, followed by passenger ships and ferries copying these practices. It is of note however that this is not necessarily caused by reductions in port dues, as for example minimisation of sewage water by passenger ships could also be triggered by actions to lower the freshwater consumption in ships. Nevertheless, from a consultation in Baltic ports\(^\text{133}\), it appears that international cruise vessels can save up to 33% of the fee payable per passenger by sorting their waste to (approved) fractions. In the port of Rauma (Finland), delivery of unsorted waste is four times as expensive compared to sorted waste. Certified vessels receive a considerably lower fee for the delivery of oily waste.\(^\text{134}\)

**Lack of harmonisation and way forward**

The description in the previous paragraph has illustrated that differences still prevail in the implementation of the indirect fee system and more broadly in the overall waste reception “services”\(^\text{135}\) of ports (and countries by extension). This lack of harmonisation can bring about competitive distortions between ports and uneven waste flows, as opposed to the objective of the no special fee system to share the waste burden in a fair manner between ports.\(^\text{136}\) It is unclear if a harmonised fee system would totally address this problem, but it surely aggravates the discrepancy between waste volumes in ports.

| Other vessels | 0.017 EUR/GT | Extremely high costs for the reception of the waste (compared to similar ships), costs will be charged. |


\(^\text{133}\) [http://www.portofrauma.fi/?eng/e_jatehuolto.html](http://www.portofrauma.fi/?eng/e_jatehuolto.html)

\(^\text{134}\) Services in a broad sense would then mean reception facilities, ability to meet the needs of ships without undue delay and the tariffs charged thereto.

\(^\text{135}\) P.c. Monika Stanckiewicz of HELCOM
and strengthens the attractiveness of certain ports over other. The problem is even more apparent when the situation is regarded in a wider EU context. Ships may have the incentive to discharge waste in the NSF ports (fee irrespective of the use) instead of paying an administrative fee (and direct fee per m³) in other EU ports. EMSA (2010) indicates that the effects of a wide variation of fee systems creates incentives for ships to do “PRF shopping”, with vessels delivering all or part of its waste of a certain type in one port, and the rest in another or even a third port. This 'shopping around' may reduce the overall costs for the ship and may be an unintended side effect of the EU Directive.

<table>
<thead>
<tr>
<th>Cost recovery and fee systems in EU Member States</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is still quite a difference in implementation and application between (and sometimes within) Member States. The wording of Article 8 has enabled Member States to create a wide variety of approaches and systems for the recovery of costs and the collection of fees. As a result, little harmonisation has been achieved in this area.</td>
</tr>
<tr>
<td>The analysis indicates that only a few of the systems observed in the Member States’ ports visited meet all the established principles and requirements in the Directive. Some of the No Special Fee systems and one version of the Administrative Fee system seem to meet most of the principles in Article 8. The main difference between these two systems appears to be that the fee for all ships using No Special Fee ports includes a delivery right for ship-generated waste (up to a maximum volume), whereas the Administrative Fee system does not include any delivery right. Given the diverse cost recovery and fee systems in place, it may be necessary to revise the principles (Article 8.2) in order to improve their user-friendliness and increase the incentives for using these systems. Questions that could then potentially be adressed are the need for further guidance on the “cost elements” to be included and the relationship between “fees” and “cost” or the question whether the incentive element could be improved by including the right to deliver a certain volume of ship-generated waste in the fee. The concept of a “significant contribution from all ships irrespective of use of PRF” and the scope of covered wastes would need to be clarified.</td>
</tr>
</tbody>
</table>

There have been some initiatives to increase harmonisation both in HELCOM states and at EU level. HELCOM meetings provide opportunity to discuss the implementation of the indirect fee system and exchange experiences. The newly established HELCOM Cooperation Platform for PRF¹³⁸ - to promote dialogue and exchange experience on good

¹³⁷ A diversity of systems have been applied in EU ports. The (100%) indirect fee system is not solely implemented in the Baltic Sea region. ¹³⁸ [http://www.helcom.fi/shipping/waste/en_GB/waste/](http://www.helcom.fi/shipping/waste/en_GB/waste/)
practices in planning, implementing and operating PRF for sewage - also deals with the harmonised implementation of NSF and discusses it amongst administrations, ports, and shipping industry. Various projects have also looked into the differences between Baltic ports and are elaborating best practices in waste management (on board and in ports). It is of note that these harmonisation efforts mainly focus at PRF and waste management on-board instead of harmonising fee systems.

The EU is currently in the process to consider a revision of the EU Directive 2000/59/EC on Port Reception facilities. The public consultation has been organised between mid July and mid September 2011. Some potential shortcomings in the implementation of the Directive have been identified (through differences in interpretation), confirming that the current system is not optimal and that not all ship-generated wastes and residues from ships calling at EU ports are actually collected. In order to further improve the system, a formal review of the Directive has been initiated and the impact assessment should be completed by the end of 2011.

1.3.3.4 Relation to other policy initiatives

The instrument of the NSF system has clear relations with other policy instruments and does only work when combined with other instruments (sufficient port reception facilities, prohibition of discharging, control of illegal dumping). It has been described earlier in the paragraph 1.3.3.1 that it is framed within the Baltic Strategy to prevent pollution from ships. The strategy combines a set of measures and regulations with the main goals to ensure ships’ compliance with global and regional discharge regulations and to eliminate illegal discharges into the sea of all wastes from all ships.

The Baltic strategy (implementation 1996) is an early version of the EU directive 2000/59/EC on Port Reception Facilities for ship-generated waste and cargo residues (implementation in Member States by 2002). The Directive pursues the same aim as the MARPOL 73/78 on the prevention of pollution by ships, which all the Member States have signed. However, in contrast to the MARPOL 73/78, which regulates discharges by ships at sea, the Directive focuses on adequacy of PRF (HELCOM, 2009). To achieve adequacy, the reception facilities shall be capable of receiving the types and quantities of ship-generated waste and cargo residues from ships normally using that port.

There is a close connection between the HELCOM Recommendation and the Baltic Strategy and the PRF Directive. In contrast to the recommendations of HELCOM, the Community Decisions are legally binding and can be enforced by legal sanctions (Ljungberg, n.d.). The eight (EU) Baltic Sea states are bound by the PRF Directive but

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139 P.c. Monika Stanckiewicz of HELCOM
their fee systems have been influenced and structured along the lines of the Recommendation i.e. including a positive incentive in the fee system (contains a delivery right). Article 8 of the EU Directive on PRF states that “all ships need to contribute significantly to PRF costs irrespective of actual use of facilities”. The PRF Directive allows various kind of cost recovery systems to coexist within the EU, with the only requirement that not less than one third of the total cost to be recovered is charged through an indirect fee. (Most) Baltic states have implemented a 100% indirect fee. It has been described already that there are some variations in NSF implementations in the Baltic, mainly regarding limitations such as reasonable (Last Port Of Call or LPOC) or excessive amounts. Other port reception financing systems may also provide incentives for landside disposal of waste (curbing discharge at sea...)

- “free of charge” systems, which charge no fees to ships for waste reception, handling, or disposal;
- “fixed fee” systems, which are similar to the no-special fee systems, but the waste disposal cost is a separate fixed fee and is paid regardless of whether or not the ship offloads waste; and
- “deposit-refund” systems which charge ships a mandatory waste management fee as a deposit, then refund all or part of this fee to those ships that use the port reception facility services.

EMSA (2010) categorises cost recovery systems in no special fee systems and administrative fee systems, with multiple (smaller) variations between ports. The main difference lies in the fact that administrative fee systems do not contain a delivery right. The system consists of an administrative fee (to the port, often refundable) and separate charging based upon actual delivery (usually to private waste handlers).

1.3.4 Evaluation of the measure
The instrument of the indirect fee system for ship-generated waste will be further screened against the evaluation criteria earlier defined in the report. Previous paragraphs have described the implementation (and regional differences) of the no special fee system in the Baltic Sea as this is a key element in the evaluation of the instrument.

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142 P.c. Monika Stanckiewicz from HELCOM
Goal achievement

This paragraph looks into the use and environmental effects of an indirect fee system as a part of a wider strategy to reduce (illegal) discharges at sea. The no special fee system has been installed primarily to reduce the incentive for ships (from cost perspective) to discharge wastes at sea instead of delivering onshore. A more harmonised system also contributes to a more fair sharing of the cost burden related to waste and to avoid undesirable waste streams between countries or ports.

The evaluation of the target fulfilment would require clearly defined policy objectives. In the case of the no special fee system, these have not been precisely defined. Objectives that are not quantifiable, specific or limited in time are difficult to evaluate (Van der Vlist et al, 2007). It is therefore difficult to define indicators that could relate to the dual purpose of the no special fee system. The overall objective of the no special fee system (and the wider Baltic Strategy) comes down to reducing the pollution from shipping waste, by facilitating reception of waste and providing incentives to delivery on-land. These targets could be further translated in terms of amounts of pollution / garbage at sea or delivery of waste to reception facilities in ports. These indicators have also been proposed to evaluate the success of the cost recovery fee systems under the EU Directive 2000/59/EC on PRF. There is however a lack of reliable statistics on quantities of ship-generated wastes received by ports. The EMSA horizontal assessment report on the implementation of the directive confirms that this problem persists in 2011 because there is no mandatory obligation to report delivered waste volumes (EMSA, 2010). Moreover, waste quantities delivered through contracts with own waste handlers (e.g. exempted ships) are often not known.

HELCOM (2006) states that the objective of the Baltic Strategy is to come to a situation with negligible illegal pollution (from ships), meaning that both the number of instances and the amount of pollutants discharged should continue on the downward trend and be close to zero in mid-term. To measure the level of illegal pollution, HELCOM listed a number of indicators: Number of illegal (both observed and estimated) discharges, number of polluters found/convicted, number of oily birds, beaches contaminated by oil (in km), abundance of marine litter, amounts of wastes delivered to ports compared to general shipping activities. According to HELCOM, these indicators are supposed to illustrate (the scale of) illegal pollution, and (if possible) its environmental effects as well as effectiveness of the enforcement of the relevant HELCOM measures. There is however a lack of reliable information to compile these indicators in a consistent and continuous manner.

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145 Adding the comment that overall information on maritime traffic should also be a part of the evaluation.
Brief evaluation will be discussed for the three defined ship-generated waste categories covered by the system, (operational) oily waste, sewage and garbage or solid wastes. This assessment includes information from some individual ports though it is important to note that there is no complete overview of waste related information available. Ports do not necessarily compile or report the same statistics on waste (waste categories, ship categories, …). Moreover, ports usually have no insights on waste quantities from ships that are exempted from the No Special Fee and / or mandatory delivery and have made own arrangements with waste handlers. The relative importance of this unknown share of ship-generated waste can differ significantly between Member States.

**Oily waste**

The Baltic Sea has been designated as a special area under MARPOL (Annex I), leading to a near complete prohibition of oil discharges at sea. According to HELCOM\(^{146}\), it is not feasible to develop a reliable indicator on amounts of oil delivered by ship call due to the rather complex legislation and diverse factors affecting the amounts and ship types to be covered by the indicator. It is argued that statistics on illegal oil spills (i.e. from normal operation and tank cleanings, not accidental pollution) could provide an indication of the effect of the no special fee system, though it can’t be isolated from the increased effectiveness of aerial surveillance (and its deterring effect). It is of note however that, even with increased aerial surveillance and oil drift control systems, polluters remain unknown in a vast majority of cases of detected illegal discharges. In 2010, out of the total number of confirmed illegal discharges (149), as little as in 9 cases (6 %) the polluters were identified.

In general, the number of detected oil spills in the Baltic Sea has been constantly decreasing, even though the density of shipping has rapidly grown and the aerial surveillance activity in the countries has been substantially improved. The amount of oil detected at sea has also decreased over the years. These evolutions can be read from Figure 11 and Figure 12.

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\(^{146}\) Personal communication Monika Stanckiewicz from HELCOM.
The no special fee system in the Baltic has been introduced in the year 2000 for oily wastes. The above graphs are showing a gradual decrease in the number of detected oil spills since but it is not possible to define a causal relationship between the instrument and the effect. Hassler et al (2010) note that the no special fee system seems to have had some effect in reducing the number of intentional spills, but argue that the fact that it is still a lot faster to clean tanks en voyage than in ports, in combination with less than perfect implementation of the system, has reduced its effectiveness.
**Garbage and solid waste**

An important objective of the no special fee system is the encouragement for ships to deliver waste in ports. There is no straight forward indicator to measure the implementation of the NSF, the overall trend (towards the objective) could be viewed only indirectly, for example through the amounts of solid waste per ship call for countries/ports with available data.\(^{147}\) Some statistics on the amounts of waste delivered to PRF have been collected by HELCOM and presented below (Figure 13):

![Figure 13: Comparison of the amount of garbage delivered to ports to the total number of calls at these ports for some Baltic countries (Source: HELCOM, 2010)](image)

The generally increasing trend in Figure 13 may indicate a positive development in the increased use of port reception facilities across the Baltic. In three countries, there is an increase in the amount of garbage delivered; in one country, a slightly decreasing trend can be observed (no trend can be determined for the fifth country due to the short data set). Little or no data is available for the remaining countries (HELCOM, 2010). The values of the indicator themselves should not to be compared between the states due to the different nature of ship traffic in the ports and different units (m\(^3\) and tonnes). The same trend has been confirmed by a survey in ports under the New Hansa project\(^{148}\) on sustainable ports and cities in the Baltic: 4 ports indicated an increase in the delivery of solid wastes while 1 port identified a decrease or stable evolution.

HELCOM assessed the marine litter pressure in the framework of UNEP Regional Seas Programme on marine litter (UNEP, 2009). In its analysis, HELCOM asked countries about garbage delivery to the ports. Garbage constitutes approximately three to ten % of the total amount of waste delivered to the ports (based on four responses). Two countries

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147 Personal communication Monika Stanckiewicz of HELCOM
indicated that the ‘No-Special-Fee’ system has had an effect on the amounts of garbage delivered to the ports, whereas one responded that the system has had no effect at all. Most of the countries do not collect any relevant data at the central level, so it was difficult to assess the effectiveness of the system.

The report (HELCOM, 2009) states that economic incentives have already been introduced in the Baltic Sea area and that the Baltic Strategy on Port Reception Facilities for Ship-generated Wastes has probably affected the amount of marine litter in the Baltic Sea. It is argued that the main strength in the HELCOM area is that the sea-based sources are well covered by the Strategy (enforcement of existing requirements). At present no evaluation could be made on the effectiveness of the “no-special-fee” system, for example due to the lack of detailed data on the amount of garbage delivered to reception facilities per number of calls into major Baltic port of different types of ships.

Besides delivery to PRF, HELCOM can only rely on general trend indicators since wide scale monitoring is not organised. There is a certain amount of information concerning the amounts of litter found on the beaches along the Baltic coasts (gathered by NGOs). However, no statistically based monitoring has been done and the comparison of the results is difficult since there is no common method for reporting the litter (UNEP, 2009).

Generally, there is a lack of metrics for evaluating the effectiveness of measures implemented to prevent and reduce marine debris. Recordkeeping (e.g., number of vessels discharging garbage at ports, amounts of garbage discharged, number of reports of inadequacies, number of violations) could all be useful indicators of effectiveness. Yet, there is no comprehensive collection of this type of data domestically or internationally. Some indicators should probably be set locally, since there are big differences between the areas, e.g. some areas have abundance of fishing-related litter whereas in some areas the origin of the litter is clearly in cargo ships and tankers or passenger ships. Recreational use of the coastal areas is a significant source everywhere in the Baltic (HELCOM, 2009).

**Sewage**

Delivery of sewage (especially relevant for passenger ships) in ports has been subject of strong debate in the Baltic area (see paragraph 1.3.3.1). Discharging of sewage is still allowed (only on a sufficiently large distance to nearest land if not sufficiently treated), though the Baltic will be installed as a special area for sewage under MARPOL, meaning that passenger ships will be required to treat sewage onboard to remove nutrients prior to the discharge into the sea or deliver it to a port reception facility (PRF). The effect of the no special fee system is therefore likely to be impacted by the absence of a prohibition to

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discharge sewage at sea. Information on port delivery of sewage is presented for some individual ports.

Today, it is argued that only a small number of major ports around the Baltic Sea, meet the conditions of adequate reception facilities for sewage from large cruise ships, Stockholm and Helsinki. Both ports experienced an increasing trend in the delivery of sewage water in the port. In Stockholm, total delivery increased from +/- 350,000 m³ in 2003-2004 to more than the double in 2005-2006 (over 750,000 m³). A gradual increase has also been observed for passenger ships and cruise ships only, with an increase from 500,000 m³ to more than 600,000 m³ over the past 5 years. For Finland, the most recent evolution is illustrated below in Figure 14.

![Figure 14: Evolution of the delivery of sewage from passenger ships in the port of Helsinki (Source: personal communication Kaarina Vuorivirta, Quality and Environment Manager)](image)

For the port of Tallinn, another major destination for cruise ships in the Baltic, there is no clear trend in sewage delivery by ship call (different types) between 2008 and 2011 (estimate). The indicator is stable for passenger ships (between 1 and 1.3 m³ by call as opposed to large fluctuations for cruise ships (+/- 8 m³ in 2008, below 5m³ in 2009 to more than 13 m³ by call in 2010-2011). Other ships have only marginal amounts compared to these ships.

Trends for ports are difficult to compare as they have both largely different reception facilities and a potential different implementation of the no special fee system. For the two major EU passenger ports Stockholm and Helsinki, there is a strong increase in port delivery. Hänninen et al (2009) refer to the different implementation in ports. In the spring

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150 Port reception facilities for sewage from passenger ships. Presentation by Gun Rudeberg (Port of Stockholm) on a Workshop on upgrading port reception facilities for sewage from passenger ships, 16 June 2011 Helsinki.
of 2008, Port of Helsinki launched a campaign to increase the amount of cruise liners to leave their waste water ashore. All the cruise liners calling in Helsinki have been given the information about the nutrient load problem in the Baltic Sea. In St-Petersburg and Tallinn sewage can be collected (only) by truck service but it appears to be not efficient in case of cruise ships. In contrast to Helsinki and Stockholm, the no special fee system in Tallinn is restricted to sewage quantities below 7m³.

Hänninen et al (2009) state that cruise liners calling at Baltic ports seldom leave their sewage waters in port reception facilities. The shipping companies then argue that the advanced wastewater purification systems (AWP) onboard their vessels are adequate even though they do not remove nutrients. Cruise ships rarely find reception facilities in ports sufficient in capacity and quality of treatment. Treatment onboard ship is frequently better than is available on shore, or one may find that the vendor accepts the waste, only to discharge it into the port without treatment (this is unacceptable to the cruise lines, therefore, promoting treatment onboard). WWF confirms that more than half of the cruise ships in the Baltic Sea still dump their toilet water straight into the sea, even if conditions for adequate port reception facilities are met, for example like in Stockholm or Helsinki. In September 2010, at the end of the cruise season, Stockholm had 240 ship visits and only 115 used existing port facilities, some of these 115 only for small amounts, suggesting that most of the sewage, even from these, has been dumped at sea. 151 Helsinki claims somewhat higher figures with nearly 70% cruise ship calls (in 2010) using the PRF of the Port of Helsinki. 152

Additionality

As the no special fee system is part of a larger set of measures and other legislation (e.g. EU Directive on PRF), it is difficult to consider the effect of legislation, increased PRF, increased enforcement (because there is existing legislation but discharges away from coast and below certain concentrations not always illegal) in isolation. Sweden have had the no-special fee system since 1980 and many aspects of both legislation and environmental consciousness have changed during that time. Statistics of the Swedish Transport Agency can’t be used for evaluating whether the increasing amounts of waste is due to the no-special fee or to other causes. 153

It is estimated that about 63%154 of the total theoretical nutrient contained in a ship’s sewage dumped into the sea would be eliminated if all passenger ships operating in the

152 Wastewater reception facilities at the port of Helsinki. Presentation by Kaarina Vuorivirta at the seminar “Baltic Ports and Environment – new regulations and challenges” held on 7th December 2010 Malmö, Sweden
153 Personal communication with Stina Paulin, Environmental Specialist at the Maritime Department of the Swedish Transport Agency.
154 Baltic Ports Organisation Secretariat (2011). Future environmental regulations for shipping in the Baltic Sea area and their consequences for the seaports. On the basis of
Baltic Sea area would discharge all sewage into port reception facilities, or use an effective sewage treatment system capable of reducing nutrients from sewage. However, not every Baltic passenger port has implemented the “no-special fee” system reducing the incentive effect to deliver on land.

The above description has shown that it is not feasible to identify a causal relationship between the installation of the no special fee system and increased delivery of ship-generated waste in ports. From the different examples, it can however be assumed that the lack of harmonisation between fee systems and port reception facilities may hinder the overall effect, as ships may refrain from delivery in ports due to the lack of sufficient PRF and restricted implementation of the no special fee system (direct charging above certain quantities).

Effectiveness in relation to GES (MSFD) and side-effects
When ships are increasingly delivering their wastes in ports instead of discharging at sea, this may have a positive impact on several GES-descriptors (see paragraph 1.3.2). The overall trend of waste delivery in ports is increasing (also by ship call), though there is a lack of reliable statistics to measure the effectiveness of the system as the reporting of waste quantities delivered is not mandatory nor exhaustive (many private handlers do no report any waste amounts). The impact on the state of the marine environment (indicators related to GES can also not be identified as the cost recovery system can’t be seen in isolation from other policy initiatives).

However, it is important to note that the indirect fee system for all ship generated wastes (by its design) provides incentives for ships to deliver wastes in ports. No clear evidence could be found however that an indirect fee system proofs to be more effective than other existing cost recovery mechanisms (EMSA, 2011).

1.3.4.2 Information on costs and benefits
The no special fee system is integrated as an initiative in a wider Baltic Strategy, making it difficult to have a good view (and evaluation) of costs and benefits of the policy instrument. The no special fee system or indirect charging principle has been installed to encourage ships to deliver waste ashore and to avoid undesirable waste streams between ports, thereby encouraging a sound sharing of the waste burden.

The next paragraphs will cover some aspects on costs associated with this waste burden (for ports and ships). The text also further describes the feasibility or impacts in terms of financing.

the seminar “Baltic Ports and Environment – new regulations and challenges” held on 7th December 2010 Malmö, Sweden.
Cost recovery and fees

The measure is a way to (re)cover (part) of the costs of waste management in ports. In the European Directive 2000/59/EC on port reception facilities, ports should have partial recovery (at least 30%) through indirect fee but can still chose how much and how (partly variable). HELCOM states have all introduced the no special fee system, though with variable implementation characteristics. The indirect fee system is one of the possible schemes for cost recovery and to fulfil the requirements of EU Directive 2000/59/EC.

Ports need to recover the costs of waste management in order to make their operations economically viable. HELCOM Recommendation 28E/10 stipulates that the fee should be distributed among ships and collected as part of or in addition to the port dues and can include:

- investments in reception facilities, stationary and mobile;
- operation of reception facilities;
- repair and maintenance costs of such facilities;
- costs of handling, treatment and final disposal of the received wastes.

Removing the economic incentive to discharge at sea in se would entail that ships should not face too large costs when delivering on shore as compared to the situation where they don’t deliver. This private cost for ships then includes the waiting time, the waste fee and other potential costs related to on shore delivery. The indirect fee system by its design stimulates delivery as ships need to pay a fee per port visit even if no waste is delivered. Costs for ports are not assumed to be really different as compared to other charging systems.

In practice, ports will estimate their costs for waste management of ship-generated wastes through a tendering procedure and projections of the port activity. Total waste costs are then redistributed over the different ship types and translated to a waste fee.\(^{155}\)

The principles of calculation of fees are reported to national authorities, the fee rate is entirely the port’s business. Interviews with several Baltic ports\(^ {156}\) have shown that the waste fees more or less cover the total costs of waste handling of ship-generated wastes, though one port argues that investment costs are not (fully) recovered. It is of note that actual costs are not known in advance making it difficult to calculate the appropriate level of the fees.\(^ {157}\) Detailed information could not be identified. In Poland, where the fee system is only partly indirect, Polish ports’ adjustment to the Directive led to a loss of some 5 % of its annual revenue (Baltic Ports Organization research) and imposed

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\(^{155}\) Personal communication Gun Rudeberg, General Counsel and Head of Environmental Affairs, Port of Stockholm.

\(^{156}\) Ports of Stockholm, Helsinki and Tallinn.

additional legislative requirements of reception facilities. These are not recovered through environmental fees. Apparently the country experiences problems in bringing these fees into the Polish system of port fees. The system of “no special fee” as an answer for controlling waste left in the port area started in 2005, but appears to be less successful than in other Baltic Sea countries.

Ports can make their own decisions on the level of the waste fees. It is their strategic decision to balance between sufficient cost recovery and installing a rate at a level that it remains attractive for ships to call at the port. Paragraph 0 already described the differences in tariffs and fees between ports. Figure 15 presents a simulation of waste fees for different types of (passenger) ships in 4 Baltic ports. One port (Stockholm) does not further differentiate based on the ship’s gross or net tonnage.

![Figure 15: Examples of waste fees (€ per ship call) for different passenger ships in 4 Baltic ports](image)

Furthermore, the figure shows that the waste fees not necessarily reflect the adequacy of port reception facilities in specific ports. For cruise ships, only Stockholm and Helsinki appear to have sufficient capacity to accept sewage from (large) cruise ships. Nevertheless, the waste fee in the port of Riga appears to be much higher than in other ports. According to BPO (2011), contrasting to the HELCOM Recommendation, the port of Riga applies a direct charging for sewage from passenger ships. The port of Tallinn has the lowest fee level though it is of note that the delivery under the no special fee system is restricted to 7m³, which is low for cruisers. EMSA (2010) also identifies that, in practice, the relationship between fees and costs often remains unclear in EU Member


159 Waste management and “no-special-fee” system. Presentation by Ellen Kaasik (Port of Tallinn) on a Workshop on upgrading port reception facilities for sewage from passenger ships, 16 June 2011 Helsinki.
States and there is a lack of transparency in relation to the underlying calculation leading to the price for different PRF services.

De Langen et al (2008) note that for large ships, the waste disposal costs are only about 5% of the total port dues. For small vessels, waste disposal costs can be a more significant percentage of the overall port dues. Figures from the port of Tallinn\textsuperscript{160} suggest that the waste fee covers a fairly small percentage of total port fees, ranging from 1-2% for cargo ships to 8-9% for passenger and cruise ships. These are average figures and no further information is available on by ship size. The relative share of the waste fee in the Port of Tallinn increases with more frequent port calls, because vessels receive reductions on the tonnage fee with an increasing number of port calls.

**Benefits of reduction of pollution or waste discharges at sea**

The isolated effect of the no special fee system cannot be clearly assessed. Some indicators and figures have illustrated that the instrument may have contributed to an increase in the amount of waste delivered in ports and thus reducing the dumping of waste at sea. The benefits of the measure cannot be estimated based on available information.

It is important to note that the costs associated with pollution from shipping are significant. Any positive impacts of the measure could help to reduce the costs of (illegal) pollution from ships. Some examples are listed below:

- Costs of marine debris are difficult to calculate (Kalli et al, 2005): Lost tourism, beach cleanups, maintenance and repairs of damaged vessels and losses in fishing are examples contributing to unknown total costs.

- Beach-cleaning operations have been carried out for example along the Polish coast since 1992, removing 50 - 100 m$^3$ of waste each year. The costs for beach cleaning and removal of litter from harbour waters was 570,000 € in 2006 (UNEP, 2009). UK municipalities spend approximately €18 million each year removing beach litter. Similarly, removing beach litter costs municipalities in the Netherlands and Belgium approximately €10.4 million per year. Clearly, in that ship-source litter makes up a large proportion of marine litter.\textsuperscript{161}

- Bickel et al. (2006) estimate that the environmental cost of a tonne of oil spilled is € 15,000, when the costs of natural resource damages, costs imposed on the users of the marine environment and costs of cleaning up are considered.

\textsuperscript{160} Personal communication Ellen Kaasik, Port of Tallinn.

\textsuperscript{161} Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas
Financing of port reception facilities or management of ship-generated waste

The indirect fee system is a charging system for waste services in ports. The provision of port reception facilities poses a burden on ports as the investments are often large and the reception of wastes demands extra work for the port staff. The adequacy of facilities is however a necessary condition for a successful implementation of the no special fee system, avoiding undesirable waste streams between ports. This can be considered as the main objective of the EU Directive 2000/59/EC. Some insights on associated costs for ports are further shown in Table 7 below. Information has been found regarding reception of sewage, mainly because Baltic ports are required to upgrade facilities before the Baltic Sea can be designated as a Special Area for sewage under MARPOL. Information on investments and port costs are not easily shared as ports are private actors in a competitive business.

Table 7: Investment costs for reception facilities for sewage (Source: BPO, 2011)

<table>
<thead>
<tr>
<th>Port</th>
<th>Localization of sewage reception facilities</th>
<th>Estimated cost of sewage reception facilities</th>
<th>Status of sewage reception facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copenhagen</td>
<td>New cruise quay (four berths)</td>
<td>2.7 million EUR</td>
<td>To be constructed (until 2013)</td>
</tr>
<tr>
<td>St. Petersburg</td>
<td>New ‘Marine Facade’ cruise port</td>
<td>2.3 million EUR</td>
<td>Already in place</td>
</tr>
<tr>
<td>Rostock Warnemünde</td>
<td>Cruise quay</td>
<td>1.7 million EUR</td>
<td>To be constructed (until 2012)</td>
</tr>
<tr>
<td>Helsinki</td>
<td>2 quays in Katajanokka</td>
<td>0.5 million EUR</td>
<td>Already in place</td>
</tr>
<tr>
<td></td>
<td>new cruise berth in West Harbour (450 m)</td>
<td>0.2 million EUR</td>
<td>Already in place</td>
</tr>
</tbody>
</table>

1.3.4.3 Suitability – Fit for use (context) and feasibility

The Baltic Strategy had already been implemented before the EU introduced its Directive 2000/59/EC on port reception facilities. Pollution from shipping has been a major pressure in the Baltic for a long period as it is one of the most heavily trafficked seas. The specific characteristics of the Baltic sea make it especially vulnerable for oil pollution and discharges of sewage. Hänninen et al (2009) notes that the nutrient load from ships is much easier to control compared to the atmospheric emissions or nutrient inputs from land-based sources even though the main nutrient load is derived from the latter ones.

The no special fee system can be considered as a single response to the multiple pressures related to ship-generated wastes. The system is however not likely to work when it is not embedded in a wider strategy or (legislative) framework, covering other (regulatory) incentives to deliver waste and attention for a harmonisation or upgrade of adequate facilities. The design of the system includes good incentives for ships to deliver on land though various interpretations (restrictions in amounts or types of waste under the system, granting of exemptions) risk to limit the incentive element for ships and a fair
distribution of the waste burden between ports. Moreover, other charging systems can also provide incentives to deliver waste on land (see paragraph 1.3.3.4).

It is of note that the indirect fee system is considered as a suitable tool by different stakeholders. The European Community Shipowners Association (ECSA) believes that most of the troubles with the application of fees (as required by Article 8 of the EU Directive 2000/59/EC) could be solved if the principle of “no-special-fee system” was widely applied on ships (excluding exemptions).162 ECSA emphasises that the system would need to be reasonable and transparent and non-discriminatory and not a back-door toward increasing port earnings. Seas At Risk refers to direct charging of waste reception as the major disincentive to the use of PRFs. The NGO notes that some other EU ports (besides Baltic ports) also utilise a no special fee system, but for it to be truly effective it should be implemented without waste thresholds and should be rolled out across a region. Finland national authorities also believe that an all-European no special fee system, including mandatory delivery of waste would be beneficial. It is argued that the HELCOM system, with all its flaws (different implementation, unfair sharing of waste burden, …), still works better than the Directive as it is today.163

It is considered essential to have the (harmonised) system applied in a wider geographical area, in order to create a level playing field. HELCOM Recommendation addresses also the need that the ports in the North Sea implement a similar system. HELCOM also indicates the importance of the (revision of the) EU Directive for facilitating the implementation of the system in order to avoid a differing or contradictory vision between Baltic and other EU Member States.164 Differences in charging systems can make some ports more attractive over others (De Langen et al, 2008), opposed to the objectives of the HELCOM recommendation 28E/10 where a fair sharing of the waste burden is proposed.

1.3.4.4 Social, legal and institutional context
Institutional capacity to implement and control

The setup and legal base for the no special fee system in the Baltic has been described in an earlier paragraph 1.3.3.1. The HELCOM Recommendation 28E/10 can only be considered as soft legislation as HELCOM does not enforce its recommendations. Law enforcement measures as such have never been used by HELCOM, as the (Helsinki) Convention does not authorise their use (Ljunberg (n.d.). Contracting Parties need to

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164 Personal communication Monika Stanckiewicz of HELCOM
translate the Recommendation in national legislation to make it binding. EU member countries (8 Baltic States) are bound by the EU Directive 2000/59/EC on port reception facilities. This has resulted in different implementation of the indirect fee system in Baltic countries, though HELCOM claims that these countries have generally inspired their fee systems on the HELCOM Recommendation.\textsuperscript{165}

In a wider context, the very nature of shipping activities also make it difficult to control the actual delivery of waste (mandatory delivery in Baltic is more strict compared to the requirements of the EU Directive 2000/59/EC). The port itself doesn’t control if waste is actually delivered or whether ships leave ports with (too much) waste on board. Enforcement appears to be difficult for Port States, especially related to the delivery of waste.\textsuperscript{166} Regarding illegal pollution, the Helsinki Convention has installed a duty for the States bordering the Baltic Sea to conduct aerial surveillance for detecting suspected offenders of anti-pollution regulations at sea. Aerial surveillance is carried out regularly in most parts of the Baltic, though some problematic issues should be improved: some Baltic states are not able to detect the spills at night or in poor visibility (no remote sensing equipment), some states do not carry out surveillance flights in accordance with HELCOM Recommendations and only a small part of potential polluters are identified and an even a smaller are part brought to justice. (HELCOM, 2006). Difficulties are also experienced when it comes to the control of the waste management practices from exempted ships due to lack of resources.\textsuperscript{167}

Ports need to make sure that they have sufficient PRF, receive waste without causing undue delay for ships and must receive the wastes (delivery right applies for example in Sweden, but not in all Baltic countries). In practice, statistics from the entrepreneur or waste handler (amount and types of waste) are rarely compared with the notification form unless significant differences could be expected.

\textbf{Distributional impact and acceptance}

The no special fee system as a charging system for waste services is designed to recover port costs for waste handling. The HELCOM Recommendation 28E/10 lists the type of costs that can be included in the waste fee. The calculation system for fee rates need to be approved by national authorities though no examples could be identified here. National authorities only need to approve the calculation principles while the fee rate is the sole responsibility of ports.

The indirect fee system is inspired by the polluter pays principles though allocation of the estimated costs to polluters can vary among ports. HELCOM Recommendation 28E/10

\textsuperscript{165} Personal communication Monika Stanckiewicz of HELCOM

\textsuperscript{166} Baltic experience of the no special fee system for port waste reception. Presentation by Markus Helavuori, Maritime Inspector of the Finnish Transport Safety Agency. 20th international KIMO conference, 9 October 2010.

\textsuperscript{167} Personal communication Kaarina Vuorivirta, Port of Helsinki. Referring to the capacity of the Finnish Transport Safety Agency.
states that the fee system has to be fair, transparent, reflect costs, and made clear for port users. It can for example be based on the vessels gross tonnage or the number of passengers. ECSA\textsuperscript{168} argues however that the use of the Gross Tonnage (GT) as differentiation makes no sense as GT has no relation with the amount and type of ship-generated waste. Figure 15 has illustrated that the waste fees for large ships (in terms of GT) can significantly differ from others. Seas At Risk\textsuperscript{169} suggests that some form of exemption or rebate on harbour dues may have to be implemented for ships making frequent, short journeys between ports, so they are not faced with a higher cost-burden.

No clear relation could be identified between waste fees and the adequacy of the port reception facilities or delivered services. The shipping sector claims that these differences and the lack of sufficient PRF indeed may be disincentives for delivery in ports, but overall they are in favour of the system.\textsuperscript{170} According to Ljungberg (n.d.), ports have criticized the 'no-special-fee' system since it does not encourage vessels to reduce the amount of waste produced. Some interviewees (ports and Member States) have stated that fee reductions for good waste management practices on board may have been some motivation for shipping.

BPO (2011) has indicated that many Baltic ports are skeptical about upgrading sewage reception facilities for ships. They are not sure if the investment in sewage reception facilities will be proportional to the environmental effect. Baltic ports claim that upgrading reception facilities should be voluntary and it should be their own choice as there are (yet) no regulations which make upgrading a port’s sewage reception facilities obligatory. They also argue that ports’ reception facilities are not the only solution for preventing sea pollution by sewage from ships. Passenger shipping industry could invest in onboard sewage treatment plants, which would make ships less dependent on reception facilities in Baltic Sea ports. BPO (2011) provides figures for associated costs showing that the estimated cost of onboard sewage treatment plant may be less cost efficient than for reception facilities in ports (see Table 7).\textsuperscript{171}

A survey on several Baltic ports shows that 60% of the ports are satisfied with the system.\textsuperscript{172} It has however been stated that the issue of waste tourism is apparent. Ports


\textsuperscript{169} Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas

\textsuperscript{170} Personal communication, Mattias Rust of WWF


\textsuperscript{172} Port and City Environment as a follow up of the New Hansa Sustainable Ports and Cities. Presentation by Minna Alhosalo, Juha Kalli at Sopot, 6 September 2007. This has been confirmed by personal contacts with 3 Baltic ports.
and countries with 100% implementation of the indirect fee system and providing good waste reception services are more attractive for ships.

1.3.4.5 Flexibility and adaptability
The no special fee system is a cost recovery mechanism for port reception facilities. The issue of ship generated waste will remain in the future and is likely to become more important with the increasing maritime traffic. The measure provides flexibility for ports as they are responsible for the level of the fee and their own cost recovery.

The system also allows to provide incentives to shipping companies that have implemented waste minimisation practices on board. It is expected that facilities both in ports and on board ships will further improve in the future.

1.3.4.6 Broader risks and opportunities
It has already been described that cost recovery systems may have an (undesirable) impact on the attractiveness of ports to shipping companies. More specifically, differences in charging systems for waste disposal can distort the playing field and lead to an inefficient allocation of resources.\textsuperscript{173} Ports are operating in a competitive environment and Port authorities aiming to maximise their port's competitiveness could have an incentive to minimise waste disposal fees. Since all costs have to be recovered, fees can only be reduced when the amounts of waste are minimised, as will be the case when high direct fees are charged. Ports with an indirect fee system will then attract more waste and will need to charge relatively high charges since the greater the amount of disposed waste, the higher the costs.\textsuperscript{174} This paradoxical situation emphasises the need for harmonised charging principles in order to aim for a fair sharing of the waste burden.

1.3.5 Enabling and limiting factors
The no special fee system can’t be isolated or installed as a stand alone measure. The cost recovery mechanism accompanies legislative provisions for reception and delivery of ship-generated wastes in ports (EU Directive 2000/59/EC, MARPOL 73/78 and HELCOM Recommendation 28E/10). Ports are working in a competitive environment and the installation of a (e.g. indirect) fee system is today part of a strategic decision to find the balance between installing adequate port reception facilities / services, while ensuring a

\textsuperscript{173} Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas

\textsuperscript{174} See De Langen et al (2008). The precise effects of cost differences for waste disposal on port choices (i.e. ships choosing a specific port) are impossible to assess. For some commodities and supply chains, waste costs may be insignificant, while for other supply chains the price elasticity may be very high, so that small changes in port costs have an influence on port choice.
sufficient level of cost recovery and providing incentives to ships to deliver ship-generated wastes in ports.

Several factors can have an influence on the delivery of ship wastes in ports and more specifically the effect of a certain fee system in ports. As the cost recovery system is part of a larger set of instruments (the Baltic Strategy), some of the factors mentioned here will inevitably also play a role for these instruments. Following paragraphs will further look at the elements that will play a role in the overall success or potential difficulties arising from and within the system.

- Strong design
- Stakeholder commitment and cooperation
- Adequate (reception) facilities
- Information, enforcement and control

1.3.5.1 Strong design: the need and challenge of harmonisation
The legal framework to stimulate delivery of ship-generated in ports is already in place in the Baltic region.\textsuperscript{175} HELCOM Recommendation 28E/10 provides guidelines for the implementation and principles of the no special fee system. The system has been gradually broadened to cover oily waste (MARPOL annex I), solid waste (annex V) and sewage (annex IV), with a further expansion to litter caught in fishing nets in 2007. The HELCOM guidelines provide more specific design elements\textsuperscript{176} compared to Directive 2000/59/EC, but in practice operations still vary throughout the Baltic region. HELCOM Recommendations are not legally binding and Contracting Parties do not necessarily translate these provisions in national law.

Some sources state that the current (absence) of a legal framework for certain wastes encourages ships to discharge at sea, for example sewage or certain MARPOL annex V wastes (garbage).\textsuperscript{177} This practice is further motivated by the lack of uniform disposal fees or the different implementation of the no special fee system. The US National Research Council (2008)\textsuperscript{178} refers to different types of (indirect) fee systems that may motivate shippers to on-land delivery and did not provide arguments for a specific design. WWF argues that the lack of harmonisation and differences in implementation creates uncertainty amongst ship owners and lack of incentives for ports to upgrade their

\textsuperscript{176} E.g. definition of regular services as a basis for exemption.
\textsuperscript{178} Committee on the Effectiveness of International and National Measures to Prevent and Reduce Marine Debris and Its Impacts
facilities. Different ports work with their own waste handling system based on different types of cost recovery which often remained vague. This creates unclear situations about the amount of waste that can be delivered, the level of the fee, the time it takes to deliver and the available facilities in the harbour. Seas At Risk further argues that a more complex situation most likely results in vessels continuing to dump waste.

WWF also regrets the absence of clear law regulating port facilities (particularly in relation to reception of sewage from cruise ships) and states that such would have been absolutely unthinkable on land.

Without ignoring the presence of multiple fee systems that could provide incentives for ships to deliver waste in ports, some necessary conditions for fee systems can be identified. Key characteristics of a charging system including the right incentives to deliver waste in ports are listed below, combining the perspective of different stakeholders (shipping, ports, NGOs):

- Harmonised, explicit and enforced charging system: transparency is important for ships to have a possibility to know beforehand how large their fee is. The introduction of a harmonised system (and good implementation thereof) in a wider geographic area (regulatory issue) can be hampered by the competitive environment where ports and shipping companies are operating. Ports may have the economic motivation to make their port more interesting for ships, e.g. by aiming to attract lower waste quantities that could result in lower waste costs / fees and port fees for (all) ships. Different charging systems may impact waste streams between ports.

- Fee included in the port fee (No Special Fee)

- Differentiated charging system to give incentives for good waste management practices on-board (minimise waste amounts and facilitate waste handling).

Both HELCOM Recommendation and the EU directive have described costs that are related to PRF in general terms. In order to have a more harmonised design of the cost recovery system, a better definition of costs that can or should be included is needed.

In a workshop report on cost recovery systems under Directive 2000/59/EC, it was argued that some Member States worked with the IMO interpretation of costs of port reception facilities (as a baseline), though the problem of different interpretations across Member States on the range of port reception facilities costs that could be recovered

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179 Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas


181 See for example EMSA report 2011 on a workshop on Port Reception Facilities for ship-generated waste and cargo residues, 13 & 14 April 2011 Lisbon or Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas
persists as of today.\textsuperscript{182} No evidence could be identified for the Baltic States neither, though individual contacts seem to confirm that ports are more or less able to recover the PRF costs (no definition or calculation provided), as described in paragraph 0. Waste fees have been found to be different among ports while not clearly reflecting the adequacy of reception facilities. The above may confirm that additional guidance to the definition of PRF costs is advisable.

1.3.5.2 Stakeholder commitment and cooperation

Despite an immense legal framework controlling discharges from ships in the Baltic Sea the prevention of pollution can only work satisfactorily if all the actors involved work together and take their particular responsibility.\textsuperscript{183} Effective handling of ship-generated waste requires cooperation between different parties and mutual understanding appears to be the key to facilitate operations. Several of these elements do not relate to the fee system specifically, but do hinder or influence the motivation for ships to deliver their waste in ports.

For ports, this would mean that they must facilitate discharges in ports and not pass on the problem to other ports. The relation between ports and ships is reflected in the provided / received services and the associated cost recovery system. Experiences in the Port of Stockholm demonstrate the huge organisation related to the arrival of cruise ships: +/- 40 buses for passengers, different waste containers for different fractions and limited space at quayside. Good communication between the ship and the port is indispensable in effective handling and is in the benefit of both. Since 2000, the Port of Stockholm has dedicated capacity to go on board of large cruise ships in order to demonstrate (in practice, together with the crew) the steps to deliver ship-generated waste efficiently. This initiative is considered as a good practice in the Port of Stockholm.\textsuperscript{184}

Several initiatives have been launched in order to address the problem of lack of harmonisation between waste management practices on board ships and the requirements defined by ports. The latter can be further related to the next steps in the waste chain, most often the organisation of the municipal waste management. This is a major challenge for ships as these are calling at multiple ports and countries/regions with differing requirements. An international agreement is a prerequisite for successful harmonisation of waste collection in ports, provided that the next steps in the waste chain can also satisfy the stated requirements. Examples of initiatives to further harmonise the

\textsuperscript{182} EMAS Workshop reports 2006 and 2011
\textsuperscript{184} Personal communication, Gun Rudeberg Port of Stockholm.
waste management are found under New Hansa project for sustainable ports and cities (period 2003-2005) and the Baltic Master II project.

During the New Hansa project, common guidelines for three concrete practices – prevention of ships’ emissions to the air, receiving and handling waste from the ships and management of waste waters – were created (Memorandum of Understanding (MoU) on Sustainable Ports and Maritime Policy in the Baltic Sea Region). The MoU indicated the potential of a joint Baltic system for economic incentives for waste minimisation practices on board ships (fee reductions) and stated the issue of losing competitiveness when introducing such instruments in isolated ports only. No further reference to this (voluntary) initiative is however identified in recent documents.

The Baltic Master II projects aims through one of its deliverables to define a regional standard in the Baltic Sea for how to sort waste. The proposal on how to sort waste onboard ships as well as in port is being developed in cooperation with Linnæus University in Kalmar and tested by three ports of Västervik, Kalmar and Oskarshamn, and the Regional Council of Kalmar County. Main difficulties for an effective and successful result are the various interpretations made by the countries around the Baltic Sea of regulations like compulsory waste discharge at the quay and the application of a system for charging. A consistent response from all Baltic Sea States would be required to the proposals put forward. Many interest groups should be heard when agreeing on the fractions to be sorted.

PIANC (2011) is stating that improvements in waste management rely on the willingness of the industry to perform according to modern (land based) standards, since securing the enforcement of regulation at sea is challenging for authorities. It is argued that the awareness of the general public and the users of shipping services may have more effect than regulation. Shipping companies could be encouraged by incentive-based port dues. Ships (e.g. passenger ships) already put a large effort in sorting systems, but this effort is meaningless without an active and prepared counterpart on shore (see 1.3.5.3). Depending on the operational profile of the ship, systems can often be operated in sorting- or and non-sorting mode and adapt this to the regulations in the cruising area. Reductions of waste fees could have served as a “carrot” for shipping companies to introduce waste minimisation techniques, though other elements have also played a role (e.g. cleaner seas are also in the benefit of cruise ships).

To conclude, Baltic ports are currently mainly cooperating by sharing best practices at national or Baltic Sea level (for example site visits organised by Baltic Ports Organisation BPO). Cooperation between ports is not expected to lower waste costs and is as such not

185 [http://www.newhansa.net/index.htm](http://www.newhansa.net/index.htm)
189 Personal communication Gun Rudeberg, Port of Stockholm.
considered as an opportunity. Waste handling is usually assigned to entrepreneurs by individual tendering procedures and waste handling and sorting rules differ significantly between countries and even cities.

1.3.5.3 Adequate (reception) facilities

The availability and maybe sometimes the capacity of the reception facilities are limited in some ports. This is a serious impediment to the reduction and prevention of discharges at sea.\textsuperscript{190} It is often argued that time is too valuable for ship owners to wait for reception facilities and they tend to leave the harbour anyway. One port has stated that the lack of adequate facilities causing time delays for ships is a key limiting factor for a good functioning of the no special fee system, as this inevitably results in waste tourism between ports.

Adequacy can be assessed using IMO Guidelines for Ensuring the Adequacy of Port Waste reception Facilities. Information on PRF is available at the website of the IMO’s Global Integrated Shipping Information System (GISIS). According to HELCOM, “adequate port reception facilities” means facilities that meet the needs of ships using them, and don’t cause delays to ships. PRF and their capacity are related to the traffic pattern (frequency and type of ships visiting given port) and future traffic developments. HELCOM indicates that inadequacy of reception facilities is reported through IMO circular (flag state to the port state). Throughout the years, few such inadequacy reports have been issued regarding the Baltic Sea ports.\textsuperscript{191}

HELCOM established a Cooperation Platform on Port Reception Facilities in the Baltic Sea in order to promote a dialogue on the provision of adequate port reception facilities for sewage in passenger ports of the Baltic Sea among key stakeholders (BPO, 2011). They include Baltic Sea passenger ports, the shipping industry, especially cruise lines, national administrations and municipal wastewater treatment plants. Moreover, the Cooperation Platform’s aim is to exchange experiences on good practices in planning, implementing and operating PRF for sewage, provide guidance on how to upgrade PRF in the first priority ports, promote harmonized regional implementation of the “no-special fee” system for sewage delivery.

To achieve the goal of zero discharge at sea, ships need to be able to discharge their waste at ports and should have incentives (or at least they should not face disincentives) to do so. Further work is needed to define adequate port reception facilities: While parties to MARPOL are required to ensure adequate port reception facilities, the standards for adequacy are unclear. Additional guidance is provided though MARPOL does not


\textsuperscript{191} Personal communication Monika Stanckiewicz from HELCOM
establish (qualitative and quantitative) minimum standards. IMO could provide assistance to achieve these standards and it would be essential to include port managers and users in the development of clearer standards.\textsuperscript{192} ECSA (2010) confirms a major concern of the industry and beliefs that adequacy should be defined by the shipping industry and not the other way around. Moreover, they are defending the combination of adequate reception facilities and the no special fee system.

Kalli et al (2005) state that the actual reception of waste in practice is often not a problem for ports, but further disposal and treatment of received waste may be a difficult task. Waste should be treated and disposed by using environmentally sustainable methods. Ports do not have waste incinerators or other methods to treat waste by themselves. This means that other parties play an important role in building a waste management system in a port. At a recent HELCOM meeting in September 2011, the role of the extended part of the waste handling process has been confirmed. Ports have very different starting points depending on the (waste) capacity of the municipality they are located in. This has an impact on both the fees they are paying (to waste handlers) and their reception capacity. WWF claims that basic demands on the “extended” waste handling process would be needed and relevant national authorities would need to guide and enforce both ports and municipal waste treatment plants.\textsuperscript{193}

1.3.5.4 Enforcement and control

The implementation of the no special fee system can’t be enforced as it is no requirement in EU legislation nor in most national laws. Control on illegal pollution from ships is however a key element to further encourage ships to deliver waste in ports instead of discharging at sea.

Illegal pollution in the Baltic area is generally controlled through aerial and satellite surveillance. HELCOM (2010) mentions that the Baltic Sea region has one of the highest rates of verifications and feedback on satellite oil spill indications. Although most parts of the Baltic with regular traffic zones are covered by national aerial surveillance, some Contracting States still do not carry out surveillance flights in accordance with the HELCOM Response Manual and the Recommendations. Hassler et al (2010) explicitly state that even when a no special fee system would work as it is supposed to, operators may nevertheless have considerable incentives to clean tanks at sea (oily waste). The major reason for this is that it saves time compared with using the port facilities. It is reasonable to expect intentional spills to be more common in regions where surveillance is known to be lax. Hassler et al (2010) provide no reliable data on this exist, but refer to


\textsuperscript{193} Personal communication Mattias Rust of WWF
the large differences in flight hours in different regions and expect operators to choose certain areas rather than others.

Despite improved mechanisms of detection, investigation and prosecution of the polluters, there is still a low probability for being convicted and ships still discharge illegally even though the economical driver for this activity has been reduced significantly during recent years (HELCOM, 2006). HELCOM’s Clean Seas Guide 2009 included that Baltic Sea States have agreed to harmonise administrative fines by deciding on a minimum level. This initiative is intended to be preventive and wants to eliminate greatly varying fines, in order to avoid a situation in which it is cheaper to discharge illegally than to port reception facilities. No further evidence has been collected on the actual implementation of this harmonised minimum level.

A major problem faced by port authorities concerns the notification of a ship’s next port of call. Recent research indicates that substantial numbers of ships do not end up disembarking at the port they indicated to Port Authorities. Port States need to control the mandatory delivery of wastes and need to ensure that exempted ships also fulfil waste management obligations. Some countries point at the difficulty to effectively control these requirements (e.g. Finland).

1.3.6 Literature and resources mobilised


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194 Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas


• HELCOM MARITIME 9/2010. Maritime Group, Ninth Meeting Norrköping, Sweden, 9-11 November 2010. Agenda item 3: Matters arising from meetings within the framework of HELCOM and HELCOM Baltic Sea Action Plan


• Ljunberg, H., (n.d.) The Baltic perspective status and outlook on HELCOM and PSSA. Gahmberg, Hästö & Co, Attorneys-at-Law, Finland


• Swedish Maritime Administration (1999), The Baltic strategy, a report on the progress of the Baltic strategy for port reception facilities for ship-generated wastes and associated issues


Presentations
• Port and City Environment as a follow up of the New Hansa Sustainable Ports and Cities. Presentation by Minna Alhosal0, Juha Kalli at Sopot, 6 September 2007
• Port reception facilities for sewage from passenger ships. Presentation by Gun Rudeberg (Port of Stockholm) on a Workshop on upgrading port reception facilities for sewage from passenger ships, 16 June 2011 Helsinki.
• Waste management and “no-special-fee” system. Presentation by Ellen Kaasik (Port of Tallinn) on a Workshop on upgrading port reception facilities for sewage from passenger ships, 16 June 2011 Helsinki.
• Wastewater reception facilities at the port of Helsinki. Presentation by Kaarina Vuorivirta at the seminar “Baltic Ports and Environment – new regulations and challenges” held on 7th December 2010 Malmö, Sweden

Articles, newsletters and position papers

- Seas At Risk position paper to EU consultation (2011): Ship waste dumping and the clean ship concept How an improved EU PRF Directive can play a key role in Cleaning up the Seas
1.4 Case study Real Time Closures of Scottish Fisheries

1.4.1 Introduction: Real Time Closures of fishing grounds

Closing access to fisheries is a standard policy tool, but usually it is blunt and unpopular. By using up-to-date information systems, closures can be managed in ‘real-time’, that is, on a day-to-day or week-to-week basis. Such systems reflect the flexibility of fish population movements as well as changes in the economic and social context of fishing.

Whilst not the first in the world, the Scottish Real Time Closure (RTC) scheme was the first in the EU. It has developed since its pilot in 2007 and has inspired other RTC schemes both in the EU and further afield.

This case study will describe the scheme, look at analyses of it and draw conclusions about how it can be applied elsewhere.

1.4.2 Environmental problem and objective of the measure

The problem of low white fish stocks has been apparent in the North Sea for a long while now. Cod is scarce and measures have been taken by the EU and Norway to monitor and protect the species. However, quotas have caused the problem of discards, where fish are caught then returned to the sea so that the vessel does not exceed its quota.

The MSFD requires that for Good Environmental Status (GES) “populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock” (EU 2008: Annex 1, Descriptor 3).

The RTC scheme therefore has this as its final objective. More specifically, it aims to reduce cod mortality by reducing discards, and it does this by diverting fishing effort away from the areas with the most cod. This is part of a wider scheme that manages fishing effort, and in doing so works with the quota system. That is, the quota system limits how many fish can be landed, but cod avoidance and effort management systems such as the RTCs make it less likely that vessels overfish by making it harder or more expensive to catch fish per unit effort. This should reduce discards by reducing the quantity of over-quota catch as there is a greater incentive to fish efficiently and within quota.
1.4.3 Measure: definition and context

1.4.3.1 (Legal) Background and implementation

The Common Fisheries Policy is the EU’s policy for managing fish stocks and allocating fishing resources. It has been reformed and updated a number of times, and future reforms are planned to be implemented on 1 January 2013\textsuperscript{195}.

In the wake of the 2002 CFP reforms, the UK introduced the Cod Recovery Plan (CRP) in 2005 which focuses on limiting days at sea to limit effort. In 2009 the flat rate basic allocation of days at sea was 160 days for the North Sea (for whitefish vessels). In 2011-12 the allocation is 105 (Scottish Government 2011). However, vessels may apply for a different allocation based on their annual average effort for 2004-2007 (Curtis et al 2009) which affects their “buy-back” potential.

The Conservation Credits Scheme (CCS) is the scheme used by the Scottish Government to manage fishing effort under the Cod Recovery Plan’s 2007 changes. This has the aim of making sure that whitefish stocks in Scottish waters can recover to sustainable levels, specifically by lowering instantaneous cod mortality by 25% from 2008 to 2009 (Bailey et al. 2010). In this scheme a basic fishing time quota is given to cod fishing boats and extra day’s quotas can be awarded if the boats take up certain practices such as more environmentally sensitive equipment\textsuperscript{196}. The measure was set up in 2008 to help Scotland meet the Cod Recovery Plan’s targets. There is a steering group of around 25 members that meets monthly to provide direction and input from all stakeholders. The scheme was originally voluntary but had a 94% participation rate (WWF 2009).

Measures set up by the scheme included the original RTC, amber areas (voluntarily closed areas revised quarterly; now dropped from the CCS due to low take up (Holmes et al 2011)), and permanent and seasonal closed areas. The largest closure area is known as the “Windsock” (due to its shape) is located north of the mainland, and was in place before the Conservation Credits Scheme. There is also the “Long Hole”, which is closed December to April, and re-opening is not automatic, and three other seasonal closures with automatic reopening. Vessels catching whitefish must use cod avoidance gear when they reach 90% of their quota, and the “high grading ban” stops vessels discarding the lower weighted fish they catch.

So under the CCS, the basic rate established can be extended by a number of factors, for example, the extensions available for using certain types of fishing gear are shown in

\textsuperscript{196} http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/17681#a1
Table 8. Here, if a vessel has opted for the flat-rate allocation, they can gain an extra 24 days at sea if they opt for using level 4 gear, but only 8 days if they opt for level 1 gear. The table also shows the percentage change in days if the vessel has chosen the “average annual record” or “track record” system of allocation. Take-up of the scheme for 2009 is shown in Table 9. It shows that most options had a low take-up in percentage terms, particularly for gear options rather than the spatial options. Also, vessels that landed less than 2.5% cod by weight can receive 200 days allocation for fishing outside certain areas.

### Table 8: Flat rate buy back allocations of days 2011-2012 (source: Scottish Government 2011)

<table>
<thead>
<tr>
<th>Classification</th>
<th>TR1 gears</th>
<th>TR1 Flat rate (days)</th>
<th>TR1 track record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 gear</td>
<td>“130mm cod end”</td>
<td>+8</td>
<td>+5%</td>
</tr>
<tr>
<td>Level 2 gear</td>
<td>“300mm belly mesh”</td>
<td>+12</td>
<td>+7%</td>
</tr>
<tr>
<td>Level 3 gear</td>
<td>“Orkney trawl”</td>
<td>+20</td>
<td>+12%</td>
</tr>
<tr>
<td>Level 4 gear</td>
<td>“Eliminator trawl”</td>
<td>+24</td>
<td>+15%</td>
</tr>
</tbody>
</table>

### Table 9: Take-up of buy-back options under the Conservation Credits Scheme (Curtis et al. 2009)

<table>
<thead>
<tr>
<th>Take-up of buy back options</th>
<th>Take-up</th>
<th>Eligible Vessels</th>
<th>% take-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Spatial options</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Avoid amber areas</td>
<td>66</td>
<td>391</td>
<td>16.9%</td>
</tr>
<tr>
<td>2. Specified selective gears – whitefish (one option per vessel)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.i. Eliminator trawl</td>
<td>0</td>
<td>169</td>
<td>0</td>
</tr>
<tr>
<td>2.ii. Orkney cod avoidance trawl</td>
<td>4</td>
<td>169</td>
<td>2.4%</td>
</tr>
<tr>
<td>2.iii. 130mm or greater cod end</td>
<td>7</td>
<td>169</td>
<td>4.1%</td>
</tr>
<tr>
<td>3. Specified selective gears – Nephrops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Nephrops SMP</td>
<td>23</td>
<td>133</td>
<td>17.3%</td>
</tr>
</tbody>
</table>

Source: Scottish Government. Information accurate as at 27th July 2009, may change as individual vessel owners opt in or out of the individual schemes.

The CCS is negotiated by the steering committee (now the Fisheries Management and Conservation Group (FMAC) and so changes and revisions occur over time— for example, the RTC scheme has become compulsory within the CCS. That is, whilst the CCS is voluntary, in order to take part in the CCS, the vessel must observe the RTCs.
Specific details of the RTCs

The RTC scheme was first piloted in 2007. After the pilot, the specific details have changed regularly. The key changes are included in the overview of the scheme that follows.

Aim

The CCS as a whole aims to achieve a 25% reduction in cod mortality from 2008 to 2009. Whilst there is no official target for the reduction caused by the RTCs, they are closures are expected by some observers to achieve an 11% reduction in cod fishing mortality, (Bailey et al 2010, Holmes et al 2011).. This was calculated using landed cod weights before and during the pilot closures (Holmes et al 2011) and so may not be the best guide for the revised RTC’s impact. The original aim of the pilot was to protect juvenile cod, then spawning cod (Catchpole and Gray 2010). WWF (2009) classifies the measure as coming under the ‘cod avoidance’ part of the CCS to avoid discards, rather than the effort reduction part. The measure works by deflecting fishing effort from areas of high cod concentration rather than halting fishing entirely.

Threshold Triggers

A closure of an area can be triggered by either an observation of a cod concentration greater than the observation trigger or by analytical triggers based on what is known as Logged Per Unit Effort (LPUE). That is, by combining landing data with log-book information of fishing effort, an average effort per landing can be calculated – if this is high enough, it is considered evidence of high abundance of cod stocks and the areas fished are considered for closure. This is explained in more detail below.

The observation trigger is based on an observed positive sample which is currently 40 cod caught per hour’s trawling as seen by an observer on board a vessel. The cod can be any size. Originally it was 60 cod over 35cm, then 50cm in the pilot, then 80 cod in total for 2008. In the pilot there had to be three positive samples within 48 hours of each other and within a 7.5 mile radius of the original sample (UK Government 2008). The samples in the pilot were either taken through observers or skippers themselves. Samples from Norwegian vessels were included in early years (WWF 2009) but have not been mentioned since. Holmes et al (2011) state that it was expected that there would be around 10 closures per year via this method. The level can change based on observer data collected by Marine Scotland (Science) and the distribution of cod per hour over observed trips. Analytical triggers are based on combining cod landed with GPS signals from boats known as Vessel Monitoring System (VMS) data. These signals provide information about location and speed of all vessels over 15m long, and since trawling
occurs at a different speed to cruising, the total trawling time can be estimated. From the total cod caught and the time spent trawling the LPUE can be calculated which gives an indication of how abundant cod were. This is based on landings not catches but still provides an indication that is useable for RTC monitoring. The LPUE data is calculated for 7.5 nautical mile squares known as sub-rectangles. The 50 (25 up to 2010) highest sub-rectangles in each of four main RTC zones\(^{197}\) are presented to Marine Scotland (Compliance) (MS(C)) for analysis for closure proposals. Data from the previous 14 days from all UK vessels in Scottish waters and all European voyages landing into Scotland are considered. The logbook data is used to get cod landings, combined with the VMS data, to select up to 11 closures. LPUE of less than 0.05 are discarded (Bailey et al 2010).

There are a maximum of 11 closures normally, but there can also be an extra 3 if there are positive samples (observation trigger). If the LPUE is not high enough for enough zones then as many closures as possible will be implemented. The pilot specified 9 closures maximum, without zonal limits.

Analytical closures were not used until 2008 but since observational closures are much rarer, depending on the presence of an observer on board the ship, were introduced to increase the number of closures.

Also, there has to be at least one closure in the West Coast Zone, and although there are no minimum closures in the other zones, there is an aim for at least one in each zone.

Within 12nm\(^{198}\) of land the closures are more flexible in size and shape (see below), but a positive sample for an observation trigger is needed. Closures are only considered in exceptional circumstances and under consultation with the steering group to provide the industry with a say. This is because the 12 nm coastal zone represents different economic considerations.

**Areas**

The pilot specified that the closure areas were to be 7.5 nm x 7.5 nm, or just over 50 sq nm. By 2009, the area was 50 sq miles but this did not have to be a square, rather it could be defined by up to six points. In June 2010 the maximum area of a closure is 225 sq nm – approx. 15nm x 15nm and the default shape is square but it could be have up to six edges.. In some instances, a shape other than square is used because of the

\(^{197}\) Note that the South-West zone was dropped from the RTC scheme in 2010 as cod numbers were never high enough to trigger closures.

\(^{198}\) Nm – nautical mile = 1.852 km
presence of other closures or the 12nm coastal boundary. The closures normally last 21 days.

Buffer zones and Commercial Impact Zones

In order to prevent there being too many closures in a small area, which would increase the difficulties and costs of fishers, the scheme has had buffer zones built in. These are boundaries around each closure which either restrict or forbid further closures. At first, in the pilot, there could not be more than three closures in a 45nm square. In 2008, this was changed so there could not be more than three in a 25 mile radius (WWF 2009). This became known as a Commercial Impact Zone (CIZ) by 2009. This figure was arrived at by dialogue with industry (Bailey et al 2010). By 2011 this had been simplified to a buffer zone of 15nm around each closure and there could be no closures within a buffer zone.

Monitoring, Penalties and enforcement

The scheme is monitored in a number of ways. The Scottish Government’s Marine Monitoring Centre uses the Vessel Monitoring System (VMS) data to observe where vessels are and so can notify them via email directly if they are in a closed zone. Some trips include observers from various bodies including the Scottish Fisheries Protection Agency (SFPA), and independent observers (Scottish Government 2009). Closed Circuit Television cameras on board ships and skippers’ log books are also used to help monitor catches. Also, from the start of the pilot skippers were encouraged to report areas of high cod concentration. This altruistic behaviour is not necessarily in skippers’ short-term interests, but if they trust the scheme will improve cod stocks and the sustainability of their livelihoods, then they have a long-term incentive to participate in such a way.

The steering group is involved in key decisions such as adjusting various parameters. It provides a voice for all major stakeholders and allows the policy to be flexible and relevant.

The scheme has always been voluntary, although since 2009 it has been a mandatory part of the Conservation Credit Scheme (which is still voluntary). After a closure has been declared, agents, skippers and organisations are notified by email, letter and a website with continuous updates199. Vessels detected within a newly established closure are not normally reported but will be notified specifically and directly of all the current closures, and will only be sanctioned if it is clear they are deliberately violating the closure.

The penalties for fishing in a closed area are 5 days’ fishing quota for a first encroachment, 10 days for the second, and 15 for the third and subsequent encroachments (Scottish Government 2011). In 2009/10 there were letters issued to owners or agents of 21 vessels concerning incursion into a closed area. After consideration of appeals, seven penalties were issued – five vessels had one deduction and one had 10 days deduction for two incursions (note the penalties were different in that period) (Bailey et al 2010). As part of the voluntary opt-in to the scheme, vessels have to comply with the penalties of the scheme if incurred.

**Take-up and outcomes**

In 2008, there were 15 closures, rising to 144 in 2009 and 165 in 2010. There are 163 as of the 4\(^{th}\) November 2011, with 10 arising from positive samples (observation trigger). It is interesting to note that closure 26/2011 was closed early in order to facilitate closure 36/2011 to occupy some of the space. This latter closure was based on a positive sample and so took precedence over the older and less accurate closure.

The pilot scheme is estimated to have saved the capture of 300,000 juvenile cod (Catchpole and Gray 2010), although as will be explored later, other studies note that as the effort is displaced, fish mortality savings are difficult to precisely allocate. WWF (2009) note that although the scheme was voluntary, in 2008 compliance was almost 100% - this includes both the Scottish fleet taking part in the scheme and from foreign vessels in Scottish waters. Indeed, Needle and Catarino (2011) also note that other nation’s vessels are notified of closed areas and anecdotal evidence suggests they generally respect the closures. The relatively low rate of incursions and penalties suggests that the scheme is well observed.

<table>
<thead>
<tr>
<th>Text from Scottish Government’s 2011 CCS Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The key features of RTCs are as follows:</strong></td>
</tr>
<tr>
<td>- A minimum of 40 cod per hour’s fishing effort will indicate a high abundance;</td>
</tr>
<tr>
<td>- The overall size of each closed area shall be a maximum size of 15nm x 15nm or the equivalent thereof. Any closures in Zone 2, inside our fishery limits of the North Sea, shall remain at the current size of 7.5nm x 7.5nm;</td>
</tr>
<tr>
<td>- There will be a maximum level of eleven closures (plus three extra in the event of a positive sample) set at any one time. If eleven closures cannot be established then the maximum possible shall be established. Any closed area will be defined by a maximum of six points;</td>
</tr>
<tr>
<td>- Closures within the 12 mile zone can only be established in exceptional circumstances which may require consultation with industry</td>
</tr>
</tbody>
</table>

113
Each closure will be as a result of one positive sample (over 40 cod per hour). Analytical closures shall be based on the highest ranked areas in relation to cod recorded on log sheets and related to time spent fishing as identified by VMS information. This is referred to as Logged Per Unit Effort (LPUE);

- Closures will last for a fixed period of 21 days after which the area will automatically re-open;
- There will be no set minimum closures in North Sea Zones 1 and 2. Closed areas shall be focussed on the highest ranking LPUE data, delivering the maximum conservation benefit. LPUE data of less than 0.05 will be discounted;
- Any closures in Zone 2 inside our Fishery Limits of the North Sea shall remain at the current size of 7.5nm x 7.5nm;
- A buffer zone of 15nm will be established around a closure. No other closures will encroach on the buffer zone;
- Other UK administrations and other Member States will be advised of closures and vessels encouraged to observe them;
- Industry will be encouraged to notify the existence (for information purposes) where they have encountered high numbers of undersized cod.
- Information on sample results and closed areas will be published on the Marine Scotland website at: http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/17681/closures
- Sampling will be undertaken by Marine Scotland and independent observers;
- Marine Scotland Science observers shall seek the permission of the vessel master before any notifications are made.
Figure 17 and Figure 18 show closures for different periods. Figure 16 shows closures in the first half of 2009, whereas the other two show closures at a given day. It can be seen how the CIZs change over time, and the range of shapes used for the RTC areas.

Figure 16: Real time closure areas declared in 2009 (as at end of July 2009) (Source: Scottish Government in Curtis et al 2009) – not all of these would be active at once.
Figure 17: RTCs for June 2010. Source: Scottish Government website, in Bailey et al 2010. RTCs: (black and yellow); CIZs (blue hatching), Juvenile RTCs (red and white) and the 12nm coastal zone (solid line) are shown.
Parties, agreements and obligations

The RTC is part of the CCS, which is a Scottish Government initiative under the CRP. It is monitored in part by Marine Scotland (Science) (MS(S)) and independent observers. At first, the RTC scheme was voluntary but is now mandatory within the CCS. Since June 2011 the Fisheries Management and Conservation group (FMAC) is the steering committee for the CCS and a range of stakeholders are on the committee, including industry and environmental associations. The (FMAC oversees the CCS, and is made up of governmental, research, industry and environmental organisations. Prior to June 2011, it was the Conservation Credits Steering Group (CCSG).
The UK fish quotas are set by the EU. Quota management is undertaken by the Scottish Government in conjunction with industry organisations. Effort management occurs through the CCS.

1.4.3.2 Exemptions and underlying rationale
Although at first the triggers required cod of a certain size, now all cod count. There are geographical exceptions for the 12nm nearest the coast since the economic considerations are different. Smaller vessels are exempt as are non-Scottish vessels in Scottish waters.

1.4.3.3 Relation to other policy initiatives
The Conservation Credits Scheme
The RTC scheme is a part of the Conservation Credits Scheme (CCS), which is the Scottish Government’s main policy for achieving the targets set in the CFP. The CCS works by setting a limit on the number of days’ fishing activity a vessel can undertake, but days can be ‘bought back’ with various environmentally beneficial actions such as modified gear.

At first the RTCs were voluntary but are now obligatory within the CCS. Days’ quotas will be removed from a vessel for violating a closure. The RTC needs to be in the wider framework unless other penalties are introduced, such as fines or criminal prosecution.

Amber areas and seasonal closures were also introduced with the CCS. Amber areas were zones identified as sensitive and if vessels opted out of these then their overall quota would increase. Curtis et al (2009) note a relatively large uptake of 16.9% of this scheme in 2008, but in 2009 this had fallen to around 10% (Holmes et al 2011) and then the scheme was dropped in 2010 due to the very limited voluntary participation. Holmes et al’s analysis suggested that amber area avoidance was ineffective and they have now been dropped from the CCS.

Seasonal closures were put in place to be longer term than RTCs but still temporary. There is no option to not observe these and so there is no incentive for participation either.

The Juvenile Real Time Closure Scheme
Although the original RTC scheme was aimed at protecting undersized cod, it soon became about all cod. From 1st September 2009, the European Community and Norway have together instituted a RTC scheme in the North Sea and Skagerrak for juvenile cod,
haddock, whiting and saithe. This scheme is similar but independent to the Scottish North Sea RTC. The scheme is not voluntary and is for all vessels in the area. For more details see the Scottish Government website\textsuperscript{200}.

These closures should not affect the Scottish scheme much. As Figure 17 and Figure 18 show, there are few Juvenile closures in the area compared to the Scottish scheme.

### 1.4.4 Evaluation of the measure

In order to evaluate the Real Time Closures policy, this section will explore how effective the measure has been based on the headings developed in this report.

#### 1.4.4.1 (Environmental) Effectiveness

A number of studies have been undertaken to assess the effectiveness of the measure. Success would fundamentally be in relation to how much the RTCs contribute to the more general CCS target of a 25% reduction. However, it is very difficult to assess cod mortality changes since data concerning discards are limited. Whilst on-board monitoring, including CCTV, can collect this data, it is expensive to monitor all discard behaviour. Instead, it is usually extrapolated from sample observations and landings data. The measure is specifically aimed at cod stocks, but there could be knock-on effects on other species as well – this is raised by some studies examined below.

This section will use three main studies to explore what impact the RTC measures may have on environmental quality, specifically cod stocks, in the North Sea. It will also look at the wider costs and benefits of the data.

These studies all come from Marine Scotland (Science) (MS(S)), one of the Scottish Government’s Directorates’ Scientific branch, previously known as the Fisheries Research Service (FRS). Needle and Catarino (2011), Holmes et al (2011) and Bailey et al (2010) are three research publications from the body, with some authors common amongst the papers. Some research methods are also common amongst these, but each paper does offer particular insights and results. The MS(S) research has access to VMS data that is not more widely available, which is very useful for RTC assessment.

Bailey et al (2010)’s paper is a summary document for the European Parliament which looks at RTCs worldwide, but for Scotland in detail. They assess the policy in four ways:

- Closure areas are compared to the known areas of cod concentration. There is an appropriate match between these areas so the authors conclude that the “methods used to generate them [the closures] are operating successfully”.

\textsuperscript{200}http://www.scotland.gov.uk/Topics/marine/Sea-Fisheries/17681/closures/Juvenileclosedareas
VMS data is used to see how vessels move in relation to closures, and find that compliance is good. Vessels tend to move away from closed areas to areas of lower concentration (this aspect is developed in Needle and Catarino, 2011).

Landings data is used for vessels observed to have been operating in areas subsequently closed and after closure. Based on previous observations, they assume that landing data is a good approximation for catch data, since catch data cannot be precisely known. They calculate that for 2008 there was an estimated reduction of 61 tonnes landed – which approximates as 153 tonnes caught compared with what would be the case with no RTCs. For 2009, the same indicators are 431 tonnes of reduced landings, and so an estimated reduction in catches of 707 tonnes respectively (although landings rose in the fourth quarter). This analysis is developed in Holmes et al (2011).

Data from tagged cod are used to estimate the likely length of time that cod shoals will remain within a closed area. Their analysis suggested that most cod “are unlikely to stay within the confines of the...closures for more than a week” when the closures were 7.5nm x 7.5 nm. Based on this assessment the scheme increased the size of the area to 15 nm x 15 nm.

Brief stakeholder analysis was carried out. RTCs were welcomed by the World Wild Fund for Nature (WWF), Royal Society for the Protection of Birds (RSPB), and the Scottish Fishermen’s Federation (SFF).

However, they also note a number of key limitations to their conclusions. These include:

- Importantly, RTCs cannot be compared against a control case. There are therefore no data on the level of catches or the fishing effort if the closures were not in place.
- Evaluation is limited as the RTCs displace fishing effort, but the aim is reduced mortality. RTCs do not necessarily affect total effort.

Needle and Catarino (2011) developed the analysis used by Bailey et al (2010) in order to estimate the extent to which vessels moved away from closure areas to areas of low cod concentration, in other words, the extent to which RTCs impact fishing effort. Data on fish concentrations and VMS are used to develop indices for relative cod importance (RCIIs). The study finds that the RCI of the areas vessels move to after a closure is lower than that of the closed area and that distances travelled are greater when moving away from a closure than when returning after opening. That is, they tentatively conclude that RTCs have reduced cod mortality. However, the authors do not explore the impact on other fish stocks, and there is a chance that by diverting effort away from cod, other species such as haddock may be adversely affected. The main conclusion is that fishing effort is displaced.
Holmes et al (2011) looked at compliance with the scheme and developed estimates of catch savings, building on work presented in Bailey et al (2010). This paper does not focus on RTCs, but does provide some results for RTCs separate from other CCS policies. Again, they find that there is compliance with the scheme, and that it is likely that vessels would have operated in the areas if they had not been closed. Catch savings were found, but less than expected. They note that assessing RTCs does not allow for the way skippers may make plans – since closures may be announced at short notice, plans are likely to be disrupted and possibly sub-optimal and estimating a counterfactual (if there were no closures...) is impossible. Catch "trajectories" calculated by the authors can help assess the likely impact of given policies and help decision makers react to events and data quicker, as any shortfall may be anticipated and reacted to. However, a lack of data leads to assumptions being required, and this in turn leads to a degree of uncertainty over the conclusions.

Curtis et al (2009) undertook a wide-ranging assessment of the UK fleet and how a variety of factors could be affecting the fleet’s economics. RTCs were included in this assessment, and a 36 vessel owners were surveyed about their behaviour and catch rates over the implementation of the RTCs and the CCS. Whilst they were asked about the costs of implementing other CCS measures, no cost questions about the RTCs were asked, only behaviour. This study was carried out by Seafish, a UK non-departmental public body with responsibility for working with industry to promote sustainable seafood. They found that less than 10% of demersal pair/seine trawlers and 38% of vessels over 24m in length reported a fall of catches, although the size of this fall is not given. In addition, some owners reported fuel and time costs of moving out from a closed area. It was noted that boats not targeting cod were still moved on, potentially moving away from a rich fishing area. Some vessel owners were concerned about vessels from outside the scheme – from other nations – moving into RTC declared closures (although other reports suggest this is rare, see for example Needle and Catarino, 2011, p. 1649).

Catchpole and Gray’s ((2010) paper is a review paper of European pilot projects aimed at discard reduction, and so it only offers a brief look at the 2007 pilot. However, it does compare key features of this pilot with other European schemes. This research was funded by the EU. Their findings are explored more in Section 1.4.5 Enabling and Limiting Factors, but here is it relevant to note that their findings were that although fishers’ quotas were raised by 11% due to compliance, it remains “unclear” whether discards were lowered.

**Goal achievement**

The literature discussed above suggests a tentative benefit to the RTCs in terms of changing the fishing effort away from areas of high cod concentration, which in turn suggests that cod mortality has been reduced. No studies appear to link this to the 11%
reduction that was expected of the policy. This may be because methods of assessing the impact are currently not accurate enough for that.

This raises the issue of whether the CCS target is useful if progress towards the target cannot be quantified.

Overall, the scheme has resulted in a change in fishing effort, which does seem to have lowered catches and has probably reduced cod mortality. However, the change in mortality is probably lower than expected. Compliance with the scheme is high, perhaps because VMS monitoring and fast communications with skippers mean that infringements can be monitored, noted and communicated quickly and accurately. Also, skippers may know that the costs of compliance are low, with catch rates falling slightly (Curtis et al, 2009) but quotas raised. The scheme seems well designed in terms of compliance and effort management, and its flexibility means that it has adapted to the best available knowledge of cod movements, but the limited environmental impact arises from the fact that effort is displaced rather than reduced significantly.

**Additionality**

The RTC scheme is embedded within the wider CCS policy. It is important for both the CCS target, potentially generating nearly 50% of the cod mortality reduction target, but also important for the implementation of the scheme. The RTCs are seen as a flexible and sensible policy and industry groups feel that they have the opportunity to influence the parameters of the scheme. The steering group offers this chance, amongst others, and as there is built-in scope for changes at regular intervals, this benefit should not be downplayed.

For example, most of the main characteristics of the RTCs have changed since the pilot. The number and size of closures, the triggers, the role of coastal zones and buffer zones. The only major parameter that has not changed is the duration of closure. Industry groups expressed interest in the scheme before it was launched, but called for a say in its development. The other aspects of the CCS are not so flexible and do not offer the same level of engagement as the RTCs. Jaworski and Penny (2009) found that in 2008 cod abundance was higher in this area than outside it, but still at a level considered low.

**Effectiveness in relation to GES**

The GES specified by the MSFD is for populations of commercial fish stocks to be within sustainable limits. By helping reduce cod mortality, the RTC scheme contributes towards this with little impact against it. However, it does not appear to be as strong a scheme in terms of GES contribution as originally hoped. This could be due to weaknesses in the current ability to assess cod mortality, but it could also be that the nature of the scheme is to divert effort rather than reduce it or eliminate it.
Whilst relatively little is known about cod patterns and the complex population dynamics, the scheme does seem to be able to adapt itself to respond to advances in such knowledge. The latest increase in the area of the closure zones may lead to a more noticeable difference in cod populations or in estimated catches and mortality since the increased size is expected to better reflect the cod movements. That is, research has suggested cod are likely to move further in 21 days than the original zones covered, and so the larger zones should make a difference. However, the broader issue of displaced effort is not necessarily addressed by this change, although fishing vessels will have to move further before resuming trawling. This change suggests that at present the economic and industry pressures are not directed at limiting the RTC scheme and so possibly in the future more restrictions could be added if the scientific evidence points to it.

1.4.4.2 Information on costs and benefits

No financial costs have been identified in the literature. This is a drawback to the assessment of the costs and benefits, but it must be assumed that costs are minimal. That is, the costs include the monitoring of LPUE, calculating and disseminating closure areas, monitoring compliance with closures, and fuel and time costs for vessels that have to change their plans as result of closure.

Financial benefits to fishers would arise from the extra quota of fishing days. These could be calculated but would vary with the size of boat and the equipment used. The ‘baseline’ case for assessing such costs and benefits would have to be the more rigid policies to achieve the CFP targets since there is no BAU case to this scenario. That is, instead of measuring costs and benefits to fishers and regulators/monitoring bodies of no-policy in place against the RTC policy, this section would have to compare the RTC policy against other proposed or possible policies such as longer seasonal closures, reduced fishing effort quotas and so on. Fishery organisations seem to give broad support to the RTCs (NFFO, 2009, SFF, 2010) so perhaps it is reasonable to conclude that the financial costs of RTCs are lower than alternatives – this support seems more conditional upon the level of engagement they have with the policy process than the financial costs. It should also be noted that the benefit stream in terms of increased catch in the future would lie with fishermen.

The VMS equipment in Scottish vessels is obligatory, which helps keep monitoring costs low. If other fisheries were considering Real-Time Closures but did not have VMS already equipped on vessels then the setup costs of the scheme would be much higher. However, VMS has a range of benefits including safety, and so if such technology had to be installed then the costs would be apportioned across the different benefit streams.
In addition, some owners reported fuel and time costs of moving out from a closed area. It was noted that boats not targeting cod were still moved on, potentially moving away from a rich fishing area (Curtis et al 2009).

If VMS equipment was not already obligatory the setup costs of the scheme would be much higher. However, VMS has a range of benefits including safety and so if such technology had to be installed then the costs would be apportioned across the different benefit streams.

Any benefits of the scheme are harder to quantify in monetary terms. Firstly, benefits arise from better environmental status, and as been explained above these are likely to be quite small. The other benefits would be the financial benefits to fisheries and the fishing industry. Here, any calculation has to compare the scheme with a counterfactual baseline. The baseline cannot be a scenario with no fishing regulation at all given the strong EU policy background for cod quotas. Instead, the baseline is best seen as an increase in longer-term closures of fishing grounds to divert fishing effort, or a greater emphasis on specific gear use to protect certain stocks.

If the baseline costs are greater than the RTC costs, then the RTCs bring a benefit to the industry. Since both the longer term closure and gear options have been included in the CCS with a much lower voluntary take-up than the RTCs it can been seen that they are less popular with vessels. This is likely to be because the RTCs have a lower overall cost. Therefore, we could see the diversion of costs from these other options as a benefit of RTCs.

The fishermen also benefit from an increase in their quota of allowable days fishing. Although their overall landing quota does not change, the increase of time available allow for greater choice and efficiency for vessels.

1.4.4.3 Suitability - Fit for use (context) and feasibility

The RTC scheme can be considered suitable for a context in which relatively little is known about fish stocks and movement, since the flexibility of both the closures and the scheme itself allows it to adapt to new information or demands. The number of changes that have been made to the scheme illustrate this.

The scheme is also suitable for the Scottish cod situation because the monitoring, communication and policy infrastructure was already there, so costs were lower. The region is large enough for there to be a number of closures in place at any one time but still provide room for fishing activities.

Dialogue between different parties involved helps balance or straighten out issues if the unsuitability is on one side. However, the process has not been entirely straightforward – the National Federation of Fishermen’s Organisations (NFFO), whilst supporting RTCs, identify “serious deficiencies in terms of a lack of transparency, communication and
involvement”, and also the problems caused by vessels from different nations being subject to RTC controls they have no say in (NFFO, 2009)

The main aspect which is unsuitable is that the choice of target is currently unmeasurable since observers cannot know both the cod mortality if the scheme is not in place (the baseline), and neither can they know total fish catches since on-board observation is costly. Cod mortality has to be estimated by extrapolating the level of discards from sample observations, and not all information about the vessel’s activities can be gained from the Vehicle Monitoring System\textsuperscript{201}. However, these may change with time.

The RTC scheme is by its very nature flexible, and so should be applicable to other fishery contexts. The limiting factors of technology costs, data collection are likely to apply to other contexts unless technological innovation or falling costs enable better catch data.

The area of the North Sea in question is a ‘boundary’ between Scotland and Norway, and to a lesser extent England. Cross-border issues in the Scottish scheme have been mild since most evidence suggests non-Scottish vessels participate in the closures. In other seas with more numerous borders, such as the Black Sea or Baltic Sea there may be greater difficulties in creating a scheme that different fisheries recognise or respect since there are more borders.

The Scottish scheme is highly data intensive, but this is not a large cost due to the existing infrastructure. Other fisheries may face larger investment and on-going costs to gather, process and disseminate the information necessary. VMS is a legal requirement for EU vessels over 15m in length\textsuperscript{202}.

Stakeholder participation and dialogue is necessary – if there are more stakeholders in other areas, and even if they are all well organised, the more groups there are, the slower and less flexible the scheme will be. The social and institutional context is clearly important here, since if good relationships are not in place, the flexibility and easily-changed nature of RTCs could become a hindrance if acrimonious relationships bog the system down with impractical or awkward suggestions. Fishery organisations seem to give broad support to the RTCs (NFFO, 2009, SFF, 2010) so perhaps it is reasonable to conclude that the financial costs of RTCs are lower than alternatives such as long-term closures or mandatory gear adoption – this support seems more conditional upon the level of engagement they have with the policy process than the financial costs so it could be useful to note that any policy implementation should have as much stakeholder engagement as possible.

Importantly, the Scottish system has treated inland waters within 12nm of the coast differently to the majority of the system – closures are smaller and require observed catch

\textsuperscript{201} VMS data can tell the location, course and speed of a vessel. Because vessels tend to trawl at a different speed to cruising, estimations can be made of what the vessel is doing but this is not known for certain.

\textsuperscript{202} \url{http://ec.europa.eu/fisheries/cfp/control/technologies/vms/index_en.htm}
data to trigger a closure. In other contexts this could be more important, for example, most of the commercial fishing in the western region of the Black Sea takes place within the 12nm zone and so it is likely that care would have to be taken about applying RTCs there. However, enforceability is increased as foreign vessels are not allowed to fish within the zone.

It is likely that the greatest long-term difficulty of implementing a successful RTC in other areas will be the same difficulty as in the Scottish case. Without a clear and reliable method of assessing the impact on fish mortality, no scheme can be fully judged.

1.4.4.4 Social, legal and institutional context

Legal basis and rationale

The cod fisheries of Scotland have strong institutional and legal frameworks in place to help implement new policies and practices. The CFP allows some flexibility for governments to choose methods for reaching given targets so that suitable options can be chosen.

The CCS’s system of buying back or removing days’ fishing rights allows the RTC scheme to have built-in costs for those who fish in closed areas. This is a strength because the scheme can be “policed” within itself.

VMS data already being collected is suitable for monitoring the compliance with the scheme.

Institutional capacity to implement and control

The institutional capacity exists at political, industrial and research levels. That is, a number of governmental and non-governmental institutions already existed before the scheme that could support and develop the implementation and control of the RTCs. This includes the fishery organisations that represent fishers on the steering committee.

Perhaps the main weakness here is, again, the lack of a robust measurement with which the scheme can be measured. Without this the research and political institutions cannot clearly measure progress or failures. The research capacity exists to deal with this, and indeed a number of research projects used here are making steps towards tackling this issue.

Distributional impact and acceptance

The measure was called for by a number of groups before it was first introduced, including fishery and wildlife organisations. There remains support and acceptance of the policy in broad terms.
The scheme seems to have support from other nations who may be affected by the North Sea cod stocks, such as Norway and England. Evidence suggests that even when they are not obliged to, foreign vessels observe the closures.

There is no evidence on the distributional impact of RTCs. The introduction of the 12nm coastal zone shows that attention is paid to how different fisheries have different economic, social and environmental considerations.

1.4.4.5 Flexibility and adaptability
The main strength of this scheme is that it is highly flexible and adaptable. With sufficient information and a strong institutional foundation, RTCs can be adjusted in many different ways. The nature of temporary closures being announced in real-time is welcomed by many as fish concentrations move constantly and are largely unpredictable. The measure was originally built for this flexibility, but the Scottish case shows that it can cope with changing demands (e.g. moving from targeting undersized cod, to spawning cod, to all cod), improved scientific knowledge (e.g. expanding the area as information about cod movement patterns is discovered) and socio-economic pressures arise (e.g. developing the 12nm zone).

The scheme is likely to be adaptable to a number of likely future scenarios. If cod stocks begin to rise again, the observation trigger would rise above the 40 cod per hour’s trawl to reflect the greater density of cod. Or, if stocks fall, then measures can be tightened.

Perhaps the only current lack of flexibility would be if it was discovered that moving vessels out of the area did not reduce in total cod mortality but just displaced it. In that case the rationale behind temporary closures would fail and a new system of regulating effort or catches would be needed. But that would be a structural change in the scheme, rather than an adaptation.

1.4.4.6 Broader impacts: risks and opportunities
RTCs were a popular policy before implementation amongst many groups. There is a risk that they provide less of an environmental benefit and more of a political benefit, since the environmental outcomes have not been definitively proven. However, the popularity is still strong, and other RTC schemes are growing, in part based on the Scottish scheme, such as the English scheme\(^{203}\) and the juvenile RTC scheme in the North Sea\(^{204}\).

\(^{203}\) [http://marinemanagement.org.uk/fisheries/monitoring/closures_rtc.htm](http://marinemanagement.org.uk/fisheries/monitoring/closures_rtc.htm)
The flexibility of the scheme remains a strong opportunity as so much remains uncertain about cod stock management. The scheme should remain robust to changes such as those brought on by climate change, by other marine policies, or economic changes. That is, it seems likely to be resilient to changes of different types and different levels.

It is likely that the scheme will become more effective as knowledge and technology grows, for example, more reliable VMS signals or greater understanding of cod movements.

1.4.5 Enabling and limiting factors

Two studies in particular have looked at factors that are needed for success of the measure. Catchpole and Gray (2010) list seven factors required for the pilot schemes they assessed to be successful. These factors were based on previous literature assessing marine policies that have worked from various sources around the world. The seven factors were:

- A perceived crisis in the industry;
- Economic incentives;
- Stakeholder participation;
- Funding;
- Expert knowledge;
- Leadership;
- Enforcement.

They suggest that the pilot for Scottish RTCs had “largely met” factors 1-6 and 7 was not applicable as it was voluntary.

Bailey et al (2010) use the Scottish scheme and insights from other schemes around the world to give some key factors as well. They are:

- Legal framework: The scheme works well as part of a system that uses administrative penalties rather than criminal offences, since these may be too slow for the ‘real time’ situations.
- Governance and administrative: the ‘real time’ nature works best within a framework that is fast moving and flexible, and the CCSG provides feedback and consultation between stakeholders that is suitable for RTCs.
- Technical: there are data collection limitations since landings are not the same as catches. However, more advanced technological solutions may be preferred from a theoretical or data perspective – even possibly sampling an identifying areas to close before vessels start catching there – but these would be very expensive.
In general, given the existence of the necessary infrastructure, the only limiting factor is technological - data limitations. The design is strong and robust to change, stakeholder commitment and participation is strong. Enforcement is appropriate both in speed and scale. However, the scheme can only displace effort away from known areas of high cod abundance and it does not measure overall cod mortality, discards and neither does it limit catches.

Complementary measure to RTCs are primarily the other components of the CCS scheme. Together, the whole scheme is designed to provide a flexible framework for the allocation of fishing days' quota - this quota can be increased as vessels opt in to various effort-reducing and effort-displacing options such as particular nets, the amber areas scheme and the RTCs. The RTCs saw large take up initially and are now compulsory within the Conservation Credit Scheme, and the amber areas scheme is cancelled, but vessels still have a choice of various gear options. If RTCs were implemented without a wider quota-allocation system, another regulatory framework would be needed to encourage involvement and discourage violation. The CCS includes long-term closures, such as the Windsock, which in conjunction with RTCs, help magnify the overall effect of the closures. That is, the long-term closures alone are not flexible enough to respond to cod movements, whilst the RTCs are not large enough to provide significant protection. Jaworski and Penny (2009) report that skippers believe that the combination of the Windsock closure and RTCs “should surely help the cod fishery plus other fisheries as well”. They also note the response that since RTCs can be applied temporarily based on real time data, why not the Windsock? This is an interesting point, since it may be that introducing RTCs changes how other schemes and policies are perceived.

1.4.6 Conclusion
The RTC scheme in the Scottish North Sea has provided a flexible tool as part of a wider fishery policy. Whilst it is not completely proven to be successful and effective at reducing cod mortality, it seems popular with stakeholders, researchers and policy makers, and has been applied in an increasing number of situations. Technology allows RTCs to be set up and monitored, but there is still a need for greater assessment techniques. It is highly likely that more RTC schemes will be used around the world, and with the right institutional frameworks, the flexibility and robustness of such schemes should allow it to be used as a key tool for efficient and adaptable fishery management.
1.4.7 Sources


1.5 Marine Protected Areas in the Mediterranean: Medes Islands

1.5.1 Introduction: Marine Protected Areas

The designation, establishment and management of Marine Protected Areas (MPAs) is regarded as an important instrument to safeguard biodiversity and the integrity of ecological processes in the coastal and marine environment. MPAs can range from areas of strict protection to areas zoned for multiple use and must be managed to maintain the full range of biodiversity. The Mediterranean is characterized by a great specific biodiversity, with a high rate of endemism. Amongst the emblematic species are *Posidonia*, red coral, brown grouper, bottlenose dolphin, fin whale, monk seal, loggerhead turtle, and the Lithophyllum rims. But the Mediterranean is ecologically vulnerable and has been subject to growing human pressures for centuries. The establishment of marine protected areas is a measure aiming to provide long-term protection, enabling restoration and the careful use of this natural heritage. MPAs further contribute to increasing the productivity of fishing areas, to regulating the different uses of the sea, to fostering sustainable tourism and to creating new job-generating activities.

There are around 100 MPAs in the Mediterranean, created for a diverse number of reasons, such as: “Restricting fishery activity (number of boats, methods, periods, species); marine protection of terrestrial parks (marine buffer zone); preservation of the flag species (sanctuaries for monk seal, marine turtles, cetaceans); restocking areas (marine reserves); preservation of the marine and/or terrestrial coastal environment (e.g. National Parks, natural marine reserves). Depending on the case and the purpose for which they were created, MPAs have different sizes and regulation differs on what and how to protect within their limits. From those, only forty-one MPAs demarcate no-take zone areas where all forms of exploitation are prohibited, resulting in slightly 200 km² of the Mediterranean fully protected no-take zone areas.

A step beyond creating individual MPAs is to establish a network of MPAs. Through interconnections and interdependencies, individual MPAs of this network can contribute positively to each other’s integrity by decreasing overall vulnerability. In the Mediterranean the only initiative working in this direction is MEDPan, a network of managers of marine protected areas in the Mediterranean. The objective of the network is to improve the effectiveness of marine protected areas management in the Mediterranean.

The MedPAN network today counts over 27 members, mainly managers of marine protected areas from the entire Mediterranean basin (including Medes Islands Marine Reserve), and 16 partners contributing to the strengthening of the network. These

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205 [www.medpan.org](http://www.medpan.org)
206 [www.medpan.org](http://www.medpan.org)
207 Ramos-Esplá, n.d., p.65
208 Pelagos, n.d
209 IUCN, 2008, p.5
210 Abdulla et al, 2008
partners manage more than 30 marine protected areas and are working towards the creation of several new sites. They seek shared common solutions to local problems of a different origin.

Figure 19: Marine Protected Areas in the Mediterranean (source: www.medpan.org)

One Mediterranean MPAs has been selected to be subject to further assessment. This is the Medes Islands Marine Protected area (and extended Natural Park as from end 2010) in Catalunya, Spain.

1.5.2 Environmental problem and objective(s) of the measure
Situated in the heart of the Costa Brava, Catalunya, the Medes Islands constitute one of the principal marine flora and fauna reserves in the Western Mediterranean.

Figure 20: Location of Illes Medes off the Catalan coast, Spain (Source: Red Iberoamericana de Reservas Marinas, 2011)

The archipelago covers an area of approximately 23 hectares and is situated a mile off the Costa Brava. The Medes Islands are a set of seven uninhabited islets called La Meda Gran, La Meda Petita, El Medellot (or La Bota), El Carall Bernat, Les Ferranelles, Els Tascons Grossos and Els Tascons Petits. It is a place of extraordinary biological and
ecological value because of the great variety of its animals and plants (1345 marine taxa identified amongst the plant and animal groups studied) in an outstanding landscape. Its historic value is proved by findings as jars and traps from the Greek era. The terrestrial part of the Reserve has become an ornithological paradise while its marine environment holds exceptional values. This richness has led to its recognition and designation through different regulations (Natura 2000, SPAMI, IBA, etc). Marine resources have been exploited for years by fishermen; particularly coral fishers. The Medes Islands were listed as a marine reserve in 1983 together with the establishment of a non-fishing zone around the islands. Since then, the area has seen a large recovery of its rich seabed and of many sea and land species previously in danger of extinction. The Parliament of Catalonia 19/1990 law for the conservation of the flora and fauna of the Medes Islands reinforced this mission. Main pressures that have been addressed and regulated by the MPA authority include fisheries and uncontrolled sailing, anchoring and diving. The main objectives of the Marine Protected area of the Medes Islands are (Law 19/1990):

- to achieve sustainable development of the municipality directly connected to the Marine Reserve;
- to achieve effective protection of the area and its biodiversity,
- to promote responsible tourism based on the exhibition of natural heritage.

The archipelago lies at less than a mile from l’Estartit municipality. At present more than 70% of the Village’s GDP is directly linked to tourism focused on the islands, mainly through diving, glass-bottomed boats and visits to the underwater trails.

In 2010, the Marine Reserve has been transformed in a Marine and Terrestrial Natural Park passing from ca. 500 to ca. 8.000 ha. The aim is to facilitate a more integrated and rational management of the terrestrial and marine area and help diversifying the leisure and reducing pressures.

The Marine Reserve and recently established Natural Park is managed through the Department of Agriculture, Fisheries, Food and Natural Environment and its Parks Service which has a team working on the spot. The reserve management deals with the coordination of the following domains: natural heritage; public uses and environmental education; control of activities and maintenance; administration and surveillance.

The case study focuses on the following scope:

- The establishment of a Marine Reserve and the “reserve” effect on fauna and flora.
- Regulation of underwater tourism to control impacts and to optimise its benefits as to co-finance the Marine Reserve (50% of the annual budget comes from diving fees,

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211 Muñoz, 2006. Its worth mentioning that Nuria Muñoz is the Director of the Isles Medes Protected Area although she is currently on a two years leave till mid 2012.

212 Muñoz, 2006
which represents the highest share in Europe) and therefore contributing to the conservation and improvement of the marine ecosystem and related resources.

1.5.3 Measure: definition and context
1.5.3.1 Legal background and implementation
Protection of the marine area dates back to a Decree of 1983 which prohibits fisheries and the extraction of live marine resources in a zone of 75 meters around the islands. This protection was extended in 1990 by the Law 19/1990 on the conservation of sea-bed flora and fauna in the Medes Islands, establishing the Marine Partial Nature Reserve. The implementation of this law resulted in the Medes Islands Protected Area becoming one of the most important protected areas in the Mediterranean. These regulations however, only protected the marine, underwater area. The Decree 328 of 1992 approves the Plan for Areas of Natural Interest (PEIN) including and finally protecting the Montgri Massif, the marine and terrestrial part of Medes Islands and the Baix Emporda wetlands. In 2006 the Montgri-Medes y Baix Ter area is designated as Special Protection Area for Birds (SPA) and Site of Community Importance (SCI) joining the Natura 2000 Network. In 2008 the Master Plan for Uses and management (PRUG) is approved for 4 years.
Up to 2010, the Medes Islands Strictly Protected Zone covered an area of 93,2 ha. An additional protected area of 418 ha stretches around the islands, reaching up to the Montgrí coast.
Figure 21: Illes Medes localisation in front l’Estartit Port at Costa Brava, South of Roses Gulf, Girona (Pozo M., et al. 2009). The strictly protected zone is in the inner box.

The area has recognition as Natura 2000 site (2007), Important Bird Area (IBA) and SPAMI (Specially Protected Area of Mediterranean Importance, 2001). It is part of the MEDPAN Network and partner to the MedPan North Programme.

In 2010 the Law 15/2010 establishing the Natural Park of Montgrí, Illes Medes and Low Ter, enlarged and transformed the protected area into a marine and terrestrial Natural Park allowing a more integrated regulation and protection of the area. The marine area has been extended from 511ha to 2037 ha while a terrestrial (coast, river mouth and mountain) area of 6155 ha has been also included. The law declares “Marine Partial Natural Reserve” the marine area around the islands and the marshes and lagoons at Baix Ter. The islands surface is declared “Integral Natural Reserve”. This extension is important to improve the environmental status of the new protected areas but moreover, to help diversify the tourism pressure on the Medes and provide alternatives in the field of nature based responsible tourism.
Figure 22: An overview of the extended Nature Park which was established in 2010. The terrestrial part of the islands has become Integral Nature Reserve (dark blue) while the former marine strictly protected zone is now a Partial Marine Nature Reserve (light blue) and the rest of the former Marine Reserve is considered buffer zone (blue stripes over green). Source: Generalitat de Catalunya, DGMN

The marine part of the Natural Park is now divided into 4 types of zones. The terrestrial part of the islands, inhabited, is classified as Integral Nature Reserve; the surrounding marine area, former Strictly Protected Zone is now Partial Marine Nature Reserve, the rest of the previous Reserve is considered buffer zone and the extended marine area is Nature Park.

The following table reflects the activities allowed, prohibited or regulated at the Partial Marine Nature Reserve and its buffer zone:
Table 10: Activities and type of regulation in Medes Islands MPA

<table>
<thead>
<tr>
<th>Marine Activities</th>
<th>Natural Park</th>
<th>Buffer Zone</th>
<th>Marine Partial Nature Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Littering; camping and lighting fires (on the beach and coast)</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Large scale fishing (trawling and purse seine)</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>To feed sea wildlife</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Underwater recreational fishing</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Surface recreational fishing</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Extraction of marine resources, spoiling animals and plants</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Small scale traditional fishing (trammel net and boulder)</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Diving (snorkeling or scuba diving)</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Anchoring</td>
<td>☑</td>
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</tr>
<tr>
<td>Navigation</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
</tbody>
</table>

☑ Allowed; ☑ Regulated; ☑ Prohibited;

The Law 15/2010 that established the Nature Park of Montgrí, Illas Medes and Baix Ter, set up a governing body, which is linked to the environmental department and brings together representatives from regional government departments with competences linked to the Park, other administrations with competences as the municipalities and bodies representing the main socio-economic sectors as agriculture, fisheries, tourism, culture, recreation, research, environment, private property, hunting and others. This body has not yet been established.

Nevertheless, the Islands Medes Protected Area as established in 1990, does have its management body, the Advisory Board. This body is responsible for the area till the new governing body is established.

The advisory board is chaired by the General Director of Natural Environment of the Catalan Government, and comprises representation of:

- For the Catalan Government: two representatives from the environmental department and one representative from fisheries, from ports and coasts, from tourism, from culture and from sports.
• For the local government: two representatives of the Municipality of L’Estartit, a representative of the Delegation of Girona and a representative of the Regional Council of Baix Empordà.

• For the commercial fishing industry: a representative of the fishermen of L’Estartit.

• For the tourism sector: a representative of the cruise ships present at the Medes Islands, a representative of the dive resorts located in L’Estartit and a representative of L’Estartit Sailing Club.

• For the sports sector: a representative of the Catalan Federation of Sport Fishing, a representative of the Catalan Federation of Underwater Activities.

• For marine science experts: a representative of the academic community and research centres; a representative of the Institute of Catalan Studies, a representative of nature conservation groups and two representatives assigned on behalf of their professional, scientific or cultural activities, who have distinguished themselves in defence of the Medes Islands.

1.5.3.2 Regulation of main activities

Diving and water recreation

Each year an average of about 65,000 dives213 take place in the Protected Area of the Medes Islands. The Medes islands are a diving paradise: 1350 taxa of marine fauna and flora are present; different depths allowing all types of diving, from beginners to experts and numerous caves and tunnels.

This practice however, has negative impacts on benthonic organisms due to physical contact with flippers, body, hands or diving equipment214. This might constitute a serious problem when diving is developed in a MPA with a high rate of frequentation215. The 1990 law for the conservation of flora and fauna of the Medes Islands seabed established a set of measures to try and control these impacts:

- Freezing the number of commercial licenses
- Limiting the number of daily dives to 450
- Establishing measures to control the number of dives
- Organising specific routes for cruise boats
- Setting up an evaluation committee as a body to discuss new measures to be introduced.

213 Source; L’Estartit Tourism Office
214 Zakai and Chadwick-Furman, 2002
215 Sanchez J. et al, 2010
In order to control these impacts it is however necessary to calculate the carrying capacity, defined as the highest possible number of divers per diving point and year, which allows a sustainable use without provoking any degradation. This capacity has a strong dependency with the characteristics of the area, its sub aquatic communities, species present and the behaviour of divers.

The Park authority has therefore commissioned a study to assess the situation at the MPA and provide tools to assess its carrying capacity. The results of this study are presented when evaluating the effectiveness of the measure.

There are 10 diving areas provided with 12 mooring boys and divided in three types depending on the characteristics of the area.

For diving at Medes Islands, it is mandatory to obtain a specific license. The request can be submitted to the Marine Reserve Office or through a Diving Centre. To obtain the licence it is mandatory to have a 2nd class or above diving certificate (or international equivalent), a federation license or private insurance, boat documents and an initiation certificate.

Snorkelling is allowed without permit for individuals but organised groups do need authorisation. Only in 2009 there were 12,000 snorkelling outings through authorised centres.

Zakai and Chadwick-Furman, 2002

This is the study referred to as Sanched J. et al, 2010.

Capellá J. 2009. Study based on data from the l’Estartit Tourism Office, the MPA and interviews to local operators.
Individual dives are the less numerous, about 3,000 in 2009, while most immersions are facilitated by accredited Centres which are grouped in two types:

- **Category A**: where one can carry out up to 37 dives a day without obligation of taking a guide, even though one does to use guides depending on difficulty, level of the divers and meteorological conditions. There are 8 category A centres.

- **Category B**: here one can carry out a maximum of 16 dives a day which must always be guided. There are 6 category B centres.
Other recreational activities include Sea Kayak and underwater tours or sea watching tours that were initially organised by the Estartit Tourist Office and are now offered by private companies, introducing the heritage of the Medes Islands to the general public.

**Fisheries**

The Law 15/2010 established the Natural Park of Montgrí, Illes Medes and Low Ter, and regulates professional artisanal fisheries in the Natural Park, albeit additional regulations can come from the next Park Management.

**Table 11:** Overview of regulations in Park areas

<table>
<thead>
<tr>
<th>Natural Park</th>
<th>Buffer zone (previous Marine Protected area)</th>
<th>Marino Partial Natural Reserve (former Strictly Protected Area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art. 5.3 Prohibits</td>
<td>Art 8 prohibits Trawling and purse seine fishing</td>
<td>Art 7 prohibits All forms of fishing or marine resources harvesting and the possession of fishing gear. Mooring</td>
</tr>
<tr>
<td>Trawling and purse seine fishing</td>
<td>Aquaculture installations</td>
<td>Recreational surface fishing with more than one rod/license</td>
</tr>
<tr>
<td>Aquaculture installations</td>
<td>Recreational surface fishing</td>
<td>Recreational underwater fishing</td>
</tr>
<tr>
<td>Fishing competitions</td>
<td>Recreational surface fishing with just one rod/license</td>
<td></td>
</tr>
<tr>
<td>Red Coral harvesting</td>
<td>Allows: Traditional fishing (gillnet and long line)</td>
<td>Allows. Extractions of authorised scientific research</td>
</tr>
<tr>
<td>Allows: Traditional fishing (gillnet and long line)</td>
<td>Recreational surface fishing with just one rod/license</td>
<td></td>
</tr>
<tr>
<td>Recreational surface fishing with more than one rod/license</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Jozami S. 2011

**1.5.3.3 Relation to other policy initiatives**

The establishment of the Marine Protected Area at first and the larger nature park later on has been based upon the framework of national, European and international legislation and regulations on this field. It is especially based on the implementation of the Birds and Habitats Directives and the establishment of the Natura 2000 network. As already mentioned, the Decree 328 of 1992 approved the Plan for Areas of Natural Interest (PEIN) including and finally protecting the Montgrí Massif, the marine and terrestrial part of Medes Islands and the Baix Emporda wetlands. In 2006 the Montgrí-Medes y Baix Ter area is designated as Special Protection Area for Birds (SPA) and Site of Community Importance (SCI) joining the Natura 2000 Network as ES5120016. This process has
resulted into enlarging the MPA into a terrestrial and marine Nature Park in order to provide it with legal protection under the national and regional legislation and a suitable management structure.

Moreover, the Medes Islands were declared Specially Protected Areas of Mediterranean Importance (SPAMI) in November 2001. This legal figure is defined by the Barcelona Convention 1995 Protocol Concerning Mediterranean Specially Protected Areas and Biological Diversity in the Mediterranean (which replaced the 1982 Protocol Concerning Mediterranean Specially Protected Areas). According to its Article 8(2) SPAMI are sites "of importance for conserving the components of biological diversity in the Mediterranean; contain ecosystems specific to the Mediterranean area or the habitats of endangered species; are of special interest at the scientific, aesthetic, cultural or educational levels". The Protocol establishes the obligation to protect, preserve and manage these areas in a sustainable and wise way, in particular through the establishment of protected zones.

1.5.4 Evaluation of the measure

1.5.4.1 (Environmental) effectiveness

Goal achievement

The main objective of any MPA is the conservation of its natural heritage and its biodiversity. The Medes Islands were listed as a marine reserve in 1983. Since then the area has seen a large recovery of many sea and land species previously in danger of extinction. Species such as cattle egrets, little egrets and night herons have returned to the islands. The Medes Islands, are home to one of the largest breeding colonies of Yellow-legged gulls in the Mediterranean. In addition about 40% of the Catalan population of Shags nests on the Islands as well.

The reserve effect is especially significant with regard to sea birds (since the terrestrial part is now inhabited) and sedentary fish species.

It can be stated that the MPA has met its objective of protecting vulnerable fish species and recovery populations even to the level of its carrying capacity; however, this effect is not seen outside the strictly protected zone. The lack of "reserve effect" outside these limits is, most possibly, due to illegal fishing practices in the buffer zone and Nature Park. A larger effort in surveillance is therefore needed.

Regarding other indicators there is evidence that the high frequentation and anthropogenic pressure brings negative impacts to Posidonia oceanica - a seagrass species endemic to the Mediterranean Sea- (mainly by mooring) and tored corals (diving and illegal harvesting). The prohibition of anchoring and the installation of ecologic mooring buoys within the Marine Partial Nature Reserve since 1990 have resulted on less impacts on Posidonia oceanica in this area where monitoring shows stability as to density and coverage as well as an increment of associated species as the fun mussel which are
decreasing in other Mediterranean areas. Negative impacts are however visible in those areas of the Nature Park and Reserve Buffer Zone were anchoring is not yet regulated. Recreation, specially diving, represents a very important income for the village next to the reserve and diving taxes represent 50% of the MPA budget. The new plan will face the challenge of giving one more step to try to find the equilibrium between conservation and economic development, posing the weigh in conservation.

Effectiveness in relation to GES (MSFD)

The Reserve effect

The area has been systematically monitored since 1990. This is one of the longest monitoring efforts in a MPA in the Mediterranean sea basin.

Photo: Marine Reserve Archive

The monitoring programme focuses on the following species and communities: those fishes most vulnerable to fisheries efforts, red coral communities (*Coralium rubrum*), *Posidonia oceanica* fields, red gorgonian (*Paramuricea clavata*), crustaceous (as *Pinna nobilis*) and algae.

The main objectives of the monitoring exercise are:

- To evaluate the MPA management in relation to environmental factors and human activities that take place.

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To analyze the current state of biological descriptors, both species and communities (fish, red coral, red gorgonian and Posidonia) to evaluate the state of conservation of marine habitats and populations.

To analyze the temporal evolution of these indicators and the effect of the protection.

To analyze anthropogenic and environmental impacts in these areas: in particular of regulated activities as artisanal and recreational fishing, diving, navigation and harvesting of red coral.

To propose measures deemed appropriate to improve management and achieve a dynamic management model of protected area that achieves a sustainable balance between development (tourism and frequentation of protected areas) and conservation of its natural heritage.

For the purpose of this case study, three indicator species have been selected as they serve best to evaluate the regulation of fisheries (fish species), the impact of diving and poaching (red coral) and the results of mooring management (posidonia).

**Fish organisms in rocky coastal waters**

The structure of fish communities in a specific environment and specific period of time, is a good indicator of the state of environment and its evolution.

The monitoring of vulnerable species starts at the Medes Strictly Protected Marine Reserve in 1991, focusing on one species: the Dusky Grouper (*Epinephelus marginatus*). In 1992 the monitoring is extended to 6 very vulnerable species: the also sedentary Brown meagre (*Sciaena umbra*), and more mobile and less habitat dependent species as Common dentex (*Dentex dentex*), Gilthead seabream (*Sparus aurata*), Red porgy (*Pagrus pagrus*), Zebra sea bream (*Diplodus cervinus*), and European seabass (*Dicentrarchus labrax*). In 1994 the study area was extended to the Montgri coast present within the protected area, bordering the Strictly Protected zone. This, in order to try to find evidence of adults spreading from the protected to non protected areas (spill over) and later on to another zone outside the MPA but inside the Natural Interest Zone in order to assess the impact of underwater fisheries (prohibited in the MPA). In total 28 vulnerable or interesting species have been registered from which 23 have been taken census of.

It is clear that the maximum number of species is in the Marine Partial Reserve (former Strictly Protected Zone, ZEP) at Tascons- Ferrandelles-Carall Bernart, which is the area presenting the best results for all descriptors. The difference between the ZEP and the other areas AP (Protected zone, currently buffer zone) and EIN (currently Natural Park) is very substantial. The higher the degree of protection, the more species are present.

Looking at all highly vulnerable species, these are all presents in the ZEP, area with the maximum protection, while some are absent in the other areas. It is worth highlighting the
absence of the European seabass (*Dicentrarchus labrax*) outside the ZEP as well as the Dusty Grouper (*Epinephelus marginatus*) outside the Area Protegida (protected zone, actually buffer zone).

The abundance and biomass is also relevant to quantify the “reserve effect”. The monitoring focuses on species which are vulnerable to fishing efforts and therefore can reflect the effect of the protection of the area.

Regarding abundance, 5743 fishes were accounted in 2009, from 25 different species (see table bellow) from which 69% were *Diplodus vulgaris* and *Diplodus sargus*, followed by Mullus surmuletus, Sciaena umbra, Spondylus cantharus and Epinephelus marginatus which jointly represent 85% of the abundance. The table bellow shows the percentages of abundance in each protection zone. The highest density of very vulnerable species is found at the areas with stricter protection.

Table 12: Total abundance at Àrea Protegida de les Illes Medes i la Costa del Montgrí 2009. Results for different levels of protection: ZEP (Strictly Protected), AP (Protected zone or buffer zone) EIN (Nature Park)

<table>
<thead>
<tr>
<th>ESPECIE</th>
<th>Total/spp</th>
<th>%</th>
<th>ZEP</th>
<th>AP</th>
<th>EIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dasyatis pastinaca</td>
<td>4</td>
<td>0.07</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Dentex dentex</td>
<td>121</td>
<td>2.10</td>
<td>2.16</td>
<td>3.29</td>
<td>0.11</td>
</tr>
<tr>
<td>Dicentrarchus labrax</td>
<td>38</td>
<td>0.66</td>
<td>1.24</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Diplodus cervinus</td>
<td>59</td>
<td>1.03</td>
<td>1.01</td>
<td>0.43</td>
<td>0.17</td>
</tr>
<tr>
<td>Diplodus puntazzo</td>
<td>123</td>
<td>2.15</td>
<td>2.21</td>
<td>1.00</td>
<td>0.56</td>
</tr>
<tr>
<td>Diplodus sargus</td>
<td>1405</td>
<td>24.47</td>
<td>17.03</td>
<td>27.57</td>
<td>11.33</td>
</tr>
<tr>
<td>Diplodus vulgaris</td>
<td>2562</td>
<td>44.61</td>
<td>33.47</td>
<td>47.00</td>
<td>25.22</td>
</tr>
<tr>
<td>Epinephelus marginatus</td>
<td>160</td>
<td>2.47</td>
<td>2.44</td>
<td>0.36</td>
<td>0.00</td>
</tr>
<tr>
<td>Labrus merula</td>
<td>41</td>
<td>0.71</td>
<td>0.29</td>
<td>0.86</td>
<td>0.50</td>
</tr>
<tr>
<td>Labrus viridis</td>
<td>17</td>
<td>0.29</td>
<td>0.25</td>
<td>0.07</td>
<td>0.22</td>
</tr>
<tr>
<td>Mola mola</td>
<td>1</td>
<td>0.02</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Mullus surmuletus</td>
<td>562</td>
<td>9.78</td>
<td>2.02</td>
<td>18.07</td>
<td>7.17</td>
</tr>
<tr>
<td>Muraena helena</td>
<td>5</td>
<td>0.08</td>
<td>0.10</td>
<td>0.00</td>
<td>0.06</td>
</tr>
<tr>
<td>Myliobatis aquila</td>
<td>3</td>
<td>0.06</td>
<td>0.19</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Pagrus pagrus</td>
<td>14</td>
<td>0.25</td>
<td>0.08</td>
<td>0.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Phycis phycis</td>
<td>5</td>
<td>0.09</td>
<td>0.04</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Sciaena umbra</td>
<td>365</td>
<td>6.36</td>
<td>4.52</td>
<td>1.64</td>
<td>0.33</td>
</tr>
<tr>
<td>Scorpaena porcus</td>
<td>2</td>
<td>0.03</td>
<td>0.00</td>
<td>0.14</td>
<td>0.00</td>
</tr>
<tr>
<td>Scorpaena scrofa</td>
<td>6</td>
<td>0.11</td>
<td>0.08</td>
<td>0.07</td>
<td>0.11</td>
</tr>
<tr>
<td>Seriola dumerilis</td>
<td>1</td>
<td>0.02</td>
<td>0.01</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Sphyraena aurata</td>
<td>50</td>
<td>0.88</td>
<td>0.74</td>
<td>0.36</td>
<td>0.39</td>
</tr>
<tr>
<td>Sphyraena viridensis</td>
<td>1</td>
<td>0.01</td>
<td>0.08</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Spondylus cantharus</td>
<td>180</td>
<td>3.14</td>
<td>3.32</td>
<td>1.00</td>
<td>1.72</td>
</tr>
</tbody>
</table>

When transforming abundance into estimated biomass (see fig bellow) it is clear that there has been an increment of biomass in all areas in all levels of protection. In some cases biomass has doubled from 2008 to 2009.
The “reserve effect” seems to be the main reason for the differences in fish distribution in very vulnerable and vulnerable species at Illes Medes and Montgrí coast. However, there are heterogeneous results between study zones within the same degree of protection. Therefore, there are other factors to be considered. The differences in the habitats seem to be determining the distribution of species. The results are more homogeneous when monitoring stations are grouped by habitat type. The density of population is linked to the habitat type and extension.

The differences between the Strictly Protected Zone (ZEP) and the rest of the Reserve and Nature Park are remarkable and stable in time. The prohibition of fisheries activities should result of an increase of population of the exploited species, but whereas this effect is clear in the ZEP it is not shown for the rest of the protected area. The monitoring also shows that the ZEP is reaching its carrying capacity of the studied vulnerable species and populations are stable.

The ZEP is very effective for the protection of very vulnerable and sedentary species as the Dusky Grouper. In general, densities, biomass and sizes of vulnerable species is higher in the ZEP (even 5 times higher in the case of the Grouper) and therefore the protection level and management of this zone can be considered positive as to fish species.
However, **there are no clear positive results for the larger protected area when compared to the rest (unprotected) coastal zone.** This is not the case in other Spanish MPA where the reserve effect in other areas is clear. **There is evidence of illegal fishing in this area which could be of the cause of these negative results. Efforts on surveillance should be stressed.**

*Coral communities: indicator* Corallium rubrum*221*

Red coral is a Mediterranean endemic species of high commercial, aesthetic and ecological value. The characteristics of Illes Medes and Montgrí coast marine bottom (tunnels, caves…) provide good conditions for the development of red coral populations easy to access when diving. This results in attracting thousands of divers a year, especially at the Marine Reserve, where there is a diving industry fully developed and established and bringing income to the local economy. However, this attractiveness poses difficulties for protection.

Monitoring shows that only one of the populations of red coral presented a positive growing tendency through the years until it suffered a regression in 2009 as to the basal diameter, getting back to values of the ‘90s. The other populations have maintained their level but have not improved. Many signs are found of supposedly accidental breaks. Medium density of coral relates negatively to the level of frequentation by divers.

**After almost 25 years of monitoring red coral in the protected area, the results are not those which should be expected (increase in density, height and basal diameter) at no-exploitation zones. There are documented episodes of illegal harvesting up to 2005. This, together with the impact of divers, could be the reason for not obtaining a better evolution. These anthropogenic factors must be addressed by adequate protection and management measures.**

*Fields of marine fanerograms: indicators* Posidonia oceanica and Pinna nobilis*222*

*Posidonia oceanica* fields are one of the most important marine communities in the Mediterranean, hosting a high diversity of species and constituting reproduction areas for species of commercial interest. On the other hand they play a very important role in the regulation of the littoral dynamics, in the water transparency and its oxygenation.

The posidonia fields at Illes Medes and Montgrí coast show perturbations and low density. According to the optimum figures for the Catalan coast*223* they are classified as

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222 Idem 18

223 Submon, 2009
low density, with values between 25% and 50% in relation to the optimum density. One of the factors provoking this situation seems to be the water turbidity and the fact that the islands are just 3 km away from the Ter river mouth.

The monitoring of this field is recent and **there is no historical data to compare and determine whether the situation is stable. However, there is a clear difference between the areas where there is regulated mooring and those where the practice is free. The prohibition of anchoring and the installation of ecologic mooring buoys within the Marine Partial Nature Reserve since 1990 have resulted on less impacts on Posidonia oceanica in this area where monitoring shows stability as to density and coverage as well as an increment of associated species as the fun mussel which are decreasing in other Mediterranean areas.** Negative impacts are however visible in those areas of the Nature Park and Reserve Buffer Zone were anchoring is not yet regulated.

The indicator showing the effects of mooring is the density of fun mussel (*Pinna nobilis*). The census shows much lower density at those stations where unregulated mooring is allowed as compared to those were it is regulated. **This should guide management measures as regulated mooring boys and upper limits to the number of boats in the areas of highest frequentation.**

*Diving impacts on Descriptor 6 (sea-floor integrity)*

Diving activities are of extreme importance for the Reserve as they bring revenue through taxes of ca. 50% of the annual budget of the Reserve. However, underwater tourism has an impact on caves, corals and gorgonians. The Park is trying to minimize this impact by working closely with companies providing diving services and training monitors into eco-briefing, meaning a briefing right before the immersion, already on the sea, about the potential impacts of the visit.

The Park authority has commissioned a study[^224] to assess the situation at the MPA and provide tools to assess its carrying capacity. This capacity has a strong dependency with the characteristics of the area, its sub aquatic communities and species present and the behaviour of divers.

The study assesses the impacts of diving on benthonic communities by:

- Quantifying the impact of divers with regard to their category (preparation, age, sex, use of cameras)
- Assess the impact caused depending on the visited community (sediment re-suspension, species breaching, etc.)

[^224]: This is the study referred to as Sánchez J. et al, 2010. This is the basis for the whole subchapter.
- Define the time which can be spent over fragile communities depending on the activity
- Establish monitoring points to assess biodiversity as an indicator of the impact and/or evolution of diver’s behaviour.

The study was conducted in the Marine Partial Natural Reserve of the Medes Islands (former Strictly Protected Zone). There are 10 diving areas provided with 12 mooring buoys and divided in three types depending on the characteristics of the area.

![Diving areas per category](source: Sánchez J. et al, 2010)

- Horizontal (green): dives of little depth on bottoms of blocs or mega-blocs, posidonia fields, where impacts are linked to floatability issues.
- Vertical (red): dives on vertical walls, usually covered by gorgonians, which can get very deep. Impacts are usually caused by getting close to the walls.
- Dives in caves (yellow): dives in closed spaces as caves and tunnels, usually with fragile and low speed growing species where impacts are due to the small dimensions of the areas.
For diving at Medes Islands it is mandatory to obtain a specific license. The request can be submitted to the Marine Reserve Office or through a Diving Centre. To obtain the licence it is mandatory to have a 2\textsuperscript{nd} class or above diving certificate (or international equivalent), a federation license or private insurance, boat documents and an initiation certificate, accompanied by a monitor with higher level. Dives are facilitated by accredited Centres which are grouped in two:

- Category A: which can carry out up to 37 dives a day without obligation of taking a guide, even though they do use guides depending on difficulty, level of the divers and meteorological conditions. There are 8 category A centres.
- Category B: which can carry out a maximum of 16 dives a day and they must always be guided. There are 6 category B centres.

Data was collected and evaluated by on the one hand studying the relation between contacts and diving areas, centres and divers and, on the other hand, comparing the new data with previous studies. The results of the study of the behaviour of 166 divers between July and September 2010 can be summarised as follows\textsuperscript{225}:

- The mean number of dives contracted through diving centres is 66.000.
- The mean particular dives per year during the last 6 years were 2.320.
- Average registered depth 26,7 m.
- The average duration per dive is 51 minutes.
- 37% of dives are in caves.
- 53% of divers had contact with the seabed.
- 66,27% used a Category A diving centre while the remaining used a Category B. Divers using Category A centres realised more contacts (almost three times as much) than those using Category B ones.
- 74,10% of the divers had received a previous eco-briefing or explanations about responsible diving previous to the dive.
- 43,98% of the divers had the support of a guide (independently of the type of centre).
- 25,90% of divers had a photo camera. They caused more contacts.

Regarding the divers category, there were no significant differences in number of contacts in relation to age, sex, level, experience, depth or use of focus/lamp in the dives.

\textsuperscript{225} Jozami, 2011
In terms of management of the impact of this activity, it is especially relevant to highlight that the *divers with horizontal profile cause more impacts on the sea floor than the other types.*

*Divers using Category A centres have three times more contacts than those of Category B. Divers with guide, no matter the type of centre, have less number of contacts. There is a significant difference in the number of contacts between divers and biodiversity when there is an eco-briefing done before diving, resulting in fewer contacts.*

Due to the impact of this increasing activity, *it is essential to calculate the carrying capacity of the Park according to the type of habitats and determine upper limits of divers for the different areas, reducing the frequentation of the Reserve and regulating it better in the Park.* Rotating zones is not advisable as once a community has been impacted the recovery is slow and its full recovery difficult. It is therefore advisable to keep fixed areas. Most important, there is a need for a more strict surveillance and enforcement of the rules (time tables, zones, numbers of divers, illegal mooring buoys, etc). In view of the formulation of the new Management Plan for the whole of the Nature Park, some experts recommend, among other measures, to decrease the maximum number of divers in the Reserve and create new diving areas in the Nature park to decrease over-frequentation, to establish the obligation to use the services of guides and to make mandatory that guides and trainers have environmental education, and provide an eco-briefing prior to the immersion.

1.5.4.2 Information on costs and benefits

Cost and benefits of the instrument

The archipelago lies at less than a mile from l’Estartit municipality. At present more than 70% of the Village’s GDP is directly linked to tourism focused on the islands, mainly through diving, glass-bottomed boats and visits of underwater trails.

There are studies which have been conducted by the Tourism Office dating as from 2004, showing the financial benefits for the surrounding local communities of having the Reserve. At 2009 the economical impact is calculated to be over 10 million € for 2011.

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226 The team of University of Girona, which is conducting an evaluation and providing recommendations for the Management Plan Revision: Josep Lloret, Vanessa Rubio Mendoza and Toni Font Payeras

227 Muñoz, 2006
Table 13: Visitor information and economic impact of Medes Islands MPA 2009

<table>
<thead>
<tr>
<th>Number of immersions/dives</th>
<th>3,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diving Centres</td>
<td>64,000</td>
</tr>
<tr>
<td>Outside the Reserve</td>
<td>12,800</td>
</tr>
<tr>
<td>Snorkelling</td>
<td>12,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of users</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maritime excursions (boat)</td>
<td>125,000</td>
</tr>
<tr>
<td>Particular boat users</td>
<td>25,000</td>
</tr>
<tr>
<td>Kayak</td>
<td>6,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economic impact in Euros</th>
<th>Way of calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particular divers</td>
<td>40,500 (5 € bottle + 3,50 € tax + 5 € complementary expenses)</td>
</tr>
<tr>
<td>Diving centres</td>
<td>1,600,000 (25 € media)</td>
</tr>
<tr>
<td>Divers outside the reserve</td>
<td>281,600 (22 € media)</td>
</tr>
<tr>
<td>Snorkelling</td>
<td>360,000 (24 € (incl. tax) + 6 € complementary expenses)</td>
</tr>
<tr>
<td>Kayak</td>
<td>155,000 (20 € + 6 € complementary expenses)</td>
</tr>
<tr>
<td>Maritime excursions</td>
<td>2,750,000 (125,000 users x 16 € ticket + 6 € media expenditure)</td>
</tr>
</tbody>
</table>

**Economic impact of activities**: 5,188,100

<table>
<thead>
<tr>
<th>Impact generated by divers expenses on accommodation, lodging and others</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Media de immersions per person</td>
<td>Total: 21,000 persons</td>
</tr>
<tr>
<td>Media of overnights</td>
<td>2.5</td>
</tr>
<tr>
<td>Media total expenditure per day</td>
<td>95 €</td>
</tr>
<tr>
<td>Medium expenditure according to Tourism Studies institute 95 € <a href="http://www.iet.tourspain.es/">http://www.iet.tourspain.es/</a></td>
<td></td>
</tr>
</tbody>
</table>

**Impact through other divers expenses**: 4,987,500

**TOTAL IMPACT**: 10,175,600

Source: Capellà J. 2009

It is estimated\textsuperscript{229} that the MPA has resulted in the creation of new enterprises and new jobs (16 new enterprises and 180 new jobs on the sector), the consolidation and loyalty of a new demand (ca. 70,000 pax\textsuperscript{229}) and getting away from tourist seasonality offering a product attractive for tourists during 7 months a year.

**Financing (state-private funds)**

The MPA raises about 50% of its annual budget from diving taxes (3,5 € per person/dive) which are estimated on an average of 227,000 € per year in the 2008 Management Plan. The Catalan government provides the remaining amount up to a total budget of ca.\textsuperscript{229} Muñoz N, 2006

\textsuperscript{229} pax is short for visitors, passengers or clients in tourism business.
Suitability – Fit for use (context) and feasibility

The historical limited extension of the Marine Reserve could have hindered the interaction with the nearby coastal area and resulted in a strong over frequentation of the MPA, with negative impacts in its ecosystem. The enlargement of the protected area with the terrestrial part and the qualification as a Nature Park (passing from ca. 500 to ca. 8,000 ha.) is an adaptation that might better serve the conservation and sustainable development objectives. It is early to assess how the new size will manage to contribute to distribute the pressure of recreation in a larger area and time scale as the Management Plan is now under development. Addressing the impacts of the tourism pressure is one of the priorities of the new plan and the evaluation will be possible in a few years time.

We can consider the regulation of underwater tourism appropriate to the conditions but some negative impacts are still resulting from this practice. Adaptation measures include studies on carrying capacity and training and awareness of monitors and divers. The Park is trying to minimize this impact by working closely with companies providing diving services and training their monitors into eco-briefing, meaning a briefing right before the immersion, already on the sea, of the potential impacts of the visit. It has been proven that this system results in a much careful conduct when diving. The scientific community is almost unanimous when stating that diving pressure and impacts need to be further addressed and regulated in the new plan.

As already mentioned, recreation linked to the MPA, specially diving, represents a very important source of income for the village next to the reserve, and diving taxes represent 50% of the MPA budget. The new plan will face the challenge of giving one more step to try and find the equilibrium between conservation and economic development, posing the weigh in conservation and aiming to sustainability.

Social, legal and institutional context

Legal basis and rationale

The MPA is established by a law which also sets its management objectives. Because of this, the management measures are politically supported.

Preliminary opposition by the local population has been reported. In the case of Medes Islands, nowadays the municipality of Montgrí and village of L’Estartit fully support the MPA as a tool to protect their natural and cultural heritage and, at the same time, obtaining financial benefits. The main activities carried out in the protected area of the Medes Islands are directly linked to the observation of its natural marine heritage. Many enterprises organise scuba diving outings, commented underwater itineraries as well as...
boat trips around the Medes Islands protected area. Private individuals are also allowed to visit the marine reserve with the obligation to use mooring buoys.

Moreover, the area is of great importance to research: doctoral and master thesis, and European programmes for the study of target species (sponges, gorgonians, red coral, lobster, etc) address this area.

Institutional capacity to implement and control

In the newly enlarged Natural Park the same human resources are deployed as in the former Marine Reserve. This is not sufficient in view of the new extension of the park (from 511ha to 8192ha) and new needs for surveillance, monitoring and maintenance. The Park counts 7 permanent staff and 4 additional staff during the high season (July and August). The current crisis situation has not allowed a new allocation for human resources, which are expected in the future. Considering the results presented under the evaluation of the environmental effectiveness of the measure, it is clear that quite more resources need to be allocated to surveillance. Innovative instruments as cooperation with the private sector or other government departments on surveillance issues could be implemented. This could e.g. be done by cooperation between fishermen and the coast guard.

1.5.4.5 Flexibility and adaptability

The MPA is established by a law which also sets its management objectives allowing little flexibility as to the objectives. There is however flexibility to establish the measures to reach those objectives. The Management Plan is to be revised every 4 years following and evaluation of the previous one enabling its adaptation.

1.5.4.6 Broader impacts: risk and opportunities

The most serious risk posed to the MPA is that over frequentation and under surveillance result in larger impacts to the area and will seriously affect its values and ecological sustainability. The MPA management authority is aware of the worse-case scenario which, would not benefit the private sector, which very much depends on the reserve. There are therefore good expectations that agreements will be reached for the use of new tools and regulations that will help minimise the impact. Surveillance, especially of illegal fishing, illegal coral harvesting and mooring, should be stressed. It would be an opportunity to try and reach agreements with the private sector, especially with diving companies, to support surveillance and monitoring tasks as the MPA and its values are the basis for their business and they constitute one of the impacts received by the area.

The cooperation of artisanal fishermen could also be sought as it is mainly due to illegal fishing that the “reserve effect” is not noticeable outside the Non-take area. A stronger control should result on increased fish populations from which they could benefit.
The new extension of the Nature Park is further an opportunity to diversify the leisure offer and lower the pressure on the MPA, providing options for the terrestrial part or coastal areas within and outside the Nature Park.

At a Mediterranean level, the effort of different MPAs should be coordinated. MPAs should look for commonly agreed measures and solutions to key shared problems in order to avoid that pressures pass from one to the other. Illes Medes is working in this direction in the framework of the MedPan network and their role in the MedPan North project co-funded by the European Regional Development Fund. The project started in July 2010 and runs until June 2013. The aim of the MedPAN North project is to improve MPA management effectiveness, including the marine Natura 2000 sites and to contribute to the establishment of a network of MPAs, as part of the international commitments, and particularly the European commitments in this area.

1.5.5 Enabling and limiting factors

The establishment and management of MPAs in general requires some enabling factors without which its real effectiveness would be very limited. To the purpose of this study these have been grouped in the following categories, which also reflect to some extent their order of importance:

- **Legal and institutional Framework**: to create legislative conditions and a strong legislative framework. In EU countries the implementation of related EU directives triggers this process.

- **Strategic planning and management**: this set of factors would include the need to participatory agree with all relevant stakeholders on an adequate and implementable Management Plan, addressing key conservation objectives; make sure to establish a good mechanism of surveillance to ensure respect to regulations; make sure that monitoring of the effectiveness of the measure is carried out well, in order to evaluate and improve management and be aware of the sufficient scale of implementation

- **Financial and socio-economical**: be aware that the measure must have a positive impact on major economic sectors or at least does not cause harm to these sectors; try and keep the costs of implementation low and consider the use of taxes on recreational activities in the MPA which can constitute a relevant source of income.

- **Public acceptance and ownership**: creating public acceptance through communication, awareness, participation, conflict resolution and agreements; stress ownership of the measure (both by the MPA manager and society); emphasize the socioeconomic benefits for the local communities, and proof that by means of research and monitoring.

- **Coordination and networking**: the effort of different MPAs must be coordinated. MPAs should look for commonly agreed measures and solutions to key shared problems in order to avoid that pressures pass from one to the other
Once an MPA has been established special attention will need to be given to **limiting factors** which might hamper its effectiveness, including for example:

- Lack of historic monitoring data or incompatibility with new monitoring methodologies;
- Lack of proper surveillance (and the difficulty/cost to carry it out on sea) can affect the effectiveness of conservation measures (e.g. illegal capture of red coral in the Medes islands)
- Illegal behaviours in protected areas might hamper not only the conservation and recovery of the protected area but affect the reserve effect in the adjacent zones as well.
- Recreational activities based on natural heritage (as diving) must be regulated in a way that the conservation objective is prioritised and the impact of the activities minimized.
- Opposition of economic sectors, especially fisheries.

### 1.5.6 Conclusion

The Reserve constitutes a model to understand the evolution of natural systems in a zone where certain activities are prohibited.

In the case of Medes Islands it can be stated that the MPA has met its objective of protecting vulnerable fish species and recovery populations even to the level of its carrying capacity; however, this effect is not seen outside the strictly protected zone. The lack of “reserve effect” outside these limits is, most possibly, due to illegal fishing practices in the buffer zone and Nature Park. A larger effort in surveillance is therefore needed.

Water and underwater recreation is an opportunity for marine reserves, regarding economic benefits (through taxes), integration in local economy bringing benefits, and education and awareness. In the case of Medes Islands, diving represents a very important income for the village next to the reserve and diving taxes represent 50% of the MPA budget. There is evidence however that the high frequentation and anthropogenic pressure brings negative impacts to *Posidonia oceanica* (mainly by mooring) and red corals (diving and illegal harvesting). The prohibition of anchoring and the installation of ecologic mooring buoys within the Marine Partial Nature Reserve since 1990 have resulted on less impacts on *Posidonia oceanica* in this area where monitoring shows stability as to density and coverage as well as an increment of associated species as the fun mussel which are decreasing in other Mediterranean areas. Negative impacts are however visible in those areas of the Nature Park and Reserve Buffer Zone were anchoring is not yet regulated. These anthropogenic factors are to be taken into account.
when agreeing on the new regulations for the management of the area (Management Plan 2012-2016). The new plan will face the challenge of giving one more step to try and find the equilibrium between conservation and economic development, emphasizing conservation.

1.5.7 Sources

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**Expert contacts that have provided personal communications:**

- Álex Lorente, Marine Technical Officer at Montgrí, Medes Islands and Lower Ter Natural Park. Catalan Government, Department of Agriculture, Fisheries, Food and Natural Environment
- Josep Capellà: Tourism expert and author of the study regarding benefits for the local communities directly linked to the Illes Medes Marine Reserve. Former Tourism Councillor of L’Estartit and Head of Communication of Land and Landscape Foundation (Territori I Pasissatge)
- University of Girona team which is providing and evaluation and recommendations for the Management Plan Revision: Josep Lloret, Vanessa Rubio Mendoza and Toni Font Payeras
2 Annex 2: Approach to establish interconnections between measures and MSFD-elements

The link between measures and MSFD-elements has been established in a two-step approach:

Step 1: Definition of the link between measures and i) pressures and impacts (as defined by MSFD, Annex III Table 2) and ii) sectors and/or uses.

The interconnection for the majority of measures could be established in a sound way. The bulk of the allocation difficulties have been observed in the classification of measures related to the impacts of contamination by hazardous substances, systematic and/or intentional release of substances and nutrient and organic matter enrichment. The following judgemental approach has generally been used, except in the situations where two of the “chemical” substances were mentioned:

- systematic and/or intentional release of substances generally relates to measures regarding air pollution (NOx, SOx, etc.)
- contamination by hazardous substances relates to measures regarding oil prevention, etc.
- nutrient and organic matter enrichment generally relates to measures regarding waste water treatment, port reception facilities and agricultural activities.

Other difficulties often related to measures targeting nature conservation e.g. designation of MPAs. These MPAs clearly address multiple pressures (avoidance of extraction of species, marine litter, invasive species, noise, etc.). For reasons of consistency, we generally opted to link these measures with nature conservation (as a user) and impact category biological disturbance. The most suited pressure was assumed to be selective extraction of species (decrease in biodiversity) but this is not necessarily based upon a direct relation.

Besides establishing interconnections with pressures, the measures have also been linked with possible driving forces for the pressure, i.e. a sector or use. Attention has primarily been focused at the most dominant sectors or (in case) sectors that are particularly targeted by the identified measure. For most sectors, pressures are highly

230 In these situations, the links have been presented as two different rows in the database. As such, the measure could indeed be found for the two associated pressures.

231 It is worth noting that nature conservation is not a driving force for the pressure in these situations. Nature conservation more contributes to the future possible uses relying on the results of nature conservation activities.

232 Sometimes activities have been added to the table but the definition of a standard set of activities has appeared to be challenging.
related to a certain phase or activity that emphasize the time-aspect of the pressure (e.g.,
noise disturbance due to pile-driving during the construction phase of a wind farm,
seabed disturbance due to beam-trawling (execution phase). The inventory includes
some (more technical) measures related to the development/construction and or
dismantling/decommissioning of specific attributes of a user (ship, pipeline, construction,
etc.), where the pressure on the marine environment arises from specific phase of the
activities. Such information can be included in the columns that are dedicated for
qualitative information. For the sector fisheries for example, it might be relevant to
indicate the severe impact of trawling and distinguish between beam trawling and other
fishing techniques.

**Step 2: Definition of the link between measures and the GES descriptors (as defined by
MSFD, Annex I)**

The assessment from this part of the exercise strongly relied on Annex 3 (Integration
table, linking state characteristics to pressures through impacts) from the draft report on
the relationship between initial assessment and criteria for GES (European Commission,
DG ENV, draft April 2011)\(^{233}\).

With the combination of impact ("pressure theme") and the pressure (see step 1) as a
starting point, Annex 3 of the cited draft document has guided the assessment to
establish the relations with the 11 GES descriptors from MSFD. Annex 3 differentiates
between pressure, state, impact criteria & indicators and defines links between the
different elements and GES-descriptors (rows and columns in the Annex 3 table). For the
purpose of the inventory of measures in this study, the following approach has generally
been followed:

- Start from “Impact & pressure” (see step 1 described above; see annex 3 pink
code) e.g., marine litter
- Link to pressure (annex 3: yellow code) and/or impact (annex 3: orange code)
criteria & indicator and the related GES descriptor; and indicate this in the
database as “YES”. For the example of marine litter (column), the pressure
criterion (yellow) will be “10.1. Characteristics of litter in the marine and coastal
environment” and impact criterion (orange) “10.2 Impacts of litter on marine life”;
both referring to the GES indicator D10 “Properties and quantities of marine litter”
indicated by “YES”. Note that for this step it is important to interpret the measure
correctly, as in some cases the starting point can be more than one pressure,
despite the fact that in the database the main pressure is indicated. For example
the removal of pile cutters brings along “marine litter”, but the action on its own

\(^{233}\) European Commission (April 2011, draft report). Relationship between the initial
assessment of marine waters and the criteria for good environmental status” by the
Marine Environment and Water Industry Unit, DG Environment.
can result in physical loss or damage, giving a “YES” for both D10 Marine litter and D6 Sea floor integrity.

- Link these further with the state criteria & indicators (annex 3: green code) and their related GES descriptor if relevant; and indicate this in the database as “YES, possibly”, as these are much more defined as a higher level/ broader sense. There is a high chance that a particular state indicator will be influenced, but not all of them. For the example of marine litter and its related pressure and impact criteria, a link (following the row) can be made with GES descriptor D1 Biological diversity and with D3 Commercial exploited fish and shell fish within safe biological limits. For the indication of “Yes, possibly” the definition of the measure should be considered to determine the relevance of the link. For example if the measure relates to lost fishing gear, the link with D1 and D3 is clear. If the measure relates the reduction of plastics, the link with D1 is clear, but the link with D3 is less obvious. Here, expert opinion is used for indicating the “yes, possibly” link.

There are some exceptions to this approach. In case some links are very clear simply through the description of the measure, the “yes, possibly” has been turned into a “YES”
### Annex 3: Integration table, linking state characteristics to pressures through impacts

<table>
<thead>
<tr>
<th>Annex 5.1</th>
<th>CDM Decision</th>
<th>Biological disturbance</th>
<th>Physical loss</th>
<th>Other physical disturbances</th>
<th>Other characteristic/indicators</th>
<th>State criteria &amp; indicators</th>
<th>Systematic &amp; international agreements</th>
<th>Natural and organic carbon enrichment</th>
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<tbody>
<tr>
<td>Physical damage</td>
<td>Underwater noise</td>
<td>3.1.3 State criteria and indicators</td>
<td>3.1.4 Habitat disturbance</td>
<td>3.1.5 Other physical disturbance</td>
<td>3.1.6 Other characteristic/indicators</td>
<td>3.1.7 State criteria and indicators</td>
<td>3.1.8 Systematic &amp; international agreements</td>
<td>3.1.9 Natural and organic carbon enrichment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical &amp; Chemical Features</th>
<th>Biological Features (other than habitat types and ecosystems)</th>
<th>Habitat Types</th>
<th>Ecosystems</th>
<th>Other Features</th>
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<tbody>
<tr>
<td>Component</td>
<td>State criteria &amp; indicators</td>
<td>Pressure theme</td>
<td>Pressure theme</td>
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<td>Physical</td>
<td>Transient and permanent changes</td>
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Annex 4: Description and background to the data collection process

The data gathering process has built upon a two-track approach. Literature review served as a starting point to detect relevant sources, organizations and experts. Experts have been contacted to provide their experiences on specific requirements of this study. Primarily, the experts' contributions aimed to expand the inventory of potential measures and to detect interesting case studies where measures have been implemented. Both data collection steps are further detailed below.

Desk literature study
At the initial stage, internet sites of key organizations in the marine domain (e.g. CPMR, HELCOM, OSPAR, ...) were assessed in order to identify ongoing projects and programs of these organizations. The key motivation of this action was to identify experts for later interviews and to lead to relevant publications on possible measures.

Next, the internet data search has been broadened to a structured review via search engines to identify initiatives at different geographical scales (regional seas, national, non-EU) and from different policy areas. The screening process covered a broad range of diverse economic and environmental measures, measures tailored to the marine environment or actions that have potential to target certain specific sectors or pressures.

Interviews
55 organizations have been approached to contribute to the inventory part of the study. The following Table gives a non-exhaustive overview of all contacts, presented in alphabetical order:
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<th>Description</th>
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<tr>
<td>Bath University</td>
<td>MARS Network</td>
</tr>
<tr>
<td>Bellona</td>
<td>MEDSOS (Mediterranean SOS Network)</td>
</tr>
<tr>
<td>BSNN (Black Sea NGO Network)</td>
<td>Min. Environment &amp; Forests, Romania</td>
</tr>
<tr>
<td>CNR (Consiglio Nazionale delle Ricerche - Istituto di Scienze Marine)</td>
<td>MIO-ECSDE Mediterranean Information Office for Environment, Culture and Sustainable Development</td>
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<tr>
<td>CPBSAP (Commission on the Protection of the Black Sea Against Pollution)</td>
<td>MSC (Marine Stewardship Council)</td>
</tr>
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<td>CEFAS (Centre for Environment, Fisheries &amp; Aquaculture Science)</td>
<td>National Scientific Institute of the National Academy of Sciences, Ukraine</td>
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<tr>
<td>CMP (Wageningen University – Centre for Marine Policy)</td>
<td>NEFCO Nordic Environment Finance Corporation</td>
</tr>
<tr>
<td>CIESM (The Mediterranean Science Commission)</td>
<td>OECD Organization for Economic Co-operation and Development</td>
</tr>
<tr>
<td>CPMR (Conference of Peripheral Maritime Regions of Europe)</td>
<td>OSPAR</td>
</tr>
<tr>
<td>DEFRA (UK Department for Environment Food and Rural Affairs)</td>
<td>PAP/RAC (UN Priority Actions Program/Regional Activity Centre)</td>
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<tr>
<td>ECNC (European Centre for Nature Conservation)</td>
<td>RSPB (Royal Society for Protection of Birds)</td>
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<tr>
<td>EAERE (The European Association of Environmental and Resource Economists)</td>
<td>SSPMLPP</td>
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<tr>
<td>UNEP MAP (Mediterranean Action Plan)</td>
<td>SINTEF Marine Environmental Technology</td>
</tr>
<tr>
<td>EEA</td>
<td>SEI Marine Products (Sterndrive Engineering)</td>
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<td>Organization</td>
<td>Institution/Location</td>
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<td>Finnish EPA (SYKE)</td>
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<td>FEPORTS (The Port Institute for Studies and Co-Operation in the Valencian Region)</td>
<td>UBC-net (The University Of British Columbia Fisheries Centre)</td>
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<td>FP7-Water</td>
<td>Univ. Messina</td>
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<td>Univ. Barcelona</td>
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<tr>
<td>HELMEPA (Hellenic Marine Environment Protection Association)</td>
<td>Univ. Parma</td>
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<tr>
<td>ICES (International Council for the Exploration of the Sea)</td>
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<td>WWF</td>
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<td>Institute for Coastal Marine Environment /National Research Council, Italy</td>
<td>WWF-Bulgaria</td>
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<tr>
<td>IEEP (Institute for European Environmental Policy)</td>
<td>PECSD (Public Environmental Centre of Sustainable Development - Bulgaria)</td>
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<tr>
<td>IMARES (Institute for Marine Resources and Ecosystem Studies)</td>
<td>Zakynthos National Park</td>
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<tr>
<td>IUCN (International Union for Conservation of Nature)</td>
<td>La Maddalena</td>
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The following table gives an overview of the 24 semi-structured interviews that have been conducted.

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<th>Sea Basin</th>
<th>Expert</th>
<th>Position</th>
<th>Organization</th>
<th>Address details</th>
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<tr>
<td>Baltic Sea</td>
<td>Brusendorff, Mrs. Dr. A.C.</td>
<td>Executive Secretary</td>
<td>HELCOM</td>
<td><a href="mailto:annechristine.brusendorff@helcom.fi">annechristine.brusendorff@helcom.fi</a></td>
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<td>Grönholm, Mr. B.</td>
<td>Head of Secretariat</td>
<td>Union of the Baltic Cities – Commission on Environment (UBC)</td>
<td><a href="mailto:bjorn.gronholm@ubc.net">bjorn.gronholm@ubc.net</a></td>
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<td></td>
<td>Kaminska, Mrs. K.</td>
<td>Expert</td>
<td>HELCOM</td>
<td><a href="mailto:Katarzyna.kaminska@minrol.gov.pl">Katarzyna.kaminska@minrol.gov.pl</a></td>
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<td></td>
<td>Scharin, Mr. Dr. H.</td>
<td>Environmental economist</td>
<td>Stockholm Resilience Centre</td>
<td><a href="mailto:henrik.scharin@stockholmresilience.su.se">henrik.scharin@stockholmresilience.su.se</a></td>
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<td>Sjövall, Mr. M.</td>
<td>Communication Manager</td>
<td>Nordic Environment Finance Corporation (NEFCO)</td>
<td><a href="mailto:mikael.sjovall@nefco.fi">mikael.sjovall@nefco.fi</a></td>
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<td>Black Sea</td>
<td>Coman, Mrs. C.</td>
<td>Executive director</td>
<td>Black Sea Coastal Centre</td>
<td><a href="mailto:ccbblacksea@gmail.com">ccbblacksea@gmail.com</a></td>
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<tr>
<td></td>
<td>Otilia, Mrs. Dr.M.</td>
<td>Counselor</td>
<td>Ministry of Environment and Forests, Romania</td>
<td><a href="mailto:otilia.mihail@mmediu.ro">otilia.mihail@mmediu.ro</a></td>
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<td>Rubel, Mr. Dr. O.</td>
<td>Economist</td>
<td>National Scientific Institute of the National Academy of Sciences, Ukraine</td>
<td><a href="mailto:rubeloleg@gmail.com">rubeloleg@gmail.com</a></td>
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<td>Velikova, Mrs. Dr. V.</td>
<td>Pollution Monitoring and Assessment Officer (retired after interview)</td>
<td>Commission on the Protection of the Black Sea Against Pollution</td>
<td><a href="mailto:secretariat@blacksea-commission.org">secretariat@blacksea-commission.org</a></td>
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<td>Zivarov, Mr. Dr. A. and Gileva, Mrs. Dr. E.</td>
<td>Expert and Executive Secretary</td>
<td>Black Sea NGO Network</td>
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<td>North East Atlantic</td>
<td>Skontorp Hognes, Mr. E.</td>
<td>Researcher life cycle assessments of seafood products</td>
<td>SINTEF Fisheries and Aquaculture</td>
<td><a href="mailto:Erik.Hognes@SINTEF.no">Erik.Hognes@SINTEF.no</a></td>
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<td>Stuart, Mr. Dr. R., Brazinskaite, Mrs. R. &amp;</td>
<td>Divisional director and economists</td>
<td>CEFAS, Environment and Ecosystems Division (UK)</td>
<td><a href="mailto:stuart.rogers@cefas.co.uk">stuart.rogers@cefas.co.uk</a></td>
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<td>Pastoors, Mr. M.</td>
<td>Executive director</td>
<td>Centre for Marine Policy, Wageningen University &amp; Research Centre (Netherlands)</td>
<td><a href="mailto:martin.pastoors@wurs.nl">martin.pastoors@wurs.nl</a></td>
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<td>Mediterranean</td>
<td>Cil, Mrs. Dr. A.</td>
<td>Program Manager Nature and Society</td>
<td>European Centre for Nature Conservation (ECNC)</td>
<td><a href="mailto:Cil@ecnc.org">Cil@ecnc.org</a></td>
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<td>Head of Press Office</td>
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<td><a href="mailto:e.lippi@lamaddalenapark.org">e.lippi@lamaddalenapark.org</a></td>
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<td>Lorente, Mr. A.*</td>
<td>Marine Technical Officer</td>
<td>Catalan Government, Department of Agriculture, Fisheries, Food and Natural Environment, Montgri, Medes Islands and Lower Ter Natural Park, Spain</td>
<td><a href="mailto:alorente@gencat.cat">alorente@gencat.cat</a></td>
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<td><a href="mailto:andrea.delucia@iamc.cnr.it">andrea.delucia@iamc.cnr.it</a></td>
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<td>Mediterranean</td>
<td>Franzosini, Mr. C.*</td>
<td>Staff biologist</td>
<td>Miramare Marine Park, Italy</td>
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<tr>
<td></td>
<td>Prem, Mr. M.</td>
<td>Executive Director</td>
<td>Priority Actions Program / Regional Activity Centre (PAP/RAC)</td>
<td><a href="mailto:marko.prem@ppa.htnet.hr">marko.prem@ppa.htnet.hr</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Telephone number: +385 21 340 471</td>
</tr>
<tr>
<td></td>
<td>Triantafillou, Mr. C.</td>
<td>Assistant executive coordinator</td>
<td>Hellenic Marine Environment Protection Association (HELMEPA)</td>
<td><a href="mailto:c.triantafillou@helmepa.gr">c.triantafillou@helmepa.gr</a></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Telephone number (+30) 2109343088</td>
</tr>
</tbody>
</table>
**Evaluation of the consultation and desk research**

Both methods of data collection were clearly complimentary. Interviewees often referred to interesting published or unpublished literature, or to other organizations or experts.

Knowledge of specific measures or cases, contrary to strategic or long term objectives or high level/regional issues which are not the focus of the inventory, was mostly present at national institutions and NGOs that are often involved in implementing or translating strategic measures to the field.

Some contacts (e.g. national authorities) found it difficult to identify measures considering the early stage in the implementation of the MSFD they are in. Different organizations are currently working on appropriate measures for their setting and are conducting assessments on e.g. associated cost and benefits (e.g. Germany, UK, Italy).

Regarding the regional coverage of information on concrete measures and cases, the Mediterranean and Black Sea appeared to be the more challenging ones. During the interview with dr. Marco Prem, the director of the UN Priority Actions Program/Regional Activity Centre (PAP/RAC) in the Mediterranean, it has been stated that action programs are currently being implemented, but reporting or evaluations on measures or initiatives are not presented yet. The interview with the Commission on the Protection of the Black Sea Against Pollution equally presented a large amount of information on strategic programs, but information on more concrete measures was not available. The most specific and supported information originated from the Baltic Sea and North Sea Region (OSPAR region by extension). A lot of effort has been put into approaching actors in the Black Sea and Mediterranean. Some contacts (e.g. Black Sea NGO network) have proved relevant although to the general conclusion was that the proposed measures were already integrated in the database based on implementations elsewhere.
Annex 5: Indicators of GES

*Indicators of GES based on HELCOM*

A number of efforts have been made to better define Good Environmental Status by Member States and Working Groups. These include work by HELCOM. HELCOM identified a number of objectives for GES and have an indicator set that includes a number of metrics that may be relevant.

### Table 14: Goals, Objectives and Metrics for Good Environmental Status – based on HELCOM

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
<th>Metrics*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concentrations of nutrients close to natural levels</td>
<td>Nutrient emissions/concentrations</td>
</tr>
<tr>
<td>Sea unaffected by eutrophication</td>
<td>Clear water</td>
<td>Secchi depth</td>
</tr>
<tr>
<td></td>
<td>Natural level of algal blooms</td>
<td>Bloom biomass/occurrence</td>
</tr>
<tr>
<td></td>
<td>Natural distribution and occurrence of plants and animals</td>
<td>Spatial distribution of species, alien species</td>
</tr>
<tr>
<td></td>
<td>Natural oxygen levels</td>
<td>Oxygen levels</td>
</tr>
<tr>
<td>Sea life undisturbed by hazardous substances</td>
<td>Concentrations of hazardous substances close to natural levels</td>
<td>Emissions/concentrations of hazardous substances</td>
</tr>
<tr>
<td></td>
<td>All fish safe to eat</td>
<td>Levels of contaminants in fish/incidence of exceeding of limits</td>
</tr>
<tr>
<td></td>
<td>Healthy wildlife</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radioactivity at pre-Chernobyl levels</td>
<td>Radionuclide levels</td>
</tr>
<tr>
<td>Favourable status of biodiversity</td>
<td>Natural landscapes and sea scapes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thriving and balance communities of plants and animals</td>
<td>Biodiversity indices</td>
</tr>
<tr>
<td></td>
<td>Viable populations of species</td>
<td></td>
</tr>
<tr>
<td>Maritime activities carried out in an environmentally friendly way</td>
<td>No illegal pollution</td>
<td>Pollution levels</td>
</tr>
<tr>
<td></td>
<td>Safe maritime traffic, without accidental pollution</td>
<td>Accident numbers</td>
</tr>
<tr>
<td></td>
<td>Efficient response capability</td>
<td></td>
</tr>
</tbody>
</table>
Goals | Objectives | Metrics*
--- | --- | ---
Minimum air pollution from ships | Air pollution emissions from ships |  
No introductions of alien species from ships | Incidence of alien species introduction |  
Zero discharges from offshore platforms | Discharge levels from offshore platforms |  

Notes * Metrics based on the study team’s judgement – drawing on existing indicators

Table 15: Overview of the GES descriptors and associated criteria and indicators (draft document by EC’s Marine Environment and Water Industry Unit, April 2011)

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Criterion</th>
<th>Indicator</th>
<th>Type of indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.</td>
<td>1.1 Species distribution</td>
<td>1.1.1 Distributional range</td>
<td>S</td>
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<tr>
<td></td>
<td></td>
<td>1.1.2 Distributional pattern within the latter, where appropriate</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>1.1.3 Area covered by the species (for sessile/benthic species)</td>
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</tr>
<tr>
<td></td>
<td>1.2 Population size</td>
<td>1.2.1 Population abundance and/or biomass, as appropriate</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>1.3 Population condition</td>
<td>1.3.1 Population demographic characteristics (e.g. body size or age class structure, sex ratio, fecundity rates, survival/mortality rates)</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3.2 Population genetic structure, where appropriate</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>1.4 Habitat distribution</td>
<td>1.4.1 Habitat distributional range</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>1.4.2 Habitat distributional pattern</td>
<td>S</td>
<td></td>
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<tr>
<td></td>
<td>1.5 Habitat extent</td>
<td>1.5.1 Habitat area</td>
<td>S</td>
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<tr>
<td></td>
<td>1.5.2 Habitat volume, where relevant</td>
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<td></td>
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<tr>
<td></td>
<td>1.6 Habitat condition</td>
<td>1.6.1 Condition of the typical species and communities</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>1.6.2 Relative abundance and/or biomass, as appropriate</td>
<td>S</td>
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</tr>
<tr>
<td></td>
<td>1.6.3 Physical, hydrological and chemical conditions</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.7 Ecosystem structure</td>
<td>1.7.1 Composition and relative proportions of ecosystem components (habitats and species)</td>
<td>S</td>
</tr>
<tr>
<td>D2 Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.</td>
<td>2.1 Abundance and state characterisation of non-indigenous species, in particular invasive species</td>
<td>2.1.1 Trends in abundance, temporal occurrence and spatial distribution in the wild of non-indigenous species, particularly invasive non-indigenous species, notably in risk areas, in relation to the main vectors and pathways of spreading of such species</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>2.2 Environmental impact of invasive non-indigenous species</td>
<td>2.2.1 Ratio between invasive non-indigenous species and native species in some well studied taxonomic groups (e.g. fish, macroalgae, molluscs) that may provide a measure of change in species composition (e.g. further to the displacement of native species)</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2.2 Impacts of non-indigenous invasive species at the level of species, habitats and ecosystems, where feasible</td>
<td>I</td>
</tr>
<tr>
<td>D3 Populations of all commercially exploited fish and shellfish are within safe biological</td>
<td>3.1 Level of pressure of the fishing activity</td>
<td>3.1.1 Fishing mortality (F)</td>
<td>P</td>
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<tr>
<td></td>
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<td>3.1.2 Ratio between catch and biomass index (‘catch/biomass ratio’)</td>
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</tr>
<tr>
<td></td>
<td>3.2 Reproductive capacity of the stock</td>
<td>3.2.1 Spawning Stock Biomass (SSB)</td>
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<tr>
<td></td>
<td></td>
<td>3.2.2 Biomass indices</td>
<td>S/I</td>
</tr>
<tr>
<td>Descriptor</td>
<td>Criterion</td>
<td>Indicator</td>
<td>Type of indicator</td>
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<tr>
<td>limits, exhibiting a population age and size distribution that is indicative of a healthy stock.</td>
<td>3.3 Population age and size distribution</td>
<td>3.3.1 Proportion of fish larger than the mean size of first sexual maturation</td>
<td>S/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3.2 Mean maximum length across all species found in research vessel surveys</td>
<td>S/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3.3 95% %ile of the fish length distribution observed in research vessel surveys</td>
<td>S/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3.4 Size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation</td>
<td>S/I</td>
</tr>
<tr>
<td>D4 All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.</td>
<td>4.1 Productivity (production per unit biomass) of key species or trophic groups</td>
<td>4.1.1 Performance of key predator species using their production per unit biomass (productivity)</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.2 Proportion of selected species at the top of food webs</td>
<td>S</td>
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<tr>
<td></td>
<td></td>
<td>4.3 Abundance/distribution of key trophic groups/species</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.3.1 Abundance trends of functionally important selected groups/species</td>
<td>S</td>
</tr>
<tr>
<td>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.</td>
<td>5.1 Nutrients level</td>
<td>5.1.1 Nutrients concentration in the water column</td>
<td>P</td>
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<tr>
<td></td>
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<td>5.1.2 Nutrient ratios (silica, nitrogen and phosphorus), where appropriate</td>
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<td>5.2 Direct effects of nutrient enrichment</td>
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<td>5.2.1 Chlorophyll concentration in the water column</td>
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<td>5.2.2 Water transparency related to increase in suspended algae, where relevant</td>
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<td>5.2.3 Abundance of opportunistic macroalgae</td>
<td>I</td>
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<td>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</td>
<td>I</td>
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<td></td>
<td>5.3 Indirect effects of nutrient enrichment</td>
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<td></td>
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<td>5.3.1 Abundance of perennial seaweeds and seagrasses (e.g. fucoids, eelgrass and Neptune grass) adversely impacted by decrease in water transparency</td>
<td>I</td>
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<tr>
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<td></td>
<td>5.3.2 Dissolved oxygen, i.e. changes due to increased organic matter decomposition and size of the area concerned</td>
<td>I</td>
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<tr>
<td>D6 Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.</td>
<td>6.1 Physical damage, having regard to substrate characteristics</td>
<td>6.1.1 Type, abundance, biomass and areal extent of relevant biogenic substrate</td>
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<tr>
<td></td>
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<td>6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types</td>
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<td>6.2 Condition of benthic community</td>
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<td>6.2.1 Presence of particularly sensitive and/or tolerant species</td>
<td>S/I</td>
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<tr>
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<td>6.2.2 Multi-metric indexes assessing benthic community condition and functionality, such as species diversity and richness, proportion of opportunistic to sensitive species</td>
<td>S/I</td>
</tr>
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<td></td>
<td></td>
<td>6.2.3 Proportion of biomass or numbers of individuals in the macrobenthos above some specified length/size</td>
<td>S/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.2.4 Parameters describing the characteristics (shape, slope and intercept) of the size spectrum of the benthic community</td>
<td>S/I</td>
</tr>
<tr>
<td>Descriptor</td>
<td>Criterion</td>
<td>Indicator</td>
<td>Type of indicator</td>
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<tr>
<td>D7 Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.</td>
<td>7.1 Spatial characterisation of permanent alterations</td>
<td>7.1.1 Extent of area affected by permanent alterations</td>
<td>P</td>
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<td>7.2 Impact of permanent hydrographical changes</td>
<td>7.2.1 Spatial extent of habitats affected by the permanent alteration</td>
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<tr>
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<td></td>
<td>7.2.2 Change in habitats, in particular the functions provided (e.g. spawning, breeding and feeding areas and migration routes of fish, birds and mammals), due to altered hydrographical conditions</td>
<td>I</td>
</tr>
<tr>
<td>D8 Concentrations of contaminants are at levels not giving rise to pollution effects.</td>
<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>P</td>
</tr>
<tr>
<td></td>
<td>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>I</td>
</tr>
<tr>
<td></td>
<td></td>
<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>P/I</td>
</tr>
<tr>
<td>D9 Contaminants in fish and other seafood for human consumption do not exceed levels established by EU legislation or other relevant standards.</td>
<td>9.1 Levels, number and frequency of contaminants</td>
<td>9.1.1 Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels</td>
<td>P/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.1.2 Frequency of regulatory levels being exceeded</td>
<td>P/I</td>
</tr>
<tr>
<td>D10 Properties and quantities of marine litter do not cause harm to the coastal and marine environment.</td>
<td>10.1 Characteristics of litter in the marine and coastal environment</td>
<td>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</td>
<td>P</td>
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<tr>
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<td></td>
<td>10.1.2 Trends in the amount of litter in the water column (including floating at the surface) and deposited on the seafloor, including analysis of its composition, spatial distribution and, where possible, source</td>
<td>P</td>
</tr>
<tr>
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<td></td>
<td>10.1.3 Trends in the amount, distribution and, where possible, composition of micro-particles (in particular micro-plastics)</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>10.2 Impacts of marine litter on marine life</td>
<td>10.2.1 Trends in the amount and composition of litter ingested by marine animals (e.g. stomach analysis)</td>
<td></td>
</tr>
<tr>
<td>D11 Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.</td>
<td>11.1 Distribution in time and place of loud, low and mid frequency impulsive sounds</td>
<td>11.1.1 Proportion of days and their distribution within a calendar year over areas of a determined surface, as well as their spatial distribution, in which anthropogenic sound sources exceed levels that are likely to entail significant impact on marine animals measured as Sound Exposure Level (in dB re 1μPa⁻².s) or as peak sound pressure level (in dB re 1μPa_peak) at one metre, measured over the frequency band 10 Hz to 10 kHz</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.2 Continuous low frequency sound</td>
<td>11.2.1 Trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1μPa RMS: average noise level in these octave bands over a year) measured by observation stations and/or with the use of models if appropriate</td>
</tr>
</tbody>
</table>
### Annex 6: Overview of Specially Protected Areas of Mediterranean Importance (SPAMIs) (UNEP-WCMC)

<table>
<thead>
<tr>
<th>Country</th>
<th>SPAMI Name</th>
<th>Date of creation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>Banc dos Kabylies Marine Reserve</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td>Iles Habibas</td>
<td>2005</td>
</tr>
<tr>
<td>France</td>
<td>Port-Cros National Park</td>
<td>2001</td>
</tr>
<tr>
<td>Italy</td>
<td>Portofino Marine Protected Area</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td>Marine Reserve of Miramare</td>
<td>2008</td>
</tr>
<tr>
<td></td>
<td>Torre Guaceto Marine Protected Area &amp; Natural Reserve</td>
<td>2008</td>
</tr>
<tr>
<td></td>
<td>Tavolara – Punta Coda Cavallo Marine Protected Area</td>
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<tr>
<td>Spain</td>
<td>Plimerino Marine Protected Area</td>
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<tr>
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<td>Alboran Island</td>
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<tr>
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<td>Cabo de Gata Njjar Natural Park</td>
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</tr>
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<td>Fondos Marinos del Levante Almenense</td>
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<td></td>
<td>Mar Menor y Costa Oriental de la region de Murcia</td>
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<td>Columbretes Island</td>
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<tr>
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<td>Cap de Creus Natural Park</td>
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<tr>
<td></td>
<td>Medes Islands</td>
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<td>Cabrera National Park</td>
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<tr>
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<td>Maro-Cerro Gordo Cliffs</td>
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<tr>
<td>Tunisia</td>
<td>Kneiss Islands</td>
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<td>Zembra et Zembretta National Park</td>
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<td>La Gallette Archipelago</td>
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<td>France, Italy, Monaco</td>
<td>Pelagos Sanctuary for the conservation of Mediterranean marine mammals</td>
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<tr>
<td>Offices</td>
<td><a href="http://www.arcadisbelgium.be">www.arcadisbelgium.be</a></td>
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<td>Berchem-Antwerpen</td>
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<tr>
<td>B-2600 Berchem</td>
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<td>T +32 3 360 83 00</td>
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<tr>
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<tr>
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<td>Hasselt</td>
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</tr>
<tr>
<td>B-3500 Hasselt</td>
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<td>Liège</td>
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<td>Charleroi</td>
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