

FISKE2020

Towards an Ecosystem-Based Fisheries Management in Sweden



FISKERIVERKET
SWEDISH BOARD
OF FISHERIES

FISKE2020

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Introduction

A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos and *Flourishing Lakes and Streams* are two of the national environmental quality objectives that the Swedish Parliament decided on in April 1999¹. The objectives describe how, from an environmental point of view, a long-term sustainable situation can be achieved from a generational perspective, here specified to 2020. Since the decision was made in 1999, the 15 environmental quality objectives have been supplemented with a 16th: *A Rich Diversity of Plant and Animal Life*. The objectives are all broken down into a large number of interim targets. It is the three environmental objectives named here that form the basis for this publication.

During the spring of 2010, the Swedish Government carried out an evaluation of the need for continued efforts for achieving the environmental objectives². For the first time, the Government therein highlighted the ecosystems approach and focused on the value of ecosystem services. The conclusion reached was that a strategy is needed for bringing these values more to the forefront in order to reach the objectives. This means that fishing, along with all other use of the sea and water areas, must be carried out with due consideration for the area's capacity for production, its biological diversity as well as natural, cultural and recreational values.

This publication – FISKE2020 – presented by the Swedish Board of Fisheries (Fiskeriverket), can be viewed as a strategy for bringing ecosystem services in seas and lakes into the spotlight. The objectives that are presented here include all categories of fishing – fishing by the general public, commercial fishing and fishing tourism – as well as aquaculture. The ecosystem plans that form a central part of our suggestions will, in order to be extended beyond fisheries, however, need to be expanded and complemented at a future stage.

In addition to fully embracing the concept of ecosystem services, FISKE2020 is also based upon a number of more fundamental standpoints:

- that the fish to be caught should be large individuals that have spawned several times (we apply a basic model called L_{opt} -strategy);

1. Government Bill 1997/98:145, Swedish Environmental Quality Objectives: An Environmental Policy for a Sustainable Sweden.

2. Government Bill 2009/10:155, Swedish Environmental Quality Objectives - for More Effective Environmental work.

- that management should be based on ecosystem plans that vary in design and scope depending on which sea or water area each plan includes;
- that fisheries management should gain a high degree of credibility and become trustworthy in the eyes of the general public and its various interested parties;
- that financial incentives for sustainable fishing should be created by means of rights-based management (the current overcapacity in the fishing fleet can be reduced by means of transferable user rights);
- that fisheries should not be subsidised and fishers should bear parts of the management costs;
- that there should be effective spatial planning for all sea and water areas (pointing out the areas where fishing may or may not be carried out constitutes an effective and easily-controlled instrument for allocation);
- that healthy and environmentally-friendly aquaculture should be developed (a collective management responsibility and a strategic plan are essential to achieving this objective);
- that trustworthy information should be made available to consumers about fish on the market.

FISKE2020 aims to provide a basis for the debate on sustainable fishing. We present a course that is far from easy, but neither is it impossible; and we believe that, within a decade, it can lead to fishing being carried out within the framework provided by a sustainable ecosystem.

The course is presented as a number of objectives to be reached, where the principles for fisheries management are based on wider ecosystem considerations. Within this framework, it is the role of the Government to provide the fishing industries with the necessary conditions for achieving long-term sustainable fishing.

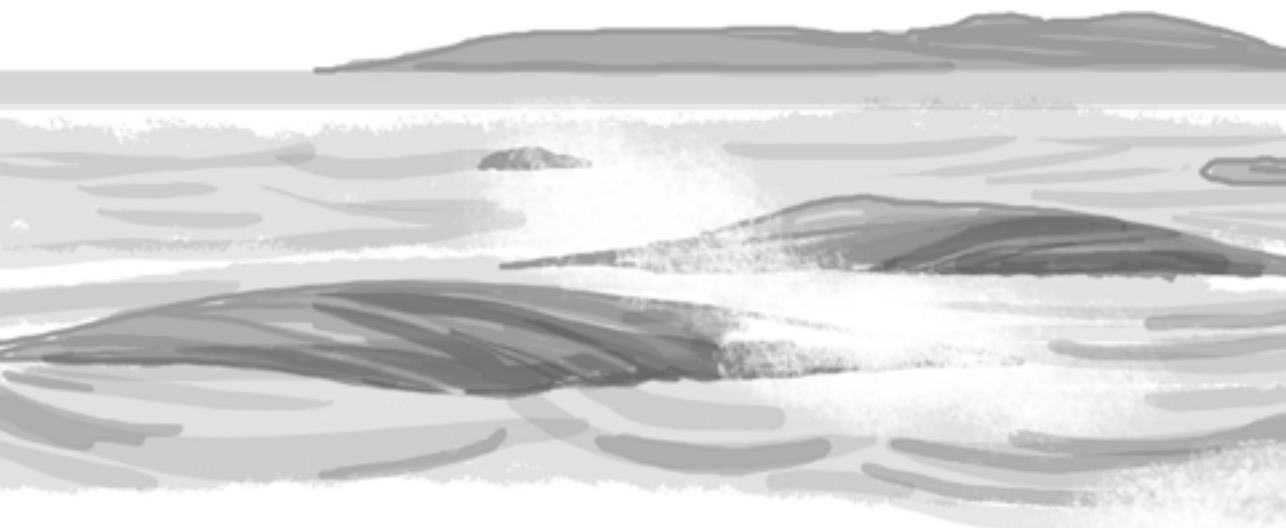
The guidelines we present here should be applicable to all seas and lakes as well as water systems. Methods for applying the ideas vary, of course, and the more species there are, and the larger the area is, the more complex management will be. For small lakes and water systems, our guidelines could be grounds for the authorities giving advice to owners of private waters. For the five largest lakes and along our coastline, they form the basis for national administration within the framework of the EU regulatory framework. For the rest of our waters this document is about how Sweden, as a Member State

of the EU, wants to influence development, and how we want to apply and complement the EU decisions.

At the same time, we are well aware that many of the objectives and measures outlined here are dependant on decisions at the EU level. Additionally, in many cases, an implementation would require new or revised Swedish legislation.

Finally, the Government has given notice of its intention to form a new authority for the marine and aquatic environment. A key concern, therefore, is to use an ecosystems approach for fisheries management to be integrated with other issues to do with marine and aquatic environments. This publication demonstrates the feasibility of this approach and how it can be implemented.

Target Area 1: Ensuring Functioning Ecosystems and Ecosystem Services



This section presents the overall objective for ecosystem-based fisheries management, whereby the current management system based on maximum sustainable yield is complemented by length-optimised selectivity so called L_{opt} -strategy (Objective 1.0). This approach is developed and converted into long-term biological objectives (Objectives 1.1-1.6). The section concludes by stating the basic steps that must be taken in order to reach these targets.

The purpose of ecosystem-based fisheries management is to restore and maintain well-functioning ecosystems so that they can supply various kinds of ecosystem services, including sustainable fishing, sustained biodiversity and functioning food webs. Management of each sea or water area must be based on plans for that specific ecosystem, dealt with in its entirety.

Objective 1.0, Ensuring functioning ecosystems and ecosystem services.

Ecosystem services can be divided into four categories: (1) provisioning services (i.e. the production of commodities such as food and clean water); (2) regulating services (e.g. disease and climate control); (3) cultural services (e.g. education and recreation); and (4) supporting services (e.g. the flow of nutrient salt and primary production). A properly functioning ecosystem supplies all of these products and services, which is why it is important to not only sustain all of the components that make up the ecosystem, but also the various processes that keep it all together. In order to ensure this, it is necessary to have indicators that measure the status structure and functionality of the ecosystems. The status of stocks of prey fish (such as herring and sprat) and their predators (like cod) are often used as indicators for ecosystem status. Other indicators include species diversity and composition, and ecosystem functions.

A growing understanding of aquatic ecosystems has shown that the size structure, distribution and genetic variation in large predatory fish can be used as indicators for the status and health of an ecosystem. The reason that the state of health is reflected in the size and quantity of large predatory fish is that top predators (predators at the top of the food chain) have a significant effect on stocks of prey fish, which, in turn, have effects further down the food chain. Management of aquatic ecosystems must therefore take into account these resulting effects and not only the number of predators. Large individuals also contribute to reproduction to a greater extent than do smaller ones, and the more age groups there are contributing to reproduction, the more stable the population becomes over time. All of the above means that it is of greatest importance to protect larger and older individuals.

To be able to define robust ecosystems, reference points or base lines need to be chosen. For example, for some of the aquatic ecosystems in this context, we could use the structure, distribution and genetic variation that large predatory fish had back in the 1950s, before the dramatic increase in exploitation of the fish stocks. In many of the ecosystems back then, the biomass and average size of large predatory fish were considerably larger than they are today. Although there have been great changes in environmental conditions since the 1950s, the situation as it was then can, in many cases, be used as a benchmark, whilst also serving as an approximate goal for geographic distribution and genetic variation in large predatory fish. Other reference points have to be used for fish stocks and ecosystems that were not in a very good situation in the 1950s, such as salmon and sea trout.

The general goal of having functioning ecosystems and ecosystem services can be broken down into the following long-term biological objectives:

Objective 1.1, Reconstructing the fish stocks.

Return the population sizes, size structures, genetic variation and distribution to levels similar to a baseline relevant to the ecosystem.

Objective 1.2, Reconstructing ecosystem functions.

Reconstruct and conserve ecosystem structures and functions by, for example, ensuring that predatory fish are present in sufficient quantities so as to have a natural regulatory role on the ecosystem and coordinating fisheries management with the management of top predators (marine mammals and birds), within the framework of ecosystem-based management.

Objective 1.3, Restoring and protecting areas and endangered stocks.

Restore and protect important spawning and nursery grounds, and, in some cases, re-establish fish stocks.

Objective 1.4, Changes in fish and fishing conditions are considered.

Fisheries management take into account expected changes in the climate and environment, changing conditions for natural production and varying methods of exploitation.

Objective 1.5, Limiting the spread of alien species.

The spread of alien species is restricted wherever possible. One possibility can be to exploit those species; for example, the Japanese oyster.

Objective 1.6, Limiting the environmental impact of fishing.

Environmental consequences of fishing in the form of bottom impact and unwanted by-catches are restricted, and sensitive species and habitats are protected.

How will these objectives be achieved?

Length-based management

An ecosystem-based management aiming to achieve well-functioning ecosystems, that provide ecosystem services, requires a great deal of detailed knowledge about the functioning of ecosystems. Today, that knowledge is fragmentary and is insufficient to be used as the basis for thorough ecosystem-based management. A less knowledge-intensive method, as a clear step towards ecosystem-based management, would be to apply the principle that fish should be caught only after they reach their optimal length. The optimal length (L_{opt}) is here defined as the body length when an unfished age group reaches its maximum biomass. This optimal length depends mainly on the growth rate of the fish and their natural mortality.

If the fishing pressure on the fish that have reached optimal length is adapted in an appropriate way, it would be possible to produce a good yield even though the size composition of the stock would be similar to that of an unfished. As a rule, the optimal length means that, by a wide margin, fish of that size have matured and been able to reproduce several times. The size structure of large predatory fish can therefore be used, not only as an indicator for the status of the ecosystem, but also as a relatively easy-to-use management tool.

Size structure

Most of the fish stocks in Swedish waters currently indicate low population biomass, a skewed length distribution and therefore a dominance of smaller individuals. Length-optimised management is a strategy that favours a stable size structure at the same time allowing exploitation of the fish stocks in accordance with the precautionary approach, since the size structure will be more similar to that of an original, unexploited, population. Another biological advantage with the L_{opt} -strategy is that fishing takes advantage of the maximum production capacity of the fish stocks, which means that the impact on the population can be reduced to a minimum at the same time as providing high yield. This does, however, mean that fishing needs to be limited to body lengths equal to or above the optimal length. Size selection has long been applied in fishing, so knowledge and work methods for developing selective gear are already well established. The difference is that the optimal length is much larger than the current minimum sizes, especially for large predatory fish.

Baltic cod – an example

Properly functioning management according to the proposed principle would provide a harvest as large as or larger than with the present management system, at the same time as a the stock would consist of a greater proportion large individuals. Taking the eastern Baltic cod stock as an example, this fact becomes clear by comparing population size structure when fishing according to the current minimum size limit (L_{min}) with fishing according to the optimal length (L_{opt}) (see figure 1.1). Note that, even if fishing is aimed solely at the largest individuals, there will still be considerably more very large individuals remaining in the population – provided that the fishing pressure does not increase significantly. It should also be noted that management based on the L_{opt} -principle must be specific for each species and stock.

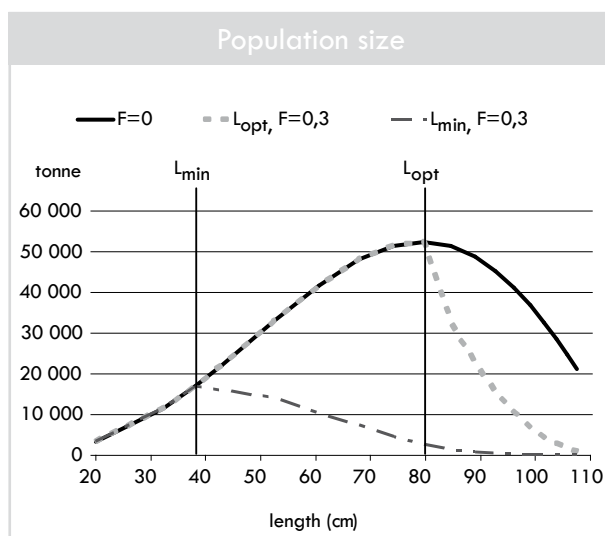


Figure 1.1. Population size in relation to length, based on knowledge of eastern Baltic cod, for two scenarios with different minimum sizes, and one scenario with no fishing ($F=0$). L_{min} = current minimum size limit; L_{opt} = optimal length according to the principle described. The solid curve represents the size structure of an unfished population ($F=0$); the long and short dashed line represents the size structure when today's minimum size limit (L_{min}) is applied in combination with current fishing mortality rate ($F=0.3$); the dotted line represents the size structure if the optimal length (L_{opt}) is applied, combined with current fishing mortality rate ($F=0.3$).

Fishing mortality rate

The L_{opt} -principle does not, however, mean that fishing over the optimal length can be unrestrained. If enough large individuals are to survive, fishing mortality rate needs to be adjusted to an appropriate level.

The fishing mortality rate combined with L_{opt} can be set at various levels in order to reach different objectives. One such objective could be to set fishing mortality so that total catches would constitute the same biomass as of today. Another objective

– which in accordance with the ecosystem approach should be guiding – is how the stock of sizes above the optimal length should decline with size; that is, how slowly the dotted line in figure 1.1 should fall for body lengths over L_{opt} . The less fishing pressure applied, the more large fish will remain in the stock – meaning that the stock will become more like an unfished one.

Species and stocks

The calculations shown in figure 1.1 can be made for species for which we have sufficient knowledge of, e.g., body growth and natural mortality; that is, the same information we currently need to be able to estimate stock status. The L_{opt} -strategy can initially be based on results from single-species models, but growth patterns, and therefore calculated optimal lengths, vary between species and stocks. For the Baltic Sea, this means the application of this principle can be based mainly on size selection in cod fishing, adaptation of fishing effort and avoiding by-catches of cod in pelagic fishing.

For species such as perch, pike-perch and salmon, which form many separate stocks, the situation is more complicated because each stock can have different figures for individual growth, natural mortality and age of maturity. In principle, though, management will not be more complicated than it is today, since all management must be based on the specific biological characteristics of each stock. As a consequence of the fact that we usually do not have enough information on every individual stock, we often have to apply adaptive management (see below) using starting points based on the biological characteristics of populations from areas with similar biological conditions, or an average value with safety margins for a species within a certain larger area.

Because fishing would only be carried out when individuals have grown to a large size, all fish that are caught would have had the opportunity to spawn at least once – often several times – and we would not have the situation we face today, which leads to maturity at a small size and low age. In addition, the ability to recover after periods of recruitment problems caused by environmental factors (e.g. climate change) would improve and by-catches and the discarding of small individuals and species would be drastically reduced.

Ecosystems

Managing fish stocks according to the L_{opt} -principle represents a step towards ecosystem-based management, even though the management in reality is aimed at individual populations. This is because, when relatively large individuals are fished, the age and size distribution, as well as the biomass of the fished populations, come to resemble unfished populations. This provides opportunities for all species to play their role in the ecosystem.

A reconstruction of, e.g., the cod population would mean that cod can regain their position as predatory fish in relation to the sprat and herring populations. This would also have an effect further down the food chain as well as on other predators. Additionally, cod would be in a better position to be present as fishable stocks in their natural area of distribution.

Calculations of optimal length for different stocks are based on the growth of individuals and the natural mortality rate of the stocks. These characteristics, however, are dependant on other components of the ecosystem, such as predators, competition and prey. If the cod population were to increase, predation upon sprat would also increase, which, in turn, would raise the natural mortality rate for sprat, thereby reducing their L_{opt} . This would probably be partly compensated for by an increased growth in a thinned-out sprat population. An increased cod population could also bring about greater competition over their food, which would reduce the growth rate of the cod and, in the long term, lead to a reduction in L_{opt} for cod. These effects, though, have little significance in the initial stages of the L_{opt} -strategy and can be adjusted for later as part of an adaptive management.

Most fisheries are multispecies fisheries with substantial by-catches, requiring additional solutions for encouraging fishing for individual species as separately as possible. This requires the continued development of species-selective gear, temporal regulations, such as closed seasons, and spatial regulations like closed areas and other types of zoning. The same effects can to a certain extent be achieved through having management measures aimed at the largest or most sensitive species, allowing the others to free ride, so to speak, which entails regulation based on the most biologically sensitive/important species.

The conditions and methods used for achieving the L_{opt} -principle will consequently shift between different sea and water areas. Ecosystem plans (see Objective 2.1) are therefore needed as a basis for long-term decision making. These plans must detail precise plans for each area and specify a realistic rate for implementation as well as how the various instruments shall weigh up against each other.

What is needed for introducing a system whereby fish are caught only after they reach optimal length?

The L_{opt} -principle requires a transition period for rebuilding the fish stocks, and a change in current regulations. During this long period of transition, changes in management would mainly consist of reduced fishing pressure and gradually increased size selectivity in the fisheries. This will be developed further in Objective 2.1, and, for commercial fisheries, also in Objective 4.1.

The now heavily exploited fish stocks need time to rebuild a length and age structure that can provide large catches. Today's fisheries are catching young and partly

immature fish, the result being that there are often relatively few larger and older individuals making up the fish stocks. One fundamental prerequisite, then, is better survival rates for all sizes of fish through reduced fishing. During this transitional phase, changes in management would mainly involve reduced fishing pressure and gradually increasing size selection through increased mesh sizes and other changes in gear design. When the size target has been achieved, fishing mortality needs to be adjusted to a level that allows enough large individuals to survive.

In some areas, additional measures would be needed in order to achieve the objectives. Apart from various kinds of zoning, this could involve restoring important spawning and nursery grounds and limiting the spread of alien species. In the North Sea, the Skagerrak and the Kattegat, many local fish stocks have been more or less eradicated. Reconstructing these populations will require direct measures in the form of closures and, in some cases, reestablishment efforts. There is a great deal of uncertainty surrounding how much time it will take to rebuild these fish stocks.

Adaptive management and ecosystem indicators

The L_{opt} -principle demonstrates how we, with today's understanding and means, can take a big step towards ecosystem-based management without drastically reducing the size of catches. It is important to evaluate the results of the L_{opt} -principle from an ecosystem perspective, which is best done in the form of adaptive management; that is, that management is checked against achieved effects on the fish population and the ecosystem, so that management measures gradually can be adjusted. In situations where we have an incomplete understanding of the biological systems and how they are affected by fishing, adaptive management is a way of still being able to take action. Additionally, it is an excellent way of using implemented management measures to increase our knowledge of both the effects of management and of the ecosystems as such.

The situation to date

The Baltic Sea

The large amount of people who live around the Baltic Sea has had, and still has, a large effect on the Baltic Sea ecosystems, mainly through fishing, nutrient discharge and pollution. Eutrophication has large consequences for coastal areas and has also had a negative effect on species composition in the open sea because of a reduced oxygen content and growing amount of anoxic sea floor. Environmental pollutants nearly obliterated top predators like seals and large birds of prey in the Baltic area in the mid 1900s, which quite likely have had an effect on the ecosystem as a whole. These top predators are now on the way to recover, which needs to be considered in the overall picture. Large-scale climate changes have also led to increased tem-

perature and reduced salinity in the Baltic Sea, which has altered some of the basic conditions for the ecosystems.

Due to the shortage of water with sufficient oxygen and salt content, cod eggs, for example, can no longer survive in the Gotland basin, limiting cod reproduction to the Bornholm basin. Combined with over-fishing of cod, this had the effect of altering the composition of the food web of the high seas of the Baltic Sea towards the end of the 1980s and the beginning of the 1990s, from a cod-dominated system, when conditions were favourable to cod between the 1970s and 1980s, to a system dominated by sprat. When the cod population declined, so did its predation upon sprat. This, in conjunction with an initial increase in zooplankton, which sprat feed upon, led to a peak in the sprat population in the mid 1990s. With a dense sprat population, the zooplankton production is no longer controlled primarily by climate factors, but by predation from sprat. The situation of a low cod biomass, high sprat biomass and low volumes of zooplankton that has been dominating since the mid 1990s also coincides with a high biomass of phytoplankton during the summer.

Other parts of the food web have also changed drastically in the past three decades; the amount of herring has gone down in the Baltic proper, whilst, since the late 1980s, herring has increased greatly in both the Bothnian Sea and the Gulf of Riga. Throughout the whole of the Baltic Sea area, though, individual growth in herring and sprat has declined sharply. Grey Seal populations are fast increasing (as is also the case for ringed seal in the Bay of Bothnia), and they are spreading further south in the Baltic proper.

Periods with high water temperatures favour population and individual growth in warm water species, but put cold water species at a disadvantage. Examples of warm water species are roach, perch, pike-perch and pike; whilst cold water species make up most of the marine species, including cod and European flounder, but also include freshwater species, like whitefish and burbot. Climate change not only increases the water temperature but also alters primary production and runoff from surrounding landmass, affecting turbidity and salinity, which, in turn, can affect fish stocks.

Damaged or destroyed recruitment and nursery grounds in coastal areas and adjacent freshwater has also had a negative effect on the development of coastal fish populations, as have obstacles to migration in water systems that open into the sea. Salmon and sea trout also declined sharply during much of the twentieth century, largely due to human exploitation – particularly the expansion of hydroelectric power, with the migration barriers and destroyed spawning grounds that it brought about. Salmon that spawn in the larger rivers are now starting to recover, thanks to reduced sea fishing.

The North Sea, the Skagerrak and the Kattegat

The history of the fisheries and the fish stocks in the North Sea, the Skagerrak and the Kattegat demonstrates the difficulties involved in creating a sustainable exploitation of the resources of the seas. During the nineteenth century, fishing banks ever further afield started to be exploited. At the same time, a gradual depletion was noticed in the Kattegat and the Skagerrak. There are, for example, reports that fishing for Atlantic halibut and rays (mainly common skate and thornback ray) near the island of Tjörn came to an end around the turn of the century.

In the beginning of the 1900s, motor-trawling was introduced to Swedish fisheries on a broad front. This technical advance was to have a profound effect on fish stocks in the North Sea, the Skagerrak and the Kattegat. Concurrently, in 1901, the predecessor to the Institute of Marine Research at the Swedish Board of Fisheries began with trawling surveys in those seas. Analyses from the nearly 110-year-old series of trawling data show four clear results: (1) Large, long-lived species have dwindled, whilst small, short-lived species do not appear to show any obvious trends. (2) The proportion of large, older, fish within a species has decreased. (3) Population density has in general decreased drastically for cod, haddock, pollack, whiting, turbot, rays and sharks. (4) The population structure has been depleted, in that many local populations with separate spawning grounds have disappeared.

The situation with the depleted population structure is especially serious. The phenomenon is particularly evident along parts of the coast of the Skagerrak, where adult fish are now largely absent. Although adult fish are in short supply, the number of young fish can still be high because they come from other areas – the North Sea, for example – and use the coastal area as a nursery ground. Despite the number of young fish, however, the availability of adults is not increasing because maturing fish usually return to their original spawning grounds when they reach two or three years of age. Similar experiences on both sides of the Atlantic demonstrate that recolonisation of local stocks is a slow process. Compilations from earlier local cod fishing along the coast of the Skagerrak also suggest that the archipelago was very productive well into the twentieth century.

The disappearance of coastal populations towards the end of the 1970s should be viewed as the result of excessive fishing. The high proportion of recaptured fish reported in various tagging experiments shows that the fishing mortality rate was very high already in the 1960s. The reason behind this has been the fast development of the fishing technology, not least the introduction of fishing using spotlights in the fjords.

The cod that is found in the Kattegat is moderately stationary and outward migration towards the Skagerrak and the North Sea is observed mainly in the northern parts. It is probable that a large amount of former local coastal stocks have disappeared in, for example, the Kungsbacka Fjord, Laholm Bay and Skälderviken Bay. During the twenty-first century, the coastal zone in the Kattegat has gradually received better

protection, although no recovery of the cod population has been observed in recent times. On the contrary, trends in the various research areas indicate that the amount of cod has actually declined in the Kattegat. The Öresund sound is an example of how a technical regulation – a ban on trawling and purse seines since 1932 – seems to be the most important reason to a better size structure and much more stable and productive stocks than can be found anywhere in the Kattegat and Skagerrak.

Sweden's five largest lakes

Apart from natural variation, the environments in the five largest lakes – Lakes Vänern, Vättern, Mälaren, Hjälmaren and Storsjön in Jämtland County, have also been influenced by man in the past hundred years, which has changed conditions for both fish and fishing. One of the biggest changes in modern times is eutrophication. During the 1950-70s, large quantities of nutrients were introduced to the lakes. All of the lakes demonstrated symptoms of eutrophication, such as algal blooms, oxygen depletion and a change of the fish communities, from salmonid fish towards cyprinids and percids. Since the large treatment plants started using chemical precipitation to reduce the nutrients in the wastewater, some recovery has taken place. In Lake Vättern, which is the lake that has recovered the most, current concentrations of phosphorus are likely on par with the natural background levels.

Many species of fish in the five largest lakes are dependant on incoming and outgoing streams as spawning and nursery grounds. Important species that need protection, like salmon and brown trout, are completely dependant on adjacent streams to complete their life cycles. The expansion of hydroelectric power in these water systems during the 1900s very much worsened the situation for these species. The unique, extremely large, downstream spawning trout in Lake Vättern was obliterated when the Motala Ström river system was exploited in the early 1930s. The likewise unique populations of trout and landlocked salmon in Lake Vänern have also seen a great decline and deterioration in their nursery environments in connection with the expansion of hydroelectric power.

From the 1990s and onwards, the climate has been milder. Somewhat shorter periods of ice coverage along with warmer summers and autumns have also had an effect on the conditions for fish and fishing. It is true that climate changes have an influence on water everywhere, but it is uncertain whether these changes have the same consequences for the deep, by cold water species dominated Lake Vättern as for the more shallow Lake Hjälmaren. Catches of certain kinds of fish whose reproduction is benefited by the warmer temperatures, e.g. pike-perch and perch, have increased, whilst catches of typical cold water species, such as burbot, char, whitefish and vendace seem to be decreasing over time.

In light of current knowledge about the status of fish populations, it is assessed that fishing in the five large lakes is generally within safe biological limits. Even though the problem of overfishing has not been as serious in the lakes as it has been at sea, it

has still been a problem. The low population of char in Lake Vättern is due, at least in part, to a too high fishing pressure with fine meshed nets. There were also similar problems in the past with undersize fish being caught as by-catches by pike-perch fishermen in Lakes Hjälmaren and Mälaren. A higher minimum size limit and better-developed methods for handling by-catches, however, has improved survival rates in young pike-perch, contributing to today's strong stocks.

What will be needed in order to introduce the L_{opt} -principle in the Baltic; the North Sea, the Skagerrak and the Kattegat; and the five largest lakes?

The Baltic Sea

The key to changing into a L_{opt} - management is rebuilding the fish stocks. To be able to introduce this kind of management, fishing mortality rate needs to be kept at a sufficiently low level – like for example the current calculated level of fishery mortality rate for the eastern Baltic cod ($F=0.3$) – whilst mesh sizes and other gear designs are adapted towards catch of only the larger fish. Managing stocks in this way will lead to an increase in both the fish stocks and their average individual sizes. If the fishing mortality rate is too high, this transitional phase will take longer time. When the average individual size in the stock increases, the size selection in trawls and fixed gear must also gradually be increased. Only when these changes have been implemented will we be in a position where L_{opt} - management can fully be applied.

A sample calculation shows that, if the L_{opt} -principle were applied to the Baltic Sea's eastern cod stock, good management results can be achieved. If selectivity is increased in the fisheries so that only cod over 80 cm in length are caught and fishing mortality rate remains at current levels, cod catches will increase in the long run by 60 percent compared to how it would be if current practices continue unchanged. Figure 1.2 demonstrates the effect that gradually concentrating the fisheries more on larger individuals would have on the landings.

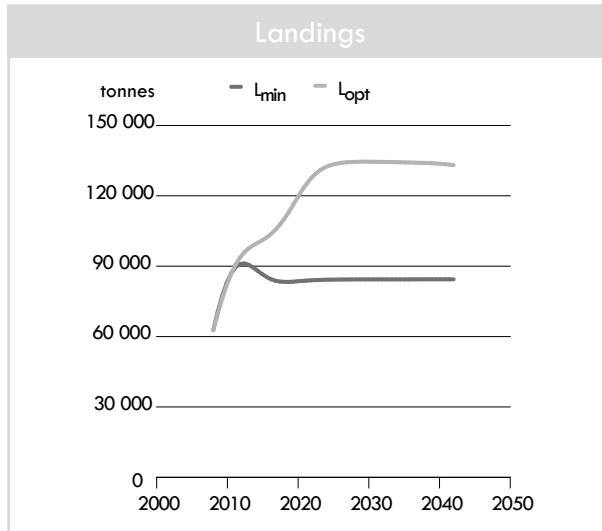


Figure 1.2. Calculated landings of cod from the eastern cod stock in the Baltic Sea based on two different management strategies. Both strategies have the same fishing mortality rate as the current calculated rate ($F=0.3$). One of the strategies involves applying the current minimum size limit (L_{min}), whilst the second strategy applies a gradual introduction of the optimal length (L_{opt}) as minimum size limit. The gradual increase in size selection equates to approximately one age class every other year until optimal length (L_{opt}) is reached.

We can see that a recovery of the population is to be expected even with an unchanged minimum limit, due to the fact that fishing mortality has recently reached a fairly low level. But we can also establish here that recovery will be much greater if selectivity in the fisheries is increased to the optimal length, and it is only then that we will achieve the desired size structure of the stock and the expected positive effects on the ecosystems.

Bearing in mind that the ecosystems in the Baltic Sea have undergone great changes (regime changes) in the latter half of the twentieth century, there are unanswered questions about whether the regulation of cod fisheries is sufficient for the cod stocks to rebuild. Studies are under way to examine some of the interaction within the fish community and its food resources in the Baltic Sea.

Table 1.1. Relevant criteria for length (cm) for some of the fish stocks in the Baltic Sea.

Species	L_{min}	L_m	L_{opt}
Cod	38	43	80
Herring	11	20	20
Sprat	—	8	10
Perch		17-23	18-24

L_{min} indicates the current minimum size limit, L_m indicates the length at which 50 percent of the individuals become mature, and L_{opt} indicates the length by which an age class reaches its maximum biomass.

Applying the above described system to coastal populations of perch, pike-perch and pike is expected to achieve comparative results on the spread of these species and their role in the ecosystem. To achieve the full effects for these species, it is also urgent that their spawning and nursery grounds are restored and protected.

The North Sea, the Skagerrak and the Kattegat

Fisheries targeting several species with significant by-catches is what predominates in these seas. The introduction of the L_{opt} -principle, therefore, will require many different measures in order to increase species selectivity in the fisheries, such as gear development as well as temporal and spatial regulations. In addition, where fishing for more than one species does takes place, it can be managed based on the largest species and/or the most biologically sensitive ones, following up the effects on the other species.

Table 1.2. Relevant criteria for length (cm) for fish populations in the North Sea, the Skagerrak and the Kattegat.

Species	L_{min}	L_m	L_{opt}
Cod	30/35	61	86
Haddock	30	29	49
Whiting	27	25	37
Saithe	35	58	118
Plaice	27	25	46
Herring	20	22	24

L_{min} indicates the current minimum size limit, L_m indicates the length at which 50 percent of the individuals become mature, and L_{opt} indicates the length by which an age class reaches its maximum biomass.

Many of the local coastal populations in the North Sea, the Skagerrak and the Kattegat have been more or less eradicated. Here, the L_{opt} -principle is not sufficient; what is needed is strong measures like closures and, in some cases, reestablishment efforts, which is likely to take a very long time.

The five largest lakes

There are great similarities between fish stocks in the five largest lakes and populations of freshwater species in the Baltic Sea. One difference, though, is that the situation is closer to the L_{opt} -principle in the lakes because of increases in the minimum size limits. In several instances, management is essentially already applied according to the L_{opt} -principle (see table 1.3).

Table 1.3. Calculated optimal length compared to the current average length of caught fish and applicable minimum size limits for some of the important species in the five largest lakes.

Lake	Species	Average length (cm) in present catch*	Minimum length at present (cm) (L_{min})**	L_{opt} (cm)
Mälaren	Pike-perch	46	40	60
Hjälmaren	Pike-perch	53	45	60
Vättern	Charr	59	50	52
Vättern	Signal crayfish	10,5	10	11,5
Vänern	Salmon	64	60	77

*Average length in current catches includes estimated by-catches of undersized fish.

**Minimum length for pike-perch caught in Lake Mälaren will be increased to 45 cm in 2012.

Just like on the east and west coasts, many species are caught together in multispecies fisheries. This requires additional solutions aimed at having these species fished as separately as possible. Continued efforts with temporal and spatial regulation of these kind of fisheries are needed, as is the creation of incentives for considerate fishing. These strategies, together with ongoing efforts for size selection, have great potential for providing a continued successful development.

A good example of favourable stock development as a result of increased minimum size limit is pike-perch in Lake Hjälmaren, where the limit was raised from 40 cm to 45 cm in 2001. In the years that followed, from 2001 to 2009, catches in the lake increased dramatically compared to the period between 1996 and 2000. Fishing in Lake Mälaren has continued at an essentially unchanged level. The differences in catch per unit effort also showed a more favourable development in Lake Hjälmaren after the increase in minimum limit. Warm summers and autumns have contributed to the production of strong year classes in both lakes, but a comparison of length distributions

in the catches demonstrates that increased catches can be explained by larger sizes in Lake Hjälmaren (see figure 1.4).

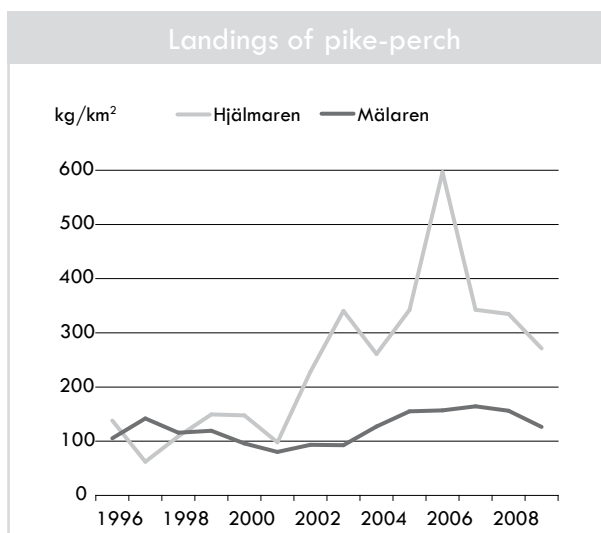


Figure 1.3. The development of annual pike-perch catches in Lakes Hjälmaren and Mälaren between 1996 and 2009. Catches are given in total annual catches per lake area. The minimum size limit was raised from 40 to 45 cm in Lake Hjälmaren in 2001.

Another comparison can be made with the poor development of the pike-perch stocks in the coastal area of the Baltic Sea. Despite very good conditions for recruitment, catches and population status at known pike-perch stocks along the coast have diminished during a period when inland pike-perch fishing has been very good. A big difference in the management of these areas is that the minimum length is smaller at the coast and that it is not followed up with larger mesh size in the same way as in the lakes.

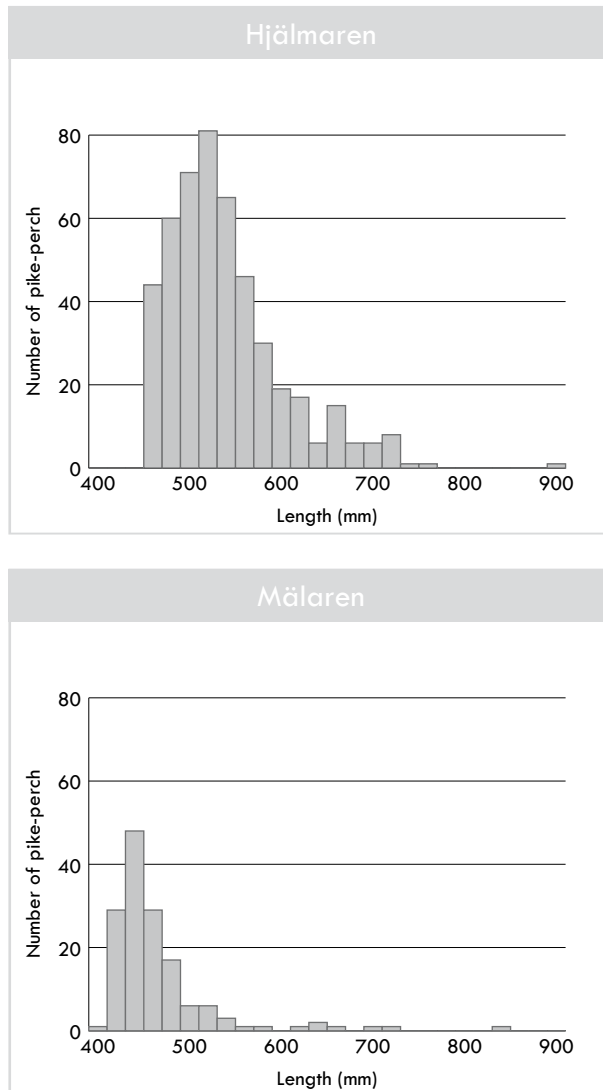


Figure 1.4. Size distribution (representative sample) of pike-perch caught in pound nets at the start of May 2008 from each lake. Length distribution shows landed catches. Undersized pike-perch is not included.



Target Area 2: Fisheries Management

This section discusses the management measures that concerns all categories of fishers and that are required for ensuring functioning ecosystems and ecosystem services (Objective 1.0). In order for this objective to be achieved, a number of lines of action are identified along with the L_{opt} -strategy within the framework for ecosystem plans (Objective 2.1). The three Objectives that follow show the principles that can be used for allocating fishing efforts between various categories of fishers. Three grounds for allocation are discussed: socioeconomic value (Objective 2.2), spatial planning (Objective 2.3) and environmental impact (Objective 2.4). The following three Target Areas (Target Areas 3-5) consider specific objectives and conditions for separate categories of fishing.

The Common Fisheries Policy (CFP) is a fully-fledged Community policy. It is currently under revision with the aim to adopt a new Basic Regulation at the start of 2013. Under the CFP, there are a number of important EU fishery regulations that encompass all major sea areas within the European Union. Hence, the national decision-making must take place within the framework that is provided by these legislative acts. Traditionally, the scope of the EU legislative acts has only embraced commercial fisheries. Within this scope, however, there is room for certain national regulations for lakes and coastal waters.

The purpose of ecosystem-based fisheries management is to revert to functioning ecosystems that can supply the full range of ecosystem services, which include sustainable fishing activities, sustained biodiversity, and a functioning food web. We here identify the need for ecosystem-based management to be concretised in the form of ecosystem plans drawn up for each sea or water area.

Objective 2.1, All fisheries management is based on the L_{opt} -strategy, to be established in ecosystem plans, that have a greater element of input regulations.

The L_{opt} -strategy creates stable stocks whilst still allowing responsible fishing of the fish populations. The strategy requires that year classes are allowed to grow until they reach maximum biomass.

This management approach is built on an ecosystem plan, whereby all kinds of exploitation of fish resources are regulated. This especially applies in cases where the public account for a substantial amount of the fishing activities.

The concept of input regulation is here regarded in its broadest sense, where it includes all kinds of fishing restrictions for if, where, how and when fishing may or may not take place. Input regulations involve:

- a) the extent of fishing, e.g., the capacity of a vessel. Measures aimed at reducing the fishing fleet as well as systems for special fishing permits is confined to this category;
- b) spatial restrictions to where fishing may take place. Included is the full range of area restrictions, from non-fishing zones to temporary measures, such as real-time closures. Also included are various systems for zoning between different categories of fishing;
- c) restricting how fishing may take place. Technical regulations involving gear design, fishing methods, mesh size and species/size selection are included here;
- d) determining when fishing may be carried out – restriction in time is here intended.

The ecosystem plans need to vary greatly in their scope and complexity depending on which sea or water area they cover. Preferably, they should also take into account other kinds of use of the resources than fishing, such as the food supply to marine mammals and birds.

The situation in 1999 and today

In 1999, commercial fishing was mainly managed through output regulations in the form of catch limitations – so called TAC:s (Total Allowable Catches) – for species which were regulated by quotas and also, through technical regulations. Today, fishing activities are still regulated by a combination of input and output regulations, where technical measures stipulating the design of fishing gears, regulating mesh sizes and minimum landing sizes are at the core of fisheries management. From a national perspective, geographical restrictions to trawling activities have been introduced with the aim to protect endangered species, spawning grounds and vulnerable habitats and fishing effort is restricted through seasonal closures and non-fishing areas. At the same time, more consideration is given to the ecosystem approach. The main instruments for fisheries management have been long-term recovery plans or management plans lasting for several years³.

In 2004, a new input regulation for commercial fishing in the North Sea, the Skagerrak and the Kattegat was introduced. This regime was adopted through the Cod Recovery Plan of 2004 and aimed to limit the total number of fishing days per gear. The cod recovery plan of 2004 was considered a failure and the effort system accompanying the plan was replaced in 2009 when a new and revised cod recovery plan was adopted. This plan introduced a new effort system, which takes into consideration the vessel's engine power and tonnage, and was based on the actual fishing effort deployed by member states per sea area and gear. Input regulation expressed in days out of port was introduced in the Baltic Sea in 2008. The regulations of commercial fisheries are further discussed in Objective 4.1.

As part of a long-term fisheries management plan in the EU, the Commission presented MSY (Maximum Sustainable Yield) in 2006 as a target for fishing mortality. ICES⁴ has since been asked to estimate fishing mortality at MSY for several fish stocks in the Union's waters. The aim is to introduce MSY as a target for fishing mortality in the long-term management plans. This has already been done for the North Sea cod stock, for the cod stocks in the Baltic Sea and the stocks of common sole and plaice in the North Sea. Sole and plaice are taken in a mixed fishery and thus, fishing mortality at MSY for the weakest stock depicts the extraction rate of the stronger stock.

Where stock size distribution is concerned as a target for management measures, it has to date not been possible to prioritise national management measures for influencing size distribution in local fish populations. The main reason for this being that the objectives outlined by the EU do not provide the opportunity to take these variations into consideration.

3. Recovery plans were introduced within the EU when, in a step towards longer-term decision making, a new basic regulation came into force in 2002 for fish populations that lie outside safe biological limits. According to these plans, fishing pressure is drastically reduced until the stocks can recover, whereby fishing can be gradually re-introduced. Long-term management plans are also adopted for stocks that are viewed as being in a poor condition but not in danger of collapse.

4. ICES - the International Council for the Exploration of the Sea.

Changes under way

The current focus of fisheries management in the EU is that more fish stocks are to be regulated by long-term management and recovery plans. The recovery plans which includes regulations of fishing effort, contains mechanisms whereby effort is reduced concomitantly with fishing mortality in order to re-build the stock targeted. In addition to forming the basis for re-building and stabilising fish stocks in the long term, the plans also serve to ensure a greater level of certainty for fishermen by way of limiting the changes in fishing possibilities between years.

Presently, at EU level, a system is being discussed for new input regulations such as real-time closures – that is, short-term closures of limited areas – and move-on measures, meaning that a vessel must relocate its fishing efforts if, for example, the quantity of young fish exceeds a certain percentage of the catch. The aim of these measures is to protect young or spawning fish but the aim may well be extended to meet the requirements of protecting threatened and vulnerable species.

What do we think the situation will be like in 2020?

It is foreseen that efforts for establishing sustainable fisheries and fishing practices will continue within the EU, based on technical regulations and long-term management and recovery plans. The evolution of ecosystem plans from the long-term management plans is here regarded as a natural step in the process toward an ever more firmly established and acknowledged ecosystem approach. Moreover, input regulations will play an increasingly important role in fisheries management both from a conservation perspective as well as a way to manage natural resources and thus, the aim of the input regulation will be to minimise the negative impact that fishing has on the environment and to reduce overall wastage of marine resources.

What decision strategies are needed so as to achieve this objective?

The most important action to take in order to introduce the L_{opt} -strategy is to re-build fish stocks. Fish stocks now heavily exploited will need time to rebuild in order for populations to obtain a length and age structure that can maximise catches according to the management model. Today's fishing is to a large extent aimed at young and sometimes immature fish, the result often being that the stocks are made up of relatively few larger and older individuals. Thus, a fundamental aspect for achieving L_{opt} is increased survival rates for all sizes of fish through reduced fishing pressure and increased size selection in fishing gears.

The L_{opt} -strategy may initially be based on results from single-species models in a similar way that advice from ICES is delivered today. However, growth patterns, and therefore optimal lengths, vary between different species and populations, meaning that measures used for maximising yield in one species do not necessarily maximise

yields in other species. Most fishing carried out in the North Sea, the Skagerrak and the Kattegat is multi-species fishing, which requires area-specific solutions. These can involve either directing management measures towards the species largest in size, i.e., adjust selectivity accordingly, whilst allowing the others to 'free ride'. It is also possible to draw up management measures tailored to meet the requirements in terms of re-building of the stock which is most weakened (see Target Area 1).

For achieving this Objective the following decision strategies apply:

1. Creating incentives for sustainable use of resources.

One prerequisite for successful fisheries management is that the legislations create incentives for the various categories of fishers to use the resources in a long-term sustainable way. An example of this could be the introduction of rights-based systems for commercial fisheries (see 4.2).

2. Substantially reducing fishing pressure by changing fishing regulations.

In the ecosystem plans that need to form the basis for the implementation of the L_{opt} -strategy, fishing activity must be considerably reduced during the period of recovery and re-building of the fish stocks. This inevitably needs to apply to the fisheries having the greatest impact on the recovery and re-building of the fish stocks and must be employed regardless of what category of fishing the regulations are aimed at. If the fishing effort is too great, the transitional period will be longer. A number of changes in the fishing regulations are also required, such as increased mesh size and increased selectivity in gears according to established ecosystem plans. In mixed fisheries, the effort can be limited according to the weakest/most vulnerable species.

3. All quota regulations are based on the catch and that all fish caught is landed.

Catch quotas will be enforced instead of the current system of landing quotas, putting the focus on what is actually caught by the fishing gear used. In line with this change of regime, requirements for monitoring will alter. In addition, catching quotas will require that all catches are landed.

4. Fisheries management is mainly based on different input regulations.

Where input regulation contributes to minimising the negative impact that fishing has on the wider ecosystem including discards of unwanted catches, input regulation must be introduced to mitigate these impacts.

5. Developing new gear.

To ensure a stable increase in fish stocks, a gradual increase in the selective properties of the fishing gear need to take place.

6. Developing ecosystem plans and including them in fisheries management.

The development of ecosystem plans implies that tailored solutions need to be outlined that take into account the specific means and goals for each sea or water area (see example below). To achieve the desired results, these plans must be established by the EU and after consultation and in agreement with other countries concerned.

7. Recognising the need for collecting data on larger parts of the ecosystem.

Following up the effects of the L_{opt} -strategy on fish populations and ecosystems requires a knowledge base that covers more of the ecosystem, so that necessary management decisions can be made. Furthermore, biological data from ICES needs to be adapted to the requirements of the implementation of the L_{opt} -model.

Where input controls – days at sea, for example – are used as the basis for management, a development needs to be seen in how biologically-based evaluations of appropriate catch quantities and fishing mortality rates are converted to fishing effort. The area of uncertainty in this regard is probably so large that parallel systems consisting of part input regulation, part quota follow-ups will be needed for an extended period of time.

8. Recognising the need for more knowledge.

Implementing and monitoring the effects of the L_{opt} -strategy based on ecosystem plans puts increasing demands on our knowledge of the structure of the ecosystems, their functions and their dynamics. This should also include the spread of alien species and their role in the ecosystem, as well as increased knowledge about the role that top predators (e.g. seals and cormorants) have. Also needed are broader scientific projects aimed at the application of multi-species models. In addition, requirements for scientific data on long-term environmental and climate changes (e.g. toxins) will need to be addressed.

9. Implementing adaptive management.

For the fisheries management model to work, a focus is needed on adaptive management, where close cooperation is established between research, management and evaluation. This means that changes need to be introduced gradually and systematically for different areas and fisheries. Experiences would then be evaluated and used as the basis for further changes. Since we have a relatively good level of knowledge about the biology, selectivity in gears and fishing patterns of cod stocks in the Baltic Sea, these populations could be used in a pilot project.

A gradual implementation of the L_{opt} -strategy will require continuous monitoring and being prepared to take alternative measures. Current biological samples and catch controls are deemed as a sufficient basis for such adaptive management with regard to landings, spawning biomass, recruitment and fishing mortality. A complement to this would be the application of indicators that reveal the size structure, geographic spread and genetic diversity.

10. Collaborating with the industries.

The term adaptive management has been used here to mean a close cooperation between research, decisions and follow-ups. Another aspect in this concept is a broader level of collaboration with the industries and other interested parties. This collaboration is discussed further in objective 2.6.

Ecosystem Plans

The current management plans are intended mainly for single species, which makes them less appropriate for regulating mixed-species fishing. Work is currently underway at ICES and elsewhere to develop fisheries management so that it can be applied to mixed-species fishing. In recent years, the importance of including the entire ecosystem in management decisions, by means of ecosystem plans for example, has been emphasised.

An ecosystem plan can be developed for geographical areas or for fisheries and should be based on the guidelines developed by FAO as follows:

- **general objectives** that are relevant to the fishery or area should be identified. The general objectives are broken down into priorities and other issues that can be dealt with by management measures;
- **operational objectives** should be set;
- **indicators** and **reference points** need to be developed;
- **decision rules** for how management measures are to be applied, should be developed;
- the implementation should be **monitored** and **evaluated**.

The method should be seen as a hierarchical approach whereby the greatest importance is to define the overall objective, the intermediate objectives and the operational objectives that the ecosystem plans aim to achieve. These Objectives should also ensure that the concrete results laid out in the plans are reached and that the management measures are considered so as to provide measurable indicators.

Ecosystem plans vary in design and scope depending on the sea or water area that is covered by each plan. The following is an example of how an ecosystem plan could be formulated for a specific sea area. A complete ecosystem plan must address all of the objectives; here, though, is an example of how Objective 1.1 could be structured:

General Objective:

Ensuring Functioning Ecosystems and Ecosystem Services.

Objective 1.1, Reconstructing the Fish Stocks.

Return the population sizes, size structures, genetic variation and distribution to levels similar to a baseline relevant to the ecosystem⁵.

Operational objectives:

- Reduce fishing mortality
- Increase spawning biomass
- Increase the proportion of large fish

Measurable indicators:

- Size structure of the population
- Spawning biomass levels
- Genetic variation
- Distribution of key species

Management measures:

1. L_{opt} -management with X cm as the optimal length for selected key species.
2. The access to fishing is rights-based.
3. Catch-based management where all catches are landed.
4. Closed seasons or zones for the protection of young and spawning fish.

5. In this plan, the base line has been set to the 1950s.

Objective 2.2, To distribute fishing resources between different categories of fishers, based on socioeconomic criteria.

The following sections (Target Areas 3-5) will present objectives for the different categories of fishers. In this context, fishing activities are divided up as follows: public fishing (Target Area 3), commercial fishing (Target Area 4), and fishing tourism (Target Area 5). In the context of these objectives, allocation of fishing resources between these categories should be based on socioeconomic criteria. This implies that different fishing categories can be prioritised depending on the species and the sea or water area. Depending on the fishing methods used, distribution can also take place within a fishing category.

In addition to socioeconomic criteria for distributing fishing resources, two other distribution methods will be discussed, namely: priorities within spatial planning (Objective 2.3) and the environmental impact of different kinds of fishing methods (Objective 2.4).

The benchmarks for fisheries management as discussed in Objective 2.1 produce completely different fish stocks than we see today. With larger populations and fishing aimed at larger individuals, fish will be distributed throughout their entire natural geographic range. Similarly, there will be a plentiful supply of large fish. This means that, apart from the ecological benefits, conflicts between various categories of fishers will no longer be so pronounced, although a certain amount of conflict over who is given preference over a certain fish population may still remain.

In addition to revenues from the sales of fish, the socioeconomic value of the use of a resource for different fishing categories also considers the social and recreational value. According to Objective 4.2, access for commercial fishing is mainly restricted by means of individual transferable fishing rights. One of the drawbacks with such a system could be that smaller vessels can be disfavoured compared to large-scale fisheries. Since small-scale fishing can in some cases generate a high socioeconomic value, it is possible to prioritise this group.

The situation in 1999 and today

Until the revision of the Common Fisheries Policy (CFP) in 2002, the EU regulated only commercial fishing in marine waters, whilst it was the responsibility of member states to ensure that non-commercial activities did not jeopardise the conservation and management of the resources covered by the CFP. Priority was thus given to commercial fishing.

This wording is not included in current CFP that took effect in 2002, even if it has been implied. Conditions have somewhat changed in recent years; the regulations that form the basis of the national eel management plans, for example, presuppose a reduction in catch in its entirety, regardless of fishing category. In the new EU Control Regulation⁶, rules are laid down that also apply to non-commercial fishing, i.e. including a prohibition in some cases to sell the catch.

National legislation dictates the general distribution between different categories of fishing by means of the Fishing Act⁷ and the Fisheries Ordinance⁸, where public fishing is regulated by limiting the maximum amount of gears. This quantity of gear can be reduced only for fishery conservation purposes.

A change in the Fishing Act in 2003 allowed the Swedish Board of Fisheries to regulate fishing based on the fishing methods used. This kind of prioritisation applies only between different categories of commercial fisheries and has made it possible to observe the regional policy objectives set by Parliament.

Changes under way

The issue of distribution between different fishing categories will be brought to the forefront when the CFP will be reviewed and in the revision of the national fishing legislation.

What do we think the situation will be like in 2020?

When a functioning ecosystem is used as the basis for fisheries management, the effect that each fishery has on the ecosystem will be taken into account. In order to be able to better utilise the available fishing resources, a more differentiated exploitation will become an obvious choice.

What decision strategies are needed so as to achieve this objective?

1. Allowing for the distribution of fishing resources based on socioeconomic criteria.

The managing authority should be permitted to allocate of fishing opportunities between different fishing categories. This distribution can be made on the basis of a socioeconomic assessment of the value of each fishery as well as with regard to its

6. Council Regulation (EC) No. 1224/2009 of 20 November 2009, establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy.

7. Fishing Act (1993:787).

8. Ordinance (1994:1716) on Fishing, Aquaculture and the Fishing Industry.

environmental impact (see Objective 2.4). This method allows, for example, the social value of small-scale coastal fisheries with regional importance to have a significant impact.

2. Developing models for calculating socioeconomic values.

There needs to be an established model for calculating socioeconomic values that can be used as a basis for allocation decisions. It is essential in this context to take the social and recreational value into account.

3. Developing fishing tourism.

The category of fishing that is currently not fully represented in the allocation of resources according to its own circumstances is fishing tourism. For certain parts of the sector to be able to expand, they need priority access to fishing resources.

Objective 2.3, To define water areas where different categories of fishing are given priority as part of the spatial planning.

In a fishery where input regulations are given a key role, zoning becomes an important element of the regulation. Apart from distributing between different types of fishing, non-fishing areas and the protection of spawning and nursery grounds is also important. The requirements of aquaculture should also be accommodated.

Spatial planning can provide a good basis for such zoning, along with the forthcoming national law on planning at sea.

The situation in 1999 and today

In the context of spatial planning according to the Planning and Building Act⁹, there are specially designated national areas of interest for commercial fishing. The National Fishing Interests were revised in 2006 and the areas that were prioritised were those where extensive commercial fishing took place. During the assessment, regional considerations were also examined. Important landing ports and home ports were also classified as national interests. However, no designation was made for important spawning and nursery grounds for those species important to commercial fishing.

Areas of special importance to recreational fishing are included in the national interests for outdoor activities and conservation of natural resources. These areas have high recreational values because of their special natural and cultural qualities, and are generally easily accessible. One of the main criteria is good opportunities for recreational fishing.

The national strategy for protecting water-related natural and cultural environments¹⁰ is yet another area-based measure of management intended to protect the aquatic environment. The strategy is aimed at protecting the most valuable environments. In order to establish adequate protection, therefore, 270 areas for fish and fishing have been designated nationally as especially valuable natural environments. Among the most valuable areas for fish and fishing, it is considered that a little less than half have received adequate protection.

The county administrative boards have established regional fishery conservation plans for the 2007-2010 period. The purpose of these plans is to achieve better coordina-

9. The Planning and Building act (1987:10) regulates the planning of land and water as well as building.

10. National action plans for protection, according to the wording in Intermediate Objective 1 Flourishing Lakes and Streams.

tion and prioritisation of funding for fishery conservation efforts. The plans contain extensive geographic inventory data and describe areas important for local fishing.

Changes under way

In 2009, a committee was appointed to propose a law on planning at sea. This law is expected to form the basis for an effective zoning of different forms for exploiting or conserving sea areas.

As a link in the efforts to achieve the *Flourishing Lakes and Streams* environmental objective, environments with conservation value for fish and fishing have been stipulated in national strategies for protecting and restoring valuable water areas. Areas that the Swedish Board of Fisheries classifies as especially worthy of conservation with regard to the existence of species that have high conservation value will be highlighted in cases involving construction in water, according to the Environmental Code¹¹. The ambition is in case of territorial protection for fish and fisheries to be revised and clarified in light of new knowledge and circumstances.

What do we think the situation will be like in 2020?

In the year 2020, differentiation between various water areas will be clearer than it is today. Areas where fishery conservation is prioritised may become national parks, nature reserves, Natura 2000 areas¹², areas covered by a nature conservation agreement or areas that are closed to certain kinds of fishing. The whole range will be represented, from non-fishing areas to those where some kinds of fishing are given priority over others.

The law on marine planning is expected to provide good opportunities for zoning at sea.

11. Environmental Code (1998:808) chapter 11.

12. Natura 2000 areas were introduced in Europe for preserving plant and animal life for future generations.

What decision strategies are needed so as to achieve these objectives?

1. Making zoning a basis for fisheries management.

Swedish water should be zoned based on permitted fishing activity, which would, in turn, be based on the socioeconomic value. The regulatory framework for gaining access to resources needs to be changed so that greater geographic controls are brought to the forefront. Another important reason for zoning is to ensure that every sea or water area contains undisturbed habitats.

2. Further developing the environmental objectives for protecting spawning and nursery grounds.

To be able to implement the *A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos* objective, the restoration of coastal habitats should be emphasised. The purpose is to identify important spawning and nursery grounds and develop regional action programmes in the same manner as for lakes and water systems. These conservation measures currently have no clear purpose within the national system.

3. Reappraisal of conditions for construction in waters.

Often times, the terms for construction in water, which are fixed by the court or government, include an obligation to hatch and stock fish into the water to compensate for the damage that construction will cause. Previously, this obligation centred on salmon, even if other species, like trout or whitefish may have been adversely affected. Re-evaluating old permits is a lengthy procedure, but the re-assessed judgements should better meet environmental objectives, such as maintaining biological diversity.

4. The introduction of non-fishing areas.

The introduction of non-fishing areas is an effective measure for managing and building up a specific fish population. A prerequisite in many cases is that regulations also be imposed on surrounding waters. Outside the fishing-free core areas, fishing needs to be regulated in a way that is adapted to the ecosystem to be managed and the fishing that may be carried out in the area. Non-fishing areas also need to be used as reference areas for management purposes.

Objective 2.4, To attach a broader environmental assessment to each kind of fishing activity.

When allocating access to fishing between different fishing categories (commercial fishing, public fishing and fishing tourism), and within these categories (by type of gear, for example), the assessment will be based on socioeconomic criteria (see Objective 2.2). Another criterion for choosing between different kinds of fishing should be the environmental effect in its broadest sense. This can be done in the form of an environmental impact assessment.

The situation in 1999 and today

According to the Fishing Act, the Swedish Board of Fisheries is authorised to consider the interests of environmental protection when regulating fishing, to the extent that it does not significantly hinder the fishing operations.

Changes under way

The on-going review of the Fishing Act includes introducing concepts of environmental law into fishing legislation, which means the incorporation of the Precautionary Principle, environment impact assessments, the use of best available technology, knowledge requirements for operators, and the principle that the person causing environmental damage should compensate for it.

What do we think the situation will be like in 2020?

One of the criteria to consider when assessing which type of fishing should be prioritised within a certain area is the collective environmental impact of fishing.

What decision strategies are needed so as to achieve this objective?

1. Having the possibility to take into account the collective environmental impact from a fishery when making a management decision.

One criterion for deciding which kind of fishing activity should be given priority within a certain area is its over-all environmental impact.

2. Basing decisions on environmental impact assessments.

An environmental impact assessment should form the basis for decisions concerning a certain type of fishing.

3. Using the best available technology.

When management decisions are made, requirements could be set for using the best available technology.

4. Setting knowledge requirements for users of a resource.

Before someone is given permission to carry out a certain kind of fishing, requirements could be set for their level of knowledge.

Objective 2.5, To fully integrate the Common Fisheries Policy into the Maritime policy and to clearly formulate and prioritise its objectives.

The Common Fisheries Policy is a Community policy within the EU, which means that decisions made by the Council of Ministers are immediately effective in all Member States. Member States are expected to implement and supplement these regulations. The creation of a Directorate-General for Maritime Affairs and Fisheries has resulted in the handling of the CFP together with other maritime environment issues. On the national level, a Fishery Conservation Act is being prepared, as is a collective authority for maritime and water environment affairs including fisheries.

The situation in 1999 and today

In 1999, the Swedish Parliament agreed on a number of environmental quality objectives, including *A Balanced Marine Environment*, *Flourishing Coastal Areas and Archipelagos* and *Flourishing Lakes and Streams*. These objectives include the management of fishing in broadly stated objectives. These environmental objectives, which present objectives from a generational perspective given as the year 2020, are what this publication is based on.

When the CFP was reformed in 2002, its objectives were not clarified and no prioritisation was made between the ecological, social and economic objectives.

The Maritime Policy is the EU integrated policy for all economic and conservational aspects of activities at sea. Within the Maritime Policy, the Marine Strategy Framework Directive¹³ has been adopted in order to achieve a good environmental status in European maritime waters. A substantial part of that directive involves fisheries; it establishes, for example, that the stock status of commercial fish and their size distribution are indicators of a good environment status.

The work that is carried out by international organisations such as HELCOM¹⁴ and OSPAR¹⁵ has increasingly come to involve fishing from an ecosystems perspective (particularly in the case of HELCOM).

13. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive).

14. HELCOM (Helsinki Commission), the Baltic Marine Environment Protection Commission.

15. OSPAR (Oslo-Paris Commission), the Commission for protecting and conserving the North-East Atlantic marine environment.

Changes under way

Of great importance in the ongoing changes in the Swedish authority structure is the integration of fishing issues with the general marine and freshwater environment. The same is true in the efforts to create a new fishing legislation.

The objectives of the CFP are also being considered in the ongoing revision. The objectives that presently apply for the policy are vague, particularly when it comes to prioritising between ecological/biological objectives, social objectives and economic objectives. The CFP, which originally formed a part of the Common Agricultural Policy, has been developed within the EU from being a policy dealing mainly with issues concerning the commercial fisheries and its development to an approach built on an ecological/biological foundation.

What do we think the situation will be like in 2020?

The integration of fishing matters with marine and freshwater issues is expected to continue. Clearer objectives within the Common Fisheries Policy will provide guidance when decisions are to be made on how EU funds will be used; for example, concerning the structural funds the development of controls and data collection. On a national level, an integration of sea and water environment issues will have led to decisions being made from a broader ecological perspective.

What decision strategies are needed so as to achieve this objective?

1. Integrating the Fisheries Policy with the Maritime Policy on a Community level.

The integration efforts need to be successful so that fishing issues can become a clearer part of the Maritime Policy.

2. Developing clear objectives within the CFP.

Unlike today, objectives in the forthcoming EU Fisheries Policy need to be clearly worded and internally prioritised. The framework should be that an ecosystem approach is applied. The objectives of the Common Fisheries Policy should be structured and prioritised according to type of ecosystem service (see Objective 1.0). On this basis, the objectives can be formulated according to the following:

- a) The Fisheries Policy should guarantee stable food supplies to consumers by using the aquatic ecosystem at as close as possible to maximum yield without putting biological diversity and the system's resistance to disturbances at risk.

- b) The Fisheries Policy should contribute to the Maritime Policy. This should be manifested by considering the sector's impact on the regulatory and supporting functions of aquatic ecosystems, such as oxygen production, nutrient salt balance and the breaking down of environmental pollutants.
- c) The Fisheries Policy should help the fishing sector to generate employment, income and recreational opportunities, and should serve as bearer of cultural heritage.

3. Integrating the Fisheries Policy nationally in a collective management of marine and freshwater environments.

The viewpoint permeating this document shows that fisheries issues form a natural part of the collective management of a sea and water area. This should be based on the ecosystem plans stated in Objective 2.1.

4. Setting up clear objectives in the Swedish Fisheries Policy.

Objectives set for the Swedish Fisheries Policy that provide for the managing authority to implement and supplement the CFP should be characterised by a similar comprehensive approach.

Objective 2.6, Establishing credible fisheries management amongst the general public and interest groups.

One basic requirement for successful fisheries management is that rules and decisions have good credibility in the eyes of the general public and interest groups in the fishing sector.

A fisheries management model built upon ecosystem plans, as advocated here, needs continuous dialogue with all interest groups. The interaction will differ depending on the sea or water area.

The importance of a high level of confidence from consumers and the general public for fisheries management is discussed in Target Area 8.

The situation in 1999 and today

Regional Advisory Councils (RAC) have been set up in the EU and currently constitute perhaps the most important way for the European Commission to hold dialogues with various interest groups. Representatives from the commercial fishing industry has the majority in these councils, but processing industries, recreational fishing and environmental and consumer organisations are also represented. The purpose of these councils is to improve cooperation within the framework of the CFP through increased participation and improved dialogue before decisions are made. The task that these councils have is to comment on the Commission's suggestions, issue recommendations or suggestions to and inform the Commission about any problems connected with the implementation of fisheries policies, and put forward proposals for improvement.

Nationally, various Co-management initiatives have been implemented and evaluated in the last decade. These have all been of diverse nature, ranging from large complex groups to Co-management groups that forms a collaboration between concerned commercial fishers (as with vendace fishing in the Bay of Bothnia).

As part of the current period of structural funds, special fishing areas have been identified. The approximately ten fishing areas are each controlled by a fishing area group, where the purpose is for a wide spectrum of interested parties to participate. Within these areas, it is possible to use structural funds for more purposes than usually applies for the Fishers Fund¹⁶.

16. In accord with the European Fisheries Fund, structural support is given to the fishing industry. The support given to the fishing fleet is decided by the Swedish Board of Fisheries.

Private waters are often managed as fishing management areas¹⁷. There are currently approx. 2,000 of national fishing management areas. This is a way for the owners of fishing waters to jointly take responsibility for their water and the exploitation of it.

One form of cooperation that is especially pointed out by the EU by means of the CMO Regulation¹⁸ is Producer Organisations. These, large or small groups of fishermen can jointly decide on shared concerns. There is also the option for Member States to delegate certain management decisions to these organisations.

Changes under way

The Regional Advisory Council's role within the EU decision-making process is an issue that is being addressed in the review of the Common Fisheries Policy.

A good basis has been formed for continued cooperation. Forms of collaboration have been developed nationally from the Co-management initiative and from the fishing area groups.

A draft for a new Fishing Act includes that regional councils should be linked to the managing authority so that it can discuss the development of fishing regulations from a regional point of view.

A new law on fishing management areas in private waters is under discussion that aims to strengthen the areas as a basis for fisheries management in private waters.

As part of the implementation of the Water Framework Directive¹⁹, regional water councils are being formed that embrace the interests of the environment, fishery conservation and fishing.

17. The Fishing management areas Act (1981:533).

18. Council Regulation (EC) No. 1234/2007 of 22 October 2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products.

19. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

What do we think the situation will be like in 2020?

At the European level, Regional Advisory Councils will be seen as an obvious and important form of collaboration with various interest groups. Nationally, the managing authority will be working in a broad and open way with interest groups. Fishing management areas will still be a cornerstone for fisheries management in private waters. A marine and aquatic environment authority with far-reaching authority and a clear focus on marine planning, the Water Framework Directive and the Marine Strategy Framework Directive will collectively plan coastal zones and sea areas. Connected regional groups will collaborate with the authority in a way that supports conservation zones.

What decision strategies are needed so as to achieve this objective?

1. Giving the Regional Advisory Councils a clearer role in the EU decision-making process.

The councils currently participate in the decision-making process and primarily communicate with the Commission. In a reformed fisheries policy, the councils should also work as a link between decisions that are to be made and its members on a national and local level. The councils could be given an extended role in the dissemination of information, exchanging experiences and training for streamlining implementation. If the CFP is broadened towards a maritime policy, it is possible that the composition of regional councils may need to be reviewed.

2. Creating a forum for Co-management on national level.

Apart from the European Regional Advisory Councils, there is a national and regional need for the development of cooperation between authorities and interested parties. This could take the form of Co-management.

3. Giving extended responsibility to Producer Organisations.

Producer organisations could be given the opportunity to make certain decisions relating to resource and distribution issues that affect their members.

4. Coordinating fisheries management and fishery conservation in inland matters.

Better fishery conservation can be created by building up knowledge and support for fishing management areas and other fisheries management. A prerequisite for such a development is that fishing management areas should be formed in places where fishing law is either unclear or fragmented. Using an ecosystems approach, the coordination for entire water systems needs to be developed, based on the Water Framework Directive.



Target Area 3: Public Fishing

Following on from the general review of fisheries management based on the L_{opt} -strategy and ecosystem plans (see Objective 2.1), this and the next two Target Areas discuss objectives and prerequisites for the different fishing categories: public fishing (Target Area 3), commercial fishing (Target Area 4), and fishing tourism (Target Area 5).

Approximately one million Swedes aged 16-74 go fishing every year in their spare time. When younger and older people are also counted, Swedes involved in recreational fishing add up to one and a half million. Their main reasons for fishing are relaxation, being out in nature and catching fish for their own family's consumption. By far the most common equipment used is hand-held gear – that is, fishing with rods, lines and hooks. 80 percent of fishers use hand-held gear exclusively. The number of those who fish only using nets, traps and pots make up less than 10 percent. 50 percent of all fishing is done within 30 km of a person's place of residence, which makes fishing resources near towns and cities especially valuable.

Fishing is carried out along the coasts as well as in fresh water, and the 16-74 age group catches approximately 15,000 tonnes of fish annually, half of which

is caught from the sea. This catch is mainly consumed at home and constitutes around a tenth of Swedish fish consumption. The most important species in recreational fishing are perch, pike, trout, greyling, salmon, char, cod, mackerel, herring, flatfish, lobster and freshwater crayfish. Catches of pike, perch, trout, greyling, char, rainbow trout and lobster are much larger than those of commercial fishing for the same species.

Public fishing is regulated by the Fishing Act. Under certain gear restrictions, everyone is allowed to fish recreationally in public and private waters along the coast and in the five largest lakes – Lakes Vänern, Vättern, Hjälmaren, Mälaren and Storsjön in Jämtland County.

Apart from state-owned mountain fishing waters, fishing rights in private waters are often divided between many owners of fishing rights, who own the rights for fishing in the same area. To be able to make use of such jointly-owned waters and improve fishery conservation whilst providing more opportunities for the general public to obtain fishing permit. Fishing management areas have been formed with government support. So far, approximately 2,000 such areas have been set up.

Objective 3.1, Widespread public fishing with social and recreation significance.

Fishing is one of the most common outdoor activities and catches for some species in recreational fishing is more significant than it is in commercial fishing. Fishing is of great social and recreational value in addition to its role in personal consumption.

The situation in 1999 and today

The most important reasons for recreational fishing are relaxation, being out in nature and catching fish for family consumption. These reasons have changed only marginally in the last ten years. Increased fishing regulations and a decline in many fish populations that are important to recreational fishing have, however, lowered the level of interest in trying to get big catches. In a sense, it could be said that the catch has become less of a motive.

Fishing remains a popular recreational activity, but the number of people fishing has decreased during this period, as has the amount of fish caught by the public. The number of fishing days per fisherman and year, though, is fairly constant.

The interest for fishing with hand-held gear continues to rise in comparison with nets, traps and pots. The proportion of people who fish exclusively with hand-held gear has risen from 70 to 80 percent. The most common kinds of hand-held gear are casting rods, spinning rods, simple rods with no reel, fly rods and ice rods.

The proportion that hand-held gear has of the total catch in recreational fishing has risen to 60 percent, whilst the proportion of catches from the sea by hand-held gear is close to 50 percent in recreational fishing. Catch per fisherman is thus much smaller for those using hand-held gear than it is for those using nets, traps and pots.

The importance of distinct marine species – such as cod and flatfish – in recreational fishing has declined, although one marine species that has become more important is mackerel. Other species that have increased in importance are perch, pike, salmon and trout.

Changes under way

In the autumn of 2009, the Council of the European Union decided on a control regulation, which introduced a sales prohibition for recreational fishing from boat at sea; that is, a prohibition against the sale of those catches. Supplementary regulations are

to be decided in 2010. By means of this sales prohibition, the concept of recreational fishing can be viewed as being defined in the Common Fisheries Policy as fishing for recreational purposes, where the catch is for the consumption of one's own household.

What do we think the situation will be like in 2020?

As the L_{opt} -strategy in management will have an impact, species of interest to public fishing will be found within their natural geographic range, and the fish will be generally larger.

In 2020, fishing will still be an important recreational activity for many people living in Sweden, although the proportion of the population engaging in it will probably be somewhat lower than it is today. This would be partly because of continuing urbanisation and a growing choice of competing recreational activities. The expected results of length-based management and better access to fish in coastal areas, along with a more natural size structure in the fish stocks, could reverse this negative trend. The popularity of recreational fishing will put demands on access to good fishing opportunities around population centres. The prospects for a tourism industry based solely or partly on recreational fishing may also increase in the countryside.

The reasons for recreational fishing are likely to have changed very little. The most popular gear will still be hand-held, and recreational fishing using nets will probably continue to decline. As it does today, most recreational fishing in 2020 will still be carried out close to home or a holiday home.

Society's emphasis on qualitative nature close to home for outdoor activities near cities and towns will have increased. There will be equally strong support for the idea that it is a public responsibility to promote public fishing in these areas.

The number of senior citizens will have risen in 2020, and an improved state of health will allow for an active lifestyle long after retirement. An increase will be seen in opportunities for and the interest in contributing to personal consumption through, e.g., fishing. During periods of high unemployment and poor economy (for society in general as well as personal), the opportunity for consuming self-caught fish is likely to become a stronger motive for public fishing.

The proportion of women who fish for recreation, together with an increased interest in fishing from people with a foreign background, is likely to rise. In the latter case, this will also have brought about an extra interest in species other than the traditional ones caught in recreational fishing.

Public access to fishing resources in public and private waters along the coast and in the five largest lakes will still be great, but gear restrictions will become more extensive. Many attractive inland waters in southern and central Sweden that are not currently

used as fishing management areas will be made accessible. Some of these waters will offer highly-specialised and attractive fishing opportunities.

Fishing management areas will continue to be the most important form of fisheries management in private fresh waters. However, the amount of waters that are leased for public fishing through the sale of fishing permits will have decreased and the prices risen. Fisheries management areas and private owners of water will come to see fishing as a source of property income to a greater extent than is the case today. It will become more common for exclusive access to attractive fishing waters. Swedish and foreign companies, as well as other interest groups, such as organisations, will rent exclusive rights to fish in certain waters.

What decision strategies are needed so as to achieve this objective?

1. Further development of fishing management areas.

The fishing management areas will continue to develop their fishing waters. Public funds will support these areas which make fishing possibilities available to the general public. This could involve merging or creating new areas, compensation for biotope measures, supervision, or information on fishing within the area.

2. Prioritising public use of the fish resources.

When the L_{opt} -strategy is introduced, the fish stocks will consist of larger individuals. This is to the advantage of public fishing as well as the fact that the fish will be available within a larger part of their natural distribution area. It is recommended that the prioritisation of different kinds of fishing is done according to socioeconomic criteria, which may, in some cases, benefit public fishing more than current priorities do.

3. Clarification of the purpose of public fishing.

The sale of fish should be reserved for commercial fisheries, whilst public fishing should be done for social and recreational purposes, or for personal consumption.

Objective 3.2, Limiting public fishing based not only on allowed gear but also on catch limitations.

It is currently the responsibility of Parliament/the Government to allocate fishing resources between public and commercial fishing. This is done through limiting the amount of fishing gear that the general public may use. Fishing could be further limited on the grounds of fishery conservation.

The situation in 1999 and today

In 1985, opportunities for public fishing were extended for fishing with hand-held gear in private waters along the east coast, around the Island of Gotland and in the five largest lakes.

In 1993, restrictions were introduced for the amount of fishing gear that may be used by members of the general public in public waters as well as private waters where fishing were allowed. When fishing with nets, long lines, traps and pots, a total of six gears may be used simultaneously. The overall length of nets may not exceed 180 metres. When fishing for lobster, fourteen lobster pots may be used in addition to the six items otherwise allowed.

Between 1993 and 2009, there were no changes made to the amount of gear allowed to be used by the general public in public waters, private waters along the coast, or in the five largest lakes.

In order to regulate the catch size and the selectivity in fishing gear, special rules have been introduced; for example, that net fishing may only be allowed at certain depths (so as to protect vulnerable fish populations) or that only a single hook may be used in rod fishing (to improve the survival rate of fish being returned to the water). A limit has been introduced for how many fish may be caught each day. Minimum and maximum sizes have also been established for some fish species caught by rod and line.

Changes under way

As a basis for decisions relating to public fishing, a number of studies have been carried out. Examples of these are studies to highlight the number of people fishing and their reasons for doing it, the economic value of fishing, effects on occupation, as well as studies to do with the catches. In order to improve management of the fish stocks, there is an increasing need for data collection, knowledge building and analysis.

As part of the spatial planning, work is under way to decide on national management objectives for water areas, rivers and species that are of particular importance to public fishing.

By means of the EU Data Collection Framework²⁰, control regulations and the reformation of the Common Fisheries Policy, demands are put on data that can enable an assessment of catches carried out by the general public.

What do we think the situation will be like in 2020?

Just like today, public fishing in 2020 will be limited primarily through limits on the type and quantity fishing gear that each person may use. A developed prohibition on the sale of catches from recreational fishing will mean that the quantity of the catch will become less important as a motive for recreational fishing. Instead, quality aspects of the fishing will be emphasised (the size of fish, species diversity and likelihood of a catch, together as well as recreation and the social aspect of fishing).

In 2020, hand-held gear will be the dominant fishing method, as it is today. Net fishing will be uncommon in city areas, and will be seriously limited in areas designated for fishing with hand-held gear and fishing tourism. As for fishing using pots, this will be done using gear that allows for the re-release of catches that will not be kept. The requirement for selectivity in fishing will be set very high. The development of selective fishing gear will also involve recreational fishing.

Ethical issues will also become increasingly important. Gear design, fishing regulations and fishers understanding will have developed to the stage where more consideration is given to the sensitivity of different species of fish.

In order to maximise the amount of catches for each fisherman per day, more limits will be imposed on especially attractive water areas and/or especially attractive species of fish with high value for recreation, adventure or fishing tourism, or waters containing so-called trophy species. Trophy species in 2020 will include pike, perch, pike-perch, salmon, trout, char, greyling and cod. Other species will also belong to that category, such as catfish, carp, lobster, common ling, haddock, pollock and wolffish.

Requirements will be set high for selective fishing methods and methods that allow a good chance of survival for fish that are re-released. Rules for min/max sizes will become commonplace in fishing; that is, that both a minimum and maximum size limit is imposed and that fish that are smaller or larger than permitted must be returned to the water alive.

20. Commission Decision 2008/949/EC of 6 November 2008 establishing a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy.

What decision strategies are needed so as to achieve this objective?

1. Developing fishing regulations.

Fishing regulations need to be developed so that they generally include requirements for re-release. Limitations of catch should take the form of maximum catch per day. As the L_{opt} -strategy produces gradual changes in the fish populations that are of interest to the general public, rules will need to be set for closed areas and seasonal closures, and the minimum landings size will need to be revised. How the fishing is regulated must, however, be according to each type of fishing.

2. Developing gear and limitation of gears with low selectivity.

For fishers to be able to fulfil requirements relating to returning fish to the water alive, gear may need to be refined and limitations may need to be set for gears with low selectivity.

3. Educating fishers.

For fishers to be able to meet all the new regulations, requirements must be set on their level of knowledge. This will be discussed further in Objective 3.3, below.

Objective 3.3, Increasing the demands on fishers.

To increase the level of knowledge amongst those fishing in their leisure time, easy-to-understand information should be distributed. In addition to this, there is an increasing need for clearer legislation. In parallel to Objective 4.4 – that commercial fishing should bear some of the management costs – those fishing recreationally should contribute to the costs of data collection, management etc. by means of a general fishery conservation fee.

The situation in 1999 and today

In lakes and water systems with fish populations that are especially worthy of protection, or in waters with high-quality fishing, restrictive regulations have been in force for decades, and high expectations are set for fishers. Interest organisations have long been educating their members about fisheries conservation. The public has a greatly increased understanding and interest in environmental issues and fisheries management, as well as the protection of endangered species of fish.

Through the years, a number of governmental studies have proposed various kinds of general fishery conservation fees, but none of these have resulted in a decision to introduce such a fee. Apart from the need of funding for fishery conservation, the oversight of fishing activities and providing information on applicable fishing regulations are motives for introducing such a fee.

There is currently no general register of recreational fishers, and they have no obligation to report their catches. This makes it difficult to collect fishing statistics by means of targeted surveys about fishing and catches and to inform the public about fishing regulations. A register connected to the payment of a general fishery conservation fee would be a good basis for both the collection of fishing data and the dissemination of information.

Fishing regulations have gradually become more detailed, requiring each fisher to learn these rules. Legislation for public fishing – particularly that along the coastlines – is difficult to understand because most of the regulations are dominated by rules for commercial fishing.

Changes under way

As fisheries management moves towards an ecosystems approach, there is an increasing need for regulating all kinds of fishing. Attention has also been drawn to species that are significant to recreational fishing such as salmon, trout and lobster. Within the

EU Data Collection Framework, as well as on a national level, improved data collection is being developed for the extent and socioeconomic value of recreational fishing.

What do we think the situation will be like in 2020?

In cooperation with other authorities and interest groups, the Swedish Board of Fisheries will have developed a system for collecting data from fishing by the general public. It will involve information that makes it possible to assess and observe developments in recreational fishing, including the number of fishers and data on catch and value. Using socioeconomic calculations, it will be possible to assess the economic value of this kind of fishing, which will also be important if the managing authority is to be able to prioritise different kinds of fishing based on their socioeconomic value (see Objective 2.2).

In 2020, a general fishery conservation fee will be charged. Integration into the CFP, along with its increased requirements on data collection and regulations, will add to the motives already discussed. The right that all European citizens have for recreational fishing in Sweden on the same terms as Swedish citizens is yet another good reason for having a general fishery conservation fee. The fee will be used mainly for fishery conservation, data collection and educating the public about the water areas and species that are especially valuable to recreational fishing. There will be a requirement for reporting catches of certain species.

Ethical issues will have become a more important subject in 2020, as will the interest in preserving fish and their ecosystems in the long term. These interests will result in the introduction of a simple fishing exam that must be passed before paying the general fishery conservation fee and gaining access to the fishing resources that are open to the public.

What decision strategies are needed so as to achieve this objective?

1. Introducing a general fishery conservation fee.

So that recreational fishers – like other users of fishing resources – will be able to pay their share of management costs, a general fishery conservation fee should be introduced. The funds could then be used mainly for conservation of fish stocks and ecosystem, management of recreational fisheries, providing information, oversight of fishing activities and data collection.

2. Improving the dissemination of information to fishers.

By means of a register connected to the payment of a general fishery conservation fee, fishers can easily be reached and provided with information. Legislation can be simplified by collecting together the regulations that apply to recreational fishing into

a special regulation, which could be made easily accessible through an internet-based system containing local information.

3. Improving the data collection from public fishing.

Under the EU Data Collection Framework, supplemented nationally, a better basis can be formed for collecting data on species caught mainly in fishing by the general public.

4. Setting requirements for knowledge of fish and the environment.

A simple fishing examination can be linked to the payment of a general fishery conservation fee. Such an exam can contain elements dealing with knowledge of fish species and ecology, the right of public access, rules and reporting obligations. The exam must also be designed for foreign nationals who want to fish in Sweden, and the exam should, of course, be done via the internet.

Objective 3.4, Improving opportunities for public fishing though central and local government commitment.

Public fishing is seen as an essential part of outdoor recreation. Municipal or state-controlled waters with attractive fishing should be made available to the public, and municipalities should facilitate access to those waters. Municipalities can give fishing a more important role in spatial planning as well as in the future marine planning.

The situation in 1999 and today

Together with state-funded fisheries management and access to public waters, fishing management areas constitute a cornerstone in Swedish fishing regulations. Government grants have been set aside for the creation of these areas if they are accessible to the general public. With support from the county administrative boards, Municipalities and owners of fishing water have created over 2,000 fishing management areas to colligate the owners' interests, lease fishing rights by means of fishing permits and carry out fishery conservation work. Municipalities are increasingly opening up their waters to the public, and state-owned fishing waters in the mountains are largely available for fishing via fishing permits.

Changes under way

Efforts to create new fishing management areas have stalled, mainly because the greatest need has already been met; although some merging of existing fishing management areas still continues.

Municipalities are showing more of an interest in promoting outdoor activities, including fishing. Increasing urbanisation and competition from indoor pursuits give rise to the need for promoting life in the outdoors. The most important reasons are for the benefit of public health and to maintain people's interest in and understanding of nature and environmental conservation. A large fishing interest amongst the population is also one of the most important prerequisites for rural fishing tourism operators.

There is currently no clear responsibility for public fishing in the spatial planning. This means that the interests and needs of recreational fishing are poorly represented in municipal planning work. Neither are municipal funds generally allocated for promoting recreational fishing in the same way they are for other important outdoor activities.

What do we think it will be like in 2020?

In 2020, public fishing will be seen as an important element in public health work. It will also be very important to rural fishing tourism operators.

There will still be plentiful opportunities for recreational fishing along the coast and in the five largest lakes. With help from the state and municipalities, the leasing out of fishing possibilities in state-owned waters and close to urban areas will have increased, as will the measures for improving the quality of fishing and the services connected with it.

Legislation will provide clearer support for the protection and development of public fishing.

Attractive opportunities for recreational fishing and fishing tourism will put high demands on the status of fish stocks, particularly for a more natural age distribution, with a higher proportion of large fish, but also for a stronger population that provides good opportunities for catches, even with the relatively ineffective gears used in recreational fishing.

The scale and focus of recreational fishing will mean that catches and opportunities for catches of especially important marine species will form an important knowledge base for fisheries management. The same will be true for lakes and water systems in general. National management objectives for promoting public fishing will have been set for water areas and species of particular importance. These objectives will be able to be followed up.

What decision strategies are needed so as to achieve this objective?

1. Improving access to municipal and state-owned water.

Municipal and state-owned waters need to be managed more in such a way that they can be used by the general public. This is especially important in urbanised areas or where there are serious conflicts of interest.

2. Prioritising public access to fishing waters in spatial planning.

Public access to fishing waters needs to be prioritised in municipal planning. Regional planning should pay special attention to fishing as a part of an active outdoor life. Well-developed marine planning should consider public access to fishing opportunities even away from the actual coastal strip.



Target Area 4: Commercial Fishing

This Target Area deals with commercial fisheries. A change in 2009 to the EU Control Regulation stipulated that the main criterion for commercial fishing is that fishing is carried out for the purpose of selling the catch. The commercial fishing also includes those who fish in private waters and sell their catch. As for the sale of the fishing activity itself, objectives will be discussed in Target Area 5 (Fishing Tourism).

In January 2010, the Swedish fishing fleet consisted of 1,412 fishing vessels having permission to carry out fishing for commercial purposes and 1,688 persons had a professional fishing license²¹. The profession is mainly concentrated along the western coast, especially in the county of Västra Götaland, where 43 percent of all fishermen live and 40 percent of all vessels belong.

The marine fishing fleet consists of many small vessels that fish with passive gears and a small number of larger vessels that mostly catch fish using some kind of trawl. The demersal trawlers (bottom trawlers fishing mainly for cod

21. The total number employed was more than this because not everyone aboard fishing vessels has a license.

and other whitefish, flatfish and shellfish) have their home ports on the west coast, along with the majority of the pelagic trawlers (pelagic trawlers targeting mostly herring, sprat and mackerel). Most of the trawlers that have their home port on the east coast fish for vendace. Vessels fishing with passive gears (nets, pots and traps) are more evenly distributed around the west, south and eastern coasts. These are normally smaller vessels, often less than 12 metres in length. The average age for a Swedish fishing vessel is about 30 years, making the Swedish marine fishing fleet one of the oldest of its kind in the EU.

The total landings value for the Swedish marine fishing fleet in 2008 amounted to 968 million SEK. In terms of landings value, the most important catches were herring, cod, fish for industrial purposes, nephrops and shrimp; together, these accounted for almost 80 percent of the total landings value. The landings value from the Swedish marine fishing fleet can be roughly divided into the following three vessel segments: pelagic trawlers, demersal trawlers and vessels fishing with passive gears (see figure 4.1).

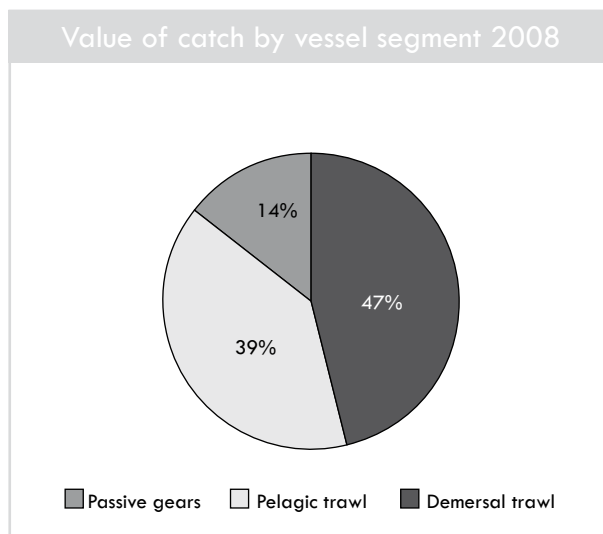


Figure 4.1. Distribution of catch value between vessel segments in, 2008.

The size of the Swedish marine fishing fleet has steadily declined since the 1950s. During the last ten years, the number of licensed fishermen dropped by 27 percent (from 2,315 to 1,688 persons) and the number of vessels in the fleet went down by 26 percent. Measurements of gross tonnes and kilowatts have fallen by 23 percent and 17 percent since 1999 respectively. This indicates that the current fleet consists of slightly larger and more efficient vessels on average than it did ten years ago. Over the same period, catch quotas for some of the most important fish stocks have been greatly reduced (cod from the North Sea, the Skagerrak strait and the Kattegat down 85 percent; cod from the Baltic down 50 percent; and herring from the Baltic down 50 percent).

The average age of fishermen is over 50 years. Recruitment to commercial fishing is at a low level, especially in the Baltic region.

The Swedish freshwater fishing fleet fishes for a number of species using passive gears. A license is required for fishing in public waters in the five largest lakes.

Apart from the five largest lakes, commercial fishing is carried out in 21 lakes in southern and central Sweden, and 13 lakes and reservoirs in the North, most of them in the Luleälven water system. The number of licensed freshwater fishermen amounts to approximately 200. In the Norrland area and in Lake Vättern, target species mainly include char and whitefish, whilst pike-pearl, eel, pike and perch are targeted in the other lakes. In addition, vendace (roe) and whitefish are fished in Lake Vänern. Pike-pearl has become the most economically valuable species in inland fishing.

Objective 4.1, Regulating commercial fisheries with an increasing element of input regulations, such as gear restrictions and that all catches are landed.

To ensure functioning ecosystems it is vital to adapt the size of the fishing fleet to the fish stocks. An important step towards that objective is to have a system of fisheries management where the fishing capacity and effort is regulated according to the possible extraction from the fish stocks. Furthermore, a transition from landings-based to catch-based management is an important way of minimising the amount of fish that is discarded.

Most of the fishing fleets in the EU suffer from overcapacity, including the Swedish fishing fleet. Together with insufficient regulation of the fishing effort, this has resulted in an extensive fishing pressure and many stocks today are seriously over-fished. Overcapacity means that there is a surplus of capital invested in the fishing business in proportion to the capital that is needed for optimal exploitation of the resources. Capital, in the form of vessels or gears, is therefore underutilised, thereby impairing the profitability of the fishing firms as well as resulting in a socioeconomic loss.

The situation in 1999 and today

Fishing has historically been regulated mainly through output regulations in the form of catch quotas set at the EU level, and also through restricted access by means of licensing systems or special permits. Additionally, various kinds of temporal and spatial restrictions for different types of gears have been introduced. Catch quotas for certain species are established by the Council of the European Union and allocated to member states through the Relative Stability Principle; that is, that each member state receives a fixed share of each quota. EU regulations manage the fish that is landed, not what is caught; and, since quotas, by-catch regulations and so forth are often not coherent with the catch composition, a vast amount of fish are discarded.

A large part of the overcapacity that is present today in the Swedish fishing fleet was accentuated at the end of the 1990s. There was then a great deal of developmental optimism in the fishing industry and amongst the administration and banks. At the same time, during the period of structural funds²² leading up to 2000, the investment support for the fishing fleet accounted for up to 40 percent of the total investment costs. The fishing fleet was also in great need of modernisation and, although some of the modernisation was necessary to increase competitiveness and improve levels of

22. The European Fisheries Fund provides structural support to the fishing industry. The financial support given to the fishing fleet is decided by the Swedish Board of Fisheries.

safety, the result was a sharp increase in capacity in a very short time. Overcapacity, combined with inadequate regulations that did not reflect the compositions of catches, brought about increasing amounts of discards.

Today, the Swedish fleet is managed by a combination of input and output regulations, which are controlled largely by EU decisions. Fisheries management in Sweden complements these regulations by setting geographical limits on where trawling can be carried out, introducing closed seasons and non-fishing areas, and by limiting capacity by means of special permits. The most important measures for fisheries management in the seas surrounding are the TAC and quota regulations, technical regulations and the management plans for cod in each sea area. All set by the EU.

Before the period (2007-2013) of the structural funds, the Swedish Board of Fisheries calculated the overcapacity in different vessel segments in terms of gross tonnage (GT) and engine power (kW). According to these calculations, the overcapacity in the shrimp trawler, pelagic (midwater) trawler and demersal (bottom) trawler vessel segments amounted to 10 percent, 30 percent and 50 percent respectively (see table 4.1).

Changes under way

The EU is currently discussing systems of input regulations such as real-time closures and move-on measures (see Objective 2.1). The purpose of these systems is to protect young and spawning fish. The current review of the technical regulations will lead to an increase in the requirements of selectivity in fishing gears. An evaluation of the current system of effort days²³ is also under way, in which the impact that vessels of less than 10 metres in length and the shrimp fishery have on the mortality rates for cod is studied.

Economic support for reducing the overcapacity has been prioritised in the current period of the structural funds. The Swedish objectives for reducing the fishing fleet by scrapping are based on the overcapacity calculated in 2006. The Swedish programme aims to keep coastal vessels and vessels using passive gears in the fleet (see table 4.1).

Table 4.1, Targets for reducing capacity (excluding vessels in the North Sea, the Skagerrak and the Kattegat).

	Vessel segment	Baseline (2006)	2010	2015
Tonnage (BT)	Shrimp trawl	4 815	3 %	10 %
	Pelagic trawl and seiners	23 914	8 %	30 %
	Demersal trawl	9 482	13 %	50 %
	Total fleet	43 770	6 %	23 %
Horsepower (kW)	Shrimp trawl	20 102	3 %	10 %
	Pelagic trawl and seiners	72 356	8 %	30 %
	Demersal trawl	50 331	13 %	50 %
	Total fleet	215 253	6 %	23 %

What do we think the situation will be like in 2020?

Together with high standards being set for selective gears and less harmful fishing methods, a transition from landings-based to catch-based management will have reduced discards to negligible levels. The ability to transfer fishing rights between users will lead to a significant decrease in the number of fishing vessels.

The profitability of the commercial fishing fleet will have increased, and most fishing vessels will fish in a selective and sustainable way. There will be competitive fishing businesses in all vessel segments, and there will be profitable companies in the small-scale coastal fishing fleet that have developed their products in close contact with the fish and seafood markets.

23. On 19 December 2008, a new cod recovery plan was decided by the Council of Ministers for the North Sea, the Skagerrak and the Kattegat. The plan came into force on 1 February 2009 and allocated a maximum level of fishing effort for Sweden, measured in kilowatt days, for different kinds of gears in those seas.

What decision strategies are needed so as to achieve this objective?

1. Introducing rights-based fisheries management.

This will be discussed in Objective 4.2.

2. Replacing current landings-based management for catch-based management.

The Common Fisheries Policy is developing towards catch-based management. As a basis for this kind of management minimum landing sizes should be phased out, selectivity requirements should reflect the target species, rules for landing composition per gear should be phased out and catch quotas introduced.

3. Developing selective gears and providing support for changes to more environmentally-friendly fishing gears.

The introduction of the L_{opt} -strategy in management will mean that, in the years leading up to 2020, fishing gears will need to be regularly changed to allow for a gradual increase in selectivity. To ensure rapid adoption, financial assistance needs to be given for gear replacement.

4. Decision is made that scientific advice must be followed and that catches need to be effectively monitored.

Scientific advice will take a different form when new management objectives are set and when the regulations are completely based on an ecosystems approach. Increasing consumer awareness along with higher demands will put extra pressure on fisheries management. To achieve best results, effective monitoring and follow-ups will be needed.

5. Abolishing capacity-enhancing subsidies.

Capacity-enhancing subsidies, wherein exemption from fuel tax is the most economically important, should be abolished. This is discussed further in Objective 4.3.

6. Following up fleet capacity and a continuous revision of applicable capacity targets.

Considering future technical advances, a continuous evaluation of fishing capacity is needed, with the purpose of assessing whether or not fisheries management is having the desired effect.

7. Developing the methodology for converting biological estimations of the exploitable stock size to estimations of equivalent fishing effort.

Where input controls – such as days at sea – are used as the basis for management, a development needs to be seen in how biological estimations of the exploitable stock size should be converted to fishing effort.

Objective 4.2, Making access to fishing resources rights based, primarily by means of a system of individual transferable rights.

Through a rights-based management systems the incentives that are necessary to establish long term well-functioning ecosystems, are created. To clarify the conditions that apply for exploiting the fishing resources, a contract should be written between the managing authority and the users in which the terms for the fishing are clearly stated.

Rights-based management means that specific fishing rights are allocated to individuals, fishing companies or groups of these (e.g. a producer organisation). The fishing right can consist of catch quotas, effort days or geographically-specific exploitation rights. The fishing rights give the fisherman the opportunity to exploit a certain part of a fish stock without constituting ownership.

The purpose of a management system of individual fishing rights is to minimise the problems associated with today's regulation, such as overinvestment, overfishing and poor profitability. When fishermen have a specific fishing resource at their disposal, incentives are created for investing in capacity in relation to the size of the resource and to catch and sell fish when it is most profitable to do so. In general, the system also creates incentives for stock conservation measures. Any success of a rights-based system depends on how it is designed; a fully-implemented system can be defined as having rights that are specific, protected, exclusive, durable and transferable.

Experiences gained from using systems of transferable fishing rights indicate that it is a successful method for creating incentives leading to a reduction in the fishing fleet. Unlike alternative measures, this method to reduce the overcapacity does not require public funding. Disadvantages can be that small vessels are disfavoured compared to large-scale fishing or that the fishing rights become concentrated to a small number of rights holders. Also to be considered amongst the disadvantages of the system is the fact that transferable rights can be difficult to revoke. Therefore, it is important that the system is correctly designed from the start so that unwanted results are prevented as far as possible.

Various kinds of rights-based management exist in Sweden. The simplest form consists of special permits, whilst the most complete system involves individual transferable catch quotas in the pelagic fishery. In, for example, the cases of the shrimp fishery in Gullmar Fjord and the vendace fishery in the Bay of Bothnia, fishing rights are linked to species and areas but are non-transferable.

To ensure that fishing is carried out in a way that is sustainable in the long term, contracts should be written between the managing authority and the rights holder where

the fishing terms and conditions are clearly stated. If these terms are repeatedly violated, it should be possible to revoke the fishing right.

The situation in 1999 and today

In 1994, Sweden introduced a requirement for fishing licenses and vessel permits for commercial fishing. These were not linked in any way to the kind of fishing that was carried out. On the contrary, the basic principle was free fishing, which meant that a license or permit holder could conduct in any type of commercial fishery.

Special permits are used for regulating the shrimp fishery in Gullmar Fjord and the vendace fishery in the Bay of Bothnia. These systems have resulted in good profitability and the stock status for both species is better than for many other species. Amongst professional fishermen in both cases, there has also been a great deal of interest in stock conservation measures.

In 2009, the Parliament issued a special law allowing transferable rights in the pelagic fishery. Quota trading began as soon as the Swedish Board of Fisheries had drawn up implementing regulations, which came into force in November 2009²⁴.

Currently, special permits are required for a number of fish species, including eel, Norway lobster (caught with pots), shrimp and Baltic cod.

Changes under way

The EU has so far left it open for Member States to introduce management strategies based on transferable rights and a number of countries have implemented different forms of such regulation. In advance of the review of the CFP, the European Commission raised the issue of rights-based management being used at the EU level as a way of regulating large-scale fishing. In order to accomplish this, however, the systems used will require a more uniform design than they do today.

What do we think the situation will be like in 2020?

Fishing rights will be transferable to a larger extent than today, leading to fewer fishing vessels, greater profitability and more efficient fishing companies. The system will not have been able to reverse the current trend, with a concentration of the fishing industry on the west coast. Producer organisations will have more of an influence on the allocation of fishing resources and the management of fish stocks.

24. Act (2009:866) on transferable fishing rights.

What decision strategies are needed so as to achieve this objective?

1. Creating possibilities for exhaustive fishing rights.

A comprehensive system for transferability is needed, and should be designed to be effective in the long term and adaptable to each sea area and its ecosystem plans. The systems also need to take regional concerns and taking small-scale fisheries into consideration. Opportunities for transferring rights between EU Member States can also exist for certain vessel categories.

2. Adapting exploitation rights to the circumstances of each fishery.

Like today, the forms will vary; but they must be based firmly on ecosystem plans and relate to how much of a reduction in fishing effort is needed to achieve sustainable fishing along with other restrictions that may be needed.

3. Basing exploitation rights on contracts.

Each contract needs to state the conditions that must be met for using the resource. If these conditions are repeatedly violated, it must be possible to withdraw the contract despite the financial implications this may mean for the user.

Objective 4.3, For fishing firms to cover their own costs.

Instead of defining objectives of profitable fishing companies, two other objectives are given here; namely, that no capacity-enhancing subsidies are provided, and that fishing firms should pay for parts of the management and control costs (see Objective 4.4).

There are two main kinds of subsidies that apply to fishing firms in Sweden. Firstly, structural funds are given within the framework of the European Fisheries Fund, which is financed partly by the EU and partly by the Swedish Government. Secondly, fishing vessels, like other shipping, are exempt from tax on fuel.

Subsidies mean that fishing companies do not bear all of their costs, which can lead to situations where unprofitable firms can continue operating even when making a loss. Subsidies can also result in overcapacity, since the cost of fishing is not covered by the fishermen.

By exempting fishing vessels from fuel tax, a competitive advantage is also given to the kind of fishing where fuel costs constitute a relatively large part of the operational costs. The tax exemption given to the fishing industry might have slowed down the development and use of more energy-efficient engines, gears and fishing methods.

The revenue from fishing depends largely on the methods used and the price that is paid for the fish at landing. Catch limitations such as quotas or fishing days are the limiting factor in most cases. The price given to the fisherman at landing can vary greatly depending on the season, day of the week and harbour.

Fishing costs can generally be broken down into five main categories:

1. Labour (30–50 percent of total costs);
2. Fuel (10–25 percent);
3. Gear (5–15 percent);
4. Repairs and maintenance (5–10 percent);
5. Capital costs (5–25 percent).

Of all of these items, fuel costs have fluctuated the most over the last decade. Figure 4.2 (below) illustrates the trend in fuel prices between 2000 and 2009. The sharp rise in fuel costs between 2003 and 2008 has had a major impact on the profitability of fishing, especially in the fuel-intensive trawling segments.

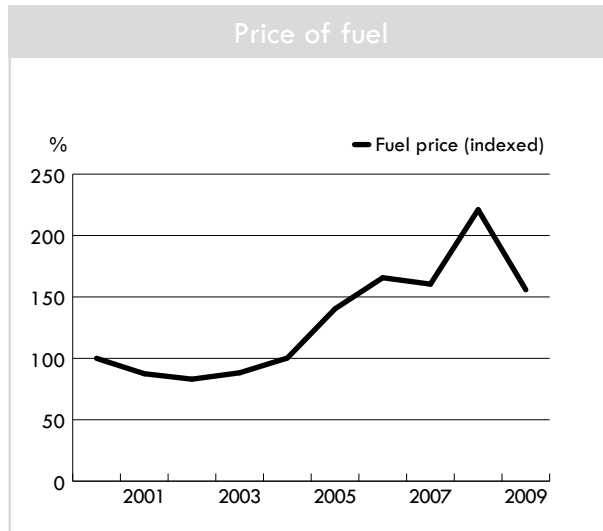


Figure 4.2. Indexed trends in fuel costs.

Value added is often used as a measure of profitability. Value added is the sum of cost of labour, depreciation, interest and the net profit.

The profitability of the Swedish fishing fleet has been strained in recent years. Since one of the effects of the L_{opt} -strategy is that the stocks exist in their natural area of distribution and the population densities increase it could result in more profitable fisheries in the future.

Table 4.2. 2008 data on the Swedish fishing fleet (the figures include only vessels with a catch value over two base amounts, approx 8 000 Euro in the year).

2008	Pelagic trawl $\geq 24m$	Siklöje-trälare	Demersal trawl (cod) $< 24m$	Demersal trawl $\geq 24m$	Demersal trawl nephrops	Demersal trawl shrimp	Passive gears $< 12m$	Passive gears $\geq 12m$
Number of vessels	35	32	65	16	90	39	414	18
kW	44 268	6 380	19 558	10 809	21 819	15 929	31 403	3 509
Tonnage	15 142	416	4 478	3 537	3 521	4 484	2 291	488
Landings tot, tonne	171 449	1 066	20 396	7 799	2 050	2 698	5 881	1 036
Landings tot, value (1000-SEK)	452 551	25 872	153 665	75 646	110 173	167 452	128 453	19 706
Value added per full time equivalent SEK	996 969	892 209	376 525	753 158	239 062	296 467	259 979	328 970
Full time equivalent (FTE)	200	17	122	44	135	109	307	26

In recent years, the economic development has been positive for the freshwater fisheries, with substantial sales to other EU countries and with a good status of the fish stocks, particularly for pike-pearch and freshwater nephrops. The total catch value from inland fishing amounted to 69 million SEK in 2007.

The situation in 1999 and today

During the period of the structural funds that ended in 2000, subsidies for production and modernisation of fishing vessels amounted to as much as 40 percent of the total cost. The equivalent level of support was reduced to 20 percent for the period that followed. During the current period (2007-2013), no direct support is provided for construction or modernisation. Of the structural funds provided during the current period – totalling one billion SEK – 200 million is for the direct benefit of the fishing industry. Scrapping premiums make up 150 million SEK of that figure.

The fuel costs vary between different fishing firms but generally make up a large proportion of the operational costs. There are major exceptions, of course, but values between 10 and 25 percent can be viewed as normal.

Changes under way

In the proposal for the new Common Fisheries Policy, the European Commission asserts that European fishing should be independent of public funding. At the same time it stresses the importance of protecting small-scale fisheries that do not always have the same competitive opportunities as the larger vessels.

What do we think the situation will be like in 2020?

The scrapping premiums and an increased use of rights-based management will lead to a great reduction in the size of the fishing fleet by 2020. The remaining fishing companies will have adapted their operations to work without government subsidies. The L_{opt} -strategy will result in better status of the fish stocks and thereby an improved profitability.

What decision strategies are needed so as to achieve this objective?

1. Abolishing fuel subsidies for the fishing sector.

Since it directly relates to fishing effort, the exemption from fuel tax represents the most production-enhancing subsidy for the Swedish fishing fleet. For the withdrawal of these subsidies to be effective, it needs to be done simultaneously throughout the EU (EEA). Sweden cannot abolish the tax exemption on its own since fisheries in Sweden's neighbouring countries are also tax exempt, and it would be relatively easy to bunker in Denmark, Norway or Finland. It would also put small-scale fishing at a disadvantage because they do not have the same opportunities for bunkering in our neighbouring countries.

2. No subsidies are paid to the fishing industry during the next structure period.

No subsidies should be provided to fishing firms except where the purpose is to speed up the change of fishing gears in order to implement improved selectivity more quickly, as required for the implementation of the L_{opt}-strategy. Providing support for the conservation and restoration of spawning and nursery grounds could be crucial during the next structural support period.

Objective 4.4, For fishing companies to bear part of the management and control costs.

If a fee is charged when vessel permit or the special permits are issued, some of the profits from the fishing industry can be used for the management and control activities that are needed for ensuring functioning ecosystems. Such a model also requires that management is carried out in a cost-effective way and that measures are implemented for reducing administrative costs for the fishing companies (see Objective 4.5).

The total cost of fishing include, not only the production costs presented in objective 4.3, but also the loss of the future value of letting the fish spawn and reproduce. In order for fishing firms to be able to operate fisheries administration is also necessary. This administration includes research activities, regulation and monitoring/follow-ups. It is therefore reasonable to expect that part of the costs involved in administration should be covered by revenue from the fishing firms.

A fee that is directly related to the fishing operation or the value of the catch would theoretically be preferable, but difficult to administer. A simpler system could be an annual fee based on the kind of fishing being carried out and, to a certain extent, the type of gear being used. In practice, this would mean that a fee is charged in relation to the renewal of a vessel permit or special permits. If the fee is linked to the gear being used, the fee can be used as an incentive to encourage the use of environmentally-friendly fishing methods. The system can be complemented by the fee being returned if a permit is not used or used only to a small extent in the year.

The situation in 1999 and today

Today the managing authority may only charge a small fee for handling applications of fishing licenses/permits etc. This small administration fee has been charged since the licensing and permit system was introduced in 1994.

Internationally, New Zealand, Australia, Canada and others have introduced fees that mean that fishing companies pay a large or small part of the management and control expenditures.

Changes under way

No definite proposal of a fee to recover parts of the management and control costs has been presented.

What do we think the situation will be like in 2020?

Following the introduction of rights-based management, the relationship between the exploitation of a resource and management costs will be made clear. The issue of how fisheries administration as a whole should be financed and managed will thereby be considered.

What decision strategies are needed so as to achieve this objective?

1. Creating a legal basis for charging a resource exploitation fee.

The possibilities that exist in current legislation allow for a fee to be charged that represents the actual costs of handling applications for licenses etc To charge any other kind of fee (or resource tax) requires a change in national legislation.

2. Developing methods for classification into fee categories and for determining the size of the fee.

When the legal foundation has been laid for an exploitation fee of this kind, careful consideration needs to be paid to what form the fee shall take and how large it should be.

Objective 4.5, To effectively monitor fisheries at minimum cost and to effectively prevent and follow-up infringements.

One of the objectives presented in Target Area 2 is establishing credible fisheries management amongst interested parties and the general public (Objective 2.6). It is particularly important from a consumer perspective that fisheries management is successful on both national and EU level. Consumers also demand that fish and fish products on the market can be traceable to its origin. In this context, it is important to have effective monitoring. It is also essential that the control activities are adapted to future technical developments at the same time as ceasing with control activities that are unnecessary for achieving the desired results.

The situation in 1999 and today

Available options for monitoring fishing activities and catches were much more limited in 1999 than they are today. The monitoring of catches was based solely on catch and landing data contained in logbooks and landing declarations and data from sales notes. Catch data from coastal fishing was insufficient until the end of 1999, when the national coastal fishing journal was introduced for vessels over a certain length that were not required to keep logbook. In 1999, there was no system for cross-checking catch data from different sources, although some automatic controls were carried out on registration.

Monitoring of fishing quotas in 1999 was based on a combination of catch data and sales information. Compiling the data for quota assessment and creating quota reports was then a very lengthy procedure.

There was no explicit strategic approach for preventive work in 1999, although effort was made for training and spreading information to the industry and other authorities.

The number of vessels providing catch data has declined by 23 percent in the last ten years, but, due to the reporting of fishing effort in the North Sea, the Skagerrak, the Kattegat and the Baltic Sea, more data is reported per vessel today than in 1999. A system of administrative sanctions for misreporting was introduced in 2008. Currently, registered data on catches, landings and sales are cross-checked with each other.

A Vessel Monitoring System (VMS) using satellite positioning has been introduced. VMS data is also cross-checked with logbook data to verify the catch areas. All vessels over 15 metres in length are now equipped with VMS system.

Today, there are much greater requirements for landing controls than there were in 1999. Formal requirements are mainly stated in the management and recovery

plans for various fish stocks. The increase in landing controls has likely contributed to a reduction in under-reporting.

The process of preventing violations through simplification of the rules and by means of training is ongoing and is being carried out at both national and EU level.

The Commission's effort to improve fishery control for Member States is underlined by the creation of the Community Fisheries Control Agency (CFCA).

Changes under way

Electronic reporting will be broadly introduced in fisheries in the coming years. In 2012, all vessels over 12 metres in length will be required to have VMS onboard. The new control regulation also increases the requirement for electronic reporting in the distribution chain, which opens up possibilities for having electronic transport documents.

Monitoring of catches will also be done further down the distribution chain. The new control regulation introduces requirements for traceability of the fisheries products in every step in the sales chain – from the fishing activity to the retail line. Additionally, trade controls are already in place from the first sale down to retail.

Monitoring of quotas and fishing effort will be further streamlined, allowing a greater degree of self-administration and control.

Effort to simplify the rules and regulations are being made, but there is a conflict of interests between the need for more information (e.g. for the purposes of traceability) and the need for simplification. Increased electronic reporting can be expected to lead to fewer errors being made. Consumers and dealers have a growing interest in knowing the origin of the fish, which raises the demand for accurate fishing documentation.

The control regulation requires the setting up of registers for handling violations, including so-called point systems, which will be introduced after the implementing rules are established.

There is an increasing level of understanding about the importance of using different kinds of control activities effectively. The control activities must be based on the consequences an infringement has for the fish stocks as well as the probability that the control method detects infringements and on its cost effectiveness compared to other methods.

Several Member States, including Sweden and Denmark, are testing the use of video surveillance as a mean to control the compliance with the discard ban, validity checks for fishing activities and simplified reporting.

What do we think the situation will be like in 2020?

The demand for legally caught fish from stocks that are sustainable in the long term will increase. This will require more effective control of both catches and fishing effort. The foundation is laid to, on a long term basis, reduce the cost for fisheries control at the same time as increasing its effect through compliance with the management plans in force to such a degree that a positive effect on the fish stock can be observed. To achieve this, future fisheries controls will need to be founded on a number of basic factors:

- electronic reporting by all parties;
- electronic, traceable information at all stages;
- developed technology for monitoring fishing activities;
- increased control cooperation between Member States;
- less detailed regulation at the EU level with the increased use of national control plans tailored to local needs, and;
- field control shall be mainly land based.

Decisions relating to management rules and control regulations will be based on a cost-benefit analysis. This will produce the right conditions for an effective distribution of financial means on a national level. When designing the regulatory framework, the following areas must be considered, stated here in order of priority:

1. Control effectiveness.
2. Simplification for industry and administration – a reasonable balance between these.
3. Cost effectiveness.

A large amount of reporting from the fishing industry as well as later stages in the distribution chain will be done electronically, without any kind of manual input. This will allow quota and effort administration to be carried out automatically, and fish that is sold at retail stage will be traceable back to the individual fishing activity through an electronic tracing system. In this way, it will be possible to use the information found on the packaging to track the fish through each stage in the retail and production chain back to the fishing trip and the individual fishing activity. The increased number of fishing restricted areas that can be expected will make geographical traceability of special interest for consumers. It is therefore important that all vessels should be equipped with surveillance systems to make monitoring possible in close to real time. Emphasis must be placed on ensuring that the allocation of fisheries management funds is used in the best possible way. The existing information systems on board vessels and on land need to be integrated in such a way that the administrative burden on board the vessels is reduced. Cost-benefit calculations will form the basis for all decision-making.

What decision strategies are needed for achieving this objective?

The design and implementation of fisheries control is strongly linked to the choice of management model and its regulation. It is essential that opportunities for controlling established managements measures are evaluated from the perspectives of both control and cost effectiveness. Prohibitions and regulations that cannot be monitored risk damaging credibility. Fundamental for future control, however, should be increased user responsibility, catch monitoring with the help of electronic systems and systematic traceability.

In addition to other objectives for fisheries management, the following decision strategies are important for a successful fisheries control:

1. The introduction of systems and regulations for creating an electronic flow of information.

Regulations and systems need to be introduced for creating a traceable electronic information flow, where every interested party reports all of their fishing operations and transactions electronically. The data will be automatically generated through electronic monitoring systems. Apart from providing more efficient monitoring, this will also reduce the administrative burden for the industry and authorities alike.

2. Calculating the cost-effectiveness of control methods.

All decisions to do with the regulation and implementation of fisheries controls need to be based on cost-benefit calculations.

3. Simpler rules are introduced.

Compliance with the regulations will be improved with the help of increased preventative measures. These can take the form of simplification of the rules, improved information, and uniform electronic documentation processes.



Target Area 5: Fishing Tourism

Fishing tourism is dealt with here as a specific user of fishing resources. The main aim of the fishing tourism industry is to sell the fishing experience itself to foreign or Swedish tourists.

Historically, fishing tourism has involved mainly catching salmon in running water with hand-held gear. The earliest known account of fishing tourism in Sweden involved British sport fishermen who went fishing in the Swedish salmon rivers in the West and the Jämtland County streams, catching large trout. Domestic fishing tourism first emerged in the 1950s, and the most exclusive fishing back then could be found in the mountain region. Companies based on fishing tourism in a strict sense have never been common, and the concept of fishing tourism has mainly involved trips where the traveller is largely expected to organize the journey personally. The need for services has therefore always been low.

Trends are changing towards an increased demand for high-quality fishing, nature and cultural experiences and a higher level of services. For the management of fishing resources, this development has brought with it an increasing need for improving fish stocks through stricter fishing rules and increased conservation efforts.

Swedish fishing tourism companies compete on an international market. The local market remains the most important, but Swedes, like those from other countries, enjoy travelling to different parts of the world for exclusive fishing experiences.

Objective 5.1, Making fishing tourism an established rural industry. Apart from specialised businesses, there should also be companies aiming for a local/regional market.

The development of fishing tourism companies has largely involved providing services for foreign tourists. The discussion has mainly revolved around access to regulated species. Presented here is the fact that the main portion of fishing tourism operations are aimed at a regional market, and that fishing is mainly carried out in privately owned waters. Especially emphasised is the importance of a broader base for the fishing tourism industry.

The situation in 1999 and today

In the 1990s, the fishing tourism displayed great variation in quality, whereby most entrepreneurs offered a product with a low service level, providing perhaps accommodation and boat hire connected with some fishing waters. A few hundred entrepreneurs offered package holidays including food and accommodation, boats, guides, gear hire and transport to the fishing water. Examples of such are fishing camps next to exclusive fishing waters, fishing for freshwater crayfish and fishing from charter vessel in the Öresund sound.

Trolling also grew into a new product for tourism in the 1990s, made possible by the development of gear and boats, the release of salmon and trout smolt into Lakes Vänern and Vättern and other places, and salmon fishing in the Mörrumsån river.

Up to 2009, the fishing tourism industry has developed rapidly. Customer demand for ever higher levels of service and fishing of high quality has been good for the industry. The number of companies has therefore increased sharply since 1999, as has the selection of fishing tourism products. Fishing for pike, perch, pike-perch and freshwater crayfish forms the basis for the fishing tourism in southern Sweden and is also on the increase in central and northern Sweden. Along the west coast, lobster fishing has developed into a product for fishing tourism. Fishing from charter vessel in the Öresund sound remains popular and salmon continue as a popular fishing tourist attraction in northern Sweden.

In total, there are close to 2,600 businesses in Sweden engaged in fishing tourism. Together, they turn over nearly a billion SEK and employ around 2,000 people. To be added to this, according to calculations from the Federation of Swedish Farmers, is the hiring out of accommodation and boats and, to a lesser extent, the sale of fishing permits. Additionally, several college courses and vocational training courses focusing on the sector have been established in recent years.

Most of these businesses engage in more than one kind of activity based on recreational fishing. The most common example is that the operation is combined with food and lodging. One third of the companies state that they offer other tourist-related activities and about one in four provide accommodation to people other than fishing tourists. Approximately two percent of the entrepreneurs are commercial fishermen.

The average business receives a third of its turnover from activities other than those related to recreational fishing, but the proportion varies depending on the size of the business. Smaller companies usually specialise more on fishing tourism alone than the larger ones do.

A survey carried out in 2008 asked fishing tourism companies about what kind of obstacles they experienced in their business. The most common reply was to do with the high cost of labour, followed by the shortage of large fish or shortage of fish altogether.

Changes under way

The special requirements that fishing tourism has for accessing fishing resources will be considered in forthcoming legislation.

The market for fishing tourism is vast. Currently, branch experts estimate that, in Europe, there are at least 30 million active sports fishermen, of which 10 percent travel to go fishing. The value of the European fishing tourism market is estimated to amount to tens of billions SEK.

What do we think the situation will be like in 2020?

The fishing tourism industry is expected to continue its rapid growth. The growing domestic and foreign interest in fishing tourism, together with an increasing demand for high-quality fishing and services are positive for the development of the industry. It can therefore be expected that the number of businesses along with the total turnover will have been doubled in the year 2020.

The Swedish domestic market will be developed as a basis for the fishing tourism industry, particularly near large population centres where there is a customer base throughout the year.

Swedish fishing tourists do not spend as much on fishing as their foreign counterparts because, as a rule, they accept lower standards of accommodation and other services. The higher requirements that foreign guests have bring opportunities for additional sales and greater profits. The ability that a fishing tourist operator has for accepting foreign guests also provides more opportunities on the home market; to be able to

offer high-quality fishing, comfortable accommodation and high-class food in combination with other activities is attractive to for instance conferences.

The abundance of fishing waters with desirable fish species and relatively untouched wilderness are amongst the greatest strengths of the fishing tourism industry. These are coupled with the right of common access and a great interest in outdoor activities. The logistical situation is also relatively good, with several airports offering scheduled services and an extensive road network that reaches out to even the most sparsely populated areas, allowing relatively quick transport to the fishing area.

What decision strategies are needed so as to achieve this objective?

1. Developing marketing and sales organisation for fishing tourism companies.

In order to increase its market share, the industry needs to organise itself more clearly by using, for example, a marketing and sales organisation (see Objective 5.3).

2. Improving availability of fishing resources.

By management measures the availability of fish can be improved (see Objective 5.2).

3. Providing more information to owners of private waters.

The fishing tourism industry is often based on fishing activities in private owned waters. Therefore, there is a great need to improve the information to the owners of private waters about the financial advantages offered by a growing industry, especially in areas with good opportunities for the development of fishing tourism.

4. Giving a clearer role to businesses in municipal planning.

When planning the use of land and water areas, municipalities and county administrative boards should pay more attention to the interests and expectations of the fishing tourism industry.

Objective 5.2, Using management measures for making fish available of a quality that satisfies the requirements of businesses based on recreational fishing.

Currently, fishing tourism operations are found mainly within fishing management areas or in private waters. Only a few companies offer fishing in public waters in the sea or in the five largest lakes.

The eight main target species in fishing tourism are:

- salmon and sea trout in lakes and running water;
- salmon and sea trout at sea;
- trout, char and greyling in lakes and running water;
- pike, perch and pike-perch in lakes;
- pike and perch at sea;
- lobster;
- crayfish in lakes;
- cod and mackerel.

The situation in 1999 and today

The management of fishing waters along the coast and in the five largest lakes takes little account of the needs of fishing tourism for good fish stocks with large individuals. Many of the regulations that have been implemented have, however, had positive effects on the fishing tourism. This applies in particular to the management of salmon and sea trout that, partly due to a prohibition on fishing with drift nets in 2006, expanded their migration up the coast of Norrland and into the wild salmon rivers.

Changes under way

The greatest obstacles that are hindering the development of the fishing tourism industry when it comes to the actual fishing are the difficulty involved in ensuring availability of fish and being able to guarantee the quality of the fishing experience. Along the coast and by the five largest lakes, businesses often lack control over their own product or over the direction that fisheries management takes.

There is now a greater understanding for and interest in developing the management of fish stocks so that it benefits fishing tourism. A number of the changes that have

been made to the regulations or are planned for fishing along the coast and in the five largest lakes have led to greater ambitions for the status of the fish stocks. This, in turn, has led to fishing activities being carried out more in line with the requirements of the fishing tourism industry.

What do we think the situation will be like in 2020?

What is mostly needed for further development of the fishing tourism industry are efforts to improve availability of the fish and opportunities for catching large fish. These efforts need to include improved regulations for how fishing should be done, who should be allowed to fish and what methods may be used. By means of, the L_{opt} -strategy for management which forms the starting point of this publication, an improvement will be seen in the availability of fish within all their natural area of distribution and there will also be more large fish available.

In this context, ecosystem plans with national management objectives for water areas and rivers are especially important.

What decision strategies are needed so as to achieve this objective?

1. Taking better care of the needs of the fishing tourism in the fishing regulations.

The proposed management objective based on the L_{opt} -strategy and the ecosystem plans (see Objective 2.1) will to a great extent address the needs of the fishing tourism industry; for example, the availability of large fish and that fish should be available throughout all their natural area of distribution.

2. Strengthening the role of fishing tourism when allocating resources between different categories of fishing.

As stated in the section concerning the distribution of fishing resources, businesses involved in fishing tourism will have a more distinct part to play. The allocation of fishing resources will, for example, be based on socioeconomic criteria (see Objective 2.2).

3. Expanding the data collection from fishing tourism.

The collection of catch data from the fishing tourism industry needs to be improved in order to provide a better basis for management. Similarly, other details about these companies need to be collected, such as economic data.

Objective 5.3, Developing marketing and sales organisation for the fishing tourism industry.

In addition to measures that can be implemented by the authorities, such as deciding on fishing regulations, or by agreements between fishing tourism businesses and the owners of fishing waters, the industry itself needs to organise its activities in a clearer way; it could, for example, develop a marketing and sales organisation.

For the international market, it is essential that businesses have access to the proper channels for reaching out with their products. A fishing tourism company is dependant on having access to a sales organisation for each market, through, e.g., an agent network. Without having good contact with the market and understanding its requirements, it is also difficult for companies to make their products marketable. The creation of a marketing and sales organisation for fishing tourism in Sweden should therefore be of great interest to the industry.

The situation in 1999 and today

There are various forms of cooperation within the industry today. On the other hand, there is no coordinated marketing of Swedish fishing tourism companies on the European market.

Changes under way

Outside of Scandinavia, there are long-established tour operators that organise fishing trips. This kind of tour operators is also being developed in Sweden. Some operators specialise in specific destinations, whilst others offer a wide selection of trips all over the world. Some cater for a broad audience and others sell only journeys of the highest quality, with the best services and, of course, great fishing – at a price to match.

It is important for fishing tourism companies to find the right customer category for their businesses and get started with the kind of sales that create the right conditions for necessary investments in services and quality. The smaller businesses usually work with the local market, often in competition with neighbouring companies. Seen from a national or international perspective, though, a local competitor can instead become an important partner.

What do we think the situation will be like in 2020?

Active tourism and ecotourism based on being in nature will become increasingly important 2020.

Long-distance tourism will increasingly be combined with various kinds of local tourism. Companies wishing to compete successfully will have to work together. The sale of trips via the internet will become the most common form.

Trade associations will be developed along with a system for environmental certification for products offered in fishing tourism.

What decision strategies are needed so as to achieve this objective?

1. Developing a business network.

It has been established that the main obstacles and difficulties that fishing tourism businesses have are in common with those faced by other companies situated in sparsely-populated areas. It is therefore essential that these businesses collaborate in various ways so as to become more powerful on a national or international market. It is also important that these businesses are included in the financial support that the state and municipalities usually provide for the development of small businesses.

2. Developing educational efforts for encouraging the improvement of skills.

To promote work for improving skills in fishing tourism companies as well as interested organisations, current educational efforts need to be developed, preferably in the context of a trade association.



Target Area 6: Aquaculture

The objectives set out here imply that the production volume of the Swedish aquaculture will remain limited but will gain competitive advantages because of being carried out in an environmentally friendly and organic way (see Objective 6.1); that the fish will be healthy (Objective 6.2); and that shellfish farming will be developed, particularly the cultivation of mussels (Objective 6.3).

The modern Swedish aquaculture industry started to develop around the turn of last century. In the beginning, it was mainly rainbow trout that was bred in small quantities, but salmon and char were also farmed. During the 1950s and 60s, most of the major rivers in the north of Sweden were expanded and hydroelectric companies were ordered to compensate by growing salmon smolt. New knowledge developed from this and, in the 1960s, the cultivation of food fish took off and new businesses established themselves in the market.

Globally, the proportion of fish for consumption coming from aquaculture has increased over the last 30 years. During the 1970s, 6 percent of fish that was consumed came from farms, whilst that number rose to 47 percent by 2006. The rate of increase has, however, declined in the last 10 years.

The number of active aquaculture businesses in Sweden has also declined over the same ten-year period, largely due to the disappearance of many of the

smaller, unprofitable companies. Meanwhile, many of the medium to large businesses have increased their volumes of production to improve profitability.

In the year 2008, about 380 people were employed in the Swedish aquaculture industry. That year, around 5,700 tonnes of food fish to the value of 224 million SEK were produced and 1,300 tonnes of fish were planted, valued at 92 million SEK. Rainbow trout, char and brown trout are the most important species for both production volume and value. There are about 200 active fish farms in Sweden. The most common kind of food fish production is net pen rearing, whilst fish for stocking pools or ponds are usually used. Mussels that are farmed in Sweden are most often grown on ropes. The majority of companies involved in aquaculture are situated in northern Sweden, but mussel and oyster production is concentrated to the county of Västra Götaland, making it the county containing the highest number of aquaculture businesses.

The total number of crayfish production farms is uncertain, but there are likely thousands of small facilities, of which many are run by hobbyists in ponds and do not require a great deal of effort to run. There are, however, very few large commercial farms for crayfish stocking.

Objective 6.1, To develop environmentally-friendly aquaculture and increase production from organic/ environmentally certified facilities.

In 2009 a governmental commission was given the task to produce a national strategy for Swedish aquaculture (SOU 2009:26). The main proposal put forward in the report was that responsibility for the aquaculture industry should be taken at the authority level and that a national strategy needs to be established for providing better conditions for aquaculture in Sweden to be able to grow within ecologically sustainable boundaries. It is these two suggestions that our argument will revolve around here.

The situation in 1999 and today

Internationally, aquaculture production has increased very quickly in the past 30 years – though not so in Sweden. Globally about half of the global fish consumption now comes from aquaculture. The interest in environmentally-friendly production methods within the fishery and aquaculture has increased sharply in the most recent decade; from great indifference, the debate that has been going on in recent years about the origin of caught fish has sparked the public's interest and raised their awareness of the origin of fish and how they are caught. Products from aquaculture will henceforth have a greater share of the market. During 2009, Swedish-grown, KRAV-certified blue mussels entered the market.

Changes under way

European aquaculture production is generally low compared with other parts of the world. The production of freshwater species is in decline, whilst the farming of marine species is increasing slightly, although the rise has levelled off somewhat. Sweden can compete mainly through the production of char, mussel and oyster. Public interest in healthy fats like Omega-3 could increase their interest in certain aquaculture products.

Enthusiasm for organic and environmentally-certified products continues to rise, and current public debate points to a strong commitment towards sustainable production. Development and revision of the environmental certification of food is underway.

The strategy from the European Commission for sustainable development of European aquaculture²⁵ has been approved, as has a new regulation on organic aquaculture.

25. The EU strategy for sustainable development of European aquaculture, COM(2002) 551, sets out political guidelines for encouraging the growth of the aquaculture sector.

The strategy includes focusing on environmentally-friendly methods of production whilst observing strict standards for animal health and offering good consumer protection. Tightened EU regulations have become an important incentive for more and more aquaculture companies to strive to make their methods more environmentally friendly. A procedure is under way whereby the environmental standards are raised in line with the development of current understanding of the environmental impact of aquaculture. Common standards for environmental assessments and control programmes facilitate a more effective development of environmentally-friendly aquaculture in several countries. Aquaculture is undergoing development through research projects in subjects such as the development of food, biotechnology, biomedicine and cultivation techniques.

The aquaculture strategy from 2009 is currently being processed within the Government Offices. The main idea in the report is that responsibility needs to be taken for issues to do with aquaculture in a collective manner and that a long-term comprehensive plan needs to be established nationally.

What do we think the situation will be like in 2020?

Environmentally-friendly and sustainable aquaculture will be developed without any overall drop in water quality anywhere in the country. Environmental controls will be improved and streamlined. Demand for aquaculture products of good environmental quality will rise and benefiting the Swedish aquaculture industry. The interest in organically-grown products will also increase, and ever increasing numbers of farms will become environmentally certified.

The Water Framework Directive²⁶, the organic aquaculture regulation and the EU strategy for sustainable development of aquaculture will be the governing factors for any decisions on the EU level.

The ability of the Swedish aquaculture industry to increase its production will be dependant on a number of factors, such as environmental limits, demand for aquaculture products, possibilities for growing new species and the development of organic production. Possibilities for development and growth in the aquaculture sector will also be dependant on training and research in the field.

Swedish aquaculture farmers will concentrate more on the preparation of their cultivated products than they do today. Companies engaging in aquaculture could also expand their business through, e.g., the internet, restaurants etc. and other activities catering for visitors, like fishing and courses. Demand for fish for restocking may increase along with the expansion of fishing tourism and fishing management areas.

26. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

Higher numbers of environmentally-aware consumers will increase demand for environmentally-certified products, including those from aquaculture. Parts of the Swedish aquaculture industry will probably continue to struggle in the debate surrounding their use of wild-caught fish as feed. Because of the debate, consumers will likely choose imported herbivorous species instead of environmentally-certified fish grown in Sweden.

Interest in health and the environment will take even greater prominence in public debate. The ability to invest money in personal health in the form of exercise, access to healthcare and buying quality food will come to be seen as an ever increasing status symbol. Because environmentally-certified products are often associated with arguments relating to good health, aquaculture products certified in this way will be able to 'free ride' on the public health bandwagon. The environmental debate will continue and will lead to increasing demands on the aquaculture industry from consumers.

What decision strategies are needed so as to achieve this objective?

1. Overall national responsibility is taken.

One authority needs to be designated for accepting the collective responsibility for all issues relating to aquaculture. Today, both the Swedish Board of Fisheries and the Swedish Board of Agriculture have central supervision. At the same time, it is the environmental assessments carried out by the county administrative boards that are seen as the greatest reason holding back the development of aquaculture. Aquaculture's part in spatial planning also needs to be clarified.

2. Building and applying a national strategy.

A complete national strategy for aquaculture should be developed together with the authorities, industry bodies and individual entrepreneurs, with the purpose of achieving environmentally-friendly aquaculture. The criteria that the authorities have for, e.g., environmental assessments should be made clearer. Economic support given to the industry should be in the form of research and development for production methods. There are a number of question areas that need to be dealt with in the context of a comprehensive plan; here, we can point out just some of the aspects that should be highlighted:

- the breeding of rainbow trout, char, blue mussel, oyster, eel, freshwater crayfish, perch, pike-perch and common whitefish;
- the development of farming fish for restocking. The need for these fish is expected to rise when fishing tourism companies and fishing management areas want to expand their operations;
- fish that feed on vegetable diet (e.g., carp and tilapia);
- increased small-scale preparation of products as a complement to aquaculture businesses;

- companies creating their own niches in the market;
- the sale of experiences – not just fish and shellfish and products from such;
- investing in methods that aim to replace animal protein with vegetable protein in fish feed;
- developing the regulations/criteria for environmental certification in aquaculture products;
- increased skills in the industry for organic production;
- to be able to stand up against international competition and lower the logistical and marketing costs, cooperation between aquaculture businesses needs to be developed, as does their collaboration with other industries; for example, those involved in local fishing;
- improved information gathering and processing of data to do with aquaculture;
- investing in research to do with the development of cost-effective and environmentally-friendly technology and feed that can, in the long term, help the industry to increase its profitability.

Objective 6.2, To ensure good health status of fish and not allow alien species or genetically modified fish to reduce biological diversity.

Two essential elements to environmentally-friendly aquaculture are (1) retaining fish in a good state of health, and (2) that alien species or genetically modified fish (which can be used in Swedish aquaculture) are kept in such a way that they do not cause loss of biological diversity.

The situation in 1999 and today

The regulations that exist today were written in the early 1990s and were intended to control and monitor the health of wild fish. Trade and transportation of fish within the EU has increased since then, bringing a greater risk of new diseases being introduced into the country, which could then spread to fish cultivations or wild fish. The EU regulatory framework essentially means that fish may be transported from one farm to another within the EU only if they come from an area that is confirmed free of listed diseases. Increased trade has brought with it a greater danger of new diseases being brought into the EU through imports.

The EU directive on health requirements for aquaculture animals²⁷ addresses health requirements and preventative measures needed for maintaining a good state of health throughout the community. As far as our national legislation is concerned, this essentially means that changes are needed in national health screening.

The strategy that the Swedish Board of Fisheries uses for controlling the release and spread of fish is intended to minimise the spread of foreign species in Swedish waters. The introduction of species that are new to the country is further controlled by the EU regulation on using alien and locally absent species in aquaculture²⁸ as well as provisions by the Swedish Board of Agriculture. According to rules by the Swedish Board of Fisheries, farming and restocking of alien species or strains is not permitted. Exceptions to this rule are rainbow trout, brook trout, lake trout, grass carp, signal crayfish and the trout hybrid splake, which can all already be found in the country. When releasing these alien species into the water, care must be taken that the action does not in any way damage original species or the biological diversity in the area.

27. Council Directive 2006/88/EC of 24 October 2006 on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals.

28. Commission Regulation (EC) No 535/2008 of 13 June 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 708/2007 concerning use of alien and locally absent species in aquaculture.

The rules for farming, restocking and movement of fish consider genetically modified fish to be alien species, which is why the rules are very strict when it comes to granting approval for cultivation in aquaculture. The ecological and genetic impact of fish escaping from farms is difficult to calculate but is generally conceived as large.

Changes under way

The EU regulation on alien species in aquaculture requires that a risk assessment be carried out in connection with permission being given for importing or transporting foreign species. Details about which facilities and authorisations exist in the EU must be made public and be kept continuously up to date. Improved documentation of fish restocking and registration in connection with authorisation decisions is also required. On the national level, a new fish restocking policy needs to be ratified.

As the directive on health requirements for aquaculture animals comes into force, there will be a transition over to risk-based monitoring of fish health. National regulations will be revised with a view to better adapting them to the new situation. Rules for planting fish will also be tightened so as to provide increased protection for biodiversity.

Genetically modified fish for food production are being developed and are expected to enter actual food production within the next few years. Amongst other things, funds are needed for studying behavioural and psychological changes in fish that have been genetically modified.

What do we think the situation will be like in 2020?

There will be better monitoring of the approval process for foreign species and strains, and no new releases will be approved for brook trout, lake trout or splake. No new species will be added to the EU list of exceptions. Permission to sell genetically modified fish will be granted; it is likely that approval will be needed within the EU for growing genetically modified fish for consumption.

Continued good health status of fish and the use of antibiotics and vaccines will stay at very low levels.

A knowledge bank will have been built up for serious aquatic diseases in wild fish, crustaceans and mussels. This knowledge bank will provide better advice to businesses and the general public, thereby helping to provide better care for and utilisation of aquatic resources.

What decision strategies are needed so as to achieve this objective?

1. Establishing a legal framework that allows for minimising the effects caused by alien species and genetically modified fish in aquaculture.

There needs to be national and European legislation for regulating the authorisation given for breeding or importing genetically modified organisms. Alien species should be used only within closed production facilities. Modified fish should not be allowed in aquaculture until the ecological consequences have been properly studied.

2. Developing health screening.

The spread of diseases can be expected to be minimal provided that preventative measures are used, such as good health screening and the dissemination of information. Authorities need to be given greater responsibility for the prevention of infectious diseases, and guidelines need to be developed for good practices in the cultivation and transportation of fish.

3. The collection of good basic data.

An authorisation database needs to be built for the aquaculture industry. It should satisfy the requirements set by the EU and must also be easy to improve and adapt to new situations.

Objective 6.3, To develop mussel farming.

We would like to pay special consideration to mussel farming and, in this context, draw attention to the fact that, apart from the production of food, mussel farming can also be seen as an environmental measure designed to reduce eutrophication.

The situation in 1999 and today

Viewed over the last decade, Swedish blue mussel farming has been on the increase, although the volume produced has varied greatly from year to year. This variation is due to temporary harvest stoppages in some years because of the presence of mussel poison and the unsteady demand coming from export markets. In Sweden, the biggest annual harvest was approximately 2,000 tonnes. The mussels are sold on both the Swedish and European markets.

In 2008, there were 17 facilities located along the west coast; and, since 2006, trials have been underway in the Baltic Sea, although the purpose in this case is the manufacture of animal feed and fertiliser.

A producer organisation for farmers of saltwater shellfish was set up in 2007, with twelve member companies that cultivate blue mussels or work with oysters. The organisation promotes cooperation between cultivators and assists in adjusting production to the needs of the market.

Environmentally-certified blue mussels farmed in Sweden have been on the market since 2009.

The use of blue mussels in biotechnology and biomedicine has been developed. For example, technology now exists for using protein derived from blue mussels in the development of a biological glue.

Changes under way

A prerequisite for large-scale mussel farming is for the harvested mussels to be able to be sold profitably. Apart from food, mussels can provide products that make very suitable animal feed as a replacement for fishmeal used in, e.g., poultry and fish feed, or as fertiliser in organic agriculture. There are currently plans for one trial facility for producing mussel meal on the west coast. The difficulty in producing mussels for feed or fertiliser is the pricing in these markets. An increased demand for organic products, large-scale production and a future system that rewards those who help to reduce the level of nutrient salts in the water could increase the competitiveness of the blue mussel.

The farming of blue mussels has proved to be an effective environmental measure for improving the quality of coastal waters in the Baltic Sea as well as the Kattegat, the Skagerrak and the North Sea. By harvesting mussels, nutrient salts can be removed from the water.

In the province of Bohuslän on the west coast, authorisation has been granted for a level of mussel farming that far exceeds current production. At the same time, some companies have expressed an interest in mussel farming off the coasts of the Halland and Skåne provinces. Provided that demand increases on the export market, the industry expects a great expansion in Swedish production in coming years.

What do we think the situation will be like in 2020?

Mussel farming in Sweden will increase. Blue mussels have the potential of becoming a much sought-after product, especially in the light of growing consumer demand for environmentally-certified products. The positive effects that mussel farming has on the environment will also strengthen its trademark. Demand for blue mussels will also increase in Sweden, thanks to product development. Swedish blue mussels will be available all over the country, but will have to compete with imported products. Products from mussel farming will be developed as feed supplements in organic poultry production and fish farming, and as a fertiliser in organic agriculture. Furthermore, the conditions for using mussels in biotechnology and biomedicine are developed.

What decision strategies are needed so as to achieve this objective?

1. Developing products from mussel farming as food.

When the potential is right – in the form of permits being granted for cultivation at a scale large enough to guarantee a stable mussel production – the industry can grow. The mussel farmers' own organisations can provide support in marketing and coordination issues.

2. Increasing the number of permits issued for growing blue mussels on the west and south coasts, especially in areas marked off as suffering from eutrophication.

In addition to food production, mussel farms can also contribute to reducing eutrophication and can therefore be seen as environmental measures in some cases. This should be considered when granting permits.

3. A more effective use of the mussel harvest in aquaculture.

Developments are underway that allow every part of the harvested mussels, even the small ones, to be used. Small mussels or shells can, for example, be used as effective animal feed.



Target Area 7: The Processing of Fish

The concluding section in this publication (Target Area 8) provides another basis for describing the potential of fishing; namely, the consumption of fish and fish products. Only some of the Swedish demand for these items is met by the domestic fish processing industry.

Fish processing in Sweden currently includes everything from small-scale processing in family-run businesses to international corporations, although the processing industry is dominated by large companies that are positioned mainly on the west coast and, to a certain extent, on the south coast. Meanwhile, the processing industry has been making headway along the coast of Norrland in recent years.

In Swedish waters there are insufficient quantities of fish of the correct size or quality to satisfy all the requirements of the fish processing industry and their need for raw materials, e.g., herring. Because of this, the processing industry in Sweden is largely dependent on fish from other countries.

Because traditional species of fish have become much more expensive, the industry has tried to replace them with cheaper species of similar quality, which has resulted in the companies turning to other countries, such as New Zealand

and Chile, in order to acquire different fish species. Although the price of fish as a raw material has risen in recent years, the continued demand for fish and fish products has allowed the industry to compensate the increase in cost by raising the prices of its own processed products.

Important end products are those made from herring and cod, but products from, for example, shrimp, salmon, mackerel and haddock are also important.

Objective 7.1, To develop fish processing as a complement to the fishing and aquaculture sectors alongside the specialised processing industry.

The future development of the processing companies that are mainly concentrated to the west coast depends greatly on international competition. Alongside these companies, we can see an opportunity whereby processing can become an important complement to fishing and aquaculture businesses. The increased availability of large fish as a result of the suggested management model (Target Area 1) should benefit these companies.

The situation in 1999 and today

The total number of processing companies has increased in the last ten years. It is mainly the number of smaller businesses that has increased; of a total increase of 30 companies (from 178 to 208), 27 have less than ten employees each.

Although the number of businesses has increased, employment has dropped by 7 percent; the total number of employees has fallen from 2,066 to 1,934. On the other hand, the number of employees amongst the smaller companies has grown; from 216 to 281, representing an increase of around 15 percent.

Trends over the period 1999 to 2008:

- the number of businesses has increased by 17 percent;
- the quantity of employees has fallen by 7 percent;
- turnover has improved by 31 percent;
- production value has gone up by 21 percent;
- production value per employee has risen by 15 percent;
- gross and net investments have halved.

Changes under way

Alongside a larger-scale processing industry that competes on the European and global markets, small-scale businesses have appeared whose main focus is processing fish caught or cultivated locally and selling the products primarily on the local or regional markets. Meanwhile, globalisation has drastically altered the situation for the large-scale processing industry.

Some of the trends that have been observed from a European perspective that apply also to the larger-scale processing industry in Sweden are discussed here:

a) Changes in the availability of raw materials. The increasing globalisation that has occurred in recent years is likely to continue. There are not enough raw materials within the EU to satisfy the demand of the European market for marine products. Therefore, large processing companies purchase the raw materials they need from all over the world, and an organisation has been set up for this very purpose. Another reason for this development is the need for predictable supplies of raw materials. Because of fishing moratoriums and fluctuating quotas, the time horizon can oftentimes be too short for the company to be able to plan its production. Domestic raw materials are therefore combined with those from other countries. Competition over materials means that processing companies need to invest in foreign operations.

b) Primary processing is outsourced to regions with low labour costs. This can reduce production costs and make it easier to obtain the raw materials. For example, a larger amount of raw material can be extracted from a fish when it is manually filleted than can be done by machine. Outsourcing to contractors in this way can affect domestic job opportunities, food safety, hygiene and quality.

c) Aquaculture being used as a source of raw materials. Methods for aquaculture are developing rapidly all over the world and the technological development helps to provide more effective production. In Southeast Asia, for example, aquaculture has become an increasingly important supplier of raw materials to the processing industry.

d) Changes in competition. Vertical integration has been observed in many European countries as a method of ensuring the availability of raw materials; that is, that processing companies are closer tied in with the fishing industry for delivery. Meanwhile small-scale processing businesses are being developed that are largely dependant on local landings but, at the same time, are more flexible in adapting their production to the supply of raw materials.

e) Changing demand and consumer preference. Overall, demand for fish and fish products has increased in recent years and there is reason to expect that demand will continue to rise, the biggest increase being seen in demand for highly-processed products.

f) Certificates of origin and environmental certification. Environmental issues have become ever more important for producers as well as consumers. It is required that fish are supplied from stocks that are sustainable in the long term, that any impact on their habitat is minimal and that any by-catches are small. Environmental certification and certificates of origin could also be a way of entering attractive markets or charging a higher product price.

What do we think the situation will be like in 2020?

Increased fish populations brought about by the implementation of the L_{opt} -strategy in management will lead to fish being caught at a lower cost, leading, in turn, to reduced costs for the production of processed goods. When fishing is carried out sustainably, the public debate on fish stocks and the environmental effects of fishing will become less relevant. It is, however, highly uncertain what kind of effect reduced costs will have on the sale price for processed products. Prices, of course, also depend highly on consumer preference (see Target Area 8), particularly to what extent a person is willing to pay a higher price for a product that is prepared locally or regionally.

Overall demand for fish products has risen, but the question is whether this trend will continue. Fish and shellfish products are healthy foods that are rich in nutritional value, and the current health trend will have a positive effect on demand. However, consumer preference can change and is influenced, for example, by alarming reports about threatened species/stocks, food trends and price changes in competing foods, such as meat and poultry.

What decision strategies are needed to achieve this objective?

1. Allowing more small businesses to develop.

The right conditions need to be created for an increase in the number of small businesses engaged in fish processing and for their sales to improve. This can be done by providing a business grant to small business. Close links between commercial fishing, aquaculture and processing would be of great value.

2. Vertical integration.

Vertical integration needs to continue, whereby closer contacts are established between large to medium-large processing companies and various groups of fishing or aquaculture businesses. The potential for such integration would be stronger if fishing businesses were given stronger control over their share of the resource by means of a rights-based system.



Target Area 8: Consumption and Trade

This section discusses fish and fish products from the consumer perspective. Since the majority of the fish that we consume in Sweden comes from other countries, the fish trade is also discussed here. Particular emphasis is put on ensuring that fish for consumption comes from sustainable stocks (Objective 8.1). In order to accomplish this, fisheries management must be credible (Objective 2.6).

Data on Swedish fish and shellfish consumption is limited. Available consumption statistics indicate that intake of fish and shellfish is slightly lower than the National Food Administration's recommendation of 2-3 times per week, or the equivalent of 300-400 grams per person per week. Consumption of frozen fish fillets (blocks of cod) has risen somewhat, whilst the amount of canned and processed fish that is consumed has been increasing considerably since the mid 1990s. Over the same period, consumption of fresh fish has dropped.

In 2008, Sweden imported fish and shellfish to the value of almost 18 billion SEK, whilst exports amounted to approximately 12 billion SEK. By way of comparison, the total landings value (the price that fishermen are paid for their catch) from the Swedish fishing fleet is approximately 1 billion SEK per year. Most of Sweden's imports of fish products come from Norway and Denmark, and much of the salmon that Norway exports is transported through

Sweden to elsewhere in the EU, which greatly increases the import/export figures for fish products in Sweden.

The EU itself is also greatly dependant on imports to satisfy the demand for fish. The level of self-sufficiency for fish products in the EU is currently about 40 percent and is likely to fall further. For whitefish (cod, Alaska pollock haddock, etc.) the level of self-sufficiency is less than 10 percent. An evaluation of Swedish fish consumption shows that approximately 40 percent of the fish comes from aquaculture and 60 percent is caught wild.

Because of the limited possibilities that the EU has for producing its own fish, there will continue to be a need for imports in the future. This means that supply on the European market will be largely dependant on global developments. Additionally, since most of the fish comes from other parts of the world, this will make it more difficult to achieve the objective of ensuring that all fish intended for consumption shall come from sustainable fish stocks. In this context, environmental certification will have an important complementary role to play.

An important part of the uncertainty about which fish consumers can eat without contributing to the depletion of stocks, comes from the lack of credibility of fisheries management. Objective 2.6 discusses how this situation can be improved.

The current food trend is that consumers want food that is good, healthy, environmentally sound and can be prepared quickly. At the same time the consumer want to have fish which is available year-round at low prices.

Whilst consumption of fresh fish has decreased, processed products and shellfish have become more popular. It can also be seen that consumption of more expensive species such as salmon is on the rise, whilst lower-priced species, like herring and sprat are being consumed less. This does not only apply to Swedish consumers. The price of fish has risen more than it has for other types of food which became especially evident in the 2000s. When fish prices are increased, consumers, to some extent, appear to choose meat products instead. Furthermore, studies show that Swedish consumers have become more sensitive to changes in food prices in the last decade. The changing consumer pattern could provide an opportunity for local coastal fishing because by far the majority of fish caught by these fishers are high-value species.

Another trend is that Swedish households spend less time preparing food. The products we buy can be prepared quickly and easily. This is noticeable when comparing the sale of fresh fish, which has declined, with the increasing amount of processed fish products that are sold. It is expected that, in 2020, this trend will continue. Fish has, perhaps undeservedly, gained a reputation for

being complicated food that is difficult to prepare, which is why many consumers avoid trying to prepare fish themselves. Changing consumer attitudes towards preparing fish and improving their products are some of the challenges facing the processing industry. By further processing and developing so-called ready-to-cook products, small-scale fisheries could also benefit from the development towards cooking that is less time-consuming.

In the wake of increased lifestyle diseases, such as obesity, cardiovascular diseases and diabetes, a lot of attention is being focused on healthy eating. Consumers want unadulterated products that are free of preservatives or additives and have a high nutritional value. Since fish and shellfish are considered healthy food containing high-quality protein and healthy fats, the health trend is positive for fish sales.

The trends that form the basis for the arguments that follow are:

- an improved market for organic foods;
- a focus on healthy eating;
- an increased demand for processed fish products that are easy to cook;
- environmentally conscious consumers who choose not to eat fish because of the danger of depleting the fish stocks;
- price-sensitive consumers who choose cheaper alternatives such as chicken;
- consumers who avoid fish altogether because it is difficult and complicated to cook.

Objective 8.1, For all fish that is consumed to come from stocks that are fished sustainably.

This objective is ambitious because most of the fish that we will be eating in 2020 will come from outside the EU. The aim should be seen from the perspective that all fish caught in EU waters or by EU vessels should come from sustainable fished stocks. Fish products that do not meet the requirements must instead be certified in some way.

The objectives that have been set for fisheries management (Objective 2.1) are intended to create long-term sustainable fish stocks. As has been made clear, the way to achieve this objective is difficult. This chapter, therefore, will assume that not all fish will be caught from sustainable populations, even though development will be heading that way. Hence, we believe that there is a need for environmental certification.

The situation in 1999 and today

There has long been a demand for organically produced food that are produced in an environmentally friendly way. This has led to a much greater selection of such products and, generally speaking, environmental thinking has made an impact. The number of environmentally-certified products in shops has increased in recent years, and there is also a clear market growth for these products.

Since most of the world's fish stocks are overfished, the interest in various kinds of marking or labels has increased. Environmental labelling and origin marking are the two main categories. In addition, large food chains have started to require traceability from their suppliers. In Sweden, there are two environmental labels used for fish products: KRAV and Naturland. The leading brand when it comes to labels of origin is the Marine Stewardship Council (MSC). In addition to these, the fishing industry in Sweden has introduced the NärFiskat concept, which translates to 'caught nearby' and guarantees that the fish is caught legally and can be traced.

Environmental labels certify the fisheries and guarantee that the labelled fish comes from the stated stock and cannot be mixed with other fish when traded. For this reason, the entire sales chain must be certified in order for the fish to be able to be tracked from the moment it is caught, all the way to the consumer. Origin marking does not require that every link in the sales chain is certified.

For farmed fish, KRAV rules apply that are intended to be comparable with other kinds of animal husbandry. There are rules for fish feed and for limiting the use of

medicinal products within the fish farms. Currently, KRAV-labelled blue mussels can be purchased. MSC, though, does not presently certify cultivated fish. The WWF (World Wildlife Fund), on the other hand, which is one of the founders of the MSC, has initiated a discussion about an international standard for labelling aquaculture products.

In 1999, the MSC started certifying fisheries on a small scale. At the time, KRAV in Sweden had not yet developed the criteria for labelling fish. For consumers, the availability of fish from stocks that were fished sustainably was not a big issue, and the information that was available to them was limited.

Changes under way

At present there is no official standard for the environmental certification of fish products, although discussions are underway at the EU level for introducing such a standard. FAO has also adopted basic guidelines for environmentally certifying fish products.

Increasing importance for the environmental labelling of fish products is a clear trend, not just in Sweden, but also in other countries, like the U.S.A., Great Britain and Germany. The American company Walmart intends to have all of its fish products that are sold on the U.S. market MSC labelled. This will naturally affect the demand for environmentally-certified fish globally. Processing companies in Sweden have taken a similar initiative.

Many fisheries that are important to the Swedish market are currently applying for MSC certification. The Danish Fishermen's Association has stated that they would like all fish to be certified wherever possible. In Sweden, cod fisheries in the Baltic Sea and pelagic fisheries are applying for certification. In the Barents Sea, an assessment is being carried out on cod and haddock fishing according to MSC guidelines. KRAV labelled cod and haddock from the Barents Sea is already available on the Swedish market.

What do we think the situation will be like in 2020?

Reliable consumption statistics will be available, allowing for more confident assessments of consumption and how it changes over time.

The development of sustainable fishing is, of course, the deciding factor for sustainable consumption. In 2020, there will be a clear trend towards better availability and popularity for environmentally-certified fish, and it is likely that certification will become a requirement for accessing certain markets and market segments.

There are currently a number of fisheries that can be classified as sustainable without being environmentally certified; these will most likely apply for certification. The consumption of environmentally-labelled fish will then be a better indicator for what proportion of the total consumption comes from sustainable fish stocks.

What decision strategies are needed so as to achieve this objective?

1. Ensuring sustainable fishing.

Swedish efforts for promoting the sustainable management of fishing resources on the EU level are probably more important for achieving this objective than are campaigns for environmentally-certified fish and/or more consumer information. The long-term objective should be for various kinds of labelling to become unnecessary because all fish will fulfil the requirements for sustainable fishing. Sound fisheries management is a prerequisite for environmental labelling; this applies also to aquaculture to a certain extent, since catching for fish feed is an important factor to be considered in the certification process.

2. Making fisheries management credible.

An objective should be set at the EU level as well as nationally for fisheries management to be credible, particularly from a consumer perspective (see Objective 2.6).

3. Controlling the origin of imported fish.

A system of origin marking for fish and fish products needs to be developed and there should be minimum requirements for marking established by the FAO.

4. Keeping a dialogue with the industries about the conditions for environmental certification.

The financial incentives created through increased demand for environmentally-certified fish and, conversely, reduced demand for unlabelled fish, could make it easier for the fishing industry to accept management measures. Continuing pressure from consumers will facilitate the authorities' efforts in this area.

Objective 8.2, Increasing consumption of sustainable fish caught and landed locally.

It is not necessarily true that consuming fish caught locally is always better than the alternatives from an environmental perspective. If the fish stocks around our coasts are over-exploited, it is better for the environment to, instead, purchase fish from stocks within safe biological limits or fish that is farmed in a sustainable way, even if the fish is transported a long distance. Provided that transportation is done in an efficient way, preferably by container ship, the share that transportation has in the environmental impact of fish consumption is only marginal. At the same time, consumers have a strong desire to purchase fish that is caught locally with a good conscience. It should therefore be one of the objectives of fisheries management for such consumption to be able to increase.

The situation in 1999 and today

The alarming reports that came in the past ten years about the status of fish stocks have, in some cases, influenced consumers to avoid fish caught locally – Baltic cod being a prime example. The fishing and processing industries claim that it has, at times, been impossible to sell cod from the Baltic Sea on the Swedish market and that most of the catch has therefore been exported to Denmark, France and other countries.

Changes under way

Locally-caught fish will in some cases have a competitive advantage, in that there is a strong trend towards greater demand and better prices for food produced locally. What has been observed in agriculture is that individual entrepreneurs have been able to create strong brands from small-scale food production, in for example on-farm dairy units. These brands are usually strengthened in connection with alarming reports in the media.

Within the fishing industry, commercial fisheries and their organisations are working to highlight the concept of locally produced. This is particularly the case with lake fishing, where the fisherman can often run his business in a fashion resembling many businesses in the agriculture sector. The Närfskat label guarantees that the fish is caught in Sweden in accordance with the regulations.

Within the framework of the European Fisheries Fund, more than ten so-called fishing areas have been formed. These areas have opportunities to use structural funds on the basis of a more general strategy for how fishing could be developed. Several of these areas intend to develop local brands.

What do we think the situation will be like in 2020?

Consumer interest in locally-produced food will most certainly continue to grow. At the same time, much of the food will continue to be produced relatively far from the market. Locally-caught fish will have the opportunity to be strengthened as a brand, either collectively through the use of Närfiskat labelling or through small enterprises that succeed in profiling their fishing as sustainable and environmentally friendly, thereby receiving a better price for their products.

What decision strategies are needed so as to achieve this objective?

1. Ensuring sustainable fisheries.

A long-term sustainable management of the fish stocks is the most important factor in ensuring a favourable price trend for locally or regionally-caught fish. If management can create a stable situation for the fish stocks along our coastline, alarming reports ought to disappear. Another difficulty, however, is that small-scale fishing today has become debilitated, especially on the east coast.

2. Improving pricing for local fishing.

There is an opportunity for local fisheries to charge higher prices for their products, since Swedish consumers appear willing to pay more for fish caught locally.

Objective 8.3, Access for consumers to safe and healthy food from the sea and lakes.

In some parts of the Baltic Sea, dioxin levels in Baltic salmon and herring exceed EU limits. Sweden and Finland have been granted an exception from EU regulations, meaning that salmon, herring, lamprey, trout, char and vendace may be sold on the Swedish and Finnish markets despite the fact that levels of dioxin and dioxin-like compounds can exceed limits. This exception extends to 2011 and is based on, e.g., dietary recommendations long given by the National Food Administration, which state that limited consumption of fish containing elevated levels of dioxins does not carry an unacceptable health risk.

The situation in 1999 and today

The levels of dioxin and dioxin-like compounds in Baltic fish such as herring and salmon as well as lake fish have been that high during the last decade that the National Food Administration has recommended limiting intake. This recommendation was strengthened in 2008 for women of child-bearing age. The National Food Administration continuously monitors levels of environmental toxins in fish and reports annually to the European Commission.

Changes under way

Because of the fact that Sweden's exception from the EU limits is soon to expire, the Government has given a mandate for exploring possible courses of action. Within the framework of this mandate, the National Food Administration will carry out extensive tests of toxin levels in fish from the Baltic Sea as well as lakes. They will also evaluate how much of an impact the dietary recommendations have amongst the population. Possible courses of action will be formulated and the consequences for the fishing industry will be accounted for. The Swedish Environmental Protection Agency is also investigating the sources of the environmental pollutants in Baltic fish.

What do we think the situation will be like in 2020?

Levels of dioxin and dioxin-like compounds in fish will have levelled off. The source of these toxins is as yet uncertain, and the same can be said for what measures can be taken to lower the levels. It is likely that some species of fish in the Baltic Sea and some lakes will be above limits in 2020.

What decision strategies are needed so as to achieve this objective?

1. Reducing the amount of harmful substances.

One aim for fisheries management and the environmental work should be to ensure that locally-caught fish is safe to consume for the entire population without constituting a health risk. Dietary recommendations are one way of ensuring this, but, in the longer term, the amount of harmful substances in fish should be reduced, especially when trying to increase consumption of locally-caught fish.

Objective 8.4, Ensuring that consumers are well informed.

If consumers had a better knowledge about fish stocks and fisheries, this would likely improve the possibility to achieve the other objectives concerning consumption.

The situation in 1999 and today

In 1999, there were no legal requirements for origin markings. Fishing was by no means discussed to the extent that it is today and neither was there any great consumer demand for information.

It can be argued that the information available on the market today is insufficient for consumers to be able to make an informed choice based on the origin of the fish. The sea areas as divided by the FAO are much too coarse in comparison to the geographic distribution of most fish stocks. Statutory marking displaying catch zone and whether the fish is wild-caught or farmed was introduced in 2001.

Certification of fish is a form of consumer information. Although this is viewed in a positive light, consumers know little about what the markings mean. Surveys that were carried out on the knowledge and attitudes of consumers indicate that, whilst consumers are interested in knowing more about the origin of the fish, potential environmental toxins as well as whether it has been fished in a sustainable way, these issues do not seem to be principal factors that guide consumption.

The repeated alarms about the situation of various fish stocks close to home as well as elsewhere in the world, combined with a level of uncertainty or lack of knowledge amongst consumers about the biological situation, can be said to have paved the way for the acceptance of so-called 'fish lists' – the one by the WWF being the best known. Newspapers are regularly publishing guides for which fish species are or are not threatened by overfishing, usually based on the WWF guide. Chain stores have promised that red-listed fish will be removed from their selection. Greenpeace and the Swedish Society for Nature Conservation (Naturskyddsföreningen) have also developed fish lists, but these are yet to have the same impact as the one from the WWF.

The purpose of these lists is the same as environmental certification and origin marking; namely, to inform consumers about which products are fished sustainably so that he or she can make an informed choice. Environmental certification has always been voluntary and is obtained on the producer's initiative. Certification therefore gua-

rantees traceability of the product and ensures that the item purchased comes from sustainable fishing. Granted, the fish lists are intended for consumers/purchasers, but they serve also as a scorecard for fisheries management. Although these lists contain information about sustainable fishing on the species/stock/fishery levels, they do not always relieve much about the products on the market. The popularity of these lists proves that consumers are looking for more information about the status of the fish stocks and that their level of confidence in how the authorities are managing fisheries is low. That is why one of the objectives outlined here is about credible fisheries management (Objective 2.6).

Changes under way

As a public authority, the National Food Administration has announced its intention to produce a fish list as an aid for consumers to be able to follow the Administration's dietary and nutrition recommendations in an environmentally-sound way. The process of producing these so-called 'eco-smart food choices' has, however, met objections from the European Commission.

The EU Common Markets Organisation regulation²⁹, which contains the rules for labelling fish in shops, is likely to be revised. The new Control Regulation that was passed in 2009 increases the possibilities for improved traceability in the distribution chain.

What do we think the situation will be like in 2020?

Fisheries will probably continue to raise debate and public environmental awareness will keep increasing. This will result in consumers continuing to demand factual information about fisheries and fish stocks, preferably in a clear and simple way. The fish list will become a concept that is even better established, the only question is which organisation or authority that will provide such a list.

What decision strategies are needed so as to achieve this objective?

1. Greater responsibility being taken by the authorities for providing consumers with information.

The National Food Administration provides information on applicable regulations, dietary recommendations and other important matters to do with food. The Adminis-

29. Council Regulation (EC) No. 1234/2007 of 22 October 2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products.

tration publishes dietary recommendations for fish based on the health benefits of fish consumption and the risks involved because of the presence of environmental toxins in certain species. The authority has also taken the initiative of producing a fish list within the framework of an environmental review of the dietary recommendations.

The Swedish Board of Fisheries annually submits information about the status of fish stocks³⁰. This information is directed to the general public but is not primarily adapted to consumer needs. It can be difficult for the individual to link the biological descriptions with the fish – often imported – that is available in the shops and with the general debate. A large study should be carried out to determine what deficiencies consumers experience with the information provided on fish and fisheries. This study should then form the basis for improved information strategies.

2. Revising the EU Common Markets Organisation regulation (CMO).

A future revision of the EU CMO regulation should contain more detailed labelling requirements to help consumers make an informed choice based on the origin of the fish.

30. The Swedish Board of Fisheries. Swedish: Fiskbestånd och miljö i hav och sötvatten - Resurs- och miljööversikt ('Fish stocks and the environment in marine and freshwater - resource and environmental overview').

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