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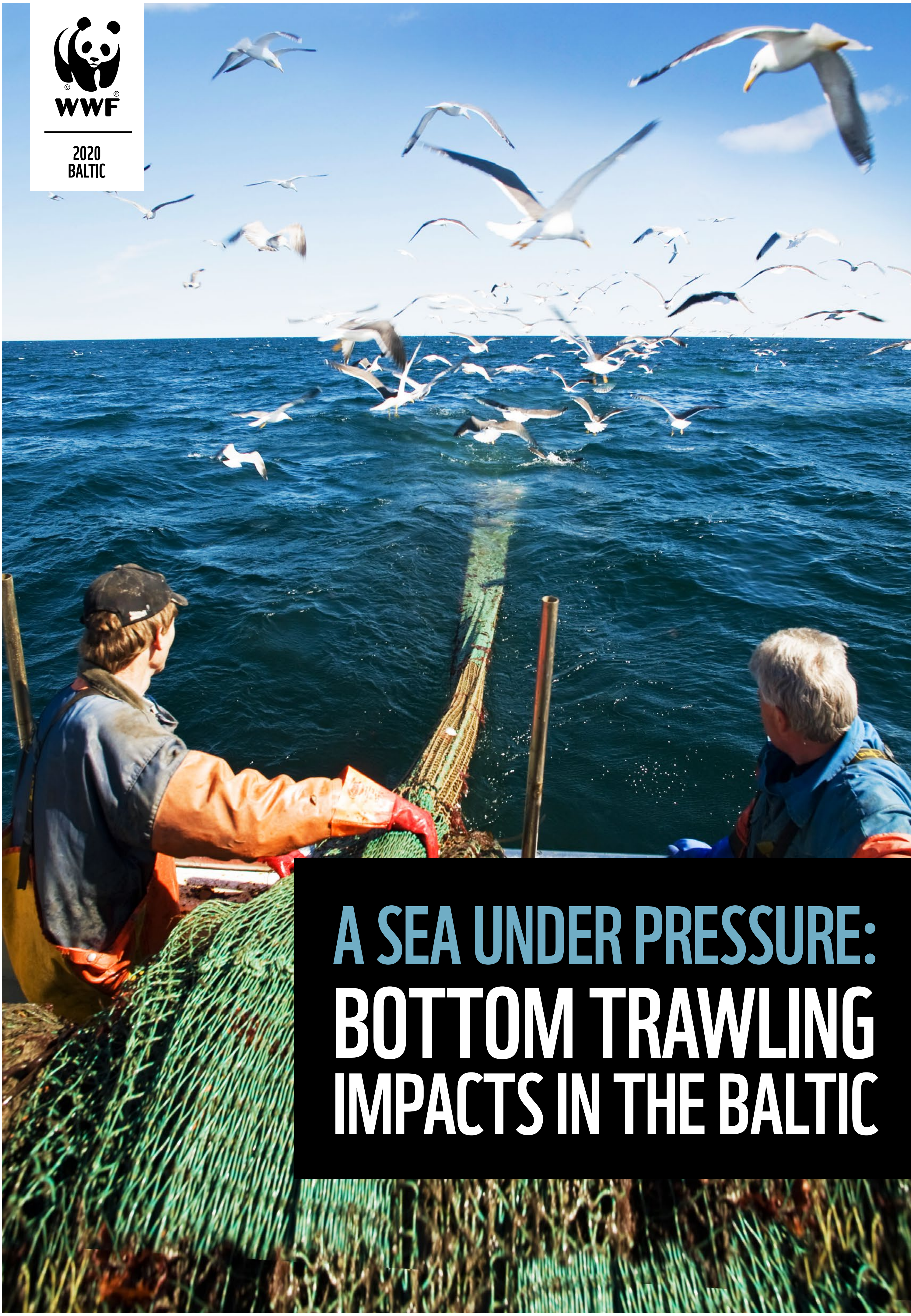

A SEA UNDER PRESSURE: BOTTOM TRAWLING IMPACTS IN THE BALTIC

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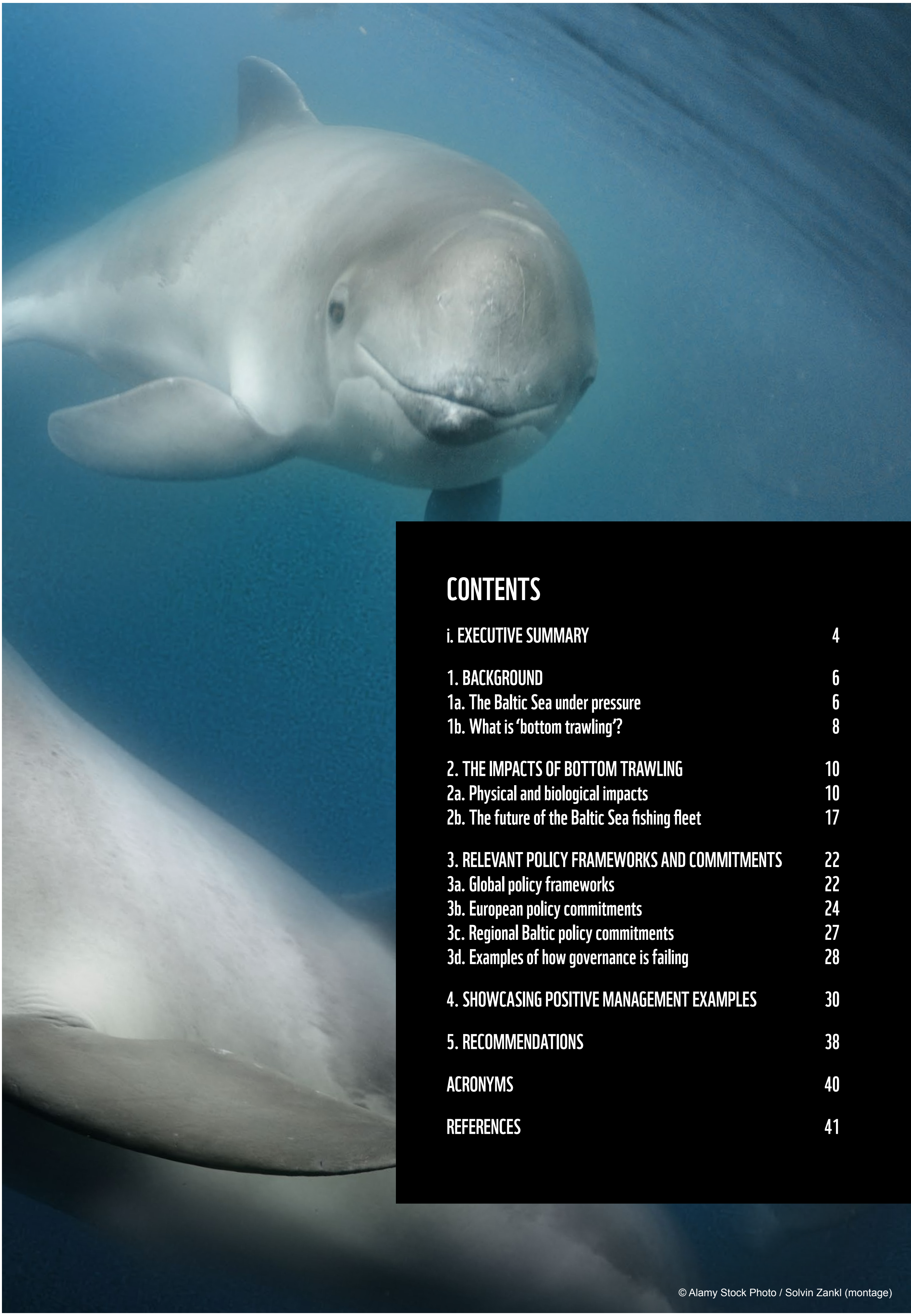

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EXECUTIVE SUMMARY

The Baltic Sea is surrounded by nine countries, whose futures are tightly connected to each other and to their shared marine resources. Yet the health of the Baltic Sea is in decline, under pressure from a number of threats. Urgent, coordinated and far-reaching action is needed to save its ecosystems and achieve Good Environmental Status across the whole region.

Fisheries are a key part of the picture. No regional maritime sector relies more on continuing ecosystem health than fisheries – and ecosystem health is something on which the fisheries themselves have a direct influence. While some Baltic Sea fisheries are operating within sustainable limits this is not the case across the whole fleet – and bottom trawling is the most harmful part of the sector by far, causing long-term damage to fish stocks and seabed habitats.

This report examines the numerous impacts of bottom trawling, which go beyond target species and affect the whole marine ecosystem of the Baltic Sea. It also highlights the current lack of coherence, implementation and coordination in the legislative frameworks intended to safeguard the health of our European waters. The fact is that in the Baltic Sea, the harmful impacts of bottom trawling are preventing us from protecting and preserving seabed habitats and attaining the target objectives of the Marine Strategy Directive Framework.

In the mid-1980s, nearly 450,000 tonnes of Baltic cod were caught annually – today the annual catch is below 20,000 tonnes. In environmental terms, bottom trawling is serially depleting the resource base, causing long-term physical damage, altering the characteristic ecosystem balance, affecting biogeochemical cycles, and negatively impacting the ability of the seabed to store and sequester carbon. From a socioeconomic perspective, the resulting situation of reduced yields, poor profitability and high future uncertainty requires urgent action from policymakers.

Nevertheless, despite the bleak overall picture of degraded ecosystems, declining catches, impoverished livelihoods and unmet commitments, studies show that the Baltic could be restored substantially if trawling was reduced and managed. The economic, social and environmental dividends would be enormous. Fishers themselves have a central role to play in addressing the situation – and in the wider region there are already examples of fishing communities which have come together with government to reverse the destructive tide.

Governments and fisheries managers have a legal obligation to achieve Good Environmental Status in the Baltic Sea through the application of ecosystem-based management, which considers the whole system and frames strategies accordingly. Forty per cent of the entire Baltic seafloor, an area of 180,000km^2, has been disturbed by maritime activities – and in the southern Baltic, the figure rises to 80-100%. The situation needs to be controlled. A decision to end, or at least minimise, bottom trawling in the Baltic Sea would sit well within the existing framework of national, regional and global policy commitments, bodies and laws. However, to be effective, such a decision would also need to address the current lack of cohesion across the multiple policies, programmes and departments that relate to Baltic fisheries. As it stands, the majority of the policy targets and goals set will simply not be met.

With this report, WWF calls on Baltic Sea governments and the European Commission to step up the implementation of ecosystem-based fisheries management and intensify their efforts to achieve Good Environmental Status.

Key areas for attention include:

1. Ban trawling within the boundaries of all national MPAs and minimise overall fishing effort in key habitats. Spatial closures must be established to conserve benthic habitat and/or communities and fish stock recovery areas, nursery and spawning areas, using a whole-site approach. Fisheries management practices must be reviewed in terms of their proximity to MPA boundaries and the impacts of bottom trawl plumes near sensitive areas such as spawning grounds.

2. Restrict bottom trawling in coastal waters to restore productivity. Bottom trawling restrictions should be in place within 12 nautical miles of coastlines to enable recovery and protection of important ecological habitats, to provide better economic opportunities for small-scale fisheries, and as a contribution towards climate change mitigation.

3. Develop ecosystem indicators for the cumulative effects of seabed disturbance. The effects of bottom trawling must be reviewed and included in the development of indicators, particularly in the protection of sensitive habitats and sediment substrates most affected by bottom trawling gear.

4. Improve fishing vessel tracking, monitoring and control measures. These must be put in place to ensure that bottom trawling is not occurring in restricted areas, and to monitor bycatch of non-target species. For transparency, remote electronic monitoring tracking technology such as Automatic Identification System and disclosed Vessel Monitoring System must be installed on all commercial fishing vessels. Remote electronic monitoring including closed circuit TV camera surveillance should be obligatory during fishing activities. A monitoring system should be set up to collect data on fisheries' impacts on wider ecosystems, per the Data Collection Regulation of 2017.

5. Eliminate or reform harmful fisheries subsidies. Governments must eliminate or reform harmful subsidies by improving sector-specific policies. This should happen both at European level through the current EMFF and future EMFAF and in horizontal legal instruments such as the Energy Taxation Directive along with national state aid programmes. Subsidies must shift towards supporting activities aimed at restoring and managing the marine environment, monitoring and vessel tracking equipment, and scientific research and data collection. Funding must be diverted from current industry-supporting research to scientific studies on the effects of fishing on marine ecosystems and the alleviation of fishing pressures.

6. Work together across governments to implement and enforce existing maritime laws. Governments around the Baltic Sea must work collaboratively, across ministries and sectors, to adhere to, implement and enforce existing laws and fulfil requirements towards limiting the impacts of bottom trawl fisheries by delivering on their obligations to the CFP, the MSFD, EMFF, the Habitats Directive, SDG 14 and the CBD Aichi Targets.

7. Establish an ecosystem-based fisheries management system that is transparent. Governments must organise a process of review for future refinements, including new scientific research and a funding mechanism to monitor performance that includes stakeholder engagement.

8. Create fully protected marine scientific reference areas. These areas are required to form baselines for better understanding the maritime pressures on marine ecosystems, and to allow scientists to measure recovery of biodiversity along with bridging the knowledge on carbon reserves and their storage potential.

9. Form a network of MPAs supporting representativity, replication and connectivity. To enable recovery of marine ecosystems and to provide benefits of larval export and potential spillover of juveniles/adults into adjacent fisheries, a network of MPAs supporting representativity, replication and connectivity across the sea basin must achieve at least 30% coverage and be effectively managed by 2030 in line with the IUCN Resolution and the new EU Green Deal for Nature.

With the current ban on bottom trawling of the Baltic eastern cod and deadlines for achieving Good Environmental Status for the Baltic ecosystem, we have a rare window of opportunity to revise the management in the region and set a precedent for the long-term benefit of the Baltic Sea and the people who depend on it. The starting point is clear: reduced bottom trawling effort and smarter management of trawling areas would improve fisheries productivity, support more prosperous coastal fishing communities, and bring many wider benefits to the Baltic countries.

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THE BALTIC SEA

SIZE APPROXIMATELY **413 000** SQUARE KILOMETRES

DEPTH TO **459** METRES

Inland sea with brackish water

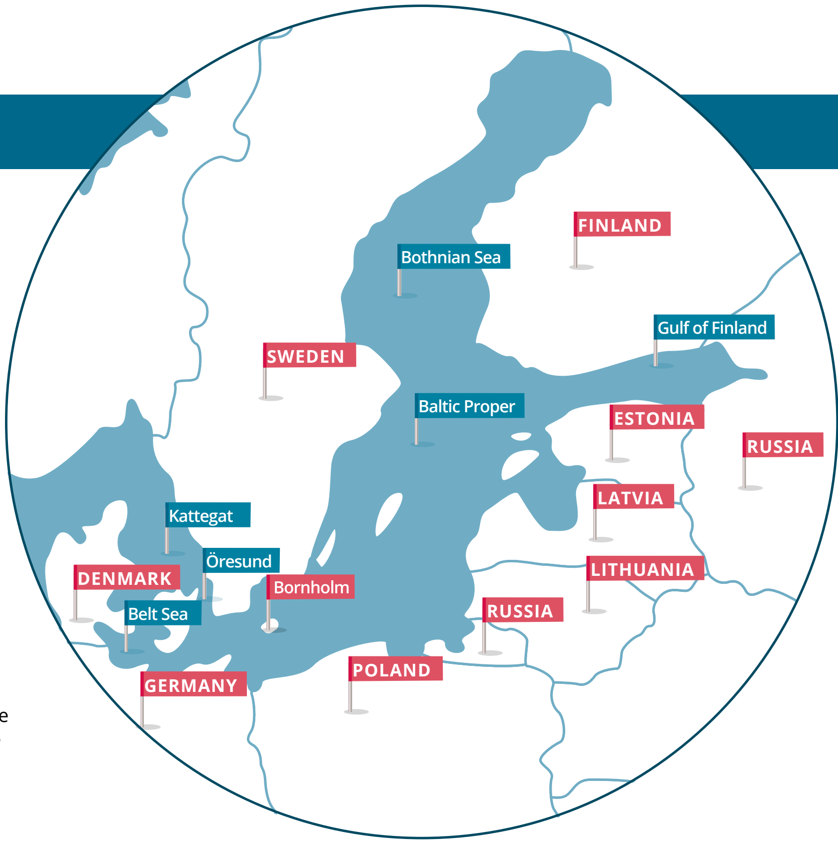


Figure 1. The Baltic Sea region has a densely populated coastline. Intense use is made of the sea and its ecosystem, which is shared by nine coastal countries, including Russia as the only non-EU member state.

1. BACKGROUND

Synopsis: The Baltic Sea is surrounded by nine countries whose futures are tightly connected through socioeconomic relationships. Yet the health of the Baltic Sea is in decline, under pressure from a number of threats. Of the various regional maritime sectors, none are more reliant on maintaining ecosystem health than fisheries. Although some Baltic fisheries have been managed within sustainable limits, since the 1950s a number have collapsed due to bottom trawling, which has caused long-term damage to seabed habitats and prevented the sea from achieving Good Environmental Status (GES).

1a. THE BALTIC SEA UNDER PRESSURE

The Baltic Sea is the world's youngest sea and one of the planet's largest bodies of brackish water – a unique environment governed by special hydrographical and climatic conditions. The strong salinity gradient from the more marine areas of the Danish straits to the nearly freshwaters of the Bothnian Sea creates a highly sensitive and interdependent marine ecosystem*. The Kattegat Sea, part of the greater North Sea, forms the link to the less saline Baltic Sea[1] between Sweden and Denmark – it is often considered as a separate part of the Baltic Sea with its own characteristic saltwater environment and species.

The nine countries surrounding the Baltic Sea are home to more than 85 million people, of whom 15 million live on the coast in diverse political, social and economic circumstances.[2] Many of these citizens rely on a healthy sea for their food and incomes, and many more value it as an important space for outdoor activities. The future of the Baltic Sea is

* An ecosystem is a community of animals and plants interacting with each other and with their physical environment (soils, water, nutrients and all living organisms). Healthy ecosystems perform a multitude of essential functions for humankind, known as 'ecosystem goods and services'.

Fishing quotas for all three cod stocks have been set above scientific advice for many years, resulting in scientists recommending complete fishing closures for two of the three stocks. It is time to take a new look at how we fish in the Baltic.

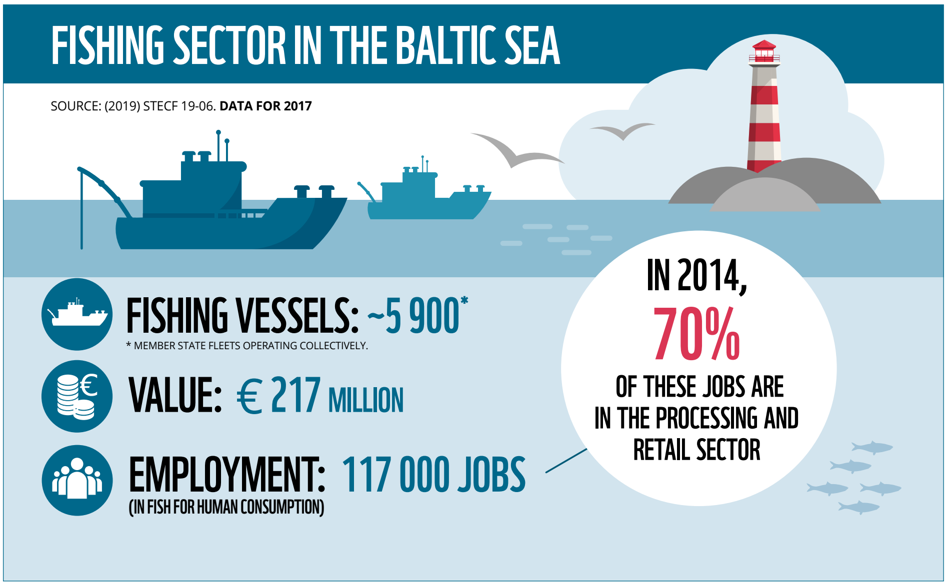


Figure 2. The latest official data on the number of fishing vessels and landed value of catches in the Baltic Sea region (2017).[6] In 2014, employment in the processing and retail sector made up 70% of the jobs related to fish caught for human consumption.[7]

inextricably linked with the life of its people, and it must be sustainably managed to assure long-term coexistence.

The Baltic Sea is intensively used, hosting a multitude of maritime sectors from fishing to shipping, renewable energy, sediment extraction and tourism. The region's diversity makes it challenging for decision-makers to find common ground on complex issues such as environmental protection, sustainable use, and management. As a result, the countries surrounding the Baltic have struggled to balance environmental, economic and social interests.

The unique biogeographical qualities of the Baltic Sea make it particularly vulnerable. Over the past 100 years, its ecosystems have been dramatically degraded. Human activities such as unsustainable exploitation of natural resources, pollution and the effects of climate change are altering the sea's ecological balance, depleting renewable resources beyond safe biological limits and jeopardising future ecosystem goods and services.[3] Runoff from agriculture, sewage, and industrial and municipal waste has meant there is five times as much nitrogen and eight times as much phosphorus in the sea as there was a century ago. As a result, eutrophication* and 'dead zones' are common problems.

Unsustainable fishing practices – quotas above scientific advice, high levels of bycatch, ongoing discarding despite regulations, and illegal, unregulated, and unreported (IUU) fishing – are all causing extensive ecosystem degradation. The crisis is particularly pronounced in the poor status of both wild salmon (*Salmo salar*)[4] and Baltic cod (*Gadus morhua*) populations.[5] Traditionally, demersal fish – in particular cod – was the most economically important target species in the Baltic Sea. Nearly a century ago, in the mid-1930s, the annual catch of Baltic cod was below 8,000 tonnes, and it was primarily landed by small vessels using passive gears such as longlines, set-nets and small seines towed in shallow waters. From 1940 onwards, however, landings rose steadily with the introduction of new gear like the otter trawl and the demersal seine (see Box 1).

During the 1950s and 1960s, more investment and new developments in trawl technology improved efficiency and opened up access to new fishing grounds. This resulted in landings ranging from 60,000 to 380,000 tonnes between the 1950s and the 1980s. Unprecedented Baltic cod catches of nearly 450,000 tonnes in the mid-1980s attracted additional vessels, both from other Baltic fisheries and other fleets that had not previously fished in the region.[8] This fleet overcapacity created intense fishing pressure that drove a steady decline, with the catch falling to 77,000 tonnes in 1992. By the turn of the century, catches of Baltic cod had risen again to 140,000 tonnes. In the 20 years since then, however, catches have again decreased, (see Figure 3) falling below 20,000 tonnes in 2019[9] and accounting for less than 5% of total commercial landings in the Baltic.[10]

The Baltic region's cod is divided by scientists into two different stocks: the Western Baltic stock, and the Eastern Baltic stock. There is also a separate Atlantic cod stock in the Kattegat Sea shared by Denmark and Sweden. Due to the dire state of the latter stock, however, there is no longer a targeted cod fishery in the Kattegat: cod is now mainly caught as bycatch in the Norway lobster fishery on an agreed bycatch rate, despite scientific advice recommending a total fishing closure. In July 2019, the European Commission introduced emergency measures for six months to close all targeted commercial fishing of the Eastern Baltic cod stock, which was further extended to only allow a bycatch rate of cod in other fisheries during 2020.[11] The Western Baltic cod stock is still being actively fished.

* Eutrophication is the enrichment of nutrients (such as nitrogen and phosphorous) in an ecosystem. If in excess, these encourage the growth of algae and other aquatic plants, leading to oxygen depletion in the water column and seabed.

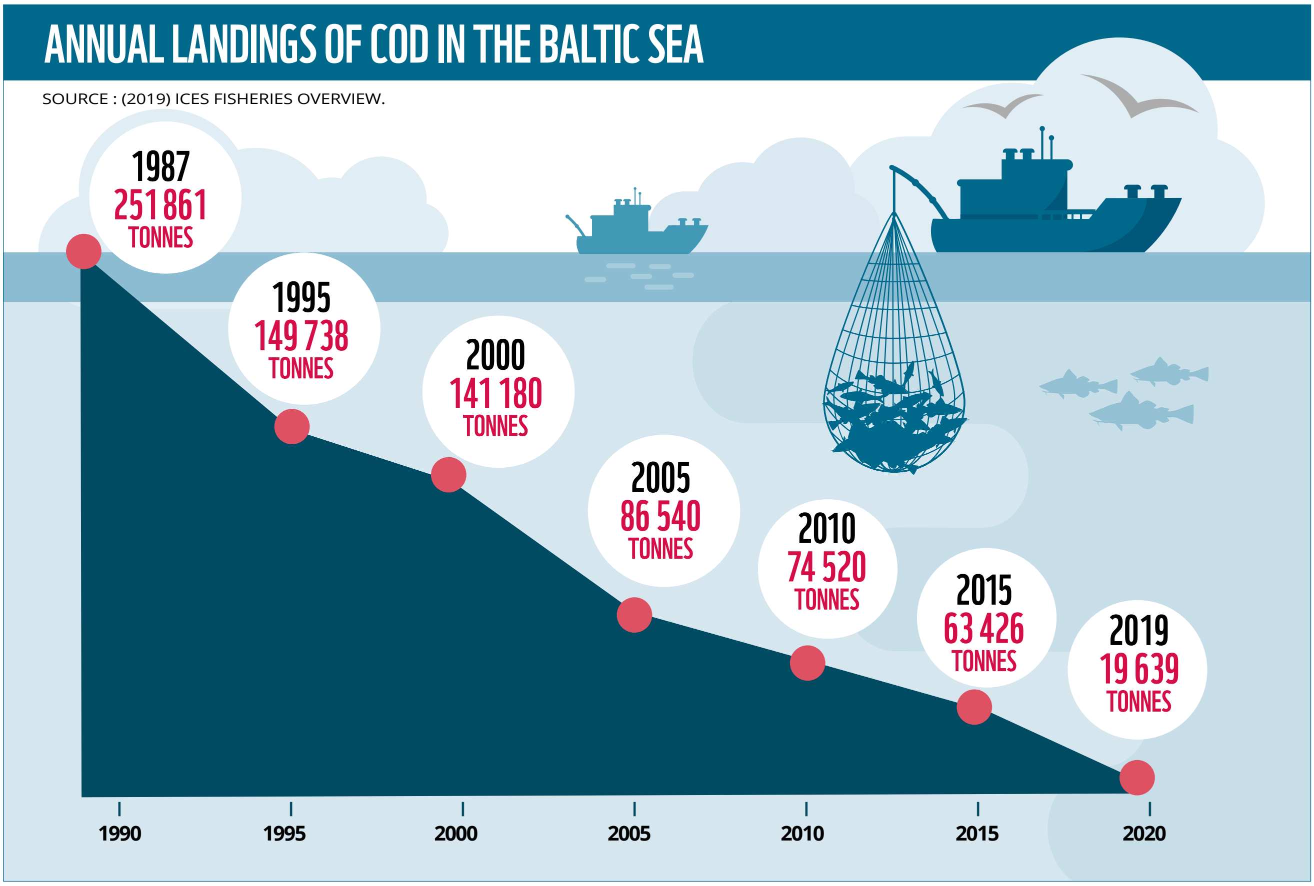


Figure 3. A timeline showing the total catch of the eastern and western Baltic cod stocks from 1987 to 2019.[12]

1b. WHAT IS 'BOTTOM TRAWLING'?

Bottom trawling is a broad term for methods of fishing that involve towing gear along the seafloor to catch fish and other species living on, near or in the seabed. In the Baltic Sea, as elsewhere in the world, people have fished the depths for centuries, initially dragging nets across the seafloor behind sail boats. With the advent of steam power in the 1880s, trawling became exponentially more destructive.[13] Steam - and later oil - powered engines allowed fishers to use larger, heavier trawling gear, leading both to bigger catches of target species and far greater volumes of incidental 'bycatch' from the non-selective design of the gear. At the outset, many fishers were opposed to the use of engine-powered trawling, which they saw as too destructive.[14] Nonetheless, in the inevitable march of 'progress' – and to take advantage of this relatively cheap source of protein to feed a growing population – engine-powered trawl vessels became the new norm and have been the standard ever since. Unfortunately, of all the unsustainable fishing practices taking place in the Baltic, bottom trawling is by far the most damaging.[15]

Mobile bottom contact fishing gear is today the most widespread human activity directly impacting seabed habitats, species and their environment. Some 25% of the world's wild seafood catch – equal to around 19 million tonnes of fish each year – comes from the use of active (towed) demersal gear.[16] In Europe alone, 43% of the shelf/slope area and 79% of the coastal seabed is considered to be physically disturbed, mainly by bottom trawling.[17] Worldwide, bottom trawlers produce multiple direct and indirect impacts on benthic ecosystems,[18] with considerable social and economic consequences.

There is wide variety in both the types of weighted gear and the ways in which they are used, but all involve actively dragging nets which remain in constant or occasional contact with the bottom during fishing. The nets are typically made from strong meshes and are often equipped with ground gear that withstands bottom impact. In the Baltic, bottom trawl gear (see Box 1) are concentrated in the south and west, and are mainly used to target cod and flatfish including plaice (*Pleuronectes platessa*) and to a lesser extent flounder (*Platichthys flesus*) and dab (*Limanda limanda*). Historically Baltic cod has been the main target species, but since the closure of fishing for Eastern Baltic cod in 2019 there has been a switch towards targeting flatfish, although cod is still caught as a bycatch.

BOX 1. Baltic Sea demersal towing gear

Common demersal gear types used in the Baltic Sea include:

The otter board trawl is the most commonly used gear. It has a cone-shaped net made from panels, which is closed in one or two cod-ends. The net is kept open horizontally by two otter boards; the vertical opening has a headline held up by floats and a heavier ground rope. Rubber bobbins or disks can prevent the net from penetrating into the ground on rough bottoms. Tickler chains are often used in front of the opening to make flatfish swim up from the seabed.

Demersal seine gear, Danish seine (or anchored seine) and Scottish seine (or flyshooting) apply two long, weighted ropes and a seine net, which are deployed in a specific pattern encircling an area on the seafloor. During hauling the weighted ropes are dragged along the seafloor towards each other, scaring and herding fish into the path of the net. In the final phase the net is pulled forward like a trawl. Danish seine nets are hauled in while the vessel is anchored, while Scottish seines are winched while also sailing forward. Scottish seine rope is usually thicker and heavier, allowing fishing on rougher, more complex bottoms.

Other mobile bottom contact gear types are the **beam trawl** (mainly used for burrowing species like flatfish, not used in the Baltic Sea) and **dredges** (used for blue mussels in Danish waters).

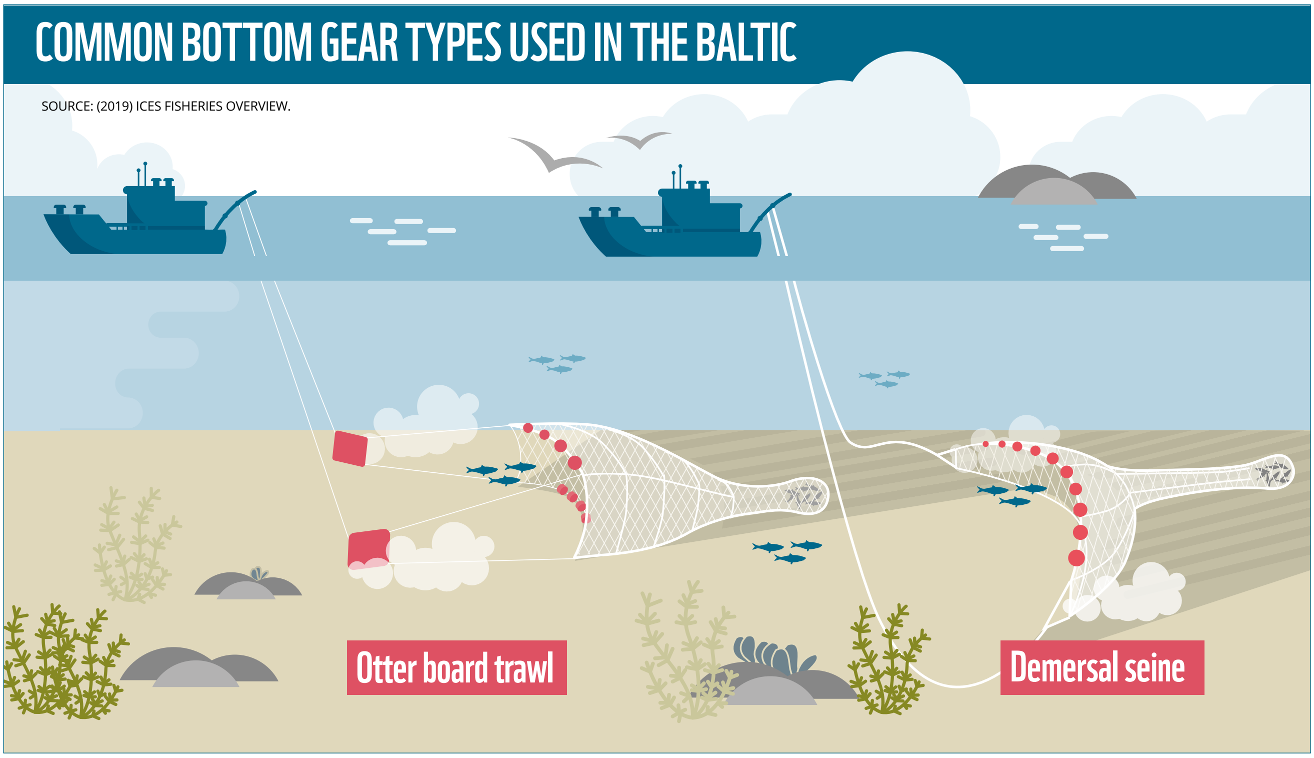


Figure 4. The main demersal bottom contact gear types used in the Baltic Sea are otter board trawl and demersal seine gear which are used to catch commercial fish stocks.[19]

2. THE IMPACTS OF BOTTOM TRAWLING

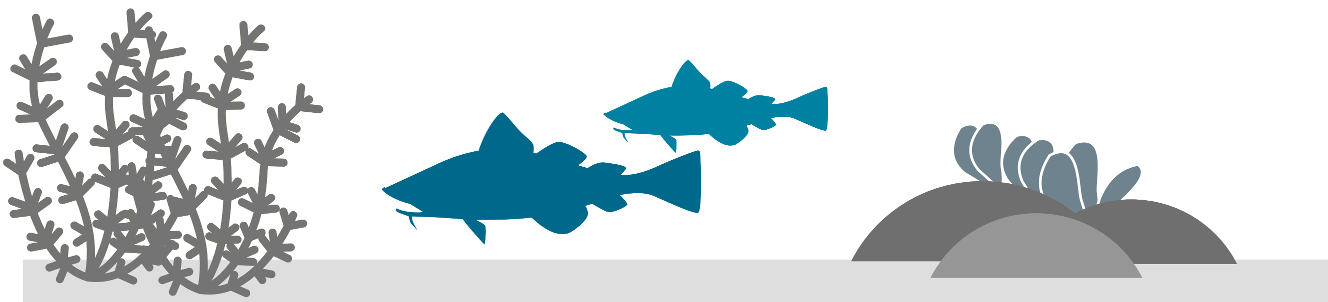
Synopsis: The presence of severely degraded benthic habitat in the Baltic Sea indicates that the impacts of bottom trawling are exponentially greater than they would be in an otherwise healthy marine environment. Periodically repeated bottom trawling is causing long-term physical damage; altering the characteristic ecosystem balance; affecting biogeochemical cycles; and negatively impacting the ability of the seabed to store and sequester carbon. From a socioeconomic perspective, the current situation of reduced catches, poor fisheries profitability and high future uncertainty may offer a window of opportunity to restructure the Baltic fleet. Reducing trawling effort and the area over which it takes place could bring benefits including more profitable ecosystem-based fisheries management and improved energy efficiency.

2a. PHYSICAL AND BIOLOGICAL IMPACTS

The impacts of fisheries on the environment vary greatly depending on the gear, operating environment, and seasonality. Heavy trawls and dredges that scrape over or dig into the sea bottom have the most impact on the environment, both in terms of habitat destruction and carbon emissions. Globally, most bottom trawling occurs on the continental shelves, on seamounts, on mid-ocean ridges and on deep-sea banks.

Substantial research has been conducted by the scientific community to analyse the action, extent and effects of bottom fisheries on the seafloors of the world and the different components of the marine environment. We now know, with quite some detail, the spatial distribution of fishing effort in many areas of the world and its overlap with potentially sensitive habitats. We also know more about the effects of this fishing on the marine environment. **In this context, science has shown that bottom trawling has numerous negative impacts on the marine ecosystem:**

- Serial resource depletion
- Damage to seafloor integrity and habitats leading to changes in fish distribution
- Changing the characteristic balance between species distribution and abundance
- Disrupting biogeochemical cycles and compounding eutrophication
- Affecting carbon storage and reducing carbon sequestration rates
- Impacts of climate change and overfishing



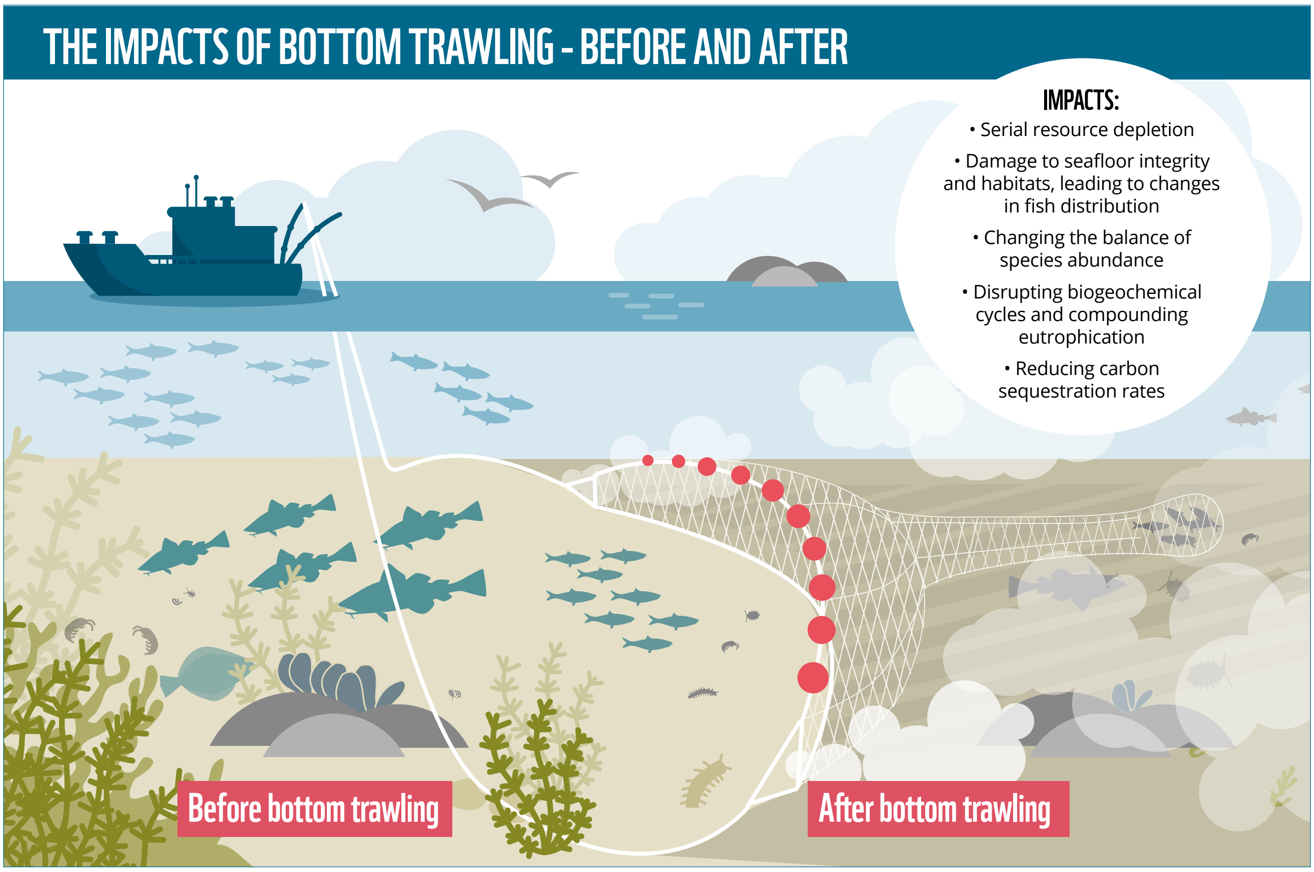


Figure 5. Bottom trawling drags a net across the seafloor, similar to a plough in a field. It mechanically alters or breaks fragile habitat structures and organisms, leaving numerous negative impacts from its passage.

The Baltic Sea has been the focus of much research on the relationship between marine habitats, their species and fishing pressure, as well as the relationship between fishing and other human pressures on the ecosystem. Yet research on the impacts of bottom trawling in the Baltic Sea is oddly scarce. Most research on bottom fisheries has been conducted in habitats of the Danish Straits, where results are not immediately transferrable to other areas of the Baltic Sea due to the particular environmental gradients and relatively high habitat variability.

Nevertheless, while information is not always easily transferable from one area/habitat/species to another, studies so far carried out on bottom trawling show that it has long-term direct and indirect negative effects on the marine environment. However, due to the combined pressures of eutrophication, deoxygenation, pollution and climate change, recovery times in the Baltic Sea will likely be far longer than would be expected in healthier marine environments. The impacts of bottom trawling on ecosystem goods and services are therefore exponentially greater in the Baltic Sea compared to other areas and are a major barrier to the achievement of Good Environmental Status (GES).

Serial resource depletion

The serial depletion phenomenon[20] is common in open-access fisheries, or indeed anywhere that quotas have been set too high or are poorly managed and controlled. Various studies demonstrate how badly managed harvesting of marine resources can lead to the exploitation, depletion and then abandonment of fishing grounds.[21,22,23,24] This 'exploit, deplete and abandon' pattern typically increases with distance from the harbour and reduced economic importance of the species targeted. In the case of bottom trawling, the threat of serial depletion comes from both the effectiveness of the active gear and the destruction of the habitat that would otherwise nurture and sustain the health of future target stocks. Both pressures jeopardise the potential for long-term ecosystem-based fisheries management and wider healthy ecosystem services due to a shift in biomass and biodiversity, effects on biological interactions, and impacts on stock density.

Fishing pressure has reduced the size of the Baltic region's two cod stocks. The state of the stock impacts reproduction potential, making the population numbers unstable.[25] Cod aggregate in dense schools during spawning. These aggregations scatter when trawlers approach, negatively affecting spawning success.[26,27] An additional impact of bottom trawling is that it catches large portions of the mature spawners (i.e. the bigger, more fecund females). Large fish produce a disproportionately higher number of eggs, and by reducing their numbers trawling further reduces the spawning stock biomass, inhibiting the ability of the fish population to replenish itself under fishing pressure. At present, the Baltic cod stocks recovery is unlikely due to their low reproduction capacity and lack of available food.[28]

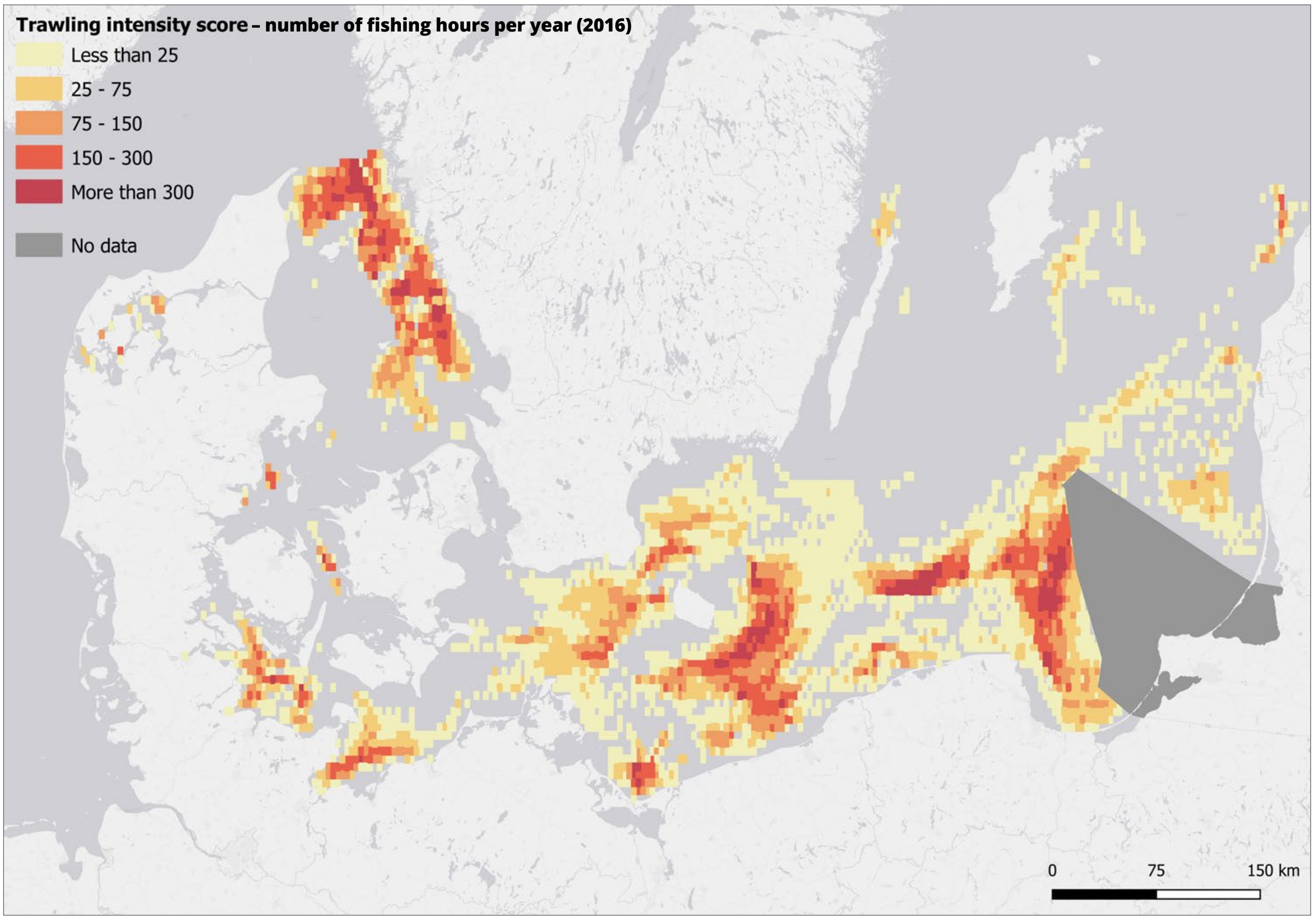


Figure 6. The distribution of bottom trawling by number of fishing hours in the Baltic Sea in 2016. The information is based on VMS/Logbook data processed by the ICES Working Group on Spatial Fisheries Data, supplied via HELCOM, and 2016 is the most recent year for which this processed and combined dataset for bottom trawling is available. No data are available for areas falling under Russian jurisdiction.[29]

Damage to seafloor integrity and habitats leading to changes in fish distribution

A functioning habitat is crucial for the life of the whole marine ecosystem, including commercial fish species. In the Baltic Sea, biogenic (e.g. seagrass, kelp, sponges and mussel beds) and geologic (e.g. boulder fields and rocky reefs) structures on the seafloor provide habitat and refuge for marine species and enhance fish survivorship.[30] Bottom trawling degrades or removes these complex structures.[31] The loss of these habitats due to trawling greatly reduces habitat complexity and available shelter for small fish and invertebrates. The heavier the trawl net and the softer the sediment, the deeper the gear penetrates into the seabed and the worse the negative impacts on organisms living below the surface.[32] Where fishing gear has penetrated the seabed, biota is far more likely to be damaged and depleted.[33] A single pass with bottom contact fishing gear has been shown to reduce benthic invertebrate abundance by 26% and species richness by 19%;[34] sessile animals such as mussels and clams are most affected and take longest to recover.[35] Sensitivity* to bottom trawling is greater in habitats with higher proportions of long-lived organisms due to their longevity and late maturation,[36] with effects two to three times greater in recovery time on organisms living more than 10 years than on those with a lifespan of one to three years.[37] As a result of trawling, sensitive species are rarely found in trawled areas, while opportunistic species (i.e. scavengers) are relatively frequent.[38] Recovery rates also depend on the habitat type, ranging from weeks on some sandy bottom habitats in tidal zones to thousands of years on deep water coral reefs. One global study estimated that, depending on the gear type, bottom trawl gear removed 6-41% of faunal biomass per trawl pass, with post-trawl recovery times on sedimentary habitats ranging from 1.9 to 6.4 years.[39] Benthic species records from 1884-1886 in the Kattegat have been compared with recent data to investigate how seafloor invertebrate species have changed after being intensively fished. Fishing has resulted in displacement with approximately 30% of the species now living at shallower depths or in the unfished zone, an indicator that chronic fishing impact has locked the ecosystem in an altered state.[40] Perhaps surprisingly, impacts on Baltic benthic habitats from physical loss and disturbance are not directly assessed within the currently available environmental indicators. To address this issue HELCOM is developing a core indicator on 'Condition of benthic habitats,' aiming to evaluate the area, extent and quality of specific benthic habitats in relation to a quantitative threshold value; and another on 'Cumulative impact on benthic biotopes' to assess adverse effects from physical disturbance.[41]

* Sensitivity is a measure of the degree of susceptibility of the seafloor environment to bottom fishing pressure – a combination of resistance and resilience. Resistance is the vulnerability of habitats, communities, species or individuals to damage caused by bottom fishing. Resilience is the capacity to recover from such damage, usually measured in terms of required recovery time (i.e. for communities to return to their undamaged state either through regrowth or migration of organisms from nearby, unaffected areas).

In the Baltic, the intensification of human activities – including bottom trawling – has been so intense and pervasive for so long that few areas within the distribution range of cod remain unaffected. Forty per cent of the entire seafloor in the Baltic Sea has been disturbed by maritime activities, covering a total area of 180,000km².[42] The spatial extent of disturbance to the seabed varies from 8% to 95% (corresponding to 900km² to 35,500km²) per sub-basin. The sub-basins with the highest proportions of disturbed seabed are in the southern Baltic Sea, in the Kattegat and the Bornholm Basin, where 80-100% of the seafloor is considered disturbed.[43]

Of all the maritime activities affecting the seafloor, bottom trawling is one of the primary threats.[44] Estimates from 2018 show commercial fishers (>12m) bottom trawls have been deployed across 59,075km² – or nearly 15% of the entire Baltic Sea, excluding the Kattegat Sea area.[45] This is slightly larger than the land area of Denmark or Estonia.

It is important to note that these calculations are for the entire Baltic Sea without being divided by sea basin, thus masking the full extent of the impacts. If calculated per sea basin it would show a substantially higher percentage impact in areas where bottom trawling is active. Mapping the average intensity of bottom trawling across the Baltic Sea and the Kattegat during 2016 shows distinctly concentrated activity to the southwest and in southern parts of the sea as shown in Figure 6, from Kattegat to Poland and the Baltic states, with higher fishing intensities in Kattegat, around Bornholm and Polish waters.

Estimates from 2018 show that bottom trawls by commercial fishers have been deployed across 59,075km², or nearly 15% of the entire Baltic Sea excluding the Kattegat Sea area.[46]

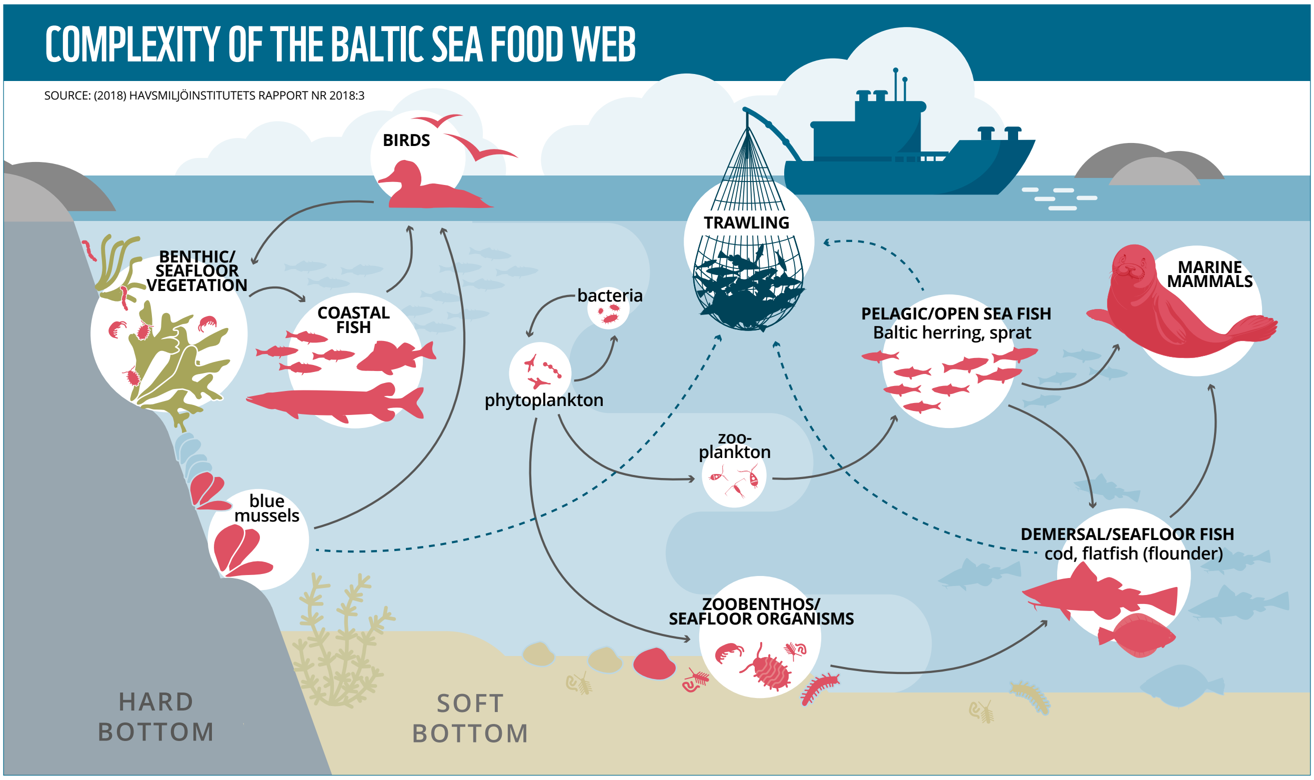


Figure 7. Bottom trawling attempts to target key species but the activity also degrades seafloor habitats, vegetation and organisms. Seafloor habitat destruction is a key reason for imbalances in the food web.[47]

Changing the characteristic balance between species distribution and abundance

Bottom trawling is thought to have broad negative impacts on the abundance and biomass of impacted benthic seafloor species due to the physical damage it causes, particularly in habitats with long-lived species.[48] Bottom trawling operations tend to homogenise habitat structure by removing the structure itself along with habitat-forming organisms, as well as reducing species complexity. The loss of major functional ecosystem components (caused by fishing out apex predators like cod) can have catastrophic effects on the ecosystem as a whole.[49] Overfishing of Baltic cod has generated a trophic cascade effect on the food web that has led to a four-fold increase in the numbers of sprat (*Sprattus sprattus*). This shift has caused a decrease in zooplankton and a doubling of phytoplankton biomass[50] that reinforces the negative effects of eutrophication. In the past, the larger cod population used to help control the size of herring and sprat populations, as they are a food source for cod at certain life stages. Sprat dominates in the current system, and by preying on cod eggs and competing for the same food as cod larvae it may be having a negative effect on its main predator.[51] In addition, the removal of demersal competitors and the alteration of seafloor substrate by bottom contact fisheries has been shown to change the diets of commercial species, ultimately affecting their body condition.[52]

Further evidence of an altered equilibrium in fish stocks is a skewed size composition which is partly the result of size selectivity and overfishing. Since the mid-1990s, the Baltic Sea cod stocks have experienced a shift in size composition. This is the result of a deliberate increase in fish size selectivity by using larger mesh sizes in trawling nets to catch larger cod, thus having implications on productivity.[53] The size structures of the Eastern and Western Baltic cod have thus changed – the trend is particularly pronounced for the Eastern stock resulting in hampered growth rates, better known as 'truncated growth'.

Over the past 25 years cod has adapted to reach sexual maturity at a length of approximately 30cm, compared to the 1990s when Eastern Baltic cod reached sexual maturity from 40 to 50cm. This phenomenon of spawning at smaller size was also observed in the Canadian Grand Banks Newfoundland cod stock shortly before the stock collapsed.[54] Smaller size brings cod few benefits as larger females have disproportionately higher fecundity and produce offspring of greater size, egg volume and egg energy content, and possibly quality assuming the same number of reproductive bouts and seasons as smaller females. Larger mothers produce larger offspring, due to greater energy investment into individual offspring, which survive better – hence larger fish are important for the restocking of marine fish populations.[55] Reproduction success rates are correlated to older age classes in the population – precisely the individuals that trawling disproportionately impacts. The loss of big female fish suggests catastrophic reproductive consequences for the future of Baltic cod and must be urgently addressed.

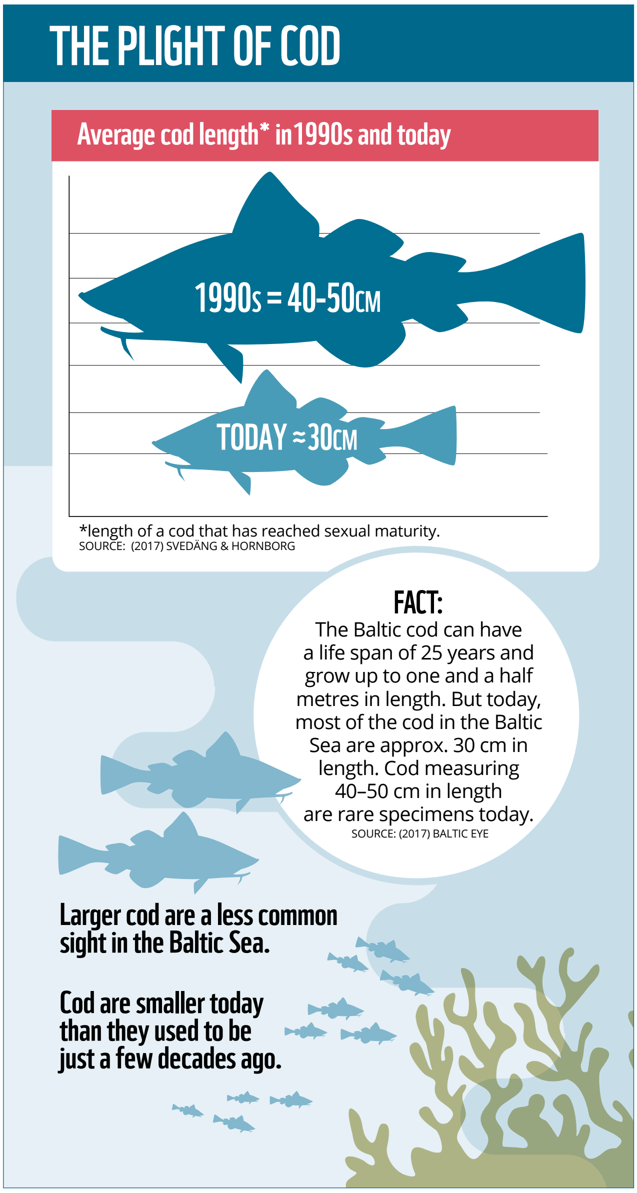


Figure 8. The reduction in sexual maturity length of the Baltic Sea cod over time.[56]

Disrupting biogeochemical cycles and compounding eutrophication

Seafloor trawling causes the resuspension, displacement and deposition of considerable volumes of sediment, yet until recently only limited attention has been given to these effects. It is becoming increasingly apparent that trawl-related resuspension is an important detrimental factor to ecosystem health due to the frequency and the extent to which bottom trawls penetrate sediments. The four impacts that have been thus far observed on the fauna and flora affected are complex, with wide-ranging behavioural, physiological and toxicological implications, including deoxygenation and denitrification:[57]

1. Sediment resuspension

Scientists are starting to explore whether bottom trawling disturbance remobilises contaminants and how this might impact ecosystems and species. Similar to the effects of dredging,[58] trawling causes particle suspension adding sediments into the water column. When disturbed, sediments release nutrients (such as nitrogen, phosphorus and sulphur),[59] hazardous substances (such as heavy metals),[60] and organic contaminants into the water column. A Norwegian study revealed that substantial amounts of contaminants were released from sediments by a trawl pass. This led to contaminated sediment suspension in the bottom waters that are likely to be semi-permanent. Within a month, mussels in the area had absorbed toxins to levels above the EU maximum advice for human consumption.[61] While the results from Norway are not immediately transferable to a Baltic Sea setting, similar processes may take place in the Baltic given the known high level of contaminants accumulated in the sediment.

2. Sediment displacement

Rates of settling for resuspended particles vary greatly between sediment types. Fine particle substrates of silt and clay take the longest to settle and show the greatest spread of resuspension as a result of bottom trawling. This matter stays suspended in the water column for several days, and can travel more than one kilometre from the trawled area.[62] Assessment of trawling impacts in the Baltic Sea region shows that mud habitats in the western Baltic and Kattegat are fished the most, followed by sand and mud in lower salinity gradients (see Figure 9).[63] Mud habitats may not be as pretty as boulder reefs full of kelp forests, but their associated biodiversity and the services they provide play an enormous role in supporting the entire Baltic Sea ecosystem. Sensitive hard bottom and bedrock habitats are impacted to a lesser extent.

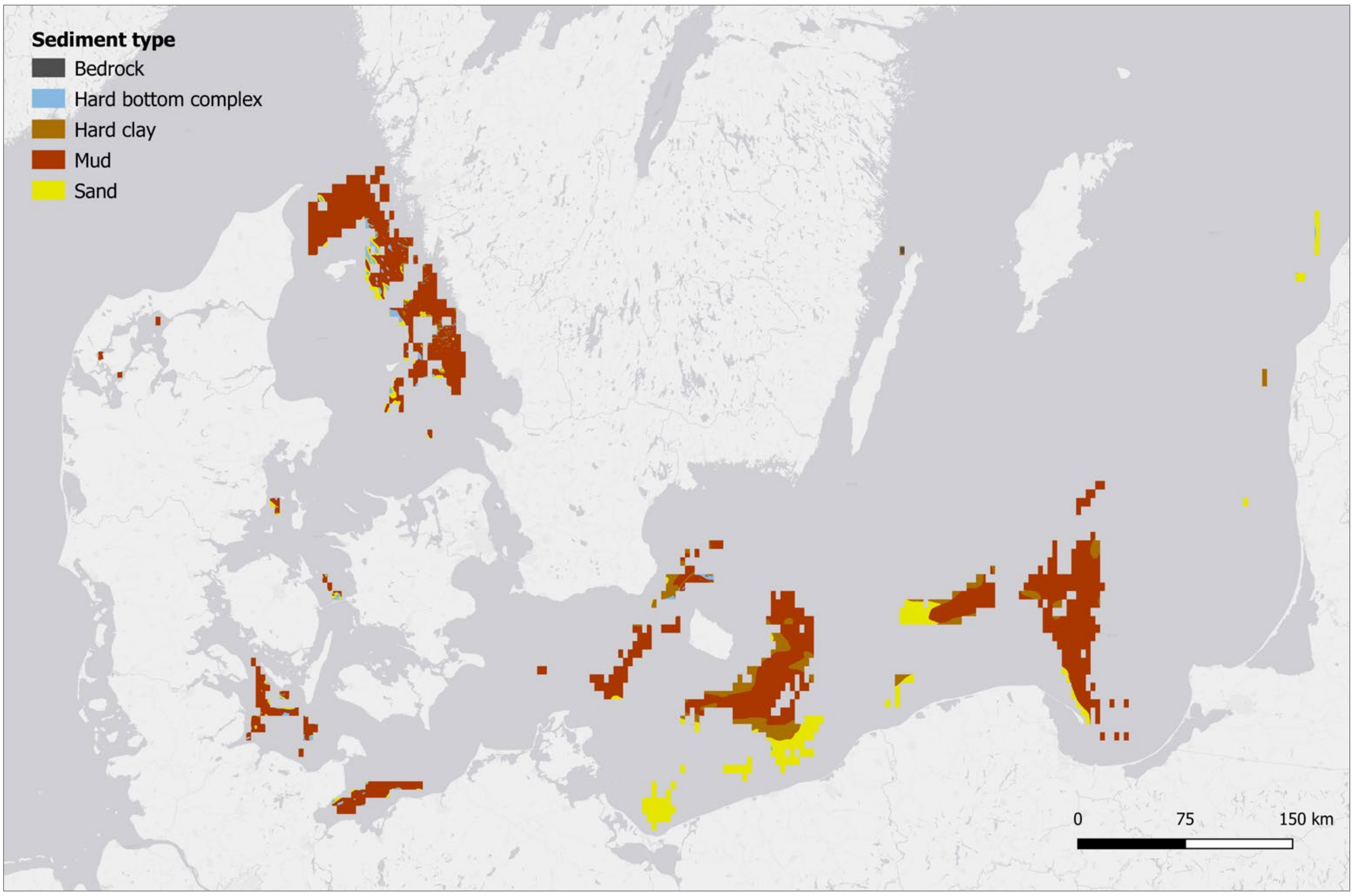


Figure 9. Seabed sediment map, showing seabed sediment types within the most intensively trawled areas of the southern Baltic Sea. This map was created by choosing the grid cells with the two highest intensity score categories (the two darkest shades of orange) from the 2016 bottom trawling intensity data layer shown in Figure 6. The seabed that falls within the area covered by these grid cells was mapped using seabed sediment data from the BALANCE project, available on the HELCOM website.[64]

3. Water clarity

Another effect of sediment displacement is decreased water clarity. Having more particles present in the water shortens the depth to which sunlight can penetrate, greatly reducing the distribution of seagrasses and algae that create habitat for many species (including commercially important fish species), store carbon and take up nitrogen from the water. In addition, suspended particles that come into contact with gills and mucous membranes can affect organisms' gas exchange and lead to suffocation. One study has shown avoidance behaviour of cod and herring at levels of low sedimentation rates down to 3mg/litre while larvae mortality increased at 10mg/litre, and decreased feed uptake in herring larvae has been registered at 20 mg/litre.[65]

4. Deoxygenation and denitrification

Physical trawl damage can destabilise the natural cycles of critical ecosystem processes including carbon, phosphorus, nitrogen and oxygen. Large oxygen-poor areas on the seafloor are an unfortunate intrinsic feature of the Baltic Sea. For areas with lower concentrations of oxygen, bottom trawling is adding to the effects of biogeochemical cycle disruptions.[66] Seafloor contact trawling destroys the complex three-dimensional redox structures in surface sediments which can chemically remove nitrates or nitrites ('denitrification'). Denitrification is a critical ecosystem function where microbe and invertebrate communities remove bioavailable nitrogen, thereby helping to buffer against eutrophication, in soft sediment seafloor habitats. Not only does trawling activity lead to as much as a 50% reduction in net denitrification, the seabed's capacity to denitrify diminishes with each trawl pass, indicating a cumulative decline in resilience.[67]

Affecting carbon storage and reducing carbon sequestration rates

The ocean is integral to the global carbon cycle and is the largest active carbon sink, absorbing between 20-50% of anthropogenic carbon.[68] The ocean is by far the largest reservoir of carbon on Earth: it is estimated to contain about 38,000 Gigatonnes (Gt), in addition to about 6,000Gt of carbon stored in marine sediments.[69] Carbon sequestration is slow, but it is of paramount importance to mitigate the impacts of climate change. Seafloor sediments and vegetation (e.g. soft sediments of clay, mud, algae, seagrass and kelp) are known to hold carbon stocks, which are released into the environment following disturbance.[70] Long-term studies that have measured the carbon stored in the seabed have shown that bottom trawling significantly reduces the rate of carbon sequestration,[71] partially due to the resuspension of sediments causing breakdown of the stored carbon in the water.[72]

Studies in the southern North Sea reveal that anthropogenic disturbance of the seafloor significantly compromises the pathways of organic carbon mineralisation, resulting in varied recovery timescales. This can substantially alter the organic carbon cycling within the seafloor.[73] On the other hand, healthy fish stocks and marine ecosystems can help to mitigate global warming by capturing and storing carbon that would otherwise enter the atmosphere and contribute to climate change,[74] the process in turn protecting the ocean and making marine life more resilient.[75] Outstanding data gaps around the effects of bottom trawling on coastal seafloor biogeochemistry translate into uncertainties in global carbon budgeting. Further research on the disruption of marine ecosystems linked to carbon sequestration is needed in the Baltic Sea. Reducing bottom trawling effort and its spatial extent would bring benefits related to restored fish size structure, lowered benthic disturbance, improved energy efficiency and more prosperous coastal fisheries.[76]

60-100%

A study in the north-western Mediterranean[77] compared untrawled to trawled areas for the effects on carbon sequestration and found continuous sediment resuspension induced by deep sea trawling could remove 60-100% of the daily organic carbon flux from the area. The trawled areas were characterised by up to 52% less organic matter and around 37% slower organic carbon turnover.

Climate change and overfishing together are accelerating the decline of ocean health, putting marine ecosystems and the goods and services they provide to society at risk.

Impacts of climate change and overfishing

While the positive effects of mitigating climate change on the ocean and marine life are currently being documented, papers that examine how ending overfishing could increase ocean resilience to climate change are less common.[78] Climate change is having significant consequences for ocean life. Ending overfishing could increase the resilience of fish stocks and the marine ecosystem in the face of climate change. Indirect pressures of overfishing include habitat degradation (from destructive fishing gear), resulting in habitat loss.[79] Habitat loss has implications for marine life but also affects other aspects of ocean health such as coastal protection and carbon storage. Reducing habitat degradation by eliminating overfishing would increase the health of marine ecosystems and the fish stocks they sustain.

Climate change and overfishing together are accelerating the decline of ocean health, putting marine ecosystems and the goods and services they provide to society at risk. As well as reducing the cumulative pressures on the ocean and increasing its resilience, ending overfishing would partly mitigate the effects of climate change[80] by reducing CO_2 emissions by the fishing sector and increasing sequestration of carbon in the ocean, strengthening the health and abundance of life in the ocean and on land.[81]

2b. THE FUTURE OF THE BALTIC SEA FISHING FLEET

Fishing in the Baltic Sea has a very long history dating back to the Stone Age. Fishing has been an important economic and social activity in the region since at least the 1500s. Historically cod was the main commercial fish species, but with stock size decreasing and catches falling dramatically, herring and sprat have dominated the total catches since the 1990s. The impacts of fleet over-capacity and destructive fishing activities like bottom trawling come with long-lasting socioeconomic consequences.

The Baltic fisheries landing value was at €217 million in 2017 - just 3% of total EU landing value.

Focus: Overall Baltic fishing fleet, and large scale fleet, including trawling and pelagic fishing for herring and sprat

The latest official fisheries data on the EU Baltic Sea fleet[82] show that in 2017 5,900 vessels landed 632,538 tonnes of fish valued at €217 million – just 3% of total EU landing value, with total revenue estimated at €226 million. Numbers of operating vessels have declined by 4.3% since 2016 and are at their lowest level since 2008. In 2017, the EU Baltic Sea fleets spent 368,431 days at sea, again a trend that has been on a general decrease since 2008. The fleet categorised as large-scale consisted of 483 vessels, which represents just 8% of the total vessels on the water. Although small in vessel numbers, the large-scale fleet was responsible for 93% of the landed weight and 79% of the total value. Denmark, Germany, Poland and Sweden accounted for 66% of the vessels operating in the large-scale fleet.

ECONOMIC VALUE OF FISHERIES IN THE BALTIC SEA PER COUNTRY

	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden
ESTIMATED NUMBER OF FISHING VESSELS SOURCE: (2019) STECF 19-06 DATA FOR 2017	472	1 587	1 469	764	251	84	789	NO DATA	485
NUMBER OF PERSONS EMPLOYED SOURCE: (2019) STECF 19-06 DATA FOR 2017	240	2 100	1 359	885	661	270	2 307	NO DATA	712
ANNUAL VALUE OF LANDINGS* (MILLION €) * FOR FISH AND SHELLFISH SOURCE: (2019) STECF 19-06 DATA FOR 2017	29.2	14.5	35.7	13.8	19.1	5.0	47.4	NO DATA	52.2

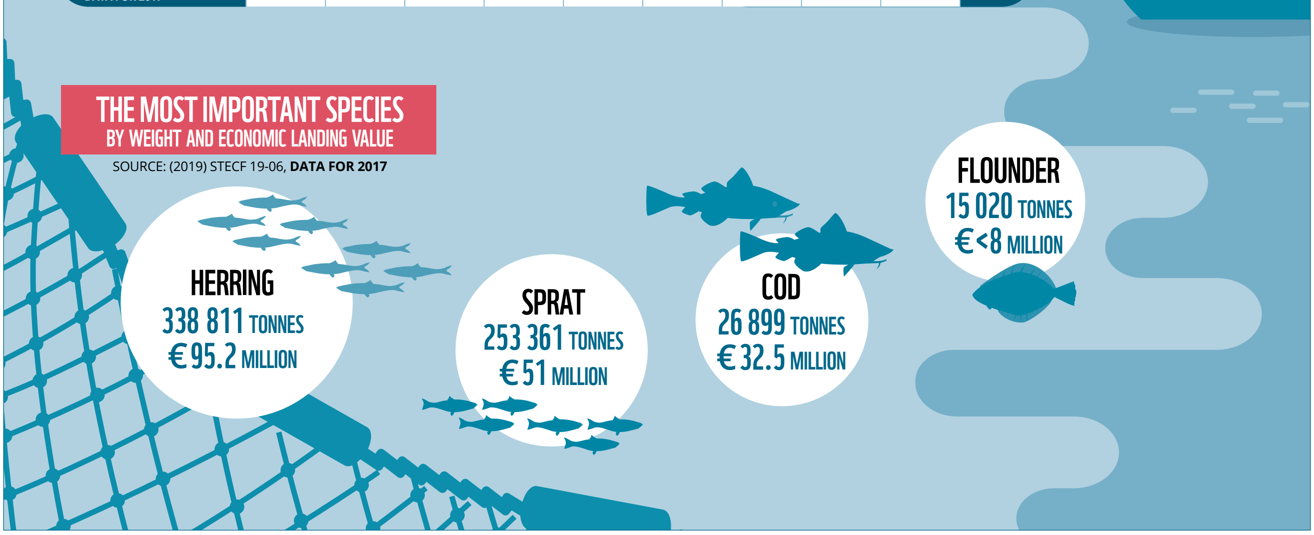


Figure 10. The total economic value of landings in the Baltic Sea by country in 2017, and the most important targeted commercial fish species landings in tonnes and by value.[83]

Focus: Bottom trawling segment of large-scale fleet
Of the top 40 segment fleets operating, 13 are categorised as demersal trawl or demersal seine targeting Baltic cod and flatfish, with a total of 196 vessels and 616 full-time employed fishers. In 2017, these vessels landed an estimated 165,000 tonnes of fish valued at €72.2 million with a total revenue of €76.8 million. The net profit was positive and higher than the year before, mainly thanks to the extraordinarily high profit produced by one Swedish demersal trawler segment that caught 77% of the overall fleet share, landing 100,000 tonnes.[84]

Focus: Cod landings with all types of fishing gear (both bottom trawl and gillnet, longline etc.)
The landed weight and value of Baltic cod steadily decreased by 50% between 2011-2017: in 2011 the 60,000 tonnes caught accounted for what was at the time the highest value of all landings, totalling €78 million.[85] In 2017, a total of 26,899 tonnes of cod were caught – approximately 15% of the landed value of all Baltic Sea fisheries, worth some €32.5 million.

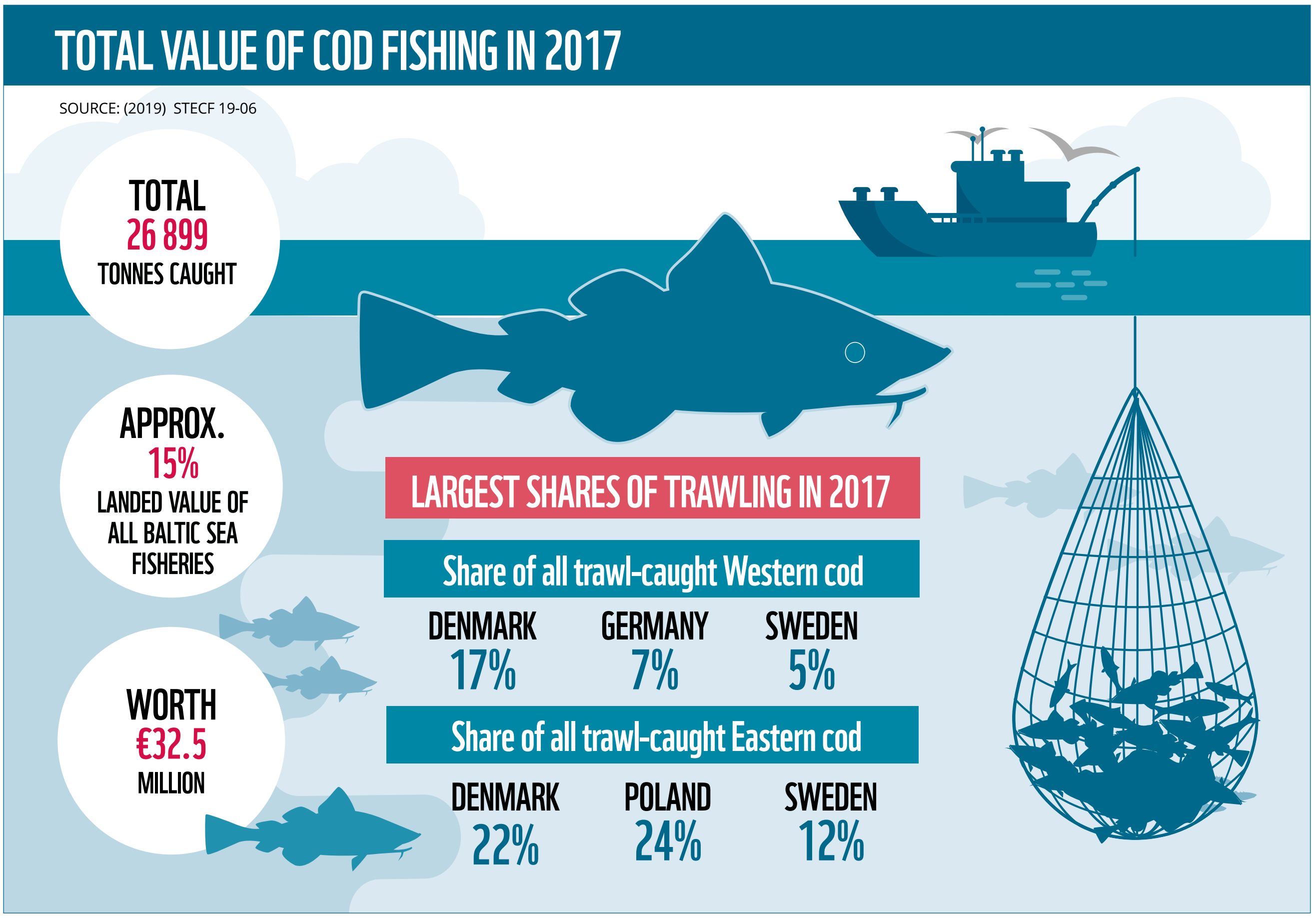


Figure 11. Total value of cod fishing in 2017.[86,87]

How will what is happening globally and in Europe ultimately affect the Baltic Sea?

In the wider context, demand for wild (non-farmed) seafood is increasingly reliant upon a natural capital base that is rapidly diminishing. Despite this, studies show that changes in management could increase fisheries' profitability while also protecting fish stocks.[88,89] The key issue is how the potential economic benefits of cod recovery can provide the fishing sector with incentives for change and how these can be translated into a case for investment, given the financially difficult pandemic period in which we're living.[90] Nevertheless, there remains an urgent need to adopt a holistic ecosystem-based approach to fisheries management.[91] The current situation in the Baltic Sea – with reduced trawling activity, poor profitability and high future uncertainty – offers a window of opportunity to restructure the fleet.

At the same time, governments must maintain long-term ambitions for protecting natural resources and ecosystems, and the viability of fisheries. These are needed even more now under the EU's Green Deal,[92] and the Biodiversity and Farm to Fork Strategies which aim to protect and restore biodiversity and make Europe the world's first climate-neutral continent – including its ocean and seas. The design of policy responses, along with how they are implemented, will be critical in ensuring they provide support to those who require it, and do so in a way that avoids encouraging unsustainable fishing now and in the future. Long-term policies will also need to take into account the new funds under the 2021-2027 Multiannual Financial Framework (MFF), such as the European Maritime Fisheries Aquaculture Fund (EMFAF), to ensure this supports an ecosystem-based fisheries management approach.

SUBSIDIES FOR BALTIC FISHING NATIONS (2018)

	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden	TOTAL
TOTAL CATCH (THOUSAND TONNES)	1 476	83	139	309	283	146	461	236	3 133
TOTAL CATCH VALUE (MILLION €)	2 542	27	64	496	245	121	305	187	3 986
TOTAL SUBSIDIES (MILLION €)	226	73	72	165	35	23	64	192	849
TOTAL HARMFUL SUBSIDIES (MILLION €)	90	31	11	60	25	15	48	37	316
TOTAL LARGE SCALE FLEET SUBSIDIES (MILLION €)	75	24	5	52	24	14	45	24	263
TOTAL SMALL SCALE FLEET SUBSIDIES (MILLION €)	15	7	6	8	1	<1	3	13	53

SOURCE: SUMAILA, U. R., EBRAHIM, N., SCHUHBAUER, A., SKERRITT, D., LI, Y., KIM, H. S., ... & PAULY, D. (2019). UPDATED ESTIMATES AND ANALYSIS OF GLOBAL FISHERIES SUBSIDIES. MARINE POLICY, 109, 103695.
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SCHUHBAUER, A., CHUENPAGDEE, R., CHEUNG, W. W., GREER, K., & SUMAILA, U. R. (2017). HOW SUBSIDIES AFFECT THE ECONOMIC VIABILITY OF SMALL-SCALE FISHERIES. MARINE POLICY, 82, 114-121.

Figure 12. The total catch, value of catch and allocated subsidies by country. Subsidies for Baltic nations are provided by Professor Rashid Sumaila (Institute for the Oceans and Fisheries – The University of British Columbia).

Government subsidies

In general, people overfish because it pays to do so. Hence, the solution to overfishing is to remove the incentive to overfish by making it unprofitable to do so.[93] The OECD has shown that policies that lower the cost of inputs, such as fuel or vessel construction or modernisation, are among the most likely to create incentives to fish more intensively and promote unsustainable fishing.[94] In addition, most of the subsidies provided to the fishing sector go to large-scale commercial fisheries to the detriment of small-scale fishers.[95]

At present, harmful European Marine and Fisheries Fund (EMFF) subsidies account for 34% of the planned funds, compared to some 45% for beneficial subsidies.[96] Compared to the EU total, the Baltic has a slightly higher proportional allocation of harmful subsidies roughly equating to 37% of the total Baltic subsidies (€849 million). In the Baltic Sea region €316 million worth of harmful subsidies were disbursed in 2018, of which €263 million went to the large-scale fleet fisheries and €53 million to small-scale fleet fisheries. As fish stocks become depleted partly due to subsidies, the fish available to feed people diminishes.[97] In the Baltic, as across the rest of the EU, paying out subsidies that negate the positive effects of other subsidies and that do not consider sustainability, makes no economic sense.

Fisheries economists consider that eliminating or redirecting harmful subsidies is a crucial step for the economic, social and environmental viability of the sector in the medium to long term.[98] There are ongoing negotiations at international level to achieve the UN's Sustainable Development Goal (SDG) on the conservation and sustainable use of oceans, seas and marine resources: this includes the commitment in SDG target 14.6 to adopt an agreement to address harmful fisheries subsidies by the end of 2020. At European level, the elimination or redirection of subsidies which harm biodiversity must take place both through the reform of sector-specific policies (such as the EMFF) as well as horizontal legal instruments (such as the Energy Taxation Directive 2003/96/EC). For instance, the removal of the fuel tax exemption for fisheries would not only increase tax revenues, but it would also create an incentive for lower impact fishing. It would make fuel-intensive and destructive practices uneconomical, provide an incentive for the development of new gears, and more selective and innovative technologies, resulting in lower ecosystem impacts and GHG emissions.[99,100]

"Over the next 30 years, investing $2 trillion to $3.7 trillion globally across several sustainable ocean-based policy interventions could generate a net benefit of $8.2 trillion to $22.8 trillion."[101]

The fisheries sector is at a crossroads. It could continue to invest in business-as-usual, which would in the long run result in public money having to be spent to reskill the fishing industry labour force as fishers will need to diversify their economic activity, or even completely change jobs. Or, positively, there is an opportunity to shift and diversify the fishing sector, making it less vulnerable. The new EMFAF could be used to support investments contributing to the diversification of the income of fishers through the development of complementary activities including investments on marine tourism, angling tourism, environmental services related to fishing, and educational activities concerning fishing.[102] Compensation schemes and actions through the future EMFAF should be used to maintain and enhance biodiversity and ecosystem services by restoring specific marine and coastal habitats in support of ecosystem-based fisheries management.

Reforming fisheries

Rather than maintaining the status quo, EMFF funds should instead promote the structural changes needed to end destructive overfishing by investing differently in fisheries recovery. Managing wild fisheries with proven sustainability practices can mean bigger, not smaller, catches of seafood.[103] A study found that rebuilding world fisheries could increase profits from the current negative $13 billion to a positive $77 billion per year.[104] Applying sound management reforms to global fisheries could generate annual increases exceeding 16 million metric tonnes (MMT) in catch, $53 billion in profit, and 619 MMT in biomass relative to business-as-usual.[105]

Reforming fisheries will result in an increase in revenues and profits to fishers in the long term. For wild-caught seafood, economic and environmental objectives are increasingly aligned. The demand for sustainably caught wild seafood continues to surge, especially among large retail chains that have made ambitious sustainability commitments, driven by growing consumer ethics and health concerns.[106] This creates opportunity for driving value in the market through branding and sustainability messaging. To increase the supply of sustainably captured seafood, several innovators are developing fishing gear that is more fuel-efficient, less destructive and more selective, thereby limiting unwanted bycatch and regulator penalties. Others are focusing on better utilisation of unavoidable bycatch and trimmings which were previously viewed as waste, using these as inputs for new products such as fish jerkies, protein powders, pet foods or even wallets made from fish skins.[107]

Fisheries investment case

The investment case for financing the transition to sustainability is clear. As the global population grows, researchers argue that investing in wild fisheries would help provide healthy diets for people over the next 30 years while replacing carbon emission-intensive land-based proteins like beef and lamb.[108] Forecasted rising incomes, urbanisation and improved distribution, worldwide per capita consumption is expected to increase by 8% (to 21.8 kg) by 2025, while nominal prices will grow 7% for wild-caught and 2% for farmed fish. The global seafood industry has been the fastest-growing animal protein sector for the past decade; and expected to be worth $390 billion and reach 196 metric tonnes by 2025,[109] primarily through the growth of aquaculture. In 2018, 67 million tonnes of fish (live weight equivalent) were traded internationally, equating to almost 38% of all fish caught or farmed worldwide. Total food fish consumption in Europe in 2017 was 16.1 million tonnes (live weight equivalent) and per capita food fish consumption 21.6kg/yr. In 2018 groundfish (i.e. hake, cod, haddock, Alaska pollock, etc.) represented 10% of the total value of internationally traded fish products.[110]

Fisheries generate significantly more value when they are sustainably managed, while also providing biological and social benefits.[111] Actions and investments that shift diets towards ocean-based proteins can reduce pressure on land and reduce GHG emissions. Moving away from the consumption of terrestrial animal products would also slow the growth in demand for freshwater to support livestock agriculture,[112] not to mention further reducing deforestation drivers.

Investing in seafood is essentially a bet on growth in demand for healthy, sustainable protein to feed a growing world population.[113] Furthermore, the fundamental economics of the global seafood market suggest that prices will continue on an upward trend, as will the demand for sustainable products.[114] Investing in sustainable fisheries should be seen as both a necessary and potentially profitable investment.[115] After all, the world's oceans support 3.5% to 7% of global GDP – the number can double by 2030, but only if governments take the right action.[116]

Sustainable blue financing

Governments need to make it financially viable for investors to invest in fisheries. They can do this by reforming and restoring fisheries, and then encouraging the private sector to invest in sustainable blue growth projects. To date, however, conservation finance has had comparatively little impact on seafood because it is a high-risk commodity due to overfishing. Of the US$5 billion in private capital committed to support sustainable food and fibre production between 2004 and 2015, only US$28 million (0.5%) was invested in promoting sustainable fisheries.[117] Conservation finance can help to reconcile ecosystem-based fisheries management with local communities' food, nutrition and livelihood security by supporting new livelihoods for fishers that provide income without causing significant social or cultural disruption (See Box 2).

BOX 2. Examples of investment opportunities:

provide fishers with **low-interest loans** to support uptake of **new low impact technology**, as well as **research initiatives**; support **upgrading tourism facilities** that connect fishers to visitors and support fishers through dedicated schemes to adapt their fishing vessel for touristic business purposes on the condition that the fishing licence is removed (i.e. not sold to another fisher). Schemes can be developed to train and **employ fishers as Marine Protected Area (MPA) rangers**, or to assist with the **maintenance of offshore wind farms** or with the **collection of data for research programmes**. Proposals have also been made for voluntary fishing gear **buy-back programmes** to encourage fishers to exit the fishery, and/or to **transition to aquaculture and/or ecotourism**.

More investors are needed to buy equity in companies with access to a sustainable supply of seafood, in order to help protect that supply so as to increase revenues, and vertically integrate supply chains to increase their margins.[118] While the scale of the necessary fisheries transition is immense, so is the amount of available capital. Private capital markets are a largely untapped resource that many

argue can help drive sustainable ecosystem-based fisheries management.[119]

Stakeholders are concluding that business-as-usual is no longer an option. The success of conservation finance will depend upon continued partnerships between private capital providers and public entities, NGOs and multilateral institutions. These organisations currently provide most of the technical support (operational assistance, monitoring, training) as well as much of the capital (philanthropic and concessionary) to facilitate fisheries management reform in addition to increasing the scale of impact and capital provided.[120]

Fishers who make their living fishing understand that depleting the source of their livelihood does not leave them with much of a future. Demand for protein from the world's growing population cannot be met by the current trajectory, and governments need to come to terms with this by acting now to transform fisheries. The fishing free-for-all attitude of yesterday is over: if we run out of fish in the Baltic there is nowhere else to go. Investing in the marine environment offers coastal states the possibility of a 'blue recovery,' especially now during the coronavirus crisis.[121]

The pandemic's impacts

The socioeconomic, environmental and human health impacts of COVID-19 have disrupted all countries, sectors and communities to varying degrees, and they cannot be ignored. All blue economic sectors are being negatively impacted by the pandemic, and fish supply chains are strongly affected, with jobs, incomes and food security at risk. Government and industry need to respond immediately to the economic and social hardships that the crisis has caused in the fishing sector.[122] When restarting the economy, it will be crucial to avoid falling back onto damaging old habits. Long-term policies mentioned in Chapter 3, along with others, will need to enable a true Green Recovery. The challenge for ocean protection will be the tendency to use the pandemic as an excuse to fail to carry out management measures that governments had already agreed to put in place. We cannot go back to business-as-usual.

The pandemic offers a unique opportunity to shift resources allocated to capacity- and effort-enhancing subsidies towards policy instruments that encourage stock and ecosystem management, improve traceability and sanitary measures, enhance safety and social protection for crews, and support sustainable and alternative livelihoods for small-scale fishers and coastal populations.[123] The current situation is an opportunity to accelerate transformations in the fisheries sector to build its resilience to future shocks.

In the Baltic, the combination of the closed target fishing on the Eastern cod and the pandemic offers an opportunity to explore how to reduce fishing pressure and increase the natural resource base of fish stocks along with seafloor habitat recovery. Redirection of government subsidies, fisheries reform and fisheries investment will all play key roles in ensuring a green recovery where investments deliver a healthier environment and a healthier economy. Financial investments will be mobilised to mitigate the economic fallout of the COVID-19 crisis, but these must assist the EU in aligning with its Green Deal ambitions. Therefore it is crucial that the new recovery instrument, Next Generation EU and funding programmes such as the EMFAF enable the EU to tackle the long-term environmental crisis and avoid undesirable trade-offs, while at the same time improving the Union's current economic prospects.[124] Transparency in policy responses will help build trust in the future of fish value chains and markets, and enable learning from the crisis to improve the sustainability and resilience of fisheries and aquaculture.[125]

Countries are increasingly willing to look at a nature-based recovery in their quest to build a better future from the coronavirus crisis. Governments more than ever must step up and deliver fair, just and green economic stimulus packages that support environmental policies, create new jobs, redirect harmful subsidies, promote circular economies, shift away from fossil fuel reliance, strengthen food security, and support the one health approach. The Sustainable Development Goals and commitments must be achieved, and all actors have a role to play. Governments in the Baltic will have to be careful not to undo all the good work done to date and grasp the opportunity to accelerate transformations in the fisheries sector to build its resilience to future shocks.

3. RELEVANT POLICY FRAMEWORKS AND COMMITMENTS

Synopsis: A decision to end, or at least minimise, bottom trawling in the Baltic Sea would sit within a framework of multiple national, regional and global policy commitments, bodies and laws. To be effective, such a decision would also need to address the need for cohesion across the multiple policies, programmes and responsible departments, as well as adopt the precautionary principle and concept of planetary boundaries. As it stands, the majority of these commitments simply will not be met, not to mention all of the ecosystem attributes that are not taken into consideration when developing optimal fisheries management strategies. Additionally, bottom trawling is incompatible with several policies as it has a negative impact on seafloor integrity and undermines progress towards the goal of achieving Good Environmental Status.

3a. GLOBAL POLICY FRAMEWORKS

The first important concept bringing the flawed logic of the current 'business-as-usual' approach into relief is Principle 15 of the UN Rio Declaration on Environment and Development, which states that "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[126] This is called the **'precautionary principle'**, and it forms an important basis for many policy positions, especially in cases where scientific evidence is lacking.

A second fundamental principle which a growing number of actors are using to guide their policies and approaches is that of the nine **planetary boundaries** within which humanity could "continue to develop and thrive for generations to come". Crossing these boundaries increases the risk of generating massive and potentially irreversible environmental changes[127], as has been effectively documented by the 2019 UN reports on biodiversity[128] and climate change.[129]

The **International Union for Conservation of Nature** (IUCN) has developed standards[130] for MPAs which are a synthesis of previous standards and relevant material from approved IUCN resolutions, recommendations and guidance documents. The standards are intended to support governments and other stakeholders engaged in MPA establishment and management towards achieving success. In the most recent IUCN guidelines on MPA definitions, industrial fishing activity is not permitted.[131]

The **United Nations Convention on the Law of the Sea** (UNCLOS) provides the legal framework for the conservation and sustainable use of oceans and their resources. **Sustainable Development Goal** 14, to "Conserve and sustainably use the oceans, seas and marine resources," sets a broader global framework within which to consider whether bottom trawling has a place in a 21st century ocean (See Box 3). In particular, Target 14.4 focuses on effectively regulating harvesting, and ending overfishing, illegal, unreported, unregulated (IUU) and destructive fishing practices. Target 14.2 further focuses on avoiding significant adverse impacts, strengthened resilience and action toward restoration to "sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.” Bottom trawling is clearly inconsistent with this aim. Target 14.6 is also relevant from the standpoint of ending damaging public subsidies for unsustainable fishing practices.

Target 6 of the Aichi Targets under the **Convention on Biological Diversity** commits all countries by 2020 to ensuring that “all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that... fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.”[132] Given the impacts described in Chapter 2, it can be argued that countries which continue with bottom trawling are not fully delivering on this obligation.

The **United Nations General Assembly** (UNGA) has extensively debated the protection of biodiversity in the deep sea from the pressures of bottom fishing in areas beyond national jurisdiction (the high seas). In 2004 a report concluded that most high seas bottom trawl fisheries were entirely unregulated and largely illegal; that no management measures were in place to prevent damage to vulnerable deep-sea ecosystems; and that the economic value of the fisheries was low.[133] To address the issue of bottom trawling on the high seas in the absence of an effective governance regime, a group of civil society organisations (70 NGOs, fishers’ organisations and law and policy institutes) formed the Deep Sea Conservation Coalition and ran a successful campaign at the UNGA. The campaign resulted in the adoption of five landmark resolutions[134] which commit all high seas fishing nations to preventing trawl damage to deep-sea ecosystems via a series of well-defined actions. Among the many commitments are specific actions required to ensure that the EU legislation on deep-sea fishing adopted in December 2016 be effectively implemented, including the ban on bottom trawling in the deep sea (below 800 metres). The resolutions marked a major change in the way in which bottom trawl fisheries are (or should be) managed, establishing the obligation of fishers to demonstrate that they will stay within the prescribed environmental limits prior to commencing fishing effort (‘reverse burden of proof’). Although the resolutions apply to deep-sea fisheries, they establish important precedents which could and should be effectively applied in the Baltic Sea context.

BOX 3. Relevant SDG 14 targets

SDG 14.2 – By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

SDG 14.4 – By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated (IUU) fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.

SDG 14.6 – By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, and eliminate subsidies that contribute to IUU fishing, and refrain from introducing new such subsidies, recognising that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the WTO fisheries subsidies negotiation.

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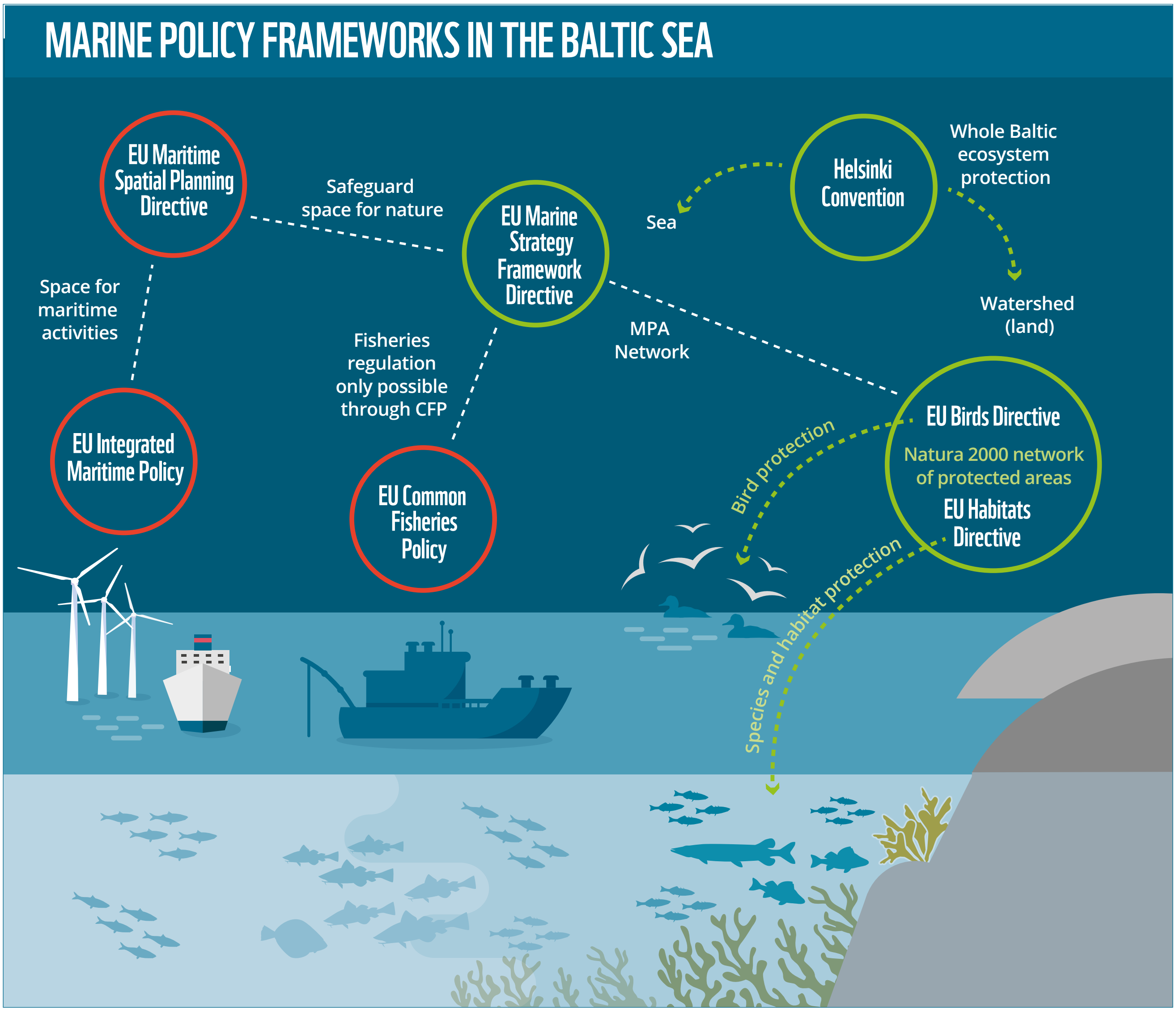


Figure 13. European policies and the regional convention for the Baltic Sea aim to support the marine environment and provide the foundation for safeguarding the Baltic ecosystem. Eight of the Baltic countries are subject to EU legislation. Legislations shown in green are central to safeguarding environmental integrity, while the red aim to manage maritime activities, including management measures for environmental protection and conservation.[135]

3b. EUROPEAN POLICY COMMITMENTS

Oceans degrade because of various human activities, and there is a pressing need to halt the decline in biodiversity and restore lost ecosystem functioning and services at sea. The EU has established key legislation to ensure this happens, including the **Birds Directive**, the **Habitats Directive** and the **Marine Strategy Framework Directive**. The new **EU Biodiversity Strategy** further includes legislation to set restoration targets (see Box 4).

The **Marine Strategy Framework Directive** (MSFD) (IP/07/1894), which was passed in 2008 and amended in 2017, is the policy framework for the protection of the marine environment and the environmental pillar of the EU's Integrated Maritime Policy which lies within the Directorate General for the Environment (DG ENV). It deals with the protection of member states' marine waters, focusing on their ecosystems at the regional level. It calls on member states to conserve sensitive species and habitats and "contribute to the protection of the marine environment, to the sustainable management of all commercially exploited species, and in particular to the achievement of Good Environmental Status by 2020".[136]

The concept of GES includes both biodiversity conservation and broader ideas of ecosystem integrity and health (See Box 5). Achievement of GES under the MSFD requires that marine systems are in "natural" condition, or at least that their current management is "sustainable" by 2020. The MSFD will require extensive use of indicators in evaluating GES. No single set of indicators will meet the needs of all EU countries in all regional seas. However, the need for conceptual consistency in assessing GES throughout European seas is vital.[137]

Among other things, demonstrating GES requires an understanding of the natural state of the relevant descriptor, how close ecosystems are to a natural state, and the relevant pressure-state relationships. At present, while the policy looks good on paper, there is a serious gap between the words and the necessary analysis of the impacts of human activities on these indicators. It is hard to imagine how we can achieve the targets without comprehensive monitoring, evaluation and learning.

MSFD descriptor 6 is particularly relevant to the question of bottom trawling: "Seafloor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected."[138] It is intended to ensure that human pressures on the seabed do not hinder the ecosystem components from retaining their natural diversity, productivity and ecological processes. At present there is no Baltic-wide action that addresses the measures to reduce seabed loss and disturbance to meet the seafloor integrity objectives by the different habitat types. Scientists are requesting that the effects of bottom trawling be included when developing indicators of the cumulative impacts on the range of benthic habitats.[139] Additionally, Article 13.4 of the MSFD obliges member states to take spatial protection measures contributing to a coherent and representative network of MPAs. This is an important obligation to be included in the current development of national maritime spatial plans by March 2021.

Connected to the spatial planning obligations under the MSFD is the 1992 **Habitats Directive** – a cornerstone of Europe's nature conservation policy that seeks to prevent activities likely to damage the environment. Also, under DG-ENV, this Directive established the EU-wide **Natura 2000** ecological network of protected areas, safeguarded against potentially damaging developments. The Directive deals with specific habitats which have their own defined characteristics and are clearly delimited in space. Recent years have seen an increased focus on establishing a network of MPAs designated under the Directive, offering another opportunity to protect seafloor habitats from destructive fishing practices. Under Article 6, the Directive obliges conservation measures within Natura 2000 sites to protect habitat areas. Most member states are developing, or have developed, joint recommendations for fisheries management in Natura 2000 sites with habitats including reefs, sandbanks and shallow bays. In the future these should provide a strengthened basis for implementing regulations on bottom trawling in Baltic Sea MPAs.

BOX 4. Quick summary - regulations and commitments that can be achieved by reducing bottom trawling effort

- SDG 14.2. 14.4, 14.6
- Aichi Target 6
- MSFD – Article 13.4
- Habitats Directive – Article 6
- Birds Directive – Article 3, 4.4
- CFP – Articles 2.3, 8, 9 and 11
- BSAP – Favourable Status of Biodiversity
- Maritime Spatial Planning Directive
- CBD Aichi Target 6
- European Green Deal Article 13
- EU Biodiversity Strategy for 2030 - 1, 2.2.1, 2.2.6, 3.1, 3.2

BOX 5. The concept of Good Environmental Status

By 2020, EU member states are to achieve **Good Environmental Status** for the Baltic under the Marine Strategy Framework Directive. This includes descriptors for seafloor integrity, biodiversity, benthic food webs and commercial fish populations – a challenge in particular to the demersal fisheries targeted by bottom trawling. It is clear that Baltic member states will be unable to achieve this deadline.

Meanwhile, the **Common Fisheries Policy** (CFP) under the Directorate-General for Maritime Affairs and Fisheries (DG MARE) is the central rulebook for managing Europe's fishing fleets and conserving its fish populations. CFP Article 2.3 sets the implementation of ecosystem-based fisheries management* (EBFM) as an objective – an essential precondition for a sustainable, forward-looking maritime sector. The approach focuses first on reducing fishing pressure of both targeted and incidental catch through multi-annual plans in line with the EU's commitment to manage for maximum sustainable yield (MSY) (IP/06/931) and with the Commission's policy to reduce bycatch (IP/07/429). A second key element is to ensure that fisheries policy is fully coherent with and supportive of the actions taken under the cross-sectoral MSFD and Habitats Directives. In particular, when adopting regional multi-annual plans specific alternative conservation measures, based on the ecosystem approach, should be included for some of the fish stocks the plan covers (CFP Art. 9).

Despite these three powerful policy frameworks, however, member states are a long way from full and coherent implementation in the water. For example, although CFP Article 8 calls for protection of fish stock recovery areas, only three of the eight EU Baltic country members have implementation of recovery areas underway.[140] Data from Sweden show that fish species and bottom-dwelling

* Ecosystem-based fisheries management as defined by CFP (art 4(9)) is "an integrated approach to managing fisheries within ecologically meaningful boundaries which seeks to manage the use of natural resources, taking account of fishing and other human activities, while preserving both the biological wealth and the biological processes necessary to safeguard the composition, structure and functioning of the habitats of the ecosystem affected, by taking into account the knowledge and uncertainties regarding biotic, abiotic and human components of ecosystems."

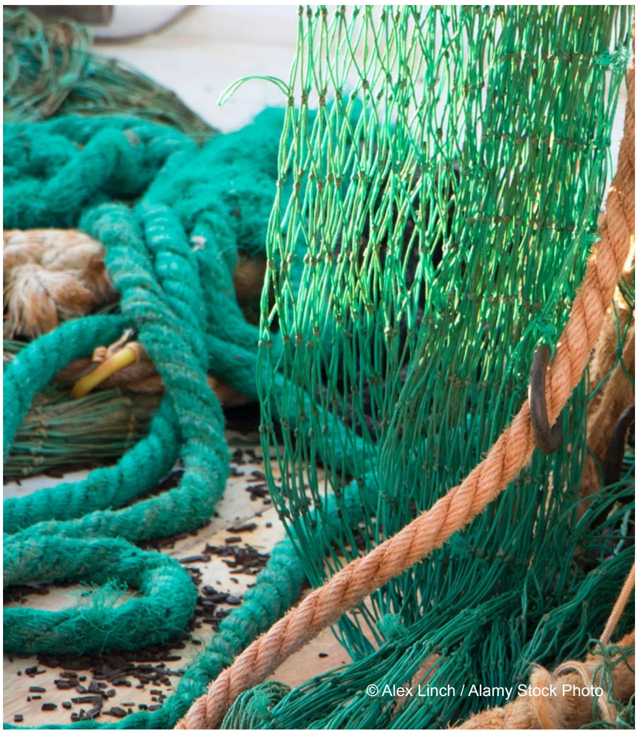
habitats are poorly represented in Natura 2000 lists of protected species, and only 26 of its 71 national MPAs[141] are protected as nature reserves.[142] More positively, several member states are in the process of implementing fisheries regulations in MPAs through CFP Article 11, as well as seeking to further collaborate on a common understanding of the needs, aim, goals and process. Unfortunately, during the process of developing joint proposals for regulation of fisheries in MPAs of a given country, other member states with historical fishing rights have sometimes tried to lower conservation ambitions and maintain trawling corridors, thereby chipping away at the effectiveness of conservation measures. Countries should instead agree on common objectives and apply CFP Article 11 more widely in limiting bottom trawling in MPAs and setting out fully protected, fishing-free zones.

The European Environment Agency notes that European fishery management policies are underpinned by strong environmental ambitions, pointing to mainstreaming and policy alignment, at least in relation to high-level GES aims under the MSFD and CFP objectives. It suggests that "targeted policy actions and committed management efforts can protect and/or restore stocks, and thus help preserve ecosystem integrity."[143] In fact, current policies guiding decisions on bottom trawling in the Baltic are loaded with aspirational objectives to implement EBFM[144] but operational objectives are few and far between, and any changes in governance have thus far been inadequate. Over- and destructive fishing still occurs, and management needs to be more precautionary, ecosystem-based, adaptive and involve stakeholder engagement. EBFM entails science-based decision-making[145], which puts increased pressure on the **International Council for the Exploration of the Sea** (ICES) – the primary fisheries-science provider to the EU – as the scope of management increases. Management agencies must both seek and act on existing ICES advice.

Through most international binding and non-binding agreements there is a national responsibility to manage marine resources and protect the marine environment, both in areas within national jurisdiction and in international waters. EU member states have the freedom to manage their own fishing in EU territorial waters (i.e. within 12 nautical miles of their coast) as long as the administration does not contravene EU regulations under Article 20 of the CFP (which allows the introduction of regulations for conservation purposes which affect neighbouring fisheries). EU rules set a minimum level for national legislation, yet member states can go further if they can prove that the action is justified and that it does not discriminate against other countries' fishing fleets. Indeed, member states have an obligation to do so if required, to achieve the objectives of EU environmental legislation.

Bottom trawling occurs in some coastal areas but is forbidden in the coastal zone in many of the Baltic Sea countries. Yet the restrictions on bottom trawling in the coastal zone vary widely between Baltic Sea countries, with national regulations ranging from 2 nautical miles to some 6 nautical miles. Within the set restrictions, a number of countries also have exceptions which allow bottom trawling even closer to the coastal shore. The coastal zone is the area that suffers the most impacts from other human activities and pressures. Moving bottom trawling to areas beyond 12 nautical miles would help restore coastal ecosystem functions, improve seafloor integrity and bring countries closer to achieving GES by enabling, at a minimum, passive restoration of the seafloor and support for fish stock recovery through protection of essential fish habitat.

Recently adopted EU commitments – the **European Green Deal** and the **Biodiversity Strategy for 2030** – give renewed hope for a proactive shift away from harmful fishing gears. The Green Deal commits the EU to protecting and restoring biodiversity under Article 13: *"The negative impacts on sensitive species and habitats, including on the seabed through fishing and extraction activities, are substantially reduced to achieve Good Environmental Status."*[146] The complementary Biodiversity Strategy commits to ecosystem-based management, transitioning to more selective and less damaging fishing methods, and underlines that the use of bottom-contacting fishing gear is the most damaging activity on the seabed. A new action plan to conserve fisheries resources and protect marine ecosystems is being developed by the European Commission to be ready by 2021. This will include measures, where necessary, *"to limit the use of fishing gear most harmful to biodiversity, including on the seabed. It will also look at how to reconcile the use of bottom-contacting fishing gear with biodiversity goals…in a fair and just way for all."*[147] It will be essential to agree on binding targets and concrete measures when adopting the action plan, as well as set financing measures for member states to speed up the transition to sustainable and more selective low-impact fishing gears.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3c. REGIONAL BALTIC POLICY COMMITMENTS

European and global policy commitments are typically taken on for implementation by a suite of regional-level bodies. The **Helsinki Convention** (HELCOM) is the governing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area. All nine Baltic countries have committed to HELCOM's **Baltic Sea Action Plan** (BSAP), which has targets running through 2021. While BSAP is impressive on paper, thus far the Baltic nations have utterly failed to meet the plan's biodiversity targets, including those focused on the main commercial fish species. While many negative environmental impacts to the Baltic Sea come from sector-driven activities dealt with by other ministries with conflicting aims in support of (short-term, often single-sector) economic growth, contracting parties to HELCOM are primarily represented by ministries of the environment whose jurisdiction is limited.

Under the goal of "favourable status of biodiversity", the BSAP includes recommendations for the conservation of benthic habitats and biotopes. In 2018 **HELCOM** conducted an integrated assessment for benthic habitats which shows that half of the soft bottom habitats are not achieving GES.[148] The current BSAP ends in 2021, and will be replaced with an updated plan for the next period, including objectives to minimise loss and disturbance to seabed habitats. It will be critical for the new plan to reflect consideration of the effects of bottom trawling, for example by developing an indicator of cumulative effects on biotopes of benthic habitats, resuspension and biogeochemical processes. While HELCOM fulfils its institutional role as environmental policymaker, focal point, developer of recommendations and coordinator, the contracting countries fall short on implementation, enforcement and monitoring of environmental policy.

Fisheries are managed through the regional group of the Baltic member states – **BALTFISH**, the regional body under the regionalisation requirement of the CFP, comprising representatives of the eight Baltic EU member states. Its main objective is to promote cooperation among fisheries administrations and other key stakeholders in developing sustainable fisheries in the region. BALTFISH functions on two planes: a high-level group consisting of member states' fisheries directors and representatives of the European Commission, and the BALTFISH Forum seminar level consisting of officials of the EU member states and European Commission, as well as stakeholders from organisations such as the **Baltic Sea Advisory Council (BSAC)**, ICES, HELCOM and NGOs. The high-level group forms its opinion by consensus among member states. BALTFISH provides recommendations to the European Commission and Council on EU fisheries conservation measures, multiannual plans, discard plans, and other regional fishery issues as granted in Article 18 on the principles for regionalisation under the CFP (EU 1380/2013). BALTFISH therefore has the mandate to propose a regional approach to ensuring the integration and delivery of the CFP commitments to meet the fisheries-related targets of the MSFD. However, to date it has not exercised this mandate, leaving an important gap in coherent regional implementation across the two key frameworks.

In an effort to constrain the short-term annual catch limits of the CFP and establish a longer-term, more regionally adapted approach to fisheries management, the **Baltic Sea Multi-Annual Plan** (BSMAP) for cod, herring and sprat was adopted in 2016.[149] However, an assessment of its effectiveness in 2019 revealed the plan to be unsuccessful in restoring stock biomass, eliminating discards, protecting vulnerable species, and minimising the negative impacts of fishing on Baltic ecosystems.[150] The plan's primary focus on fishing mortality and biomass reference points by single species stock management (as opposed to setting a direction to EBFM where multi-species relationships are the primary function for deciding the allocated fisheries pressure) is a core weakness. The plan has failed to meet and integrate the environmental and fisheries goals of EU policy, so it is not contributing to the achievement of GES in the Baltic Sea.

3d. EXAMPLES OF HOW GOVERNANCE IS FAILING

The concepts of overfishing commonly applied today are helpful for evaluating policy choices and practical use, but they are largely disconnected from the need for guidance on issues such as biodiversity, serial depletion, habitat degradation, and changes in the food web caused by fishing.[151] This reflects the failure of both management and governance structures to adopt an ecosystem-based approach, instead being too narrowly focused on single species stock status and control strategies. They thus fail to incorporate ecosystem health and ecosystem integrity properties such as biomass, trophic composition, diversity, sustainability, habitat-modifying effects of fishing activities, resilience to environmental changes, and ecological processes and interrelationships.

Despite ample legislation, the obligation to deliver GES and healthy ecosystems remains unfulfilled. Most of the protection measures that have been adopted are siloed and were not designed to take into account the marine environment as a whole. Nor were they prioritised above socioeconomic interests. There is a need to address all human uses in an ecosystem-based approach, meaning holistically, rather than through a sector-by-sector approach. There has also been a lack of commitment to these measures which has resulted in total allowable catches (TACs) being set above scientific advice. Marine and fisheries policy and regulations have neither individually nor collectively stopped the pollution, degradation and overfishing of the Baltic Sea, nor taken into account the negative socioeconomic impacts from overfishing and unsustainable fishing methods on other maritime sectors. The reason for this in part lies in the gaps identified.

Key gaps include:

- Lack of protection of soft sediment
- Lack of restrictions on bottom trawling and requirement for environmental impact assessments (EIAs)
- Lack of scientific reference areas
- Lack of ecosystem-based fisheries management metrics
- Lack of monitoring and enforcement

Lack of protection of soft sediment

To date, MPAs in the Baltic Sea have not been designed to be used as reference areas to compare an ‘undisturbed natural habitat area’ to the surrounding multi-use areas. The benthic communities on the Baltic Sea’s soft seabed have changed significantly over the past 30-50 years.[152] Formerly dominant species have declined sharply, and others have expanded. The underlying causes of these changes and their consequences are only partially understood. The seafloor-dwelling animals have several important functions in the ecosystem that rarely receive adequate attention.

Since 2017, 19.9% of threatened species globally have had at least 10% of their distribution range represented in large MPAs.[153] The framework of the MSFD for seafloor integrity and the regional seas conventions have an important role in the ecological representativeness of MPAs, in order to allow for more complete protection of underrepresented soft bottom sediment areas in these networks. Given how marginalised soft bottom areas are in MPAs, it is clear that achieving GES is incompatible with continued bottom trawling. Despite what we know about how changes in organisms that live in soft bottom sediment can affect both fish stocks and nutrient flows, there is no protection of soft bottom sediment in the Baltic Sea. To date, these seabed types are not represented in the Natura 2000 Habitat Directive (aside from Annex 1: 1110 “sandbanks slightly covered by water all the time”, and 1140 “mudflats and sandflats not covered by the water at low tide”). They are missing adequate reference areas and overall protection. Species connected to soft bottom seabed types are also not protected under Annex II of the Habitat Directive.

Lack of restrictions on bottom trawling and requirement for EIAs

Bottom trawling is, in principle, allowed on the open sea with temporal restrictions in spawning grounds. It occurs in some coastal areas but is generally forbidden in the coastal zones of most Baltic countries. Governments should instead allocate specific bottom trawling areas, preferably through an ecosystem-based marine spatial planning process including an EIA to conform with EU environmental legislation. Other maritime activities that displace or reposition sediment (e.g. dredging, port construction) are obliged to follow a permit process with an EIA statement and consultation. Bottom trawling, however, is exempted from enforced restriction and EIA requirements, even though it disturbs and damages the integrity of the seafloor across very large parts of the Baltic. To meet the requirement of seafloor integrity and fish stocks that are sustainable in size and abundance according to GES indicators, member states should be obliged to ensure (and prove) that fisheries have minimal environmental impact.

Lack of scientific reference areas

Scientific reference areas within MPAs provide useful measures of resilience in benthic systems. Unless they demonstrate rapid recovery of the seabed to predicted reference levels it will not be possible to say with certainty that the wider seas are being used sustainably. One major current weakness is the lack of sites which enable scientists to understand and measure against the ‘natural state’ for each area of seafloor. Reference sites are critical for forming a baseline to ensure that the seafloor retains the ability to recover and return to a natural state and achieve seafloor integrity and GES. Specific monitoring is needed so management measures can be adjusted if needed.[154]

Often single species fishery management strategy consists of a single management measure, such as a specified total allowable catch (TAC). In practice, a large majority of management strategies consist of a number of management measures, encompassing technical input and output controls, and a system of user rights.[155] It is important to link all management measures within ecosystem production and diversity to fishery systems. To achieve this, more complex models are required that take into account functional interrelationships among ecosystem components. Scientific reference areas will facilitate the process. Fully protected scientific reference areas within MPAs could provide research areas where measurable attributes such as biomass and production, diversity, variability, and social and economic benefits could be quantified and compared to non-protected areas. Scientists face difficulties in establishing a correct baseline (i.e. the historic/pristine conditions in which the benthic community may have included other species) for the Baltic Sea benthic community, especially given that the few untrawled habitats left are still susceptible to being trawled in future. It is hard to find areas unaffected by any fishing at all.[156]

Lack of ecosystem-based fisheries management metrics

An effective regulatory framework for fisheries depends on adequate information and political will toward simultaneously achieving a sustainable harvest of marine resources while not jeopardising the ecological status of the marine environment. It must also provide direct guidance on issues such as biodiversity, serial depletion, habitat degradation, and changes in the food web caused by overfishing. Fisheries management and species conservation are too narrowly focused on single species stock status and control strategies. Ecosystem health and ecosystem (seafloor) integrity must be concepts that can be measured for the expected benefits (ecosystem goods and services), costs and risks associated with alternative policy choices, with respect both to target and non-target species.

Metrics used today are flawed because not all accumulated effects or ecosystem dynamics are being included in the modelling. A set of ecosystem criteria are required to judge the cumulative effects of various management programmes, and could be used to measure when an ecosystem is overfished. Certain projects, such as the BENTHIS project,[157] have provided useful methods[158] to identify the areas most sensitive to bottom fisheries, as well as criteria to consider and manage fishery pressures among the complex array of other human pressures on the seafloor. These could potentially be used to direct and optimise future management of natural resources and ensure the environmental sustainability of fishing.

To improve the state of the Baltic Sea it is critical that fisheries management be adapted so as to be included in a wider ecosystem-based management approach. Failure to link seabird breeding success to intensive harvesting of their prey is a clear example of the gaps in fisheries management measures. Enhanced population dynamics models, that incorporate species interactions, can provide a framework to define and evaluate robust indicators of ecosystem overfishing and the implications of their use in the management of ecosystems and specific components.[159] As mentioned in Chapter 2a current fisheries legislation is missing key ecosystem indicators in its modelling, and the management plans for fisheries are not enough to attain the objective of the CFP. In addition, fisheries management measures must be established in all MPAs according to clearly defined conservation objectives and based on the best available scientific advice.

Lack of monitoring and enforcement

A widespread lack of fisheries monitoring is one of the key barriers to achieving transparency in stock assessment. The pattern of misreporting Baltic demersal and pelagic catches and falsifying logbooks has been documented for the past 20 years. In 2000, the Swedish Board of Fisheries conducted research and found that since the early 1990s reported landings differed significantly from the data received from acoustical surveys.[160]

The knock-on effects of misreporting are that ICES stock assessments are compromised, which undermines the basis of fisheries management. Studies suggest that if catches in all of the world's fisheries could be adjusted to meet scientifically determined targets, and if fishery economics could be optimised, fisheries could produce much more food and profits while at the same time increasing the amount of fish left in the water to keep ocean ecosystems healthy.[161] "A significant increase in control, enforcement, onboard monitoring and sampling of landings is required to ensure that misreporting does not continue."[162]

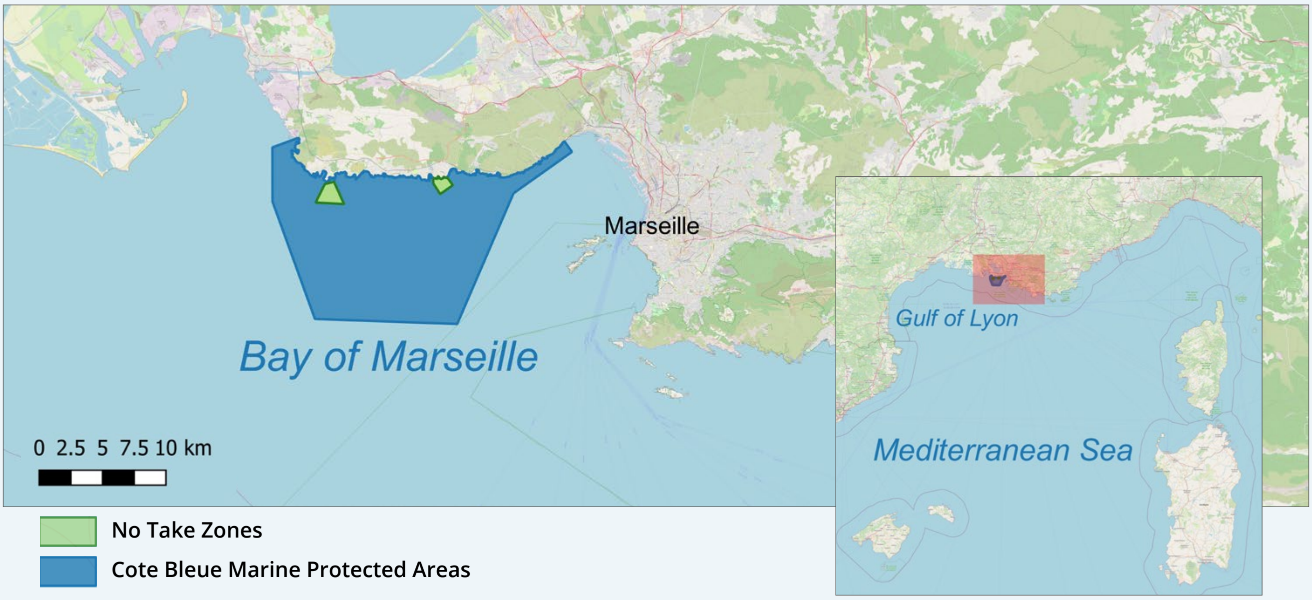
In 2009, the EU adopted a new regulation, the 'Control Regulation', to establish general rules and principles governing the control of fisheries across its member states. The regulation entered into force in 2010. It places a number of enforcement obligations on member states' competent authorities to ensure that appropriate measures are taken in the case of breaches of CFP rules: to impose sanctions; to mark serious infringement perpetrators with penalty points; and to require countries to hold a national register of all infringements of CFP rules. The application of the Control Regulation is falling short. Ten years on in the Baltic region there are still gaps in knowledge, lack of political will and enforcement.[163] "Shortcomings in the implementation mainly concern sanctions and point system, follow up of infringements, data exchange and data sharing, traceability, but also monitoring and catch reporting tools for vessels below 12 metres."[164] The Control Regulation must be improved. Some important areas for improvement are to introduce mandatory remote electronic monitoring requirements, improve traceability requirements, ensure the monitoring and control of fleet capacity, effectively control fishing restricted areas and marine protected areas, and introduce transparency requirements.

A much stronger implementation, monitoring and review process is also needed. Parties should revise their National Biodiversity Strategies and Baltic Sea Action Plans by the end of 2021; or as a minimum, submit national commitments for the most important targets. The impacts of trawling gear on overall GES, and the downstream impacts of fishing on the food web and repopulation of species stocks, require further scientific research and better indicator development.

4. SHOWCASING POSITIVE MANAGEMENT EXAMPLES

Synopsis: Within the bleak overall picture of degraded ecosystems, declining catches, impoverished livelihoods and unmet political obligations, there is still hope that the Baltic seafloor could restore itself to provide habitat and food for marine species if trawling is eliminated or greatly reduced. The fishers themselves are central to solving the problems of the Baltic Sea's fisheries. Several models exist where fishing communities have come together with government to reverse the destructive tide. Spatial measures which have benefits to both target and non-target species and enhance ecosystem functions – MPAs, no-take zones, spatial zoning, closures – should increasingly be used to address habitat issues and poor GES arising from trawling and other anthropogenic impacts on marine ecosystems.

Fishers themselves are central to addressing the problems of the Baltic Sea's fisheries today. Fishers hold invaluable intellectual capital and experience as partners in the quest to achieve long-term sustainability of their industry. As key stakeholders, fishers can and must help to steer better policy, identify the appropriate incentives, implement better practices, and become fully integrated into (and where possible, leaders of) long-term ecosystem-based environmental management, to safeguard their livelihoods now and into the future. Fortunately, several models exist where fishing communities have come together with government to reverse the destructive tide. We present four such examples, all of which apply spatial measures as the main management tool.



CÔTE BLEUE MARINE PARK, FRANCE

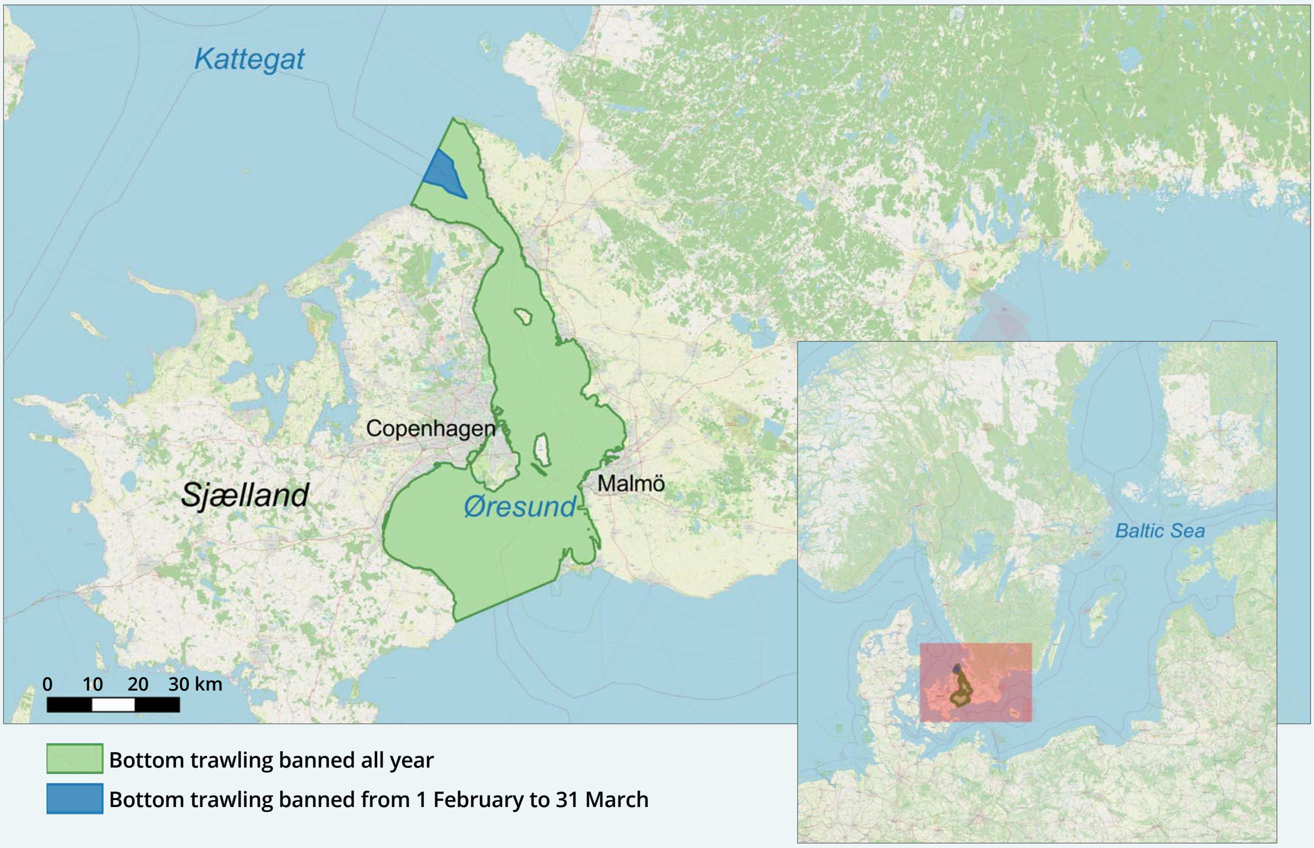
An example of collaborative stakeholder governance using an MPA and no-take zones

Established in 1983 next to Marseille, France, and included in a Natura 2000 site, the Côte Bleue Marine Park provides a case study of how MPAs can deliver on ocean governance. The park aims to protect Natura 2000 habitats and species, including *Posidonia* meadows (a type of eelgrass native to the Mediterranean). It contains two no-take zones where all fishing is forbidden, along with diving, dredging and anchoring. In the rest of the park, all activities are authorised and subject to the general regulations at sea. The reserves in the Côte Bleue Marine Park were jointly constructed by MPA authority managers and fishers. The park has succeeded because it has enforced the two no-take zones and because fishers have been active partners involved in the management and monitoring. Other areas of success are the committed long-term governance from local authorities and elected officials, the experimentation and innovation in management (e.g. artificial reefs), the educational outreach in the form of classes, and the local support of residents and users. Several studies have highlighted tangible results, such as the fact that fishers now have a more positive perception of their relationship with MPA managers. Other stakeholders have also been actively engaged through the Natura 2000 governance.

ISLE OF ARRAN, SCOTLAND

An example of a well-managed MPA and no-take zone

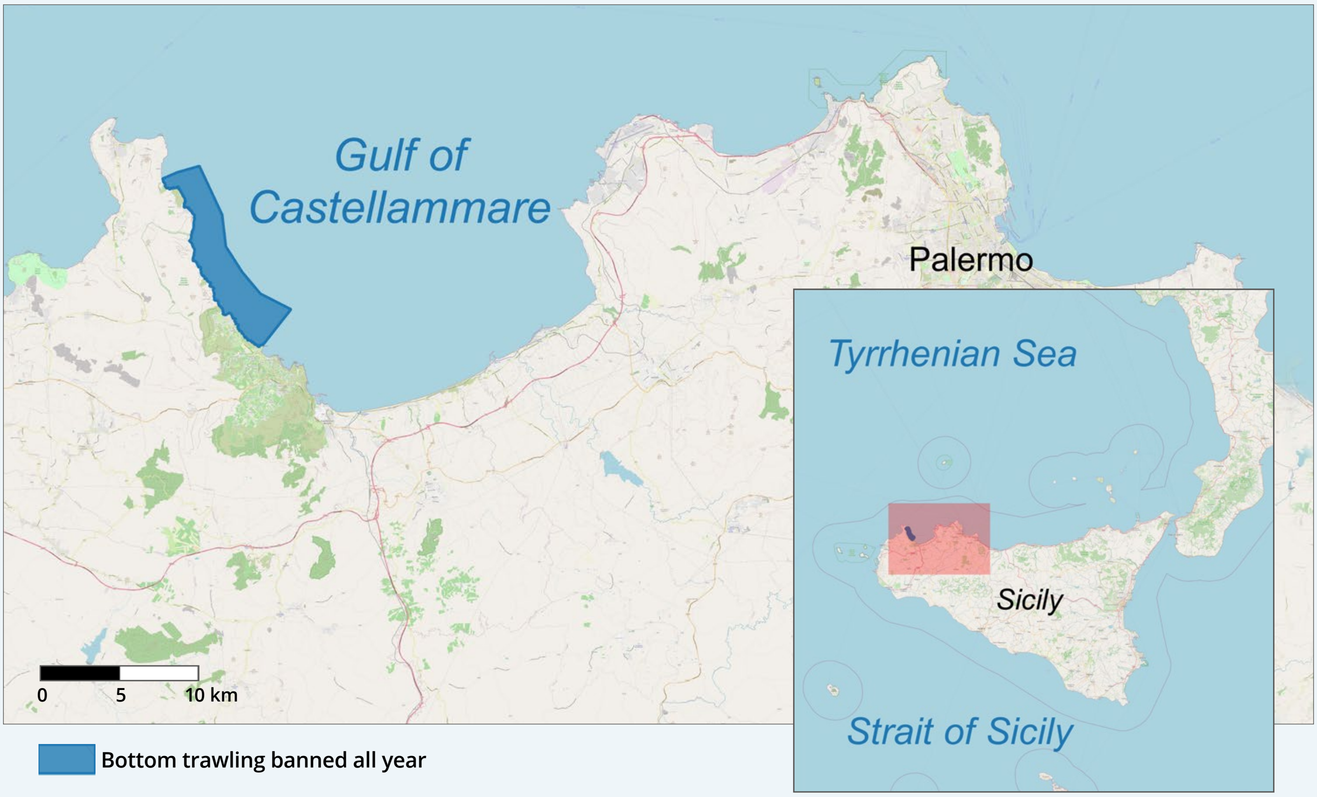
Around the Isle of Arran off the west coast of Scotland, bottom trawling and dredging caused an ecosystem collapse in the 1980s. Following 13 years of protest by the local community, a no-take zone of 2.67km² was introduced, and a larger MPA was established to protect the seagrass, maerl and mussel bed habitats and sponge communities. A 2020 report shows a substantial increase in biodiversity, along with size, age and density of commercially important species. Seagrass has returned, mussel beds have quadrupled since 2013, and the cod has recovered along with the lobster population, which produces six times more eggs than outside the no-take zones. Research shows that haddock, whiting and cod inside the MPA are responding positively to higher benthic biodiversity and landscape heterogeneity.



ÖRESUND, DENMARK

An example of a successful spatial closure

Öresund is inhabited by the only productive cod population left in the Baltic Sea.[165] The strait varies from 5 to 45km in width and is the primary route for ships travelling between the North Sea and the Baltic. Because of the danger they pose to shipping, mobile fishing gears like bottom trawls have been banned from the Öresund since 1932. Although the area is not yet an MPA, cod have demonstrably benefitted from the knock-on effect of excluding bottom trawling.[166] Research catches showed that cod were 15 to 40 times more abundant in the Öresund than in the Kattegat, with the former showing a higher degree of stability over time of fish species diversity.[167] Today primarily caught with commercial gillnets, the Öresund cod exhibit better size structure than the cod stocks that are predominantly trawl-caught, and it has become an economically important recreational area for anglers and tourism. The ecosystem services provided in the Danish/Swedish sound are many due to the eelgrass, kelp and mussel bed communities providing feeding grounds for birds and migratory routes for many fish species. In addition, sensitive benthic faunal communities that have disappeared or have been heavily reduced in neighbouring seas can still be found in Öresund.



GULF OF CASTELLAMMARE, ITALY

An example of a productive trawling ban

In 1990, a trawling ban was implemented in the Mediterranean Sea's Gulf of Castellammare over an area of approximately 200km² – 55% of the entire Gulf. The ban still allows fishers to use all non-towed bottom and pelagic gears, and permits artisanal and recreational fishing, diving and other touristic uses of the environment. Since the ban, there has been a significant increase in fish biomass within the Gulf: four years into the ban the total fish biomass had increased eightfold. Of the 11 fish species studied, all showed an increase in biomass, ranging from 1.2-fold for musky octopus to 497-fold for gurnard. Fifteen years after the ban, a survey showed that the fish biomass of all size classes was higher in the protected Gulf of Castellammare compared to unprotected areas. Moreover, the catch per unit of effort was higher.

Spatial measures – MPAs, no-take zones, spatial closures and zoning – have benefits for both target and non-target species, enhance ecosystem functions, and should increasingly be used to address habitat issues and poor environmental conditions arising from bottom trawling and other anthropogenic impacts on marine ecosystems. Restoring ocean health as showcased in the examples will require one or more of the following passive restoration elements:

Marine protected areas

WWF's analysis of MPAs across European waters shows that not only are they insufficient in number, but that the current protected areas are failing to provide either biodiversity protection or unaffected reference areas.[168] In fact, bottom trawling is still taking place within MPAs (see Figure 14). MPAs should function as a coherent network of effectively managed areas. In the Baltic region, only 7% of the marine area is covered by MPAs with a management plan, which accounts for less than half the designated MPAs in this sea basin (16%).[169] In addition, only a quarter of all Baltic Sea habitats reach the required 30% coverage, with deep offshore area habitats especially underrepresented.[170]

Effective MPAs (see Box 6[171]) are important to biodiversity for protection, regeneration, population replenishment, climate resilience, and as a basis for research and development. MPAs are essential for effective long-term management of the ocean's natural capital, including tackling overfishing. Numerous cases show how MPAs provide more fish, better habitats and increased biodiversity over time. At a period when biodiversity is in rapid decline, ecologically important areas must be safeguarded and fully protected.

For MPAs to be effective, they must specifically restrict bottom fisheries where these pose a risk to the achievement of conservation objectives related to seafloor habitats and overall biodiversity. A general ban on bottom trawling in protected areas would contribute to providing opportunities for protection to allow nature to reassert high biological values and act as a refuge for many marine species. Having reduced human activity areas where fish and other species can grow and reproduce is a vital step forward in creating viable and sustainable fish stocks. Subsequently, MPAs will improve ocean health by contributing to climate change mitigation,[172] specifically through carbon sequestration and storage in protected critical habitats (e.g. mudflats, reefs, seagrass beds, kelp); while also reducing coastal erosion due to sea level rise by safeguarding habitats.[173]

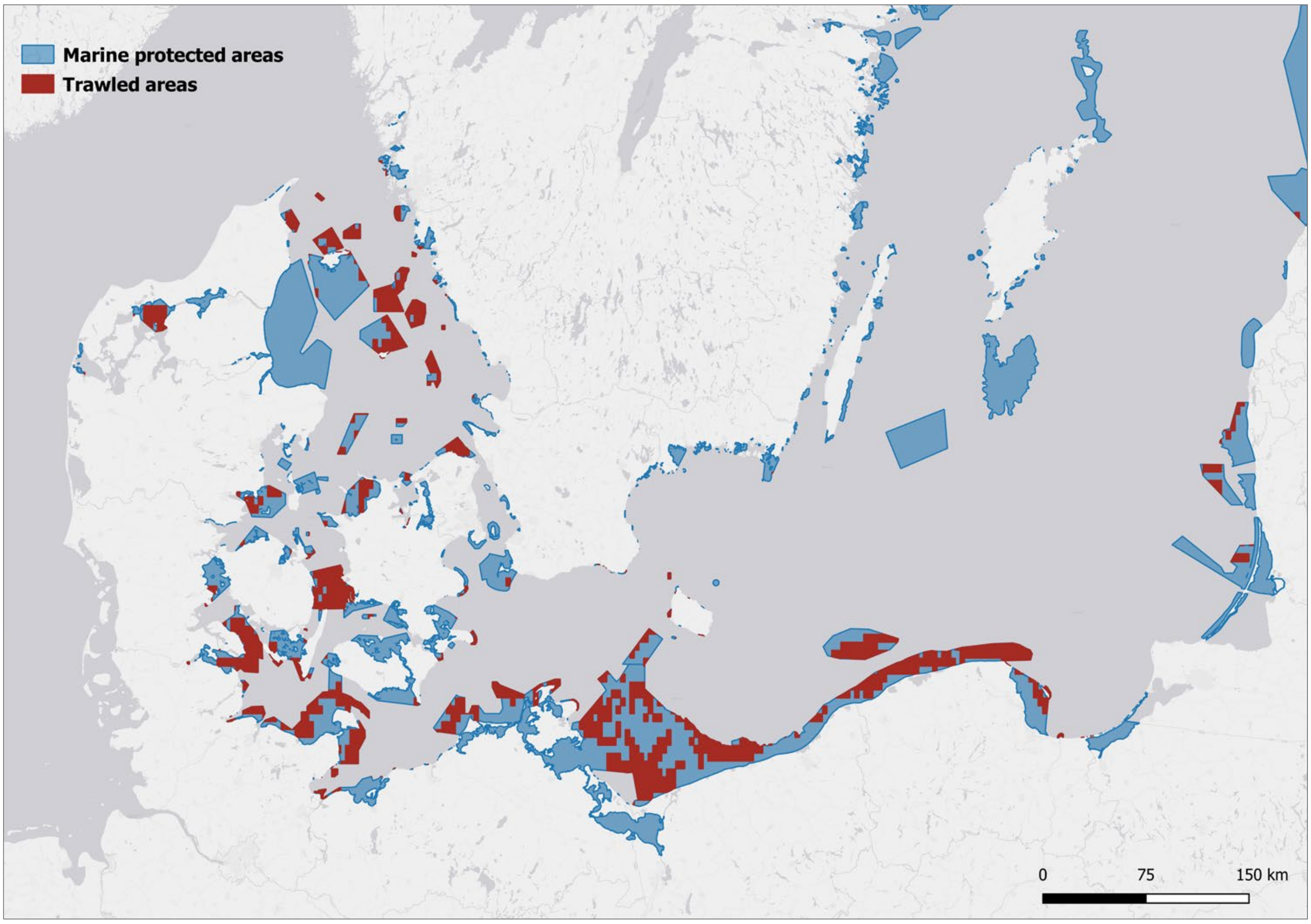


Figure 14. MPA / bottom trawling map, showing HELCOM MPAs in the southern Baltic Sea. Areas where bottom trawling takes place within MPAs are shaded red, based on an overlay of the MPA boundaries and the 2016 bottom trawling intensity grid shown in Figure 6. All grid cells with a bottom trawling intensity score >0 that fall fully or partially within an MPA are shaded red.[174]

No-take zones

No-take zones are highly effective in restoring and preserving biodiversity, as well as in enhancing ecosystem resilience. A 2017 study reported that the biomass of fish in marine reserves is “on average 670% greater than in adjacent unprotected areas, and 343% greater than in partially-protected MPAs”. Multiple other benefits are realized. Key among these are the restoration of ecosystem complexity through a chain of trophic cascades once the abundance of macrofauna has returned; greater resilience in the face of climate change; and overflow benefits to surrounding fisheries and ecotourism businesses.[175] No-take zones may also have indirect effects by protecting fish populations against the evolutionary effects of size-selective fishing, as well as against population collapses connected to management failure.[176] No-take zones are an example of how nature can restore itself if left to do so.

In Sweden, less than 1% of the national waters are full no-take zones. Nevertheless, several years ago this made up the majority of the total European no-take zone area. Large parts of Swedish waters have fishing restrictions.[177] For example, Sweden has many thousands of square kilometres of no-trawl zones along its coasts. While several examples are in coastal areas and focus on coastal (non-trawled) species, there is a large no-take zone (360km^2) protecting turbot and flounder around Gotska Sandön, and another in Kattegat (650km^2) protecting cod. Both show positive effects on the target species and serve as local examples of the potential benefits of less trawling.

BOX 6. Ecological coherence

The network-wide protection provided by effectively managed MPAs is referred to as ‘ecological coherence’, which is commonly assessed against the following criteria:

- **Representativity** – ensures that the MPA network protects the typical and unique nature in each sea basin. All habitats found in the sea basin must also be found within the MPA network.
- **Replication** – acts as the insurance of the network, ensuring that there are several copies of a given habitat across the MPA network and that they are not clustered together in only one MPA.
- **Connectivity** – ensures that individual MPAs are spatially close enough to allow species and their larvae to move between MPAs containing the required habitat type, and to seek refuge within the MPA network should an unforeseen hazard threaten their original location. Ensures both the genetic diversity and survival of the species populations, including species whose life stages depend on different habitats.

A network of MPAs is only ecologically coherent when all assessment criteria are fulfilled at the same time.

Spatial closures

Some habitats show less resilience and longer recovery time from a fishing event than others. The areas of low resilience are known as vulnerable marine ecosystems (VME) and are subject to recent management amendments globally, such as the UNGA resolutions mentioned in Chapter Three. A key tactic is often the full closure of known VMEs to all mobile bottom-contacting gear. Denmark has only 0.02% of its waters closed to all forms of fishing, while roughly 2% are closed to mobile bottom-contacting gears, primarily to protect boulder reefs.[178] Because fishing is still permitted using other gears such closures may promote a shift from active to more passive and/or low impact gears. For certain habitats or environments closures must be permanent to show a substantive effect. Temporary closures are unlikely to reduce impact on VMEs, where often a single trawling event is sufficient to cause significant lasting damage[179] as mortality is around 50% for a single passage trawl (depending on species, gear and sediment type).[180] However, the size of the closures along with any related redirection of fishing effort to other areas and habitat types must be considered too, along with other negative anthropogenic activities that may be taking place in or alongside these areas during critical times, e.g. spawning season. Although there are fishing restrictions during spawning seasons, mobile bottom-contacting gear ultimately destroys the seafloor integrity and sea bottom habitats for all species along with the ecosystem services these provide (see Figure 15).

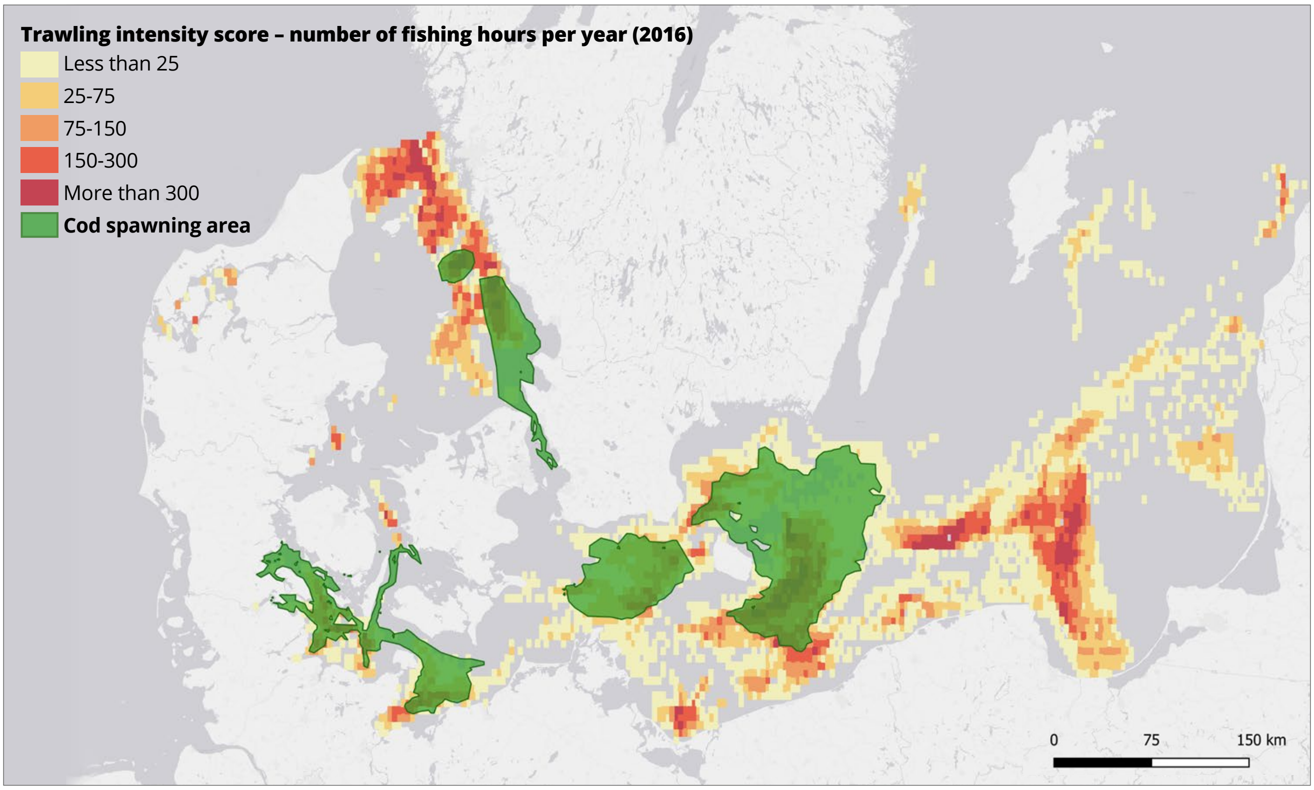


Figure 15. Cod spawning/bottom trawling map, showing the 2016 bottom trawling intensity data with cod spawning areas overlaid. Although seasonal restrictions on fishing are in place to protect some of these spawning areas at sensitive times of year, bottom trawling still takes place within these areas at other times, impacting on the integrity of the seabed habitats present.[181]

Spatial zoning

Spatial measures other than MPAs can be used to reduce pressure on the seafloor. For instance, in some cases fisheries with different gear types are incompatible within the same areas. In Sweden, an extended no-bottom trawl zone has allowed the proliferation of a Norway lobster fishery using pots and creels. Given the opportunity in the form of a zoning scheme for low-impact gears, new fisheries are given the opportunity to develop while simultaneously benefitting seafloor biodiversity.[182] The example of Öresund described earlier in the chapter reflects this point.

With many indicators currently lacking for seafloor integrity and ecosystem-based metrics not being used in current fisheries management, a restriction of bottom trawling within 12 nautical miles would allow coastal waters to recover. The coastal zone represents a source of great genetic diversity, with the largest gatherings of juvenile fish and many susceptible habitats (seaweed belts, eelgrass beds etc) that are disadvantaged by sediment resuspension plumes. Moving the trawling limit further offshore would benefit small-scale fishers using passive gears, anglers and nature tourism. It would allow for a larger proportion of the sea area to be protected from heavy-impact fishing gear and facilitate a phase-in of low-impact fishing methods. As is mentioned in section 3b, Article 20 of the CFP can be used on legal grounds to move out the bottom trawling limit as a protection measure, and it can be applied in areas where fishing is shared bi- or trilaterally with other nations. It has already been used in this way by England as a legal basis for introducing regulations in protected areas where Ireland, France and Belgium have fishing rights.[183]

5. RECOMMENDATIONS

Changes needed to support ecosystem-based fisheries management

With a clear vision of an alternative future, and a strong commitment to maintaining a healthy thriving sea for generations to come, many of today's most pressing marine challenges could be addressed. From a socioeconomic perspective, the current situation of reduced catches, poor profitability and high future uncertainty require urgent action from policymakers. The solutions are clear: reduced bottom trawling effort and smarter management of trawling areas would improve fishery productivity and increase the prosperity of coastal fishing communities, as well as bringing wider benefits to the Baltic countries, including in the fight against climate change.

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Today though there is still a lack of understanding of the multiple harmful effects of bottom trawling, so the precautionary approach should prevail, particularly in light of the fragile Baltic Sea environment. Governments have a legal obligation to ensure that human activities are not undermining the achievement of Good Environmental Status (GES). In this context, WWF calls on Baltic ministers and the European Commission to work across their authorities and sectors to intensify efforts to introduce ecosystem-based fisheries management and achieve GES in the Baltic Sea. Specifically:

1. **Ban trawling within the boundaries of all national MPAs and minimise overall fishing effort in key habitats.** Spatial closures must be established to conserve benthic habitat and/or communities and fish stock recovery areas, nursery and spawning areas, using a whole-site approach. Fisheries management practices must be reviewed in terms of their proximity to MPA boundaries and the impacts of bottom trawl plumes near sensitive areas such as spawning grounds.

2. **Restrict bottom trawling in coastal waters to restore productivity.** Bottom trawling restrictions should be in place within 12 nautical miles of coastlines to enable recovery and protection of important ecological habitats, to provide better economic opportunities for small-scale fisheries with alternative low-impact gear, and as a contribution towards climate change mitigation.

3. **Develop ecosystem indicators for the cumulative effects of seabed disturbance.** The effects of bottom trawling must be reviewed and included in the development of indicators, particularly in the protection of sensitive habitats and sediment substrates most affected by bottom trawling gear.

4. **Improve fishing vessel tracking, monitoring and control measures.** These must be put in place to ensure that bottom trawling is not occurring in restricted areas, and to monitor bycatch of non-target species. For transparency, remote electronic monitoring tracking technology such as Automatic Identification System and disclosed Vessel Monitoring System must be installed on all commercial fishing vessels. Remote electronic monitoring including closed circuit TV camera surveillance should be obligatory during fishing activities. A monitoring system should be set up to collect data on fisheries' impacts on wider ecosystems, per the Data Collection Regulation of 2017.

5. **Eliminate or reform harmful fisheries subsidies.** Governments must eliminate or reform harmful subsidies by improving sector-specific policies. This should happen both at European level through the current EMFF and future EMFAF and in horizontal legal instruments such as the Energy Taxation Directive along with national state aid programmes. Subsidies must shift towards supporting activities aimed at restoring and managing the marine environment, monitoring and vessel tracking equipment, and scientific research and data collection. Funding must be diverted from current industry-supporting research to scientific studies on the effects of fishing on marine ecosystems and the alleviation of fishing pressures.

6. **Work together across governments to implement and enforce existing maritime laws.** Governments around the Baltic Sea must work collaboratively, across ministries and sectors, to adhere to, implement and enforce existing laws and fulfil requirements towards limiting the impacts of bottom trawl fisheries by delivering on their obligations to the CFP, the MSFD, EMFF, the Habitats Directive, SDG 14 and the CBD Aichi Targets.

7. **Establish an ecosystem-based fisheries management system that is transparent.** Governments must include a process of review for future refinements, including new scientific research and a funding mechanism to monitor performance that includes stakeholder engagement.

8. **Create fully protected marine scientific reference areas.** These areas are required to form baselines for better understanding the maritime pressures on marine ecosystems, and to allow scientists to measure recovery of biodiversity along with bridging the knowledge gaps on carbon reserves and their storage potential.

9. **Form a network of MPAs supporting representativity, replication and connectivity.** To enable recovery of marine ecosystems and to provide benefits of larval export and potential spillover of juveniles/adults into adjacent fisheries, a network of MPAs supporting representativity, replication and connectivity across the sea basin must achieve at least 30% coverage and be effectively managed by 2030 in line with the IUCN Resolution and the new EU Green Deal for Nature.

ACRONYMS

BALTFISH	Regional Group of the Baltic Member States, consisting of High Level Group and Forum
BSAC	Baltic Sea Advisory Council
BSAP	Baltic Sea Action Plan
BS MAP	Baltic Sea Multi-Annual Plan
CBD	Convention on Biological Diversity
CFP	EU Common Fisheries Policy
COVID-19	Coronavirus
DG ENV	Directorate General for Environment
DG MARE	Directorate General for Maritime Affairs and Fisheries
EBFM	Ecosystem-Based Fisheries Management
EIA	Environmental Impact Assessment
EMFAF	European Maritime, Fisheries and Aquaculture Fund
EMFF	European Maritime and Fisheries Fund
EU	European Union
FAO	United Nations Food and Agriculture Organisation
GDP	Gross Domestic Product
GES	Good Environmental Status
GHG	Greenhouse Gas
HELCOM	Helsinki Commission – Baltic Marine Environment Protection Commission
ICES	International Council for the Exploration of the Sea
IUCN	International Union for the Conservation of Nature
IUU	Illegal, Unreported and Unregulated fishing
MEY	Maximum Economic Yield
MFF	Multiannual Financial Framework
MMT	Million Metric Tonnes
MPA	Marine Protected Area
MSFD	EU Marine Strategy Framework Directive
MSY	Maximum Sustainable Yield
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goal
TAC	Total Allowable Catch
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNGA	United Nations General Assembly
VME	Vulnerable Marine Ecosystem
WWF	World Wide Fund for Nature

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OUR MISSION IS TO STOP DEGRADATION OF THE PLANET'S NATURAL ENVIRONMENT AND TO BUILD A FUTURE IN WHICH HUMANS LIVE IN HARMONY WITH NATURE.