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THE COST OF FISHERIES MANAGEMENT IN ESTONIA

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ABSTRACT

The aim of this project is to measure the cost of fisheries management in Estonia. It starts with a theoretical background and then the Estonian fisheries management costs are compared with other countries' costs.
Fisheries management costs are comprised of research services, management services and enforcement services. Measured per ton of production in 2002, the cost of research services in Estonia was USD 6.7, management service costs were USD 3.5 and enforcement service costs were USD 11.3. Estonian fisheries management costs are relatively low in comparison with other countries.
Compared with other countries the main drawbacks of fisheries management in Estonia are too many landing sites and too many active fishermen given the size of the Estonian fishery. The strengths of Estonian fisheries management system are the implemented ITQ system and considerable rents from the sale of fishing rights.

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1 INTRODUCTION

The importance of fisheries management and differences between several fisheries management systems did not receive much attention during the last decades. It is not until relatively recently that it has been acknowledged that fisheries management is not costless and the important consequences that different costs of management have when evaluating management regimes. A pioneering work in this field was done by Arnason *et al.* 2000, who compared the fisheries management costs of Iceland, Norway and Newfoundland in the late 1990's. The OECD Fisheries Committee carried out a study on the costs of managing fisheries in OECD countries in 2002. That study was a follow-up of the study on the *Transition to Responsible Fisheries* (OECD 2000) which estimated that USD 2.2 billion was spent on fisheries management, accounting for approximately 36% of total government financial transfers to the fishery sector.

The cost of fisheries management in Estonia has never been studied or estimated before. Given the possible gains from having reliable estimates of the cost of management in Estonia, studying it seems to be a worthwhile enterprise.

Estonian fisheries administration is divided between different ministries, and that arrangement has caused several coordination problems as has been mentioned in the EU Commission comprehensive monitoring report on Estonian preparations for membership (EU 2003). A special expert commission (*asjatundjate komisjon*) was formed to deal with fisheries administration questions and the task of the commission is to make suggestions about possible changes in fisheries administration to the Government before March 2004.

Before planning and implementing changes in Estonian fisheries management it would be helpful to have as much information as possible about the present situation. As already stated, the cost of fisheries management is not known with any certainty. It is necessary to know both the amount of the fisheries management costs and also try to understand what influences these costs. Finally, it is important to compare the costs in Estonia with other countries.

The objective of the project is to examine the costs of managing fisheries in Estonia. The study has several goals to achieve the main objective:

To study the theory about costs of managing fisheries,

To map the fisheries management system in Estonia,

To measure the costs of fisheries management in Estonia,

To analyse and compare the fisheries management costs with other countries.

The structure of this thesis reflects those goals. It consists of two parts.

Firstly, there is a theoretical part that covers the basic theories about fisheries management costs. It starts out by defining fisheries management cost. Then there is a discussion about the need for fisheries management and the possible benefits from managing fisheries. Finally, there is an overview of the main characteristics that influence the cost of fisheries management and most common ways of providing fisheries management services.

The second part is an empirical study that is divided into four sub-chapters. The first one gives an overview of the Estonian fisheries sector. Then the Estonian fisheries management costs are measured. With concrete estimates of the management costs in Estonia in hand, they are compared with costs in a number of other countries for comparison. The last sub-chapter summarizes the main findings and states the conclusions of the project.

2 THE COSTS OF FISHERIES MANAGEMENT

2.1 Defining fisheries management costs

Fisheries management cost has been defined by Arnason (1999, p. 2) as:

> "Fisheries management expenditures are all expenditures on activities that are necessary to develop and operate the existing fisheries management regime".

It is important to realize that governments spend money on fisheries for many purposes other than fisheries management, as well. As Schrank *et al.* (2003, p. 11) point out:

> "Grants and subsidies are examples of expenditures that are often unrelated to fisheries management. The same applies to expenditures on navigational aids such as lighthouses, positioning systems, fishing harbours, and search and rescue operations at sea".

Infrastructure expenditures such as lighthouses and harbours do not arise solely to support fishing activities since they also benefit other sea-based industries and activities. Direct payments, cost-reducing transfers and market support are excluded on the basis that they are generally used to provide infrastructure support, reduce fisheries effort or capacity or to support post-harvest activities and they have no particular connection with the actual management of fisheries. Usually the purpose of this kind of support is to solve problems in a certain time period and it is not meant to be any core part of a fisheries management system. Therefore, these expenditures can be viewed as adjustment costs rather than as part of the on-going costs of fisheries management.

Arnason (1999) also draws attention to the fact, that in totally unmanaged fisheries that were common three to four decades ago and can still be found around the world, the cost of fisheries management according to this definition would be zero but the government could still be spending a good deal of money on fisheries services such as harbour facilities, lighthouses, education etc.

According to Arnason (1999), Schrank *et al.* (2003) and OECD (2003) fisheries management essentially comprises the following set of activities:

Research services (biological and economical research to inform fisheries management decision-makers).

Management services (formulation, dissemination and implementation of management policy and rules).

Enforcement services (enforcement of management rules).

OECD (2003) points out that **research services** are used as a basis for management decisions and the possible creation of new management systems. Common examples of research activities include data collection, surveys, data analysis and stock assessment. Research activities are normally determined by the information needs of the decision-makers that are implementing the management rules. For example, when setting the total allowable catch (TAC), information is usually required on the impacts of different catch strategies on the size of the fish stock biomass. When developing new management systems or rules, research advice is usually sought on the likely impacts of the proposals being considered. For example, decision-makers are likely to be interested in how a

change in a minimum mesh size limit affects the age-structure of the stock, recruitment and biomass growth. From an economic perspective, decision-makers are usually interested in whether a change in a management setting will increase the returns to fishermen and the society at large.

Management services usually comprise three functions (Schrank *et al.* 2003, Wallis and Flaaten 2003):
Administering the existing management system. This can involve monitoring fishing licences, permits, number of vessels and catch returns.
Adjusting management settings within an existing management system. An example of this is the annual process of setting TACs that commonly occurs in many countries.
Recommending amendments or additions to the existing management system. An example of this more fundamental form of change might be the decision to introduce new effort controls (e.g., limits on number of vessels) or output controls (e.g., vessel or quotas).

As Wallis and Flaaten (2003) point out **enforcement services** typically involve surveillance of compliance with fisheries laws and a role in the prosecution of fishermen who do not comply with those laws. This surveillance can either take place on land or at sea. It often involves co-operation with the Coast Guard or Navy, and surveillance at sea involves boarding of vessels and checking licences, gear and composition of the catch. Surveillance on land may involve checking landings, whether catch reports are accurate, etc. Information collected on-shore can often be used for cross-checking of catch against licences and quotas. Minor offences are usually punished by fines or the catch or gear being confiscated, while major offences are taken to the courts of law.

2.2 The need for fisheries management

In order to develop a framework for understanding and evaluating fisheries services costs, it is useful to recall why fisheries management is required.
Generally it is recognised that government intervention in fisheries is often necessary to prevent the biological and economic overexploitation that often results from the traditional open access to fish resources (FAO 1995). It can be said that it is a problem caused by the common property nature of the fishing activity. Without adequate management over the fish resource, fishers have little incentive to conserve the fish stock as the benefits of doing so are likely to be used by others. This phenomenon is often referred to as “prisoner’s dilemma”. The potential benefits that could be obtained in harvesting the resource will be lost due to a build-up of fishing capacity and effort excess of that which is required to efficiently take the available catch and theoretically, as well as practically, in many cases it is moving towards biomass collapse and therefore collapse of all fishing industry if no fisheries management is implemented.
From an economic perspective, the primary objective of fisheries management is to maximize the resource rent from the exploitation of the fish resources. Under an open access (unmanaged) regime there are incentives to waste possible rents that could be extracted from the fishery. When new operators can enter the fishery at will, they will do so until the expected profits from investing in the fishery are reduced to the same level that can be attained by investing in some other activity. Under certain conditions it may be possible to receive a higher profit from resources such as fish stocks, due to their self-

renewability, than from other economic activities. In order to be able to extract this extra rent from fisheries, it is in most cases necessary to restrict access into the industry. This is in most cases the fundamental role of fisheries management.
This is also the main message of the OECD (2003), which stresses that government intervention is mainly directed at overcoming the problems associated with open access and should aim at establishing long term sustainable yields and allocate resources in such a way that is most valuable for society. There may nevertheless be other objectives of fisheries management than maximizing economic or social rents. Governments are often concerned with ensuring equity or conservation of fish stocks or the environment. With regards to equity concerns, governments often take into account how fishing rights are distributed with regards to income and employment in different regions of the country. Such welfare schemes may run counter to economic efficiency but may, on the other side, be generated by political or social circumstances (OECD 2003).
In their report the OECD also points out that other objectives pursued by governments in managing fisheries often have less to do with maximising economic returns from fishery but are directed more towards ensuring that equity and/or conservation concerns are addressed. In terms of social concerns, governments often focus on the distribution of fishing rights, income and employment to certain individuals, groups or regions within a society. Then there are often other objectives related to the conservation of the resource, or the reduction of impacts of fishing activity on other attributes of the marine resource. In many cases, such objectives may have little or nothing to do with ensuring the economic efficiency of a fishery and may lead to a reduction in the economic efficiency of a particular fishery.
All this may be summarised by the words of Michael King (1995, p. 269):

> "As fisheries management must often address social, political, legal, economic and biological factors, the overall objectives of fisheries management will almost always involve compromise".

2.3 The benefits of managing fisheries

Before analysing possible benefits and beneficiaries of fisheries management, a distinction has to be made between the benefits that are coming from the fishery itself and the benefits that can result from fisheries management services. In many cases it is assumed that an unmanaged fishery will collapse in an economic sense (in long term perspective). Based on this assumption, all benefits from the fishery are thus products of fisheries management. Although the collapse of an unmanaged fishery is highly possible, especially for highly aggregated, high value or slow growing species, there are other possible outcomes, too. An example of that is multispecies fisheries where in the absence of management, the fishery could continue to exist, although in an overexploited form (smaller biomass and bigger effort would be the optimum case). It is also known that management is not costless, and in some cases fisheries management costs can exceed the profits from fisheries.
Wallis and Flaaten (2003) point out that the levels of expenditure to fisheries management suggest that the resource and its management is important to most governments. Fisheries services therefore have the potential to create benefits for many types of fisheries, such as commercial, recreational, etc. Generally those who benefit the most from fisheries management are:

- commercial fishermen
- consumers
- government agencies

Commercial fishers can potentially benefit from fisheries services in three ways.
Firstly, by increasing the output from the fishery by managing the stock in such a way that maximises biological yields over the long run. This management objective may not coincide with maximising economic yield for commercial fishers, but could represent an improvement on the existing situation where rent may be dissipated in the fishery.
Secondly, by reducing costs per unit of effort by reducing competition in the fishery. Reducing competition between fishers, either by allocating individual output limits (for example, through individual quotas) or by limiting inputs (for example, through limits on the number and size of vessels), creates the opportunity for increased profits for existing fishers.
Increasing the return per unit of output from the fishery. An example of this could be a change that allows fish to grow to a larger size before they are harvested.
Consumers will benefit from fisheries services if they result in higher sustainable catches and more stable supply. These benefits will be realised through the market as a decrease in the domestic price, resulting in an increase in consumers' surplus. Consumers will also benefit from fisheries services if there is an improvement in the quality of seafood products through improved quality control, the application of sanitary and phytosanitary requirements and so on.
The benefits received by commercial fishers and consumers are often described as **market benefits** (Hatcher and Pascoe 1998). The potential **non-market benefits** can be received by (*ibid*):
Recreational fishers benefit from fisheries services as a by-product of the management of commercial fishers. This is a result of potentially higher catches, less pressure on fish stocks and reduced crowding on fishing grounds that accompany effective management of commercial fishing activity.
Society, if fisheries services maintain option and existence values of fish and other species in the aquatic ecosystem.
Cultural minorities and indigenous people, if fisheries services provide for the interests and customs of those groups.
Government agencies can also be a beneficiary of fisheries services. But it is questionable whether the government agencies are non-market beneficiaries or not.
Haynes *et al.* (1986), point out that in many cases, bureaucrats may think that the size of their budget is proportional to the social value generated by their bureaucracies. That means that a larger budget means a greater value for society as a whole. Individual bureaucrats may also benefit from larger budgets. The combination of these incentives may lead to larger budgets than would be the case under more competitive conditions.
When discussing the benefits of managing fisheries it is important to note the public goods characteristics of fisheries services. A public good has two characteristics that distinguish it from private goods. First, if public good is provided for one person, it is automatically provided for all because it is not feasible to exclude any person from using it (this is often referred to as the non-excludability of public goods). Secondly, the use of a public good by one person does not diminish the amount available for others (often referred to as non-rivalry).

For example, in some research services where basic research may benefit fisheries management in terms of improving information base for decision making, it may also benefit educational institutions that is to say if the outcome of the research is published.
Both, market and non-market benefits and public and private goods characteristics of fisheries services should be considered carefully when thinking about how to fund fisheries services.

2.4 What influences fisheries services costs?

One of the key questions when evaluating fisheries service cost concerns whether or not there is an optimal level of those costs. When should costs be considered as being too high or too low? Is the quantity produced in a fishery the major driving factor in determining how much should be spent on providing fisheries services? Perhaps the value of production, the number of fishers or the size of the fleet are the major drivers or all these factors in some combination? From an economic viewpoint it seems clear that the optimal management cost is the one that maximizes the rent obtained from the fishing activity, taking into consideration all costs, including the cost of fisheries management.
The following discussion is largely based on the analysis carried out by OECD (2003).
According to an OECD (2003) publication, potential cost drivers are categorised as: geographical characteristics; fish resource characteristics; fleet structure; types of management instruments; extent of resource use conflict; and method of service delivery. But for a broader categorization it is simpler and clearer to say that potential costs can be influenced by **geographical characteristics** and by **industrial characteristics**. Industrial characteristics encompass the whole of the fisheries chain (resource, effort, counterparts, fisheries management and so on).
As pointed out by the OECD (2003) a positive relationship between the **geographical characteristics** of a country and the cost of providing fisheries services might be expected. Such geographical characteristics include the size of the Exclusive Economic Zone (EEZ), the length of the coastline and the proximity of other countries. More specifically it might be expected that the larger the coastline and the size of the EEZ, the greater the cost of surveillance and enforcement. This may be exacerbated if there were a large number of potential landing sites for the fishing fleet. With a small number of landing sites, monitoring and enforcement should not be too difficult. However, such costs may rise if fish are marketed through many small landing ports. Similarly, if there were a large number of countries undertaking fishing activities in close proximity to a nation's EEZ, then there may be increased costs associated with establishing and enforcing agreements with these countries to ensure that sovereignty over resources maintained.
Turning to **industrial characteristics** one would e.g. expect that the *quantity of fish resources* is likely to influence costs of managing those resources. Countries with significant resources may be expected to spend more in absolute terms on management than those countries with smaller resources. On the other hand there may also be some economies of scale to be gained with regards to research, management and enforcement so that the relative costs may favour countries with larger resource endowments.
Whether the fishery is a *single-species or multi-species fishery* can also be of some importance. In principle, one might expect that the problems associated with multi-species fisheries and fisheries with high by-catch and discard potential could lead to higher management costs due to the more complex nature of the resource and its

management. It should be added that managing multi-species fisheries is generally a very complicated task and is basically an unsolved problem for most fisheries management regimes.

The *state of the resource stocks* at each point in time whether they are over fished, fully fished or developing is likely to influence management costs. When the fishery is in a developing stage, for example, fisheries services costs are likely to be quite high, particularly if a major research effort is required to determine the extent of the stock and its dynamics.

Also one would expect that the *size of the fisheries sector* has an important influence on the amount of money that governments are willing to spend on fisheries management. Clearly, the larger the sector, either in absolute terms or relative to other sectors in the economy, the more money governments are likely to direct towards its management. One would also think that expectations about the prospects for the industry are likely to particularly influence research costs.

In addition to the relative size of the fishery sector, one would expect that *the size and composition of the fleet* influences the costs of management and enforcement. Given similar costs per vessel, a large fleet of small boats will involve greater costs in terms of licensing, control, monitoring and enforcement than a smaller fleet of large boats. Another important factor may be the capacity of the fleet, e.g. measured in terms of tonnage. The extent to which a country's fleet is dedicated to coastal, deepwater or distant water operations will also be a significant cost driver. Countries that have a greater proportion of their fleet undertaking distant water fishing activities face a different structure of costs in undertaking surveillance and enforcement of their fleets' activities than countries whose fleet operate solely within their own EEZs.

One of the most important issues when discussing management cost has to do with the relative impacts of the different types of *management instruments* on fisheries services costs. Management instruments can be broadly categorised as output controls, input controls and technical measures (FAO 1997). Using more common fisheries management system classification (direct biological fisheries management, direct economic fisheries management, taxes and property rights (Arnason 2001)), it nevertheless holds that costs of different management systems are not same. To take an example, input controls are considered to be costly to design, adapt, manage and enforce due to the ability of fishers to adapt their fishing effort and techniques to circumvent regulations. In contrast, alleviating such costs is one of the claimed advantages of individual transferable quotas.

Governance structure, i.e. how users are co-ordinated, how information is generated, how decisions are made and how monitoring and enforcement take place, also has an impact on what fisheries management system is chosen. Governance structure therefore also influences the magnitude of fisheries services provided and the cost of management.

The *extent of actual or potential conflict* between users and uses of the marine resource has an impact on the costs of fisheries services by affecting the amount of time and resources required to resolve conflicts between users groups and enforce any agreements that may result.

Finally, Schrank *et al.* (2003) point out that the *way in which fisheries services are delivered* to users also affects the magnitude of the costs of the services. In many countries the government is the only supplier of many fisheries services. A rationale for this may be the public good nature of the services themselves or the existence of a natural monopoly and/or limited competition in their provision as discussed above. That points to

the fact that there may be scope for reducing the cost of fisheries services through the private provision of some types of services such as research and enforcement activities.

2.5 Provision of fisheries management services

From previous sections it is already known that fisheries management services are needed; that fisheries management services have characteristics of public goods; and the way how fisheries management services are delivered has influence to the cost of management. There are different possibilities to provide management services (more pertinent ones listed in the following table borrowed from Arnason (1999)). In this section we will analyse the provision of management services in more detail.

Table 1: Provision of Fisheries Management Services (Arnason 1999).

Arrangements		Provider	Payee
1	Current Arrangement	Government	Government
2	Cost recovery	Government	Fishing Industry
3	Contracting out	Private Sector	Government
4	Self-Management	Fishing Industry	Fishing Industry

As Arnason (Schrank *et al.* 2003) points out the current arrangement of providing those services risks introducing the two major problems of providing government services, i.e. incentive problems and an asymmetric distribution of costs and benefits. Under the cost recovery arrangement the government provides the management services but the industry as the recipient of these services, has to pay the cost. In this case the industry has no incentive to ask for management services whose costs exceed the overall benefits and the government agencies have little or no incentive to produce such services. But there is still an incentive problem present because government agencies are providing the management services in this case and more or less automatically receive payments for their activities from the industry and do not have to compete with other agencies or suppliers.

According to Arnason (1999) in the third arrangement (contracting out services), the private sector provides fisheries management services according to agreement with government on the basis of some kind of competitive bidding. This arrangement can solve the incentive problem (some incentive problems may be expected to arise in contracting out and supervision of the services). It does not however solve the problem of asymmetric distribution of costs and benefits.

Under the fourth arrangement (self management) the industry takes care of the management services itself as described in Arnason (1999). This can eliminate the government incentive problem and greatly alleviates the asymmetry problem. Due to public good characteristics of fisheries management services to the members of the fishing industry, the management services still have to be provided in a centralized way. That causes incentive problems, but of smaller magnitude and therefore more manageable than those arising under the government.

As Arnason (Schrank *et al.* 2003) points out then there do not appear to be any apparent solutions to the problem of efficient provision of fisheries management services. In reality we are faced with choices between several imperfect alternatives. Comparing different arrangements clearly shows that the current arrangement where government both provides and pays for fisheries management services does not appear to be the good one. The most capable seems to be the self-management arrangement.

3 THE COSTS OF FISHERIES MANAGEMENT IN ESTONIA AND COMPARISON WITH OTHER COUNTRIES

3.1 The Estonian fishing industry – A general description

Before analyzing the fisheries management cost in Estonia it is necessary to point out the main characteristic of the industry, in particular describing geographical and industrial characteristics. The time period from 1999 to 2002 is used to estimate the cost of managing fisheries. The reason that we examine this period is two-fold. Firstly, it is interesting to see whether there have been any major changes during this period (as will be explained in detail later) and secondly, the risk of studying any extreme year (outliers) is diminished.
The Estonian fisheries sector uses the fish resources of the Baltic Sea and inland waters. Estonia also has access to the fish resources of the Northwest Atlantic Fisheries Organization (NAFO) and Northeast Atlantic Fisheries Committee. (Svalbard and NEAFC).
In the period 1999 to 2002, fishing was regulated by Fishing Act (Kalapüügiseadus RT I 1995) that entered in force in the beginning of the year 1996 and has been amended several times since.

Baltic Sea
Fishing in the Baltic Sea is divided into deep-sea fishing and coastal fishing. The species of deep-sea fishing are Baltic herring, sprat, cod and flounder, and small quantities of salmon. The main vessels type is trawlers. The International Baltic Sea Fishery Commission (IBSFC) composes every year the Total Allowable Catch (TAC) of the Baltic Sea main species and divides it between the members. The TAC is based on the scientific advice provided by International Council for the Exploration of the Sea (ICES), where Estonian scientists are represented. National quota is divided by Ministry of Environment in Estonia. An Individual Quota (IQ) system was implemented in Estonia in 1999 and 2000.
From 2001 it was allowed to transfer the historical fishing rights to any person holding a fishing permit. The transaction shall set out the extent of the transferred fishing rights and the time of transfer of the fishing rights. The transfer of fishing rights is effective as of the date on which notification is transferred to the issuer of the fishing permit, unless the transaction provides for a later date. So, from 2001 an Individual Transferable Quota (ITQ) system is implemented in Estonia. The Estonian Baltic fishery quota is given in Table 2.

Table 2: Fishery quotas for Estonia in the Baltic Sea, 1999-2002 (MoE 2003)

Species	Unit	1999	2000	2001	2002
Baltic herring	Tones	48,270	41,070	41,070	39,000
Sprat	Tones	48,210	41,200	41,200	41,200
Cod	Tones	2,243	1,869	1,869	1,353
Salmon	Individuals (Specimen-for 1 ton it is calculated 200 individuals) in the Baltic Sea	8,471	9,297	9,297	9,297
Salmon	Individuals in Gulf of Finland	9,300	8,370	6,510	5,580

Many species are caught in coastal areas. Economically, the most important ones are perch, pike perch, flounder, but also vimba, orfe and garfish; the quantities of eel, sea trout and pollan are smaller. The main fishing gear includes fyke net (a trap with the square not higher than 3 meters), nets and long lines. The fishing effort in coastal areas is regulated by the number of fishing gear and if necessary, by the quota allocation at sea up to the 20 m isobath. The number of fishing gear is fixed for each calendar year for every county according to proposals received from the counties and recommendations of scientists (Strategy 2002). To protect fish resources, ban of fishing is established in the coastal sea during spawning time and spawning places are closed for fishing according to fish species and fishing gear used. In addition to above-mentioned customary restrictions, supplementary temporary fishing restrictions are established in places where fish resources are in a poor state (a ban of fishing with certain fishing gear in some fishing areas for a certain period of the year).

Inland waters fisheries.
Industrial fishing in inland waters mainly takes place in Lakes Peipsi and Võrtsjärv. The main species are perch, pike perch, bream, sparling, whitefish and eel. The fishing gear includes nets, fyke nets, pound nets and Danish seines. The fishing effort in inland waters is regulated the same way as in coastal areas.

Distant water fishing.
Estonian deep-sea fishing is carried out by trawlers in the Atlantic Ocean, where mainly shrimp is being caught, but also small quantities of mackerel, redfish and horse mackerel. Estonia's distant water fishing possibilities are given in Table 3.
In 2002, the amount of fish caught in the Baltic Sea and inland waters was 83,597 tons. Exact quantities and values are given in Table 4. The importance of distant water fishing has decreased after 1999, but it is still very important for Estonia due to the high value of production. The quantities of the Baltic Sea and inland water fishes have been relatively constant during the examined years but their value have increased almost 80 percentage as a result of bigger demand and better market outlets.

Table 3: **Estonian distant water fishing possibilities, 1999-2002 (MoE 2003)**

	Unit	1999	2000	2001	2002
NAFO					
Redfish[1]	Tons	13,850	13,850	13,850	13,850
Redfish[2]	Tons				7,500
Squid (Illex)[3]	Tons	2,500	1,133	1,133	1,133
Yellowtail flounder[4]	Tons	30	50	67	65
Greenland halibut[5]	Tons	1,624	1,725	1,971	2,167
Shrimp (in zone 3L)	Tons		67	67	67
Shrimp (in zone 3M)	Fishing days	1,667	1,887	1,389	1,667
Svalbard					
Shrimp[6]	Fishing days	377	377	377	377
NEAFC					
Redfish[7]	Tons	2,000	1,529	1,175	1,175
Mackerel[8]	Tons	1,000	1,000	1,000	600

The distant water catch value is calculated on the basis of average prices that are demanded by the Estonian Statistical Office from catching companies. Data for the year 1999 was received only from one company and the estimated total value was based on those numbers. Although the world market prices in 1999 were high and the Estonian catch included a relatively high quantity of more valuable species (mostly mackerel) than during the following years, the total distant catch value in 1999 seems to be too high in comparison with following years when the data was more reliable.

Table 4: Catch quantities and value 1999-2002 (MoE 2003, ESO 2003a)

	Production (tons)			Value of production			
Year	Baltic Sea + Inland waters	Distant water catch	Total	Baltic Sea + Inland waters (EEK)	Distant water catch (EEK)	Total (EEK)	Total (USD)
1999	86,107	25,686	111,793	171,397,222	1,473,391,854	1,644,789,076	111,930,008
2000	85,176	24,693	109,869	180,723,521	526,948,620	707,672,141	41,675,086
2001	87,438	15,549	102,987	261,615,344	449,827,797	711,443,141	40,701,806
2002	83,597	17,817	101,414	304,933,077	497,170,674	802,103,751	48,302,045

The relative quantities of fish from different waters of Estonian fishery are given in Figure 1. When looking at quantities, the most important fishery for Estonia is the Baltic

[1] *Common quota of Estonia, Latvia, Lithuania and Russia (block quota)*
[2] *Common quota (Others quota) to member states who have not been allocated the individual quota for that species*
[3] *Common quota of Estonia, Latvia, Lithuania and Russia (block quota)*
[4] *Common quota of Estonia, Latvia, Lithuania and Russia (block quota)*
[5] *Common quota (Others quota) to member states who have not been allocated the individual quota for that species*
[6] *No more than three vessels at a time*
[7] *Co-operation quota for non-member states co-operating with NEAFC (Japan, Canada, Estonia, Latvia, Lithuania)*
[8] *Co-operation quota for non-member states co-operating with NEAFC (Japan, Canada, Estonia, Latvia, Lithuania)*

Sea fishery. The main species, Baltic herring and sprat are low value species, but during the examined period their value has increased significantly. Detailed catch information about the Baltic Sea and inland waters are given in Appendix 1.

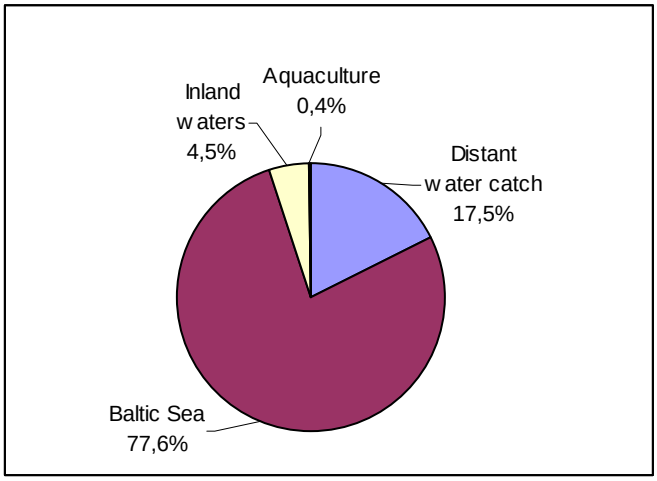

Figure 1: **Estonian fishery structure 2002 as a percentage of total volume (MoE 2003).**

The volume and value of aquaculture has been very small in the examined period and that is why it is not taken into account in the calculations of this study.

Landing sites

The length of Estonian coastline is 3794 km. The number of landing sites is given in Table 5. The table includes only landing sites where fish is landed according to landing declarations. Fish landings according to landing declarations are made only by trawlers, which means that the table does not include inland fisheries and some coastal fisheries landing places.

Table 5: Number of landing sites in Estonia 1999-2002 (MoE 2003)

Year	Number of landing sites
1999	30
2000	36
2001	33
2002	35

Fishermen

There are approximately 6000 fishermen employed in Estonia. According to the Estonian fishing Act the right to commercial fishing is granted by a fishing permit, which may be either the fishing permit for a fishing vessel or a fisherman's fishing permit.

The fishing permit of a fishing vessel grants the right to fish with commercial fishing gear at sea up to the external border of the exclusive economic zone of Estonia, outside the waters under the jurisdiction of Estonia if the state guarantees the right to fish there, or on the open sea.

A fisherman's fishing permit grants the right to fish, except for flounder, with commercial fishing gear at sea up to the 20 m isobath, on Lake Peipsi, Lake Lämmijärv and Lake Pihkva, on Narva River and the Narva reservoir, or on an internal water body. A fisherman's fishing permit for the fishing of flounder grants the right to fish flounder at sea, irrespective of the depth of the sea.
A restricted fishing permit grants persons, living or owning immovable property on the coast of sea or on the shore of inland waters, the right to fish with restricted fishing gear (Restricted fishing gear at sea and on Lakes Peipsi, Lämmijärv, Pihkva and Võrtsjärv means up to three entangling nets, one fyke net with a height of up to one meter, or a bottom longline consisting of up to 250 hooks). at sea up to the 20 meters isobath or on lakes up to 1 kilometer from shore. The number of fishermen is given in Table 6.

Table 6: Number of fishermen in Estonia (MoE 2003)

	Number of commercial fishermen	Number of fishermen fishing according to restricted fishing permit	Total
1999	NA	NA	NA
2000	2,781	3,009	5,790
2001	2,791	3,656	6,447
2002	2,564	3,963	6,527

These numbers include all fishermen with permits, restricted or not.

Fishing fleet

The Estonian fishing fleet can be divided into four categories according to where they operate:

- Coastal fishing boats (length from 2.5 to 12 meters).
- Inland waters fishing boats (length from 2.5 to 12 meters).
- The Baltic Sea fishing vessels (length over 12 meters).
- Distant water fishing vessels (average length is 64 meters).

Table 7 provides data about the commercial fishing fleets. The commercial fishing vessels accounted for in the table are vessels with length exceeding 12 meters, which means that coastal fishing boats and inland fishing boats are not taken into consideration in this table. Data for the year 1999 are taken from the Estonian Maritime Administration’s vessel register, but for 2000, 2001 and 2002 only vessels fishing permit are included.

Table 7: Number of commercial fishing vessels (MoE 2003)

	The Baltic Sea		Distant waters		Total	
	Number of fishing vessels	Total power of main engines (KW)	Number of fishing vessels	Total power of main engines (KW)	Number of fishing vessels	Total power of main engines (KW)
1999	201	35005	21	40983	222	75988
2000	157	21892	18	30014	175	51906
2001	137	21030	17	29441	154	50471
2002	125	19463	9	14345	134	33808

The number of the Baltic Sea fishing vessels decreased considerably between 1999 and 2002, but the capacity or power of main engines has not decreased as much. This means that mainly old and inefficient vessels have been removed from the industry and that new ones are more powerful. The decrease in the number of vessels is probably influenced by the implementation of an ITQ system in Estonia. Eero (2002) has analyzed capacity utilization of the Estonian trawl fleet and according to her results the estimated technical overcapacity was at least 33% in 2000.

The distant water fishing fleet consist of a shrimp fishing fleet (8 vessels altogether), where well-equipped vessels are used, especially designed for catching shrimps. The vessels are also furnished with modern fishing gear and processing equipment as well as storerooms for fish. The shrimp fishing vessels comply with high hygienic requirements. One vessel fishing redfish and non-regulated species in the NAFO regulatory area is also technically well equipped.

The remaining Estonian distant water fishing fleet at the beginning of examined period was constituted by vessels, which had remained in Estonia regained its independence from the Soviet Union. These vessels were used for catching redfish, mackerel and trachurus in the open sea areas where a fishing permit was not required by the Estonian law till November 2000 and where fishing vessels flying the Estonian flag exercised fishing beyond fishing grants allocated to Estonia (M.A. 2002). A decrease in the number of the distant water vessels resulted from diminished fishing possibilities, decreased fish prices in 1999 and 2000, and the fact that those were old and inefficient vessels.

3.2 Fisheries services costs in Estonia

All the institutions acting in fisheries sector and using public funds are shown in Appendix 2. The expenditure data for those institutions that are involved in fisheries management comes from the official government expenditure record (*Riigikassa)* for the years 1999-2002. All the items that could be interpreted as direct expenditures are taken into account. Institutions that are dealing additionally with fishery along with some other activities are estimated and a respective percentage from expenditure record is taken into account.

In addition to the government expenditure the fishing permit fee is also recorded and included in the calculations. The right to fish commercially and restricted fishing rights are subject to a fee. The size of the fee for each calendar year is determined by the Government, based on the special characteristics of the fishing grounds, the type of fishing gear and its fishing capacity, or the fishing possibilities to be divided on the basis

of an international agreement. The fee for the right to fish commercially and the fee for restricted fishing rights shall not exceed 4% of the normal value of the quantity of fish caught, but usually it is lower than 4%.
A part of the fishing rights (both volume quotas and gear-use rights) in all Estonian fisheries were allocated each year through auctioning while the remainder was to be allocated on the basis of the history of the use of recent fishing rights. After some heated debates, the political decision to allocate 90% of the fishing rights each year on the basis of recent catch history and only 10% by auctions was made by Parliament in December 2000. This, what may be called 'historical right' was defined as the catches taken and gear or fishing days used during the last 3 years. Subsequently, if the national fishing possibilities remain stable, each enterprise cannot lose more than 10% of its fishing rights each year, in case it is not willing or able to buy additional quotas at the auction (Vetemaa *et al.* 2001). This auction system was used for three years, but in 2003 before the parliamentary elections the auctions were stopped, due to political reasons.
This fee goes to the Environmental Investment Centre (EIC) and is used for different national environmentally oriented projects. With regards to fisheries projects there is a special national fishery program administered by the EIC.
The amount of received fishing right fees is given in Table 8. Starting from the year 2000, a fishing right fee was collected also from distant water fisheries and that is why there is a big change in the sums. According to Eero (2002) the fishing rights prices increased in auction almost twentyfold in 2001, but in 2002 the market became much more stable with regards to asks and bids. That may explain why the sums decreased in 2002.

Table 8: Received fishing right fees 1999-2002 (MoE 2003)

Year	1999	2000	2001	2002
Received fishing right fees (EEK)	3,600,000	27,359,213	25,590,973	21,992,587
% of the value of landings	0.22	3.87	3.60	2.74

To be able to compare over time and later across countries it is necessary to deflate the expenditure series by an appropriate price index and calculate the series according to a common currency numeraire. The price index selected for deflating is the consumer price index (*Tarbijahinna indeks*) as published annually by the Estonia Statistical Office (ESO 2003b). The foreign currency numeraire selected is the US dollar. The transformation of expenditures from Estonian currency to US dollars is done on the basis of average annual US dollar exchange rates of Estonian Bank.
A comprehensive table about fisheries services cost in Estonia is given in Appendix 3.

3.2.1 Research service costs

Research service is mainly provided by the Estonian Marine Institute. This institute was originally under the administration of Ministry of Environment, but after 1999, when the fisheries administration was changed, the institute was moved under the auspices of the Ministry of Education and Research and is now an independent part of Tartu University. (See Appendix 2).

The Estonian Marine Institute has three sectors:
1. Marine Modeling sector.
2. Marine Biology sector.
3. Fisheries Research sector.
In addition to money from the annual budget, some research activities that are needed for fisheries management are also financed by the EIC. Money for research activities from EIC has been applied additionally to the funding of the Estonian Marine Institute also, for example by Institute of Zoology and Hydrobiology and Võrtsjärv Limnological Station. These have been research activities directed to inland waters and inland waters fishery.
The monetary expenditures on research services are given in Table 9. The sums have slowly increased during the observed period. The real growth in 1999 prices during the four examined years has been 11%.

Table 9: Cost of research services 1999-2002

	1999	2000	2001	2002
1. Estonian Marine Institute (EEK)	5,505,000	4,900,663	5,105,000	4,340,000
2. EIC funds (EEK)	3,028,500	3,894,360	5,203,963	6,861,760
3. Total (EEK)	8,533,500	8,795,023	10,308,963	11,201,760
4. Total (EEK, in 1999 prices)	8,533,500	8,456,753	9,388,855	9,878,095
5. Total ($US)*	580,716	517,942	589,778	674,561

** converted at each year's exchange rate*

3.2.2 Management services costs

Management services are provided by two different ministries – Ministry of Environment and the Ministry of Agriculture. All fisheries administration was under Ministry of Environment until some functions were redirected to the Ministry of Agriculture (MoA) in 2000. Estonian fisheries policy has to take into account the Common Fisheries Policy (CFP) of the European Union (EU) as Estonia is soon to join the union. CFP can be divided into four main areas dealing with:

- **Conservation of fish stocks**. On the basis of scientific studies on the main stocks the Council of Ministers decides on the amount of fish that EU fishermen will be allowed to catch the following year. TACs are divided among Member States. Each country's share is called a national quota. To protect fish stocks, a number of technical rules have been adopted. Catches and landings have to be recorded in special log books. In Estonia those log books are the responsibility of the Ministry of Environment.
- **Structures** (such as vessels, port facilities and fish processing plants). The EU's structural policy helps the fishing sector adapt to today's needs. Funding is available for projects in all branches of fishing and for market and development research. In Estonia the Ministry of Agriculture started to deal with processing plants in 2000 for which a special investment support program is available. Support measures for ports, diminishing fishing effort and finding new markets is also under the auspice of the Ministry of Agriculture and will be implemented in 2004.

- **The common organisation of the market**. The objective is to match production and demand for the benefit of both producer and consumers. This task is governed by the Ministry of Agriculture.
- **Relations with third countries**. This includes fishing agreements with non-European Community members and negotiations within international organisations. Both Ministries are involved in this area.

The cost of management services are given in Table 10. The real growth in 1999 prices during the four examined year has been 1,289,605 EEK or 32%. After 1999 five new people started to work in Ministry of Agriculture (structural policy) and the number of people dealing with fisheries in the Ministry of Environment was reduced from 16 people to 9 people. For 2002 the according number in the MoE was 14 and in the MoA 7. Implementing CFP has lead to new policy areas for both ministries and that partly explains the rise in the costs of management services. Not all policy areas are yet covered and there is a trend to further growth. To implement all policy areas of CFP it is estimated that the number of workers needed should be 39 (Kirsipuu 2003).

Table 10: Cost of management services 1999-2002

	1999	2000	2001	2002
1. Ministry of Environment (EEK)	2,444,162	1,600,629	2,260,541	3,384,127
2. Ministry of Agriculture (EEK)	0	826,658	1,185,609	1,226,369
3. International cooperation from EIC funds (EEK)	993,463	596,107	628,717	500,000
4. Member fees				
4.1. IBSFC (EEK)	325,712	470,032	532,615	491,335
4.2. NAFO (EEK)	175,243	225,538	279,432	326,931
5. Total (EEK)	3,938,580	3,718,964	4,886,914	5,928,762
6. Total (EEK, in 1999 prices)	3,938,580	3,575,927	4,450,741	5,228,185
7. Total ($US)*	268,025	219,011	279,581	357,025

* converted at each year's exchange rates

3.2.3 Enforcement service costs

Fisheries enforcement services are provided by the Environmental Inspection and by the Environmental Services. Surveillance of compliance with fisheries law in the Baltic Sea and on the distant water catch is done by inspectors of Environmental Inspection. In the Baltic Sea it involves boarding of fishing vessels and checking fishing permits, fishing gear and the size of fish. On board all distant water vessels there are observers who are officials of Environmental Inspection. All the vessels catching outside the Estonian Exclusive Economic Zone have to be equipped with satellite monitoring systems and data from this system is directed to Environmental Inspectorate. Environmental Inspection also checks landings of the Baltic Sea trawlers at ports. Those checks are made randomly and approximately 20-30% of landings are checked. In 1999 these functions were provided by Marine Inspection. In 2002 the Environmental Inspection has 147 employees of which 40 were dealing with fisheries enforcement and surveillance.
Surveillance of compliance with fisheries law in coastal fisheries and inland waters is provided by Environmental Services that has inspectors in every county. Total number of staff in 2002 was 286 and 15 of them were working in the fisheries.
The inspectors of the Veterinary and Food Board carry out control in the fish processing sector, checking hygiene, food safety and quality. In addition, all factory vessels (Estonian distant water fleets) have to be approved by the Veterinary and Food Board. Fish storage conditions in vessels, in ports and in transportation should also be controlled by this board. In all, 12 inspectors are employed to control fish processing enterprises.
The Veterinary and Food Laboratory conducts chemical and microbiological analyses from samples that the Veterinary and Food Board have taken during the control process. It constitutes only a very modest part of their work.
The cost of enforcement services are given in Table 11. The EIC funds are mainly used to finance surveillance in distant waters as the Environmental Inspection does not have special sums in their own budget for financing surveillance and control action in distant waters.

Table 11: Cost of enforcement services 1999-2002

	1999	2000	2001	2002
1. Marine Inspection (EEK)	10,155,150	0	0	0
2. Environmental Inspection (EEK)	0	8,779,330	7,901,578	9,341,300
3. Enforcement from EIC funds (EEK)	3,834,000	2,900,000	5,150,000	5,540,000
4. Environmental Services (EEK)	0	1,796,272	2,004,275	2,174,688
5. Veterinary and Food Board (EEK)	1,842,776	1,842,776	1,842,776	1,842,776
6. Veterinary and Food Laboratory (EEK)	112,864	152,571	155,772	160,178
7. Total (EEK)	15,944,790	15,470,949	17,054,401	19,058,942
8. Total (EEK, in 1999 prices)	15,944,790	14,875,912	15,532,242	16,806,828
9. Total ($US)*	1,085,063	911,090	975,686	1,147,714

** converted at each year's exchange rates*

In 2001 and 2002 the EIC costs were higher due to a purchase of special inspection vessel "Kulkuri". The Veterinary and Food Board provided adequate information solely for the year 2002. The number of inspectors dealing with the fishing industry has been constant

during the examined period and that is why data from 2002 was generalized for the whole period.

3.2.4. The total cost of fisheries services in Estonia

When summing up the different costs we find that the cost of fisheries management in Estonia totalled USD 1.94 million in 1999 and USD 2.18 million in 2002. In 2002 the cost of research services totalled USD 0.67 million, cost of management services totalled USD 0.36 million and cost of enforcement totalled USD 1.15 million. Costs distribution by % between different services is provided in Figure 2.

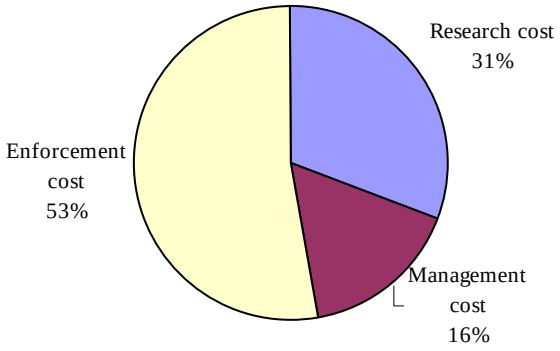

Figure 2: Estonian fisheries management cost breakdown in 2002

Research services costs in fixed 1999 prices have increased from 1999 to 2002 by 15.8%, management services costs by 32.7% and enforcement services costs 5.4%. Consumer price index rose 13.4% during the examined period.

3.3 Fisheries management costs in Estonia in comparison with other countries' costs

Having obtained estimates for the fisheries management costs in Estonia a comparison of the available cost data from other OECD countries from the year 1999 is possible. Detailed data about OECD countries fisheries management costs in 1997 is also available and is given in Appendix 4.
The data for other countries from 1999 is compared with Estonian data from 1999 and 2002. The year 2002 is added because in 1999 there were big changes in the Estonian fisheries management regime and data from 2002 reflect better and more precisely the actual cost of fisheries management.
Table 12 provides a summary of the OECD countries' (OECD 2003) and Estonian fisheries services costs. The European Union, the United States and Japan have the highest total costs among those countries. The Estonian modest sums are mostly due to the relatively small size of the fishing sector in comparison with most other countries. The low cost of Mexico is partly caused by exchange rate changes during the sample period.

Table 12: Costs of managing fisheries in 1999 (USD million) (OECD 2003)

	Research service	Management service	Enforcement service	Total costs
Australia	45.7	16.8	30.8	93.3
Canada	52.4	60.4	50.3	163.2
Estonia 1999	0.58	0.27	1.09	1.94
Estonia 2002	0.67	0.36	1.15	2.18
European Union	232.1	118.2	265	615.4
Iceland	13.5	2	11.9	27.4
Japan*	219.9	140.7	105.6	466.2
Korea	28.3	47.9	246.1	322.3
Mexico	0.3	0.4	0.01	0.7
New Zealand	7.9	11.1	9	28
Norway	30.2	9.6	82.8	122.6
United States*	202.5	240.5	170.5	613.5

* data from the year 2000

Figure 3 provides a graphical description of the relative shares of countries' expenditures on various components of fisheries services. On average the provision of enforcement services accounted for the largest share, on average at 39.6% of the total costs. Research and management services accounted for 34 and 26.4%, respectively.

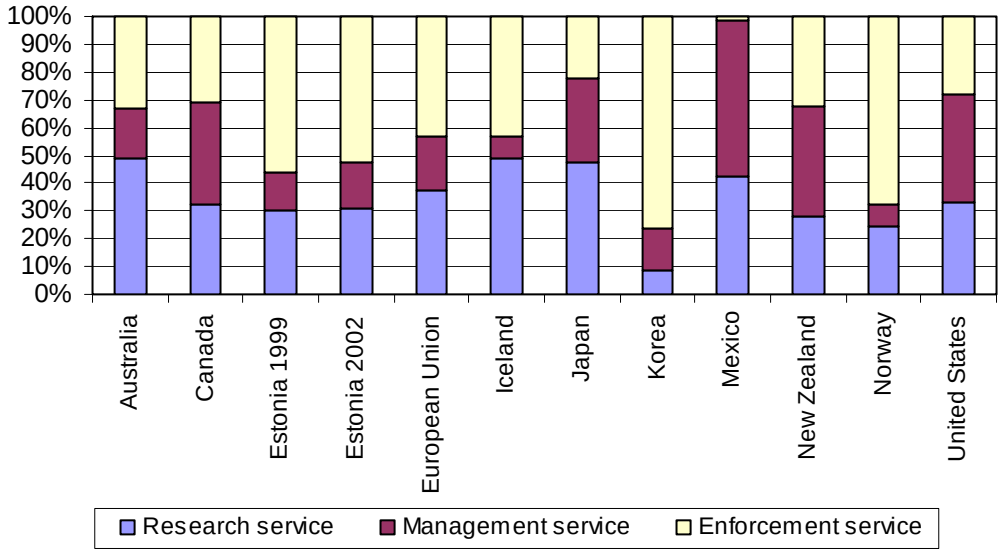

Figure 3: Cost shares of fisheries services in 1999 (OECD 2003)

In Estonia (in 2002) the largest share of total management costs was enforcement service with 52.8%. The research services accounted for 30.7% and management services 16.5%. When looking at the averages, Estonian research and management services levels are lower and enforcement service share higher than the averages. Although there are significant variations between different countries, the Estonian shares of services are most similar to what is to be found among countries of the European Union.

In Table 13 the fisheries management cost data is combined with other data to show a range of indicators that can help in understanding some characteristics behind fisheries services costs.

Table 13: Cost indicators in 1999 (OECD 2003)

	Fisheries management costs in relation to:					
	Coastline *$US per km*	Landing sites *$US per site*	Production *$US per ton*	Value of Production *%*	Employment *$US per fisher*	Fleet size *$US per vessel*
Australia	1562	115221	448.7	8.5	5446	6898
Canada	669	-*	176.6	14.1	2913	6798
Estonia 1999	509.7	64460	17.3	1.7	-	8710.8
Estonia 2002	574.4	62265	21.5	4.5	333.9	16263.4
European Union	6789	-	116.1	10.0	2675	7144
Iceland	5491	421393	16.3	3.3	4856	13862
Japan	13399	159065	71.8	2.9	1727	2169
Korea	27922	765509	139.3	9.5	1889	4814
Mexico	64	12059	0.7	0.1	3	7
New Zealand	4963	-	40.3	-	2804	14388
Norway	2141	222937	47.2	9.7	5498	9290
United States	30792	-	138.6	17.0	-	20405

* data not available

Management cost per length of coastline in Estonia in 2002 was relatively low and similar to Canada's. The length of the coastline however does not appear to be a strong factor influencing the magnitude of fisheries services costs. For example, Japan' cost/km is more than twenty times higher than in Estonia, but management costs as a proportion of production value is even smaller than in Estonia. This is the case of very high value production in Japan. A longer coastline can certainly add to the management and enforcement challenges, but it does not necessarily lead to higher costs.

Costs per landing sites in Estonia are relatively low in comparison with other countries, except for Mexico. It indicates that there are too many landing sites in Estonia. It must be emphasized that included in those calculations are only ports where fish is landed from trawlers. If all the small costal and inland ports are also taken into account then the cost per port is even smaller. Compared to Iceland we see that management cost per landing site can be very high, but the costs per ton of production very low. Australia, for example, has the highest costs per ton of production but around average costs as a percentage of the value of production.

There is a considerable variation in the costs of fisheries services relative to employment in the sector across different countries. The Estonian cost of USD 333.9 per fisherman is relatively low and it is associated with a large number of fishermen.

The United States has the highest total cost per vessel. Big differences in the Estonian figures over the two sample years (in 2002 two times higher cost per vessel than in 1999) is due to the decreased number of vessels and furthermore in the year 2002 only vessels that had fishing permits were included in the computation. The high figure in 2002 per

vessel can be deceptive due to the fact that there are a lot of coastal and inland water boats with length up to 12 meters that are not included in the calculations.

3.3.1 Research service costs comparison

The cost of providing research services can be expected to be particularly influenced by the production and value of production. The government may be willing to spend greater amounts on research in those areas of the economy that are important for the society and often the amount of expenditure on research is influenced by the expected benefits from research. As it is difficult to calculate the expected future value of the fisheries sector one would expect that allocation decisions are made on the current size and value of the industry.

The shares of countries' fisheries services budgets devoted to the provision of research varies considerably across countries, ranging from 9% for Korea to 49% for Iceland. Australia, the European Union, Iceland, Japan and Mexico devote a relatively larger proportion of their fisheries services costs to research than Estonia (as can be seen in Figure 2).

Table 14, which shows research services costs in different countries, also as a proportion of production per ton (USD 6.7 per ton in 2002) and as percentage from production value (1.4% in 2002) are relatively low in Estonia.

Table 14: Indicators of research services costs in 1999 (OECD 2003)

	Costs of research services in relation to:			
	Production *(USD per ton)*	Value of production *(%)*	Fleet size *(USD per vessel)*	Employment *(USD per fisher)*
Australia	219	4.1	3378	2667
Canada	56	4.5	2161	936
Estonia 1999	5,2	0.5	4888	-*
Estonia 2002	6.7	1.4	5034	103.3
European Union	43	3.8	2391	1009
Iceland	8	1.6	6810	4856
Japan	33	1.3	1023	815
Korea	12	0.8	423	166
Mexico	0.3	0.04	2.8	1.4
New Zealand	11	-	4072	794
Norway	12	2.4	2285	1352
United States	46	5.6	6750	-

* data not available

It seems difficult to draw any clear conclusions from this comparison. However it seems like richer and more developed countries spend relatively more on research than poorer countries, with the notable exceptions of Iceland and Norway.

3.3.2 Management service costs comparison

The key factors likely to influence the costs of delivering management services are the size of the sector and the size of the industry. The regulatory system that is in place for managing the administrative aspects of the sector can also be a significant factor.
Iceland and Norway have significantly smaller shares of total costs devoted to management services than the other countries (as can be seen in Figure 3). These countries, together with Estonia and Mexico, also have the lowest management costs per ton of production as can be seen from Table 15 which compares management service costs in different countries.
There can be a certain link between management service costs and management frameworks or systems. For example, both Iceland and Norway have management frameworks that are based on the use of output controls (ITQs in case of Iceland and vessel quotas in Norway). In 2002 the ITQ system for the main Baltic Sea species was implemented in Estonia. In these three countries, Iceland, Norway and Estonia, management service costs per ton produced and in proportion to production value is very low. Management services costs in relation to fleet size are not very informative. But looking at total fisheries management costs per vessel (as can be seen in Table 13) we see that these countries which use mainly output controls, have relatively high total cost per vessel. It is due to the small size of the fleet, but the small fleet size can be a result of the use of output control that tends to encourage the rationalization of fleet.

Table 15: Indicators of management services costs in 1999 (OECD 2003)

	Costs of management services in relation to:			
	Production *(USD per ton)*	Value of production *(%)*	Fleet size *(USD per vessel)*	Employment *(USD per fisher)*
Australia	81	1.5	1241	980
Canada	65	5.2	2491	1079
Estonia 1999	2.4	0.2	1207	-
Estonia 2002	3.5	0.7	2664	55
European Union	22	1.9	1218	514
Iceland	1	0.2	999	350
Japan	16	0.9	655	521
Korea	21	1.4	715	281
Mexico	0,4	0.04	4	2
New Zealand	16	-	5701	1111
Norway	4	0.8	730	432
United States	54	6.7	8017	-

3.3.3 Enforcement service costs comparison

Estimates of enforcement services costs are given in Table 16. Estonian enforcement services cost per ton of production are relatively low, being similar to New Zealand and higher than in Iceland. Korean high enforcement cost (7.2% of production value) can be explained by a special Marine Policy Agency (OECD 2003) that is delivering enforcement service in Korea at a high cost.

Table 16: Indicators of enforcement services costs in 1999 (OECD 2003)

	Costs of enforcement services in relation to:				
	Coastline *(USD per km)*	Production *(USD per ton)*	Value of production *(%)*	Fleet size *(USD per vessel)*	Employment *(USD per fisher)*
Australia	516.25	148.26	2.8	2279	1800
Canada	206.47	54.48	4.4	2097	898
Estonia 1999	285.99	9.71	1.0	4888	-
Estonia 2002	302.51	11.32	2.4	8565	176
European Union	2923.91	50.01	4.3	3077	1152
Iceland	2397.58	7.11	1.4	6052	2120
Japan	3033.84	16.26	0.6	491	391
Korea	21318.78	106.38	7.2	3676	1442
Mexico	0.93	0.01	0.001	0.1	0.05
New Zealand	394.34	12.92	-	4615	899
Norway	1446.44	31.87	6.5	628	3714
United States	-	38.5	4.7	5683	-

When looking at enforcement services cost as a proportion of fleet size and employment the picture is similar to research and management services costs – the cost per fisherman is very low and per vessel high in Estonia.

3.4 Summing up the main findings about management costs in Estonian fisheries

According to our calculations the total cost of fisheries management in Estonia is relatively small compared with most other countries for which we have available data. The total cost amounts to around 4.5% of the total value of production. Cost of research services in Estonia is around USD 6.7 per ton of production which is similar to the cost in Iceland. When looking at management service costs it amounts to USD 3.5 per ton of production which is similar to Norway. The cost of enforcement services is USD 11.3 per produced ton which is similar to New Zealand.
Based on these numbers one could say that the Estonian fisheries management system is quite effective. One possible reason for those low costs may simply be the lack of available funds. It is also right to point out that those estimates do not incorporate quality assessments of the services provided by different actors that make up the fisheries management system.
Figure 4 shows the trend in fisheries services costs in Estonia in fixed prices. It seems obvious that there is clear increasing trend in the costs. Taking into account the fact that Estonia is soon to join the EU then it is not out of place to compare the costs in Estonia with the average costs in the EU. Estonian research services cost per ton is 6.4 times lower than the EU average, management services 6.3 times lower and enforcement services 4.4 times lower. Of course, it is not an aim in itself to achieve the average level of the EU fisheries services costs. At the same time it would be a little bit naive to believe that Estonia is able to implement EU's common fisheries policy with the current prices of fisheries services. Therefore it seems likely that there will be increase in fisheries services costs and maybe the shares of research and management services will increase and the share of enforcement will decrease in line with the average level in the EU, but the amounts will probably increase in all three of them. It should nevertheless be kept in mind that it depends on each Member State which and what kind of tools it uses to achieve the objectives set out by the CFP which means that theoretically the costs of fisheries services do not necessarily have to increase.

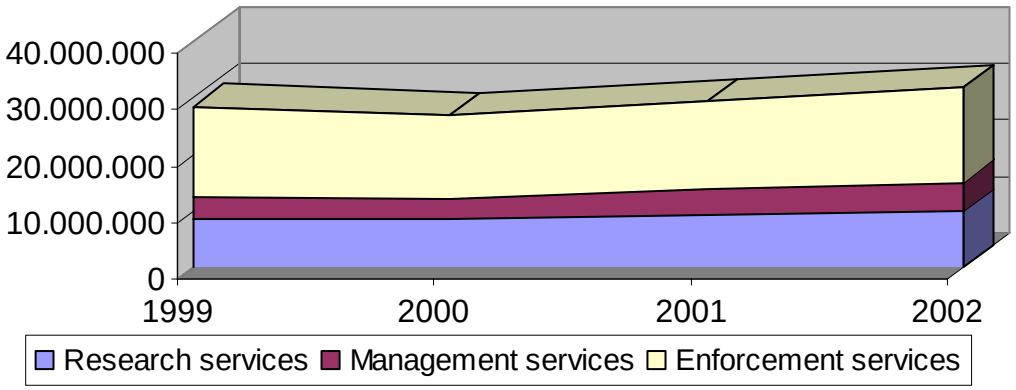

Figure 4: Fisheries services total costs in Estonia in 1999 prices, 1999-2002.

One would also assume that the value of production might increase with Estonia joining the EU, mainly because of higher prices in the EU market and partly because of better surveillance. According to subjective estimates then approximately 40% of landed fish is

not recorded at all and that is why the official data (used in this project) represents perhaps only a little more than half of the real catch. As Vetemaa *et al.* (2002) point out then the apparent substantial price rise in the trawling auction suggests that Estonian fishing enterprises are forced to buy quota in order to increase their catches. That seems to indicate that it is almost impossible to give a common interpretation of the quality of enforcement services provided. We can only hope that there is a certain compliance among fishing companies to the laws and regulations, otherwise the ones who have bought fishing rights at an auction are in an economically difficult situation compared to those who do not register all their catches. Such problems are common to most EU countries. For example it is estimated that only 50-90% of all catches are reported in Sweden (Eggert and Ellegard 2003).

One problem with estimating enforcement services is the fact that approximately 20% of registered landings are checked by surveillance officers and the rest is controlled through documentation, i.e. collected first sale receipts. A study by Nielsen and Joker (1995) showed that such documentation is not a good indicator of the quality or quantity of the landings as fishermen find it relatively easy to falsify the sale receipts. This is probably also the case in Estonia. The weakness of paper control is absent in Iceland as all the landings are checked *in situ* at harbours and this system has proved to be very effective.

The fishing rights fees have provided the government with income from the fishery amounting to 27.4 million EEK in 2000 (3.87% of the value of fishing). The total fisheries services costs at the same time were 28 million EEK. It means that 97.8% of fisheries services costs were covered by income from the fishing companies. Taking into account the fact that these amounts are paid by commercial fishers, but in addition to them several counterparts benefit from fisheries services, the result is remarkable. In 2002 the level of services covered by the sale of fishing rights had decreased to 61%. In comparison with other countries, for example in 1999, the proportion of costs recovered from industry was 50% in New Zealand, 37% in Iceland and 23% in Australia (OECD 2003).

When discussing fisheries rents and services in Estonia it should be born in mind that all services are chiefly provided and financed by the government and the fishing industry through the EIC (see also Table 1). By using money obtained from the sale of fishing rights through the EIC it is also possible to contract out some services. In fact some research services have been contracted out from EIC. The main problem using this income from the sale of licences through EIC has had to do with transparency.

If the costs of fisheries services increase in the future, as discussed previously, then there is also the possibility that the beneficiaries of these services will cover the costs themselves directly. For example, in case of inspection, cost of this service can be covered by the industry and it does not have to be just a cost recovery arrangement. As Andersen and Sutinen (2003) point out, the government fishery management providers face incentives that lead to an inefficient supply of services as public employees do not have the incentive to produce services at the lowest cost or to increase the value of those services. Inspection can also be provided by a certified private company, as in Iceland and if there is competition between service providers then a better value and price balance may be achieved.

As we discussed in the theoretical part of this work, the most promising arrangement seems to be self-management. In the framework of CFP producer organization(s) (PO) should be established in Estonia in 2004. If the PO's prove to be efficient, it may be possible to delegate a wide range of fisheries services to them and leave only a minimum

level of services to governmental institutions. It is generally acknowledged that when active agents in the fisheries feel involved in the decision-making, they have a stronger incentive towards compliance. But it has been pointed out that this does not have to be the case. Nielsen and Mathiesen (2003) argue that some fishermen may not want to take part in the collective decision-making as it imposes on them a moral obligations to report misdemeanours of fellow fishermen.

The Dutch fishing sector is so far the only one within the EU that operates under an ITQ system (Davidse 2003). The Dutch fisheries management cost in relation to landed value was 5% in 1997 (Appendix 4). Taking into consideration that Estonia also has an ITQ system it is interesting to note that with such a system Estonia has relatively low fisheries management cost in relation to landed value. It can be assumed that Estonian fisheries management costs will continue to stay under the average level of the EU costs as an ITQ system seems to be low-cost compared to other management systems.

Discussing different ways on how to recover fisheries service costs or how to increase the quality of fisheries services one additional point should be noted. Pascoe *et al.* (2003) point out that a potential problem can arise if only one Member State of the EU introduces a management charge when its fleet competes with others for a shared stock. Higher costs are likely to reduce effort with consequent longer term economic benefits to the industry and these benefits may not accrue to the Member State who imposed the charges. This can result in a free-riding problem, where the states who do not reduce their fleets free-ride on other countries' reductions. This provides incentives for some countries to wait until other countries have imposed management costs and then reap the benefits.

It seems to be an important task to find optimal level of fisheries services. The current situation in Estonia demands a larger workforce to provide management services. Hiring more staff means higher costs, but will probably result in better services. It is necessary to look at all parts of the management system, i.e. management services, research and enforcement services, as the chain is only as strong as its weakest link.

In order to measure efficiency and effects of fisheries services it is necessary to agree on certain criteria and indicators. To avoid lobbying such an analysis would preferably be carried out by someone who is not attached to the fishery. On the other hand performing such an evaluation by someone inside the industry may enhance learning within the industry and lead to positive incentives.

Comparing management costs in Estonia with costs in other countries yielded two important results. The first result is that there seem to be too many landing sites in Estonia. The second finding is that the fishermen seem to be too numerous. Many of them are part-time fishermen and cannot survive solely on the income derived from the fishing activity. Any policy aimed at decreasing the number of fishermen would most probably result in a social problem as those fishermen who exit the fishery might find it difficult to find alternative sources of income.

4 CONCLUSIONS

Fisheries management costs covers research services, management services and enforcement services. Costs of fisheries management is only partly covered by the government. When measuring fisheries management costs it is necessary to take into account all the costs needed to run the existing fisheries management regime.

In 2002 the total fisheries services cost in Estonia was USD 2.18 million and the cost per ton of production was USD 21.5 which constituted 4.5% of the value of production. Enforcement services accounted for the largest share of total management costs in Estonia or 52.8% of the total.

The cost of fisheries management in Estonia is relatively low compared to costs in other countries. Nevertheless it is difficult to conclude that this low cost means that the Estonian fisheries management works poorly or inefficiently in comparison with others.

An ITQ system has been implemented in Estonia for the main Baltic Sea species. The right to fish is subject to a fee up to 4% of value. Additionally, a part of the fishing rights were allocated through auctions in 2000-2003.

Income from the sale of fishing rights covered 61% of fisheries services costs in 2002, but in 2000 it covered 97.8%. This is remarkably high in comparison with other countries.

When compared with other countries the main weaknesses of the Estonian fishing industry are too many landing sites and too many fishermen.

There is a clear increasing trend in the cost of fisheries management in Estonia. Nevertheless it does not necessarily have to rise with respect to value due to an increase in the value of the catch and perhaps because of better surveillance. There are several ways to increase the efficiency in the provision of management services, for example by making use of self-management arrangements.

It might be that Estonians will come under increased pressure to improve the whole fisheries management system when entering the European Union. The Estonian fleet may have some disadvantage when competing with fleets that do not have to pay for their fishing rights.

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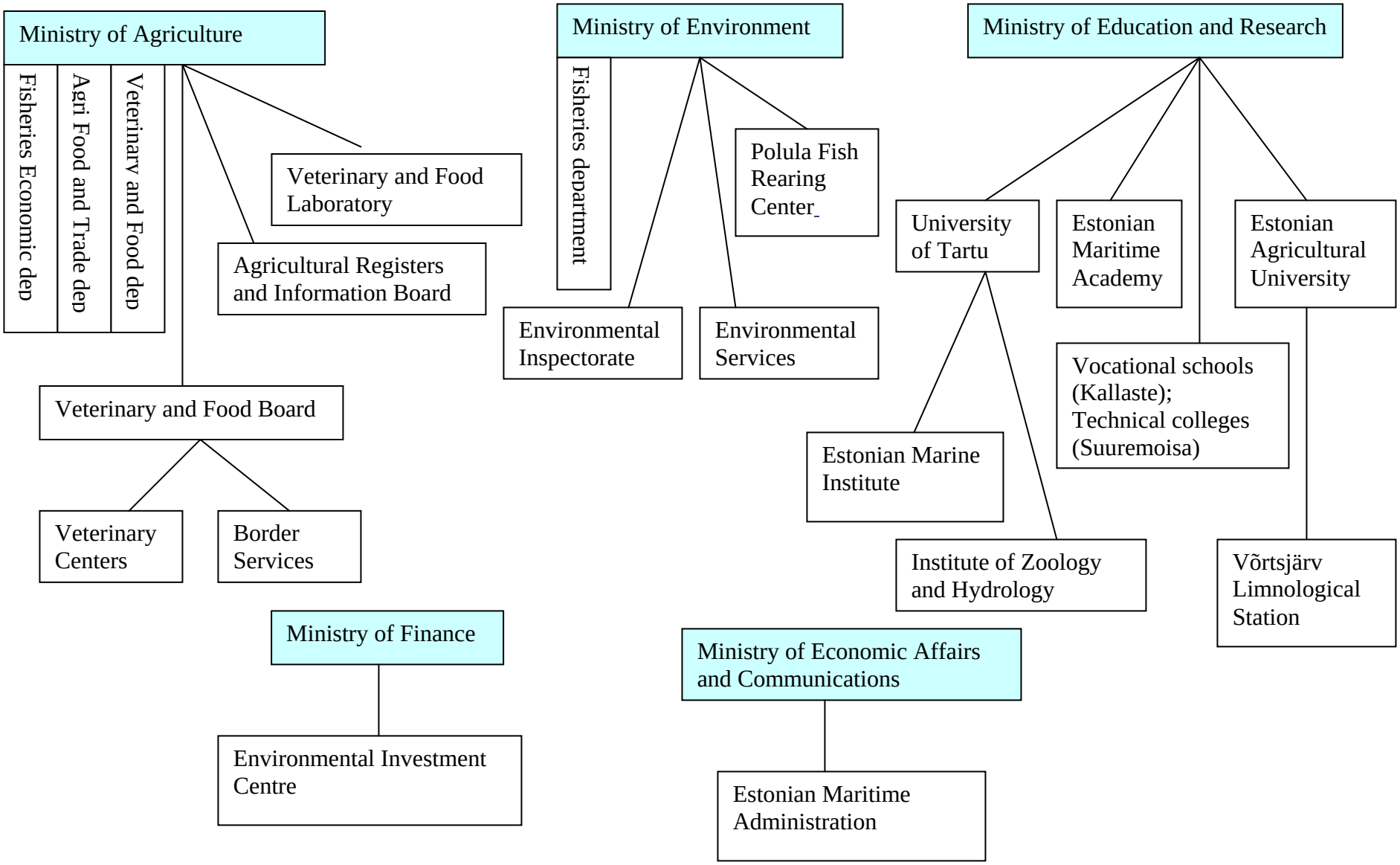
APPENDIX 1: FISH QUANTITIES AND PRICES ABOUT ESTONIAN WATERS. 1999-2002 (MOE 2003)

	1999			2000			2001			2002		
Species	Quantity (tons)	Price EEK/kg	Value in EEK	Quantity (tons)	Price EEK/kg	Value in EEK	Quantity (tons)	Price EEK/kg	Value in EEK	Quantity (tons)	Price EEK/ kg	Value in EEK
Baltic herring	44038.406	1.34	59,011,464	41735	1.865	77,835,794	41737.817	2.423	101,130,730	36250.356	2.515	91,169,645
Sprat	36406.513	1.29	46,964,401	41393.8	1.89	78,234,358	40776.968	2.21	90,117,098	40717.031	3.125	127,240,722
Cod	1059.773	12.07	12,791,460	514.179	15	7,712,685	754.857	11.78	8,892,211	37.209	13	483,717
European flounder	414.875	6.21	2,576,373	419.466	6.06	2,541,964	482.213	6.045	2,914,977	500.553	5.855	2,930,738
Atlantic salmon	13.519	30.50	412,329	21.042	31.25	657,563	14.128	47.26	667,666	15.705	50	785,250
Sea trout	9.760	50.00	488,000	13.264	49	649,936	12.733	54.29	691,264	16.005	47.86	765,999
European eel	59.984	89.99	5,397,960	26.716	95.235	2,544,298	66.930	89.47	5,988,236	49.655	90.42	4,489,805
Pollan	62.959	11.17	703,252	32.774	15.2	498,165	41.989	19.025	798,845	58.192	20.23	1,177,224
Vendace	47.490	3.5	166,215	0	0	0	0.000	0	0	0.000	0	0
Vimb	122.911	3.45	424,042	101.059	3.01	304,188	82.611	8.25	681,544	114.723	6.36	729,638
Common bream	194.741	7.99	1,555,980	10.489	7.82	82,024	327.263	7.85	2,569,015	401.374	9.1	3,652,503
Pike-perch	770.436	19.00	14,638,284	25.133	25.52	641,394	517.179	32.8	16,963,461	976.078	34.11 5	33,298,901
Northen pike	152.470	11.98	1,826,590	21.262	17.35	368,896	199.008	14.165	2,818,945	218.091	18.01	3,927,819
European perch	976.269	17.07	16,664,911	279.81	21.994	6,154,141	686.171	25.19	17,284,653	823.568	18.13	14,931,288
European smelt	1007.647	3.50	3,526,764	90.141	3.46	311,888	762.748	5.875	4,481,145	2320.371	5.75	13,342,133
Roach	323.934	5.75	1,862,620	243.615	3.62	881,886	503.148	4.79	2,410,080	766.590	4.675	3,583,808
Eelpout	1.564	1.00	1,564	1.381	1.33	1,837	1.339	1	1,339	0.760	1	760
Orfe	52.101	6.62	344,908	60.537	6.345	384,107	39.586	9.37	370,920	30.212	8.57	258,917
Garfish	122.425	2.78	340,341	135.144	4.59	620,311	111.131	6.6	733,462	148.335	5.57	826,226
Burbot	53.647	8.23	441,514	2.173	6.5	14,125	37.904	9.33	353,640	41.215	8.17	336,727
Lamprey	15.928	22.58	359,654	8.246	12.265	101,137	28.349	21.26	602,700	25.027	24.52	613,662
Other	199.686	4.5	898,587	40.628	4.5	182,826	254.092	4.5	1,143,416	86.132	4.5	387,594
Total	86107.038		171,397,221	85175.9		180,723,521	87438.16		261,615,344	83597.241		304,933,077

APPENDIX 2: ALL INVOLVED INSTITUTIONS IN FISHERIES OPERATING ON PUBLIC FUNDS



APPENDIX 3: COSTS OF FISHERIES SERVICES IN ESTONIA 1999-2002

	1999	2000	2001	2002
Annual average $US exchange rate	14.6948	16.9807	17.4794	16.606
Consumer price index 1999=100	1	1.04	1.098	1.134
Research cost				
	1999	2000	2001	2002
1. Estonian Marine Institute (EEK)	5,505,000	4,900,663	5,105,000	4,340,000
2. EIC funds (EEK)	3,028,500	3,894,360	5,203,963	6,861,760
3. Total (EEK)	8,533,500	8,795,023	10,308,963	11,201,760
4. Total (EEK, in 1999 prices)	8,533,500	8,456,753	9,388,855	9,878,095
5. Total ($US, in current prices)	580,716	517,942	589,778	674,561
Management cost				
	1999	2000	2001	2002
1. Ministry of Environment (EEK)	2,444,162	1,600,629	2,260,541	3,384,127
2. Ministry of Agriculture (EEK)	0	826,658	1,185,609	1,226,369
3. International cooperation from EIC funds	993,463	596,107	628,717	500,000
4. Member fees				
4.1. IBSFC (EEK)	325,712	470,032	532,615	491,335
4.2. NAFO (EEK)	175,243	225,538	279,432	326,931
5. Total (EEK)	3,938,580	3,718,964	4,886,914	5,928,762
6. Total (EEK, in 1999 prices)	3,938,580	3,575,927	4,450,741	5,228,185
7. Total ($US, in current prices)	268,025	219,011	279,581	357,025
Enforcement cost				
	1999	2000	2001	2002
1. Marine Inspection (EEK)	10,155,150	0	0	0
2. Environmental Inspection (EEK)	0	8,779,330	7,901,578	9,341,300
3. Enforcement from EIC funds (EEK)	3,834,000	2,900,000	5,150,000	5,540,000
4. Environmental Services (EEK)	0	1,796,272	2,004,275	2,174,688
5. Veterinary and Food Board (EEK)	1,842,776	1,842,776	1,842,776	1,842,776
6. Veterinary and Food Laboratory (EEK)	112,864	152,571	155,772	160,178
7. Total (EEK)	15,944,790	15,470,949	17,054,401	19,058,942
8. Total (EEK, in 1999 prices)	15,944,790	14,875,912	15,532,242	16,806,828
9. Total ($US, in current prices)	1,085,063	911,090	975,686	1,147,714
Fisheries management cost				
Total (EEK)	28,416,870	27,984,936	32,250,278	36,189,464
Total ($US)	1,933,805	1,648,044	1,845,045	2,179,301
Fishing rights fee (EEK)	3,600,000	27,359,213	25,590,973	21,992,587
Difference between cost and fee (EEK)	24,816,870	625,723	6,659,305	14,196,877
Fishing rights fee % per total value (on EEK bases)	0.22	3.87	3.60	2.74
Value of production (all catch, EEK)	1,644,789,076	707,672,141	711,443,141	802,103,751
Value of production (all catch, $US)	111,930,008	41,675,086	40,701,806	48,302,045
Value of production (only Estonian waters, EEK)	171,397,222	180,723,521	261,615,344	304,933,077
Cost % per total value (on EEK basis)	1.7	4.0	4.5	4.5
Cost % per total value (on $US basis)	1.7	4.0	4.5	4.5

APPENDIX 4: OECD COUNTRIES MANAGEMENT COSTS 1997 (SCHRANK *ET AL.* 2003, P. 212-213)

	Research Services ($US million)	Management Services ($US million)	Enforcement Services ($US million)	Total, Management Costs ($US million)	Landed Value ($US million)	Management Costs/Landed Value	Landings (,000 tons)	Management Costs/Landings
Estonia 1999	0.58	0.27	1.09	1.94	111.93	1.7%	111.79	17.35
Estonia 2002	0.67	0.36	1.15	2.18	48.3	4.5%	101.41	21.50
EU 15 Total	181.65	137.77	272.91	592.34	9324	6%	6377	87.22
Iceland	9.45	3.59	7.56	20.59	877	2%	2224	9.26
Norway	23.53	16.95	57.64	98.12	1343	7%	2856	34.35
Denmark	27.18	7.92	14.3	49.4	521	9%	1813	27.25
Finland	14.46	4.26	1.8	20.52	29	70%	119	172.7
Germany	19.32	5.03	21.17	45.52	194	23%	260	175.36
Greece	6.47	4.79	24.85	36.11	387	9%	153	236.33
Ireland	9.63	0.77	81.74	92.14	220	42%	309	298.53
Italy	7.04	5.73	48.74	61.5	1749	4%	441	139.32
Netherlands	16.4	2.72	5.45	24.56	466	5%	448	54.84
Portugal	8.79	9.5	6.65	24.95	319	8%	206	120.89
Spain	11.61	17.06	8.38	37.05	3443	1%	1007	36.81
Sweden	20.17	8.96	12.87	42	129	32%	350	120.14
United Kingdom	25.11	11.41	45.56	83.08	1012	8%	888	93.61
Mexico	10.8	5.4	0.6	16.8	1017	2%	1222	13.75
United States	95.44	165.73	400	661.17	3644	18%	4635	142.66