THE BALTIC SEA AS AN EXAMPLE OF ENVIRONMENTALLY SOUND FISHERIES

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1 Introduction

The Project "The Baltic Sea as an Example of Environmentally Sound Fisheries" was commissioned by the Federal Agency for Nature Conservation in Germany (BfN). The project team consists of fishery biologists and fishery economists of private companies, registered associations and the University of Greifswald (Department of Land Economics). The aim of this project is to improve the knowledge of fisheries economics, fisheries ecology and biology as well as different fishing methods to develop a fisheries management system that works in harmony with nature. Although just one third of the project time has passed, it is already obvious that there is anything but a discrepancy

between the needs of working fishermen and conservation. The fishermen depend on a sound ecosystem and profit from sustained fisheries.

At the conclusion of this project in summer 2004 it should be possible to provide further recommendations for a sustained exploitation system in the German part of the Baltic Sea. That means comments on protected areas, ecological and economical consequences of the ban on some fishing methods and the future of the small scale inshore fishery. The task of the University of Greifswald has been to analyse the present fisheries management in the Baltic Sea especially in view of the regulations made by the International Baltic Sea Commission (IBSFC) and the European Union (EU). Furthermore the usefulness of marine protected areas (MPA) has been examined and their costs calculated.

In a second step the economical effects on the introduction of a more selective fishing gear – especially longlines – were calculated. Possible

Table. 1 : Pros and Cons of MPAs as Fisheries Management Tools

Pro MPA	Con MPA
Fisheries biology • Increase in reproduction and survival of juveniles • Higher abundance and species diversity • Improvement of age structure • Protection of genetic diversity and avoidance of genetic shift • Prevention of growth, overfishing **Ecology** • Habitat protection • Balance of the ecosystem **Management** • Constant catches • Higher catches in adjacent areas • Existence of a concrete area which planners and stakeholders can concentrate on • It is socially benefited protecting important coastal areas • Only little information is necessary for its establishment **Research** • Precautionary approach: Insurance against insufficient knowledge • Protection of fragile species and populations • Reference area for the evaluation of the consequences of fishing (demography, environmental influences)	**Fisheries biology** • Migration • Little flow out of the MPA provides little benefit for fisheries • Strong flow out can lead to over-exploitation outside the MPA **Economics** • Missing rules outside the MPA: - No benefit for fisheries - A MPA in one area can lead to greater fishing activities in other areas • Short-term decrease of catches • Costs of designing **Management** • Lack of precise models to predict optimum location **Operating expenditure** • Loss of fishing grounds • Increasing fuel costs • Increase in working hours • activity in remote areas • decreasing catches because of less available time • higher competition for remaining fishing grounds **Common social costs** • Increase in unemployment • Compensation of missed catches • Costs of execution and observance

costs of compensation and ideas such as remunerating ecological services (following organic agriculture) will be discussed in this project, too.

2 Discussion

In the following section the pros and cons of marine protected areas (MPA) are gathered and discussed (see Table. 1). Arguments are presented in favour or against MPAs regarding to their relevance to the Baltic Sea. Climate, migration of target species, catching grounds and habitats have been considered.

2.1 Advantages of MPAs

After the formation of an MPA the immediate repercussions due to the cessation of all fishing activities are beyond dispute. Abundance, mean age and size, number and density will rise in an MPA leading to an increase in spawning biomass (HALL 1999[1]). This chain of cause and effect is described in the report „*The role of marine reserves as fisheries management tools*" of WARD et all. (2000). It should be noted in particular that increasing age and size of fishes has a big impact on the efficiency of spawning success (shown by FARROW 1996, BLEI & OEBERST 2001). It has been suggested that the reproductive efficiency of older cod is much better because they are better able to locate areas with good spawning conditions.

The crux of the reasoning – the preservation of old, large and therefore more fecund fishes – is a powerful argument in favour of the establishment of MPAs (HOLAND & BRAZEE 1996[2]).

[1] also: KENCHINGTON 1995, HOLAND & BRAZEE 1996, BOERSMA & PARRISH 1999, DIXON et all. 1993, ROBERTSON & POLUNIN 1993.
[2] BOERSMA & PARRISH 1999, ROBERTSON & POLUNIN 1993

HALL (1999) agrees that the preservation of the spawning biomass is a high priority. However, the real challenge is to control the fishing activities in the marine reserves. Sometimes this can be achieved by other fisheries management tools, e.g. temporal restrictions or Individual Transferable Quotas (ITQ). Unfortunately quotas can lead to targeting of the larger fish alone thus increasing the fishermen´s profit. Therefore MPAs have a further advantage over ITQs (ROBERTSON & POLUNIN 1993). Additionally, MPAs are a precautionary approach and an insurance against moor management (KENCHINGTON 1995, MPA NEWS VOLUME 4 2002, AGARDY 1997).

However, the introduction of an MPA can be quite complicated. Size and site of the protected area must be carefully considered in order to protect the target species and not to harm the fishery. That is why further research needs to be done in the future. But the costs after the creation of an MPA are probably much lower than the administrative expenses of ITQs. The expenditure for the observance might be the same for both controlling the mesh size / catch amount and the MPA.

Positive effects of protected spawning grounds are unquestionable (HANNESSON 2001[3]). Spawning grounds at the German eastern Baltic coast are necessary for fresh water species. Protection of these also assists cod through the protection of their prey. However. the pelagic eggs and larva of cod are not dependent on structures but on hydrography. The spawning ground of cod is located in deep basins to the east of the isle of Bornholm where eggs can develop in a permanent saline layer (ROHLF 1999 and THIEL et all. 1996). High oxygen levels improve in the Baltic, resulting from

[3] KENCHINGTON 1995, HOLAND& BRAZEE 1996, BOERSMA & PARRISH 1999, ROBERTSON & POLUNIN 1993, SOEBEL 1996, AGARDY 1997, BOHNSACK 1999, HALPERN & WARNER 2002, SCHMIDT 1997, COMMITTEE ON ECOSYSTEM MANAGEMENT FOR SUSTAINABLE MARINE FISHERIES et all. 1999

climate dependent inputs from the North Sea, improves spawning conditions. Thus reduced industrial and agricultural sewage inputs would improve the reproduction process of the cod stocks in the Baltic Sea (THIEL et all. 1996).

After the introduction of an MPA eggs and larva produced in the reserve, can spill over into the adjacent areas and in the long run as the reserve 'fills up' an emigration of adults will take place. In literature this kind of migration is regarded as a result of the so-called "*ideal free distribution*" (JENNINGS et al. 2001). Optimum conditions in the protected area give rise to overpopulation and some individuals profit by migration.

Long-term results of MPAs include the protection of the genetic diversity (KENCHINGTON 1995[4]), betterment of the age structure (AGARDY 1997), protection of the habitat (HALL 1999[5]) and the ecosystem balance at the end (SOEBEL, 1996). In the Baltic cod fishery the protection of the habitat has a special importance because cod is often fished with bottom trawls leading to a destruction of the benthic structures. This destruction affects organisms at the bottom upon which cod feed. Young cod eat infaunal worms and molluscs and with rising age may also prey on fish (Muus & Dahlström, 1991).

It could be argued that the long-term effects MPAs cannot easily be achieved by other fisheries management tools. A degree of habitat protection might be easily realised by

[4] HOLAND & BRAZEE 1996, ROBERTSON & POLUNIN 1993, SOEBEL 1996, AGARDY 1997, BOHNSACK 1999, CHARLES 2001)
[5] ROBERTSON & POLUNIN 1993, MPA NEWS VOLUME 4 2002, COMMITTEE ON ECOSYSTEM

a prohibition of bottom beam trawls. That suggests that there is often little difference between an MPA and other fisheries management tools. However, an improvement of age structures and ecosystem balance can only be achieved by MPAs. Yet another argument in favour of an MPA is that there is a concrete area lying ahead which planners and stakeholders may concentrate on (AGARDY, 1997). With the help of the findings the management strategies regarding the special characteristics of the area and the fish stocks can be improved.

Although an MPA might be to the debit of a fisherman´s individual benefit, there are advantages for the society by researching into fisheries, species interactions and environmental influences on the stocks. We really need this virgin or zero zones - otherwise every new generation of fishermen, ecologists and economists can only base their research on the present conditions and the knowledge of the originally sound ecosystem will be lost forever.

2. 2 Disadvantages of MPAs

Fisheries Biology

Especially the migration of the target species are often used as an argument against the establishment of a protected area. The Baltic species do not depend on special structures and riffs and especially the cod is highly migrating. Authors differ in the minimum percentage of the number of the target species, but up to 50 % seems too fantastic, because the whole Baltic[6] (RECHLIN & BAGGE, 1996) is the habitat of the

[6] Without the middle and north Bothnian Bay because of the low salt content

species[7]. On the other hand temporal escapes from the protected area into the fishing grounds will rise the quantity of catches there. That is why unattached smaller marine reserves seem to fail the aims of an MPA for both fishes and fishermen. In HANNESSON´s (2001) opinion the MPAs improve the fish stocks but waste capital and expenditure of human labour. BOHNSACK (1999) agrees and wants the possibility of short-term failures to be kept in mind. Indeed, perforce catches will get smaller. This dry spell could be bridged by payments to compensate the fishermen´s losses. But in the long run the fishermen will profit from the sustainable fisheries and looked at this point of view it is not wasted money but an investment in the future.

CHARLES (2001) remarked that without a spill over there will be no economical profit of an MPA at all. This argument against an MPA can easily be refuted by good planning and the right choice of the area.

It is unthinkable that a spill over of fishes attract fisheries that much that an economical balance might be restored after the introduction of an MPA. An economical balance means an open-access balance and that is impossible in the case of the Baltic with its multiple restrictions and the shared quotas between different associations. The demand for limiting the fishing effort in adjacent areas (HANNESSON 1998 und CHARLES 2001) is already realised in German waters to a great extend.

The lack of specific models to predict the optimum area for an MPA is no reasonable argument (BOHNSACK, 1999) and cannot be accepted as an excuse. MPAs have to be installed to give research an opportunity of learning from.

[7] HANNESSON 2001: 50% of the habitat, TAGGART & HOOGE 1999, BOERSMA & PARRISH 1999: each biogeographic region has to put with 20-30 % under protection, Berghahn & Vorberg 1997)

Economical considerations

By reason of high administrative costs BRECKLING (1997) and HANNESSON (2001) argue against an establishment of marine reserves. The bereavement of fishing grounds will normally lead to a longer length of the trip increasing the costs for fuel. Owing to the prolonged trip the fishermen have to spend more working hours to catch the same amount of fish as before. There will also be higher competition in the remaining fishing areas (BRECKLING, 1997 und HANNESSON, 2001). These conclusions can only be drawn if the scenario is seen at short notice. In the long run external effects on fisheries have to be internalised. And this could be reached, for example, by an MPA. Indeed, in the present situation it is obvious that fishermen are not able to pay the external costs all alone. Maybe, the society has to pay for them for a short period. BRECKLING (1997) and LAEVATU (1996) (Ed.) criticise MPAs weighing heavily on the society (e.g. unemployment relieves, compensation of missed catches, salaries for the observance etc.). But indeed, these expenditures are also connected with other fisheries management instruments. The present observance of special mesh sizes or the quantity of allowed catches has to be done by civil servants anyway. An the assumption that fishermen loose their jobs because of an MPA seems to be a wild guess.

3 Conclusions

The preservation of old and big individuals is the nub of a sustainable fishery. MPAs can lead to a future stabilisation of catch amounts and positive effects like genetic diversity, the improvement of age structures, protection of habitats and an ecosystem balance.

Unquestionable, reference areas in the Baltic Sea are necessary irrespective of fisheries (since the Baltic is a special brackish ocean on continental crust). Otherwise future generations will not be able to understand and reconstruct the virgin state of the Baltic. This is an important task because in comparison with ecosystems on land the hydrographical conditions cannot be stopped at the border of a reserve like, for example, anthropogenesis eutrophication.

Additionally there is the question of how to divide the remaining marine areas between different users such as fishermen, power production companies with offshore wind engines, military requirements and conservation. Are the different needs complementary or do they exclude each other? Chief considerations concerning the economical losses of fishermen by MPAs and how to compensate them for should be done in the future. It is also a question of whether the juridical guidelines are sufficient to make compensation payments for missed catches possible.

Improved conditions for the important small scales fishery, which could possibly become a victim of the struggle for the remaining fishing grounds, are recommended.

References

Agardy, T. (1997) *Marine Protected Areas and Ocean Conservation,* Academic Press, USA.

Armstrong, C.W. and Reithe, S. (2001) *Marine Reserves: Will they accomplish more with management costs*? In: Marine Ressource Economics, Volume 16.

Berghahn R. and Vorberg, R. (1997) *Schwierigkeiten bei der Auswahl und der Bewertung von Referenzgebieten.* In: Schutzgemeinschaft Deutsche Nordseeküste e.V. (SDN) (Hrsg.): Referenzgebiete. Sinn und Unsinn von nutzungsfreien Zonen an unseren Küsten. Schriftenreihe der Schutzgemeinschaft Deutsche Nordseeküste e.V. Heft 2. SDN-Kolloquium 1998.

Boersma, D.P. & Parrish, J.K. (1999) Limiting abuse: Marine protected areas, a limited solution, *Ecological Economics* **31**.
Bohnsack, J.A. (1999) Incorporating No-Take marine reserves into precautionary management and stock assessment. In: Restrepo, V. R. (Editor). 1999. *Proceedings of the Fifth National NMFS Stock Assessment Workshop: Providing Scientific Advice to Implement the Precautionary Approach Under the Magnuson-Stevens Fishery Conservation and Management Act.* U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-40.
Breckling, P. (1997) *Referenzgebiete auf Kosten oder zum Nutzen der Fischerei*? In: Schutzgemeinschaft Deutsche Nordseeküste e.V. (SDN) (Hrsg.): Referenzgebiete. Sinn und Unsinn von nutzungsfreien Zonen an unseren Küsten. Schriftenreihe der Schutzgemeinschaft Deutsche Nordseeküste e.V. Heft 2. SDN-Kolloquium 1998.
Charles, A. (2001) *Sustainable Fishery Systems.* Fish and Aquatic Resources Series 5. Blackwell Science.
Committee on Ecosystem Management for Sustainable Marine Fisheries, Ocean Studies Board, Commission on Geoscience, Environment and Resources & National Research Council (1999) *Sustaining Marine Fisheries.* National Academy Press Washington D.C.
Davis, J.B. (chief-editor) *Measuring the Effects of Marine Reserves on Fisheries*: The Dilemmas of Experimental Programs, in: MPA News Volume 4, No. 4, October 2002.
Dixon, J.A., Scura, L., Fallon & Van´t Hof, T. (1993) *Meeting Ecological and Economic Goals: Marine Parks in the Caribbean,* Ambio Vol. **22** No. 2-3.
Farrow, S. (1996) *Marine protected areas: emerging economics,* Marine Policy, Vol. **20**, No. 6, Great Britain.
Halpern, B.S. & Warner, R.R.(2002): *Marine reserves have rapid and lasting effects.* Ecology Letters **5**.
Hannesson, R. (2001) *The Economics of Marine Reserves, in: Economics of Marine Protected Areas*, Fisheries Centre Reseatch Reports 2001, Volume 9, Number 8, University of British Columbia.
Kenchington, T.J. (1995) *Marine Protected Areas: A fishing management perspective,* Cadus Associates, Canada.
Laevatu, T. (1996) (Ed.) *Exploitable marine ecosystems: their behaviour and management.* Fishing News Books.
Sanctuary Advisory Council (2001) *Questions for the science advisory panel I.* http://cinms.nos.noaa.gov/marineres/SPpdfs/Questions_0117c.pdf.07.01.2003
Schmidt, K. F. (1997) *'No-Take' Zones Spark Fisheries Debate.* In: Science Vol.**277**.
Sobel, J. (1996) *Marine Reserves: Necessary Tools for Biodiversity,* Global biodiversity: an international forum on the variety of life on earth, Vol. **6**.
Taggart, J.S. & Hooge, P. (1999) *Testing the Effectiveness of Marine Reserves: A Multi-Species*, Multi-Reserve Experiment.