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The Baltic Sea

A Roadmap to Recovery

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Executive summary

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This report describes the poor environmental state of the Baltic Sea today and identifies the development of the European Marine Strategy, and the associated proposal for a Directive, as the key political process which could provide the means to reverse the Baltic's decline. With some modifications, as set out in this report, there is a real chance that the proposed legislative measures can make a difference to the way Europe's seas are managed, giving marine ecosystems the chance to recover, fish stocks to rebuild and our seas to catch their breath.

The Baltic Sea today is one of the most exploited and polluted seas in the world. Eutrophication has become a problem of enormous proportions and has implications for the wider Baltic ecosystem. The threat to all life in the Baltic is further compounded by the addition of other threats, such as over-fishing, toxic contamination and the introduction of alien species. Other activities that threaten the Baltic Sea include sand and gravel extraction and oil and gas exploitation. In addition, the rise in shipping and oil transportation has increased the likelihood of a major maritime disaster.

Marine reserves are one form of Marine Protected Areas (MPA). They offer the highest level of protection, being areas of the sea that are fully protected from any damaging human activity - much like national parks on land. Marine reserves protect not only single species, but the full variety of species and their habitats. They also preserve the complex interactions between species that make up an ecosystem. They are increasingly recognised as an essential tool in consolidating species and habitat protection with other uses of the marine environment, in particular fisheries management, and may even benefit fisheries in a number of ways. Moreover, marine reserves provide an undisturbed habitat that can yield invaluable information for scientific research.

This report will show that marine reserves must play a key role in the recovery of the Baltic Sea. In the political context, the European Marine Strategy, and associated proposed EU Directive for the protection of the marine environment, could deliver the mechanism by which large-scale marine reserves are established in the Baltic Sea. Furthermore, it would, for the first time, provide a coherent policy for the protection of the Baltic, together with sustainable resource management. It is now up to the governments of EU member states to make the most of this opportunity, by moving beyond the sectoral approach and putting the health of the marine environment, and of Europe's citizens, at the centre of their decision-making. Now is the time to deliver on political promises - to make a network of large-scale marine reserves a reality in the Baltic.

Abbreviations

CFP	European Union Common Fisheries Policy
DDT	Dichlorodiphenyltrichloroethane
EEZ	Exclusive Economic Zone
EMS	European Marine Strategy
EU	European Union
MARPOL	International Convention for the Prevention of Pollution from Ships
HCH	Hexachlorocyclohexanes
ICES	International Council for the Exploration of the Sea
IBSFC	International Baltic Sea Fisheries Commission
IMO	International Maritime Organization
IUU	Illegal, Unregulated and Unreported fishing
MPA	Marine Protected Area
PCB	Polychlorinated biphenyls
POP	Persistent Organic Pollutant
PSSA	Particularly Sensitive Sea Area
SAP	Salmon Action Plan
TBT	Tributyl tin

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1. Introduction

Urgent action is required to reverse the decline of the Baltic Sea. New management measures must be introduced which have the ecosystem approach and precautionary principle at their core. To achieve this, all the different sectoral activities that impact upon the marine environment must be placed under one umbrella. The recently published proposal for an EU Directive for the protection of the marine environment (Marine Strategy Directive) provides a unique political opportunity for countries around the Baltic to work together and make this a reality.

This report briefly describes the poor state of the Baltic Sea, and shows that the proposed Directive can set the stage for the establishment of a network of large-scale marine reserves in the Baltic, badly needed for its recovery. A growing body of scientific evidence shows that the establishment of marine reserves, that cover significant portions of the world's oceans and seas, is an important tool needed both to protect biodiversity and to rescue and enhance fisheries.

Human activities have resulted in the severe environmental degradation of the Baltic Sea. During the past two centuries, excessive nutrient loading has turned a clear-water sea into a eutrophicated marine environment. Industrial activities such as shipping, dredging, dumping, coastal development and fish farming are placing increasing pressures on vulnerable marine habitats and natural resources. The gradual pollution of the Baltic Sea by hazardous substances has caused severe physiological and reproductive problems in marine animals and also threatens human health. In addition, over-fishing has resulted in the drastic decline of many Baltic Sea fish populations with significant impacts on the entire Baltic Sea ecosystem.

The Baltic Sea has always been of great importance for the people living along its shores. It is criss-crossed by vital shipping routes and its fisheries contribute significantly to the coastal economies. The Baltic Sea is also a recreational and holiday destination with increasing socio-economic value. However, the Baltic marine ecosystem is very vulnerable to human disturbance. It is the world's largest brackish water basin, with nine countries forming its coastline and another five countries in its catchment area which together cover an area four times the size of the actual Baltic Sea basin. Approximately 85 million people inhabit this catchment area.

The Baltic is a shallow sea almost entirely enclosed by land. It receives fresh water from over 200 large rivers as well as from direct rainfall, whereas seawater can enter only through the narrow and shallow straits between Denmark and Sweden. This limits the water exchange with the open sea; typically, it takes about 25-30 years for all the water in the Baltic Sea to be replaced.[1]

The salinity of the surface water decreases from 15 parts per thousand by the Danish straits to 3 parts per thousand in the Bothnian Bay and the easternmost parts of the Gulf of Finland.[2] As the Baltic Sea is a relatively young sea, only a few species have adapted to living in its brackish waters. The distribution pattern of the various species reflects their original habitats and salinity tolerance. Hence the number of marine species is highest in areas near the Danish Straits and decreases eastwards and northwards, while the number of fresh water species increases with decreasing salinity. In general, the food webs of the Baltic Sea are simpler than in the open ocean, making the ecosystem more prone to natural fluctuations and thus more sensitive to human-induced disturbances.

In addition to the horizontal salinity gradient, the salinity varies with depth, increasing from the surface to the sea floor. Because of their different densities, the fresh and salty water masses do not mix easily, and a boundary layer is formed at a depth of around 50-80 metres. This permanent halocline limits the vertical mixing of the water layers, thus leading to low oxygen levels in the deep waters of the Baltic Sea. As oxygen consumption has greatly increased due to eutrophication, vast areas of the sea floor have turned into anoxic (without oxygen) deserts void of most forms of marine life.

2. Threats to marine life in the Baltic Sea

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2.1 Eutrophication

Eutrophication is currently considered to be one of most serious threats to the ecosystems in the Baltic Sea. In the summer of 2005, exceptionally widespread blue-green algal blooms were observed. In addition, large areas of the water layer below 70 metres are anoxic and thus void of life.[3] These are typical and severe symptoms of eutrophication - a process caused by excessive inputs of nutrients to the aquatic ecosystem. Eutrophication is also to be blamed for the cloudy waters and the rapidly increasing amounts of filamentous algae, which again have led to ecosystem level changes such as the shrinking distribution of bladder wrack *Fucus vesiculosus,* a perennial seaweed providing important spawning habitats for several fish species in the Baltic Sea.

2.1.1 Nitrogen and phosphorus

Excess input of nitrogen and phosphorus is the most important factor in the eutrophication of the Baltic Sea. These nutrients enter the sea as waterborne or airborne inputs emanating from diffuse or point sources. Sources of nutrients in the Baltic Sea include atmospheric emissions of airborne nitrogen compounds emitted by the combustion of fossil fuels (i.e. from heat and power generation and traffic); emissions from animal manure and husbandry; from agriculture, managed forestry, and urban areas or natural background sources (natural erosion and leakage from unmanaged areas etc.). Important point sources include inputs from municipalities, industries and fish-farms, both through discharge into inland surface waters and directly into the Baltic Sea. The main pathways are direct atmospheric deposition on the water surface, riverine inputs and point sources discharging directly into the sea.[4]

2.1.2 Anoxic sediments lead to internal loading

When primary production exceeds the rate of consumption, as in the case of severe algal blooms, the excess organic material settles on the seafloor. Decomposition of the organic material in the seabed uses up any remaining oxygen, thus leading to the development of extensive areas suffering from oxygen deficiency or anoxia. As the benthic invertebrates and bottom-living fish die or move to other parts of the sea, these areas become underwater deserts.

Anoxic sediments also release nutrients back into the water, thus further intensifying the eutrophication process. This so-called "internal loading" significantly slows down the ability of the Baltic Sea to recover as the sediments have huge nutrient reserves which will not immediately disappear, even if the external loading is reduced.

2.2 Toxic contamination

Owing to its geographical and oceanographic characteristics, the Baltic Sea is particularly vulnerable to toxic contamination and is considered to be one of the most polluted sea areas in the world. The adverse effects of toxic substances on marine organisms range from the development of cancers, reproductive problems and developmental disorders, to "gender bending", a result of certain chemicals' interference with hormones such as oestrogen and testosterone.

Contaminants are introduced directly and indirectly from a wide range of sources such as domestic sewage, industrial discharge, leaching from waste tips, atmospheric fallout, urban and industrial runoff, accidents (spillages and explosions), oil production, mining, agriculture (nutrients and pesticides), sea-dumping operations, ballast dumping and tank washing by ships, radioactive discharges, or natural pollutant sources, e.g. volcanoes and forest fires.

2.2.1 Heavy metals

Although the concentrations of some heavy metals have decreased in many parts of the Baltic Sea, with both the atmospheric depositions and riverine inputs generally declining, high concentrations can still be found in certain marine organisms such as the Baltic herring.[5]

Heavy metal concentrations (such as cadmium and mercury) in the Baltic Sea are several times higher than in the northern Atlantic. The main reasons for these high concentrations include intense industrial activity, large population in the catchment area, and above all, the slow rate of water exchange.

Heavy metals originate mainly from land-based sources, but atmospheric deposition is another significant contributor to the total heavy metal load. Heavy metal concentrations in the Baltic are subject to fluctuations influenced by the periodic saltwater inflow from the North Sea.[6]

2.2.2 Organic compounds

Many toxic compounds are capable of bioaccumulation, i.e. of being stored in living tissues. A few examples are - Dichlorodiphenyltrichloroethane (DDT), Polychlorinated biphenyls (PCB), Tributyl tin (TBT), Dioxins and Polycyclic Aromatic Hydrocarbons (PAHs). The concentrations of these persistent organic pollutants (POPs) are higher in organisms further up the food chain.

The sources of POPs include industrial discharges, such as the organochlorines found in effluents from pulp and paper mills, runoff from farmland, anti-fouling paints used on ships and boats, and waste that has been dumped at sea. Since the complete ban of several POPs in the 1980s, the amounts of organochlorine pesticides such as DDT and technical grade HCH *(hexachlorocyclohexane or lindane)* have decreased considerably in the waters of the Baltic Sea.[7] Similar trends can be seen in the concentrations of POPs in marine organisms: e.g. measured concentrations of PCBs in herring muscle have been decreasing at a yearly rate of between 4.1 and 9.7% since the late 1970s.[8]

TBT is an extremely toxic organic compound that has been widely used as anti-fouling paint on ships since the 1970s. Its sub-lethal effects include so-called "imposex phenomena" where female molluscs show male characteristics, as well as a range of other hormonal and physiological changes. The International Maritime Organisation (IMO) ban on the use of harmful organotins in anti-fouling paints used on ships has been in force since the beginning of 2003. All TBT-based paints on ship hulls have to be removed or covered by 2008. Owing to past harbour and ship yard activities, sediments in many coastal areas around the Baltic Sea are still heavily contaminated with organotins. Worryingly, current coastal developments and maintenance activities have seen TBT spreading back into the marine environment via dumping activities, sometimes even in vulnerable coastal areas.

BOX 1: DIOXINS IN THE BALTIC SEA

Recently dioxins have received a lot of attention in the Baltic Sea area. Dioxins (the short name for chlorinated dibenzo-p-dioxin (PCDD) and dibenzofuran (PCDF) compounds) are formed as by-products or impurities of several different industrial processes as well as from most combustion processes, such as chemical, paper and metal industries, incineration of municipal and hazardous waste and small scale burning. The burning of fossil fuels also contributes to their presence in the environment. Large quantities of dioxins are stored in seabed sediments, having accumulated over several decades. Smaller quantities are still reaching the Baltic Sea, although releases have decreased during the last 10-20 years.

Dioxins accumulate especially in fatty fish such as herring and salmon, which in turn are consumed by humans. Acute dioxin exposure can cause a number of detrimental effects e.g. skin lesions, altered liver function, depression of the immune system, and endocrine and nervous system abnormalities. Long-term exposure may result in developmental effects in children as well as cancer and other diseases.

Finland and Sweden have been authorized by the EU Commission to place fish with dioxin levels exceeding the EU limits onto the domestic market during a transitional period ending on 31 December 2006.

2.3 Fisheries

With the increasing size of fishing vessels and fishing gear, as well as the development of technologies such as satellite information systems, geographic positioning systems (GPS), and fish finders, fish can now be found and caught more efficiently than ever before. Over-fishing poses a serious threat to many fish stocks in the Baltic Sea and can be viewed as the most serious human impact on the world's oceans at the present time. The commercially exploited species in the Baltic Sea fisheries are mainly marine fish: about 90% of the total fish catch consists of cod *(Gadus morhua)*, herring *(Clupea harengus)* and sprat *(Sprattus sprattus)*. Even though salmon *(Salmo salar)* only accounts for about 1% of the total catch by weight, it is still a commercially important species.[9]

2.3.1 Cod

Cod is overall the most important species in the commercial fisheries of the Baltic Sea. There are two distinct stocks of cod in the Baltic: the Atlantic cod *(Gadus morhua morhua L.)* and the Baltic cod, also known as the eastern cod *(Gadus morhua callaris L.)* The Atlantic or western cod inhabits the areas west of Bornholm Island including the Danish Straits, whereas the Baltic or eastern cod occurs in the central, eastern and northern parts of the Baltic with the exception of the Bothnian Bay.

There is only one well-functioning spawning area for cod in the Baltic today, as eutrophication and the lack of oxygen have led to poor viability of cod eggs.[10] This, combined with dramatic over-fishing, has drastically reduced cod catches in the Baltic Sea since the mid 1980s.[11] The stock size and spawning stock biomass of both the western and eastern cod reached a historically low level in 1992. As the fleet capacity and fishing effort have not been reduced accordingly, the fishing mortality has increased during the stock decline. Also, the fishing pressure on the young fish has increased and this, together with the discarding of cod below the legal minimum size and the by-catch of pre-recruit cod in the sprat and herring fisheries, has exacerbated the problem.[12] Illegal, unreported and unregulated (IUU) fishing is another significant problem for the Baltic cod, depleting stocks and undermining management efforts and recovery measures.

ICES considers both Baltic cod stocks to be outside safe biological limits and classifies them as over-exploited and suffering from reduced reproductive capacity. Despite all these problems, annual quotas are consistently set at a much higher number than is recommended by ICES.

2.3.2 Herring and Sprat

The most important pelagic fish in the Baltic Sea fisheries are herring and sprat. They are fished for human consumption but some are used to produce fish meal and fish oil.[13] Herring is the only marine fish species that has adapted to live and reproduce throughout the Baltic Sea.

The Baltic's herring populations have been affected by a decrease in the abundance of the large zooplankton that they feed on. The zooplankton decrease is connected to changes in the hydrography of the Baltic Sea (decreased salinity and increased mean temperatures) and possibly to increased predation by fish.[14] In addition, the widespread disappearance of cod

2. Threats to marine life in the Baltic Sea

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has greatly affected herring and sprat populations, increasing the number of individuals now competing for the same diminished food source. The combined effect of these factors has reduced the average size of fish of any particular age (weight-at-age) in the Baltic Proper and the Gulf of Finland since the mid 1980s.[15]

The spawning stock biomasses of herring in the Central Baltic are currently low and assumed to be outside biological limits, whereas in the Bothnian Sea and the Gulf of Riga stocks have increased following management measures taken in previous years.[16]

The Baltic sprat is currently considered to be harvested inside safe biological limits. However, the situation should be closely monitored since after peaking in the mid 1990s, the spawning stock biomass has declined due to a massive increase in catches.[17]

2.3.3 Salmon

The Baltic Sea population of Atlantic salmon has been practically isolated from the Atlantic for thousands of years. Salmon is an anadromous species that spends most of its life in the sea, but migrates to a home-river to spawn. Each salmon river is home to a genetically unique population. However, the majority of the salmon rivers around the Baltic are polluted or have been dammed to produce hydro-electricity, thus preventing spawning migrations. In order to save the salmon, extensive restocking programmes for Baltic salmon have been operating for many years. Although this has saved the Baltic salmon from extinction, the overall genetic diversity of the population has subsequently diminished. This reduced genetic diversity may result in the entire population being more susceptible to diseases such as the M74 syndrome (early mortality syndrome - a problem of fry mortality first discovered in salmon hatcheries).[18]

In order to monitor the development and to create more specific rules for the management of Baltic salmon, the International Baltic Sea Fisheries Commission (IBSFC) adopted a detailed Salmon Action Plan (SAP) running from 1997-2010.[19] The stricter regulations on fishing, especially in the coastal areas and at the mouths of the salmon rivers, together with the introduction of salmon fishing quotas, have had a positive effect on the numbers of salmon returning to spawn since the mid 1990s. However, ICES has stated that the initial targets were underestimated and should be re-evaluated, and that the re-establishing of wild salmon populations in potential salmon rivers has not succeeded as planned, most likely as a result of detrimental coastal fishing practices.[20]

2.3.4 Fisheries impacts on ecosystem and biodiversity

Fisheries have a significant impact on marine ecosystems through the removal of large quantities of fish. In the past, this was not regarded as a problem; owing to the high fecundity of fish and the large expanse of the seas, it was assumed that human exploitation could not pose a threat to marine fish populations. During the last few decades, as over-exploitation has led to the depletion of fish stocks and extinction of populations all over the world, this assumption has been proven very wrong.

The increased mortality of the target species is not the only effect of fishing on the ecosystem. The selective removal of the large, fast-growing individuals leads to a decrease in the biomass and mean size of fish within a stock. This may indeed affect the evolutionary characteristics of a population and can result in changes in the gene pool, resulting in a population of smaller individuals.[21]

In addition to the direct effects on the target species, fishing has a significant impact on the entire marine ecosystem through changes in population dynamics and food webs. The stock developments of cod and sprat in the Baltic Sea demonstrate how fisheries can affect the trophic levels of an ecosystem. Sprat feed on cod eggs and immature cod, whereas mature cod feed on sprat. Therefore, when the cod population crashed in the beginning of the 1990s, the sprat population increased dramatically. Consequently, the preying of sprat on zooplankton increased, leading to the thriving of phytoplankton, and thus intensifying the problem of eutrophication. The increase in the numbers of both sprat and herring led to a growing competition for a diminished food supply, finally resulting in reduced average sizes of these species.[22]

2.3.5 Destructive fishing techniques

Fisheries are not only detrimental to the target stocks and species but also damage the wider marine environment. Bottom trawling for demersal (bottom living) species such as cod, is one of the most destructive fishing methods. Trawls scrape and plough the seabed, thus disrupting the sediment, destroying habitats and killing large numbers of benthic invertebrates. As the trawls are unselective, trawling also has a significant impact on the size and age distribution of fish. This can be seen in the Öresund Sound, between Denmark and Sweden, where bottom trawling has been banned since 1932. According to recent studies, the size distribution of the cod stocks there is more natural than in areas where bottom trawling is still permitted.[23] This is significant, as older and larger fish are important in the maintenance of the stocks, in that they produce more eggs and their offspring are generally more viable.

2.3.6 Bycatch and discards

The incidental catching of non-target fish, marine mammals, sea birds and invertebrates is known as bycatch. Vast quantities of fish are thrown overboard for a number of reasons and these fish are known as discards. Some fish are discarded because there is no market for them or because the quota for the species has already been taken; others are discarded because they are too small or of too poor quality to achieve the best prices on shore - a phenomenon known as "highgrading"; and some are thrown away simply because they have been damaged.

Bycatch of fish is mainly associated with trawling. In Sweden, 5-20% of cod catches are discarded by weight. The proportion in numbers of individuals is significantly larger. In recent years, catches have contained at least three non-marketable small cod for every cod of marketable size. Norway has banned discards of fish, and Denmark has banned highgrading, but no decision has of yet been decided at EU level.[24]

Apart from fish, thousands of seabirds and hundreds of mammals are killed every year in the Baltic Sea as a result of being entangled in fishing gear (for grey seals, drowning in fishing gear is the most common cause of death). Gillnets and fixed gear cause the greatest problems with bycatch of birds and mammals. Bycatch has resulted in a long-term population decline for the common porpoise *(Phocena phocena)* in the Baltic Sea.[25]

In addition to the mortality of many of the discarded fish, discarding has other effects on the ecosystem. The tipping of dead fish and offal back into the sea provides food for scavenging sea birds such as herring gulls. According to studies made by the Working Group on Seabird Ecology, the distribution of herring gulls in the Baltic Sea in wintertime is determined to a considerable extent by the local distribution of discarding fishing vessels. Another cause for concern is the effect of uneaten offal sinking to the seafloor; massive discharges of fish remnants in a small area may have negative effects on local oxygen conditions. Since the Baltic Sea has large areas suffering from oxygen depletion, it is very important to avoid dumping fish remnants in the Baltic Sea.[26]

BOX 2: MARINE MAMMALS IN THE BALTIC SEA

Harbour Porpoise The only commonly occurring species of cetacean in the Baltic, the harbour porpoise *(Phocoena phocoena)*, is threatened with extinction. Environmental pollution, hunting, and severe winter ice conditions have significantly reduced the population.[27] Recently, it was estimated that the harbour porpoises in the Baltic only number a few hundred individuals.[28] Despite the generally poor quality of available data, there is sufficient evidence to conclude that porpoises are now much less common in the Baltic than they were in the past, and that much of the decline occurred from the 1940s onwards. There is also sufficient evidence to conclude that bycatch in fishing gear such as gillnets, driftnets and other fixed gear, has played an important role not only in reducing the abundance of porpoises, but also in preventing the recovery of the population.

To improve the situation for the Baltic harbour porpoise, ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas), developed a recovery plan (the Jastarnia plan) and advised changes in fishing gear, clearance of ghost nets, as well as reduced fishing capacity in some particularly important areas. They conclude that bycatch reduction is of the highest priority for the recovery of the Baltic harbour porpoise.[29] Despite the advice given and decisions taken, not enough has been achieved to secure the survival of the population. For example, contrary to everywhere else in the EU, salmon driftnets are still permitted in the Baltic until 2008. Without the introduction of urgent measures for the protection of these small marine mammals, there is a real risk that they will be made extinct in the Baltic Sea.

Seals in the Baltic There are three seal species in the Baltic Sea, of which the grey seal *(Halichoerus grypus)* has the largest population. The two other species are the ringed seal *(Phoca hispida)* and the common seal *(Phoca vitulina)*. After a massive decline in the 1970s, the number of seals is now growing: the grey seal population went up from 2000 to 16,000 from the 1970s until 2004, and the ringed seal from 2000 to 6000 in the same period.[30] These numbers are still very far below the numbers at the beginning of the 1900s, when it is estimated that the population of the grey seal was around 100,000 and the ringed seal 200,000.

Historically, the seals have been an important resource for coastal communities in the Baltic and hunting was one cause of the reduction in these populations in the early 1900s. Fishing and bycatch still causes the death of seals (mainly pups) which get caught in fishing gear - one of the reasons for the slow recovery of the species. However, the main problem for the seals in the Baltic was, and still is, toxic pollution. In the 1970s PCBs *(polychlorinated biphenyls)* were the primary cause of reproductive failure in females and subsequently led to the significant decline in the population.[31] Toxic pollutants still cause intestinal ulcers and uterine tumours in the seals, and this, together with increased levels of hunting and deaths caused by fishing gear, continues to pose a threat to the survival of these species.

Seals and fishermen often compete for the same depleted resources, but it is important to bear in mind that seals are not responsible for the depletion of fish stocks in the Baltic - the fault lies with the deteriorated marine environment and over-fishing in some areas. The seals' consumption of fish corresponds to just a few percent of the large quantities of fish taken by fishermen.[32]

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2.3.7 Illegal, unregulated and unreported (IUU) fishing

IUU fishing, also known as pirate fishing, incorporates a wide range of activities. Fishing without a licence or out of season, harvesting prohibited species, using banned types of fishing gear, catching more fish than is allowed, and not reporting or misreporting catch weights are all examples of fraudulent behaviour and IUU. In the Baltic Sea, fishing that is not in line with the fisheries conservation and management measures of the EU and the International Baltic Sea Fisheries Commission (IBSFC), or fishing in a State's national or inshore waters without authorisation, are further examples of IUU fishing. The ICES Baltic Fisheries Assessment Working Group estimates the level of IUU to be as high as 35-40% in the Baltic cod fishery, around 20% in the Baltic sprat fishery, approximately 35% in the Baltic herring fishery (2004) and about 10% of reported landings in the salmon fishery.[33] These figures are extremely worrying, especially as the annual quotas for cod generally exceed scientific advice. Fish piracy further complicates management measures and recovery plans for stocks, and jeopardises the livelihoods of legitimate operators.

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BOX 3: THE SAD TALE OF FISH FARMING IN THE BALTIC

Trout *(Oncorhynchus mykis)* farming was introduced into the Baltic in the beginning of the 1970s and was concentrated in the northern Baltic Sea and the Archipelago Sea. Originally, it was intended to be a small-scale activity that was to provide extra income to coastal fishermen in order to sustain island communities. Trout farming quickly expanded and became a large-scale commercial activity. Aquaculture installations were established in shallow bays and inlets of the Baltic Sea usually typified by limited water circulation. The resulting pollution rapidly led to the deterioration of local water quality and the degradation of the surrounding marine environment. The sad effects of eutrophication and consequent disappearance of valuable fish breeding grounds, has led to significant changes in marine habitats and also to further declines in fish catches in the areas adjacent to such fish farms.

In Finland, the peak of aquaculture production was in the 1990s. Despite a sharp reduction in the amount of nutrients released due to technological improvements in the fish feed used, fish farming is still a big local contributor to the nutrient load. Locally, aquaculture contributes to 65% of the total phosphorus and 31% of the total nitrogen outputs in the Åland Isles.[34] (The Åland Isles recently adopted a decision to reduce the phosphorus releases resulting from fish farming by 80% by 2015. This will be achieved by moving operations to land where waste waters can be appropriately treated in closed systems.)

The current dependency on fish oil and meal as fish feed for carnivorous fish species also contributes to the degradation of marine ecosystems elsewhere. It takes approximately two to three kilos of wild fish to produce one kilo of salmon or trout.[35] Most of the fish feed fed to the farmed Baltic trout comes from the North and the Barents Seas. These so-called "reduction fisheries" harvest small fish species such as sand eels *(Ammodytiae)* and herring *(Clupea harengus)*, species which are the essential foundation of the North and Baltic Seas foodwebs.

As long as fish farming is dependent on fish protein derived from wild caught fish, aquaculture cannot provide a sustainable solution to the world's food production challenges. Alternatives to fish meal and oil, such as the cultivation of rag worms *(Nereis diversicolor)*, are being developed and together with closed cultivation systems can potentially change the direction of this industry.

2.4 Sand and gravel extraction

The extraction of sand and gravel for use in construction, land reclamation, and coastal defence has serious impacts on the marine environment by destroying benthic communities and altering habitats. The structure of benthic communities in these areas changes, due to the fine sediment particles that are suspended by the action of the dredger which smother benthic organisms. Opportunistic organisms that can re-establish themselves rapidly after such physical disturbance are favoured, whereas populations of large, long-lived species, such as bivalves, are diminished. The removal of sand and gravel may also cause the resuspension of toxic contaminants from the sediments into the water column and have impacts on local hydrographical conditions.

The marine and gravel resources of the Baltic Sea are exploited around Denmark, Germany, Finland and the St. Petersburg area of Russia. Poland has also exploited them at a lower level. In Sweden, exploitation was almost completely abandoned in 1992 for nature conservation reasons.[36] For other countries, including Lithuania, Latvia, Estonia and the Kaliningrad region of Russia, exploitation of marine aggregates might become significant in the future.[37] In recent years, the extraction of marine aggregates has remained fairly stable throughout the ICES region. However, in Finland, where extraction had been negligible since 1996, 1.6 million m^3 of marine aggregates was extracted in 2004 for use in the Helsinki harbour development.[38] Finland now has extensive plans to open up more coastal areas to large-scale sand and gravel extraction. Environmentalists and local communities are becoming increasingly concerned by the impacts resulting from the resuspension of toxic contaminants and the destruction of significant fish spawning grounds and other important habitats.

2.5 Oil and gas exploration

Interest in oil exploration in the Baltic Sea is growing. Surveys show that there may be considerable reserves in Polish, Russian, Lithuanian and Latvian exclusive economic zones (EEZs). In March 2004, Russia's LUKoil opened an oil-drilling platform near the Curonian Spit, despite opposition from many environmental organizations. The Curonian Spit is a narrow coastal strip shared by Lithuania and Russia (Kaliningrad) with National Park status in both countries. This ecologically sensitive area has been on the UNESCO World Heritage List as an outstanding natural area since 2000. The drilling activity has given rise to great anxiety about the preservation of the spit as there is increasing evidence[39] that the discharge of drill cuttings and chemicals during normal exploration and production operations has significant impacts on the chemistry and biology of the marine environment.[40]

2.6 Shipping

During the last decade, shipping has increased significantly in the Baltic Sea. At any given time, around two thousand sizeable ships are normally at sea in the Baltic, including large oil tankers, ships carrying dangerous and potentially polluting cargoes, and many large passenger ferries. 15% of all ships' cargoes in the world are loaded or unloaded in a Baltic port. This makes the Baltic, together with the Kattegatt and Skagerack, one of the world's busiest navigable waters.[41] Although maritime transport is generally one of the most environmentally friendly ways of transporting goods, it also has negative impacts such as air pollution, ship-generated wastes (discharges of sewage, oil or oily mixtures, noxious liquid substances and rubbish), accidental pollution (oil spills and losses of other hazardous cargo), and the introduction of alien species from ballast water.

2.6.1 Oil transport

The navigational difficulties and winter sea-ice, together with a sensitive marine ecology, make the Baltic Sea especially vulnerable to oil spills. The crowded shipping lanes are witnessing the environmental effects of the increasing traffic - in the Baltic alone there are around three hundred reported operational discharges of oil annually, all in direct contravention of the International Convention for the Prevention of Pollution from Ships (MARPOL)[42] regulations. Despite improving controls, the vast majority of the culprits go uncaught and unpunished, and even when caught, the fines are not large enough to act as a deterrent. The actual number of illegal spills is estimated to be around one thousand annually.[43] The impacts of oil pollution are readily visible and it is estimated that every year hundreds of thousands of seabirds in the Baltic Sea die as a consequence of oil emissions.[44] According to the aerial surveillance of deliberate illegal oil discharges from ships, the number of observed illegal oil discharges gradually decreased every year from 1999 to 2003, although the amount of shipping increased over the same period.[45]

The transportation of oil in the Baltic is set to triple over the coming decade-and-a-half, due to predicted increases in Russian oil exports.[46] As traffic volumes in the Baltic Sea continue to rise rapidly and substantially, the risk of catastrophic accidents also increases. More attention has to be given to the safety of these forms of transport; however, international maritime legislation does not allow en-route states many opportunities for regulating traffic along their coasts. The most significant improvement has been the worldwide phase-out of single hull tankers carrying heavy grades of oil which came into force on 5 April 2005 (Annex I of MARPOL 73/78). However, the transportation of light grades of oil in single hull tankers still continues in the Baltic Sea and elsewhere.

Since the end of 2005, the whole Baltic Sea (excluding Russian sovereign waters) has been officially designated as a Particularly Sensitive Sea Area (PSSA) by the International Maritime Organization (IMO). This designation allows the coastal states to propose extra protective measures for the Baltic Sea that fall within the competence of the IMO.

Despite necessary and welcome improvements, many significant problems still remain unsolved, including the continuation of illegal discharges, misconducts in ship operation and maintenance by the crew, as well as ship construction and inspection issues. There is an urgent need for these issues to be addressed in a comprehensive fashion. For example, a package of measures associated with the Baltic PSSA could be implemented in order to minimise the occurrence of catastrophic oil spills in the Baltic Sea. For information on shipping safety in the Baltic Sea, Greenpeace has produced a report: '*Hazardous Games in the Baltic*' (2005).[i]

i. Available on-line at: http://www.greenpeace.org/raw/content/finland/se/dokument/hazardous-games-in-the-baltic.pdf

2. Threats to marine life in the Baltic Sea

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2.6.2 Introduction of alien species

Alien species are brought to the Baltic Sea mainly in ships' bilge and ballast waters. Owing to the increase in shipping, more alien species are finding their way into the Baltic Sea than ever before. Some of these non-indigenous invaders may have a strong impact on the structure and dynamics of marine ecosystems and may, in some cases, completely replace less competitive local species. In a recent report, the Swedish Environmental Protection Agency ranks the introduction of alien species as the third most serious threat to the marine environment in the Baltic Sea.[47] About one hundred non-native species have been recorded in the Baltic Sea, and about two-thirds of them have been able to establish viably reproducing populations. Most of these invasive species originate from freshwater or brackish-water environments, particularly from North America or the Ponto-Caspian region.[48]

2.7 Climate change

Climate change caused by anthropogenic emissions of greenhouse gases will have significant long-term effects on the marine ecosystems of the world. It is hard to predict the exact effects of climate change, just as it is hard to predict the exact rise in temperature we should expect. A rise in sea temperature would, however, bring fundamental changes to the already damaged ecosystem of the Baltic Sea and reduce the seasonal ice coverage.

Climate change would exacerbate the effects of euthrophication. A rise in temperature would make the thermal stratification of the water in summer months more pronounced and speed up the decomposition of dead material - two factors which would, in some areas, lead to the more serious consequence of oxygen depletion. The intense blooms of blue-green algae would also increase. Some Baltic fish species would greatly benefit from warmer temperatures, while a temperature rise could prove detrimental to cod which reproduce best at temperatures below eleven degrees Celsius. A decrease in the salinity level is also predicted as a consequence of climate change.[49] Taking all of these factors into account, means there is a risk of major changes to the flora and fauna of the Baltic Sea.[50]

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3. Marine reserves
a tool for conservation and restoration

3.1 Definition

The term 'Marine Protected Area' (MPA) is becoming increasingly common in the context of marine biodiversity conservation, habitat protection and fisheries management. The term covers a wide range of protection measures, with an equally wide array of benefits conferred by this status. MPAs can be created for many purposes, ranging from the protection of a single species to a whole habitat or ecosystem, to the protection of certain interests, such as small-scale or recreational fishing.

Marine reserves are one type of MPA. They are areas of the sea that are fully protected from damaging human activities - much like national parks on land. They thus offer the highest level of protection of all MPAs. In 2004, Greenpeace published a report *'Rescuing the North and Baltic Seas - marine reserves a key tool'*[ii], and adopted the following commonly used definition of marine reserves:

Large-scale marine reserves are areas that are closed to all extractive uses, such as fishing and mining, as well as to disposal activities. Within these areas there may be core zones where no human activities are allowed, for instance areas that act as scientific reference areas or areas where there are particularly sensitive habitats or species.[iii]

Some areas within the coastal zone may be opened to small-scale, non-destructive fisheries, provided that these are sustainable, within ecological limits, and have been decided upon with the full participation of affected local communities.[iv]

Fully protected marine reserves are now widely recognised as the category of MPA that is necessary to give the level of protection needed to ensure that the health and productivity of the world's oceans are restored and maintained. In a consensus statement on the benefits of marine reserves, the American Association for the Advancement of Science stated "full protection (which usually requires adequate enforcement and public involvement) is critical to achieve this full range of benefits". Other forms of MPA do not provide the same benefits as marine reserves.[51]

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ii. Available on-line at: http://www.greenpeace.org/raw/content/international/press/reports/rescuing-the-north-and-baltic.pdf

iii. Within the EU, these core zones are likely to be Natura 2000 sites such as Special Areas of Conservation under the Habitats Directive and Special Protection Areas under the Birds Directive.

iv. In the European Context this would apply to the area within the 12 nautical mile territorial limit.

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BOX 4: EU AND INTERNATIONAL COMMITMENTS FOR MARINE PROTECTED AREAS (MPAS)

The ongoing degradation of the oceans has been recognised at a global level, and a number of significant commitments exist with the objective of reversing this decline with the help of MPAs.

* The Convention on Biological Diversity (CBD)

The CBD explicitly identified the need to protect marine and coastal biodiversity as a priority at the first Conference of the Parties (CoP) in 1994. In 2004 (COP7), the parties to the CBD took a further and major step forward by committing to the establishment of a global network of marine protected areas by 2012, now set out in CBD Decision VII/28. The Decision further specifies that this network should be composed of:

comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas that collectively ... contribute to achieving the three objectives of the Convention and the 2010 target to significantly reduce the current rate of biodiversity loss.[52]

The CBD's Programme of Work further states that within the integrated network of marine and coastal protected areas there should be '**areas where extractive uses are excluded** [emphasis added], and other significant human pressures are removed or minimised, to enable the integrity, structure and functioning of ecosystems to be maintained or recovered'.[53]

* The World Summit on Sustainable Development (WSSD) Plan of Implementation.

In 2002, world leaders further confirmed their commitment to MPAs, by agreeing to develop and facilitate the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing practices, and the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012.[54]

* The Helsinki Convention (HELCOM)

The HELCOM Ministerial Declaration adopted in Bremen in 2003 included key recommendations regarding marine and coastal management, most notably the establishment and management of Baltic Sea Protected Areas (BSPA). Special attention is to be given to coastal areas as well as areas outside territorial waters in need of protection. For each BSPA, management plans are to be established that consider all possible threats to the site, including:

'extraction of sand, stone and gravel; oil and gas exploration and exploitation; dumping of solid waste and dredged spoils; constructions; waste water from industry, municipalities and households; intensive agriculture and intensive forestry; aquaculture; harmful fishing practices; tourism; transport of hazardous substances by ship through these areas; military activities'[55]

* The EU Habitats and Birds Directives

As early as 1979, in response to public dismay over the annual killing of wild birds, the EU adopted the first nature conservation legislation at European Community level - the EU Birds Directive, which required the provision of special protection areas for birds. Followed thirteen years later, in 1992, by the EU Habitats Directive, the EU laid the foundations for the establishment of an EU-wide network of protected areas, known as Natura 2000. Although sites have to be designated on land and at sea, the two Directives are principally directed at the protection of nature on land and do not address the full range of marine habitats, species and functions. Moreover, their implementation in the marine environment is many years behind schedule and currently insufficient to protect the wider marine ecosystem from activities such as fishing.

3.2 Marine reserves as a tool for conservation

Marine reserves are primarily a tool for conservation. Conservation is about protecting not just a single species, but the full variety of species and their habitats, as well as preserving the complex interactions between species that make up an ecosystem. To do so requires an approach that considers all these aspects. Marine reserves, which protect entire areas from a range of human impacts, do just this, which makes them a unique tool for conservation. In addition, an ecosystem approach should also extend to activities outside the marine reserves; for example, by considering not just the direct impacts of fishing on a single target species, but on other species that are caught, the impacts on the habitat, and changes to the balance between species.

Marine reserves can be used to protect specific areas that are important to key life stages or targeted species such as spawning and nursery grounds, migration routes and feeding grounds. They also bring additional benefits for fisheries, recreation and other uses of the marine environment.

The establishment of marine reserves has been shown to result in a long-lasting and often rapid increase in the abundance, diversity and productivity of marine organisms.[56] While the benefits of protection are more apparent for species that spend much or all of their time within a marine reserve, reserves can also offer protection to migratory species if they are protected at vulnerable stages, such as in spawning and nursery grounds.[57]

In order to protect the whole spectrum of marine biodiversity, it is vital that all major habitats are represented within a regional network such as in the Baltic Sea. Scientists have developed useful criteria to help identify priority areas of the marine environment that should be protected to achieve the greatest effects.[58] These are:

* *sites that include vulnerable habitats, e.g. off-shore banks or sea mounts*
* *sites that contain vulnerable life history stages, e.g. fish spawning and nursery grounds*
* *sites that are capable of supporting exploited or rare species*
* *sites that provide ecological services.*

Marine reserves can also restore ecosystem balance lost to human activities. For example, fishing for target species can upset the balance of predator/prey relationships, and result in habitat change. As these changes occur over long periods of fishing at unsustainable levels, the altered habitat is sometimes not recognised as unnatural, and not noticed until a marine reserve is established and larger fish return and restore balance. For instance, experience from New Zealand shows that protecting an area with over fifty percent bare rock, grazed clean by sea urchins in a marine reserve, can restore the ecosystem balance to levels where seaweed beds and large fish and crayfish (predators of the sea urchins) return.[59]

BOX 5: LARGE-SCALE MPAS IN TEMPERATE ZONES

Most well documented cases of MPAs are in the tropics, where the protection of even small reef areas has been shown to lead to significant improvements in the ecological state of the reefs and thus to increased fish catches outside the MPA. However, MPAs have also been used successfully in temperate environments.

Probably the best and most extensive example of the use of an MPA in a temperate environment is the closure of three large areas of the Georges Bank in the North Atlantic. Early in 1994, in a final attempt to halt the decade-long decline of groundfish stocks in the Northwest Atlantic, three large areas, totalling 17.000 km^2 on the American side of Georges Bank, were closed to all fishing except lobster potting. Seasonal closures, quota reductions and other conventional management tools had not achieved the anticipated results, and the Georges Bank closures were implemented as emergency measures. Scientific surveys indicate that the closures produced an almost immediate effect, reducing fishing mortality and thus supporting the rebuilding of stocks. After only four years, all commercial ground fish stocks had increased steadily in abundance. Some, like haddock, showed signs of recovery for the first time in decades, and as a result of these encouraging trends fishing was able to continue outside the areas.

Fish habitats within the Georges Bank closed areas also recovered. It is likely that this further increased stock recruitment. Moreover, quite unexpectedly, commercial invertebrate stocks also benefited greatly from the closed area, with a 14-fold increase in commercial-sized scallops over 4 years. Significantly, scallop recruitment to areas outside the MPA has increased and become more dependable, sustaining an active fishery. Scallop landings from Georges Bank in 1998 were more than twice the level of 1994, whereas landings in the Middle Atlantic Bight (without MPAs) declined by around 50% over the same period.[60]

The Georges Banks experience is in stark contrast to the Canadian Grand Banks, where no closed areas were implemented. The Grand Bank fisheries collapsed, and despite a 10-year old moratorium, no recovery has been observed.

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3.3 Marine reserves as a tool for fisheries management

The establishment of a network of marine reserves can benefit fisheries in a number of ways. Marine reserves enable exploited populations to recover and habitats modified by fishing gear to regenerate. As unexploited areas, marine reserves act as valuable reference areas that can be used to help understand the effects of fishing outside. They also influence management decisions, thus underpinning the ecosystem approach.

In addition, there is a growing body of evidence to suggest that the establishment of a network of marine reserves can lead to enhanced yields in adjacent fishing grounds. This can be the result of either the spillover of adults and juveniles across reserve boundaries or from the export of larvae or eggs from reserves to fished areas.

One of the major problems with fish stocks that have been depleted by over-fishing, is that there are very few large fish remaining in the population. Large females are essential, because they produce many eggs of better quality. Generally, when a female doubles in length, she produces eight times more eggs.[61] These eggs show higher levels of fertilisation and better survival rates. Hence a few large, mature females may contribute far more to reproduction than a large number of first-time spawning females. In marine reserves, some female fish will, over time, grow large and make very significant contributions to the eggs and larvae that may be exported out of the reserves.

Marine reserves can help provide a more predictable catch from year to year, thereby enhancing fisheries' stability. They also serve as a form of insurance against uncertainty and reduce the probability of over-fishing and fishery collapse.

3.4 Marine reserves - other benefits

Marine reserves provide an undisturbed habitat that can supply invaluable information for scientific research. Assessing environmental change occurring during the recovery of degraded and damaged ecosystems is necessary in order to obtain a better understanding of the complexities of marine life. Marine reserves are unique sources of long-term data, providing the opportunity to monitor species and their habitats - which is essential to the supply of reliable information for future conservation and management policies.

Nature areas with specific protective status, such as marine reserves, also act as sites of interest for recreational and tourist use. Over time, the non-extractive uses of the area can be further developed and as areas recover, so will populations of species of special interest such as birds, pinnipeds and cetaceans.

BOX 6: MARINE RESERVES AND EUTROPHICATION

Poor water quality and the effects of eutrophication on marine ecosystems and biodiversity are considered to be one of the most serious threats to the Baltic. Whereas the establishment of large-scale marine reserves at sea cannot directly control land-based pollution, the increased protective regime offers benefits that also serve to buffer some of the effects of pollution and improve the water quality both within and outside the reserves.

A number of issues should be considered in this respect:

* *As a first step, the official recognition of an area as significant, and the consequent increased protective status and legislation, allows more stringent measures to be applied to activities in and around the marine reserve that also affect water quality and ecosystem health. This was shown in a recently established marine reserve designation in Kungsbackafjorden in Sweden, where one of the ways to meet the conservation goals of the reserve was to lessen eutrophication, and thus restrictions were applied to land use around the reserve.[62] These measures could also be applied on a larger scale to whole river catchments or coastal zones in order to improve the water quality in the marine reserve.*
* *Marine reserves will prohibit destructive and extractive activities inside the reserves, but again increased recognition and legislation related to the area, could also be used to limit activities beyond the reserve boundaries where negative impacts on water quality in the reserve could be anticipated.*
* *A third benefit of a marine reserve in relation to deteriorating water quality, is simply the chance given to ecosystems to recover from direct exploitation by human activities. This in itself will result in communities that are more stable and resistant to the negative ecosystem changes caused by eutrophication*

3.5 Size, scaling and connectivity of marine reserves

Studies of marine reserves have shown that whatever their size, they will lead to increases in density, biomass, size of individuals and diversity, if properly protected and enforced.[63] In fact most established, highly protected marine reserves are small in scale, but have been shown to yield positive effects. For example, the tiny reserves at Apo Island in the Philippines and Hol Chan in Belize have been remarkably effective. However, small marine reserves are unlikely to be self-sustaining and will not adequately protect vital ecosystem functions or maintain habitats' complexities. Ecological viability increases with size, as does resilience.

In order to protect whole ecosystems, it is important to ensure that all habitats are represented within a network of marine reserves and that habitats are replicated within the network. The 2003 World Parks Congress in Durban recommended that "networks should be extensive and include strictly protected areas that amount to at least 20-30% of each habitat"[64]. The term 'at least' is important, as the World Parks congress clearly recognised that some habitats will require a greater proportion to be protected than others. For isolated and regionally rare habitats, for instance, it will be necessary to ensure that a greater proportion of those habitats are afforded protection, as they will need to be self-sustaining.

Although proportional increases occur in all reserve sizes,[65] absolute increases in numbers and diversity are clearly important. For example, doubling fish numbers in a small reserve from 10 to 20 fish is substantially different from doubling the fish numbers in a large reserve from 1000 to 2000. Equal relative differences in biological measures between small and large reserves nearly always translate into greater absolute differences for larger reserves, and so larger reserves will be necessary to meet conservation goals.

Two leading experts on the science of fully protected marine reserves, Callum Roberts and Julie Hawkins of the University of York in the UK, have come to the conclusion that *"all arguments converge upon the importance of large-scale protection with maximum benefits generally falling in the range of 20% to 40% of the sea area in reserves".*[66] While most existing marine reserves are small, some countries are beginning to designate bigger areas. In 2004, Australia designated 34% of the Great Barrier Reef Marine Park as a highly protected marine reserve.

Studies focusing on the benefits of marine reserves to fishing, suggest that maximum benefits will accrue when large areas are put off-limits to fishing. Recent models suggest that more than 35% of the total area needs to be in no-take reserves to prevent recruitment over-fishing of sedentary species, such as sea urchins or many reef fishes, but area requirements will differ for species on account of their differing biology.[67]

Moreover, the total area of sea that needs protecting is likely to increase as the degree of human impact outside the reserves increases. This is because populations in reserves will become more dependent on those in other reserves for their replenishment, while fisheries outside the marine reserves will become more dependent on replenishment by offspring from protected populations.[68]

In order to conserve a representative range of habitats and species, a number of marine reserves will need to be established and it is important that these are situated in a network that ensures connectivity. Many marine species have open water dispersal phases, and eggs and larvae are often carried long distances away from where they were spawned. As the marine reserve coverage of an area increases, so will connectivity. As the number of reserves in a network increases, so will these links, but at a faster rate.[69]

Some experts have stressed the importance of making the reserves in a network of different sizes.[70] Marine reserves should typically increase in size moving from nearshore to offshore. Small reserves will be harder to identify in offshore areas, harder for fishers to comply with, and thus harder to enforce.[71] Also, as a rule of thumb, protected areas will need to be larger in offshore regions because scales of animal movements tend to be larger offshore.

Building a network of smaller marine reserves in the coastal zone will have the advantage of spreading fishery benefits to fishing communities along the coast, rather than concentrating them around a few large marine reserves with some communities closing their fishing grounds altogether.[72]

3.6 Greenpeace proposal

To ensure the recovery and long-term survival of Baltic marine ecosystems, and to allow the Baltic Sea to catch its breath, governments need to agree on, and implement, a representative network of marine reserves that cover both the coastal zones and the Exclusive Economic Zones (EEZs).

In 2004, Greenpeace published a set of maps for the Baltic and North Seas in the report: *"Reversing the decline of the Baltic and North Sea - Marine Reserves a key tool".* The methodology for the maps can be found in detail in the report.[v] This report outlines Greenpeace's vision for a Baltic network of marine reserves that cover approximately 40% of the sea area, and contains a full methodology for the development of maps.

Greenpeace is not alone in calling for the establishment of large-scale marine reserves. In 2003, the World Park Congress also recommended that a global system of effectively managed, representative networks of MPAs should be developed by 2012. Strictly protected areas would form the basis of this network, with the Congress recommending that at least 20 to 30% of the world's seas and oceans should be fully protected in marine reserves.[73]

Moreover, in 2004, the UK's Royal Commission on Environmental Pollution (RCEP) recommended that 30% of the UK's EEZ be designated as no-take zones to reverse the impact of fisheries on the marine environment. A year later, in 2005, the United Nations Millennium Project called for 10% of the oceans to be covered by Marine Reserves in the short to medium term, with a long-term goal of 30%. Greenpeace's demand is consistent with these calls.

v. The report is available on-line at: http://www.greenpeace.org/raw/content/sweden/rapporter-och-dokument/kartor-foerslag-paa-marina-rese.pdf

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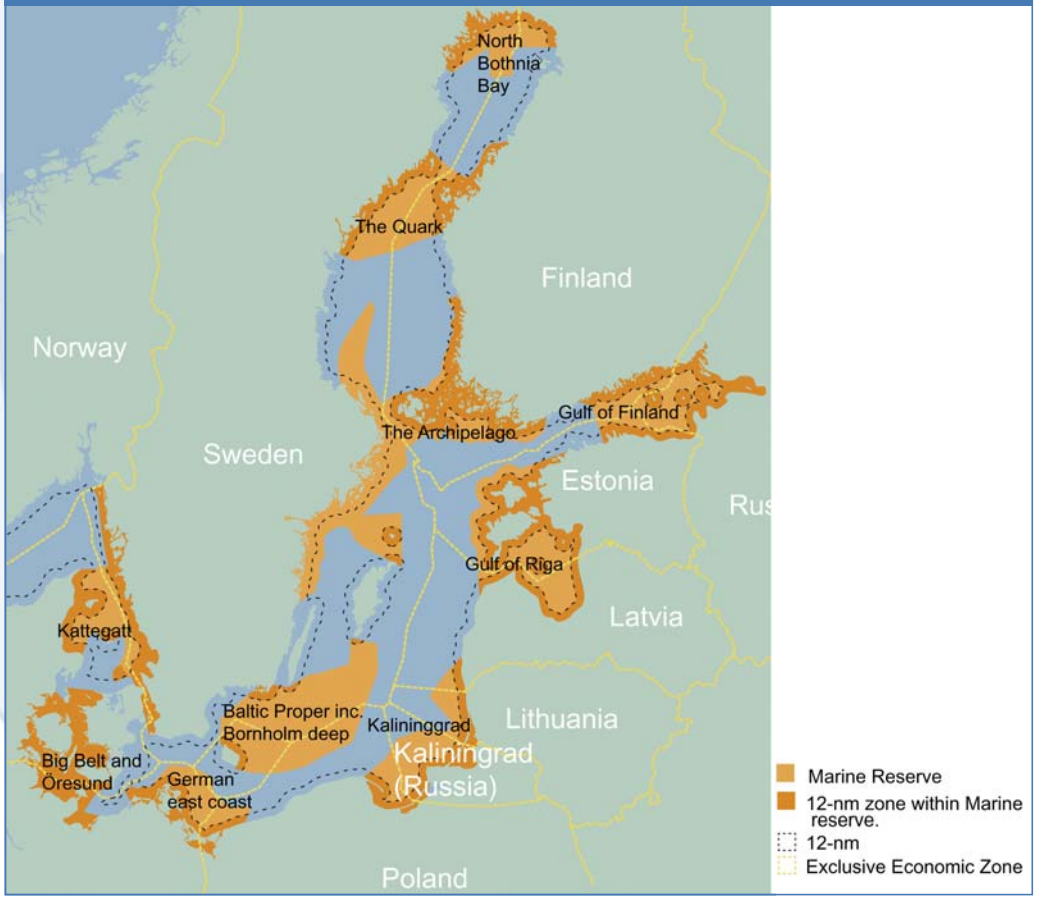
FIGURE 1: MAP OF PROPOSED MARINE RESERVES



BOX 7: APPROACH AND PRINCIPLES FOR THE COASTAL ZONE

Within the coastal zone (12 nautical miles), a network of marine reserves is just as important as outside. The large scale marine reserves of the open seas cannot always be directly extended into the coastal zone. The coastal marine reserve network needs to be established in consultation with local communities, at the same time ensuring protection together with equitable access to fishing resources.

The same ecological principles apply to establishing a marine reserve network in the coastal zone. These are:

* *A network that covers an adequate proportion of the marine area.*
* *Protection for each habitat type; not only rare, unique or pristine sites, but also examples of common habitats, which are often degraded, but are also often critical habitats for marine species.*
* *Protection of each type of habitat must cover an adequate proportion of that habitat, and include sufficient replication of sites.*[74]

Properly applied, a coastal marine reserve network will be supported and enforced by the local community, and will bring benefits within the reserves (such as education, research, recreation and tourism opportunities) and can also benefit small-scale fisheries in surrounding areas. This has been demonstrated by the establishment of a network of small-scale coastal marine reserves. One such reserve was established in Egypt's Red Sea which resulted in an increase of more than 60% in the catch per unit effort of a surrounding fishery after only five years of protection.[75]

To ensure that both the benefits of marine reserves and access to fishing areas are distributed equitably around the coastline, the design of a network must consider social as well as biological factors. For the network to be successful, full consultation with a broad range of stakeholders, not just those with sectoral interests, is essential.

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4. Caring for the rest of the sea

Greenpeace is recommending the protection of 40% of the Baltic Sea by marine reserves. However, the benefits of marine reserves are dependent upon and enhanced by ecologically sound management of the surrounding sea. To ensure that all of our seas - and not just the 40% that lie within reserves - are managed in a sustainable and equitable way, we have to fundamentally change the way we manage marine resources.

It is time to implement existing commitments and apply the ecosystem approach and precautionary principle to the management and protection of our marine environments. Decisions regarding marine management should not be taken on a sector-by-sector basis, but must be fully integrated within the broader framework of environmental protection. This integrated approach should further be reflected in strong marine legislation, which protects the sea from all aspects of human activity and thus safeguards the marine resource base for now and for the future.

For this to be achieved in both the European context and in the Baltic Sea, strong EU legislation that regulates the very activities that are responsible for the deterioration of the Baltic Sea is required. This must include elements for controlling the impacts of fishing, shipping, gravel and sand extraction and other extractive and disposal activities that take place in marine and coastal areas. It should further consolidate measures that are available to control the impact of land-based activities, such as agriculture, domestic and industrial waste-water treatment and industrial production.

In concrete terms, this means:

* ***Applying the precautionary principle*** *The burden of proof must be reversed, so as to require those that have a primary interest and financial benefit in developing activities such as aquaculture, oil and gas extraction, seabed mining, a new fishery or other types of coastal and off-shore projects to demonstrate that they will not damage or destroy the marine environment.*
* ***Introducing ecosystem based management to fisheries*** *No species exists in isolation, and fisheries management is fundamentally flawed if it does not account for the complex relationships between species, and between species and their habitats. The disastrous results of managing fisheries while destroying their critical breeding habitats through bottom trawling, for example, demonstrates that we must move away from single stocks or species management.*
* ***Eliminating destructive fishing practices*** *Destructive fishing practices have no place in sustainably managed fisheries and must be banned. Driftnets are an obvious example. Unacceptably high levels of bycatch, in particular of the harbour porpoise, have resulted in an EU-wide ban of driftnets, which with some delay is now also being implemented in the Baltic Sea.*
* ***Reducing fishing capacity and effort*** *In the Baltic, over 70% of the commercially exploited fish stocks are over-fished.*[76] *Fishing fleet over-capacity in the EU has been estimated to be as high as 60% in some fisheries, and despite fleet management programmes aimed at bringing capacity down, the issue has yet to be adequately addressed. Fishing capacity continues to expand, and this presents an obstacle to achieving equitable and sustainable use of marine resources. Fishing capacity outside marine reserves must be adjusted to a level that the sea can sustain, taking into account the best possible scientific advice and the precautionary principle. Subsidies encouraging over-capacity must be eliminated.*
* ***Eliminate pirate fishing*** *The management of fisheries and the marine environment is only as good as its enforcement. However IUU fishing threatens the marine environment and the livelihoods of those who fish legitimately. Loopholes in fisheries management, lax attitudes allowing unreported landings and limp enforcement of regulations must be urgently addressed.*
* ***Stopping pollution*** *The sea is not a waste dump; however the Baltic Sea, like most other seas and oceans, has been treated as such. There are many agreements and commitments to protect the Baltic Sea from pollution, but what is needed is a fundamental change in approach. Out of sight does not mean out of mind, and using the sea as a sewer, rubbish heap or toxic dumping ground is simply not acceptable. Environmental policies need to have rigorous, ingrained "polluter pays" legislations.*
  Strong measures need to be put in place to stop the further eutrophication of the Baltic Sea and economic incentives at EU level should be used to this end. Cross-sectoral co-operation needs to be developed.
* ***Introducing sustainable shipping*** *Significant risks will always be associated with the transportation of goods at sea. To minimise the risks and the environmental impacts of normal shipping operations, a holistic cradle-to-grave clean ship approach needs to be applied to all ships. Shipping lanes need to be directed away from the most sensitive areas and compulsory pilotage needs to be adopted in hazardous routes such as the Danish straits. Environmental awareness needs to be made part of crew training, and standards strictly monitored by both flag and port states. In case of infringements, such ships should not be allowed to transit the sensitive Baltic Sea.*

5. A changed political context

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5.1 Introduction

Since the accession of Poland and the Baltic States to the European Union (EU) on the 1 May 2004, all but the easternmost parts of the Baltic (notably the eastern parts of the Gulf of Finland and the Kaliningrad region which fall under the sovereign jurisdiction of the Russian Federation) fall under EU rules and the domestic laws of EU Member States. EU decisions relating to the marine environment are therefore highly significant in terms of determining the state of the Baltic Sea. Although the governance regime in the Baltic has been simplified, the management of certain activities, and the protection of the Baltic Sea in general, remain under the control of a mix of national, regional and international regimes.

Prior to 2004, for instance, management decisions on Baltic fisheries were taken in a multilateral context, within the International Baltic Sea Fisheries Commission (IBSFC). With EU enlargement, negotiations are now taking place bi-laterally between the EU and the Russian Federation. Moreover, most of the Baltic Sea is now governed by the Common Fisheries Policy of the European Union.

Perhaps the most prominent multilateral agreement that continues to influence Baltic governance is the *Helsinki Convention for the Protection of the Marine Environment of the Baltic Sea Area.* Its governing body, the Helsinki Commission (HELCOM), is made up of all nine coastal states, including Russia, and the European Union. The Commission adopts recommendations on measures to address certain pollution sources and other areas of concern. The recommendations, to date some 200 of them, are to be implemented by the Contracting Parties through national laws. In addition to the Helsinki Convention, aspects of shipping and maritime policy are being dealt with within the context of the International Maritime Organization (IMO), a specialized agency under the UN.

5.2 Moving towards a Baltic Action Plan for the Protection of the Marine Environment

While HELCOM continues to govern the protection of the Baltic environment at a multilateral level, most of the waters of the Baltic now fall within the EU system of environmental governance, just as they do for fisheries management.

At present, the EU has no single coherent policy for the protection of the marine environment. However, in October 2005, the European Commission presented a new European Marine Strategy (EMS) and associated proposal for an EU Directive aimed at an integrated approach to the protection of the marine environment. This new Directive will provide a dedicated instrument for marine protection and add to a number of existing EU laws that contribute to, or help regulate, aspects of marine protection. These include, most notably, the EU Habitats and Birds Directives, which protect certain species and habitats and require the protection of areas of sea as part of the EU's Natura 2000 network of protected areas; the Water Framework Directive, which is aimed at achieving a good ecological status of, amongst others, coastal waters by addressing the pollution of surface waters of rivers and lakes; Environmental Impact Assessment (EIA) rules that require prior assessment and authorisation of certain plans and projects with a potential impact on the environment, as well as laws addressing land-based pollution, waste-water treatment, ship-safety and provisions limiting the impact of certain fishing practices on the marine environment etc.

The new European Marine Strategy and associated Directive have their legal basis in the environment chapter of the EC Treaty and the sixth Environmental Action Programme, which identifies the need for comprehensive and integrated marine legislation. They are the result of three years of consultations, and constitute the first real chance to translate global commitments for marine protection into real action at EU level.

As it stands, the proposed Directive sets out a framework for the development of national strategies. These must aim at achieving Good Environmental Status (GES) in the marine environment by 2021 at the latest, as well as safeguard the protection and preservation of the marine environment and the prevention of its deterioration.[77] The Directive foresees that measures be taken at regional level within three distinct marine regions - the Baltic Sea, the North East Atlantic Ocean and the Mediterranean Sea. Each EU coastal state would have to develop a marine strategy for its European marine waters. In doing so, Member States should co-operate with other coastal states in their region. Co-operation may be facilitated through existing institutional structures, such as the Regional Marine Conventions - OSPAR for the North Sea and wider Atlantic, The Barcelona Convention for the Mediterranean Sea and HELCOM for the Baltic.[78] Consequently, this may translate into enhanced co-operation within HELCOM to develop a joint Action Plan for the protection of the Baltic Sea.

The Commission's proposal is a long-overdue and welcome step towards legally binding targets and deadlines to halt and reverse the dramatic decline and deterioration of Europe's marine environment, and the Baltic Sea in particular. Unfortunately, however, it falls far short of expectations and fails to establish the overarching framework needed to apply an ecosystem approach to the management of Europe's seas. The Commission was charged with developing legislation that would, amongst others:[vii]

1. protect, allow recovery and, where practicable, restore the function and structure of marine biodiversity and ecosystems in order to achieve and maintain good ecological status of these ecosystems;

2. institute a change in fisheries management to reverse the decline in stocks and ensure sustainable fisheries and a healthy ecosystem, both in the EU and globally;

3. require the phasing out of pollution in the marine environment so as to ensure that there are no significant impacts or risks to human or ecosystem health and/or on uses of the sea;

4. require the elimination of human-induced eutrophication by 2010;

5. require that concentrations approaching background values are achieved for all naturally occurring radioactive substances, and values close to zero for artificial radioactive substances by 2020;

6. contain the use of marine services and goods and other activities in marine areas to levels that are sustainable and that do not compromise uses and activities of future generations nor the capacity of the marine ecosystem to respond to changes;

7. apply the principles of good governance, both within Europe and globally.

Member States, together with the European Parliament, are now charged with making sure that the Commission proposal will meet the above ambitions and that the Directive will serve as an implementing tool of regional and international commitments, in particular those on marine reserves, not least in the Baltic. The proposal must be amended to ensure that:

* *all EU Member States, not least those around the Baltic Sea, take collective responsibility by committing jointly to restore, maintain and protect the marine environment within and beyond Community waters, with the overall aim of achieving biologically diverse and dynamic oceans and seas that are safe, clean, healthy and productive now and in the future;*
* *the proposal contains a clear vision of what constitutes a healthy marine environment, rather than defer this decision to a later date and to a forum that excludes key actors from the discussions;*
* *in preparing strategies or action plans for achieving Good Environmental Status (GES), Member States produce a single regional marine strategy per marine region (or sub-region) rather than individual national strategies;*
* *all EU Member States are obliged to achieve GES and to improve the health of Europe's seas, with a particular onus on coastal states. Simply obliging them to draw up national strategies 'designed to achieve good environmental status' is not enough;*
* *provisions are introduced that embed the objectives of the Directive into all relevant EC policies, thus helping to consolidate measures and clarify interactions between the Directive and other EC law, to ensure that GES can be achieved in the context of other policies such as the Common Fisheries Policy;*
* *the Directive makes more of existing laws and raises the bar on marine protection, consistent with international commitments and the recommendation of the UN Millennium Project to establish large-scale Marine Reserves.*

vii. Objectives as defined during the stakeholder consultation process and the Commission's 'Towards a European Marine Strategy' document (COM(2002)593)

5. A changed political context

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5.3 Fulfilling a political promise - making marine reserves happen

This report has already highlighted the importance of marine reserves in protecting the Baltic Sea. The proposed Directive clearly misses the opportunity to acknowledge and build on the advice of:

* *the World Parks Congress, which recommended in 2003 that "networks should be extensive and include strictly protected areas that amount to at least 20-30% of each habitat."*
* *the United Nations Millennium Project, which in 2005 called for 10% of the oceans to be covered by Marine Reserves in the short to medium term, with a long-term goal of 30%.*

As a minimum, the Directive should include provisions for the use of large-scale marine reserves as a mandatory component of regional marine protection. Greenpeace advises that this should be in the scale of 40% of the Baltic to be fully protected. A map of proposed marine reserves in the Baltic was published in the 2004 Greenpeace report 'Marine Reserves for the North and Baltic Seas'.[viii]

Moreover, the proposed timeline for implementation of the Directive is unrealistic. While a target date for achieving good environmental status by 2021 may be broadly acceptable, measures for the protection of the marine environment must be operational well before the suggested date of 2018. After all, progress should already be underway to meet the following European and international targets:

* *by **2004**, to have established a regular process for global reporting and assessment of the state of the marine environment (WSSD);*
* *by **2006**, to have made every effort to achieve substantial progress to protect the marine environment from land-based activities (WSSD);*
* *by **2006**, to have identified marine protected areas in the OSPAR and HELCOM regions;*
* *by **2008** to have taken action to address the under-representation of marine and inland water ecosystems in existing national and regional systems of protected areas (CBD Decision VII/28)*
* *by **2009** to have designated protected areas as identified through the national or regional gap analysis (including precise maps), and complete by 2012 in the marine environments the establishment of comprehensive and ecologically representative national and regional systems of protected areas (CBD Decision VII/28).*
* *by **2010**, to have halted the loss of biodiversity in Europe (EU Sustainable Development Strategy);*
* *by **2010**, to have encouraged the application of the ecosystem approach in marine management (WSSD);*
* *by **2010**, to have completed a joint network of well-managed MPAs in the OSPAR and HELCOM regions;*
* *by **2012**, to have developed marine protected areas consistent with international law and based on scientific information, including representative networks and time/area closures for the protection of nursery grounds and periods (WSSD);*
* *by **2012**, to have facilitated proper coastal land use and watershed planning (WSSD);*
* *by **2015**, to have integrated all protected areas and protected area systems into the wider land- and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity and the concept, where appropriate, of ecological networks (CBD Dec VII/28).*
* *by **2015**, to have achieved environmental objectives under the Water Framework Directive (i.e. out to 1 nautical mile);*
* *by **2020**, to have achieved the cessation of inputs of hazardous substances into the Baltic, with the ultimate aim of achieving concentrations in the environment near to background levels for naturally occurring substances and close to zero for man-made synthetic substances (HELCOM).*

Some Member States have set themselves even stricter targets. Under no circumstances should EU regulations encourage Member States to renege on their past commitments.

viii. The proposal is available on-line at: http://www.greenpeace.org/raw/content/sweden/rapporter-och-dokument/kartor-foerslag-paa-marina-rese.pdf

6. Recommendations

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The precarious situation of the Baltic marine environment requires urgent and collective action to restore and protect marine life. Marine reserves are a proven and accepted conservation tool, providing for the full protection of the entire spectrum of species, habitat and ecosystem diversity and allowing the sea to 'catch its breath' and recover a self-sufficient ecosystem balance. They can also provide additional benefits for fisheries, recreation and science.

In 2006 and 2007, the European Union has a unique opportunity to lay the basis for a long-overdue, coherent and effective EU marine law - the EU's first real chance to translate global commitments into real action for the protection of Europe's seas. For the Baltic, this means investing in a Baltic Action Plan and working at EU level to improve the draft Directive, notably by including the more ambitious objective of having to achieve a healthy marine environment, integrating criteria that define good environmental status, and adopting a more ambitious timetable for the implementation of the Directive. Most importantly, Baltic States should fulfil their promises as regards the protection of areas of sea, by proposing a network of fully protected marine reserves covering 40% of the Baltic Sea.

The proposed Marine Directive should build on existing law and commitments, and as a minimum, should include provisions for the use of large-scale marine reserves as a mandatory component of regional strategies for marine protection. It should further ensure the sustainable management of all marine resources, whether protected by marine reserves or not. To be effective in this regard, it must address all the human-induced pressures on the marine environment, including impacts of fishing, pollution and shipping.

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