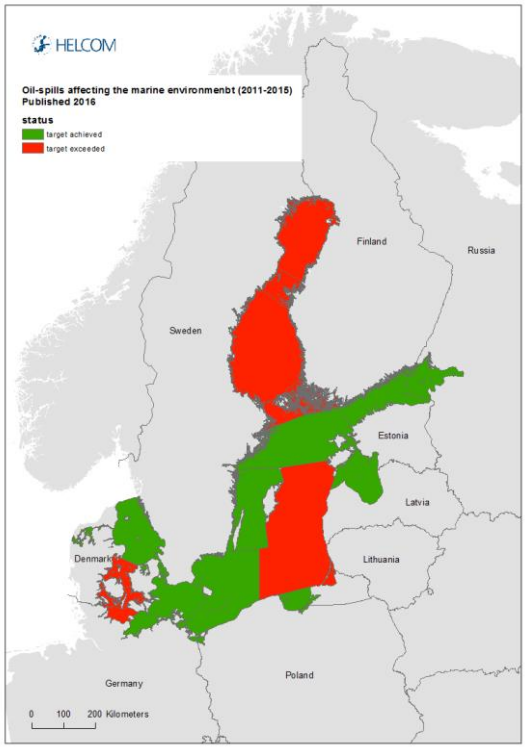
Operational oil spills from ships

Key message

The indicator threshold value is based on estimated volumes of oil introduced to the Baltic Sea as illegal discharges of oil. The volume of oil is considered to be the most relevant metric to evaluate the effect on the marine environment from oil spills.

In the assessment period of 2011-2015 the estimated annual average volume of oil exceeded the threshold value in the Bothnian Bay, The Quark, The Bothnian Sea, The Åland Sea, the Eastern Gotland Basin, the Kiel Bay and the great Belt. The threshold value is defined based on a modern baseline defined by a reference period 2008-2013 when the estimated volume of oil was considered to be at a historically low level.

Both the number- and the size of illegal oil spills detected in annual aerial surveillance show decreasing trends in all sub-basins. This shows that the measures implemented in recent years have been successful in decreasing the pressure on the environment caused by oil spills. Oil spills are principally detected along the main shipping routes.



Key message figure 1: Status assessment results based evaluation of the indicator 'operational oil spills from ships'. The assessment is carried out using Scale 2 HELCOM assessment units (defined in the HELCOM Monitoring and Assessment Strategy Annex 4). Click to enlarge.

Aerial surveys of oil spills have been carried out by Contracting Parties of HELCOM for several years with standardized methods, annually covering nearly the entire Baltic Sea. The confidence of the indicator evaluation is therefore considered to be high. However, decline in flight hours in recent years might have a negative effect on the confidence in the future.

The indicator is applicable in the entire Baltic Sea area.

Relevance of the core indicator

Oil is an important commodity in the region with large volumes being transported across the Baltic Sea and constitutes the main fuel of the absolute majority of ships in the region. Oil and other petroleum products end up in the marine environment through intentional introduction or due to negligence, often as oil in bilge water or via dumping of waste oil or due to release during an accident. All oil spills pose a significant threat to water birds and other marine animals, both acute death and chronic toxic effects are known.

The indicator evaluates the sustainability of handling of oil and petroleum products in the Baltic Sea region, as sustainable activities should ensure minimal number of spills and volume of oil introduced to the marine environment.

Policy relevance of the core indicator

	BSAP Segment and Objectives	MSFD Descriptors and Criteria
Primary link	Enforcement of international regulations – no illegal discharges	Annex III – Contamination by hazardous substances; introduction of synthetic compounds
Secondary link		8.2. Effects of contaminants
Other relevant legislation: IMO MARPOL Convention Annex I, Helsinki Convention including Annex VII		

Cite this indicator

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Results and confidence

Volume of oil detected in the Baltic Sea

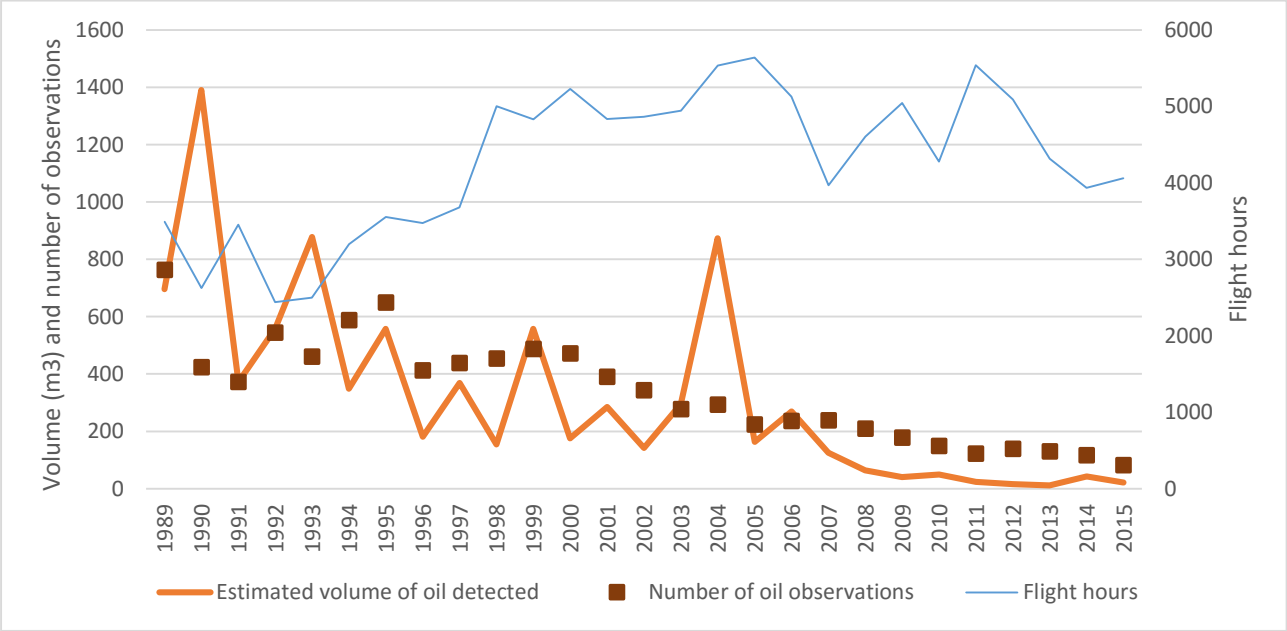
During the assessment period 2011-2015 the estimated annual average of oil-spills exceeded the amount during the reference period 2008-2013 in seven of the 17 HELCOM sub-basins (Result table 1).

Results table 1. Indicator evaluation for the assessment period.

Sub-basin	Threshold value; annual average of total spills during reference period 2008-2013, m3	Evaluation; annual average of oil spill during assessment period 2011-2015, m3	Indicator result red – exceed threshold green – achieve threshold
Bothnian bay	0,1135	0,2922	Bothnian bay
Quark	0,0007	0,0576	Quark
Bothnian sea	0,1863	0,3548	Bothnian sea
Åland sea	0,1363	0,9286	Åland sea
Gulf of Finland	5,2447	3,5672	Gulf of Finland
Northern Baltic Proper	14,3056	1,9960	Northern Baltic Proper
Gulf of Riga	0,0124	0	Gulf of Riga
Western Gotland Basin	0,2304	0,1349	Western Gotland Basin
Eastern Gotland basin	1,8503	2,8722	Eastern Gotland basin
Gdansk Bay	0,1038	0,0981	Gdansk Bay
Bornholm Basin	2,8667	1,4121	Bornholm Basin
Arkona	7,6978	6,8491	Arkona
Bay of Mecklenburg	0,4070	0,2561	Bay of Mecklenburg
Kiel Bay	0,1575	0,1669	Kiel Bay
The Sound	0,1121	0,1031	The Sound
Great Belt	0,4215	3,4862	Great Belt
Kattegat	0,4212	0,3698	Kattegat

Proportionally the largest exceedance was detected in the Quark, however if ranked in based on the estimated spill volume during the assessment period the second smallest volume was detected for the Quark. The largest estimated spill volume during the assessment period was detected in the Arkona Basin, however detected spill volume in the reference period was also relatively large ranking the Arkona Basin tenth when considering the proportion of the spill in the assessment period compared to the reference period.

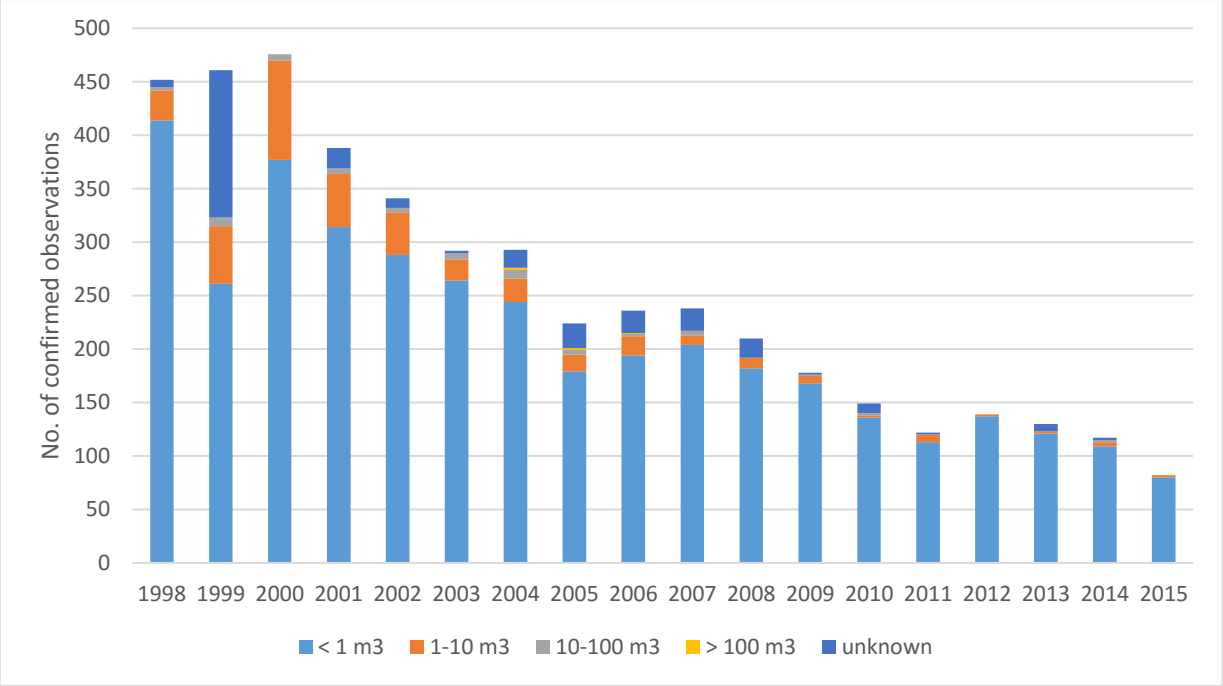
When considering the amount of oil in the marine environment over a longer time period a clear downward trend can be detected. The amount of oil that has been introduced to the marine environment as illegal spills detected through aerial surveillance has decreased significantly since the 1980's when the monitoring began (Result figure 1). The decrease is considered to be a positive sign, especially considering the increased shipping traffic as well as enhanced use of satellite images. The number of flight hours, i.e. the monitoring effort, has varied during the decades. However, the documented decrease in amounts of oil introduced to the Baltic Sea is considered to reflect the actual situation, as the supporting parameter on pollution per flight hour index confirms the decrease.



Results figure 1. The estimated amount of oil from detected oil spill, the number of observations and number of flight hours between 1989 and 2015.

The peaks detected 1990 and 2004 were likely caused by single events (Result figure 1**Error! Reference source not found.**). In 1990 an accidental spill due to a collision between the Soviet tanker Volgonef 1263 and the West German dry cargo ship Betty at the Swedish south coast is the main cause, whereas the underlying cause for the accident in 2004 is undocumented. The peak values highlight that single oil spills may introduce large amounts of oil to the environment, and underline the importance of estimating the volume of introduced oil when evaluating whether the pressure is at a level allowing the environment to reach a good environmental status.

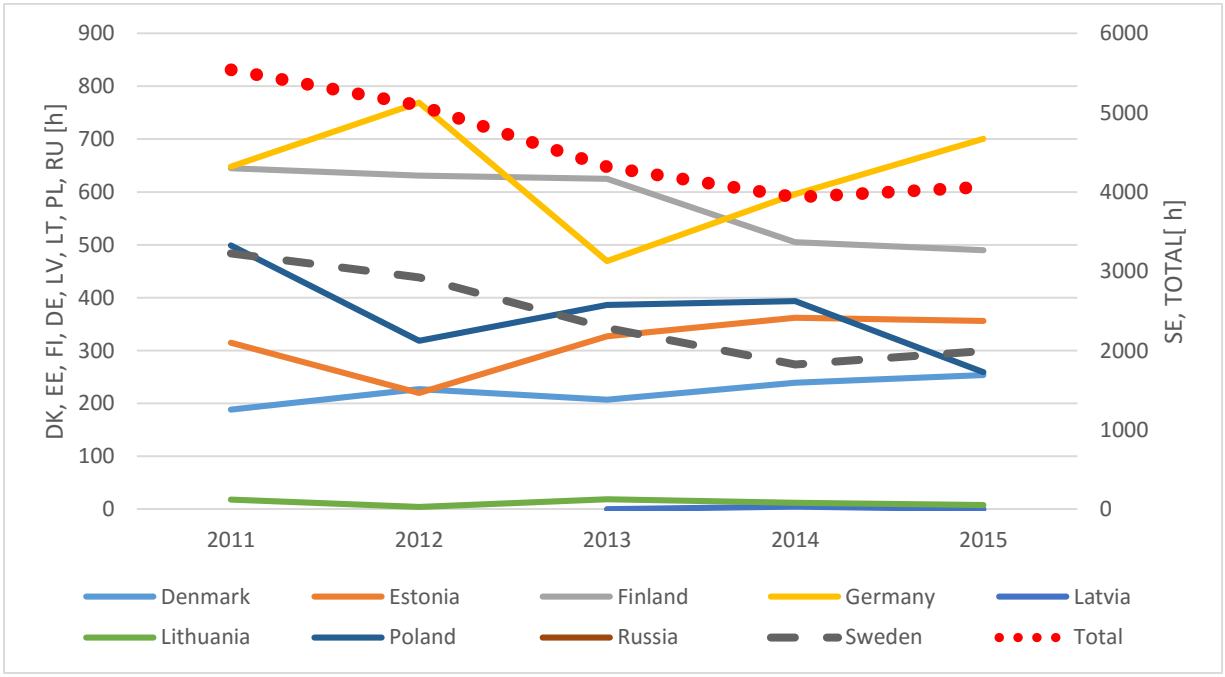
Overall decreasing trends have been detected in both the number of spills and the size of single spills. Noticeably, the number of detected oil spills larger than 10m^3 has decreased significantly in recent decades (Result figure 2). Out of the 130 detected oil spill in 2013, 80% were estimated to be smaller than 0.1 $m^{3.}$



Results figure 2. The number of detected oil spill and the size of detected oil spill between the years 1998 and 2013.

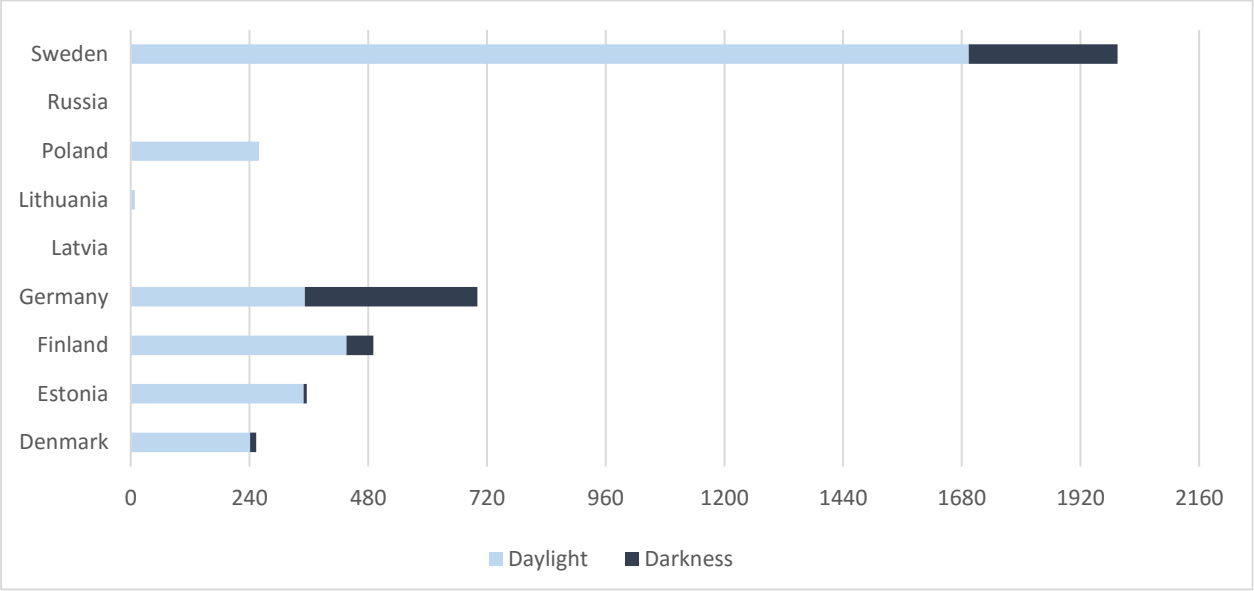
Monitoring effort during the assessment period as flight hours

All HELCOM countries have been involved in aerial surveillance monitoring during the assessment period, during which a slight downward trend in the total number of flight hours can be detected (Result figure 3).



Results figure 3. Total number of flight hours in the aerial survey per country between 2011– 2015.
Note that the number of flight hours for Sweden (dashed green line) and the total number of flight hours (dotted black line), are indicated on the secondary vertical axis.

The total number of aerial surveillance flight hours during the year 2015 varied between countries (Results figure 4).



Results figure 4. Number of flight hours per country in daylight and darkness during the year 2015.

Confidence of the indicator status evaluation

Aerial surveys of oil spills have been carried out by HELCOM Contracting Parties with standardized methods, covering the entire Baltic Sea for several years. Thus, the confidence of the indicator evaluation is high. In recent years the number of flight hours have decreased somewhat and some countries have not been able to conduct aerial surveillance according to the standardized methods. If this trend continues, the confidence of the indicator evaluation will be lower in the future.

Good environmental status

The threshold value for the indicator on oil spills affecting the marine environment is defined as the annual average volume of oil introduced to each sub-basin during the selected reference period (Good environmental status table 1). The reference period selected for the modern baseline of the indicator is 2008-2013, during which the estimated volume from spills have been at a historically low level (Good environmental status figure 1).

Good environmental status table 1. Environmental target expressed as volume of oil per sub-basin.

Sub-basin	Annual average of total spills during reference period 2008-2013 [m3]
Bothnian bay	0,1135
Quark	0,0007
Bothnian sea	0,1863
Åland sea	0,1363
Gulf of Finland	5,2447
Northern Baltic Proper	14,3056
Gulf of Riga	0,0124
Western Gotland Basin	0,2304
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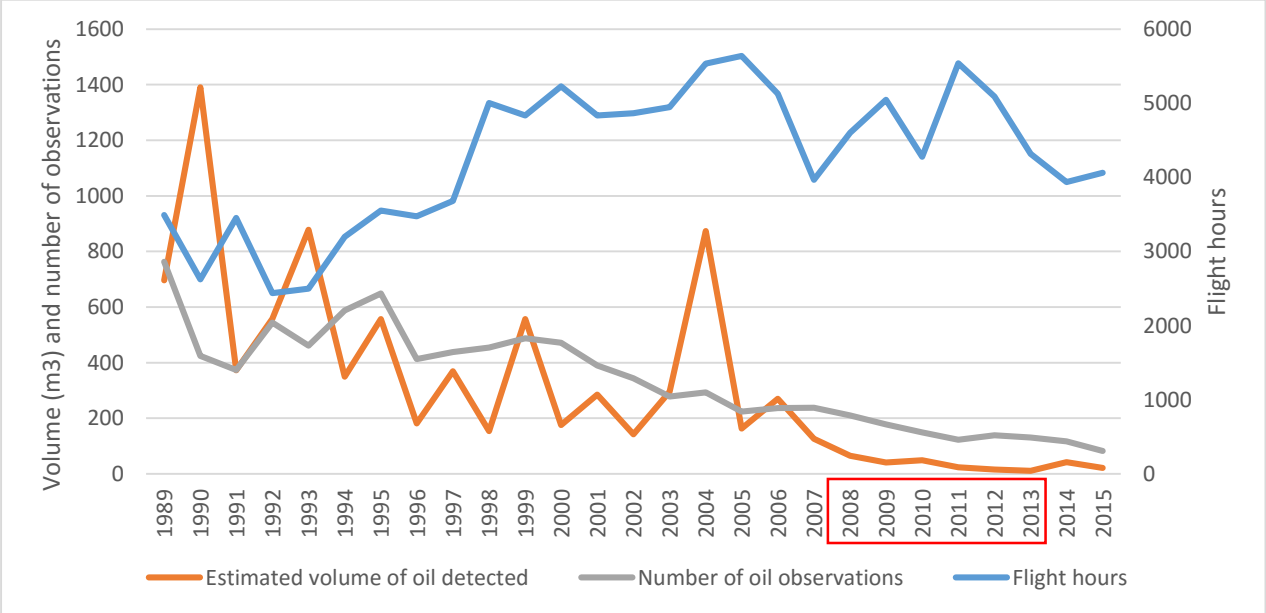


Good environmental status figure 1. The estimated volume of oil from detected oil spill and the number of observations and flight hours between 1989 and 2015. The red square identified the reference period used to determine the threshold value.

It is important to note, that the HELCOM Contracting Parties have committed to the goal of 'No illegal oil spills detected through annual aerial surveillance activities' in the Baltic Sea Action Plan (BSAP) in line with the 1992 Helsinki Convention, and that this goal is aligned with the requirements of MARPOL Annex I. This goal is still to be strived for, and is not to be considered as substituted by the environmental target of this indicator. The environmental target of this core indicator has been derived for the purpose of evaluating the status of the marine environment, and exceeding the target is considered as having a harmful effect on the environment. However, reaching the level of zero spills must still be strived for in the long-term.

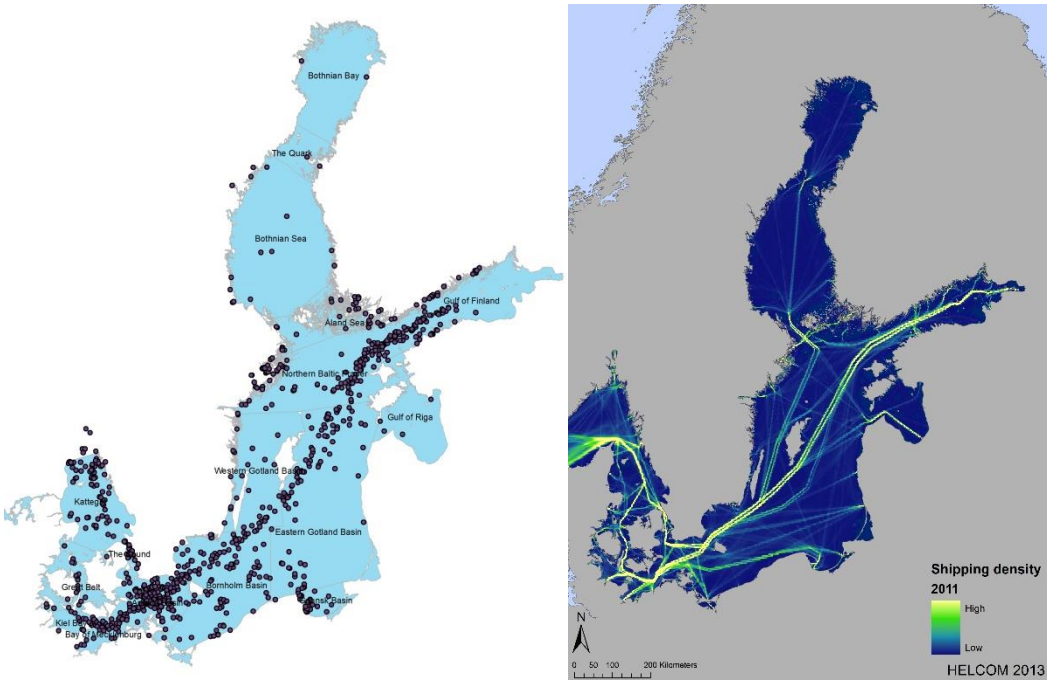
Assessment protocol

The assessment units considered appropriate for this pressure core indicator are the 17 sub-basins of the Baltic Sea, i.e. the HELCOM assessment units on Level 2.

The ArcMap 10.3 Selection tool (Select by location- Are within a distance of the source layer feature: 1km) has been used to select the spills within an assessment unit/sub-basin and to sum the amount of oil from these spills. Finally the annual average of spilled oil has been summed separately for each sub-basins in the assessment period.

Compliance to the threshold is to be evaluated annually for each assessment unit. The estimated volumes from all detected oil spills are summed to form an annual oil-spill estimate for each sub-basin. The methods for estimating the volume of each detected oil spill are detailed in the Standard Pollution Observation Format Completion Guide as found in the HELCOM Response Manual Volume I.

It should be noted, that aerial surveillance efforts are focused along the most heavily trafficked shipping routes in the Baltic Sea, and the main route constitutes the Baltic Deep-Water Route from the Danish Straits to St Petersburg. This can be illustrated though the spatial distribution of the detected oil-spills during the reference period and shipping density during 2011 (Assessment protocol figure 1).



Assessment protocol figure 1. Spatial distribution of oil spills detected during the reference period 2008-2013 (left) and monthly average density of shipping during 2011 (right).

Assessment units

The indicator is applicable in the whole Baltic Sea. The indicator is assessed using HELCOM assessment scale 2 which consists of 17 Baltic Sea sub-basins. The assessment units are defined in the HELCOM Monitoring and Assessment Strategy Annex 4.

Relevance of the indicator

Holistic assessment

Human maritime activities affecting the status of the marine environment is assessed using several indicators and spatial data on pressures. Each indicator focuses on one important aspect of the complex issue. In addition to providing an indicator-based evaluation of the oil-spills affecting the marine environment, this indicator will also contribute to the next holistic assessment to be completed in 2018.

Policy relevance

The Baltic Sea area has been designated as a 'special area' in accordance with International Convention for the Prevention of Pollution from Ships (MARPOL), 1973, as modified by the Protocol of 1978 relating thereto, Annexes I (oil), IV (sewage) and V (garbage). Any discharge of oil or oily mixtures into the Baltic Sea is prohibited in accordance with MARPOL (1973/1978) and the 1992 Helsinki Convention.

The goal is to achieve a Good Environmental Status (GES) of the marine environment by 2021 in accordance with the Baltic Sea Action Plan (BSAP) and by 2020 in accordance with the EU Marine Strategy Framework Directive (MSFD). The pressure from oil spills must be kept at a low level in order to reach the GES goal.

Far-reaching prohibitions and restrictions on any discharge into the sea of oil or oily mixtures, sewage from passenger ships and garbage have been introduced by the Baltic Sea States to comply with the requirements of a MARPOL 'special area'. Oil is defined as meaning petroleum in any form, including crude oil, fuel oil, sludge, oil refuse and refined products. Oil discharges are equally prohibited from the cargo tanks of oil tankers and any machinery spaces or ballast tanks of all types of ships. Some discharge of oily mixtures can be permitted but only when the oil content of the effluent does not exceed 15 parts per million. The oil filtering equipment of all ships of 400 gross tonnage or above must have arrangements that ensure an automatic stop if the oil content of any discharge exceeds 15 parts per million. All ships less than 400 gross tonnage flying the flag of a State bordering the Baltic Sea, should comply with guidelines concerning holding tanks or filtering equipment for separating oily water. The responsibility for avoiding discharges of oil or other harmful substances rests not only with the master and his crew, but also with the charterer, the ship-owner and the ports.

All ships entering the Baltic Sea area are urged to comply with the anti-pollution regulations of the 1992 Helsinki Convention. This applies to all ships, irrespective of whether or not they are flying the flag of a Contracting Party to the Helsinki Convention. To uphold the anti-pollution regulations all ships, with some exceptions, are required to deliver oil to a reception facility before leaving port. Oil loading terminals and repair ports are provided with reception facilities to receive and treat all the dirty ballast and tank washing water from oil tankers. Additionally, all ports are provided with reception facilities for other residues and oily mixtures from all ships. The countries bordering the Baltic Sea have agreed that a ship should not be charged for using the reception facilities to encourage delivery, also known as the no-special-fee system, and that the cost is to be covered through e.g. general harbor fees or general environmental fees.

The EU directive on port reception facilities for ship-generated waste and cargo residues (2000/59/EC) aims to reduce the discharges of ship-generated wastes and cargo residues into the sea, especially illegal discharges, by improving the availability and use of port reception facilities. The directive recognizes and

does not contradict with the procedures and mechanisms agreed by the Contracting Parties to the Helsinki Convention.

Effects of oil spill on the ecosystem

The introduction of non-synthetic oil-based products to the sea water poses a severe threat to the integrity of populations of seabirds and can also cause alterations in the food web through introduction of polyaromatic hydrocarbons through the planktonic food-web. Devastating effects of oil on waterbirds can also have a structural effect on marine food web integrity, as waterbirds are an integral part of the Baltic Sea ecosystem and play an important role in the marine food-web as herbivores, benthivores, piscivores or scavengers.

Waterbirds aggregate to specific feeding grounds in winter. Up to 90% of the wintering population aggregates to areas less than 5% of the entire Baltic Sea according to a census (Durinck et al. 1994). Any oil spill in or near these areas constitute a severe threat to the entire waterbird population in the Baltic Sea. Small amounts of oil on the sea surface are sufficient to cause a severe pressure on the wintering waterbird populations as the birds spend most of the time on the sea surface. Even minor oil contamination of the plumage is known to severely reduce the buoyancy of the waterbirds and expose them to hypothermia.

In the last decade maritime transportation has been growing steadily. An increase in the number of ships also means that one could expect a larger number of illegal oil discharges. Both oil tankers and other kinds of ships are among the suspected offenders of anti-pollution regulations. Oil pollution due to ship traffic has been considered the most severe threat to wintering seabirds and waterbirds in the coastal zone of Lithuania (Zydelis and Dagys 1997).

Monitoring requirements

Monitoring methodology

Co-operation on surveillance within the Helsinki Convention is carried out in accordance with Annex VII (Regulations 1, 3, 4, 10) to the 1992 Helsinki Convention and HELCOM Recommendation 34E/4. The procedures are further specified in Chapter 7 of HELCOM Response Manual Volume I.

The aerial and satellite surveillance activity conducted in the Baltic Sea by the HELCOM Contracting Parties is described in the HELCOM Response Manual Volume 1, Chapter 7 on aerial surveillance, including flight frequency, cooperation, equipment to be used, observation and documentation of spills etc.

Contracting Parties bordering the Baltic Sea are to conduct aerial surveillance in order to detect suspected offenders to the anti-pollutant regulations in accordance with the 1992 Helsinki Convention Annex VI. The aerial surveillance should be carried out at least twice per week over regular traffic zones including approaches to major sea ports as well as in regions with regular offshore activities. Other regions with sporadic traffic and fishing activities should be covered once per week. Experienced observers/pilots shall conduct reliable detections, classifications and quantification of observed pollution, their frequencies and geographical distributions. Also the Coordinated Extended Pollution Control Flights (CEPCO), which constitutes continuous surveillance of specific areas in the Baltic Sea are to be organized regularly (Super CEPCO biannually in the Baltic Sea (duration: several days), CEPCO North/CEPCO South, every second year, when there is no Super CEPCO (duration: 24h or more), Mini CEPCO, when considered needed (duration: 12h or more).

Aerial surveillance is supported by satellite observations of the CleanSeaNet (CSN) satellite surveillance service provided by the European Maritime Safety Agency (EMSA). It is recommended that satellite detections are checked as soon as possible by aerial surveillance or other means available.

Monitoring is carried out based on agreed methods described in the HELCOM Monitoring Manual in the sub-programme Acute Pollution based on the approach developed through the Response Manual Volume I.

Current monitoring

All Contracting Parties to HELCOM have agreed to participate in the collaboration on airborne surveillance to the best of their ability. The design of the aerial surveillance monitoring currently enable evaluation of all HELCOM sub-basins in this indicator and is considered sufficient. More information on current monitoring is available on the aerial surveillance site.

Current monitoring also includes remote sensing techniques. Satellite images are delivered to the countries by the European Maritime Safety Agency (EMSA) in near real time and provide a first indication of possible slicks to be checked by aircraft on spot.

Description of optimal monitoring

Current aerial surveillance efforts are considered to be sufficient to provide a high confidence evaluation of the volume of oil introduced to the Baltic Sea as visible spills.

Data and updating

Access and use

The data and resulting data products (tables, figures and maps) available on the indicator web pages can be used freely given that the source is cited. The indicator should be cited as following:

HELCOM (2017) Oil-spills affecting the marine environment. HELCOM core indicator report. Online [Date viewed], [Web link]

Metadata

Monitoring data on oil spills in the Baltic Sea is available since 1988, however, the annual reporting activities in the HELCOM framework started in 2000. Data is annually reported to the HELCOM Secretariat by the Contracting Parties which have conducted surveillance activities in the reporting year and the data is stored in a database hosted by the HELCOM Secretariat and made publically available on-line.

Reporting of the annual surveillance activity by the Contracting Parties to the HELCOM Secretariat is described in the Response Manual according to an agreed format and data standards. Quality assurance of data reported by the Contracting Parties is done by the HELCOM Secretariat.

Contributors and references

Contributors

HELCOM Informal Working Group on Aerial Surveillance - HELCOM IWGAS

Archive

This version of the HELCOM core indicator report was published in July 2017:

HOLAS II component - Core indicator report – web-based version July 2017 (pdf)

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Žydelis R, Dagys M, & Vaitkus G (2006): Beached bird surveys in Lithuania reflect marine oil pollution and bird mortality in fishing nets. Marine Ornithology 34: 161-166.

Additional relevant publications

HELCOM Annual report on illegal discharges observed during aerial surveillance are published: http://www.helcom.fi/action-areas/response-to-spills/publications/

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