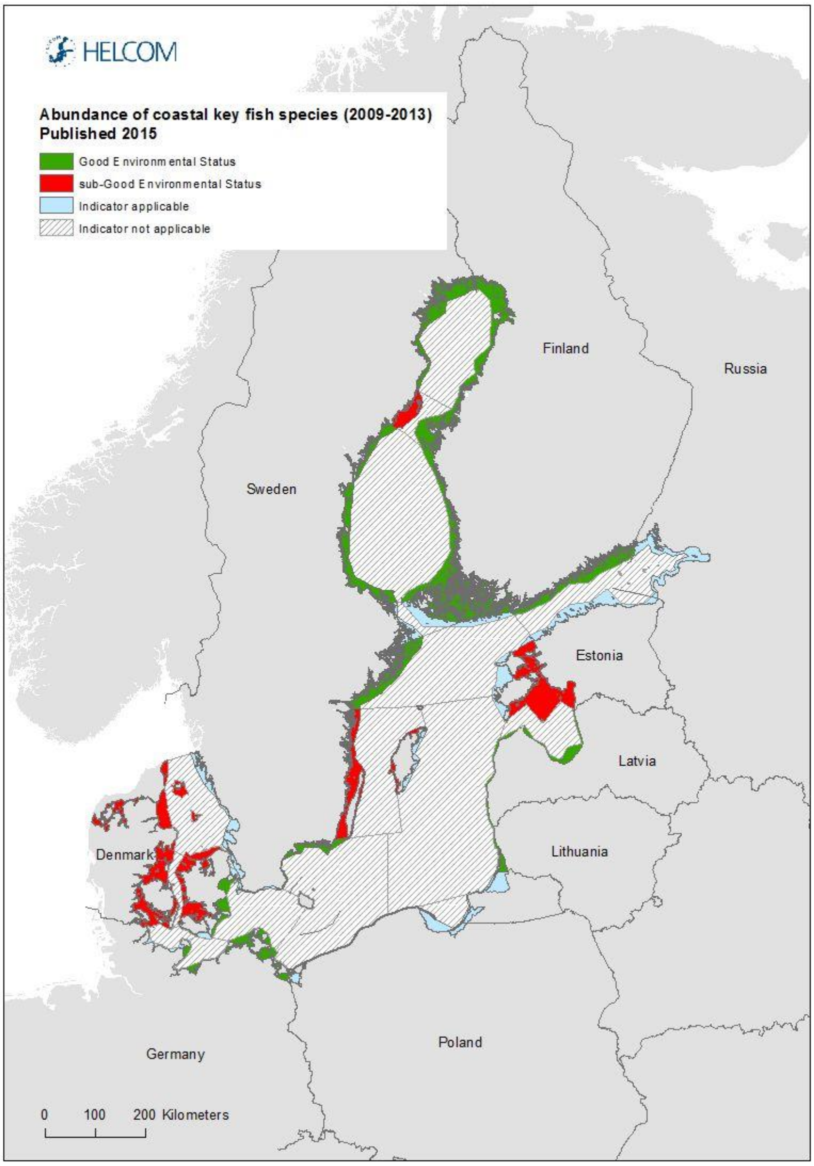
HELCOM core indicator report
October 2015

Abundance of key coastal fish species

Key message

This core indicator evaluates the abundance of typical species of fish, such as perch and flounder, in the coastal areas of the Baltic Sea, to assess environmental status. As a rule, Good Environmental Status (GES) is achieved when the abundance is above a set site and species specific boundary. The current evaluation assesses status during the period 2009-2013.



Key message figure 1: Status assessment results based evaluation of the indicator 'abundance of key coastal fish species'. The assessment is carried out using Scale 3 HELCOM assessment units (defined in the [HELCOM Monitoring and Assessment Strategy Annex 4](#)). Click to enlarge.

GES is achieved in 29 out of a total of 49 monitoring locations and in 16 out of the 24 coastal HELCOM assessment units that were assessed. Generally, GES is more often reached in areas in the northern and eastern parts of the Baltic Sea where perch is the key species. In the western and southern areas where flounder is the key species, the environmental status is more often sub-GES.

The level of confidence of the assessment differs across areas, and is higher in areas with the longest data series dating back to the late 1990s. The monitoring areas in the northern and eastern parts of the Baltic Sea, where the environmental status is better, are generally considered as reference areas for environmental monitoring with low human impact, whereas the southern areas are generally more impacted.

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

Relevance of the core indicator

Coastal fish communities are of high ecological and socio-economic importance in the Baltic Sea, both for ecosystem functioning and for the recreational and small-scale coastal commercial fishery. As such, the state of coastal fish communities generally reflects the ecological state in coastal ecosystems.

Changes in the long-term development of the abundance of coastal fish species mainly reflect effects of increased water temperature and eutrophication in coastal areas and/or changes in the level of human exploitation or predation pressure.

Policy relevance of the core indicator

	BSAP Segment and Objectives	**MSFD Descriptors and Criteria**
Primary link	Biodiversity • Natural Distribution and occurrence of plants and animals • Thriving and balanced communities of plants and animals • Viable populations of species	D1 Biodiversity 1.2. Population size (abundance biomass) D3 Commercial fish and shellfish 3.2 Reproductive capacity of the stock
Secondary link	Hazardous substances • Healthy wildlife	D4 Food webs 4.3 Abundance/distribution of key trophic groups and species
Other relevant legislation: In some Contracting Parties of HELCOM potentially also EU Habitats Directive and EU Common Fisheries Policy		

Cite this indicator

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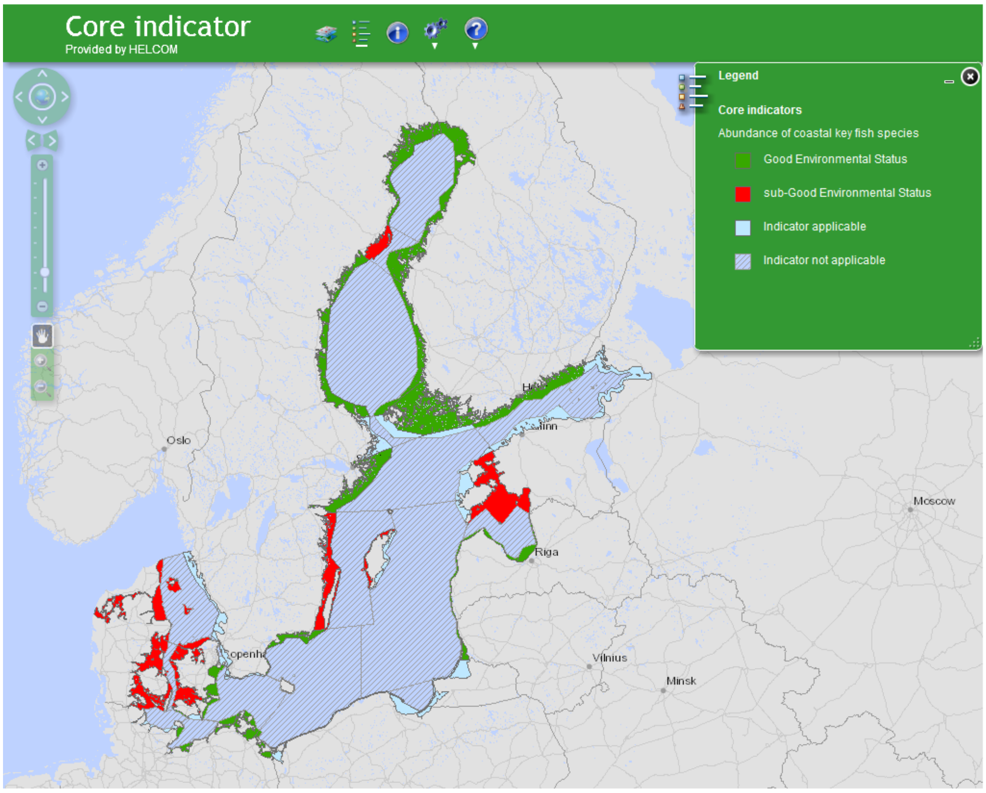
Core indicator report – web-based version October 2015 (pdf)

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

Results and confidence

The current evaluation of GES using coastal fish evaluates the period 2009-2013 and is based on time series data dating back to 1998-2002 using a 'deviation from baseline approach' or a 'trend based assessment', depending on the time series coverage. Evaluations were carried out for 29 of the total 42 ‘scale 3 assessment units’. Data up to 2013 was only available for 18 of the assessment units. For more information on assessment units, see [Assessment protocol.]



GES is achieved in most of the monitoring locations (29 out of a total of 49 locations). Within some assessment units there are differing GES classifications across monitoring locations, likely reflecting differences in the local appearance of coastal fish communities. When summarizing over HELCOM assessment units, GES is achieved in 16 out 24 assessed units, indicating an overall rather good environmental status of key coastal fish species in the Baltic Sea.

There are, however, some general patterns suggesting that the status depends on the geographic area and species assessed. In more northern and eastern areas, where perch represents the key species, the status is generally good (GES is achieved in 13 out of 26 units where perch is key species), whereas in more southern and western units where flounder represents the key species, status is generally not so good (GES achieved in only four out of 11 units where flounder is key species).

Result table 1. Status evaluation outcome per monitoring location and assessment unit for the assessment period 2009-2013.

Subbasin	Country	Monitoirng area	Period	Coastal water type	Species	Assessment method	Status
Bothnian Bay	Finland	ICES SD 31	1998-2013	Bothnian Bay Finnish Coastal waters	P	Baseline	GES
Bothnian Bay	Sweden	Råneå	2002-2013	Bothnian Bay Swedish Coastal waters	P	Trend	GES
Bothnian Bay	Sweden	Kinnbäcksfjärden	2004-2013	Bothnian Bay Swedish Coastal waters	P	Trend	GES
The Quark	Finland	Rectangle 23 & 28	1998-2013	The Quark Finnish Coastal waters	P	Baseline	GES
The Quark	Sweden	Holmön	1998-2013	The Quark Swedish Coastal waters	P	Baseline	GES
The Quark	Sweden	Norrbyn	2002-2013	The Quark Swedish Coastal waters	P	Trend	subGES
Bothnian Sea	Finland	ICES SD 30	1998-2013	Bothnian Sea Finnish Coastal waters	P	Baseline	GES
Bothnian Sea	Sweden	Gaviksfjärden	2004-2013	Bothnian Sea Swedish Coastal waters	P	Trend	subGES
Bothnian Sea	Sweden	Långvindsfjärden	2002-2013	Bothnian Sea Swedish Coastal waters	P	Trend	GES
Bothnian Sea	Sweden	Forsmark	1998-2013	Bothnian Sea Swedish Coastal waters	P	Baseline	GES
Åland Sea	Sweden	Lagnö	2002-2013	Åland Sea Swedish Coastal waters	P	Trend	GES
Archipelago Sea	Finland	ICES SD 29	1998-2013	Archipelago Sea Coastal waters	P	Baseline	GES
Archipelago Sea	Finland	Finbo	2002-2013	Archipelago Sea Coastal waters	P	Trend	GES
Archipelago Sea	Finland	Kumlinge	2003-2013	Archipelago Sea Coastal waters	P	Trend	GES
Northern Baltic Proper	Sweden	Askö	2005-2013	Northern Baltic Proper Swedish Coastal waters	P	Trend	GES
Gulf of Finland	Finland	ICES SD 32	1998-2013	Gulf of Finland Finnish Coastal waters	P	Baseline	GES
Gulf of Riga	Estonia	Hiiumaa	1998-2013	Gulf of Riga Estonian Coastal waters	P	Baseline	subGES
Gulf of Riga	Latvia	Daugagriva	1998-2007	Gulf of Riga Latvian Coastal waters	P	Trend	GES
Gotland basin	Sweden	Kvädöfjärden	1998-2013	Western Gotland Basin Swedish Coastal waters	P	Baseline	subGES
Gotland basin	Sweden	Vinö	1998-2013	Western Gotland Basin Swedish Coastal waters	P	Baseline	subGES
Gotland basin	Latvia	Jurkalne	1999-2007	Eastern Gotland Basin Latvian Coastal waters	F	Trend	GES
Gotland basin	Lithuania	Monciskes/Butinge	1998-2011	Eastern Gotland Basin Lithuanian Coastal waters	F	Trend	GES
Gotland basin	Lithuania	Curonian Lagoon	1998-2011	Eastern Gotland Basin Lithuanian Coastal waters	P	Trend	GES
Bornholm basin	Sweden	Torhamn	2002-2013	Bornholm Basin Swedish Coastal waters	P	Trend	GES
Bornholm basin	Germany	Pomeranian Bay, Outer	2003-2103	Bornholm Basin German Coastal waters	F	Trend	GES
Bornholm basin	Germany	Stettin Lagoon (German part)	2008-2013	Bornholm Basin German Coastal waters	P	Trend	GES
Bornholm basin	Germany	Peene river / Achterwasser	2009-2103	Bornholm Basin German Coastal waters	P	Trend	GES
Bornholm basin	Germany	East of Usedom Peninsula	2009-2103	Bornholm Basin German Coastal waters	F	Trend	subGES
Arkona basin	Germany	Greifswalder Bodden	2008-2013	Arkona Basin German Coastal waters	P	Trend	GES
Arkona basin	Germany	Strelasund	2009-2103	Arkona Basin German Coastal waters	P	Trend	GES
Arkona basin	Germany	Darß-Zingst Bodden chain	2008-2013	Arkona Basin German Coastal waters	P	Trend	GES
Arkona basin	Germany	Northeast of Ruegen Island	2008-2013	Arkona Basin German Coastal waters	F	Trend	subGES
Arkona basin	Denmark	Præstø Fiord	2005-2012	Arkona Basin Danish Coastal waters	F	Trend	subGES
Arkona basin	Germany	North of Kühlungsborn city	2008-2013	Mecklenburg Bight German Coastal waters	F	Trend	GES
Arkona basin	Germany	Wismar Bight and Salzhaff	2008-2012	Mecklenburg Bight German Coastal waters	F	Trend	GES
Arkona basin	Germany	Börgerende	2003-2013	Mecklenburg Bight German Coastal waters	C	Trend	GES
Arkona basin	Denmark	Area south of Zealand (Smålandsfarvandet)	2008-2013	Mecklenburg Bight Danish Coastal waters	F	Trend	subGES
Belt Sea	Denmark	Sejerø Bay	2005-2013	Belts Danish Coastal waters	F	Trend	subGES
Belt Sea	Denmark	The Great Belt	2005-2011	Belts Danish Coastal waters	F	Trend	subGES
Belt Sea	Denmark	Southern Little Belt and the archipelago	2005-2013	Belts Danish Coastal waters	F	Trend	subGES
Belt Sea	Denmark	Odense Fiord	2005-2013	Belts Danish Coastal waters	F	Trend	GES
Belt Sea	Denmark	Århus Bay	2005-2013	Belts Danish Coastal waters	F	Trend	subGES
Belt Sea	Denmark	Fiords of Eastern Jutland	2005-2013	Belts Danish Coastal waters	F	Trend	subGES
The Sound	Denmark	The Sound	2005-2013	The Sound Danish Coastal waters	F	Trend	subGES
Kattegat	Denmark	Isefjord and Roskilde Fjord	2005-2013	Kattegat Danish Coastal waters, including Limfjorden	F	Trend	subGES
Kattegat	Denmark	Northern Kattegat	2005-2013	Kattegat Danish Coastal waters, including Limfjorden	F	Trend	subGES
Kattegat	Denmark	Northern Limfjord	2005-2013	Kattegat Danish Coastal waters, including Limfjorden	F	Trend	subGES
Kattegat	Denmark	Skive Fiord og Lovns Broad	2008-2013	Kattegat Danish Coastal waters, including Limfjorden	F	Trend	subGES
Kattegat	Denmark	Venø Bay and Nissum Broad	2005-2013	Kattegat Danish Coastal waters, including Limfjorden	F	Trend	subGES

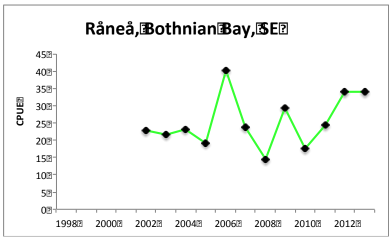
In the northernmost parts of the Baltic Sea (Bothnian Bay and The Quark), the status is generally good. In most monitoring locations the relative abundance of perch is high and stable or increasing. Only in one location (Norrbyn) is the CPUE decreasing over time.

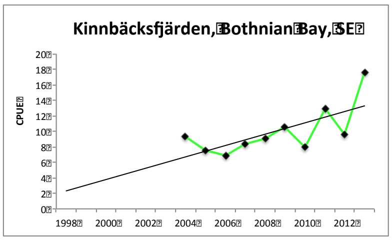
In the Bothnian Sea, Åland Sea and Archipelago Sea, the relative abundances of perch are generally high and stable, but not increasing. In the only location where GES is not achieved (Gaviksfjärden) there is no temporal trend over the relatively short time-period assessed, and the average abundance of perch is more than 50% lower than in other locations monitored with the same gear (Långvindsfjärden, Lagnö, Finbo and Kumlinge).

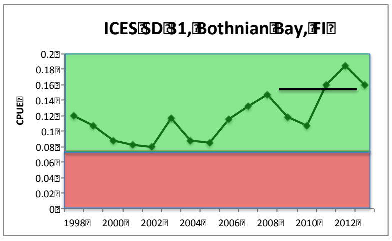
In the central part of the Baltic Sea (Northern Baltic Proper, Gulf of Finland, Gulf of Riga and Gotland Basin) there are differences in the status across the monitoring locations. In the more northern regions (Gulf of Finland and Northern Baltic Proper) and southern areas (Western part of the Gotland Basin) GES is achieved, whereas one of the Gulf of Riga monitoring stations (Hiiumaa) and the Swedish locations in the Gotland Basin (Kvädöfjärden and Vinö) are assessed as having sub-GES.

In the Bornholm Basin (Swedish and German coastal waters) status is overall good, and in the Arkona Basin the status is characterized by GES in the German areas and sub-GES in the Danish coastal waters. In the remaining assessment units and monitoring locations in Danish waters (where flounder is the key species), GES is generally not achieved, even though one location (Odense Fjord) is characterized by GES.

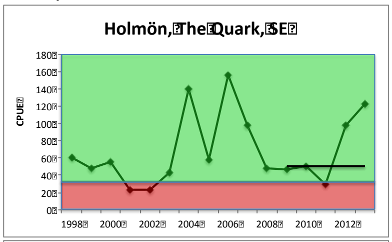
Bothnian Bay

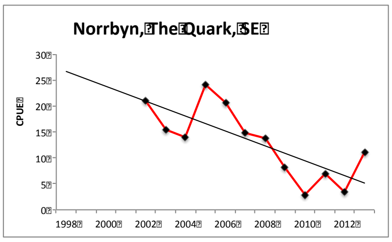


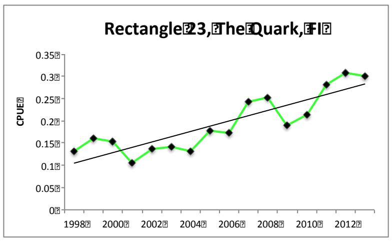


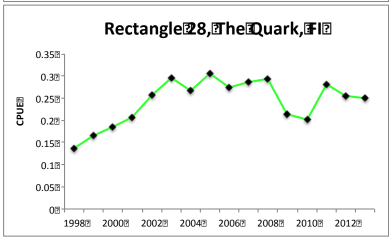


The Quark

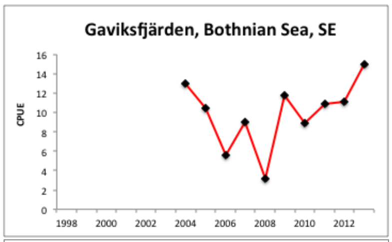


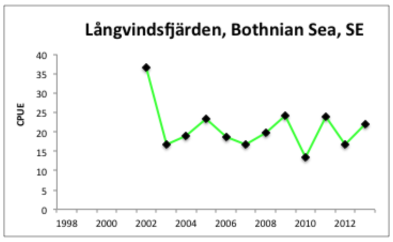


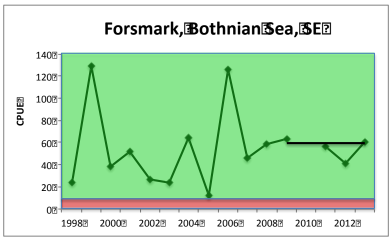


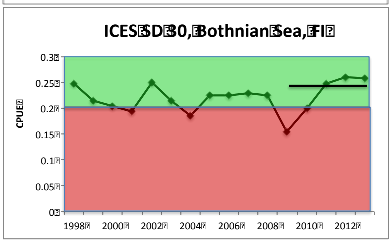


Bothnian Sea

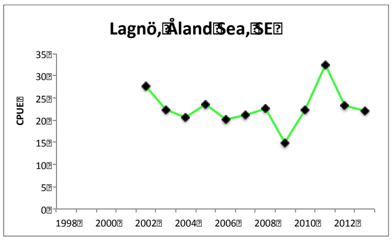




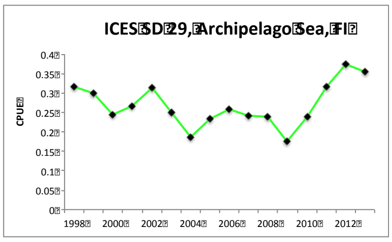


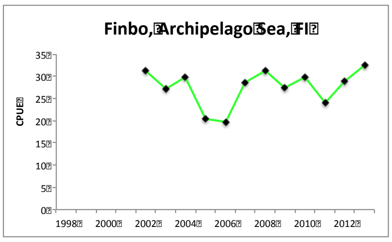


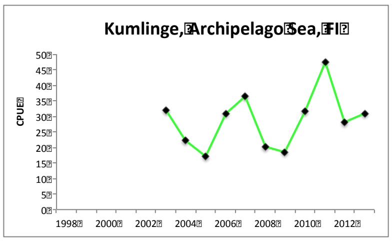
Åland Sea



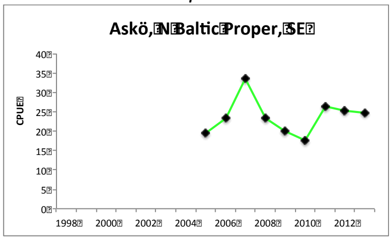
Archipelago Sea



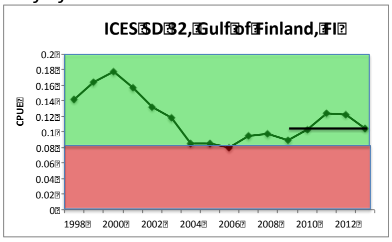




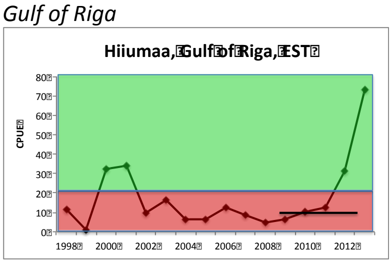
Northern Baltic Proper

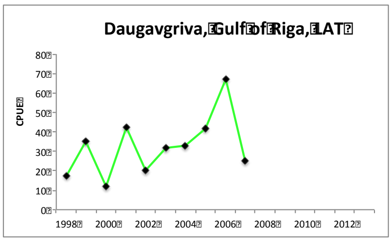


Gulf of Finland

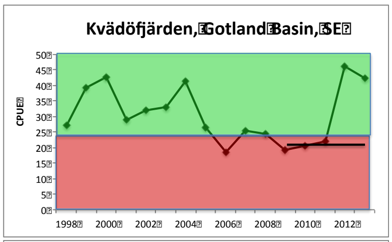


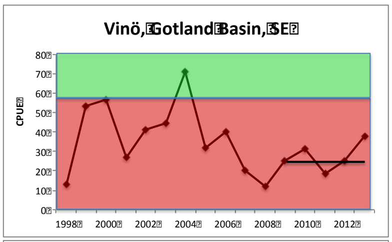
Gulf of Riga

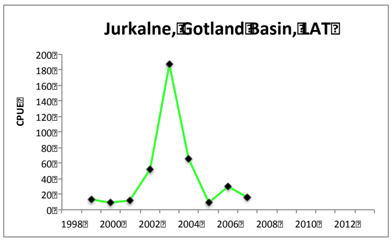


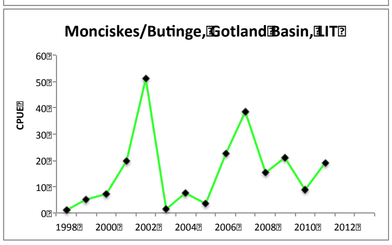


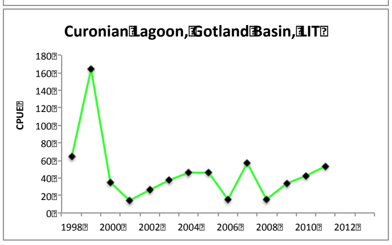
Gotland Basin



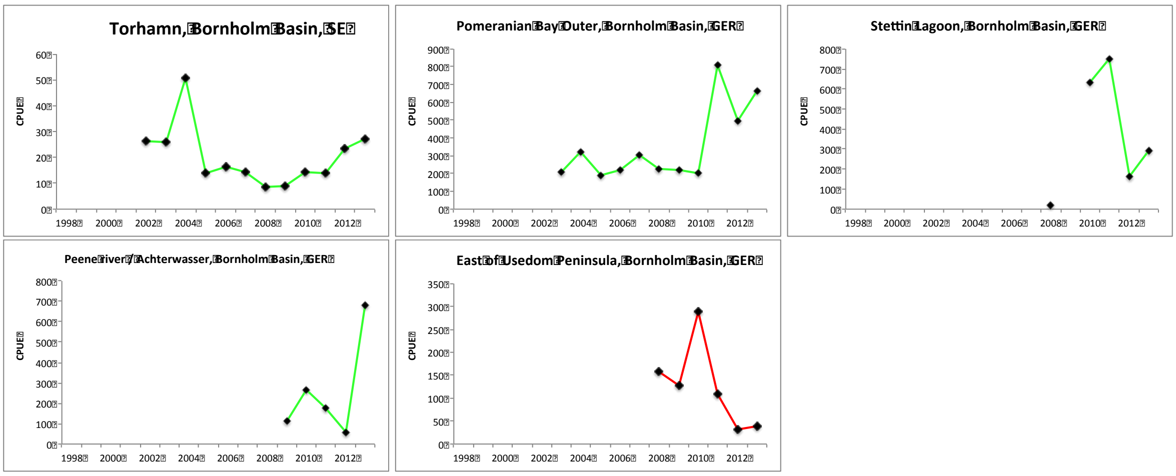




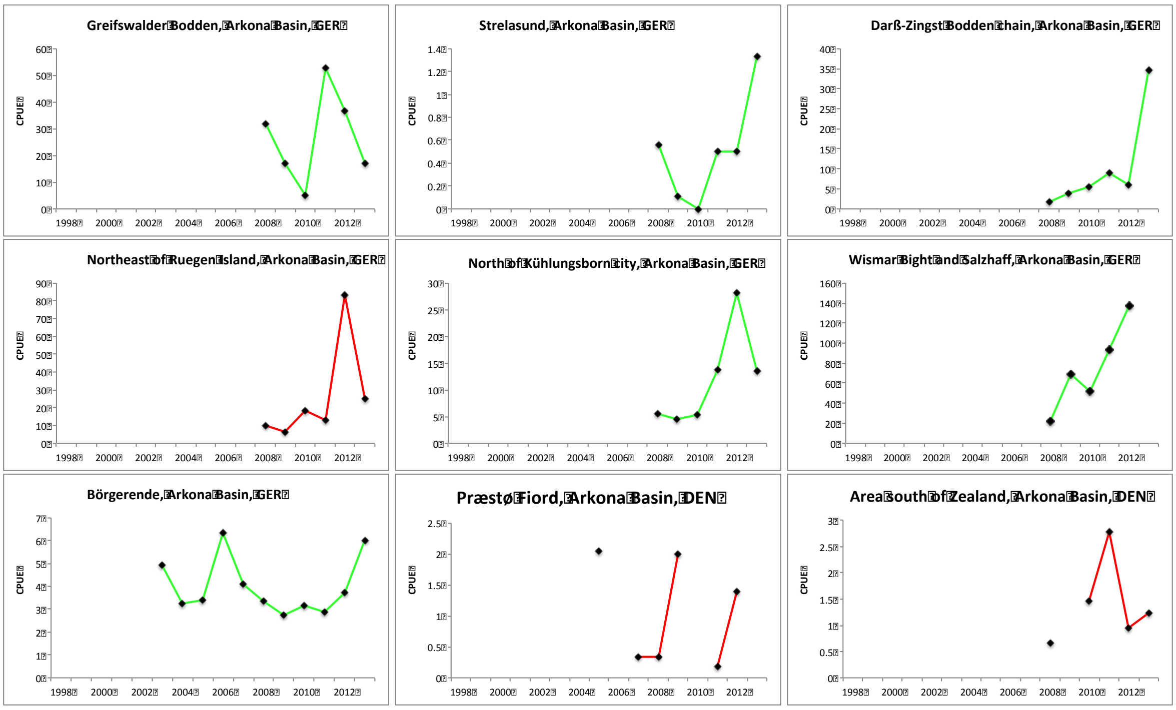




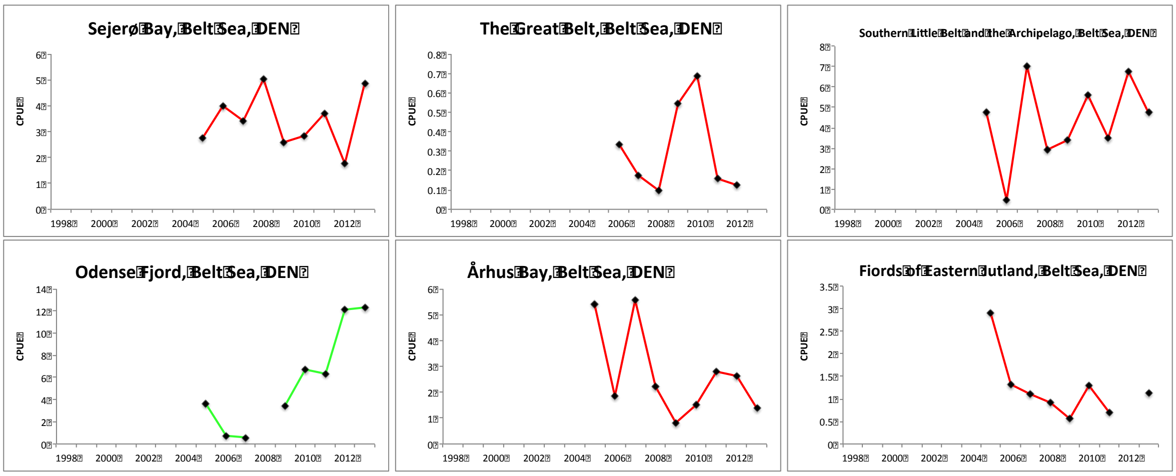
Bornholm Basin



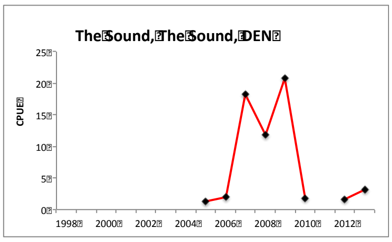
Arkona Basin



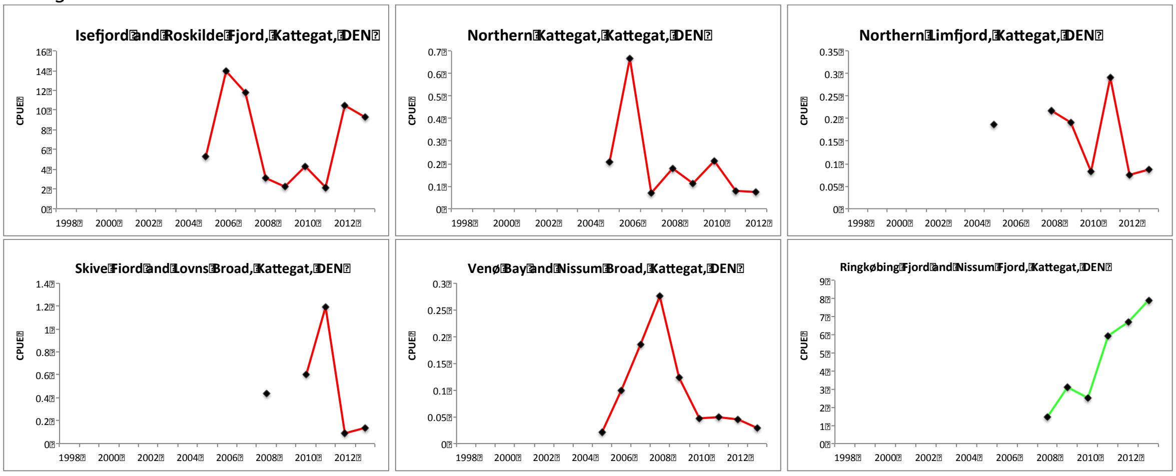
Belt Sea



The Sound



Kattegat



Results figure 1. GES evaluations are displayed per sub-basin for each monitoring location. In locations where the baseline approach is applied, the GES boundary is displayed as a green and a red field and the evaluation of GES/sub-GES is made for each point in time. The black lines indicate the median of the evaluated period. For assessment units where the available data only allowed for a trend based evaluation, a green lines denotes a GES evaluation outcome whereas a red line denotes a sub-GES evaluation outcome.

Confidence of the indicator status evaluation

To date, no approach has been developed for rigorously determining the confidence of the status evaluation for coastal fish indicators. The confidence might vary across assessment units, countries and monitoring programmes since, for example, the number of years for which coastal fish monitoring has been carried out varies between assessment units. Generally, the confidence of the evaluation is higher in locations where monitoring started before 1999, whereas it is lower for locations with data availability for a shorter time period.

Some assessment units cover relatively large coastal areas with few monitoring programmes, making the assessment less confident. Since coastal fish communities are typically more local in their appearance than the scale of evaluation applied in the indicator, there might be diverging evaluations across monitoring locations within an assessment unit, hence yielding a lower confidence of the evaluation of environmental status. On the other hand, the confidence is naturally higher in those assessment units which cover rather limited geographical areas and that have several monitoring locations with the same status.

Since different gears and methods are used in different countries to monitor coastal fish, assessments are not directly comparable across locations. However, each data point presented in the results of the indicator represents a yearly average across several observations (numbers differ across monitoring programmes), and since the assessment of status within each location is based on baseline conditions within that specific location and the specific gear used, the confounding effects from differences in methodology are not likely to substantially lower the overall confidence of the evaluation.

In order to improve the confidence of the evaluation, longer time series are needed in some monitoring locations, and in some areas additional monitoring data is needed. Also work is needed to develop a quantitative approach for determining the confidence of the evaluations as well as principles for aggregating status evaluations across areas and indicators.

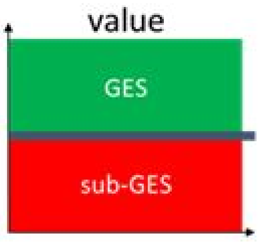
Good environmental status

Good Environmental Status (GES) is achieved when key species abundance is above a set boundary. The quantitative boundaries for GES for coastal fish are based on location-specific baseline conditions where time series covering more than 15 years are available (10 year baseline + 5 year evaluation period). In areas where shorter time series are available, a trend based approach (time series covering less than 15 years) is used. The approach used in the different monitoring locations is presented in the Results section.

A baseline needs to be to be defined for determining the GES boundary. The period used to define the baseline needs to cover at least 10 years in order to extend over more than twice the generation time of the typical species represented in the indicator and thus cater for natural variation in the indicator value due to for example strong and weak year classes. For the period used to determine the baseline to be relevant, it must also be carefully selected to reflect time periods with stable environmental conditions, as stated within the MSFD (European Commission 2008). Substantial turnovers in ecosystem structure in the Baltic Sea are apparent in the late 1980s, leading to shifts in the baseline state (Möllmann et al. 2009) and for coastal fish communities substantial shifts in community structure have been demonstrated in the late 1980s and early/mid 1990s (Olsson et al. 2012). In some areas, there have also been minor shifts in fish community structure later (see environmental fact sheet for further background).

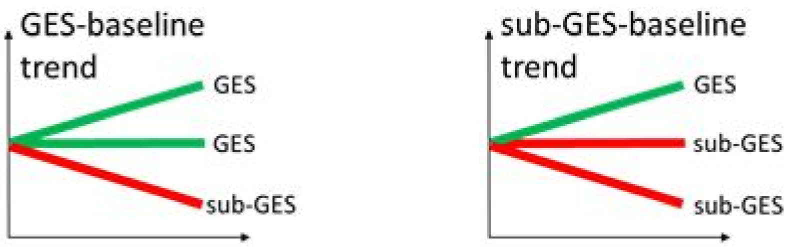
Estimates of the relative abundance and/or biomass of key coastal fish species are used to evaluate whether GES is achieved or not. These estimates are derived from fishery independent monitoring, recreational fishermen surveys and/or commercial catch statistics. Since there are strong environmental gradients in the Baltic Sea and coastal fish communities and stocks are typically local in their appearance and respond mainly to area specific environmental conditions, the evaluations for coastal key fish species are carried out on a relatively local scale.

The evaluation period applied when using the baseline approach should cover five years to cater for natural variability. GES is evaluated based on the deviation of the median value of the indicator during the assessment period in relation to the boundary level (Good environmental status figure 2).



Good environmental status figure 1: Acceptable deviation from baseline is used to define the boundary between GES and sub-GES.

When using the trend based approach, GES is evaluated based on the direction of the trend of the indicator over the time period considered in relation to the desired direction of the indicator (Good environmental status figure 2).



Good environmental status figure 2: Application of the trend based approach for evaluating environmental status where GES is defined based on the direction of the trend of the indicator compared to the desired direction of the indicator over time.

Typical species considered in the context of this indicator are perch (*Perca fluviatilis*), flounder (*Platichtys flesus*) and cod (*Gadus morhua*), depending on the sub-basin. Perch is generally the key species in coastal fish communities in the less saline eastern and northern Baltic Sea (Sweden, Finland, Estonia, and Latvia), and in more sheltered coastal areas in Lithuania, Poland and Germany. In the more exposed coastal parts of the central Baltic Sea and in its western parts the abundance of perch is generally lower and flounder is used as key species. Cod is the representative species in the western and more saline parts of the region.

Assessment Protocol

This indicator uses two different approaches for evaluating whether Good Environmental Status (GES) is achieved. The approach used depends on the data used for the evaluation. If certain criteria are met, then the baseline approach is used. If not, then the trend based approach is used.

Baseline approach

Coastal fish datasets must meet certain criteria in order to be able to apply an evaluation of GES using the baseline approach:

1. The time period used to determine the baseline should cover a minimum number of years that is twice the generation time of the species most influential to the indicator evaluation. This is to ensure that the influence of strong year classes is taken into account. For coastal fish, this is typically about ten years. In this evaluation, the time period used to determine the baseline period against which GES is evaluated spans over the years 1998-2008.
2. The dataset used to determine the baseline must not display a linear trend within itself ($n \geq 10$, $p > 0.05$), as the baseline for evaluation should optimally reflect the community structure at stable conditions and not a development towards a change in the environmental status.
3. Before evaluating GES, it should also be decided whether or not the baseline reflects GES. This can be done either by using data dating back earlier than the start of the period used to determine the baseline, using additional information, or by expert judgment. For example, if data from time periods preceding the period used for determining the baseline have much higher indicator values, the baseline might represent sub-GES (in case of an indicator where higher values are indicative of a good environmental state) or GES (in case of an indicator where higher values are indicative of an undesirable state).

Once the baseline status during has been defined, GES boundaries are defined as the value of the indicator at the Xth percentile of the median distribution of the dataset used for determining the baseline. The median distribution is computed by resampling (with replacement) from the dataset used to determine the baseline. In each repetition, the number of samples equals the number of years in the dataset. In order to improve precision, a smoothing parameter may be added in each repetition. The smoothing parameter is computed as the normal standard deviation of the re-sampled dataset divided by the number of years resampled. To evaluate GES during the evaluation period, the median value of the indicators during the evaluation period is compared with the specific GES boundary (see Good environmental status figure 1 and decision tree in Assessment protocol figure 1):

1. In situations where the baseline conditions represent GES, the median of the years to be assessed ($n=5$) should be above the 5th percentile of the median distribution of the dataset used to determine the baseline in order to reflect GES.
2. In situations where the baseline conditions represent sub-GES, the median of the years to be assessed ($n=5$) should be above the 98th percentile of the median distribution of the dataset used to determine the baseline in order to reflect GES.

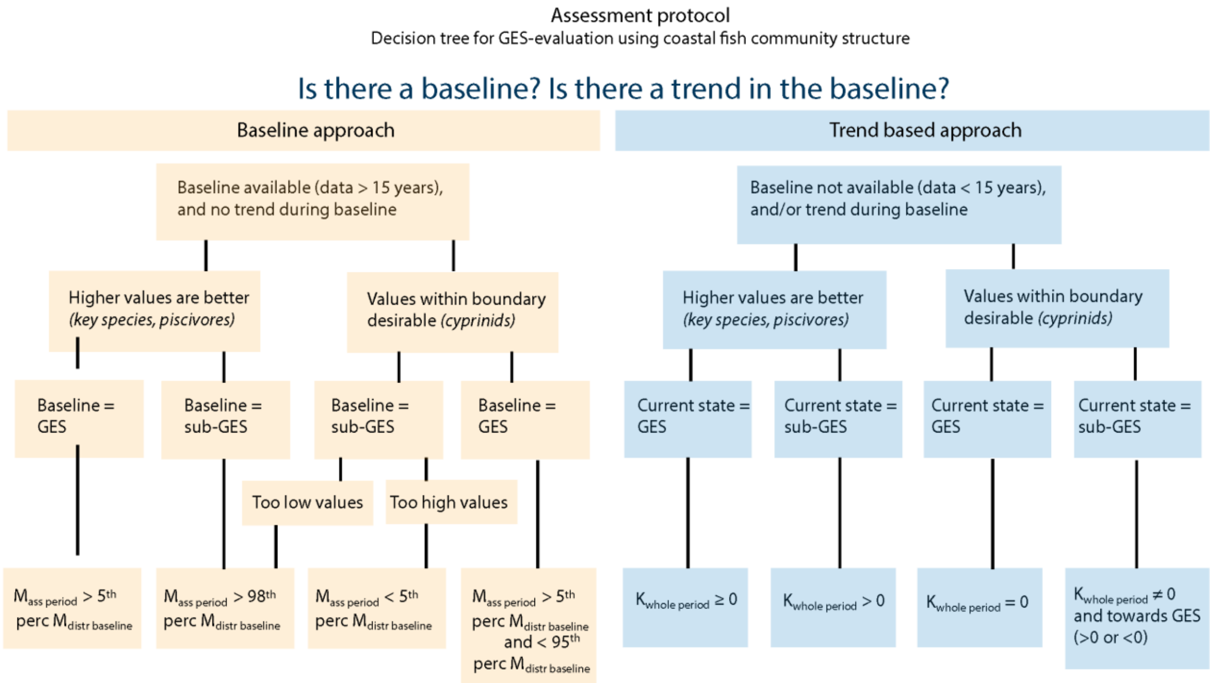
Trend based approach

If the requirements for defining quantitative baseline conditions are not met (e.g. short time series, or a linear development during the period used to determine baseline conditions), then a trend based evaluation should be used. Data should date back to the early/mid-2000s to be included in the evaluation.

In the trend based approach, GES is defined based on the direction of the trend of the indicator compared to the desired direction of the indicator over time (Good environmental status figure 2). When the first years of the time series assessed represent GES, the trend of the indicator over time should not be negative in order to represent GES. If the first years of the time series assessed represent sub-GES, the trend in the indicator should be positive in order to represent GES. The level of significance for these trends should be $p < 0.1$.

Decision tree for GES evaluation using coastal fish community structure

In the decision tree (Assessment protocol figure 1) the indicators are abbreviated as follows: *abundance of key fish species* as *'key species'*, *abundance of piscivores* as *'piscivores'* and *abundance of cyrpinids* as *'cyprinids'*. Baseline refers to the period 1998/1999–2008. $M_{ass\ period}$ refers to the median of the assessment period (2009-2013), perc = percentile, $M_{distr\ baseline}$ refers to the bootstrapped median distribution of the baseline period, and K refers to the slope of the linear regression line over the whole time period.



Assessment protocol figure 1. Decision tree for GES evaluation using coastal fish community structure.

Assessment units

Due to the local appearance of typical coastal fish species, status evaluations of coastal fish communities are representative for rather small geographical scales. In this evaluation the HELCOM assessment unit scale 3 'Open sub-basin and coastal waters' has been applied. The indicator is not evaluated for the open sea sub-basins since the species in focus are coastal.

Evaluations were carried out for 29 of the 42 assessment units and data up to 2013 was only available for 19 of the assessment units. The number of units evaluated is currently restricted by the monitoring activities.

In assessment units with several monitoring datasets the summed status (representing the majority of monitoring locations within the unit) is used to determine the status of the assessment unit. If equal numbers of monitoring locations have GES and sub-GES, then the one-out-all-out procedure is applied.

The assessment units are defined in the HELCOM Monitoring and Assessment Strategy Annex 4.

Data analyses

The data used for the evaluations are derived from fishery independent monitoring, recreational fishermen surveys and/or commercial catch statistics.

Fishery independent monitoring

The analyses are based on catch per unit effort (CPUE) data from annual averages of all sampling stations in each area. To only include species and size-groups suited for quantitative sampling by the method, individuals smaller than 12 cm (Nordic Coastal multimesh nets) or 14 cm (other net types) were excluded from the assessment. Abundance is calculated as the number of individuals of the species included in the indicator per unit effort (CPUE).

Commercial catch data

Analyses were based on catch per unit effort data (CPUE) in the form of kg/gillnet day, and each data point represents total annual catches per area. The gillnets used have mesh sizes between 36-60 mm (bar length) and hence target a somewhat different aspect of the fish community in the area. In addition, fishing is not performed at fixed stations nor with a constant effort across years. As a result, the estimates from the gillnet monitoring programmes and commercial catch data are not directly comparable, and only relative changes across data sources should be compared.

Relevance of the indicator

Biodiversity assessment

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 abundance of key coastal fish species, 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 abundance of coastal fish key species addresses the Baltic Sea Action Plan's (BSAP) Biodiversity and nature conservation segment's ecological objectives 'Natural distribution and occurrence of plants and animals', 'Thriving and balanced communities of plants and animals' and 'Viable population of species'.

The core indicator is relevant to the following specific BSAP actions:

- ' to develop long-term plans for, protecting, monitoring and sustainably managing coastal fish species, including the most threatened and/or declining, including anadromous ones (according to the HELCOM Red list of threatened and declining species of lampreys and fishes of the Baltic Sea, BSEP No. 109), by 2012', and
- ‘develop a suite of indicators with region-specific reference values and targets for coastal fish as well as tools for assessment and sustainable management of coastal fish by 2012'.

The core indicator also addresses the following qualitative descriptors of the MSFD for determining good environmental status:

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'

Descriptor 3: 'Populations of commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock' 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:

- Criterion 1.2 (population size),
- Criterion 3.2 (reproductive capacity of the stock), and
- Criterion 4.3 (abundance/distribution of key trophic species).

In some Contracting Parties the indicator also has potential relevance for implementation of the EU Habitats Directive.

Role of key coastal fish species in the ecosystem

Coastal fish, especially piscivorous species, are recognized as being important components of coastal food webs and ecosystem functioning (Eriksson et al. 2009; Olsson et al. 2012). Moreover, since many coastal fish species are rather local in their appearance (Saulamo & Neuman 2005; Laikre et al. 2005; Olsson et al. 2011), the temporal development of coastal fish communities might reflect the general environmental state in the monitoring locations.

Key fish species in coastal ecosystems generally have a structuring role in the ecosystem, mainly via top-down control on lower trophic levels. Also, viable populations of key coastal fish species are generally considered to reflect an environmental status with few eutrophication symptoms and balanced food webs (Eriksson et al. 2011; Baden et al. 2012). Key coastal fish species are generally piscivores and/or benthivores.

Human pressures linked to the indicator

	General	MSFD Annex III, Table 2
Strong link	Several pressures, both natural and human, acting in concert affect the state of coastal key fish species. These include climate, eutrophication, fishing, and exploitation and loss of essential habitats. To date, no analyses on the relative importance of these variables have been conducted.	Physical loss -sealing Physical damage -abrasion -selective extraction Inference with hydrological processes -significant changes in thermal regime -significant changes in salinity regime Nutrient and organic matter enrichment -inputs of fertilisers and other nitrogen and phosphorus-rich substances Biological disturbance -selective extraction of species, including incidental non-target catches
Weak link	There might also be effects of hazardous substances on the state of key coastal fish species	Contamination by hazardous substances -introduction of synthetic compounds-introduction of non-synthetic substances and compounds

The state of key coastal fish species in the Baltic Sea is influenced by multiple pressures, including climate, eutrophication, fishing mortality and exploitation of essential habitats, but also by natural processes such as food web interactions and predation from apex predators.

The effects of a changing climate generally have a large impact on the species considered here (Möllman et al. 2009; Olsson et al. 2012; Östman et al. in revision) as do alterations in the food web (Eriksson et al. 2009; 2011). Stressors related to human activities, mainly exploitation of essential habitats (Sundblad et al. 2014; Sundblad & Bergström 2014) and fishing (Edgren 2005; Bergström et al. 2007; Fenberg et al. 2012; Florin et al. 2013) also impact the state of coastal fish species. For obligate coastal species such as perch, the outtake in many countries is mainly from the recreational fisheries sector and to a lesser extent from the small-scale commercial fishery (Karlsson et al. 2014), whereas cod and flounder are mainly exploited in the offshore commercial fishery. In the more saline western Baltic Sea, flounder is also targeted by recreational fisheries.

The effect of eutrophication on the state of coastal fish species is also of importance (Bergström et al. in prep), and might increase with higher latitudes (Östman et al. in revision).

The abundance of key species of coastal fish (such as perch and flounder) is influenced by recruitment success and mortality rates, which in turn might be influenced by ecosystem changes, interactions within the coastal ecosystem and abiotic perturbations. An increased abundance of perch may, for example, reflect increasing water temperatures, moderate eutrophication, availability of recruitment habitats, low fishing pressure and low predation pressure from apex predators (Böhling et al. 1991; Edgren 2005; Bergström et al. 2007; Linlokken et al. 2008; HELCOM 2012; Olsson et al. 2012; Östman et al. 2012; Östman et al. in revision). As for the majority of coastal species, exploitation of recruitment areas has a negative impact on the development of perch populations (Sundblad et al. 2014; Sundblad & Bergström 2014). Changes in the long-term development of the abundance of perch could hence reflect effects of increased water temperature and eutrophication in coastal areas and/or changes in the level of exploitation or predation pressure.

The abundance of flounder is favoured by somewhat increasing water temperatures, moderate eutrophication and low fishing pressure (Olsson et al. 2012; Florin et al. 2013). Increased presence of ephemeral macroalgae due to eutrophication reduces the suitability of nursery habitats (Carl et al. 2008), and increases in the level of predation from avian predators negatively affect the abundance of juvenile flounder with unfavourable consequences to recruitment (Nielsen et al. 2008). Changes in the long-term abundance of flounder thus may reflect effects of eutrophication and/or changes in the level of predation pressure and fishing mortality in coastal areas.

Natural interactions such as predation pressure from apex predators, foremost cormorants (Phalacrocorax carbo), could at least locally impact the state of coastal fish communities (Vetemaa et al. 2010; Östman et al. 2012). In some areas the outtake of coastal fish by cormorants exceeds, or is of a similar magnitude, to that of the commercial and recreational fisheries (Östman et al. 2013).

Monitoring requirements

Monitoring methodology

The HELCOM common monitoring on coastal fish is described on a general level in the **HELCOM Monitoring Manual in the sub-programme: Coastal fish.**

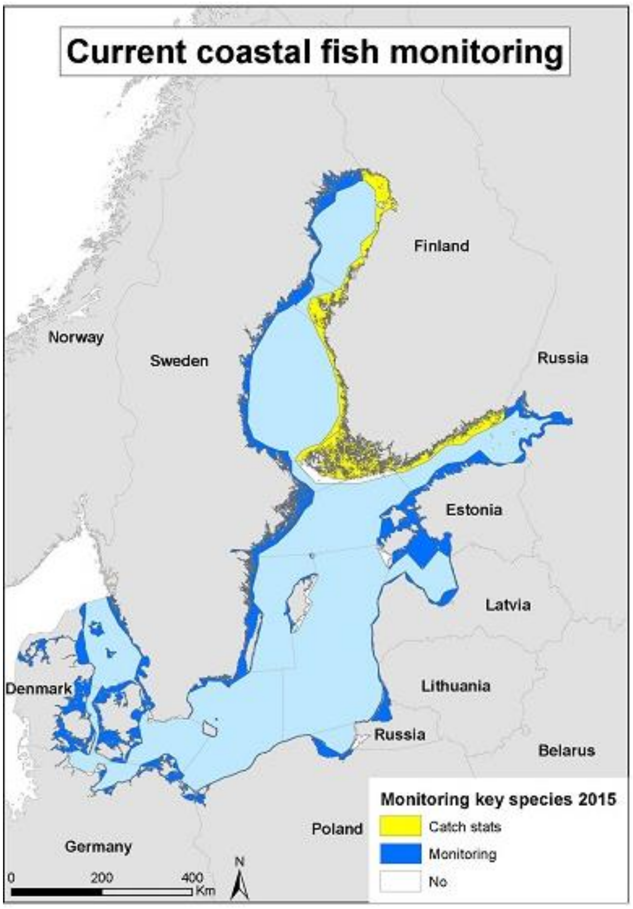
The HELCOM common monitoring on coastal fish is described in guidelines that were adopted in 2014.

Current monitoring

The monitoring activities relevant to the indicator that are currently carried out by HELCOM Contracting Parties are described in the HELCOM Monitoring Manual in the Monitoring Concepts table as well as in the guidelines for coastal fish monitoring.

Sub-programme: Coastal fish
Monitoring Concepts table

Coastal fish monitoring is rather widespread in the Baltic Sea, and at present covers 34 of the total 42 scale 3 HELCOM coastal assessment units (Monitoring figure 1).



Monitoring figure 1. Coverage of current coastal fish monitoring by HELCOM assessment unit scale 3. Catch stats = commercial catch statistics, Monitoring = fisheries independent monitoring, No = no current monitoring. Click to enlarge.

There are spatial and temporal gaps in the current monitoring. The current monitoring of coastal fish in the Baltic Sea represents a minimum level of effort and serves as a first step for evaluating the status of coastal fish communities. The current monitoring likely yields insights into major and large scale changes in coastal fish communities in the Baltic Sea, but unique and departing responses in some areas are possible.

Since monitoring and assessments in Latvia ceased in 2007, no indicator updates or status assessments can currently be undertaken for that area. In Lithuania, monitoring is only carried out every third year, so no update since 2011 is available. In Estonia, coastal fish monitoring is carried out at several locations, but the assessment has only been made for one location (Hiiumaa).

Description of optimal monitoring

Due to the presence of natural environmental gradients across the Baltic Sea and the rather local appearance of coastal fish communities (and hence their differing structures and responses to environmental change), the spatial coverage of monitoring should be improved in some areas in order to enhance the confidence of the evaluation outcome. When designating new potential monitoring sites, it should be considered that the levels of direct human impact on the coastal fish communities in the existing monitoring locations are low, and future locations should include more heavily affected areas.

Current monitoring is designed to target coastal fish species preferring higher water temperatures and that dominate coastal areas during warmer parts of the year, typically those with a freshwater origin. Monitoring of species like whitefish, herring and cod that dominate coastal fish communities in more exposed parts of the coast and during colder parts of the year is, however, rather poorly represented. Monitoring of these species and components should be established.

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 (2015) Abundance of key coastal fish species**.** HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN 2343-2543

Metadata

Data are typically collected annually in August by national and regional monitoring programmes. Commercial catch statistics in Finland represent total annual catches. See HELCOM (2015) for details. For future updates of this evaluation, data should be collected on an annual basis.

A few time series of coastal fish began in the 1970s (Olsson et al. 2012), whereas others were started in the 1980s. The majority of the available time series of coastal fish community structure was, however, initiated in the mid-1990s. In Finland and Sweden a new coastal fish monitoring programme with a higher spatial resolution was established in the early 2000s. For more information, see HELCOM 2012.

Data from 1998 and onwards have been included in the current assessment to cater for shifting baselines, while including as much data as possible.

The raw data on which this assessment is based, are stored in national databases and extracted for assessments. Each country has its own routines for quality assurance of the stored data. No common database currently exists for the coastal fish core indicator data. Different options for developing a regional database for the coastal fish core indicators (i.e. not raw data) are currently being investigated. The aim is to clarify options for data-arrangements for the purposes of updating the core indicator in the future during 2015.

Data source

Coastal fish monitoring is coordinated within the HELCOM FISH PRO II expert network. The network compiles data from fisheries independent monitoring in Finland, Estonia, Latvia, Lithuania, Poland, Germany, Denmark and Sweden. Coastal fish communities in the Baltic Sea areas of Russia are to some extent monitored as well. In Poland, a fishery independent coastal fish monitoring programme was established in 2014 and since no time series data exist, data from Poland was not included in the current assessment. In Germany, data are derived from coastal fish monitoring within national projects such as the artificial reef programme outside Rostock/Warnemünde off the summer resort Nienhagen (since 2002), the eel monitoring programme along the coastline of Mecklenburg-Western Pomerania (since 2008), and the coastal trawl survey in the Pomeranian Bay by the University of Rostock (since 2003). None of these three projects have long-term secured funding. In Denmark, there is no coastal fish monitoring programme and the data provided relies on voluntary catch registration by recreational fishermen through the "key-fishermen" project, which has no long-term secured funding (initiated in 2005). Due to lack of geographical coverage, the state of coastal fish communities in Finland is monitored using estimates of catch per unit effort (CPUE) from the small scaled coastal commercial fishery. There are some additional monitoring locations (see HELCOM 2015) which were not included in this assessment due to lack of funding in some countries for carrying out status assessments.

The institutes responsible for sampling are: Natural Resources Institute Finland (Luke) (Finland), Provincial Government of Åland Islands (Finland), Estonian Marine Institute (Estonia), University of Tartu (Estonia), Institute of Food Safety, Animal Health and Environment "BIOR" (Latvia), Nature Research Center (Lithuania), National Marine Fisheries Research Institute, Gdynia (Poland), Association Fish and Environment Mecklenburg-Vorpommern e.V. (Germany), University of Rostock (Germany), National Institute of Aquatic Resources, Technical University of Denmark (Denmark), Department of Aquatic Resources, Swedish University of Agricultural Sciences (Sweden).

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Archive

This version of the HELCOM core indicator report was published in October 2015:
Core indicator report – web-based version October 2015 (pdf)

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

Older versions of the indicator report are available:
2013 Indicator report (pdf)

References

Baden, S. et al. (2012) Shift in seagrass food web structure over decades is linked to overfishing. Mar Ecol Prog Ser 451: 61–73.

Bergström, U. et al. (2007) Effekter av fredningsområden på fisk och kräftdjur isvenska vatten. (In Swedish). Finfo 2007:2.

Bergström, L. et al. (In prep.) Coastal fish abundance in relation to environmental gradients - variability at different scales.

Böhling, P. et al. (1991) Variations in year-class strength of different perch (*Perca fluviatilis*) populations in the Baltic Sea with special reference to temperature and pollution. Canadian Journal of Fisheries and Aquatic Sciences 48: 1181-1187.

Carl, J., Sparrevohn, C., Nicolajsen, N., Støttrup, J.G. (2008) Substratum selection by juvenile flounder *Platichthys flesus* (L.): effect of ephemeral filamentous macroalgae. J. Fish Biology 72: 2570-2578.

Edgren, J. (2005) Effects of a no-take reserve in the Baltic Sea on the top predator, northern pike (*Esox lucius*). Master thesis, Stockholm University.

European Commission (2008) Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy. Official Journal of the European Union L164: 19–40.

Eriksson, B.K. et al. (2009) Declines in predatory fish promote bloom-forming macroalgae. Ecological Applications 19: 1975-1988.

Eriksson, B.K. et al. (2011) Effects of altered offshore food webs on coastal ecosystems emphasizes the need for cross-ecosystem management. Ambio 40: 786-797.

Fenberg, P.B. et al. (2012) The science of European marine reserves: Status, efficacy, and future needs. Marine Policy 36(5): 1012-1021.

Florin, A.B. et al. (2013) Effects of a large northern European no-take zone on flatfish populationsa. Journal of fish biology 83(4): 939-962.

HELCOM (2012) Indicator-based assessment of coastal fish community status in the Baltic Sea 2005-2009. Baltic Sea Environment Proceedings No. 131.

HELCOM (2015) Guidelines for coastal fish monitoring sampling methods of HELCOM.

Karlsson, M. (2014) Nationell plan för kunskapsförsörjning om fritidsfiske inom fisk-, havs- och vattenförvaltningen. (In Swedish) Aqua reports 2014:12. Swedish University of Agricultural Sciences, Drottningholm. 71 pp.

Laikre, L. et al. (2005) Spatial genetic structure of northern pike (*Esox lucius*) in the Baltic Sea. Mol Ecol 14: 1955–1964.

Linlokken, A. et al. (2008) Environmental correlates of population variables of perch (*Perca fluviatilis*) in boreal lakes. Environmental Biology of Fishes 82(4): 401-408.

Möllman, C. et al. (2009) Reorganization of a large marine ecosystem due to atmospheric and anthropogenic pressure: a discontinuous regime shift in the Central Baltic Sea. Global Change Biology 15: 1377–1393.

Nielsen, E., Støttrup, J., Nicolajsen, H., Bregnballe, T. (2008) Undersøgelse af sammenhængen mellem udviklingen af skarvkolonien ved Toftesø og forekomsten af fladfiskeyngel i Ålborg Bugt. (In Danish) DTU Aqua-report 179-08. 82 pp.

Olsson, J. et al. (2011) Genetic population structure of perch, *Perca fluviatilis L*, along the Swedish coast of the Baltic Sea. Journal of Fish Biology 79: 122–137.

Olsson, J. et al. (2012) Abiotic drivers of coastal fish community change during four decades in the Baltic Sea. ICES Journal of Marine Science 69: 961-970.

Östman, Ö. et al. (2012) Do cormorant colonies affect local fish communities in the Baltic Sea? Canadian Journal of Fisheries and Aquatic Sciences 69: 1047-1055.

Östman, Ö. et al. (2013) Estimating competition between wildlife and humans–a case of cormorants and coastal fisheries in the Baltic Sea. Plos One 8: e83763.

Östman, Ö. et al. (In revision) Influence of anthropogenic stressors and abiotic drivers for temporal variation of ecological state indicators of coastal fish communities in the Baltic Sea. Applied Ecology.

Saulamo, K., Neuman, E. (2002) Local management of Baltic fish stocks – significance of migrations. Finfo 2002, No. 9.

Sundblad, G. et al. (2014) Nursery habitat availability limits adult stock sizes. ICES Journal of Marine Science 71: 672-680.

Sundblad, G., Bergström, U. (2014) Shoreline development and degradation of coastal fish reproduction habitats. Ambio 43: 1020-1028.

Vetemaa, M. et al. (2010) Changes in fish stocks in an Estonian estuary: overfishing by cormorants? ICES Journal of Marine Science 67: 1972–1979.

Additional relevant publications

Lehikoinen, A. et al. (2011) Temporal changes in the diet of great cormorant (*Phalacrocorax carbo sinensis*) on the southern coast of Finland – comparison with available fish data. Boreal Environment Research 16 (suppl. B): 61-70.

Neuman, E. (1974) Temperaturens inverkan på rörelseaktivteter hos fisk i en Östersjövik. (In Swedish) Statens naturvårdsverk, PM 477. 84 pp.

Olsson, J., et al. (2015) Using catch statistics from the small scale coastal Baltic fishery for status assessment of coastal fish. Aqua reports 2015:13. Swedish University of Agricultural Sciences, Öregrund. 65 pp.

Thoresson, G. (1996) Guidelines for coastal fish monitoring. Swedish Board of Fisheries, Kustrapport 1996:2.

Voipio, A. (1981) The Baltic Sea. Elsevier, Helsinki.

HELCOM core indicator report, ISSN 2343-2543