A Bridge Over Troubled Waters?

An ecosystems based approach to fisheries management in the Baltic Sea

Anna Helen Björk Davies
annahbd2000@yahoo.dk

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Supervisor: Ann Åkerman
ann.akerman@lucsus.lu.se
LUCSUS
046 222 4809
P.O. Box 170
SE- 221 00
Lund, Sweden

Anna Helen Björk Davies
May 2010

Abstract

Marine fisheries around the world are suffering serious declines due to overfishing, marine pollution, habitat destruction and coastal squeeze. This thesis will consider the fisheries crisis in the Baltic Sea, and will suggest ecosystem based marine management (EBM) as a potential tool in moving from an over-subsidised, overcapacity, unsustainable industry, towards a fishery which is valued, cared for and conserved by the users of the resource, the fishermen, who act as stewards of the common resource.

Expert interviews, literature review and document scrutiny provide the methodological basis for the research. EBM and stewardship are merged on a theoretical scale, with suggestions as to how the two concepts can be integrated to ensure transparency, responsibility and conservation of the resource, not just for the target fish species, but for the full ecosystem, even if the entirety of the complex marine system is not yet fully understood.

Examples of real world use of EBM as well as instances of fostering a sense of stewardship are used to superimpose a vision for what the fishery might look like in the Baltic, with lessons learned from various examples around the world.

Barriers for the implementation of EBM are considered, and the implications of a sustainable fishery in the Baltic Sea and in Europe are discussed. Although effective implementation of EBM seems far from the current reality, the Baltic Sea could potentially provide an excellent foundation for the further expansion of EBM, both as a solution within EU fishing grounds, and also fisheries around the world.

Key Words: Ecosystem based marine management, stewardship, sustainable fishery, the Baltic Sea.

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Acronyms

BS RAC: Baltic Sea Regional Advisory Commission

CFP: European Union Common Fisheries Policy

EBM: Ecosystem Based Marine Management

FAO: UN Food and Agriculture Organisation

ICES: International Commission for Exploration of the Seas

LME: Large Marine Ecosystem

MSC: Marine Stewardship Council

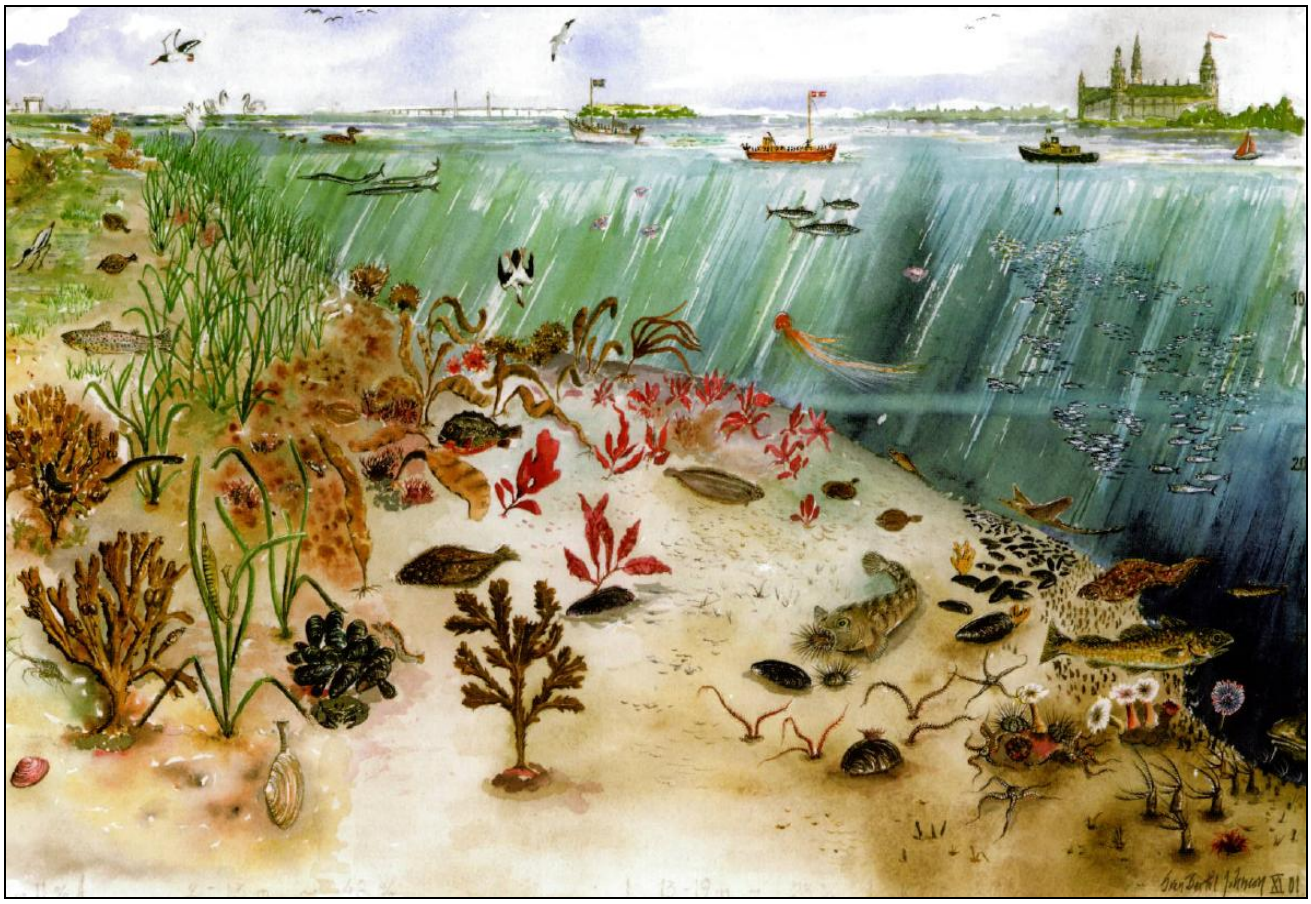
NGO: Non Governmental Organisation

WWF: World Wildlife Fund

A Vision for the Baltic Sea

A vision for how the fishing industry of the Baltic Sea might look, if equipped with effective and efficient management, transparent and accepted governance and fishermen who are allowed to take responsibility for the industry and inspire a sense of stewardship over our common marine resources.

An early morning trip to a local fishing harbour off the east coast of Sweden is met by a number of fishing boats coming into shore, each with their dedicated catch of the day. The fishermen are happy, the days catch has been good, and the men are ready for a warm cup of coffee before heading into land. The fish they have caught are part of the region's major source high quality animal protein and is valued and prized by the local consumers. The days of overfishing, competition for a dwindling resource, and daily catches of small, undersized fish are over; today the catch consists of large, mature fish, which will gain a good and fair price on the market. The fishing industry, which the fishermen are proud to be part of, is efficient, and does not rely upon subsidies. Management of the fishery is simplified, and fishermen are part of decision making and debates on policy implementation, as are other stakeholders in the fishery and marine domain. The fishermen do not only focus on catching the fish, they also work with scientists and managers to monitor stocks, locate nursery grounds and track migration routes. There is transparency throughout the fisheries sector, and fishermen, authorities and consumers are able to enjoy the fruits of a proficient fishing industry which acts as a model for the rest of the world's fishing fleets (Adapted from Reform of the CFP Green Paper, 2009).



Source: Øresundsvandsamarbejdet, 2009

1 Introduction

Marine fisheries across the world are facing a crisis (Worm et al, 2006). Aquatic ecosystems face increasing threats due to human activities; pollution, climate change, acidification, coastal squeeze and eutrophication – to name but a few (Bonnaci et al, 2007). The plight of the marine fishery is one, which, if it had been suggested to fishermen as little as 50 years ago, would have been rejected. The oceans have been considered a limitless resource for generations. One only has to read accounts from fishermen at the world renowned Grand Banks in Canada who describe an ocean so full of cod that a man could have walked on water on the backs of the fish, and that the boats struggled to plough through the vast amounts of fish, to believe, as so many have done, that human activities can surely not impact upon the vast, limitless resource under the water's surface.

"I believe then that the cod fishery, the herring fishery, the pilchard fishery, the mackerel fishery and probably all the great sea fisheries are inexhaustible; that is to say, that nothing we do seriously affects the number of fish. Any attempt to regulate these fisheries, from the nature of the cause, to be useless." Huxley, 1884. (Cushing, D.H. 1988, pp 117)

Yet, in the past four decades there has been a forced shift in this belief. Oceans once teeming with life and fish now lie quiet and clear. Nets once hauled up brimming with cod now come up empty. Ecosystems, once so vibrant and diverse now suffer from eutrophication and anoxia, and coastal communities, once pulsating and growing now sit on the coasts, aging and silent (Thulin and Andrushaitis, 2003).

Overfishing of the world's oceans is a crisis which cannot be attributed to one source. A growing human population, ever increasing standards of living, and a demand for fish as one of the world's most important protein sources has lead to developments in fishing technology which allows us to haul fish out of the water at a rate which could never stand the test of time (Worm et al, 2009).

Worldwide, marine fisheries have been, and continue to be exploited to a degree what can only lead to depletion of individual stocks, with potentially ruinous consequences (Helfman, 2007). Not only consequences for the fishing industry, upon which 164 million people around the world rely*[1](World Bank Report, 2009), but also for the marine environments as a whole, where the fish species that we value as an important protein source play an important role in the healthy functioning of marine ecosystems (Miller, 2007).

In accordance with the global threat to fisheries, the Baltic Sea has, since the 1980's undergone large scale alterations in the functioning and the health of the ecosystem (Lindegren, 2010). This alteration is largely due to the severe overfishing of primary target species; cod, sprat and herring, as well as other commercially valued species. The European level attempts at regulating the fishery within the EU have lead to the Baltic fishery being subject to regulations concerning total allowable catches, quota allocation and fishing gear limitation. Some of these regulations have been beneficial to the ecosystem, such as the 2008 ban upon harmful driftnets. Other regulations have not had the desired protective effects and have

[1] The exact number of people reliant upon the fishing industry is difficult to pinpoint, however this statistic, taken from the World Bank Report; "The Sunken Billions" can be split into 41 million people employed in the catch sector, and the remaining 123 million involved in post harvest processing, distribution and sales.

resulted in the devastating practice of high grading and discarding of fish that lie outside of the size or species quota*[2]

The following thesis will aim to tackle the fisheries*[3] crisis in the Baltic Sea where the capability for collaboration of stake holding states, the willingness to recognise the problem, and the levels of potential investment and research into the area should provide the ideal grounds for the emergence of new and innovative fisheries management proposals potentially leading to a transition towards a successful fishery.

It is difficult to pinpoint a successful fishery, as success depends upon the measures being considered (Cunningham, 2005). However as history has demonstrated, a successful fishery cannot continue to be successful for long, without the health of the ecosystem, the integrity of the fish stocks and some regulation of harvest. Therefore this thesis will suggest ecosystem based marine management (EBM) as a potential pathway towards a sustainable and long-term successful fishery. Each marine environment is unique and exceptional; therefore a solution in the Baltic is not necessarily transferrable to other instances. It is however important to highlight that the fisheries crisis exists on a global as well as a regional scale. Thus an example of a successful sustainable fishery in the Baltic could be used as a flagship example for further expansion into the EU and global fisheries.

1.1 Objectives and Research Questions

The fisheries crisis is a vast topic, encompassing ecology, biology, economics, socio-economics, communities and traditions. Thus this thesis will aim to focus upon one aspect of the fishery, namely a potentially sustainable management tool and will propose solutions which, according to findings, could have potentially far reaching effects. Ecosystem based marine management (EBM) is an increasingly utilised term within the field of marine management. It suggests that management of the marine environment should consider the ecosystem as a whole, rather than separate entities. That the health and integrity of the marine ecosystems is reliant upon terrestrial and coastal activities, water quality, balance throughout the trophic levels. This will in turn also affect fish populations, and in return a healthy fish population is part of the healthy ecosystem. A particularly crucial aspect of EBM in this context is that humans are considered part of the ecosystem, and human activities and needs are also factored into the delimitation of a healthy ecosystem. Figure 1 presents a visual demonstration of some of the many requirements for the move towards EBM. The double-ended arrows indicate that while each of the aspects is needed to reach EBM, EBM will, in turn, also enhance the weight and vigour of each of the aspects. Stewardship amongst fishermen is highlighted in red as the requirement which will be explored in this thesis.

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[2] This refers to the practice of dumping fish, dead or dying, overboard due to exhausted quotas. High grading refers to selection of the most valuable fish (by size or species) and then dumping less valuable individuals overboard. The practice of discarding and high grading has been identified as one of the major challenges for a reform of the CFP (BS RAC Conference, Baltic Sea Fisheries: Lessons Learned and Future Perspectives, October 2009).

[3] The terms fishery and fishing industry are, in much literature, used almost interchangeably. In this instance the fishery will be referring to an area with an aquatic population (fish or shellfish) which are harvested for commercial value. The fishing industry refers to the entire system of activities involved in catching, culturing, processing, conserving, storing, transporting, marketing and selling the fish or fish products. This thesis deals almost exclusively with the catch sector of the fishing industry.

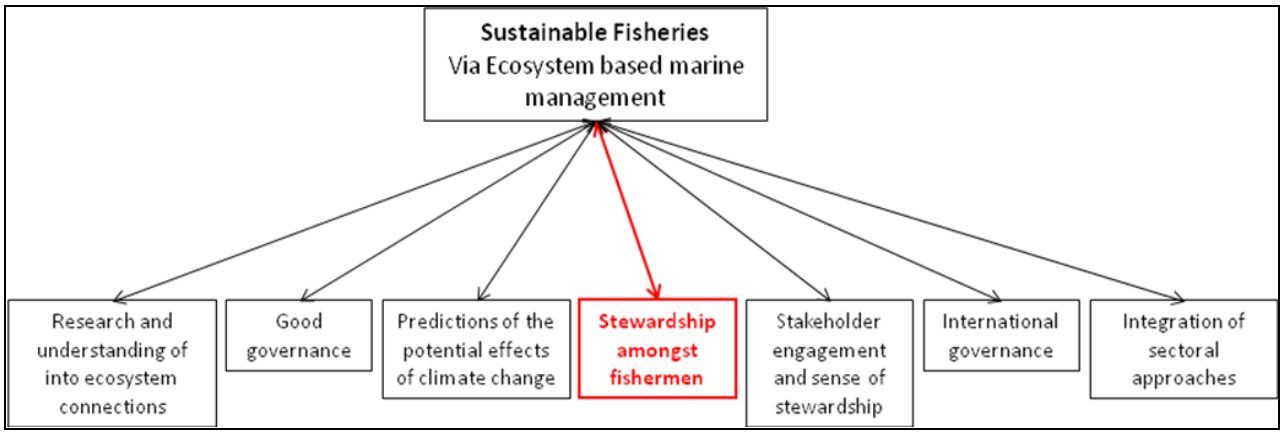

Figure 1: Visual demonstration of some of the many requirements for a move towards EBM and sustainable fisheries.

The research questions which will be used to examine this connection (highlighted in red, figure 1) are:

- Can an enhanced sense of stewardship amongst fishermen play a part in the transition towards ecosystem based marine management and a sustainable fishery in the Baltic?
- What instruments can be utilised to try to foster a sense of stewardship, thereby taking one of the steps towards ecosystem based marine management?

To satisfy these questions, two major concepts must be examined in order to elucidate what both stewardship and ecosystem based marine management means within the realm of fisheries management.

The first concept which will be considered is the concept of ecosystems based marine management. This is a concept which has seen much discussion and utilization throughout the past decade, with the increasing awareness of anthropogenic activities having damaging impacts upon the marine environment. The principles of ecosystem based marine management will be examined as a potential tool for fostering an increased sense of stewardship amongst fishermen.*[4]

The second is the concept of stewardship over the fishery as a resource. This will be briefly covered on a large scale, considering the responsibility of society as a whole, human beings and consumers, but will be more rigorously covered on the level of the fisherman. How might stewardship over the fishery resource be enhanced amongst the people to whom the resource matters the most; the fishermen?

These concepts will be used to reflect upon the Baltic Sea fishery, to investigate the viability of the ecosystems approach in the Baltic Sea; how it might be used to enhance stewardship, and what some of the potential knock-on effects might be upon coastal communities on the shores of the Baltic. Certainly the effects of implementation of such an innovative management method would have far reaching effects far beyond coastal communities, but the scope of this paper will be limited to looking at this aspect.

Although both the concepts seem, when considered individually, to fit into the future paradigm for sustainable fisheries, their immediate connection is perhaps less obvious. This paper will argue that without fostering a sense of stewardship amongst fishermen, the ecosystems approach to fisheries cannot be

[4] Some texts refer to fishermen and women in a generic terms; fishers, fisher-folk, fisher-people, however in this thesis fishermen is used and denotes both men and women involved in the fish catch sector.

effectively implemented. In tandem to this is the argument that the ecosystem approach to fisheries could, and should, if implemented properly, encourage stewardship and care for the resource amongst its users.

Initially the examination of these concepts will be done on a theoretical level, based on extensive literature review, interviews and the experience gained from fisheries management meetings and conferences. To further substantiate the examination, it will be further endorsed by evidence taken from other real world examples of the implementation of the ecosystem approach, one example from the case of Chesapeake Bay, USA and the other from the Shetland Islands, Scotland.

2 Methods and resources

The fishing industry consists of two fundamental elements; the population of fish living in their marine ecosystem element, and the human beings catching the fish (Branch et al, 2006). Only in rare instances are the fish populations managed, thus fishery management is actually people management (Larkin, 1988, Hilborn, 2007). The management of fisheries, and the studies and research behind fisheries management is highly transdiciplinary, with vital inputs from ecologists, biologists, anthropologists, economists and modellers. It would be near impossible to assimilate the valuable knowledge and insights required to generate one vision or method for a sustainable fishery, but rather several aspects must be taken into consideration, and dealt with one at a time. This paper will, as aforementioned, focus upon one aspect of fisheries management, namely the role of stewardship amongst fishermen within the approach of ecosystem based marine management and in turn will consider the return potential for EBM to foster a sense of stewardship amongst fishermen.

Ecosystems based marine management is examined as a tool used by fisheries managers and acts as a guide upon which an idealised vision of fisheries in the Baltic Sea can be constructed. In this instance the ecosystems based marine management is re-invented as a conceptual framework to provide grounding for the research and connect the various threads of inquiry. Past instances and cases of the use of ecosystem management in various marine ecosystems are used to provide evidence for how stewardship might be effectively fostered within the marine environment, with the eventual aim of moving towards a more sustainable, long-lived fishing industry in the Baltic, and perhaps beyond. These past examples have been selected due to their diversity, in scale and resource availability, as well as their attributes which can be reflected back to the Baltic Sea instance.

2.1 Expert interviews

A series of explorative interviews have been carried out, in order to gain some insight into the topics covered, and to create an overview of what the major concerns are amongst stakeholder groups (see appendix for a list of interviews). All the interviews have been informal and with little planned structure, in order to ensure a free flow of ideas and concerns, without imposing restrictions upon what may or may not be expressed. This allowed for follow up of interesting aspects of what was revealed (Kvale and Brinkman, 2009 pp 106). Most of the interviews have been carried out face-to-face, as this allows maximum transfer of ideas and expression. However some of the interviews have, due to travel and time constraints, been over the telephone, and via e-mail. The list of interview candidates is very mixed, with much of the contribution coming from the science and limnology aspect of fisheries management, others have been from policy and EU regional commission level, and yet other contributions from non-governmental

organisations such as WWF and the MSC (marine stewardship council). Motivation and impressions have also been drawn from attendance at several small and large scale conferences and meetings (see appendix for full list of attended meetings / conferences). The impressions gained at the conferences and meetings have been a significant tool for gaining an insight into what topics are of importance to the various sectors of fisheries management, ranging from small to large scale issues and problems. Due to the scope of the project a comprehensive stakeholder analysis has not been carried out, as this was considered superfluous to the task at hand. Rather a selection of expert interviews was used to provide an overview of the main topics and concerns. Documentation and literature analysis has then used to ground the interview results to the conceptual framework. Examples of EBM around the world have been used to draw upon the relevant experiences which could be adapted to suit the Baltic Sea example.

2.2 Limitations and scope

With unlimited time and resources this study could perhaps have been far more elaborate. This might include stock assessments before and after various management approaches in localised regions. May include more specific use of fish populations in places where the ecosystem approach has been applied, or might look at other indicators of ecosystem health, such as the number of, and health of, keystone species, water quality or fishery income in specific small marine ecosystems.

However this research is not solely about stock assessment or fish populations, but is rather an examination of the potential effects that a holistic and wide-ranging ecosystem view might have on the people who deal with and depend upon the natural resource. Time and scope constraints eliminate the possibility for actual stock assessment or ecosystem health evaluation, as these changes take years to manifest. Therefore the research will be based upon documentation from previous experiences in other locations and other ecosystems, using these past instances to provide evidence for a potential future in the Baltic Sea.

The Baltic Sea provides the geographical boundaries for the study, as one of the important aspects of EBM is that it be adaptive to each unique ecosystem. A prescription to suit large swaths of ocean would be superfluous and counter to one of the main principles of EBM.

The application of effective EBM requires inputs and efforts across many sectors of society (Tallis, 2010). This paper deals only with a small segment of EBM, namely the use of stewardship to enhance EBM within the fisheries sector. There are countless opportunities for further study and extensive reflection upon further implementation of EBM. Some of these research opportunities will be considered in the conclusion of the paper.

2.3 The fishery as common property

Discussion, management and debate surrounding the Baltic Sea must take into consideration that there are nine nations holding a stake in the issues. All of these have some interest in the fishery, and all of which have a coastal fishing fleet operating. Thus it is difficult to generalise rules for fishermen across the regions, nations and traditions. However the inherent common-property nature of the fishery, which allows fishermen to move across the seas, also allows fisheries science to take the stance that fishermen and fishing fleets can be thought of as one rational economic entity that will, in aggregate, decide upon ways and means that will maximise their wellbeing within their regime. This allows fisheries scientists and

managers to predict outcomes of actions for geographical regions rather than on an individual basis for distinct regional, national or target-species fleets. (Hilborn, 2007). This aggregate fleet dynamic can be blamed for one of the roots of the fishery crisis, namely the "race-to-fish", which encourages each fisherman to catch as much as possible here and now, for fear that it will have been caught by his neighbour tomorrow (Branch et al, 2006).

Although fishermen and fishing fleets will, as a rule, act to maximise their wellbeing and their incomes, it would be unfair to blame the tragedy of the commons and the current "race to fish" solely on the actions of the fishermen. In many instances they have simply worked within the governance regime that was provided. The CFP's infamous 1970's and 80's moves towards maximising fishing fleets, subsidisations, low interest loans and fuel subsidies encouraged a massive race to fish, whereby the largest, fastest and most efficient ships enjoyed the most profit. This resulted in the notorious overcapacity of the fishing fleet, with ships too large, too fast and too efficient for the fish stocks to be able to meet the need. This overcapitalisation is the major legacy which EU fisheries deal with today, and sets the scene for the incentives to fish throughout the past 30 years (Hilborn, 2007).

3 Background to the global fisheries crisis

There is some variation in the beliefs of the severity of the problem. Some fisheries scientists, most famously, Worm et al, in 2006 predicted that all the world's wild fish stocks would have collapsed by the year 2048, meaning that the annual catch of the stock would be less than 10% below the highest recorded catch. Other, less alarmist studies report the disastrous predictions of Worm et al. are wrong, that high trophic levels such as skip-jack tuna have yet to be severely reduced (Essington et al, 2006), and that many fish stocks still have a high recovery rate despite relative dispersal (Huchings, 2000). But there seems to be, across the board, recognition that many of the world's fisheries are seriously overexploited, and that a depletion of the world's fish stocks will, unless somehow altered, have severe consequences in the near future (Hilborn, 2007). Although it is difficult to place specific numbers upon the levels of decline in fisheries, it has been estimated that worldwide, up to 70% of the 200 commercially valuable marine species are being threatened by loss of habitats, marine pollution, coastal squeeze, loss of spawning grounds, as well as massive overfishing. This is a major hindrance to sustainable development in the affected regions, as fish provides one of the major sources of protein for a large number of people around the world. In particular for coastal communities the heavy reliance upon fish as a food source means that the declining fish population may have a devastating effect upon traditional lifestyles (Miller, 2007).

3.1 The fisheries crisis in the European Union

One world region which has overseen severe changes in the marine ecosystem, and which now must deal with the uncomfortable consequences is the European Union. Fisheries in European waters go back to the initial settlement of humans in Europe, and in many cases much of the history of Europe has been shaped by fishing and the development of the fishing industry (Kurlansky, 1998, 2008). It was not until the 1970's and 80's that the European Union began to introduce the Common Fisheries Policy (CFP), that the European fishery became a unified force to be reckoned with. Initially the CFP was set up to create an area of free trade within the fishing industry, with the same rules and regulations, to ensure a fair deal for fishermen from across Europe, within the newly established 200 nautical mile exclusive economic zone (EEZ). The CFP quickly developed into a mechanism by which organization of vessels and instalments was

controlled, market was regulated and investment was supplied to maximise the catch as efficiently as possible. By 1992 there was realisation that overinvestment in fishing fleets, ship size and capacity was resulting in overfishing and declining fish stocks. Thus conservation regulation was introduced, to try to restrict the amount of catch allocated to each ship. However there was little will to actually reduce the newly-improved fishing fleet (Daw and Grey, 2005). A review was scheduled for 2002, which revealed continued and worsened depletion of fish stocks, thus quotas where tightened, scrapping of fishing boats began and subsidisation of the fishing fleet was initiated to compensate fishermen for their loss of revenue. In 2009 another review of the CFP took place. This review exposed further dissemination of the fish stocks, and took a close look at where the major failings of the CFP lie. A Green Paper was produced in April 2009, which has been praised for its clear and candid admission of disappointments, and which outlines the main failures of the CFP, and offers inputs from EU countries, organisations, stakeholder and citizens to try to make change and improve the situation in EU waters before it is too late.

3.2 The failures of the Common Fisheries Policy (CFP)

Recently the EU could celebrate the 25th anniversary of the birth of the Common Fisheries Policy (CFP). It was meant to be one of the major achievements of the EU, an example of cooperation and consensus leading to a successful win-win situation for all; fishermen, politicians, consumers and the fish, a sign of the end of territorial disputes over 12/200 miles exclusive zones, and the end of declining fish stocks. However, this was not to be. Precisely where the EU's fisheries plans have failed is difficult to determine. The European Commission Reform of the CFP Green Paper from April 2009, identifies five major structural failings underlying the fisheries crisis: 1) Overcapacity of the fishing fleet, 2) unclear and diverging policy objectives, 3) short-term focus, 4) insufficient responsibility assigned to the industry itself and 5) a deficiency in political will to warrant a culture of compliance within the industry. All these failings have brought the European fisheries to its knees, to a point where the International Commission for Exploration of the Seas (ICES) is calling for an immediate ban on cod fishing in the North Sea (and is being ignored) (Hentrich and Salomon, 2005), where 88% of stocks are fished beyond their maximum sustainable yield, 30% of stocks are outside safe biological limits (ICES, 2008) and where consumers experience such mixed messages that apathy is becoming the norm. These failings spell out bad news for the fish and for marine diversity. It is bad for the fishermen and for all the associated industries, and bad news for coastal communities and their traditional ways of life. In light of this it is justified that there is a call for change in the fishing industry, changes in management, attitude and approach to fisheries on a national, regional and at European level (Borg, 2009).

However, the fishing industry is notoriously difficult to plan and manage, due to the common property arrangement (Arnason, 2007). The 200 nautical mile EEZ regulation allows exploitation of natural resources, such as oil, gas and minerals to be granted to each owner country; however fish are a naturally migrating, mobile resource, which cannot be sourced down to one territory or fishing ground. Thus each fisherman in the sea is reliant upon the actions of other fishermen. This has created a classic case of the tragedy of the commons, with each fisherman partaking in the "race to fish," competing to maximise their own share of the resource with little or no consideration of the long term effects of overexploitation of the resource (Fujita and Bonzon, 2005). The current EU model provides access across the European borders for market and sale of fish and shell fish products, but also incites damaging competition across borders for the ever dwindling fish stocks (Hentrich and Salomon, 2005).

Another source of contention within planning and management of the fishing industry is the vast array of different stakeholder groups, all of which hold the belief that their own view is most important. Politicians and economists, who each aim for the best solutions with least possible cost, ecologists, using science and data to try to prove the plight of the fish populations, consumers, vying for the lowest price and not least the fishermen whose lives and livelihoods rest upon the fate of the fishing industry. These variations in opinions and goals have lead to demands from the environmental and political community for better science to underpin quotas, catch levels and caps, however the incentives to maximise catch persist. The long term solution to the fisheries crisis must be a management approach which amends the incentives and aligns the economic, social and ecological goals (Fujita and Bonzon, 2005).

3.3 Research Setting: The Baltic Sea

The Baltic Sea provides the setting for this particular thesis. It is a brackish, semi-enclosed sea with a surface area of 377,000km2, and a length of 1,600km, with decreasing salinity the further north one goes (see figure 2). As a result various fish species can be found thriving in zones throughout the Baltic, with freshwater species in the north, and salt water species in the south. There are a limited number of commercially significant fish species, with the fishery focused on three main species; sprat, herring and cod, which account for 85% of the catches and are, according to ICES standards, overexploited.*[5] Nine countries border the coasts of the Baltic, and have vessels which fish these waters; Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Germany and Russia (encyclopaedia Britannica, 2010). At present regulation for the Baltic Sea fishery is set by the CFP. However there is an increasing effort to decentralise the regulations, in accordance with recognition of the specific conditions existing within each fishery, and a desire for more regionally based management. Therefore the Baltic Sea frames one of the seven Regional Advisory Councils (RAC's) which act as a vehicle for Baltic Sea stakeholders*[6] to feed into, and receive information from, the central CFP policy developments (RAC factsheet, 2008). Annual total catch in the Baltic is estimated at ca 950 000 tonnes annually (2007) (EU Atlas of the Seas, 2007). Today passenger and goods transportation is the main economic activity in the Baltic, however the fishery does earn ca 540 million€ per annum (HELCOM, 1993). The Baltic Sea lies in a resource rich region of the world, and social economic resources are key elements in successful fisheries management (Cunningham, 2005). Furthermore, the Baltic, being an enclosed, relatively small, tangible body of water should provide the ideal grounds for the introduction and assessment of pioneering fisheries management techniques.

[5] Overexploited according to the International Commission for Exploration of the Seas (ICES), the body charged with providing scientific advice to the EU, implies that fishing pressure is much higher than that recommended by ICES. Continued fishing at this level is likely to deplete the stock – if it hasn't already done so (ICES advice help sheet, 2010).

[6] The BS RAC must include stakeholders from at least two member states. At present all the Baltic States have representation, except for the Russian Federation which partakes in ca 10% of the fishery (RAC Factsheet, 2008).

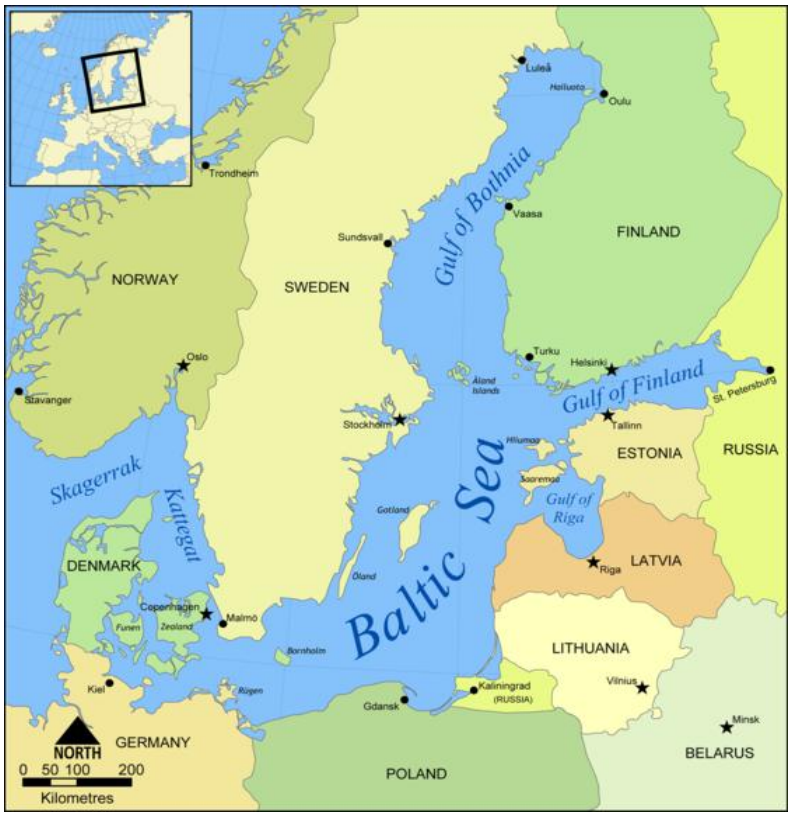

Figure 2: Map of the Baltic Sea (Source: Baltic Environmental Atlas, 2010)

4 Conceptual Framework

This paper will make use of two central concepts; ecosystem based marine management (EBM) and the concept of stewardship. There will be an examination of the two concepts separately, and then a merge of the two, to explore how stewardship over the fishery resource can be used to promote the health and viability of the marine ecosystem on the whole. Four pillars of EBM are provided, as a framework for how EBM is to be interpreted and implemented. These four pillars will be used to connect EBM to stewardship to exhibit the importance of stewardship infusion into all the aspects of the sustainable fishery.

4.1 Ecosystem Based Marine Management

"...the CFP can form part of a more joined-up approach to protect the ecological balance of our oceans as a sustainable source of wealth and well-being for future generations. The basic objectives of the CFP include the application of the precautionary principle to fisheries management and the progressive implementation of an ecosystem approach..." (CFP users guide fact sheet, 2008).

Ecosystem based marine management (EBM) is a concept which is emerging today as a potential starting point for the conservation of, not just fisheries, but of marine ecosystems as a whole (Helfman, 2007 pp 459). There is, amongst marine planners, fisheries scientists and fishery managers an increasing understanding that "*Only intact, healthy ecosystems can provide the complete range of benefits that we humans want and need over time*" (McLeod pp 4, 2009).

Single species management has been the prevalent management regime throughout the CFP, but today, as demonstrated by the above quotation from a CFP users guide fact sheet, slow changes are occurring. The shortcomings of the single-species management tool have, in several instances, been recognised, but are, as of yet not fully and comprehensively rectified (Marasco et al, 2007). Some management bodies and advisory councils have taken steps toward the multi-species approach to management (Rochet and Trenkel, 2003), but the EBM suggests a step even further. Existing marine management is based on sector-by-sector activities. Disconnected departments, agencies and projects manage fisheries, eutrophication, water quality, aquaculture, land run off and agriculture without recognition of the inherent connections between them, and conceals the synergies between the services they provide us (Guerry, 2009 pp 17). EBM suggests a shift away from the sector based management, and offers a way to put the pieces of the puzzle together, while keeping humans' well being central to the overarching perspective of ecosystem health (Guerry, 2009 pp 19).

The characterization of the EBM is as varied and diverse as each marine ecosystem in the oceans, and must, in each instance, be adapted and modified to fit each case in point. However one central factor of EBM which is apparent in all its variations, and which sets it apart from many other conservation tools is the importance of the integration of human needs, and the acknowledgement that humans too represent an integral part of the ecosystem. Beyond this human presence in EBM, the variations and distinctions between the definitions may present both benefits as well as disadvantages. With the lacking discernable and definite definition and user-guide, the ecosystems based approach may be difficult and costly to implement, however the disparities may also provide an ideal platform from which to create an ecosystems based approach to each system that is as unique and distinctive as each habitat to which it is applied. There are, however several reoccurring themes discernible in each EBM definition (for a complete list of EBM definitions see appendix 2). There is a broad recognition that there is a wide fan of users of the marine environment, both direct and indirect as well as human and non-human, thus we must be willing to accommodate and merge our needs with both the current needs of the ecosystem, and also the needs of the future. Thus there is an element of stewardship for future human and non-human generations within the ecosystems approach to fisheries management. The human component of ecosystem management is important, as it would be naive to ignore the anthropogenic effect upon all ecosystems, terrestrial and marine, but the approach recognises and acknowledges the interactions of humans with the physical, biological and ecological components of the system (Marasco et al, 2007).

4.2 Four Pillars of EBM

Beyond the varying definitions of EBM in practice it is also possible to delineate basic pillars upon which EBM rests. In this instance four pillars of the ecosystem approach to marine management have been identified, through extensive literature review of authors, researchers and marine management practitioners, whereby definitions of ecosystem based marine management have been extracted, and the reoccurring similarities have been condensed into four essential pillars McLeod and Leslie have provided a clear overview of EMB, and this is what the four pillars are based upon. The four pillars are indistinct, due to the indefinable character of ecosystem based management: each instance will be individual and adaptable, but also because each of the pillars have overlapping characteristics, and one cannot stand forthright without the others.

1) **Connections**: Ecosystem based management is reliant upon the understanding of, or at least acknowledgment of the links which exist, both within the marine ecosystem, and also with the social and economic systems which rely upon the natural services provided by the ecosystem. The interactions between human activities and the ecosystem being considered varies from place to place, varies in scope and varies in intensity, therefore an effective and successful implementation of the ecosystem approach to marine management must consider connections and linkages on all levels, from the trophic levels of microscopic plankton, to global levels of exclusive economic zones and global ocean currents (McLeod and Leslie, 2009).

2) **Cumulative Impacts:** Ecosystem based marine management considers the impacts of multiple activities both within and beyond the immediate range of these activities. This requires appreciation of the interactions with drivers of change on both smaller and larger scales, and recognition that individual actions will affect ecosystem services in the immediate and distant vicinity (Guichard and Peterson, 2009).

3) **Multiple Objectives**: Ecosystem based management does not focus on simply one ecosystem service derived from the marine ecosystem, but rather the broad range of services. The multiple series offered can be exemplified by the image of a vibrant marine ecosystem, where several human activities can thrive in tandem with a healthy ecosystem. This requires an insight into the connections between the ecosystems services, in order to enable the inevitable exchanges and potential tradeoffs between sectors (Rosenberg and Sandifer, 2009).

4) **Managing humans and their activities**: Ecosystem based marine management does not entail ecosystem management, rather management of human activities and the impacts and influences upon marine ecosystems (Larkin 1988, Hilborn, 2007).

In the following paper these four pillars of ecosystem based marine management will be used to ground the research in a conceptual base. Each of the instances used to exemplify the use of ecosystem based marine management will reflect back to these pillars, and will demonstrate the potential use of each of the pillars in the Baltic Sea example.

Before applying the ecosystems approach to any fishery it is important to delineate the boundaries of the ecosystem in question. Each of the oceans of the world is of course connected, thus cannot be cleanly cut. Many fish species migrate between seas, and are dependent upon activities that might go on many miles from their location. On a large scale the world's oceans have been categorised into 64 large marine ecosystems (LMEs), of which the Baltic Sea is one. But it cannot be denied that fish migrate from the Baltic, into the North Sea and beyond, therefore activities in the Baltic cannot be considered separate from other oceans. The boundaries of the Baltic Sea LME are defined primarily by geographic and topographic features, which makes the Baltic Sea so particular, and also so vulnerable to the activities of humans – overfishing is but one of the many threats to the Baltic Sea, which already suffers from increased eutrophication due to nutrient excess and pollution from heavy industry and the many populated urban areas along its shores. But even within the one LME there are embedded multiple habitats, each of which hosts its own features, such as sandy beaches, kelp forest, sea grass beds, rocky shores and pelagic habitats, each of which may play a part in the larval, juvenile or adult stage of the fish lifespan or provide an important component in the upper or lower trophic level (Scientific Consensus Statement on Marine

Ecosystem Based Management, 2005). Thus the LME must be considered in its entirety, both spatially and on a trophic level. However, despite substantial advancements in our understanding of marine ecosystems over the past decades, there are still complexities and intricacies of which we have little understanding. In particular our understanding of the vital interactions between trophic levels is inadequate (Persson, personal interview 2010).

The inadequacy of our current knowledge is not; however, necessarily an obstacle in the use and implementation of the ecosystems approach to fisheries, as it can be used in systems that differ in the levels of information and uncertainty by way of the precautionary approach to fishing. This implies that where information is lacking or uncertain it is prudent to err on the side of caution in setting management targets and limits. The higher the level of uncertainty surrounding a certain area or activity, the more stringent management measures would be applied. Because of the transdisciplinarity required for the effective use of the ecosystem approach, and the many complexities, stakeholders and varied objectives, there will always be some element of uncertainty, thus some precaution will always need to be exercised. If at all possible the ecosystems approach would enable a shift in the burden of proof, so that fishing can only take place if it is proven to do no harm to the fish, the habitat, the non-target species or the ecosystems on a whole (Pikitch et al, 2004).

4.3 Stewardship and the fishery

"The human race is challenged more than ever before to demonstrate our mastery, not over nature but of ourselves."

- Rachel Carson (1907 – 1964).

Angry fishermen shout their disapproval of the lowered allowed catch outside the parliament building in Brussels. Local level representatives rile at the decisions made in a distant cities by distant politicians. Consumers curse the ever increasing cost of buying fish for dinner, and fisheries scientists throw their hands up in apathy (Goodlad, 2005 and Mason, 2009. BBC News, 20 November 2007). All the while fish stocks continue to dwindle. There is a call for a new way of thinking about the management of our world resources, perhaps even a change in values, not only in how we value the produce and outcome of the resources, but how we value to resources beyond our own individual gain (Pinkerton, 2009, pp 242).

The key to the sustainability of a fishery is good governance (Hilborn, 2007). In the case of the fishing industry it has been proved time and time again that governance based on top-down regulation and control results in unhappy fishermen, non compliance to rules and, in the long run, a breakdown of the governance system (BS RAC Conference Stockholm, October 2010, Hilborn, 2007). The Chairman of the Danish fishermen's association in a press release October 13 2009, describes legislation introduced by the European commission as "*grotesque and unacceptable... the Danish fishery is being destroyed by bureaucracy*" (Andersen, 2009), clearly expressing dissatisfaction with a central regulation system. On the other hand successful fisheries management systems benefit from governance which is transparent, where decisions are made on an appropriate scale and where the involved stakeholders feel adequately represented throughout the process (Hilborn, 2007). The appreciation of the importance and value of the stakeholders, especially the fishermen themselves is extraordinarily important to foster a sense of stewardship, care for the environment in question, and a long term interest in the future of the resource.

Lacking compliance with set regulations and defiance of the rules has not been ignored in the EU's CFP. Indeed the CFP reform in 2002 introduced the Community Fisheries Control Agency (CFCA), whose task it is to instil a culture of compliance and ensure that the regulations are observed (CFCA factsheet, 2008). Despite the importance of recognition of the problem, it is nonetheless apparent that the CFCA is a typical top-down agency, which reports back to the central EU, thus stripping the fishermen of the responsibility which could instil the sense of stewardship required. The 2009 Green Paper calling for a reform of the CFP also recognizes lacking compliance as a problem, stipulating that "*Fisheries control has generally been weak, penalties are not dissuasive and inspections not frequent enough to encourage compliance*" (Green Paper, 2009 pp 12). The stance taken by the CFP has, traditionally encouraged solutions through increased regulation rather than allocation of ownership; however even in the Green Paper the question is posed weather increasing self-management by the industry might contribute to compliance. This indicates increased awareness for the need for stewardship amongst fishermen.

5 Ecosystem based marine management and stewardship in practice.

The following sections will take the conceptual ideas of EBM and stewardship, and attempt to apply them to the current reality in the Baltic. The connections between the two concepts will be examined, and the result will be analysed to provide a suggestion for tools and management techniques applicable in reality. This will be further grounded in a discussion of two examples of application of EBM and stewardship in real world examples from across the world. This will be related back to the Baltic Sea to try to identify which lessons can be learned from existing examples that can be used in the Baltic Sea setting.

5.1 The role of stewardship amongst consumers.

The question of who should take responsibility of diminishing natural resources is one which is applicable to all the worlds' global commons, not just limited to the fishing sector. A growing global population, relative increasing affluence and a paradigm that demands more and more of the planet has lead to resource disputes over water, minerals, climatic conditions, land, trees and even the clean air we breathe. Fish and fish product consumption has risen dramatically over the past decades, with global consumption nearly doubled since the 1960's (9 kg per capita consumption in 1960, compared to 16 kg consumption in 1997) (WHO Availability and consumption of fish website). Thus, in the neoliberal free market economy, one might argue that the fishermen do nothing but adhere to the market as the best regulatory mechanism; where there is demand there will be a supply (Pinkerton, 2009). This adheres to the path set out in recent years, where market forces are deemed to be the solution to problematics (Jaquet, 2009). Therefore adhering to the market based effort; some might argue that a move towards a more sustainable fishery does not necessarily come from the actions of fishermen and fisheries management, but that this drive should rather come from the side of the consumer. If there was enough demand for sustainably caught fish on the market, then perhaps the fisheries crisis could be averted. However some people would argue that the reason the destruction of marine life by subsidised fishing fleets could proceed as far as it has done is because the public at large have been largely unaware of the state of the problem and the nature of the modern industry (Pauly, 2007). Thus increasing awareness of the fisheries crisis, and allowing consumers to make more informed and educated decisions about their consumption could, potentially, be a step in the right direction: Allowing the public at large to act as stewards over a common resource.

Consumer awareness campaigns and certification schemes have sprung up over the past decade, in an attempt to facilitate the move from consumers towards making informed decisions, and allow the support of certified sustainable fisheries. Recent European consumer polls have revealed that 79% of those questioned feel that the environmental impacts of the seafood is an important consideration, and that 87% would prefer to buy seafood that was eco-labelled (Grey and Hatchard, 2007). Even if this concern is not fully translated into reality at the check-out counter, it does reveal a desire amongst those questioned, for a good and trustworthy eco-labelling scheme.

The first major campaign centred upon the fishing industry was the "dolphin safe" tuna campaign in the 1990. Today there is a host of market based initiatives to try to promote a more sustainable fishery, including Seafood Watch, Friends of the Sea, International Seafood Guide, and most well established and well known; the Marine Stewardship Council (MSC). Despite the good intention behind the certification schemes, they have had to face a series of problematics, amongst others, diversity in the basic definition of sustainability, certification allocation, lacking consideration of socio-economic attributes including food security and the capacity to adapt to local issues as well as the question of whether can it be fair to certify large scale industrial fishing fleets with the same certification as a small scale artisanal fishery? (MSC Hearing, December 2009, Jaquet et al, 2009). The complexities behind certification schemes are further exacerbated by many government schemes advocating higher consumption of fish for health benefits, while at the same time advising restricted consumption of some fish due to mercury and heavy metal content (Brunner et al, 2008). As well as inconsistencies caused by complexities and conflicts, the certification schemes have also suffered a series of mislabelling problematics and simple cheating of the labelling system (Gulbransen, 2009). This jeopardises the credibility amongst consumers, thus taking two (or more!) steps backwards instead of taking steps towards increased education, demand for, and execution of sustainable fisheries throughout the world. Based on the limitations and difficulties of an effective and proficient consumer based promotion of sustainable fisheries it is fair to say that labelling and certification schemes alone will not resolve the global fisheries crisis. Rather they can be seen as facilitation for consumers to make their own informed decisions, and take on the role of stewards in the only way possible to them.

5.2 Stewardship amongst fishermen

The public sentiment of stewardship might, on some scale, promote further steps towards a sustainable fishery, however these steps will be slow to manifest, and in unpredictable days of economic crises, people may prove to be unwilling to pay a premium for sustainably caught fish. If we are to believe fisheries scientists such as Worm et al.'s claims that the world fisheries will have collapsed by 2048, then perhaps we do not have time to wait for slow change. Even less alarmist reports than Worm et al.'s infamous prediction call for rapid change. Thus stewardship must be fostered elsewhere, and we must look to other solutions than simply the market. Thus this paper argues that the promotion of a sense of stewardship amongst fishermen will play a vital role in the implementation of EBM in the Baltic Sea.

In the Baltic Sea there have been a variety of different attempts at management tools and conservation techniques. Most of these have been very much focused upon single species conservation, and have used stock assessments as an indicator of success. Very little research has been carried out to assess the fishermen's opinions and feelings about the regulations and restrictions (Suuronen, 2010). However a few studies have been carried out recently to assess fishermen's reactions to Marine Protected Areas (MPA's) in

the Baltic. Although these studies do not strictly adhere to questions of stewardship, some of the results do reveal a desire for more responsibility to be designated to fishermen, and flexibility to make decisions not solely based on a high income today, but with consideration of the future. Suuronen et al. report that the fishermen interviewed in their studies about MPA's expressed the following: "*Being allowed to catch larger legal sized fish in the most favourable fishing grounds would reduce cost of harvests i.e. increase profitability of harvests. According to their views it would also decrease the capture and discarding of undersized cod because fishermen would not be displaced towards areas dominated by smaller sized fish. Swedish fishermen were also in favour of improved gear selectivity and gradual increase of minimum landing size.*" Furthermore the fishermen involved in this study expressed that simplicity and flexibility of management systems, with clearly stated long term goals would be beneficial to the fishery. It was also found that management activities should be equal for all fishermen, regardless of nationality*[7]

This evidence demonstrates that, certainly the fishermen interviewed in this instance, have a wish for more responsibility. This is in stark contrast to the experience expressed by Peter Larkin, a renowned fisheries manager who, in the 1970's was confronted with the attitude from fishermen that "*my job is to catch as many fish as possible, your job is to keep me from catching too many...*" (Hilborn, 2007). Fisheries management is far more reliable, useful and effective in a working environment of transparency, mutual respect and cooperation. This cooperation allows managers to extract correct and reliable data from fishermen, thus further enhancing an additional aspect of EBM. It fosters a culture of compliance and gives fishermen incentives to fish in a non-destructive manner (Hilborn, 2007).

5.3 Stewardship within the dedicated access regime

Conventional fisheries management throughout the past decades has been dominated by the theory that increased regulation will result in a more sustainable fishery (Fujita, 2005). However experience with this approach has far from always resulted in the desired outcome. Regulation tools such as limited time at sea, stringent total allowable catch levels, closed areas have, in many instances, exacerbated the "race to fish", and have often put fishermen, managers, scientists and environmentalist and odds with one another. This is further revealed in an excerpt from the US Commission on Ocean Policy (2004, pp 287), and is equally relevant for European example:

"The race to fish has created an unfortunate cat-and-mouse-chase. In response to each new measure designed to limit fishing effort, fishermen developed new fishing methods that, although legal, undermined the goal of reaching sustainable harvest levels. This prompted managers to promulgate more restrictive measures and fishermen to develop more ingenious methods to work around them. For example, if managers limited the length of the boat, fishermen increased its width to hold more catch. If managers then limited the width, fishermen installed bigger motors to allow then to get back and forth from fishing grounds faster. If managers limited engine horsepower, fishermen used secondary boats to offload catch while they kept on fishing."

[7] At present there are conflicting regulations. For example seasonal closures of differing lengths depending on nationality, and different landing size rules (Suuronen et al, 2010 and Øresundsvandsamarbejdet, 2009). This makes policing of regulations difficult, and breeds discontentedness amongst fishermen.

Dedicated access is an approach which is being increasingly advocated within fisheries management is the assignment of access privileges to fish specific entities using appropriate methods for the prevalent community, economic and environmental conditions. Although this approach is not directly advocated within the EBM approach, this paper argues that the assignment of dedicated access does indeed adhere to EBM, and that the dedicated access approach allows the fishermen or communities who hold the access to act as long term stewards of their dedicated resource. Thus allocating responsibility to the industry and giving the fishermen a stake in the long term health of the marine ecosystem upon which they rely.

The assignment of access to the fishery encloses the ocean commons, and creates an incentive for fishermen and fishing fleets to maximise profits, not through maximisation of catch, but rather maximisation of efficiency and increasing the quality of the product and thus also the eventual price (Hilborn et al, 2005). The fishery is able to become more efficient, as the fishermen tailor their investment in the fleets to suit their share of fish. This allows a cost reduction as opposed to the former practice of overinvestment in order to compete in the "race to fish". The dedicated access system allows fishermen to fish for a longer period of the season due to reduced overall capacity. This means a less rushed fishing season, more time to take steps to avoid bycatch, eliminate the practice of high grading and focus on production of high quality fish. Longer fishing seasons also reduce sloppy behaviour at sea and high risk fishing where fishermen go to sea in inclement weather conditions, cause habitat damage through carelessness, loose gear, suffer high bycatch rates and risk creating a supply glut on the market thus loosing the value of their efforts (Fujita and Bonzon, 2005). A longer fishing season is equally beneficial to the ecosystem as more fish are left in the ocean to fulfil their ecological roles, thus it is a win-win situation.

Conventional fisheries management regulation is often unpopular with fishermen, and the suggested regulations are, as aforementioned often disregarded or diverted to allow fishermen to continue fishing. However there is a clear connection between profitability of the fishery and willingness to comply with management tools. When fishermen feel put upon, and when regulations reduce incomes it is only natural and fully understandable that the fishermen vehemently oppose the regulations (Goodlad, 2005). However if the fishermen can see improved financial gain from management tools, as is prescribed by dedicated access, then the fishermen are likely to conform to the conservation measures, support conservation and increase compliance, while at the same time increasing profits (Fujita and Bonzon, 2005). The conversion of maximum catch to maximum value focus also typically results in better compliance with conservation measures, such as protected areas for spawning and migration paths, because the fishermen continue to have a stake in the health of the fish throughout their lifespan, not just as catch in the net.

The dedicated access system, which also goes by the name of fishing tenure, local rights or rights-based fishery management, comes in several forms, some of which have more success in promoting sustainability than others. The Individual Transferrable Quota (ITQ) system is one which has been in place in several sites since the 1970's. Initially used in Iceland and New Zealand, ITQ's are privatisation of access which aims to solve the problem of overfishing through market based tools, allowing the transferability of fishing rights via the free market. ITQ management strategies are primarily devised for single species, as opposed to EBM (Hilborn et al, 2005). In many cases the ITQ system has seen the fishing rights being bought up by the highest bidder, often distant from the coastal communities, and sometimes even from a distant country. Revocation of access for local fishermen, reduced diversification of communities and a loss of flexibility and adaptability in nearby coastal communities have ensued (Pinkerton, 2009). A dedicated access system based on the principles of EBM would ensure that flexibility and adaptability of near coastal communities are not compromised. The dedicated access would be allocated over long time periods, thus allowing the

fishermen or community with the fishing rights to take responsibility and bear the consequence of long term planning for the future. This is in contrast to the ITQ system where rights can be sold as soon as the fishery exhibits loss of productivity (Branch et al. 2006).

Another difference is that the dedicated access system brings with it strong incentives for fishermen and the access holders, be it community, individuals or cooperatives, to invest in research, management strategies and data collection to make the most of the resource over time. This is due to the asset value of the resource being allocated to the access holder, thus there is an interest in sustaining productivity over time, rather than the focus upon short term gains resulting in practice such as excessive discards and high-grading to only land the most profitable fish of the day (Hilborn et al, 2005).

Despite the benefits of the dedicated access system it does still present several challenges which must be overcome to ensure effective implementation. In particular the process of allocating the access privileges can be contentious, causing rifts in community and creating a ranking of access holders. Current CFP allocation of total allowable catches are based on the idea of "relative stability", which fixes allocation to member states based on historic catches. This method aims to prevent repeated annual argument, and is intended to provide fishermen with a catch allowance stable to the state of the stock in question. Compared to the concept of EBM, and in line with stewardship, the relative stability concept is quite obsolete. The system eliminates the possibility for flexibility within the catch sector, disallowing adoption of different techniques or patterns. It contributes further to the practice of discarding by generating more national quotas. It encourages short-term decision making, focuses only on personal profit at the expense of holistic and long term thinking (CFP users guide, 2009 and Green Paper 2009).

Armed with the benefits of stewardship and long term thinking, it is nonetheless difficult to allocate dedicated access, as reducing fleet capacity must inevitably result in some winners and some losers (Branch el al, 2006). Suggestions on how to overcome this potential social volatility are provided by the NRC 1999. Suggestions include an equal opportunity lottery system, a priority ranking or a market mechanism. The market mechanism would, in the case of EBM, be less than ideal, as the access would simply be outsourced to the highest bidder rather than the local community thus resulting in similar social discrepancies as described by the ITQ system. (NRC, 1999, pp 143 – 147).

As for the fishermen who lose out and are not allocated fishing access, Ezcurra et al. (2009, pp 241) use an example of allocation of no-take–marine reserves in the Gulf of California to suggest that fishermen put their unique knowledge and understanding of the seas to good use; helping with research, monitoring and studies of the seas, in order to further understanding and appreciation of the ecosystem on a whole. This would additionally help to breach the gap between scientists and fishermen, which so often occurs when scientists make suggestions to curb fishing efforts (Branch et al, 2006, Hilborn, 2007).

5.4 The connections between EBM and stewardship.

An essential component of the evolved understanding of the importance of ecosystems, their services and human's role in the system, is the importance of the healthy ecosystem function overtime. If we are to continue to reap the benefits, the health of the system must be cared for and nurtured. This signifies a notable expansion of the scale of moral concern; recognition that there is a moral responsibility on an intergenerational level; that moral obligations extend beyond our immediate interests and to the interests of future generations (Moore and Russel, 2009, pp. 336). The effective and pragmatic use of EMB will not only require the massive task of developing an understanding and appreciation of all the minute physical

connections which unite each level of the ecosystem, as well as human activities. It will also call for careful consideration of the social, cultural and spiritual context of management decisions which, in accordance to the aforementioned second pillar of EBM, cannot exclude the deep awareness of our moral obligation to future generations (Moore and Russel, 2009, pp 338).

The moral theory behind EBM and the reasoning behind environmental stewardship has been identified as being dominantly consequentialist (Moore and Russel, 2009 pp 326). This implies that the weight of morality behind actions is determined by the effect the actions have or will have in the future. In simple terms; the right course of action is the one that is most likely to maximise benefits. To some this might denote the most value to humans, with little or no thought beyond human wants and needs. However there is an evolving development and growing understanding within this theory, to which EBM adheres. Beyond looking only at human well-being as the goal of management actions, there has developed a realisation that there are innumerable connections to the ecosystems around us. Meaning that human well-being, health, happiness and productivity is inexorably reliant upon the heath of the ecosystem which supports it. This is expressed by the US Commission on Ocean Policy (2004, pp 66): "*While humans have always depended upon particularly valued species for food, medicine, and other useful products, there has been a clear tendency to ignore species that do not have a clear recognisable impact upon society. However, it is now understood that every species makes some contribution to the structure and function of its ecosystem.*" This understanding is currently undergoing further evolution to include less tangible concepts too; spiritual value, creative capacity, intellectual dexterity and a sense of belonging, all of which are intricate to value and measure, but essential nonetheless (Kellert, 2003).

5.5 The four pillars of EBM and their relevance to stewardship.

The intricate links between EBM and stewardship are apparent on a theoretical scale, however on a pragmatic level the connection may be flimsy and easily lost in the array of interventions and actions required for effective naissance and implementation of EBM. However the genuine sense of stewardship and long term care for the ecosystem are what will allow EBM to thrive over time. It is with the practical implementation that the aforementioned four pillars of EBM can be used as a constant reference point to ensure that stewardship is adequately fostered throughout the process.

The first of the four pillars: **Connections**. This pillar of EBM, understanding the linkages between both human and ecological systems is perhaps that which exhibits the most apparent relevance to stewardship. The linkages on the ecological scale are what need to be understood and protected, for example by conserving spawning grounds and migration paths, preserving the delicate trophic balance and ensuring that human activities do not have negative effects on either side of the target species.

The links on the human scale; inextricable links between social, economic and ecological systems pertain to stewardship. People will always strive to maximise their sense of well being, and if this motivation can be harnessed to work in tandem with ecological, economic and social goals then that is one step closer to the establishment of sustainable fisheries (Branch et al. 2006).

The second pillar: **Cumulative Impacts**. For stewardship to penetrate the cumulative impacts required as a facet of EBM, the stewards, i.e. the fishermen will need to be conscious of the effects of their activities both within their own range, on a small scale, and beyond their immediate vicinity, on a large scale. In practice this will require education and appreciation, as well as admission that not all the cumulative

impacts are fully understood, but that in such instances a precautionary approach is adopted to protect before damage can be done.

The third pillar: **Multiple objectives**. Consideration of the broad range of ecosystems services offered by a healthy marine ecosystem requires that the concept of stewardship goes beyond just the fishermen, and is shared with all the users of the direct and indirect marine ecosystem services. In this instance the utilitarian provision of fish as a food source is the most palpable ecosystem service, however a range of services beyond the fishery are also important (Helfman, 2007, pp 13). For example the nutrient cycle, carbon sequestration, water drainage systems, habitat provision and cultural tradition through human interactions with the marine and coastal environment. In practice this would require stewardship to be encouraged within all user groups, such as farmers whose waterways end at the sea, local industries who make use of the coastal services and the tourist trade which relies upon clean and healthy waters for value creation. An essential point is that all these services are, in some way, connected, and as expressed by Chapin et al (2000) "*ecosystems services are generated by the biodiversity present in natural ecosystems*." Thus the actions of the fishermen will affect the actions a land based users and vice-versa. This will also require an appreciation and understanding of the complexities of the ecosystems services, both to humans and to other members of the ecosystem (Helfman, 2007, pp 13).

The fourth pillar: **Managing humans and their activities**. Managing people and human activities does not simply entail giving orders and expecting them to be followed (Larkin, 1988). Learning from past instances of fisheries management teaches us that the key to the sustainability of fisheries is good governance (Hilborn, 2007). This entails a scale of decision making appropriate to the fishery, adequate stakeholder representation and transparency of the governance system. However the stakeholder representation, just governance and transparency can be difficult in a sphere with so many differing opinions, aims and goals. Nonetheless there is wide recognition within the fishing community that the Baltic fishery needs a different management strategy and that overcapacity is a serious problem. There seems to be a consensus that capacity needs to be reduced, subsidies removed and exploitation rates lowered. There is agreement on where to go, but disagreement in how to get there. Ecologists recommend marine protected areas and closure of grounds, managers want to encourage stock building while allowing fishing to continue and economists promote fishing further down the food chain to different fish species (Hilborn, 2007). This disagreement can perhaps be breached by the use of the ecosystems approach, where humans are seen as a vital entity of the marine system, where vulnerable zones are protected and the spill over effect of protected areas allow fishermen to enjoy a earning money from a valued and lasting resource.

5.6 Learning from real world experiences.

"Wise men profit more from fools than fools from wise men; for the wise men shun the mistakes of fools, but fools do not imitate the successes of the wise."

- Cato the Elder (234 BC – 149 BC), from Plutarch, Lives (via Bennet, 2005).

The following paragraphs will take examples of international instances of implementation of EBM and use the lessons learned in these real world examples to illustrate what steps could be taken to implement EBM and stewardship in the Baltic. It must be emphasized that one of the most important aspects of EBM is that it must be adaptive to each unique example, and must be flexible – thus instances from other regions could never be precisely superimposed onto the Baltic, as there is no single prescription for a sustainable fishery. (Hilborn, 2007). However this does not prohibit lessons being learned from the successes and failures of

other examples. There are perceptions that the implementation o f EBM is complicated, expensive and thus prohibitive and as a result of these perceptions there are few examples of marine EBM on a large scale. The instances which do exist tend to be fishery based, relatively small scale, or still in initial phases. Thus much of the reasoning behind EBM is theoretical (Tallis et al, 2010). However in this instance two examples have been selected, each to illustrate a specific point; Chesapeake Bay, one of the world's leading examples of EBM, shares many characteristics with the Baltic Sea example. The other instance, from the Shetland Islands is particularly apt to demonstrate the importance of the sense of ownership over the fishery and the management plans, which results in an enhanced sense of stewardship amongst the fishermen.

5.7 Real world example one: Effective sector integration in Chesapeake Bay, USA.

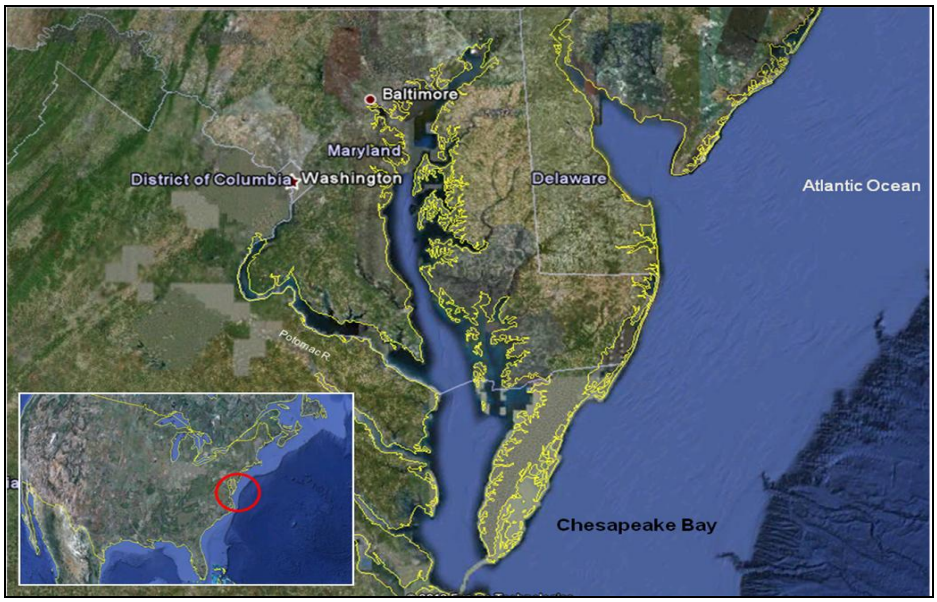

Figure 3: Map of Chesapeake Bay, location of one of the world's most comprehensive applications of ecosystems based management (Source: Google-earth.com).

One of the world's most inclusive, thorough and long lived attempts at implementation of EBM is in Chesapeake Bay, USA (location map figure 3). It is an example of management which must, and has, taken into consideration a vast ecological area, an array of differing habitats and flora and fauna, a range of industries and economic activities, as well as dense human populations on its shores. Thus there are many similarities between the Baltic and Chesapeake Bay, and managers in the Baltic would do well in taking examples of the successes, and learning lessons from the failures of management of Chesapeake Bay. Similarities include a comparable population, with 15 million people living within ten kilometres of the Baltic shores, compared to 16 million living in the Chesapeake Basin (Geographica World Atlas, 2007). Several metropolises lie on the coasts of the Chesapeake Bay; Washington DC, Baltimore, Richmond and Norfolk, the history and development of which have resulted in many of the environmental issues which parallel those faced in the Baltic; eutrophication of waters due to agricultural runoff, growing populations, nutrient leaching, non-source pollution as well as the dwindling fish and shell fish stocks. In the Chesapeake Bay region these problems were, as is conventional, originally tackled as individual issues, with managers and scientists working on separate sectors. However already in the 1980's an increasingly ecosystem based approach was employed, including various interventions to protect forest, reduce eutrophication by limiting fertilisation, attempts at reduction of urban sprawl and reduction in harmful effluence. A range of

limits were also placed on the otherwise rapidly deteriorating fishing industry of the region, curbing harvest of several commercial species, creating sanctuaries for sedentary shell fish species and restoration of wetlands, sea grass beds and migratory routs upstream (USGS Chesapeake Bay Activities website, 2010).

Many of the interventions could, potentially have been devastating to the fishing communities, and in many instances the changes in conditions did force social and institutional change. However an opinion voiced by Chambers (2006), in a heritage and cultural history of Chesapeake Bay, expressed that the lifestyles and the livelihoods of coastal and fishing communities are inherently flexible and adaptable to changing economic and environmental circumstances. Variations in markets, currents, historical and ecological events are required that coastal communities are adaptable to change. Coastal and fishing communities in the Baltic would perhaps do well to keep this flexibility in mind when it comes to changing the habits and fishing methods of a lifetime.

However it would be naïve to think that moves to reduce catch can be carried out without some objection. In the instance of Chesapeake Bay the reduction of catch of the most lucrative commercial species; the Blue Crab by 15% in 2002 generated controversy and disagreement amongst scientists, managers and fishermen. This mistrust is paralleled in many fishing sectors the world over, including the Baltic (Lindeman, personal interview, 2010). In Chesapeake Bay this concern is being tackled by escalating stakeholder involvement and generating public sentiment surrounding the issue, engaging stakeholder in decision making and inclusion of stakeholders in policy implementation (Boesch and Goldman, 2009).

The decline in fish and shellfish catch, due to stock depletion and limitations by policy have also lead to a shift in employment. Less capacity in the fishing industry has necessitated a move towards new occupations. Thankfully more and more people are making use of the bay beyond fishing, including recreation, leisure boating and recreational fishing. This has allowed fishermen to adapt to the new requirements of the region, leasing boats to recreational users, facilitating tourism and perhaps even assisting in improving aspects of the ecosystem such as water quality through monitoring, and conservation skills. (USGS Chesapeake Bay Activities website, 2010).

The observed shift can be described as a move from extraction of resources to instead a higher level of stewardship of the resources; for Chesapeake Bay to remain attractive to recreational users it is important that waters are clean, water quality is good and biodiversity is vibrant. This message is strengthened by an annual "report card", produced by the Chesapeake Bay foundation and printed in the local newspapers. To score an entire complex, multifaceted ecosystem on a "report card" is a near-impossible task, however the health of the environment is "averaged out" to generate a message that is clear and easy to grasp, and this project is still under development to create scores on a regional level also, and to make the connections between fish populations, water health, nutrient leaching, agricultural activities and other human activities understandable to all interested stakeholders and laymen (Boesch and Goldman, 2009).

In the Baltic Sea example the involvement of inhabitants of the region and laymen could be part of an important step towards enhancing a sense stewardship in the communities at large, and bestriding the otherwise sectoral approach to marine and coastal management. This would, as is attempted by the Chesapeake Bay "report card" require information and education aimed at the public, making the information accessible and comprehensible and highlighting how the multitude of problems affect us each in person. Many of the threats are, to the average Baltic resident, perhaps invisible to the naked eye. Tales of climate change, habitat loss, fish stock collapse and the near extinction of countless marine (and terrestrial) animals have lead to a phenomenon of "environmental fatigue", where people simply feel

overwhelmed by the environmental crisis, and thus choose apathy as a simple diversion (Kerr, 2009). However if the problems of the Baltic Sea are made tangible and personal, then perhaps more interest could be generated. A good example might be the issue of eutrophication. Recent summers have seen growing instances of closed beaches on the coasts of the Baltic due to algal blooms and dangerous toxins in the coastal waters, this is as a result of initial stages of eutrophication. This problem, upsetting as it is, makes the environmental issues surrounding the coasts real and physical to every bather, walker and user of the coasts. Thus by educating, informing and highlighting the roots of the problem, stakeholders and concerned members of the public would be able to identify their own role in the problem and thus also enhance a sense responsibility for the issue, albeit on a small scale. It is important that information be distributed in a way that is not accusatory, critical or pointing fingers at anybody in particular. The issues being dealt with are a result of historical activities for which no one person holds responsibility, and we have all, in some way, reaped the benefits of the actions which are now creating the problems in the Baltic Seas.

The example of EBM implementation in Chesapeake Bay is not flawless. The region continues to face an array of environmental threats, including severe eutrophication (Campbell, 2009). Nonetheless it is valuable to gain insights into the successful integration of sectors, and the attempts at making the projects and interventions accessible and comprehensible to laymen who, directly or indirectly, also hold a stake in the health of their coastal region.

5.8 Real world example two: At the helm of EBM on the Shetland Islands, Scotland.

Figure 4: Location map indicating the Shetland Islands in the north of the UK. An example of where community management has turned the fishery around. (Source: Goole earth.com)

One of the most unique aspects of EBM, which differentiates it from many other fisheries management approaches, is the importance of integration of humans and human needs into the otherwise species dominated regime. Identification of a successful fishery is, certainly, recognized by balanced fishing efforts,

stable stock levels, profitability, allowing the industry to operate without the aid of subsidies, are all generally regarded as principal indicators of a healthy fishery. However an additional indicator which is advocated here, could be how well fishermen and the fishing community are integrated in the establishment and procedures of fisheries management (Goodlad, 2005). An often-cited example of this integration come from the community based management initiatives in the Shetland Islands in Scotland. Although this example does not strictly adhere to all the principles of EBM, it does underline the importance of, and the road to a sense of stewardship in conservation of fisheries.

The Shetland Islands are one of the most important fishing centres of Europe, however with its extreme location in the far North of the UK it has, in many ways been a distinct unit, economically, socially, environmentally and culturally*[8]. Despite this peripheral location Shetland has proved itself to be central to co-management development of fisheries management.

Fish and fish products stand for ca 80% of Shetlands exports, with an annual value of the catch at ca £45 million, and ca 20% of the workforce are employed within the fishing industry. Thus the fishery, dominated by sand eel catch, decline in the 1980's had the potential for grim consequences for the otherwise resource poor region. In 1991 the sand eel stock was close to collapse, and a moratorium upon catch was imposed for four years. Environmental groups also voiced loud concerns that the fishing industry was taking its toll upon the unique seabird colonies which populate the Shetlands, due to the use of destructive fishing gear. In 1995 the moratorium was lifted, but with heavy restrictions upon catch size. This displeased both the fishermen who were losing revenue and the environmental groups wanting to conserve seabirds, who felt that the move did nothing to protect the bird populations. However this stalemate was broken when, for the first time, fishermen and the environmental groups met to find an improved management scheme for the fishery (Goodlad, 2005). After extensive discussions is was agreed that a community fishing quota should be initiated, with a two month closed season allowing for the undisturbed lifecycle of the seabirds. Furthermore the fishery should be managed by the local fishing industry's elected representatives, rather than the central Scottish office (Crean, 1999). Since the establishment in 1998, the Shetland fishery reports success, with limited ships allowed to fish, no vessels larger than 20 metres, and quotas set according to sound scientific advice. The vessels allowed to participate in the fishery were allocated, by fishermen, according to those holding a historical record of fishing in the area, thus the access rights were retained within the local community. Gear regulations and considerate fishing practice has resulted in the recovery of seabird populations. Support from stakeholders and the community, operation by locally elected representatives, responsibility allocated to the fishermen themselves has all been a part of enhancing the sense of ownership and stewardship of the fishery resource (Goodlad, 2005).

An important issue when considering the implementation of EBM, especially when trying to ensure a sense of stewardship and ownership amongst stakeholders is who or what regulatory body is to stand at the helm and direct the management system, this is the lesson that can be learned from the Shetland example. There are many additional examples of small scale co management and local level fisheries management systems across the world, but many of these remain on a small, relatively local level. (Tallis et al, 2010). However within the EU the need for devolution of management from the current centralised system has been recognized with the establishment of the Regional Advisory Councils, consisting of stakeholders who can feed information into the CFP (RAC factsheet 2008). Despite this acknowledgement, the RACs are

[8] Due to the historical connections Shetland retains strong links with the Baltic countries.

nonetheless a part of the macro level management. Perhaps effective EBM with genuine stewardship would require even more responsibility devolved to the regional level. The example from the Shetland Islands demonstrates how the contentious sand eel fishery was turned around through cooperation between environmentalists, fishermen, the state and other relevant stakeholders (Cunningham, 2005). A regulatory order, consisting of representatives from local government, environmental NGO's, local community councils, processing plants as well as fishermen was set up and a series of regulations, dedicates access and an enforcement system were devised. A major downfall of this system is however that the regulatory order has no genuine enforcement power. There is no mandate for the regulatory order to police or prosecute non compliance. However, in a clear testament to the effectiveness and power of local management, this potential downfall has never been put to the test. The management system has been drawn up, executed by and administered by local fishermen and stakeholders, thus commands widespread support and regulation compliance (Goodlad, 2005).

The example of the Shetland Islands is far from unique. Similar instances of community management can be seen working effectively in parts of the Gulf of Mexico, California (Ezcurra, 2009), in Andhra Pradesh, India (Salagrama, 2005) and in Kayar in Senegal (Alioune and Catanzano, 2005).

5.9 Moving forwards with EBM.

The effective use and implementation of EBM has been hemmed in by perceptions of shortcomings and challenges. However the instances delineated in this thesis demonstrate that taking steps towards EBM is not necessarily an impossibility. The initiation of EBM as a management tool to date has been plagued by limitations which can be boiled down to two main points; consideration of single sectors as separate entities and overlooking the important role of ecosystem services in management and decision making (Lindegren, 2010, personal interview). However growing evidence from science and academia, not to mention the failings of the current system, could trigger a move towards a more ecosystem based mind set.

One of the major barriers particularly pertinent to the Baltic Sea is the international setting. The nine countries holding a stake in the Baltic Sea fishery each have their own standards and agenda when it comes to marine and fisheries management. An intervention on one side of the Baltic may seem acceptable and satisfactory, but might be unthinkable on the other. This presents a big problem to EBM, which requires the cooperation of all the users of the sea to be effective. The EU has certainly tried to breach these differences, through the traditional allocation of quotas according to relative stability (as mentioned in section 5.3), however the regulative allocation of rules is perhaps not in line with the aim of enhanced stewardship. This highlights the need for good, cross-border cooperation, and the need for international governance. The BS RAC (as mentioned in section 3.3), attempts to bring together stakeholders from each of the member a country, thus this does represent a step in the right direction. However without the full cooperation of all involved states, this will continue to present a challenge.

6 Conclusion

This thesis has considered a fraction of the many vital aspects of successful fisheries management. It has proposed how fishermen, standing on the front line of the fisheries crisis, might be brought onboard the growing wave of EBM (Tallis et al, 2010). The connections between EBM and stewardship have been examined on a theoretical level, and have been linked through the use of a dedicated access to fisheries

regime. These concepts have then been grounded into reality by consideration of two real world examples of EBM, and certain relevant aspects from these have been used to reflect upon potential moves towards EBM in the Baltic.

The recognition that only intact, healthy ecosystems can provide the complete range of benefits that humans want and need over time will be imperative to the transition towards EBM. However if we are to continue to reap the benefits, then the current single species, single sector management approach should be abandoned. There is a vast array of actions required for this to be done effectively and successfully, however the importance of stakeholder engagement, transparency, support between sectors, and enhanced stewardship must not be ignored. If this can be done properly the benefits could be unbounded. Allowing the input from fishermen into the knowledge base, having reliable, consistent data, allocation of fishing rights and fostering a sense of ownership can all play a part in the move towards a more sustainable fishery. This would also allow inclusion of stakeholders beyond just the fish catch sector, but would include stakeholders throughout the Baltic region. Consumers who feel empowered and informed to make the "right decisions" are also a step in the direction of EBM.

Nonetheless, there is much more to be done, with a host implications and some controversy within the proposed solutions. Fisheries management is broad ranging and transdiciplinary, therefore one could never hope to provide a silver bullet solution on paper. Rather fisheries management needs to be carried out in the field, to allow adaptation and flexibility to work within each unique and distinctive instance. Nonetheless it is important and valuable to consider the theory behind the actions, and especially to learn lessons from real world examples. By explicitly linking EBM with stewardship, through the dedicated access tool it is hoped that this paper will provide a concrete stepping stone between the theoretical design of EBM and the real world implementation of EBM. The links between EBM and stewardship through dedicated access which have been examined here demonstrate that these concepts can work in tandem and that they provide a crucial step towards the transition to sustainable fisheries in the Baltic. At present a decisive move towards EBM seems very distant, with most management remaining within the singe-species approach (Lindegren, 2010, personal interview). Nonetheless solutions must be devised and suggested if we are to move beyond the fisheries crisis in the Baltic and the oceans at large. The Baltic Sea setting should provide the ideal locale for this move. The willingness to cooperate between nations, the manageable scale and not least the pressing fisheries crisis could, if implemented well, bring the Baltic to the forefront of fisheries management. This could serve as a model both to the European level fisheries, but also globally.

The following section will conclude this thesis by linking the fisheries crisis to sustainability issues in society at large, and will suggest a few of the potential trajectories for further research within the field.

6.1 Implications of a Sustainable Fishery on a Large Scale

Healthy fisheries have their greatest instrumental value to human beings as a utilitarian resource. They provide food and thus drive an economic sector. However a healthy fishery is also important as a segment of a wider ecosystem. Typically the "charismatic" species; polar bears, dolphins and pandas, have been used as ecosystem health indicators (Williams and Dublin, 2000), however in the waters of the Baltic the "charismatics" are few and far between. Thus an assessment of ecosystem health, biodiversity and integrity of the environment would often rely upon the profusion, species, composition and roles of fish because they are relatively easy to tally, classify and are responsive to ecological changes. Accordingly the

fish stock can serve as a repository of information about the environment (Helfman, 2007). Fish species which occupy the top of the food web can be of further interest to humans, as bioaccumulation of toxins and heavy metals in fish could provide advance warning to humans about water quality conditions and the presence of pollutants which might affect human health (Bernes, 2004).

Convincing the public at large that we need to protect and conserve fishery resources is not difficult. Reasoned argument, explanation of the importance and a general understanding of ecosystems is enough to persuade most people that the fisheries of the world are threatened and something should be done about it. However what is much harder is convincing the public that expenditure of public funds, tax money and considerable effort will be necessary to protect species which may or may not have economic utility, which may or may not collapse despite our best efforts, or habitats which we may never visit nor desire to visit. Facing this challenge will require understanding and appreciation of the inherent, nonutilitarian value of the ecosystem as a whole (Helfman, 2007). In many ways this challenge is mirrored in many other environmental and sustainability issues, in that humans have been charged with the position of intergenerational stewards, conserving a resource which may or may not be of value to future generations.

One of the basic premises of EBM is that humans are an important part of the ecological system. In the literature and textbooks on the topic this in most cases refers to humans as part of the ecological chain. However the human role in the ecosystem can, with a little resourcefulness, be enlarged to a far larger scale. An example is the knock on effect of the overcapacity and overexploitation of many of the EU's fishing grounds. The overexploitation at home has lead to the purchase of fishing rights abroad, at fishing grounds off the coasts of Africa, the Caribbean and distant Pacific Islands. These purchases, known as fisheries partnership agreements (FPAs) have lead to the fishing rights being taken away from local artisanal fishermen, and allocated to large scale fishing vessels (WWF Fishing problems: Unfair fisheries partnership agreements). With little or no other option, the local fishermen are forced to turn to alternative options for survival. Some, most notoriously off the coast of Somalia turn to piracy; hijacking ships and tankers for ransom money. Others are forced to flee their countries and turn to the western world for help as economic migrants. Yet others make the perilous journey across waters in small boats and join the swelling ranks of illegal immigrants on the coasts of Spain, Italy and France, all in search of a better life (Conference on small scale fisheries, trade agreements and human rights, September, 2009, Copenhagen). Although it would be an immense, perhaps never ending task, a comparison of the cost to society of these factors, to the cost of effective fisheries management, could prove to be very telling (Lindegren, personal interview, 2010). Indeed, in some instances the FPA's work well, with the intention of funding reaching developing communities to assist in alternative occupation. However in many instances the intended funding disappears on the winding path of corruption. The linkages from the unsustainable fishery in Europe, to the major social and economic challenge of piracy and illegal immigration are not farfetched. Therein lays the significance of transboundary governance, and the extension of the sense of stewardship beyond one's own backyard, to stewardship on a large scale, of the resource as a whole. The global fisheries crisis is a worldwide problem, which requires local, adaptive solutions to each unique ecosystem. Otherwise there is a real risk that good governance in one location but not in another will simply result in the export of the problem – as is exemplified by the FPAs.

6.2 Further Study

Further study within the range of this thesis topic might include closer examination of the genuine desire amongst ordinary fishermen for increased responsibility. Much of the information in this thesis has been sourced from literature, meetings and interviews where the stakeholders are already engaged, thus perhaps skewing the responses. It would perhaps be of interest to interview less "engaged" fishermen, to gain a broader perspective on the question. Questionnaires could be sent out and interviews conducted to gain an insight into the fishermen's views upon EBM and stewardship.

Additional study must also consider the many other requirements needed for implementation of EBM in the Baltic. Figure 1 in section 1.1 suggests six requirements, in addition to the stewardship examined in this paper. Research and understanding of ecosystem connections, good and transboundary governance, potential effects of climate change, other stakeholder engagement and integration of sectoral approaches, as well as many other aspects need to be examined in order to effectively implement EBM. Indeed the necessity of these aspects would be true in any fishery, however the Baltic is surely well on the way, being one of the most closely researched and examined water bodies in the world, and having a relatively large resource base available to invest in the requirements.

One of the specified requirements; climate change seems to be the catchphrase of the decade, and yet it is much more than a catch phrase, even within the scope of the Baltic Sea. Several ongoing studies are currently looking into the environmental effects of temperature and climate variations in the Baltic (Lindegren, 2009). The results of these will be very relevant in order to further the understanding of the ecosystem and what the effects might be of shifting migration routes, plankton blooms and algal growth in the Baltic, to name but a few, as these will all impact the fishery with potentially devastating or beneficial consequences. The impending consequences of climate change upon fisheries is also acknowledged by the CFP in the 2009 Green Paper. The question of the effects of climate change and how to ensure that fisheries do not undermine the resilience of marine ecosystems is stated as one of the major challenges for the future knowledge base for the CFP reform.

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http://www.fao.org/docrep/011/i0250e/i0250e00.htm (accessed April 2010).

HELCOM The Baltic Sea Joint Comprehensive Environmental Action Programme:
http://www.baltic.vtt.fi/demo/balful.html (accessed April 2010).

HELCOM website:
http://www.helcom.fi/home/en_GB/welcome/ (accessed April 2010).

ICES Advice Help Sheet:
http://www.ices.dk/advice/fishstocks.asp (accessed May 2010).

Mason Chris (2009) "EU Begins Fisheries Policy Review" BBC News 25 May 2009.
http://news.bbc.co.uk/2/hi/europe/8066509.stm (accessed March 2010).

US Commission on Ocean Policy September 20th, 2004:
http://oceancommission.gov/ (accessed March / April 2010).

USGS Chesapeake Bay Activities website:
http://chesapeake.usgs.gov/: (accessed March – April 2010).

WHO Global and Regional Food consumption Patterns and Trends:
www.who.int/nutrition/topics/3_foodconsumption/en/index5.html (accessed March 2010).

WWF Fishing problems: Unfair fisheries partnership agreements:
http://wwf.panda.org/about_our_earth/blue_planet/problems/problems_fishing/access_agreements/
(accessed May 2010).

8 Appendix One:

8.1 Expert Interviews

Clink Sally, BS RAC Executive Secretary

August 2009 – April 2010, Copenhagen, Denmark.

Persson Anders, Associate Professor, Lund University, Limnology Dept.

Tuesday 9 Febuary, 2010, Lund, Sweden.

Lindegren Martin, Post Doc. DTU Aqua

Friday 19 February, 2010, Malmö, Sweden.

Milewska Ewa, WWF Poland

Friday 26 February, 2010. (via e-mail)

Predki Piotr, WWF Poland

Wednesday 3 March, 2010. (via e-mail)

Gårdmark Anna , Swedish Board of Fisheries

Wednesday 3 March 2010, Lund, Sweden.

Fischer Lothar, German Cutter and Coastal Fishermen's Association

Tuesday 9 March 2010, Copenhagen, Denmark.

8.2 Attended Meetings and Conferences

Conference on small Scale fisheries, trade agreements and human rights.

Africa Contact, Borups Højskole, Copenhagen, Denmark.

12 September 2009.

BS RAC Conference, Baltic Sea Fisheries: Lessons Learned and Future Perspectives.

Grand Hotel Saltsjöbaden, Stockholm, Sweden.

1 – 2 October, 2009.

Marine Stewardship Council, Public Hearing

Det Levende Hav (the living sea)

Klimaforum, DGI Byen, Copenhagen, Denmark.

16 December 2009

Danish Maritime Authority

WISTA (women's international shipping and trading authority)

Vermundsgade, Copenhagen, Denmark.

11 February 2010.

JACKFISH and Focus group meeting

Pelagic RAC and Baltic Sea RAC

Danish Food Industry Agency, Copenhagen, Denmark.

9 March 2010.

Hållbart fiske – hur når vi dit?

Hållbar Utveckling Skåne Seminarium

Skeppet, Maritimt centrum, Simrishamn, Sweden.

17 March, 2010.

9 Appendix Two

9.1 Definitions of ecosystem based marine management from various sources

The North Pacific Fishery Management Council (Witherell et al.): "An ecosystems approach to fisheries management is defined as the regulation of human activity towards maintaining long-term system sustainability (within the range of natural variability as we understand it)."

The Food and Agriculture Organisation of the UN (FAO Fisheries dept. 2003): "An ecosystem approach to fisheries strives to balance diverse societal objectives by taking into account the knowledge and uncertainty about biotic, abiotic, and human components of ecosystems, their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries."

The Scientific Consensus Statement on Marine Ecosystem-Based Management (McLeod et al, 2005): "Ecosystem based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem – based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem based management differs from current approaches that usually focus upon a single species, sector, activity or concern; it considers the cumulative impact of different sectors."

National Oceanic and Atmospheric Administration (Murawski and Matlokc 2006) "An ecosystem approach to management is one that provides a comprehensive framework for living resource decision making. In contrast to individual species or single-issue management, EAM considers a wider range of relevant ecological, environmental and human factors bearing upon societal choices regarding resource use."