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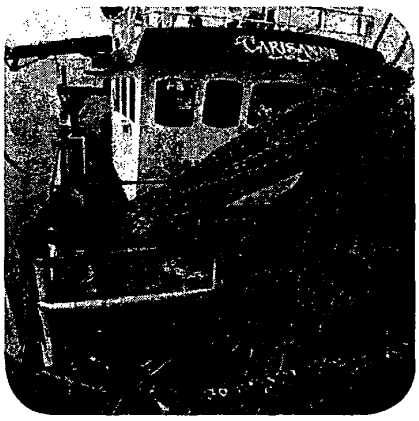
A Sustainable Future for Baltic Sea Cod and Cod Fisheries



Prepared by WWF Denmark
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Photos on cover:
The codend coming aboard a trawler - (c) WWF-Canon / Quentin Bates
Cod in bucket - (c) WWF-Canon / Mike R. Jackson
Photo: (c) WWF-Canon / Mike R. Jackson.

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Abbreviations

BSPA	Baltic Sea Protected Areas
CFP	Common Fisheries Policy
EC	European Commision
EFF	European Fisheries Fund
EU	European Union
F	Fishing mortality
FAO	United Nations Food and Agriculture Organization
HCR	Harvest Control Rule
IBSFC	The International Baltic Sea Fisheries Commission
ICES	International Council for the Exploration of the Sea
IUU	Illegal, unregulated and unreported fishing
MLS	Minimum Landing Size
MSY	Maximum Sustainable Yield
RAC	Regional Advisory Council
SSB	Spawning Stock Biomass
TAC	Total Allowable Catch
VMS	Vessel Monitoring System
WSSD	World Summit for Sustainable Development
WWF	World Wide Fund For Nature

1. Introduction

The following report presents WWF's position on the management of the Baltic cod fisheries. The ambition of this report is to highlight the urgency of the problems facing the cod fisheries in the Baltic region and to identify key steps and recommendations to ensure a sustainable future for Baltic cod and Baltic cod fisheries.

In 2002, at the World Summit for Sustainable Development in Johannesburg (WSSD), world leaders committed to an ambitious goal: All global fish stocks must be utilized according to Maximum Sustainable Yield (MSY)[1] before 2015. MSY is a laudable objective that was signed off on by the Worlds' governments, including the EU Member states.

While this was a step in the right direction, WWF believes that MSY, on its own, will not deliver sustainable fisheries. Other steps are needed to safeguard the marine ecosystem, particularly in light of the Member States' nature conservation responsibilities, as well as their commitments under the Common Fisheries Policy to progressively implement an ecosystem based approach.

Several EU fisheries are currently far from the targets set in Johannesburg. Assessments conducted by the International Council for the Exploration of the Sea (ICES) indicate that the majority of EU fish stocks are over exploited, including the Baltic cod. For some stocks, the fishing mortality is as much as five times higher than that needed to achieve MSY.

In July 2006, the European Commission presented a proposal for a multi-annual plan for the Baltic cod. The Commission acknowledged the critical state of the stocks and suggested a perennial reduction in fishing effort, starting in 2007. The Commissions proposal, however, does not recognize the urgency of the problem nor does it provide clear guidelines for how and when the cod stocks must be recovered. The proposal also lacks direction for how the fleet should adapt to income reductions during the build up of the cod stocks.

WWF continues to advocate for policies that will restore balance in the ecosystem so it can provide the basis for strong and stable harvests. This could be achieved by adhering to an ecosystem based approach to fisheries management. Mismanagement of the stocks and non-compliance to existing regulations are the major reasons the situation today is so critical; governments must do all they can to correct these problems and attempt the recovery of cod. There are serious lessons to be learnt from the collapse of the cod stocks in Canada in 1992 where attempts for recovery were left until it was too late.

Given the heterogeneous fleets and fishing patterns in the Baltic, it is particularly important that the approach to fisheries management in the Baltic aim for simplicity, transparency and uniformity in the regulatory setup between countries. The current management system is too rigid and has clearly failed to solve the problems of illegal fishing, overcapacity, overfishing, discards and insufficient data collection on what is actually being caught in the region.

[1] The underlying management objective for the MSY concept is long-term yield maximation. By comparing the present fishing mortality to the fishing mortality at which MSY is expected to be taken, we can obtain guidance concerning how much we should reduce or increase fishing mortality to achieve our objective (NORD, 2000).

2. Status of cod stocks in the Baltic

The Baltic Sea ecosystem has a relatively simple biological structure. The fish community is dominated by three species: cod, herring, and sprat. Their overall abundance is greatly determined by the specific hydrographic conditions and the fishing pressure in the Baltic.

The stock is divided into an eastern and western Baltic cod stock (see figure 1) with different morphometric characteristics and population genetics. The stocks overlap in the area near Bornholm Island with the eastern population being the largest in size and distribution.

2.1 Breeding conditions

The breeding success of Baltic cod depends on environmental conditions. After spawning, cod eggs sink low into the Baltic depths where they drift during incubation. Oxygen-depleted deep water conditions have prevailed throughout recent years in the central Baltic Sea area, and this has inhibited the successful development of cod eggs.

Fishing pressure is the other key factor influencing cod recruitment, with many young fish being caught before they have spawned for the first time. The number of fish of reproductive age is estimated to be far below the sustainable limit (see also chapter 4.5). At such low levels, the stock is unlikely to produce good year classes, even under favourable environmental conditions.

Both the herring and sprat stocks are likely to have benefited from reduced predation by the declined Baltic Sea cod stocks over the years. Increased stocks of herring and sprat have resulted in increased predation on cod eggs which has further impeded the recovery of the Baltic cod.

Higher stocks of sprat leads to higher predation on zooplankton which, in turn, results in less predation on phytoplankton and therefore more algae growth (phytoplankton) and subsequently a lower oxygen content in deeper layers as the algae sinks (Döring, 2006).

"The breeding success of Baltic cod depends on environmental conditions."

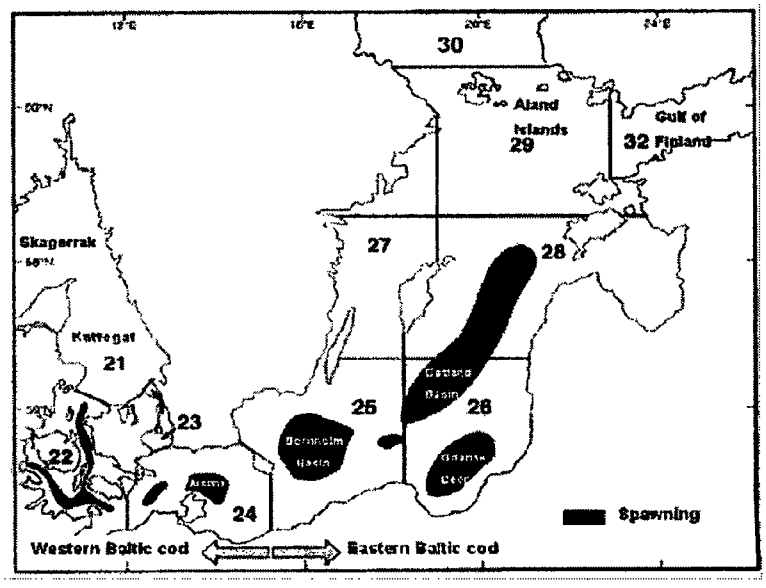


Figure 1:
The spawning areas of the two Baltic cod stocks (ICES GLOBEC, 2005).

2.2 Fisheries impact on the Baltic cod – state of the stocks

Between 150,000 and 250,000 tons (t) of cod were caught per year in the Eastern Baltic (ICES areas 25-32) from 1970 to 1980. The maximum catch was reached in 1984 with 391,000 t, and the minimum so far in 1994 with 38,000 t (see figure 2).

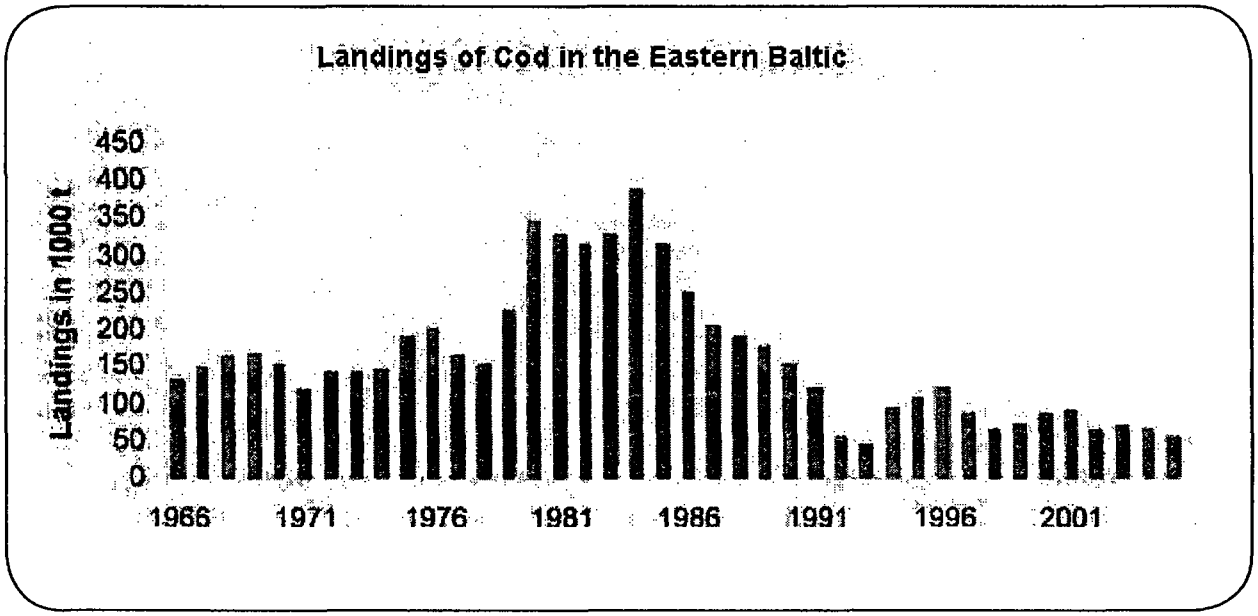


Figure 2:
Landings of cod in the eastern Baltic (area 25-32) from 1966-2005 (ICES, 2006b).

At present, the cod stocks are classified as being fished unsustainably. In 2006 ICES made the following assessment for the Western and Eastern Baltic stocks:

State of Western stock – ICES area 22-24:
"ICES concludes that the exploitation boundaries for this stock should be based on the precautionary limits. Accordingly, the catch in 2007 should be less than or equal to 20,500 t" (ICES, 2006a).

State of Eastern stock – ICES area 25-32:
"ICES concludes that the exploitation boundaries for this stock should be based on the precautionary limits. Accordingly, no catch should be taken from this stock in 2007 and a recovery plan should be developed and implemented as a prerequisite to reopening the fishery" (ICES, 2006b).

2.3 The fishing fleet and fishing mortality

The western Baltic cod is primarily fished by Denmark and Germany. Comparing the size (in kW) of the total Danish and German fleets with the fishing mortality of cod (figure 3), illustrates that the fishing mortality (F) has *not* declined significantly (it even rose after 2003) despite the fact that the main fleet (Danish) fishing for this stock was diminished by around 25% from 1995-2005 (WWF, 2006).

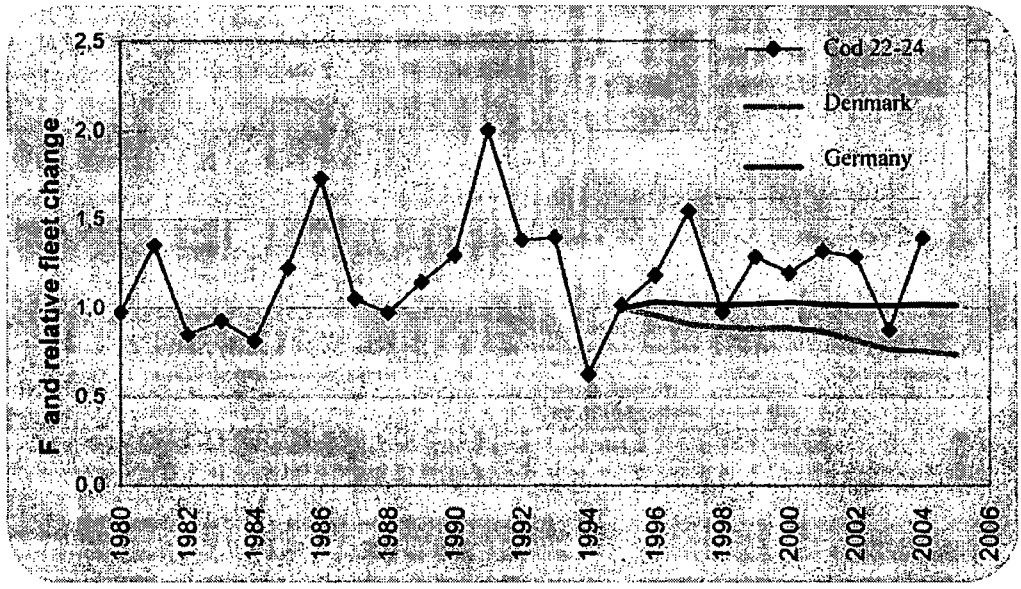


Figure 3: Fishing mortality (F) of western Baltic cod in 1980 - 2004 and relative change in size (in kW) of the Danish and German fleets in 1995-2005 (1995 = 1) (WWF, 2006).

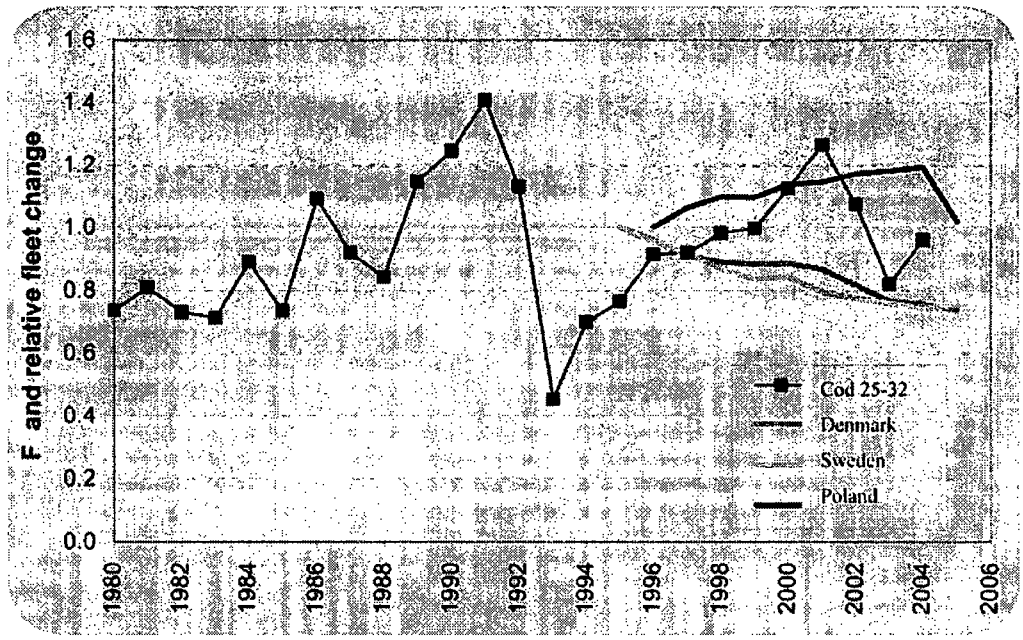


Figure 4: Fishing mortality (F) of eastern Baltic cod in 1980 - 2004 and relative change in size (in kW) of the Danish, Swedish and Polish fleets in 1995-2005 (1995 = 1) (WWF, 2006).

The eastern Baltic cod is mainly fished by Denmark, Sweden and Poland. Between 1995 and 2005 the size of the Danish and Swedish fleet (in kW) decreased by about 25% (see figure 4), while the Polish fleet did not begin to decrease until 2004 when the EU-withdrawal programme was launched.

Overall, the above figures show that the fishing mortality has not decreased significantly despite reductions in the fleet capacity. This calls for further reductions in the fleet capacity and for better understanding of how fishing capacity influences fishing mortality. Chapter 4.1 discusses how capacity should be measured.

2.3 Bycatch

Several studies of the major fisheries for cod, herring, and sprat show relatively low levels of bycatch in the Baltic (ICES, 2005) except there does seem to be a problem with the bycatch of undersized cod in the fisheries targeting cod.

Many gill nets are lost every year (or thrown overboard) resulting in an "invisible" bycatch of cod. Surveys estimate that e.g. Swedish fishers lose between 145-158 km of gill net every year and that the catch from these lost nets that keep "fishing"[2] is approximately 162 tons of cod pr 100 km of gill net (Larsson and Valentinsson, 2003). The mortality caused by lost nets in Sweden may seem marginal but, if all lost nets from all Baltic fishing fleets are included, it quickly adds up (Larsson and Valentinsson, 2003). It is therefore a serious problem that should be addressed.

Non-commercial species, including birds and sea mammals, are also caught as bycatch in fishing nets, such as set nets, and to some extent in salmon driftnet and fykes.

- Pollution and the effects of climate change are posing increasing threats to the successful reproduction of cod stocks, which further endanger the sustainability of the stocks
- Both cod stocks in the Baltic Sea are overfished
- Reduction in the fleet has not lead to significant decrease in fishing mortality
- Predation from other species (herring and sprat) has negatively impacted the cod stock's reproduction

Photo: (c) WWF-Canon / Quentin Bates

[2] Experiments by Tschernij and Larsson (2003), show that during the first 3 months, the relative catching efficiency of lost nets decreased by around 80%, thereafter stabilising at lower levels around 5-6% of the initial level.

3. Current management strategy

The current fisheries regulations in the Baltic include annual Total Allowable Catches (TACs) accompanied by an extensive array of technical measures, such as seasonal closed areas[3], minimum landing sizes, engine size restrictions, gear restrictions and regulations on e.g. selectivity panels in demersal trawls targeting cod. The seasonal and spatial closures in use are typically combined with technical measures on gear type and mesh sizes.

EU Baltic fisheries policy is developed with scientific advice, which is based on comparing the current status of the stocks to reference points for the biomass and the fishing mortality rates. If possible, this is done separately for each of the stocks.

The reference levels are given as limits for biomass (B_{lim}) and fishing mortality rates (F_{lim}) , with the intention that management measures should be designed so that the probability of a stock crossing either of the thresholds is low. Precautionary management targets or thresholds (B_{pa}, F_{pa}) are set in order to *ensure* the limits are not crossed. The fishing mortality thus becomes a key variable which is used in setting the targets for fishing effort.

The European Commission, in July 2006, put forward a proposal for a Council Regulation (EU 2006a) for a multi-annual management plan for the cod stocks in the Baltic Sea. The plan defines a yearly reduction in fishing effort by 10% (counted as days at sea) until the defined target for fishing mortality is reached. No timeline is given for recovery of the stock or how it should be estimated. The proposal also lacks a strategy for how fishers/the fleet should adapt to the proposed changes.

Furthermore, the proposal does not sufficiently take into account the critical situation of the eastern cod stock; the lack of drastic recovery measures disregards the scientific advice, further jeopardizing the stock. Recommendations are also lacking with regards to how scientists and fisheries managers should work with the fishing industry to improve the data collection on total landings and discards.

The Commission's proposal does include measures to advance the monitoring, control and enforcement strategies of the fisheries. If the plan is properly implemented, it will form the basis for establishing more accurate information about fishing and illegal activities.

The proposed plan integrates technical measures, effort adjustments and total allowable quotas (do you mean catch?).
No initiatives, however, are taken to increase the minimum landing size of Baltic Sea cod or the mesh sizes of fishing gear. The proposed areas for fisheries closures are insufficient in terms of period.

"No timeline is given for recovery of the stock or how it should be estimated"

[3] There is currently (2006) a seasonal closure of the cod fisheries in the Western Baltic (area 22-24) between 15th March and 14th May. The Eastern Baltic (area 25-32) cod fishery is subject to three seasonal closures (June 15-September 14, October 14-20 and December 16-25). In addition to the more general closures, there are specific closures of three areas from 1st May to 31st October (the Bornholm Deep, the Gotland Deep and the Gdansk Deep).

[4] B_{lim} is the level under which the recruitment is being reduced. Recruitment is limited by the size of the mother stock.
[5] F_{lim} is the level of fishing mortality which, on a medium term scale, results in maintaining the stock at the level of Blim.

4. Barriers to sustainable management of the Baltic cod fisheries

Decision makers and fishers face a number of barriers to the successful implementation of sustainable Baltic fisheries management policy, some of which have been in existence for years and have had an enduring impact on the fisheries. The following chapter goes through the important problems facing Baltic fisheries management. Proposed solutions to these problems are discussed in chapter 5.

4.1 Overcapacity

The sustainability of Baltic Sea fisheries is threatened by overfishing. While recent management programs to control input and reduce fleet size have shown some progress (ICES 2004), fishing capacity is still far in excess of that needed to harvest stocks.

In addition, managers must take into consideration that fishers are, to a large extent, continuously applying new technology and inventing new ways to explore the resource. It is estimated that there is a 2-3% increase in fishing capacity efficiency every year due to technical innovations (Teknologisk Institut, 2003).

The main instrument used to reduce capacity is vessel decommissioning (or buyback) through the voluntary removal of redundant vessels. However, when taking out vessels from the fleet the remaining fishers (vessels) may increase their effort (in order to utilize a larger remaining share of the quota if this becomes available), resulting in a similar level of fishing pressure. It is likely that a general reduction in capacity, in itself, will not solve the problem of overfishing. When capacity is removed it is often done so from the less profitable fisheries. Overcapacity in the most profitable fisheries, currently the cod fisheries, therefore remains. Capacity reduction programs must therefore be supported with e.g. specific effort regulation and technical measures.

Inadequate estimates / indicators for measuring the *real* capacity of the fishing fleets are a hindrance to establishing a robust fisheries management. The current capacity indicators in EU fisheries are length / tonnage / power on main engine. The fact is that fishing capacity is much more than just how much a vessel weighs, or holds, or thrusts (see Lindebo, 2004). Fishing capacity is determined by the fishing gear being used, the electronic equipment onboard, the type of fishery, the distance to fishing grounds, the fishers experience and the facilities onboard for handling the catch.

Estimations of fishing capacity should therefore be based on the following indicators:

- type, sizes and number of fishing gear
- fish-finding technology
- vessel size (length and width)
- main engine (HP)
- technology for handling and storing the fish
- fishers ability to catch fish (age, catch records)

Having information about these factors will improve the estimate of the actual fishing power of the fleet.

Photo: (c) WWF-Canon / Quentin Bates

4.2 TACs set at unsustainable levels

TACs are supposed to be based on the scientific advice provided from ICES, as requested by the EU Commission. The EU Council of Ministers, however, has a history of weighing the advice from ICES with the short term economic and socioeconomic interests of the fishing sector in mind. Consequently, the TACs agreed may differ substantially from the scientific recommendations.

In 2006 the EU Commission proposed a TAC for Baltic cod (ICES area 25-32) at 45,339 tons, **three times higher than what was recommended by ICES**[6] (ICES, 2005). This discrepancy poses a serious threat to the legitimacy of the management system and to the long term sustainability of the Baltic Sea fishery.

Table 1 illustrates the variations between the ICES advice, the total reported catches and the agreed TACs from 1994 to 2004. Reported catches are based on commercial landing data and estimates of misreported and unreported catches. ICES (2005) claim that the catches are about 35-45% higher than what the industry has actually reported. To avoid flawed assessments, ICES has chosen to include misreported and non-reported catches (data in table 1). Information about illegal landings is, by nature, highly biased and for some countries there is no data. Therefore the figures should be read with caution and be seen as an indicator of the total catch and the fishing trends.

As shown in table 1, there have been years where the agreed TACs and the total catches have exceeded the advice from ICES – most evident is the Eastern stock in 1994.

	Western stock		Eastern stock		The Baltic total	
Year	Advice	Reported catch	Advice	Reported catch	TAC (agreed)*	Reported catch (total)
1994	22,000	30,695	25,000	93,354	60,000	124,049
1998	35,000	34,216	60,000	67,428	160,000	101,644
2002	36,300	24,158	0	67,018	76,000	91,176
2004	29,600	20,854	13,000	68,578	75,000	89,432

Table 1: Management of the western and eastern Baltic cod stocks (area 22-24 and 25-32) in tons *) For total Baltic (ICES, 2005)

4.3 Discard and by-catch

Cod which is caught in violation of bycatch regulations, minimum landing sizes and quotas is often discarded. Discards also occur from highgrading[7], as cod fish of lower value are discarded in favour of the most valuable fish (the larger cods), which are retained on board. With considerably higher prices for larger cods[8] (sometimes double), there are incentives for highgrading, particularly when quotas are low (Raakjaer and Mathiesen, 2003). Despite the prohibition of highgrading in Danish cod fisheries it is recognized that this regulation is very difficult to enforce (DIFRES, 2006)

[6] 14.900 tons

[7] Highgrading is when fishers discard the less valuable cod (the small sized cod, but not undersized) and retain the most valuable (the medium and large sized cod).

[8] The prices on the smallest allowable category (#5) of cod is between two third and half the price of the medium sized cod (category # 3 and 4). The majority of the landings of cod by Danish fishers in the Eastern Baltic are the small fish of category # 5 (Mogens Grønwald, employee at Espersen A/S on Bornholm Island, 2006, Pers comm.).

The scientific documentation of discards in the Baltic is relatively limited so a continuous time series does not exist. The volume of the discard in 2004 is illustrated in Table 2.

Discard	Cod	Dab	Plaice	Whiting	Flounder	Others
Tons	1.561	391	493	92	1.905	150

Table 2: Estimates of discard rates (in tonnes) in the Baltic Sea in 2004 (DIFRES, 2006).

Cod fisheries are characterized by bycatch of flatfish, primarily flounder, while fisheries targeting other species may include cod as bycatch. The cod bycatch in the herring and sprat fisheries is generally considered low by scientists. Large herring catches, however, may include a substantial catch volume of cod and thus the herring-sprat fishery should be monitored.

While bycatch and discarding can and has been reduced through the use of technical measures (e.g. gear selectivity and closed areas), the application of effective or comprehensive discard reduction measures in the Baltic Sea has not been accomplished. In chapter 5.1 effort management is discussed as a measure that could contribute to reductions in discards. However, mesh size regulations should still be used a key technical measure to limit bycatch.

4.4 Illegal fisheries and control and enforcement

Illegal fishing in the Baltic Sea is reinforced by ineffective control and enforcement, as well as by restrictive quotas, overcapacity, the absence of alternative fishing opportunities, incompatible regulations and seeing "colleagues" benefit from illegal fishing (Raakjaer and Mathiesen, 2003), (ICES WGFAS, 2005).

Since 1993 ICES has gathered information about unreported landings from sea samplings, formal and informal contacts with the fishing industry, and from the inspection of import/export records. For the 2005 assessment ICES estimates that the total catches of cod in some countries are as much as 50-100% greater than what is officially reported from fishers (ICES WGFAS, 2005).

It is important that decisions makers are aware that non-compliance has complex socio-economic, biological, technical and political drivers, which makes it difficult to find simple shortcut solutions. A necessary step forward is to restructure the enforcement system and harmonize monitoring and sanctioning across the region. Some ideas for this are discussed in chapter 5.

4.5 Technical measures are not working

The mesh size in fishing gear corresponds with an agreed on minimum landing size (MLS) of the target species. For example, when the mesh size in the trawl is 110 mm, it corresponds to a MLS of 38 cm. The MLS for cod has been increased over the years from 33 cm to 35 cm in 2002 and to 38 cm in 2003 with increases in mesh sizes accordingly.

"It is important that decisions makers are aware that non-compliance has complex socio-economic, biological, technical and political drivers"

Research fisheries with various gear types show it is possible to obtain an effective selectivity with certain gears. However, when these gears are applied in commercial fisheries there are several uncertainties (fishing practice and level of compliance) which make it difficult to estimate the actual effect on the status of the stock.

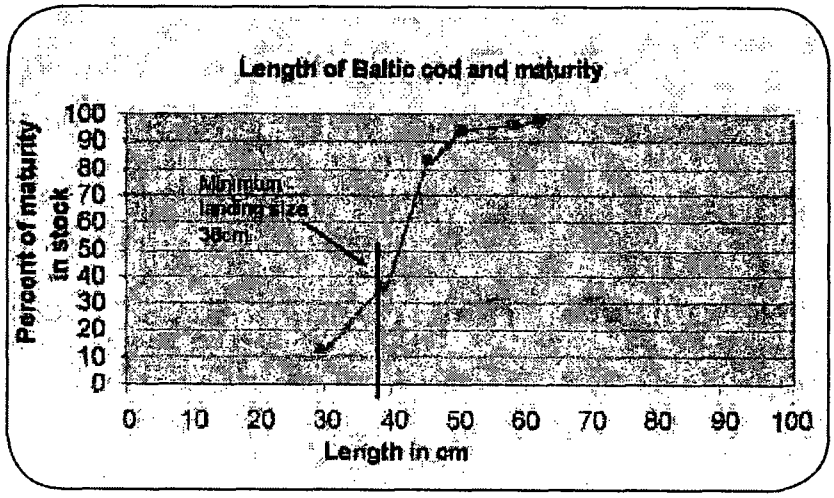


Figure 5: The MLS and the percentage of mature fish in the cod stock at different fish lengths.

Clearly the technical measures presently in place have not achieved the desired reduction in fishing mortality / or increase in spawning stock biomass (SSB), so further or different measures must be taken (see chapter 5 for elaboration on this). One explanation could be that with a MLS of 38 cm only 36% of the cod fish reach maturity before they can be legally caught – see figure 5. With such a low percentage of cod stock being left to reproduce, the stock will have difficulties recovering.

- Unreported landings account for up to 50 – 100 % of the reported landings in some countries
- More than 1.500 tons of Baltic Sea cod was discarded in 2004
- Technical measures have not achieved the desired reduction in fishing mortality
- There are incentives for highgrading of cod, particularly when stocks are low
- Lack of management legitimacy and compliance is undermining all attempts to secure sustainable management

5 Creating a sustainable future for Baltic Sea cod and cod fisheries

The previous chapters have highlighted the challenges and barriers to the sustainable management of the Baltic cod fisheries.
The following chapter presents a number of management measures which together, if properly implemented, WWF believes will help rebuild and stabilise the cod stocks.

It is often said that there are "too few fish and too many fishermen". Translated into more correct academic terms, the postulate should rather be: The current *Spawning Stock Biomass* (SSB) cannot sustain the current *Fishing Mortality* (F). The diagram below (figure 6) illustrates how the fisheries exploitation rates should be concluded based on the scientific advice (see also chapter 2.2).

The diagram provides a simple and clear picture of the status of fish stocks. Both stocks are placed in the lower right hand corner. The Western cod stock falls into a combination of *fully fished* and *overfishing*, whereas the Eastern stock is in the *high risk zone*[9].

There is little doubt about the objectives for the management of the Baltic cod stocks and the fishery in the Baltic Sea. Spawning stock biomass must increase and the fishing mortality must decrease!

It is important to recognize that neither cod recovery nor sustainable long term management will be achieved unless action is taken within several areas.

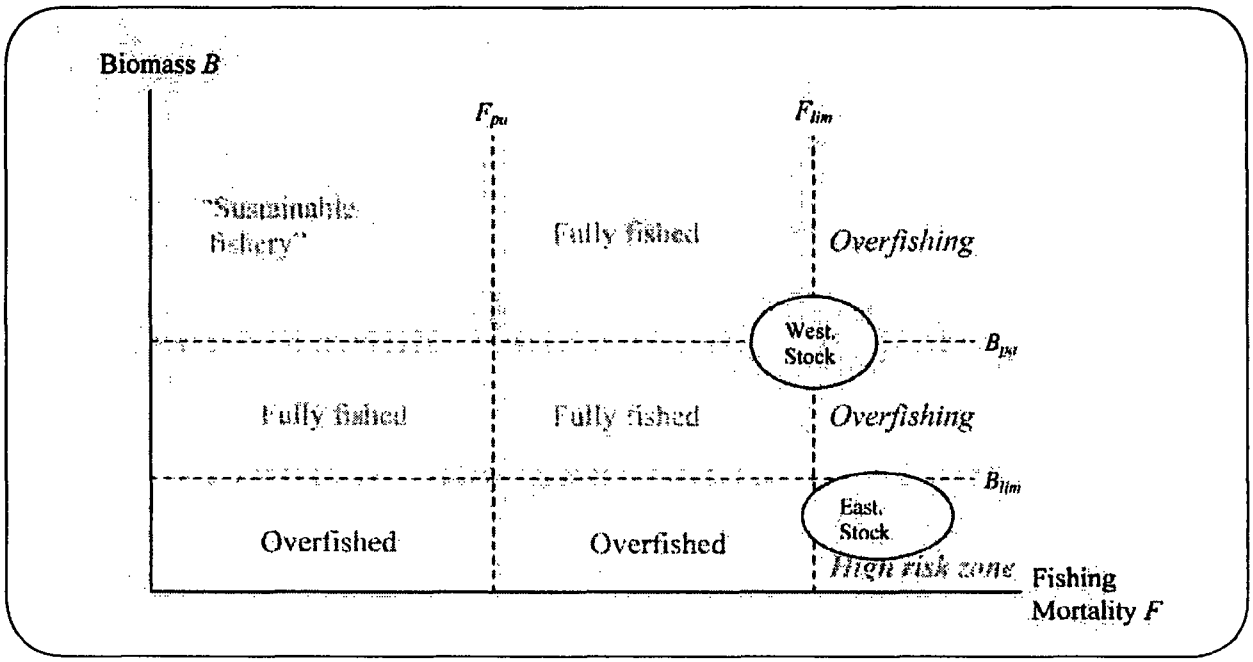
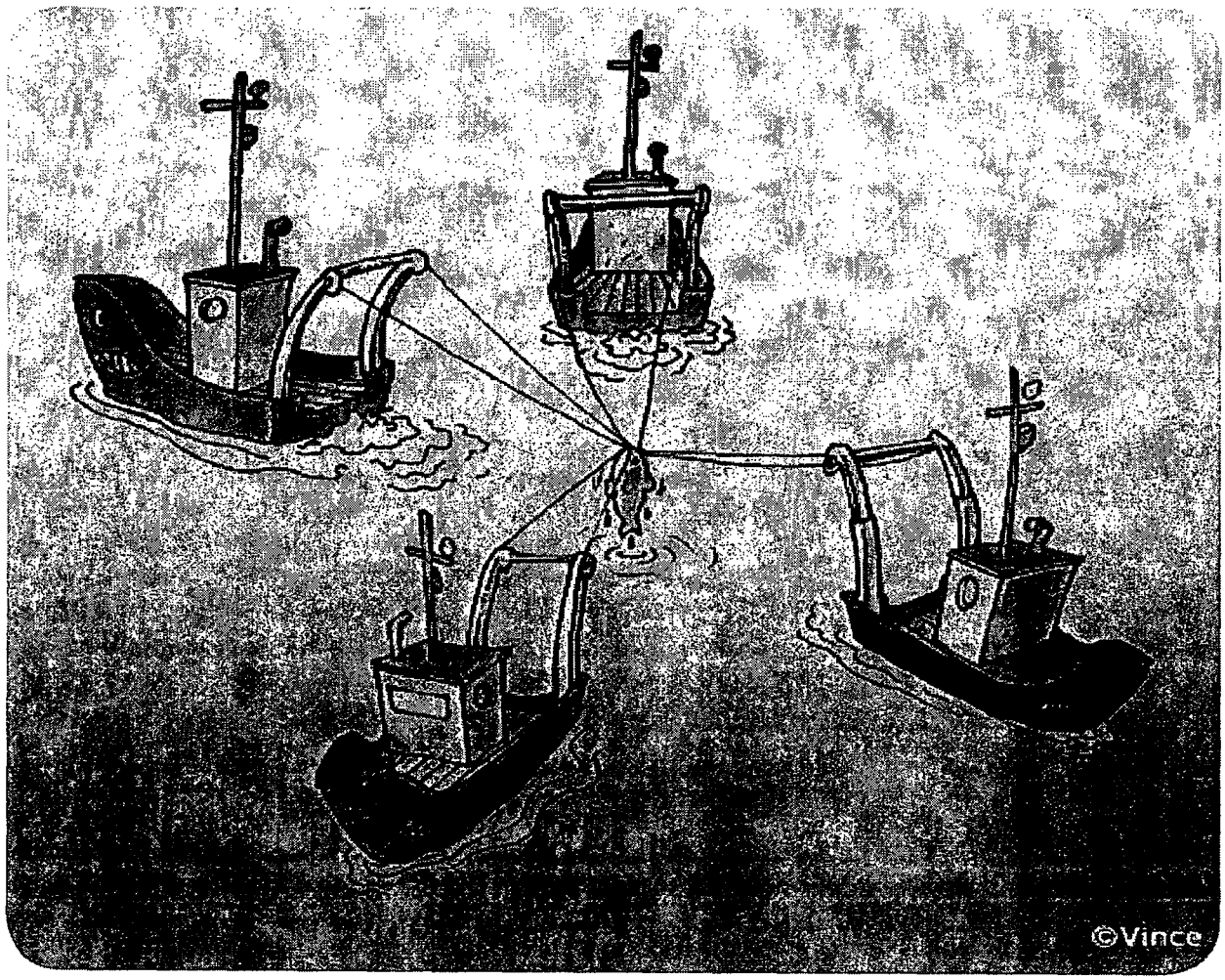


Figure 6: Fishing mortality and biomass (adopted from Ralf Döring 2005).

[9] This is indicative assessment on the basis of ICES (2006b) estimation.



5.1 Quota and effort adjustment

The road to sustainable fisheries in the Baltic Sea necessitates the implementation of a recovery plan. When recovery is achieved, a long term management plan must follow. An agreed Harvest Control Rule (HCR) should form the core of both a recovery – and management plan.

A HCR is a mechanism that defines management responses to varying situations. The European Commission has recommended (EU, 2006b) a HCR for the Baltic Sea cod stocks which defines an annual 10% (decrease) adjustment in fishing effort (days-at-sea) and an annual 15% (decrease) adjustment in the TAC until the fishing mortality declines below a given level. A gradual approach is likely to be supported by the catch sector. However, with reference to the fact that the eastern cod stock is in the *high risk zone* and that scientists repeatedly have advised *no fishing*, the Commissions proposal undermines all intentions to manage the stock in accordance with a precautionary approach. The HCR proposed by the European Commission is applicable to stocks in the *overfishing squares*. Recovery measures must be implemented when stocks are in the *high risk zone*.

A necessary step to recovery is a closure of the cod fishery in the eastern Baltic until the stock can be documented as being outside the *high risk zone* and has entered the *overfishing* square. State and EU funded compensation to cod fishers should be considered as a measure to initiate a temporary, but general closure of cod fisheries in area 25-32.

[10] For example, a harvest control rule can describe the various values of fishing mortality which will be aimed at for various values of the stock abundance. It formalizes and summarizes a management strategy. Constant catch and constant fishing mortality are two types of simple harvest control rules (http://www.oceansatlas.com/world_fisheries_and_aquaculture/html/glos/terms/1684.htm).

Effort management

The failure of the existing management regime demonstrates the need to find alternatives. Effort based management has been tested in other fisheries (Denmark and Faroe Islands) and holds some promising lessons. Currently the Commission is considering the Danish Kattegat mixed fisheries as a pilot area for the implementation of effort regulation – possibly in 2007/2008.

Basic principles to apply an effort based management regulation in the Baltic cod fishery should:

- Allow fishers to bring ashore what is actually caught so that discard rates (because of quota limits) are minimized and the incentives for overriding quotas and misreporting catches are absent.

- Be based on fishing days-at-sea (kW days-at-sea[11]). Each vessel should be allocated fishing time according to its fishing capacity (see chapter 4.1), the target specie and the fishing season (time of the year).

- Ensure that the total number of kW days-at-sea represents the potential total catch of cod which must not exceed the TAC and the national quotas. Thus the TAC and national quotas will set the upper limit for the total catches.

- Allow all catches to be landed in order to give biologist and managers an overview of what is actually being caught. New and updated information about the "real" catches will alter the resource assessments and the understanding of illegal landings. Until now, biologists have been assessing stocks on the basis of uncertain and imprecise landing data.

- Allocate days-at-sea on a monthly basis, in order to mitigate the race to fish and expand the fishing season over a longer period according to optimal times for fishing. Depending on the season, a days-at-sea regulation will lead to different catches of the target specie and so this must also be taken into account. The existing use of closed periods in the Baltic should be maintained in combination with the days-at-sea approach.

- Monitor the trends in fish prices as the days at sea regulation is implemented. If landings of all catches lead to significant declines in cod prices (e.g. the January quarter) managers must adjust the allocation of days-at-sea to avoid abrupt price fluctuations.

Successful effort management requires a profound understanding of the capacity and the catches of each fleet segment[12]. New measures for improved monitoring must include: close cooperation with representative commercial boats (reporting all activities), random use of observers onboard, compulsory Vessel Monitoring Systems (VMS) and electronic logbooks onboard boats above 12 meters.

[11] Lessons could be learnt from the Faroe Islands where a kW days-at-sea has been implemented.

[12] If the management target is a reduction in fishing mortality rates on principal stocks, then the days at sea by a vessel of a given fleet segment must be substantially reduced from present levels. It is highly likely that, for example, a 20% reduction in days at sea will result in a less than 20% reduction in fishing mortality rates because vessels have numerous means of compensating for reduced sea time. Improved vessel construction (subsidised until 2004), fishing net design, modern fish positioning equipment and improved telecommunication etc. have resulted in an actual increase in fishing capacity of the fleets despite decommissioning programs (Teknologisk Institut, 2003).

5.2 Improve data quality

The management system with TACs is characterized by requirements to ensure quantifiable predictability. The TAC system depends on having data which can illustrate the link between total catches and the impact on single stocks. However, ICES recognizes the challenges and the limits in working with the single stock approach. With overexploited stocks, increasing levels of illegal fishing and uncertain catch data, the predictability of single stock behaviour is low and so precautionary steps must be taken to reduce the risk of stock depletions and the economic decline of the industry.

To address the challenge posed by unreliable catch data, WWF recommends that:

- Voluntary (incentive driven) data collection from *representative* commercial boats of the fleet should be implemented. The participating fishers should report all fishing activity, including catch and discards. The voluntary data collection should cover a limited number of boats per fleet segment. The participating fishers should be evaluated on an ongoing basis to ensure quality and reliability in the data collection.

- The use of on board observers should be harmonized across countries in the Baltic region and should cover various fleet segments – in particular those where misreporting is suspected.

- Electronic recording of catch on a daily basis should be compulsory for vessels of 12m and above.

- The cooperation between scientists and the catch sector should be closer. Over time biologists and fishers must build a common understanding about the benefits of co-management in a way that invites fishers to take responsibility and support data collection and stock assessments. This should include awareness about the negative consequences of misreporting and the disadvantages for the catch sector if they do not participate in data collection.

5.3 Ensure fishers compliance with fisheries regulations

To move from recovery to long-term management of the fish stocks in the Baltic Sea, a regional inspection scheme must be adopted and a concentrated effort must be made to stop consistent violators. The Commission and Member states must also give effect to their own plan of action to eradicate IUU fisheries (EU, 2002).

Experiences from the North Sea have demonstrated the difficulty in monitoring and enforcing numerous technical measures and species by species output restrictions. Managers should strive for simplicity in order to break the vicious cycle of applying additional rules to the already opaque complex of regulations. Improved enforcement and higher levels of compliance may be expected with a more simple and transparent set of regulations (e.g. effort regulation, one net rules, temporal closures to all member states and spatial closures to all fishing).

The participating fishers should report all fishing activity, including catch and discards.

5.4 Improved Technical Measures

It is essential that fish are not caught before they have the opportunity to reproduce. Minimum Landing Sizes (MLS) accompanied by mesh size regulations are important measures for the recovery of the Baltic cod stocks. It is important to note, however, that even when Baltic Cod have reached a size of 45cm (7 cm above MLS) only about 83 per cent of the fish have reached maturity (ICES WGBFAS, 2006).

Experience from the implementation of the BACOMA cod end in the Baltic fisheries demonstrated that it is the MLS and not the mesh size that determines what part of the catch is landed. Gear regulations must be compatible with MLS and fishing practices if the gear selectivity is to be successful. If mesh size is changed to allow small individuals to escape, the minimum landing size must be changed accordingly. Strict and abrupt regulations, unless capacity is reduced or fishers have alternative fisheries to exploit, are likely to lead to more circumventions (Raakjaer and Mathiesen, 2003).

The current Bacoma cod end regulation with 110 mm mesh size has proven more accepted by the catch sector than the 120 mm. The 120 mm mesh size simply had too high selectivity and created a strong incentive for the fishers to manipulate the gear with the ambition to decrease the selectivity. The implementation of the 110 mm Bacoma cod end thus results in a higher level of compliance which gives a more predictable level of selectivity and therefore a more correct picture of the actual fishing mortality on cod.

The above suggests that an increase of Minimum Mesh Sizes and MLS must be enforceable and transparent and should be implemented in close cooperation with the catch sector.

New fishing gears are constantly being developed with the aim to improve selectivity in cod fisheries. The T90 trawl is a new promising gear type which, in comparison to the Bacoma cod end, has a higher catch rate and better selectivity. The T90 is more gentle to the fish which leads to a better catch quality and a higher survival rate of smaller fish escaping the trawl (Sintef, 2006). It is important that the research in gear technology continues and that improved gear types are applied in commercial fisheries.

Considering the critical state of the eastern stock, there should be a thorough evaluation of all areas which are important spawning and nursery areas for the Baltic Sea cod to facilitate a rapid recovery of the stocks. This evaluation should include the already existing seasonally closed areas[13] in the Bornholm Deep, the Gotland Deep and the Gdansk Deep. If the area closures in the Eastern Baltic are only temporary or seasonal, some reductions in fishing mortality might occur but the growth in fish size, recruitment and concentration

[13] Seasonally closed areas in the Baltic Cod Fisheries (EU, 2006).

Area 1:
- 55o45' N, 15o30' E
- 55o45' N, 16o30' E
- 55o00' N, 16o30' E
- 55o00' N, 16o00' E
- 55o15' N, 16o00' E
- 55o15' N, 15o30' E
- 55o45' N, 15o30' E

Area 2:
- 55o00' N, 19o14' E
- 54o48' N, 19o20' E
- 54o45' N, 19o19' E
- 54o45' N, 18o55' E
- 55o00' N, 19o14' E

Area 3:
- 56o13' N, 18o27' E
- 56o13' N, 19o31' E
- 55o59' N, 19o13' E
- 56o03' N, 19o06' E
- 56o00' N, 18o51' E
- 55o47' N, 18o57' E
- 55o30' N, 18o34' E
- 56o13' N, 18o27' E

5.5 Ecosystem Based Management

The Baltic Sea contains a variety of Marine Protected Areas (MPAs) – established either as Baltic Sea Protected Areas (BSPAs) under HELCOM or as Natura 2000 sites under the Habitats and Birds Directives from the European Commission. There are also a number of areas designated according to national laws in the various countries.

An MPA is a marine area that has been designated to protect marine biodiversity in contrast to closed areas that are areas designated for fisheries management. However, MPAs for biodiversity related objectives may also provide benefits for fish stocks (e.g. spillover effects (fish migration), protection of nursery and spawning grounds) and closed areas for fisheries can contribute to the protection of marine biodiversity and ecosystems.

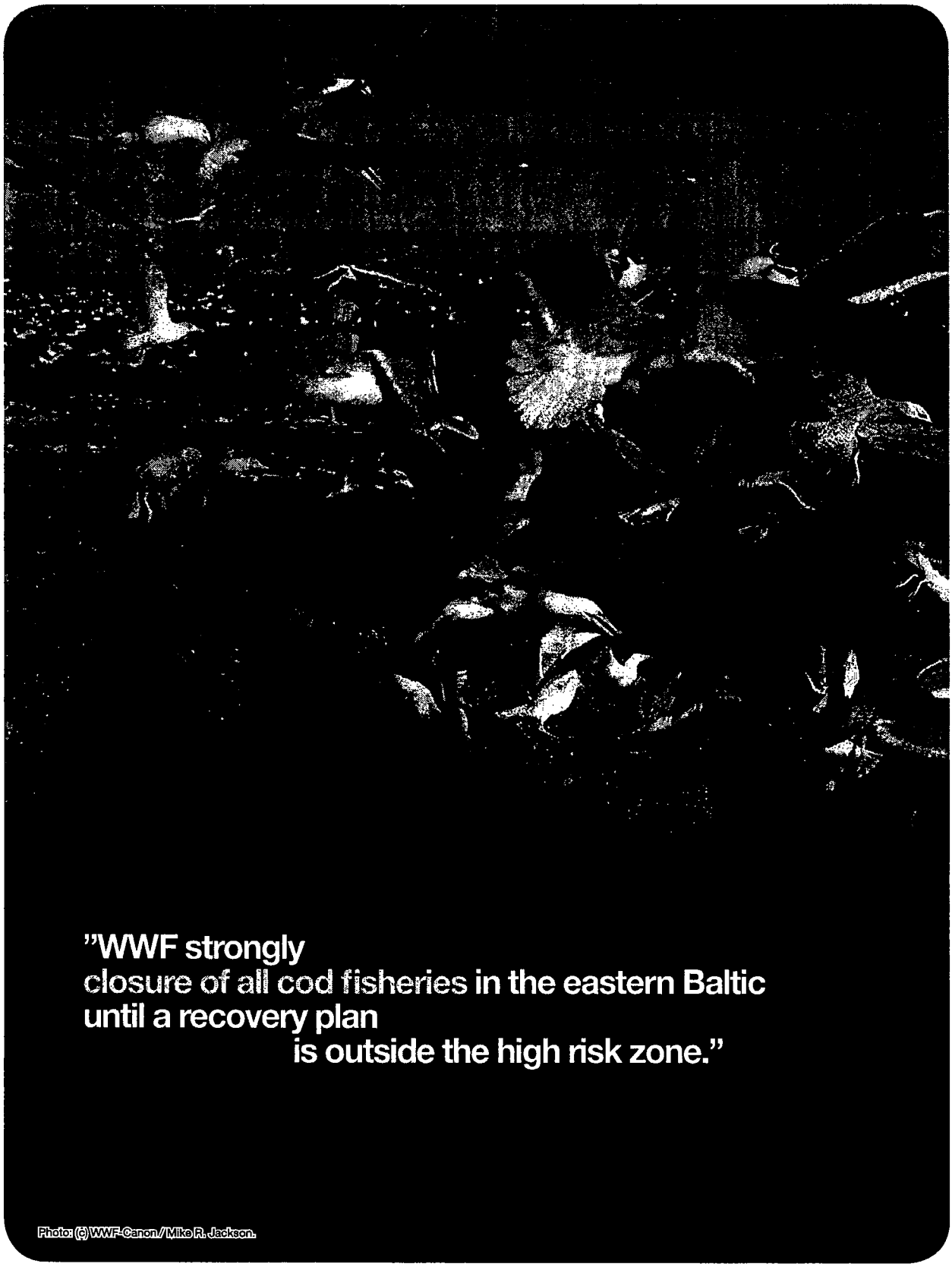
There are practically no restrictions on fisheries today in the designated MPAs in the Baltic and so it should be of highest priority to develop management plans for fisheries in MPAs.

A general set of measures is unlikely to balance the objectives for all MPAs. It will be necessary to work on a site by site basis and define sustainable measures adapted to the marine values, threats and uniqueness of each area.

The current knowledge about the biodiversity of most MPAs is often insufficient to set up site-specific regulations and so more information is needed. The design of a management plan for fisheries in MPAs should as a minimum include:

- For each site, a total overview of the species and habitats (including fish habitats such as, feeding, spawning and nursery areas, etc.) that form the basis for the designation.
- For each site, an overview of what other interests beside fishing that are bound with the area e.g. recreation, eco tourism, sailing, nature conservation.
- For each site, an overview of the various kinds of fisheries occurring in the MPA.
- For each site, an overview of the kind of fishing gear currently being used.
- For each site, an overview of the negative impact of the fishery on the biodiversity.

Based on this information, it should be possible to define what kind of fishery, and gear, is compatible with the protection criteria.


"WWF strongly
closure of all cod fisheries in the eastern Baltic
until a recovery plan
is outside the high risk zone."
Photo: (c) WWF-Canon / Mike R. Jackson.

6. Conclusion

The Baltic Sea cod stocks are overexploited and risk commercial extinction. The mismanagement of the cod stocks cannot continue – immediate action is needed. From this report it is evident that the problems are severe and that there are no easy fixes.
The primary challenge undermining the potential for a sustainable future for cod and cod fisheries is the overcapacity of the fishing fleet.

WWF strongly recommends an immediate closure of all cod fisheries in the eastern Baltic until a recovery plan is in place and until the eastern stock is outside the high risk zone. A recovery plan must include a thorough reform of the control and enforcement structures to ensure compliance and reliable data for stock assessments. If financial compensation is needed in certain fleet segments it should be provided by the governments, who are ultimately responsible for the mismanagement and overcapacity.

The fisheries management regime must be unlocked from a rigid output based system and undergo true reform. Policy makers must be ready to introduce new concepts for management and take radical steps to stop overfishing, reduce overcapacity and bring compliance and legitimacy into fisheries management.

Given the diverse fishing patterns, fleet structures, management and enforcement procedures around the Baltic, managers and policy-makers must aim for simplicity and uniformity in their management approach in order to ensure that targets are reached and that stakeholders experience equity and effectiveness in the management reforms. The chosen management strategy must work in practice and not only look good on paper. All areas that are not working must be dealt with continuously to ensure a robust and predictable development.

Important steps towards ensuring the sustainability of Baltic cod fisheries:

- **All targeted cod fisheries in the Eastern Baltic (area 25-32) must be stopped until** a recovery plan is in place and it can be documented that the Baltic cod stocks are outside the High Risk Zone.

- The current excess in **fleet capacity must be reduced** and this needs to be accompanied by assessments of the continuous increase in fishing capacity from technological innovations.

- **Effort regulation** based on a system of kW days-at-sea system which allows fishers to land all catches during their days-at-sea must be tested as an alternative system. The total catches within such a days-at-sea system must not exceed the national quotas. The kW days-at-sea system and the catches must be assessed within the first year and the national quota should be adjusted to these data.

- **Provision of reliable catch data** must have the highest priority in a future management system. Sampling surveys from representative boats of the various fleet segments; a closer cooperation between scientists and fishers and a pilot implementation of days-at-sea regulation are key measures to improve the quality of catch data.

- **Maintain gear selectivity** as a measure to reduce bycatch and increase minimum landing size (MLS) over a period of time.

- Surveillance and enforcement must have an international and regionalized form and be **harmonized in terms of monitoring and sanctions.** The EC must give effect to its own plan of action to eradicate IUU fisheries (EU, 2002).

- **Enforcement authorities should focus their effort on consistent violators.**

- **Regulations should be easy to monitor and enforce.**

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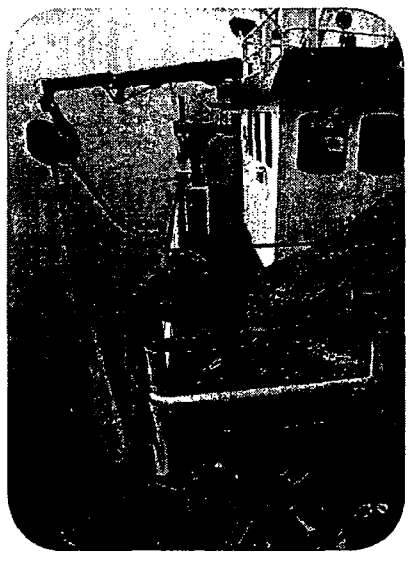

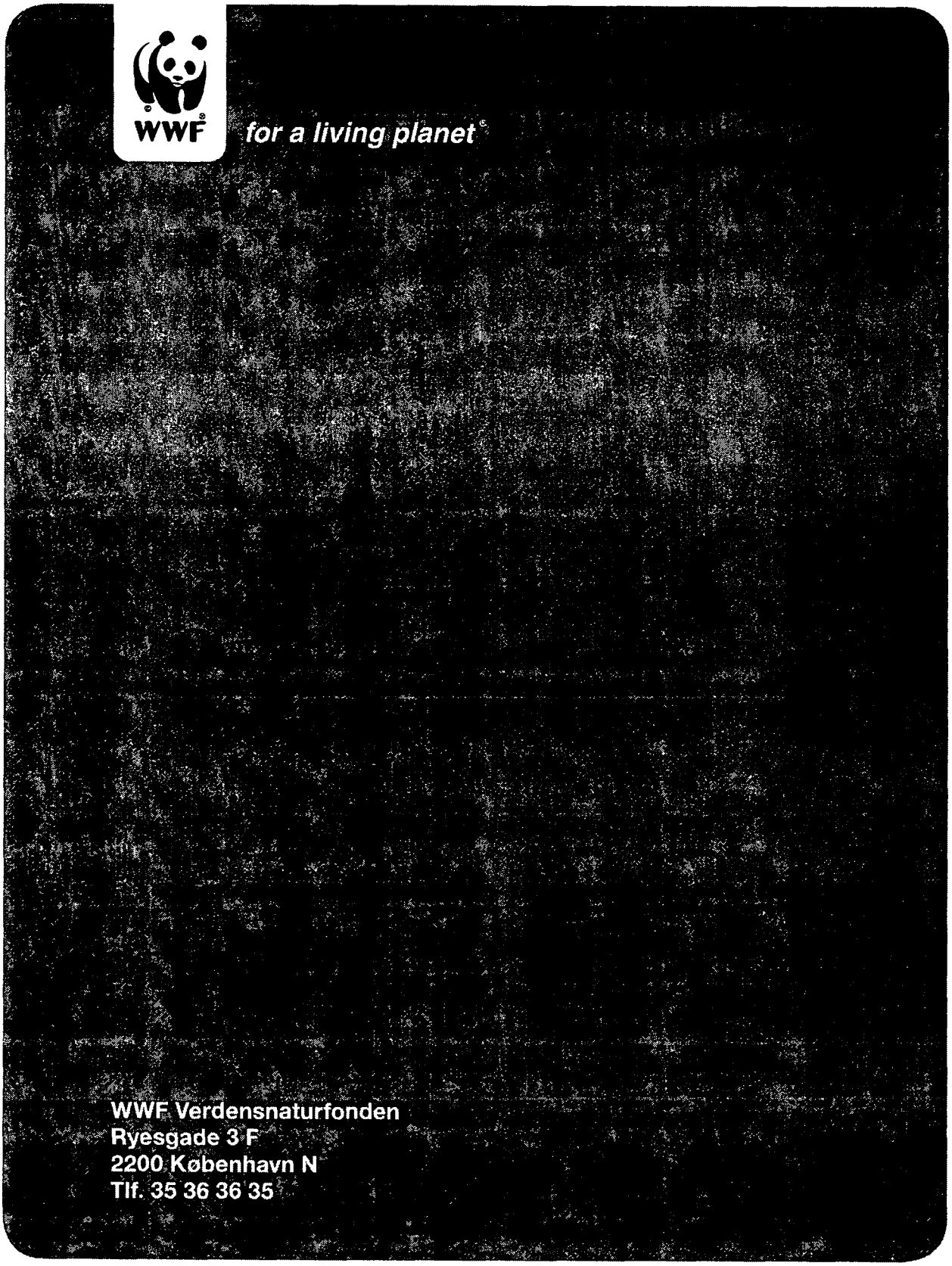

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