HELCOM core indicator report
December 2015

Number of drowned mammals and waterbirds in fishing gear

Key Message

This core indicator evaluates whether the number of drowned marine mammals and waterbirds are below the level considered to reflect sustainable levels, i.e. whether the mortality due to by-catch is within limits that enable reaching Good Environmental Status (GES) for the marine mammals and waterbirds. Currently no environmental target has been defined for the core indicator, however the concepts for determining the targets based on removal- and conservation targets have been described and are proposed to form the basis of the core indicator target setting activities. Currently no complete evaluation has been carried out.

Key message figure 1: Status assessment results based evaluation on the indicator 'number of drowned mammals and waterbirds in fishing gear'. The assessment is carried out using Scale 2 HELCOM assessment units (defined in the HELCOM Monitoring and Assessment Strategy Annex 4). Click to enlarge.

For harbour porpoise, increased mortality due to drowning (including death by suffocation) in fishing gears is estimated to be the greatest source of mortality to the populations in the Baltic Sea and the number of drowned animals is believed to be above the considered environmental target of 'unacceptable interactions' for this species. Recent modelling efforts have shown that incidental catch is also a relevant source of human induced mortality in grey seals. No recent incidental catch estimates are available for ringed seals.

For waterbirds, drowning in fishing gear is believed to be a significant pressure on the populations of long-tailed duck, scoters, divers and some other waterbird species in wintering areas with high densities of waterbirds. Although a declining trend in numbers of by-caught birds has been detected in the last two decades, this is generally not believed to be a result of improved fishing practices. Declining trends in the abundance of wintering waterbirds (e.g. due to factors such as breeding success) have been detected which likely contributes to declining incidental catch numbers. In countries such as Denmark and Sweden, a reduced fishing effort may also have contributed to this declining trend.

Once the assessment is carried out, the confidence of the indicator evaluation is expected to be moderate to high.

The indicator is applicable in the waters of all the countries bordering the Baltic Sea.

Relevance of the core indicator

This core pressure indicator evaluates the number of drowned marine mammals (cetaceans, seals and otters) and diving waterbirds in fishing gears. The populations of these highly mobile animals are sensitive to additive mortality caused by fishing gear due to their characteristic slow reproduction.

The distribution and abundance of marine mammal populations is closely linked to healthy fish stocks and influenced by many human activities. For harbour porpoises, by-catch has been identified as the main cause of human-related mortality which is likely to inhibit population recovery. Drowning due to by-catches in fishing gear is a significant pressure on population trends and demography of waterbirds, as the numbers of drowned birds represent a relatively large proportion of the total population size.

The indicator is an important tool for detecting intolerable mortality in key populations of the highly mobile species due to fishing activities.

Policy relevance of the core indicator

	BSAP segment and objectives	**MSFD Descriptor and criteria**
Primary link	Biodiversity • Viable populations of species • Thriving and balanced communities of plants and animals	Annex III
Secondary link	Eutrophication • Natural distribution and occurrence of plants and animals	D1 Biodiversity 1.1 Species distribution (range, pattern, covered area) 1.2 Population size (abundance, biomass) 1.3. Population condition (demography, genetic structure) D4 Food-web 4.1. Productivity of key species or trophic groups

		4.3 Abundance/distribution of key trophic groups/species
Other relevant legislation: In some Contracting Parties also EU Birds Directive, EC Action Plan for reducing incidental catches of seabirds in fishing gears, EU Habitats Directive, Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) and Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)		

Cite this indicator

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Core indicator report – web-based version November 2015 (pdf)

Extended core indicator report – outcome of CORESET II project (pdf)

Results and Confidence

A complete evaluation of whether Good Environmental Status (GES) is achieved in terms of the number of drowned mammals and waterbirds in fishing gear has not yet been carried out. Currently, only indicative results are presented due to the lack of availability of suitable monitoring-based data and only rough estimates of mammals and birds drowning in fishing gears could be calculated based on case studies. Thus the presented results do not allow for a confident assessment of whether the environmental target is reached.

Marine mammals

For harbour porpoises, the by-catch risk is highest in various types of gillnets: set gill nets (gear type: GNS), entangling nets (trammel nets, GTR) and driftnets (GND) (ICES 2013a). The latter are banned in the Baltic Sea, but some hybrid nets such as 'semi-driftnets' which are fixed on one end of the net with the other end drifting around this anchor are of special concern.

For seals, in addition to the gear mentioned above, fykenets (FYK) are of special concern (ICES 2013a, Vanhatalo et al. 2014). These might also pose the greatest threat to Eurasian otters (Raby et al. 2011).

By-catch of harbour porpoises and seals is difficult to estimate and reliable studies are scarce, but for harbour porpoise the suffocation through by-catch in fishing gears is believed to be the greatest source of mortality and requires immediate action (ASCOBANS 2009, 2012).

It has been estimated earlier that a minimum of 300 grey seals, 80 ringed seals and 7–8 harbour seals annually drown as by-catch in the Baltic Sea (Korpinen & Bräger 2013). Based on recent interviews of fishermen from Sweden, Finland and Estonia, and accounting for the variability in seal abundance and fishing effort and also for underreporting of by-catch incidents, the annual by-catch of grey seals in trap nets and gill nets in these countries is much higher than earlier estimates. The study suggests that around 2,180-2,380 individual seals were by-caught in 2012, probably representing at least 90% of the total by-catch in the whole Baltic Sea (Vanhatalo et al. 2014). Related to counted seal numbers (Finnish Game and Fisheries Research Institute 2013), the by-catch rate is thus 7.7-8.4% while the annual population growth rates were estimated to be 9.4% (2000-2004) and 3.5% (2004-2009) in Finland (Kauhala et al. 2012) and 7.5% along the Swedish Baltic Sea coast since the 1990s.

Waterbirds

Diving waterbirds are especially vulnerable to set gill nets (GNS), entangling nets (trammel nets, GTR) and driftnets (GND), but by-catch also occurs in other static fishing gears such as longlines (ICES 2013a, b). Taxonomic groups under high pressure are divers, grebes, cormorants, alcids, mergansers and ducks. High by-catch numbers are reported from regions of high bird abundance (e.g. wintering birds on offshore banks and in coastal areas, Larsson and Tydén 2005, Žydelis et al. 2009, 2013, Bellebaum et al. 2012). Several studies have shown that the gillnet fishery in the Baltic Sea can in certain places cause high bird mortality. A rough estimate comprised 100,000-200,000 waterbirds drowning annually in the North and Baltic Seas, of which the great majority refers to the Baltic Sea (Žydelis et al. 2009, 2013, Bellebaum et al. 2012). Locally, by-catch rates have decreased during the last two decades, likely as a result of declined abundance of wintering waterbirds (Bellebaum et al. 2012). Areas where waterbirds aggregate are often overlapping with gillnet fishery (Sonntag et al. 2012), thus the by-catch problem is of special relevance when gillnet fishery is

exercised in the areas with many foraging waterbirds, which can be present during the breeding period, during migration, for moulting and for wintering.

Confidence of indicator Evaluation

Monitoring data on numbers of drowned waterbirds and mammals due to by-catch collected on an annual basis do not exist. Results of scientific studies and pilot studies so far only produced limited data. Ongoing studies such as the Danish CCTV study may help increasing the confidence in the near future. So far, the confidence in any previous estimates of the pressure exerted by by-catch of the relevant populations is low. All estimates are believed to be underestimates, and the proportion of unreported cases is likely to be high. Nevertheless, the magnitude of the waterbird by-catch has been sufficiently clarified on a regional scale (Žydelis et al. 2009). The extent of the problem for marine mammals is not well known due to the lack of by-catch data from existing monitoring programmes. By-catch numbers for seals and harbour porpoises are either absolute minimum numbers (from reported by-catches) or estimates from pilot studies. The study by Vanhatalo et al. (2014) has recently increased the knowledge about seal by-catch. However, in order to assess GES, monitoring data are needed instead of single estimates.

Environmental Target

Due to lack of sufficient monitoring data, it has not been possible to set an Environmental Target (ET) for this core indicator on number of drowned mammals and waterbirds in fishing gear. However, the concepts for determining targets based on removal- and conservation targets have been described and are proposed to form the basis of the core indicator target setting activities.

The concept to apply an ET supported by species specific removal- and conservation targets has been developed in other contexts, including in work carried out under the Commission for the Protection of the Marine Environment of the North-East Atlantic (OSPAR). In developing EU Marine Strategy Framework Directive (MSFD) appropriate targets for reaching the overall goal of Good Environmental Status (GES) related to by-catch, OSPAR proposes a target based on reduction in annual by-catch rates until a level is reached which is lower than the level at which conservation objectives are expected to be met (ICES 2014b). This approach to setting an ET requires setting species specific conservation targets and defining reference points (removal targets) for the annual by-catch rate.

Removal targets are based on 'unacceptable mortality levels' for the indicator species. 'Unacceptable interactions' have been defined for harbour porpoises (ASCOBANS 2000, see also species specific targets below). Levels of 'unacceptable interactions' are related to the total human induced mortality of which by-catch is an unknown fraction that may differ regionally. These levels of 'unacceptable interactions' should not be misinterpreted as 'acceptable levels' if the values are below the reference points.

Conservation targets are focused on the state of a stock or a population. A target for a safe human-induced mortality limit (as a consequence from the removal target) is usually the outcome of a simulation over a certain time period using a population dynamic model. During the time period, the target for the stock size is to be reached. In order to set a safe human-induced mortality limit, the time scale of the simulations have to be agreed upon, i.e. the period within which the conservation target should be reached (ICES 2014a). ICES concluded that such human induced mortality limits (or threshold reference points), should account for uncertainty in existing estimates of by-catch and allow for current conservation goals to be met in order to enable managers to identify fisheries that require further monitoring and those where mitigation measures are most urgently required (ICES 2013a).

In the long-term, mortality in a healthy population must not exceed the birth rate (natality) in order to sustain the population. In seriously depleted populations the human-related mortality must be close to zero to allow for recovery. All the highly mobile indicator species have a slow reproductive rate (K-strategists), and thus the 'unacceptable' mortality due to drowning in fishing gear has to be set at a low level, in order to avoid serious long-term implications for the populations. Due to the fact that the indicator species are affected by several pressures from various human activities, the general aim must be to minimize by-catch of marine mammals and waterbirds as much as possible.

The use of trend-based targets is not considered appropriate for by-catch, due to the risk of falsely indicating a good status when the target is reached. A slight downward trend may falsely indicate an improvement, as by-catch is less likely to occur in depleted populations close to regional extinction due to the simple fact that fewer animals occur in the area.

Alternative target setting approaches

For management purposes, interim objectives or short-term and longer-term removal targets have been set for certain species, such as the harbour porpoise. The simplest management approach for setting an interim target is defining a reference point as a fixed percentage of the best population estimate. However, there are uncertainties regarding both values which have to be taken into account. These have been included in more sophisticated approaches (e.g. potential biological removal (PBR) or catch limit algorithm (CLA)) aiming at more conservative targets. Any interim targets should be applied keeping in mind the general aim of ultimately reducing by-catches to zero (resolution no. 5- ASCOBANS 2006).

The **By-catch Risk Approach (BRA)** can be used for determining an ET. A BRA was initially developed for cetaceans at an ICES Workshop (ICES 2010) in order to identify areas and fisheries that are likely to pose the greatest conservation threat to by-caught cetacean species, taking into account the uncertainty of the population structure. The BRA highlights areas where the greatest problems occur and enables educated fisheries management decisions.

The **potential biological removal (PBR)** can also be applied, and is used to set removal targets under the US Marine Mammal Protection Act. The conservation goal is the 'optimum sustainable population' defined as being at or above the population level that will result in maximum productivity (ICES 2014a). For birds, the ICES Workshop to Review and Advise on Seabird Bycatch (WKBYCS) recognises PBR only as an initial and rapid assessment tool, which can indicate possible unsustainable mortality levels that would have to be followed by more sophisticated methods for reliable analyses (ICES 2013b). In addition, the workshop pointed out that basic assumptions of the PBR concept need testing and validation before applying to birds.

A **catch limit algorithm (CLA),** based on the principles of the International Whaling Commission's (IWC) revised management procedure (RMP) for commercial whaling, has been used to calculate by-catch limits for harbour porpoises in the North Sea (Winship 2009). The next step should be to expand the capability of the model by incorporating multiple areas in the model. Further, a CLA for the Baltic Sea populations still needs to be developed. In the calculations by Winship (2009), the underlying conservation objective has been assumed to be the ASCOBANS interim conservation objective (IWC 2000) 'to allow populations to recover to and/or maintain 80% of carrying capacity in the long term'.

Since 2009, ICES has advised the European Commission that CLA is the most appropriate method to set limits on harbour porpoise, but this advice still has not been acted upon (ICES 2014a). It is to be noted that all approaches rely on a suitable monitoring programme as a prerequisite and that none of the approaches described above can be applied directly to depleted populations (such as the harbour porpoise Baltic Proper population).

Targets for harbour porpoise

Within the frame of ASCOBANS, conservation targets have been agreed on for the population size of harbour porpoises for two management units: (1) the Kattegat, Belt Sea and Western Baltic population and (2) the Baltic Proper population. ASCOBANS (2002, 2009, 2012) has adopted an interim goal of restoring (and maintaining) the populations of harbour porpoises to at least 80% of their carrying capacity. The ASCOBANS *Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat* (ASCOBANS 2012) states that ASCOBANS has advised that, to be sustainable, 'the maximum

annual anthropogenic induced mortality (including by-catch, but also less conspicuous causes of death such as stress caused by pollutants or noise) for harbour porpoises should not exceed 1.7% of the best estimate of the population size' (Resolution No. 3, Incidental Take of Small Cetaceans, Bristol 2000).

Scientific analyses based on data from a survey of the southern and western part of the Baltic Proper indicate that for the critically endangered (2) Baltic Proper population, recovery towards this goal could only be achieved if the by-catch were reduced to two or fewer porpoises per year (Berggren et al. 2002). This resulted in the objective (i.e. a removal target) of the ASCOBANS *Recovery Plan for Baltic Harbour Porpoises* (Jastarnia Plan) to 'reduce the number of by-caught porpoises in the Baltic Proper towards zero' (ASCOBANS 2002, 2009). In the light of new data from the SAMBAH survey it has to be specified what is meant by 'towards zero'.

The IWC stated that a flag of concern should be raised if the number of small cetaceans captured is greater than 1% of their total population size. The 1% limit can also be found in the Resolution No. 3, Incidental Take of Small Cetaceans as an intermediate precautionary objective (ASCOBANS 2000). The resolution states that where there is significant uncertainty in parameters such as population size or by-catch levels, then 'unacceptable interaction' may involve an anthropogenic removal of much less than 1.7%.

To date, the exact level of by-catch is unknown for both harbour porpoise management units in the Baltic Sea. Thus, from this perspective the removal target should be less than 1% for the population of the Western Baltic, Belt Sea and Kattegat (Czybulka et al. in prep), whereas for the Baltic Proper population (which is depleted) the target to be applied would be 'as a matter of urgency, every effort should be made to reduce the porpoise by-catch towards zero as quickly as possible' (ASCOBANS 2009).

The abundance point estimate of harbour porpoises in the Baltic Proper assessed by means of 304 acoustic data loggers is 447 animals (95% CI: 90-997) (SAMBAH 2014). The size and trend of the population of the Western Baltic, Belt Sea and Kattegat is unclear, due to the results from different surveys indicating opposite trends in population size and it is not clear if this reflects real trends in population abundance (ASCOBANS 2015). An estimate of 18,495 animals (CV = 0.27, 95% CI: 10,892-31,406) has been provided from shipbased surveys (Sveegaard et al. 2013). This population estimate excluded the Öresund and the area east of the island of Fehmarn, in which low densities have been reported from aerial surveys (Gilles et al. 2014). In contrast, a survey including the 'gap area from Fehmarn to Cape Arkona estimated 40,475 animals (CV = 0.24, 95% CI: 25,614–65,041) (Viquerat et al. 2014). The area included in this survey may in part overlap with the Baltic Proper population's range (Benke et al. 2014) and the included western Kattegat, where high densities were recorded, is currently believed to also be used by animals from the North Sea population (Sveegaard et al. 2013).

The 1% limit (applicable due to the uncertainty of by-catch levels and population abundance, see above) can be used as a starting point or an interim-target only for the Western Baltic-Belt Sea-Kattegat harbour porpoise population, as it has already been agreed upon in various international conventions and conservation bodies such as ASCOBANS, OSPAR, IWC and thus is widely accepted. As this limit is applied to the 'best' population estimate, and the confidence interval covers a wide span, it is suggested that as a precaution the lower value of the 95% confidence interval of the figures of the Sveegaard et al. (2013) survey should be used as the target. Modelling 'safe' human-induced mortality limits (including by-catch) using concepts such as a PBR and a CLA for harbour porpoises is necessary to improve the management of the populations in the different areas. It would be appropriate to determine targets using the PBR and CLA,

which take the uncertainty of data into account, and as soon as simulations using these approaches are available, the above mentioned target for the different management units should be reconsidered.

Targets for seals

No specific removal targets for seal by-catch have been formulated to date that could directly be applied as an ET for this core indicator. The HELCOM Recommendation 27-28/2 recommends reducing incidental by-catches of seals to a minimum level and if possible to a level close to zero and to develop efficient mitigation measures.

The conservation target for seals within the HELCOM area is that the populations grows until limited by the environmental carrying capacity of their Baltic Sea habitat. Recovery towards this target will be allowed as a long-term objective. A lower reference limit below which the survival of the population is at risk and a middle reference limit are used for anthropogenic removal licenses. The overall target is to continually improve the situation of the seal species, but no timescale for its achievement is given (Lonergan 2011).

Information about the distribution of Baltic seal species is provided in the extended core indicator report, as well as in more detail in the core indicator on distribution of Baltic seals.

Targets for otters

HELCOM (2013) lists by-catch in fishing gear, among others pressures, as a major threat to Eurasian otters. However, the extent of the problem is not known. No goals or targets for by-catch reduction have been formulated yet.

Targets for waterbirds

A reduction in the number of by-caught waterbirds is needed to reach conservation goals. For the species concerned, analyses of thresholds for unacceptable losses of individuals are lacking, but are urgently desired as soon as data from by-catch monitoring become available. Among the class of birds with a wide range of patterns of population dynamics, it has to be stressed that many of the waterbirds are species with high longevity, low reproductive rates and late maturity. These characteristics make them vulnerable to the loss of adult individuals in particular (Dierschke & Bernotat 2012).

Environmental targets that could be provisionally considered have been derived using the PBR concept in some initial studies. However, the ICES Workshop to Review and Advise on Seabird Bycatch (WKBYCS) only recognizes PBR as an initial and rapid assessment tool that can be used to indicate possible unsustainable mortality levels, and that more sophisticated methods are required in addition for a reliable analysis (ICES 2013b). Basic assumptions of the PBR concept in relation to birds also require further testing and validation before they can be used as a robust basis for target setting (see also Richard & Abraham 2013). As an action under the EU Plan of Action (European Commission 2012), a relevant scientific body will review criteria and possible biological indicators which could be used for setting management targets. It is thus a preliminary suggestion that the ET will be reached when waterbird by-catch is below the removal targets and it has been proven that the set removal target is effective (e. g. by a trend towards the conservation target in the population monitoring data). Thus the removal targets derived based on PBR must be considered as provisional only.

So far, uncertainties impede the application of PBR in a management context to set trigger levels for by-catch in a population (ICES 2013b). It is also important to note that deriving a 'maximum allowable catch' of

seabirds appears not to be consistent with the EU Plan of Action's (European Commission 2012) overall objective to 'minimise and where possible eliminate' by-catch and with Article 5 of the EU Birds Directive, which requires Member States to take measures prohibiting the 'deliberate killing or capture [of birds] by any method'. According to Article 7 of the Birds Directive, exceptions from the prohibition of deliberate killing are allowed in the context of hunting, and some of the species listed in Annexes II/1 and II/2 include species prone to drowning in fishing gear in the Baltic Sea.

In northern Europe, the impact of by-catch on population dynamics has so far only been estimated for three species by applying the PBR approach. CLAs have not been applied to waterbird populations, and would require information on population trends currently unavailable for the majority of Baltic waterbirds. Application of PBR and CLA approaches appears to allow for formulation of species-specific ETs for waterbirds, as soon as reliable estimates of the species specific mortality levels can be obtained through by-catch monitoring. A prerequisite for the application of PBR and CLA is knowledge about the species specific mortality and population sizes as input parameters, but data are not yet sufficiently available for all species.

An overview of recent estimates for the numbers of waterbirds wintering in the Baltic Sea is given by Skov et al. (2011). Accordingly, the by-catch problem concerns 8,575 red-throated and black-throated divers, 8,300 great crested grebes, 770 red-necked grebes, 2,890 Slavonian grebes, 54,000 great cormorants, 30,450 common pochards, 476,000 tufted ducks, 127,000 greater scaups, 515,000 common eiders, 2,300 Steller's eiders, 1,486,000 long-tailed ducks, 412,000 common scoters, 373,000 velvet scoters, 174,000 common goldeneyes, 12,600 smew, 25,700 red-breasted mergansers and 66,000 goosanders, but also less considerable numbers of common guillemot, razorbill and black guillemot (the latter not quantified by Skov et al. 2011).

For long-tailed duck, greater scaup (including wintering birds in the Netherlands) and common guillemot, the PBR approach has been applied (Žydelis et al. 2009) in order to derive removal targets that can be provisionally considered. For the declining population of long-tailed duck (Skov et al. 2011) the PBR limit was calculated to be 113,000 individuals, of which roughly half is reached by estimates of annual mortality from by-catch (22,000 birds), hunting (24,000 birds in EU countries alone, Mooij 2005) and oiling ('tens of thousands', Larsson & Tydén 2005). The PBR limit for greater scaup is 3,700 birds, a value exceeded by losses from fisheries in Northern Europe alone and intensified by losses owing to other pressures. For common guillemot, the calculated PBR limit of 620 individuals is more than twice exceeded by the estimated minimum by-catch for the Baltic Sea (Žydelis et al. 2009). Cumulative impacts including losses from by-catch were found to reach critical limits also in the red-throated diver (Dierschke et al. 2012), a species severely suffering from drowning in gill nets also in other parts of its distributional range (Warden 2010).

Assessment Protocol

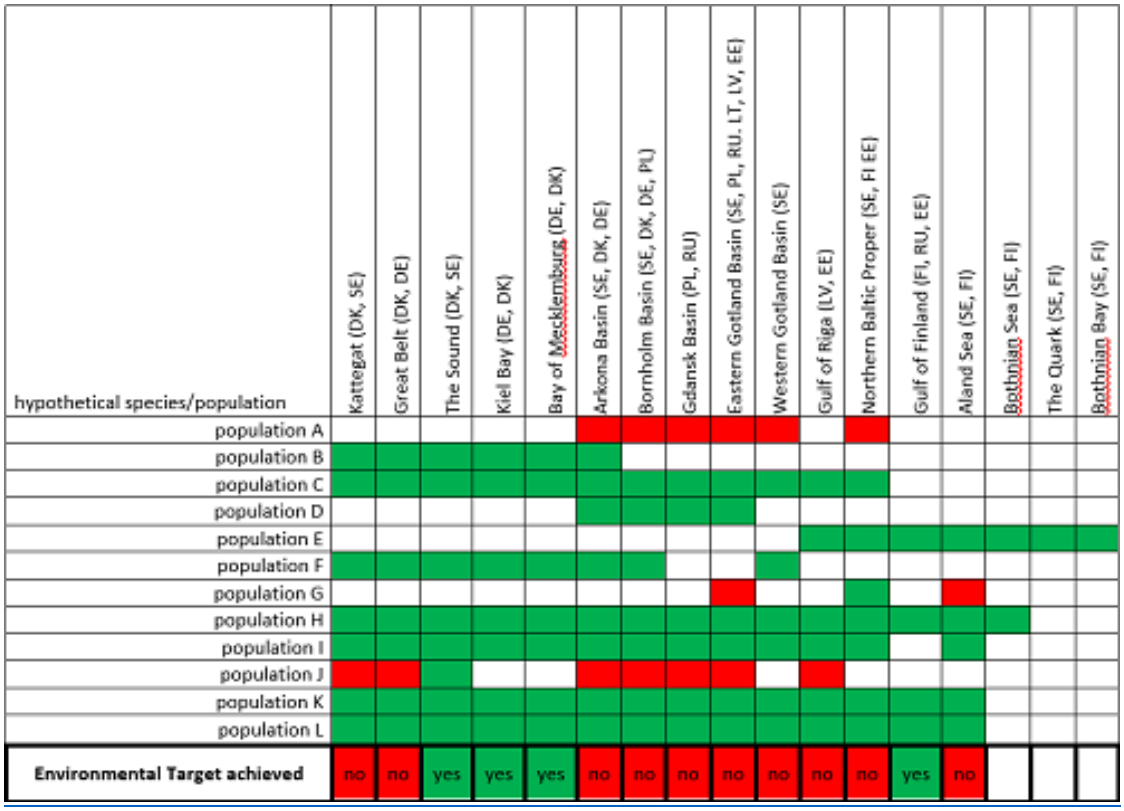
Good environmental status (GES) is achieved if the by-catch numbers of all assessed species within a given assessment unit are below the Environmental Target (i.e. threshold level). The 'one-out, all-out' principle is applied when different species within the same assessment unit show different results.

Whether the potential biological removal (PBR) the or catch limit algorithm (CLA) method is used to compare by-catch numbers in a population to its size, the level of pressure on a population is considered to be at an unacceptable level if the contribution of by-catch brings human-caused mortality above the environmental target (ET) threshold. A population-specific evaluation is applied to all HELCOM level 2 sub-basins in which i) the population occurs and ii) by-catch causing fishery is spatially overlapping with the distribution of that population.

The ET evaluation for a single sub-basin is done using the 'one-out, all-out' principle, which for instance is applied in the EU Water Framework Directive (European Commission 2000). This means that the ET is not reached if by-catch for a single population contributes to exceeding the pre-defined threshold of human induced mortality for that population.

It must be taken into account that not all species are distributed throughout all sub-basins. Consequently, for areas outside the distributional range, no conservation- or removal target for the species are needed in the particular sub-basin and the number of species assessed varies among the sub-basins. A hypothetical example of the evaluation procedure on the level of sub-basins is demonstrated in Assessment protocol table 1.

Assessment protocol table 1. Hypothetical example for the assessment of Good Environmental Status (GES) using the by-catch indicator on a sub-basin level. The by-catch number of any population is compared to the specific threshold level (e.g. PBR, CLA), and the assessment result (green: by-catch numbers below threshold; red: by-catch number above threshold) is transferred to all sub-basins in which that population occurs. Note that despite too much by-catch, a given sub-basin is allowed to achieve a good rating, if the distributions of by-catch causing fishery and the respective population are not overlapping (in this example in population G/Northern Baltic Proper and population J/Sound). Following the 'one-out, all-out' principle, the assessment result of a given sub-basin is non-GES if any of the occurring assessed mammal or bird populations has a sub-GES rating in that sub-basin. Click to enlarge.



hypothetical species/population	Kattegat (DK, SE)	Great Belt (DK, DE)	The Sound (DK, SE)	Kiel Bay (DE, DK)	Bay of Mecklenburg (DE, DK)	Arkona Basin (SE, DK, DE)	Bornholm Basin (SE, DK, DE, PL)	Gdansk Basin (PL, RU)	Eastern Gotland Basin (SE, PL, RU, LT, LV, EE)	Western Gotland Basin (SE)	Gulf of Riga (LV, EE)	Northern Baltic Proper (SE, FI EE)	Gulf of Finland (FI, RU, EE)	Aland Sea (SE, FI)	Bothnian Sea (SE, FI)	The Quark (SE, FI)	Bothnian Bay (SE, FI)
population A																	
population B																	
population C																	
population D																	
population E																	
population F																	
population G																	
population H																	
population I																	
population J																	
population K																	
population L																	
Environmental Target achieved	no	no	yes	yes	yes	no	no	no	no	no	no	no	yes	no			

Assessment units

The indicator is applicable in the whole Baltic Sea, as it is known that by-catches of birds and mammals in fisheries occur in the whole area. The indicator will be evaluated 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.

Assessments concerning the by-catch of mammals and birds face the challenge that on the one hand the situation of marine areas needs be assessed on a scale that allows for identification of problem areas where actions should be taken (e.g. within the MSFD framework), but on the other hand the methods available need to be exercised on the level of populations. Given the high mobility of marine mammals and waterbirds, and the distributional range of populations, assessments will necessarily need to incorporate a scale of the range of a population or management unit, but also needs an adjustment to HELCOM assessment units, with Scale 2 appearing to be an appropriate one.

For example, in the case of the harbour porpoise, two management units exist: 1) the population of the Western Baltic, Belt Seas and Kattegat and 2) the Baltic Proper population. Certain high-density areas (probably representing key habitats) have been identified (Sveegaard et al. 2011; SAMBAH 2014). The preliminary distribution maps produced within the SAMBAH project make it possible to draw a contour around an area where the probability of detecting a porpoise within a given month is e.g. 30% or higher. Based on this, the area around the Midsjö offshore banks south-east of Öland Banks seem to be of crucial importance during the summer months when the Baltic Proper porpoise population is spatially separated from the population of the Western Baltic, Belt Sea and Kattegat. This approach is similar to choosing certain kernel contours based on satellite transmitter data of tagged porpoises (as used in Sveegaard et al. 2011). By-catch risk assessment can be made combining this data with available information on fishing effort with gear types known for high by-catch risk (e.g. gillnets with large mesh size).

As the assessment for this core indicator has to be made using HELCOM assessment units, for the population of the Western Baltic, Belt Sea and Kattegat, the HELCOM open sea assessment units Kattegat, The Sound, Great Belt, Kiel Bay, Bay of Mecklenburg and Arkona Basin should be combined. For the Baltic Proper population, a combination of the assessment units Arkona Basin, Bornholm Basin, Western and Eastern Gotland Basin, Gdansk Basin and Northern Baltic Proper is necessary. More northern and eastern regions may be added as information becomes available if these areas are regularly inhabited by harbour porpoises. In the overlapping area where both populations occur (i.e. Arkona Basin), by-catches should be assigned to the endangered Baltic Proper population as a precautionary approach.

Difficulties exist both in measuring by-catch and population size to a sufficiently high degree of accuracy on a regional scale. If this information becomes available, the assessment units may be downscaled. Assessment protocol table 2 shows some examples of mammal and waterbird distributions downscaled to HELCOM assessment unit scale 2.

Assessment protocol table 2. Distribution of some marine mammals and waterbirds on the level of HELCOM level 2 sub-basins (after Skov et al. 2011; Sveegaard et al. 2011; Härkönen et al. 2014; SAMBAH 2014). Click to enlarge.

	HELCOM level 2 sub-basin																
	Kattegat (DK, SE)	Great Belt (DK, DE)	The Sound (DK, SE)	Kiel Bay (DE, DK)	Bay of Mecklenburg (DE, DK)	Arkona Basin (SE, DK, DE)	Bornholm Basin (SE, DK, DE, PL)	Gdansk Basin (PL, RU)	Eastern Gotland Basin (SE, PL, RU, LT, LV, EE)	Western Gotland Basin (SE)	Gulf of Riga (LV, EE)	Northern Baltic Proper (SE, FI EE)	Gulf of Finland (FI, RU, EE)	Aland Sea (SE, FI)	Bothnian Sea (SE, FI)	The Quark (SE, FI)	Bothnian Bay (SE, FI)
harbour porpoise (Baltic proper)						x	x	x	x	x		x					
harbour porpise (W Baltic)	x	x	x	x	x	x											
ringed seal									x		x	x	x	x	x	x	x
red-throated diver	x	x	x	x	x	x	x	x	x	x	x	x					
Slavonian grebe						x	x	x	x								
great cormorant	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
common eider	x	x	x	x	x	x	x			x							
Steller's eider									x			x		x			
long-tailed duck	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
common scoter	x	x	x	x	x	x	x	x	x	x	x	x		x			
velvet scoter	x	x	x			x	x	x	x		x						
common goldeneye	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
smew	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
red-breasted merganser	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
goosander	x	x	x	x	x	x	x	x	x	x	x	x	x	x			

Relevance of the Indicator

Biodiversity assessment

The level of pressures affecting the status of biodiversity is assessed using several core indicators. Each indicator focuses on one important aspect of the complex issue. In addition to providing an indicator-based evaluation of the numbers drowned mammals and waterbirds in fishing gear, this indicator will also contribute to the next overall biodiversity assessment to be completed in 2018 along with the other biodiversity core indicators.

Policy Relevance

The core indicator on number of drowned mammals and waterbirds in fishing gear addresses the Baltic Sea Action Plan's (BSAP) Biodiversity and nature conservation segment's ecological objectives 'Viable populations of species' and 'Thriving and balanced communities of plants and animals' as well as the Eutrophication segment's ecological objective 'Natural distribution and occurrence of plants and animals'. It also address the following specific target:

'By 2015 by-catch of harbour porpoise, seals, water birds and non-target fish species has been significantly reduced with the aim to reach by-catch rates close to zero'.

In the BSAP, it was further agreed to set up a reporting system and database for harbour porpoise by-catch, and competent fisheries authorities were urged to minimize the by-catch of harbour porpoise.

The core indicator also addresses the following qualitative descriptors of the MSFD for determining good environmental status (European Commission 2008a):

Descriptor 1: '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' and

Descriptor 4: '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',

and the following criteria of the Commission Decision (European Commission 2010):

- Criterion 1.1 (species distribution)
- Criterion 1.2 (population size)
- Criterion 1.3 (Population condition)
- Criterion 4.1 (Productivity of key species or trophic groups)
- Criterion 4.3 (abundance/distribution of key trophic species)

For the three seal species occurring in the Baltic Sea, the HELCOM Recommendation (27-28/2) adopted in 2006 relating to seals recommends:

- to take effective measures for all populations in order to prevent illegal killing, and to reduce incidental by-catches to a minimum level and if possible to a level close to zero;
- to develop and to apply where possible non-lethal mitigation measures for seals to reduce by-catch and damage to fishing gear, as well as to support and coordinate the development of efficient mitigation measures.

Presently, management objectives for all protected species are unclear at the EU level (ICES 2013a). While broad commitments have been made to achieve Good Environmental Status (GES) under the EU Marine Strategy Framework Directive (MSFD), and to Favourable Conservation Status (FCS) under the Habitats Directive, translating these goals into specific targets on incidental catch limits is as yet unspecified by the EU.

The EU Habitats Directive lists harbour porpoise as a strictly protected species (Annex IV). The harbour porpoise and the three seal species are listed in Annex II, meaning that they are to be protected by the means of the Natura 2000 network. Article 12, para 4. of the Habitats Directive states that Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a) (European Commission 1992). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned. Member States of the EU are further obliged to develop national programmes for monitoring fisheries, including on board monitoring, under Article 3 of Council Regulation 199/2008, Commission Regulation 665/2008 and the Annex of Commission Decision 2010/93/EU (European Commission 2008b, 2008c, 2009a). These plans include detailed data on fleet capacity and fishing effort by metier and fishing area.

The EU Birds Directive aims to protect, inter alia, habitats of endangered and migratory birds to ensure their conservation in the Europe (European Commission 2009b). This not only refers to birds needing special conservation measures (Article 4 (1)) and listed in Annex I, but also to all migratory species (Article 4 (2)). Therefore, all waterbird species breeding, wintering and staging during migration in the Baltic Sea are covered by this Directive.

EU legislation clearly requires Member States to take measures prohibiting deliberate killing or capture by any method (Article 5 Birds Directive; Article 12 Habitats Directive) which also includes the mere acceptance of the possibility of killing or capture (Case C-221/04 Commission v Spain [2006] ECR I-4515, paragraph 71). Further, the Habitats Directive requires that incidental capture or killing of cetaceans is monitored, and that it should not have a significant negative impact on the species.

As a voluntary instrument within the framework of EU and international environmental and fishery legislation and conventions, the EU Commission has adopted an 'Action Plan for reducing incidental catches of seabirds in fishing gears' (European Commission 2012). It aspires to provide a management framework to minimise by-catch as much as possible in line with the objectives of the reformed EU Common Fisheries Policy (CFP), i.e. to cover all components of the ecosystem. Among others, proposed action includes the monitoring of seabird by-catch with a minimum coverage of 10% of the fisheries and mitigation measures.

The Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) aims to achieve and maintain a favourable conservation status of small cetaceans. Six of the nine Baltic Sea countries are Parties to the Convention (Denmark, Germany, Sweden, Poland, Lithuania and Finland).

All waterbird species occurring in the Baltic Sea are subject of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

Role of the pressure exerted through by-catch on the ecosystem

In Baltic Sea fisheries, the use of anchored gill nets has substantially increased since the 1990s, increasing the conflict between certain fisheries and bird and mammal species (ICES 2007). Waterbirds diving during foraging in order to catch demersal or pelagic fish (divers, grebes, cormorants, mergansers, alcids) and benthic invertebrates (ducks), respectively, are prone to become entangled in various types of nets and to die by drowning. In addition to hunting (Mooij 2005) and oiling (Larsson & Tydén 2005), drowning in fishing gear is a quantitatively important source of mortality for waterbirds living in the Baltic.

The intensification in use of anchored gill nets in the coastal waters of Estonia, Latvia and Lithuania has substantially increased the risk of drowning for the indicator species in the last decades (Zydelis et al. 1990). In other areas, such as Swedish and Danish waters, fishing efforts have decreased in recent years, consequently also reducing the number of incidentally caught highly mobile animals (Ida Carlén & Finn Larsen, pers. comm.).

In the wide range of population dynamics shown by birds in general, waterbirds belong to those species with high longevity and low reproductive rates. They are therefore vulnerable to the loss, especially of adult individuals, as it takes a relatively long time to compensate for such losses (Dierschke & Bernotat 2012). For waterbirds living in the Baltic Sea, the mismatch between the loss of individuals and the effort to replace them is most pronounced in alcids, whereas ducks may catch up more easily owing to higher reproductive rates and lower ages of first breeding. However, other factors promoting or impeding population growth rates may override this pattern, as currently visible for instance in alcids (increasing owing to favourable food supply; Österblom et al. 2006; Hario et al. 2009), long-tailed duck (declining owing to low reproductive success) and common eider (declining due to reduced mussel stocks; Laursen & Møller 2014).

The same applies to harbour porpoise and seals, which are top predators in the Baltic Sea marine food web and which, due to their population dynamics, are vulnerable to additive mortality (Dierschke & Bernotat 2012). Incidental mortality that exceeds the potential rate of increase will drive a population to extinction. It is thus necessary to keep the sum of all anthropogenic mortality, including by-catch, below a critical value. From the conservation perspective, immediate management consequences are needed if this critical value is exceeded. In 1991, the Scientific Committee of the International Whaling Commission recommended that incidental mortality should not exceed half of the potential rate of increase (IWC 1991). Furthermore, incidental mortality greater than one fourth of the potential rate of increase should be considered cause for concern (IWC 1996). A maximum rate of population increase for harbour porpoises used by ASCOBANS and the IWC based on their known life history parameters is 4% per annum.

For harbour porpoises, the by-catch risk is highest in various types of gillnets: set gill nets (gear type: GNS), entangling nets (trammel nets, GTR) and driftnets (GND) (ICES 2013a). The latter are banned in the Baltic Sea, but some hybrid nets such as 'semi-driftnets' which are fixed on one end of the net with the other end drifting around this anchor are of special concern (Skora & Kuklik 2003). In a number of cases, fisheries have tried to circumvent driftnet restrictions of the EU Common Fisheries Policy (CFP) through minor technical modification (Caddell 2010). Due to their properties (one end freely drifting around an anchor), semi-driftnets which are commonly used in Poland may thus attract close attention from the Commission in future years, if they remain widely used on a commercial scale (Caddell 2010). These nets have been reported as GND until 2007, and now (after the ban of GND) are considered GNS (Hel Marine Station, pers. comm.).

The mean longevity of harbour porpoises is only 8-10 years (Read & Hohn 1995; Lockyer & Kinze 2003; Bjørge & Tolley 2009). Stranding data show that only 5% of porpoises live beyond 12 years (Lockyer & Kinze 2003). Sexual maturity is reached late, at the age of 3 to 5 years (Sørensen & Kinze 1994; Adelung et al. 1997; Benke et al. 1998; Lockyer & Kinze 2003). Based on this, it is estimated that a female with a longevity of about 10 to 12 years can deliver only 4 to 6 calves during its life span (Lockyer & Kinze 2003), which would only allow for slow recovery.

Monitoring Requirements

Monitoring methodology

Monitoring relevant to the indicator is described on a general level in the HELCOM Monitoring Manual in the **sub-programme: Fisheries by-catch**.

Current national discard/by-catch monitoring programmes carried out under the EU data collection framework (DCF) do not target marine mammal and bird by-catches. Monitoring under the EU council regulation 812/2004 protecting cetaceans against incidental catch (European Commission 2004) lays measures concerning incidental catches of cetaceans in fisheries using onboard observers but is limited to larger vessels and hence results in the lowest observer coverage of fisheries posing greatest threat to porpoises and seals in the Baltic Sea (ICES 2013a).

Current monitoring

No regular monitoring activities relevant to the indicator are currently carried out by HELCOM Contracting Parties (see HELCOM Monitoring Manual in the Monitoring Concept Table).

Sub-programme: Fisheries by-catch
Monitoring Concept Table

All HELCOM Contracting Parties which are also EU Member States are obliged to carry out monitoring to provide estimates of population sizes in accordance with the requirements of the Habitats Directive and the Birds Directive.

Contracting Parties currently do not comply with Article 12 Habitats Directive as there is no monitoring in place that gives information that serves the target that incidental capture and killing does not have a significant negative impact on the species. Even more, current monitoring practice led to the unsatisfactory situation that the extent of the by-catch problem is still not known and as a consequence only minor conservation measures regarding by-catch (such as the use of pingers in a small fraction of the fishing fleet) are implemented. Some countries have been engaged in developing monitoring based on onboard video cameras recently. To date, it is not clear if this work (from pilot studies) will be extended to a monitoring programme on an annual basis and a representative fraction of the fishing fleets.

A monitoring programme is carried out under the EU Data Collection Framework (DCF). However, fishing métiers under DCF have been selected with respect to fishery data needs rather than bird and mammal by-catch data needs. It is aimed at monitoring the selectivity of gears with respect to fish discarded and thus by-catch of marine mammals and waterbirds are not even specifically addressed but rather recorded opportunistically at best. Only adding opportunistic by-catch data to monitoring programmes focusing otherwise on size and (fish) species selectivity of certain fishing gears does not provide the needed data to enhance the confidence of the indicator.

Under DCF, waterbird by-catch was monitored in Denmark, Germany, Poland and Sweden, while cetacean by-catch was monitored in Denmark, Germany, Latvia, Lithuania, Poland and Sweden (ICES 2013a).

EU Regulation 812/2004 obliges Member States to monitor cetacean by-catch in gillnets. It has been debated what gears are covered by the Regulation, as gear definitions were not formulated clearly enough for fisheries managers of some Member States (ICES 2010). This is why e.g. some Member States omitted

monitoring of trammel nets (GTR) although it is known that porpoises are also by-caught in these nets (Pfander et al. 2012). Further, monitoring under Regulation 812/2004 is not suited to the data needs for this indicator or the original idea behind the Regulation because only vessels >15 m are covered by the observer programme and the majority of Baltic gillnet fisheries is carried out by small vessels which use the same gear. Vessels <15 m are allowed to set 9 km (vessel length <12 m) or even 21 km (vessel length >12 m) of gillnets, respectively, illustrating the high risk of by-catch even by small vessels.

The Regulation also requires that Member States should design pilot schemes for small vessels; this has often not been done. The idea of scientific pilot studies is to give some indication on by-catch numbers and provide information on what monitoring method might be suitable for small vessels, although cannot replace monitoring in this large fishing segment.

Only very limited data are collected for protected waterbird taxa under DCF, and it is not possible to estimate effort or coverage. Besides national differences there are large differences in coverage between fishing métiers favouring larger vessels and mainly trawlers. As a result, there are no agreed numbers of by-caught waterbirds and marine mammals for various types of fishing gear (mainly gillnets and entangling nets) in the Baltic Sea, because so far no adequate observer coverage has been achieved with existing monitoring programmes such as DCF and Regulation 812/2004. On the other hand, the results of pilot studies such as interviews are frequently questioned by fishermen and fisheries authorities. Especially in métiers which have been identified by pilot studies as fisheries with a high risk for mammal or bird by-catch, monitoring is inadequate and a revision of existing monitoring programmes is urgently needed.

Description of optimal monitoring

Monitoring of by-caught marine mammals and waterbirds should enable the estimation of annual (seasonal) mortality from all kinds of specific fisheries to be compared to the population dynamics of the respective species. Besides effort and by-catch data, data on population size and distribution of species is also needed in order to relate by-catch numbers to the population. Monitoring results should not only address the problem of by-catch in general, but should allow to quantify impacts in order to propose management measures such as (temporary) closures of specific fisheries or fishing areas. Optimal monitoring would therefore also provide reliable population size estimates for all species considered from the by-catch perspective.

The indicator requires estimates of population sizes for those species suffering from by-catch. While such estimates are available for a number of marine mammals due to target-oriented surveys, they are quite crude for most waterbird species, especially those wintering in offshore areas. Further, uncertainties in population estimates and incomplete knowledge on spatial and temporal distribution patterns have to be addressed. Thus, internationally coordinated surveys need to be organized at least in those marine areas already identified as important for waterbirds (Durinck et al. 1994; Skov et al. 2011) and should be embedded into the respective HELCOM abundance indicators.

The species covered by the indicator are highly mobile and fishing methods differ between sub-regions or even on a local level. Due to the resulting variability in by-catch risk, a regionally and fishing method differentiated métier monitoring approach that considers fishing activity per spatial unit is recommended.

Effort monitoring, as well as by-catch monitoring, has to be carried out on a fine spatial scale in order to relate by-catch to both fishing effort and abundance of mammals and birds.

Appropriate monitoring is needed, so as not to put more burden than necessary on fisheries from management measures to fulfil legal conservation obligations. Monitoring must be able to cover all fisheries and all kinds of vessels. A comprehensive monitoring would use on-board and off-board observers, onboard CCTV cameras (also called Remote Electronic Monitoring, REM), and possibly additional methods such as interviews (ICES 2013b). In some cases, such as in fisheries with small open boats, self-sampling may be a component of the monitoring programme, but data quality must be verified independently.

Human observers are an important component to sample by-catch and collect information on composition and number of by-catch and to deliver specimen to the relevant authorities in order to conduct further examinations regarding age, sex, nutritional state, and injuries. In addition, stomach contents may help to identify in more detail the conflict between marine areas selected by fisheries and habitat demands of mammals and birds. Stranding networks can provide further by-catch information if collected specimen are examined for net marks and previous injury which could have caused by-catch. However, limitations in data quality have to be accounted for (e.g. beached bird surveys may indicate by-catch but never give any information on the type of gear or nationality of the fishing vessel which caused the fatality).

ICES (2013a) has addressed the question of whether it is possible to combine monitoring of protected and endangered species and discard sampling (which will be the main focus of fishery monitoring due to the discard ban) in the same sampling scheme. However, it is unlikely that protected and endangered species will be kept on board or landed since this could infringe on existing national legislation of numerous Member States (ICES 2013a). As a minimum requirement, provisions must be taken that detailed, meaningful photographs of by-caught mammals and birds can be taken if landing is not possible.

The DCF is currently under revision and will then be named Data Collection Multi-Annual Programme (DCMAP). The DCMAP will guide future fishery monitoring and data collection within the EU, covering a broad range of objectives including the discard ban. It is crucial that DCMAP develops adequate sampling coverage plans including mammal and waterbird by-catch in all relevant fisheries in the Baltic Sea.

Further actions for optimizing electronic monitoring

Pilot studies using cameras for monitoring harbour porpoise and bird by-catch have shown that these have the potential to be a practical and economic tool for obtaining reliable by-catch data. Further work is required to demonstrate the potential of the technique to perform consistently with regard to species identification and that all by-catch incidents are being detected (ICES 2013b). However, fishermen may reject these systems for personal reasons, hence research and international collaboration is needed on how to create a trustful attitude and to overcome personal reservations against onboard CCTV camera systems.

A main drawback of the onboard camera monitoring of bird and mammal by-catch is that a large footage has to be viewed to verify the data from fishermen's protocols. In order to reduce costs of a monitoring programme based on video observation, it may be helpful to computerize the work and view only preselected footage. Thus, the development and validation of reliable automated recognition systems for onboard camera systems is desirable.

Data and updating

Access and use

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

HELCOM (2015) Number of drowned mammals and waterbirds in fishing gear. HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN: 2343-2543

Metadata

There is currently no source of monitoring data which specifically compiles and analyses the numbers of by-caught waterbirds and marine mammals in a representative manner.

Temporal coverage of monitoring data is poor. Some studies can be used for historical sporadic information on numbers of by-caught waterbirds and mammals. These sporadic data have a very poor spatial coverage (see map in Žydelis et al. 2009).

In the BSAP, it was agreed to set up a reporting system and database for harbour porpoise by-catch. Such a database has not yet been developed.

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Archive

This version of the core indicator report was published in December 2015

Core indicator report – web-based version November 2015 (pdf)

Extended core indicator report – outcome of CORESET II project (pdf)

Older versions of the core indicator report are available:

2013 Indicator report

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