marine protected areas
in the Eastern Baltic Sea

LIFE Nature project "Marine Protected Areas in the Eastern Baltic Sea"
Reference number: LIFE 05 NAT/LV/000100

Action C1 – Assessing and reducing impact of fishery by-catch on species of community interest

Action leader P13, Institute of Ecology of Vilnius University

FINAL REPORT

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CONTENTS

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Executive summary: **Action C1 – Assessing and reducing impact of fishery by-catch on species of community interest**

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SUMMARY

Goal of the action

The main goal of this action was to investigate in detail the impact of fisheries on waterbirds and marine mammals in the Eastern Baltic Sea and, if necessary, to provide recommendations for mitigation of any significant impacts. In addition, the impact of fishery on seals was investigated in Estonia. In Lithuania and Latvia, only waterbird by-catch in fishing gear was investigated, whereas in Estonia, seal by-catch as well as seal damage to fishing gear was investigated in addition to the waterbird by-catch.

Activities implemented

As an initial preparatory step of the action, detailed background information on commercial fishery in each of the three countries was collected and summarised in a report. This summary includes various organisational aspects of the fisheries – spatial organisation (fishing sectors), licensing, distribution of fishing quotas, reporting, fishery control, fishing restrictions (temporal, spatial, gear type, catch size, etc.) as well as information on the numbers ant type of vessels/companies involved, fishing gear used, intensity trends, catches, etc. Extensive literature survey was carried out on the available studies, publications, reports on bird and mammal bycatch in relevant fishing gear, measures for mitigation and avoidance of such bycatch suggested or implemented elsewhere.
By-catch data was collected in several ways during the project. First of all, data on waterbirds and seals (in Estonia only) caught in fishing gear was collected from co-operating fishermen, operating under normal conditions along their normal fishing schedule and with traditional fishing gears. In addition, experimental fishing was carried out in Lithuania and Estonia, in order to collect an unbiased sample of bycatch data. The collected data were analysed in order to obtain bycatch rates, which allowed rough estimation of bycatch victims as well as comparison of different types of fishing gear in respect of the threat posed to birds.

Results achieved

Analysis of seal bycatch in Estonia revealed that ca. 280 seals drown in fishing gear in Estonia every year, 90–95% of them being grey seals. While any bycatch of seals in fishing gear is ethically hardly acceptable, bycatch does not appear to have hampered the continuing growth of populations of both species of seals, probably because mostly young seals, which have high

mortality anyway, become victims of bycatch. Thus, bycatch of seals in fishing gear at present in Estonia should not be considered a major threat on a population level.
Information on more than 700 waterbird bycatch events was collected during the project in all the three countries. Although the species composition of bycatch victims differed among the countries and reflected species composition of birds concentrating in different seasons in areas of commercial fishery, most common bycatch victim in all the countries was the Long-tailed Duck, which accounted for 50–60% of all the caught birds. Other common victims in Latvia and Lithuania included Velvet Scoter, divers and alcids, while in Estonia – Tufted Duck and mergansers. In all the three countries, large mesh size gillnets (>50 mm) were found to be most dangerous to birds, although only in Lithuania bycatch rate and its extent were considered to be high enough to warrant inclusion of special mitigation measures into management plans for Lithuanian SPAs.

Main lessons learned

The overall finding of bycatch assessment was that the present threat posed to waterbirds in the Baltic countries had a tendency to decrease, which is facilitated by the overall decrease in fishing effort in most areas as well as decreasing numbers of wintering birds, be it due to mild weather conditions or the overall decrease in waterbird populations. However, bycatch of birds in fishing gear cannot be overlooked and ignored, as it poses a real threat to many species of birds, can cause large numbers of casualties under certain conditions and is still poorly monitored and regulated. Obligatory reporting of bird bycatch in fishing gear is one of the measures that could facilitate both understanding the scope and extent of the bycatch phenomenon as well as reducing this threat to birds.

DESCRIPTION OF ACTIVITIES

The aim of this action was to investigate in detail the impact of fisheries on waterbirds and marine mammals in the Eastern Baltic Sea. In addition, the impact of fishery on seals was investigated in Estonia. Previous experience has shown that all species of waterbirds are threatened by fishing nets, although species differ in their vulnerability to this threat. Therefore, all species of waterbirds occurring in the project areas were targeted. Two species of seals are threatened by by-catch in fishing nets in Estonia – *Halichoerus grypus* and *Phoca hispida*, the latter to a much lesser extent that the former despite similar population sizes in the Baltic Sea. Despite the fact, that harbour porpoises are considered as irregular visitors in the East Baltic Sea, the gillnet fisheries is a potential threat to them and can significantly affect the highly endangered population.
Information on bird and marine mammal by-catch in fishing nets as well as on seal damage to fishing nets and fish catches were collected from fishermen and by means of experimental fishing (the latter only in Lithuania and Estonia, and for bird by-catch only). The collected data were analysed to reveal the most dangerous fishing gear types and methods, the most vulnerable bird species and other aspects of bird and marine mammal by-catch.

METHODOLOGY

Introduction

Death of waterbirds and seabirds as well as marine mammals has been well documented from various fisheries in different regions of the world. The Baltic Sea is no exception. Preliminary studies in Lithuania and Poland have shown that up to 10–15% of all wintering waterbirds get entangled and die in gillnets of the commercial fisheries. Such a high additional mortality may have severe negative consequences for the entire regional populations of bird species wintering in the project areas. This makes commercial fishery undoubtedly one of the major direct threats to wintering and migrating waterbirds and marine mammals (including many species of Community importance). The reduction of this negative impact is essential for ensuring the favourable conservation status of bird and marine mammal species protected in the proposed marine Natura 2000 sites in the three Baltic countries. Detailed knowledge of mechanisms of the fisheries impact on waterbirds and seals, its extent, species-specific peculiarities is essential for designing and suggesting effective mitigation measures of this impact.
In Lithuania and Latvia, only waterbird by-catch in fishing gear was investigated, whereas in Estonia, seal by-catch as well as seal damage to fishing gear was investigated in addition to the waterbird by-catch.

Background data collection on fisheries

The first preparatory step in the bycatch impact assessment involved collection and computerization of background data on the commercial fisheries and their organization in the three countries. The following background data (where available) were collected and are presented in this report below:

- number of fishermen/fishery enterprises operating in the project areas;
- fishing gear used (types of gear, construction, setting depth, hauling/checking techniques);
- types of vessels used in fishery and their deployment sites;
- spatial organisation of the fishery, e.g. subdivision of marine waters into fishing sectors, prohibited areas, fishing areas/sectors assigned to individual fisheries enterprises, etc.;
- how and by whom are licenses/permits/fishing quotas issued;
- how are fish catches and fishing effort reported, availability / accessibility of such data;
- control mechanisms / enforcement of fisheries regulations;
- legal requirements (if any) for reporting fish, bird and mammal by-catch;

- official restrictions on fishery (restriction periods on gear types, target fish species, fish sizes, fishing locations, fishing effort, etc.).

Extensive literature survey was carried out on the available studies, publications, reports on bird and mammal bycatch in relevant fishing gear, measures for mitigation and avoidance of such bycatch suggested or implemented elsewhere.

By-catch data collection

By-catch data was collected in several ways during the project. First of all, data on waterbirds and seals (in Estonia) caught in fishing gear was collected from co-operating fishermen, operating under normal conditions along their normal fishing schedule and with traditional fishing gears.

Co-operating fishermen/fishery enterprises were selected according to the location of fishing, their fishing intensity, types of gear used – previous knowledge was used to identify the areas of highest potential conflict between birds (seals) and fishery, such areas were given a priority.

For the collection of data, the co-operating fishermen/fishery enterprises were supplied with specially designed forms/questionnaires, in which they reported their fishing effort, fishing success and data on any caught birds (seals). These questionnaires were country-specific to account for the peculiarities of fishing practices and fishing gear used in different countries

In order to collect a sample of unbiased data and to perform a quality check of data, provided by fishermen, an experimental fishing was performed in Lithuania and Estonia by project partner institutions. Ichthyologists used the same fishing gear used by the local fishermen in a particular season and also followed their fishing pattern. This fishing was performed in various locations of the project areas and the data recorded included the fishing intensity with different types of gear, fishing success and waterbird by-catch (if any).

By-catch impact assessment methodology

The impact of fishery by-catch on species of Community interest were assessed in several steps:

1. By-catch rate was calculated as a ratio of birds caught in fishing gear and the fishing effort with that fishing gear. For example, the by-catch rate in gillnets is expressed as the number of birds caught per 1,000 net meter days (NMT). By-catch rate is also calculated separately for different types of gear (e.g. gill nets of different mesh sizes), different species or groups of species of waterbirds, different project areas and different seasons (where relevant). Where possible, by-catch rate will be corrected for the abundance of birds in the areas of by-catch data collection.
2. Frequency of occurrence is calculated as a proportion of fishing events that resulted in waterbird by-catch.
3. By-catch rates were used to roughly estimate the overall by-catch of waterbirds in the project areas, by using the official data on the fishing effort with different types of fishing gear in these areas.

The analysis revealed the highest points of conflict between waterbirds and fishery. According to the results of the analysis, types of fishing gear most dangerous to birds and seals are identified and the possible significance of their impact on bird and seal populations in the project areas is assessed. If and where needed, mitigation measures are proposed to reduce and mitigate such an impact thus contributing to ensuring the favourable conservation status of waterbird and seal species of Community importance in the project areas.

FISHERY OVERVIEW: ESTONIA

Administration and governance of the sector: Organization

Concerning the institutional set-up, Estonia is fairly unique in EU. Up to 2005, the Ministry of the Environment was responsible for all fisheries issues. Since 2005, however, administration and governance is divided between two ministries, the Ministry of the Environment and the Ministry of Agriculture. In aim to guarantee coherent management of the fisheries sector there are several structures where both Ministries are represented: Committee of the Fisheries Management; Fisheries Council, Monitoring Committee of Fisheries Fund.

Regional characteristics

Estonia has, in proportion to its small size, a very long coastline, on its western and northern border. The marine character of the country is even more accentuated by the existence of a large archipelago in West-Estonia. The eastern border crosses the big lake system, L. Peipsi-Pihkva, which is the fourth largest inland water body in Europe. Therefore, the fisheries sector, especially small-scale fisheries, has historically been very important both in Estonian coastal areas, as well as in the eastern region along the coasts of the L. Peipsi-Pihkva. Naturally, coastal fisheries and inland fisheries have somewhat different characteristics. However, keeping in mind that in the north-eastern Baltic Sea mostly freshwater fish species dominate, the inland and coastal fisheries have used rather similar gears.

Main fisheries and fleets

The Estonian fishing vessel register has four segments: 4S1 (Baltic open-sea trawling), 4S2 (Baltic coastal fishing), 4S3 (Atlantic distant fisheries), 4S4 (fishing in inner waters). After the entry to the European Union the ceiling of the total capacity of the Estonian fishing fleet was set as follows (by May 1, 2004): gross tonnage (GT) – 26,613 t; engine power – 64,967 kW. However, due to the vessel adjustment programs the fleet capacity in June 2008 was already somewhat smaller. The total number of fishing vessels is currently (spring 2009) 1,282, and most of them are small (up to 12 m) and are used in the Baltic coastal and inland fisheries (Table 1).

Baltic trawlers – segment 4S1

By the total revenue generated the most important segment of the Estonian fishing fleet is Baltic trawlers targeting herring and sprat. During the Soviet period the trawling sector was rather big and its production was sold over the whole of the Soviet Union. However, it used vessels which were old-fashioned and uncompetitive. The disintegration of the centrally planned economy resulted in the discontinuation of cheap fuel and other inputs provided by the state. In conclusion, due to the low profitability of this segment the number of vessels has decreased year by year. So, while in 2001 the number of trawlers 12–24 m and 24–40 m was 62 and 81, respectively, then at the beginning of 2008 the numbers were only 28 and 34, respectively. This segment is not causing any bycatch of birds and mammals. The licenses for this segment are issued by the central administration in Tallinn.

Baltic coastal fishery – segment 4S2

By the total number of vessels and fishermen the largest segment of Estonian fleet is the coastal fishery employing mainly passive gears like gill nets and trap nets. This fishery targets mostly freshwater species such as pikeperch, perch and pike, but also marine species such as flounder and spawning stocks of herring and garfish, as well as migratory species such as sea trout, salmon and whitefish. This segment is responsible for bycatch of birds (gill nets and fyke nets) and mammals, i.e. seals (fyke nets). The profitability and development of this segment will be

analysed in special section below. The number of the vessels in this segment is 800–1,000. The exact number is not known, because some of the vessels used for coastal fisheries are not entered into the fishing vessels register and some vessels still in register are already utilised in practice. The exact number of vessels in the register was 879 in 2008. The licenses for this segment are issued by the coastal counties. However, the decision on maximum number of gears by counties is made in the central administration.

Employment

Statistics Estonia and Estonian Labour Market Board collect data about employment. Still, it is not easy to measure the exact employment in the fishing sector. The most important reason is that many fishermen are only part-time employed and their main field of activity (and income source) is not fishery. This concerns especially the small-scale fishery, which in the Estonian case represents most of the Baltic coastal fisheries and freshwater fisheries.

One way to get employment figures for the coastal fisheries is to count the number of persons who have received licenses to use different commercial fishing gears. The development of the total number of coastal fishermen in Estonia (years 1996–2005) is presented in Table 1. From 2006 the statistics is somewhat different, while in earlier years just fishermen were counted, then now owners of the licenses (both enterprises and private fishermen with licenses) and fishermen fishing using licenses of the first group are counted separately. This statistics is presented in Table 2. However, interviews with fishermen have revealed that, on average, they receive only 10–20% of their income from fishing. The reason is that big part of fishermen are active mainly in other sectors of the economy (most typical sectors are agriculture, forestry, transport etc.), while another big group are retired persons who fish only with rather small effort. Rather analogous is the situation in the inland (freshwater) fishery. In trawling the situation is different. Most people working on trawlers are full-time employed. Their figure can be obtained by interviewing fishing enterprises. Another possibility is to calculate it on the basis of the total number of vessels in the segment. Since the typical crew of the trawling vessels of different size is known, the figure thus obtained is rather correct.

Table 1. Number of coastal fishermen by counties (1996–2005).

County	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Hiiumaa	181	193	191	189	211	213	218	234	255	293
Saaremaa	664	330	321	312	326	288	312	300	311	329
Läänemaa	400	314	209	195	224	169	179	204	202	230
Pärnumaa	515	493	440	440	451	404	395	412	412	425
Ida-Virumaa	?	?	81	80	111	111	110	127	106	220
Lääne-Virumaa	74	68	81	80	83	81	98	126	126	136
Harjumaa	190	188	181	187	176	185	214	207	229	370
Total	2024	1586	1504	1483	1582	1451	1526	1610	1641	2003

Table 2. The number of owners of the fishing licenses in Estonian coastal fisheries and the number of fishermen not owning licenses, but using the licenses of the first group.

2006		
County	owners of the licenses	fishermen (not owners) on licenses
Harjumaa	245	195
Ida- Virumaa	134	153
Lääne-Virumaa	97	33
Hiiumaa	169	324
Läänemaa	146	250
Pärnu	464	595
Saaremaa	270	452
2007		
Harjumaa	230	226
Ida- Virumaa	124	174
Lääne-Virumaa	92	38
Hiiumaa	151	313
Läänemaa	152	271
Pärnu	497	602
Saaremaa	250	430
2008		
Harjumaa	200	224
Ida- Virumaa	77	160
Lääne-Virumaa	90	36
Hiiumaa	159	239
Läänemaa	146	216
Pärnu	421	560
Saaremaa	239	365

Development of the profitability in the coastal fishery

Trade liberalization, which started in the 1980s and was completed in 1991, enabled (and forced at the same time) the Estonian coastal fishery to expand to new markets. Before that, all marketing and trade was organized by governmental structures and orientated to the domestic or socialist countries' markets. Those markets were stable, but the price level was low. Direct contacts with western markets were not possible, even if those markets were geographically very close. Rapid increase in exports and a high demand for fish at the beginning of the 1990s caused a sudden and huge increase in the Estonian first-buyer prices for fish, which rose nearly to the Western European level.

Since most of the Soviet-time fishermen were given the opportunity to privatize very cheaply and to take possession of the fishing gears and boats that belonged to former collective farms, there was no lack of fishing equipment. Fuel and transport were more or less the only costs associated with fishing. Since the coastal fishery is mostly carried out close to the fishing ports, fuel costs were not high. Finally, due to Estonia's small size and relatively good road network, the transport of raw fish was easy and quick. The second important factor that increased the pressure on stocks was the abolition of the border regime. As a result, due to the low input costs, high fish prices and rather healthy fish stocks, the profitability of fishery was very high at the beginning of the 1990s.

Since then, year by year, however, profitability has steadily declined. This has been caused by increasing fishing costs and by declining stocks. While the price of fuel has increased almost ten-fold during the last 15 years in Estonia, first-buyer prices in European markets have not grown much. So, while targeting expensive freshwater species a source of very big profits and well-being for fishermen was during the first half of the nineties, then during the last years it has had rather low economic importance. As a result, the number of coastal commercial fishermen has declined. Furthermore, interviews with fishermen reveal that while during the beginning of the

nineties they received nearly all their income from fishing, then, today the majority can be treated as part-time fishermen, receiving only minor part of their income from fishing. Even if there are not much data about bycatch in earlier years it is very likely that the decrease in the fishing pressure has caused also decrease in the bycatch.

Control and surveillance

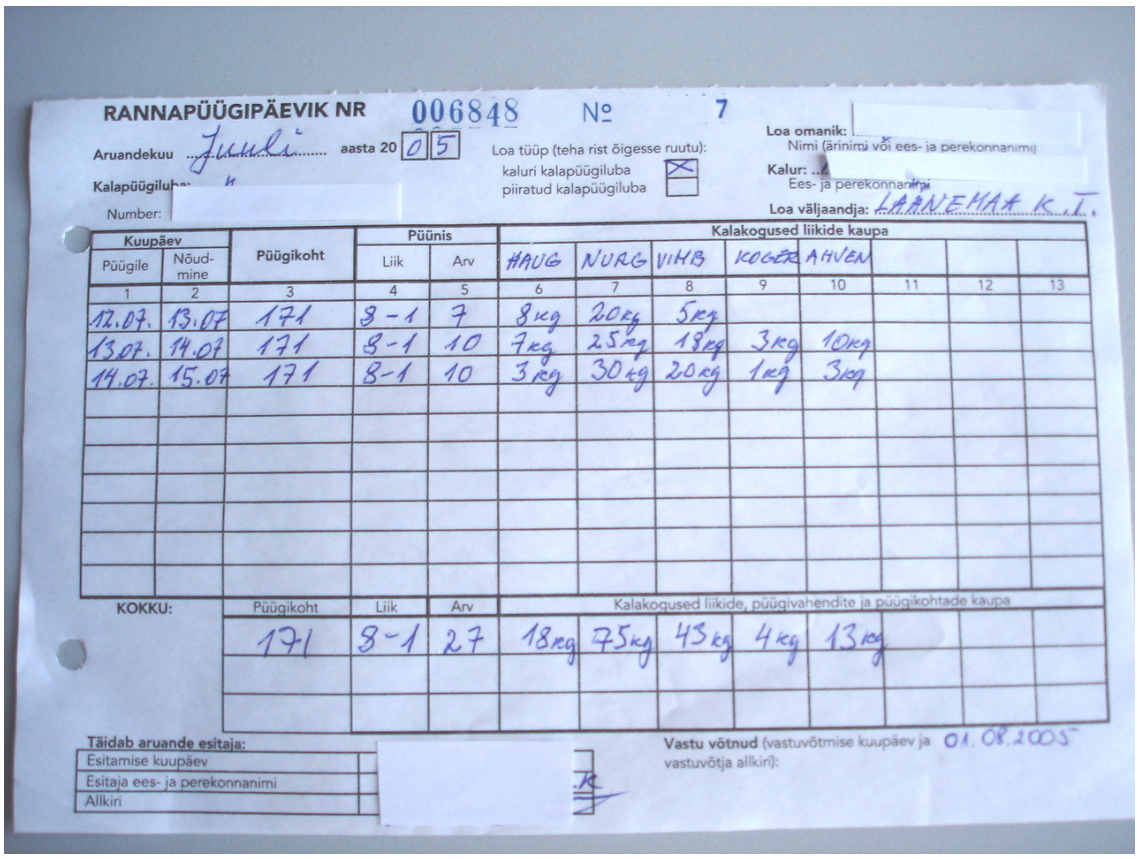
According to the Estonian domestic Fisheries Act adopted 27 September 1995 the Estonian Environmental Inspectorate (EEI; belongs into the structure of the Ministry of Environment) has the comprehensive responsibility for the Estonian fisheries control and EEI is responsible for the administrative control and control in ports. EEI is also responsible for the control of fisheries at sea. To achieve the best results EEI operates in full cooperation with the Estonian Coast Guard, the Estonian Agricultural Ministry and all other relevant authorities.

In 2005 new Fisheries Information System was launched. From 2006 onwards all fishing data is in the electronic form and easily accessible. Older data is stored on paper and only aggregated data is in the electronic form.

All fishing vessels in length more than 15 m flying Estonian flag and fishing vessels flying the flag of some other Member States (e.g. Latvian) in Estonian EEZ are monitored by the Fisheries Monitoring Centre (FMC). As the FMC responsible for receiving reports and recording of information relating to fishing activity is not operational 24/7, the EEI has organized a 24-hour contact point for prior notifications. That contact point can be reached via telephone, fax and e-mail. According to the Environmental Minister 17 December 2002 Regulation No 76, fishing vessels are obliged to transmit a prior notification of entry into port and total catches retained on board at least 2 hours in advance of arrival. However, since this fishery uses trawls and is not creating bycatch, the system will not be analysed in detail.

Coastal fishery is monitored on the base of fishermen's diaries (Fig. 1). Fishermen must register every single fishing event, i.e. note on each fishing case the date, the number of different gears used and catches taken by fishing areas system (Fig. 2). This information must be sent to the administration on the monthly basis, where it will be entered into electronic form, is stored and ready for analysis. Administration, control and scientific organisations may enter this system on the base of passwords and create electronic reports by fishing areas, months, targeted species, fishing gears etc. So, it is relatively easy to get information on total effort in coastal fisheries. Electronic system was launched

Coastal fishermen are obliged to register also bycaught birds and mammals. However, anonymous interviews conducted by the specialists of the Estonian Marine Institute reveal that most fishermen hide the bycatch data and don't register it in their diaries. The main reason is the fear that bycatch events may decrease their fishing possibilities in future. So, unfortunately Estonian Fisheries Information System is not reliable source of bycatch data.



RANNAPÜÜGIPÄEVIK NR 006848 № 7

Aruandekuu ...Juuli... aasta 20 05

Loa tüüp (teha rist õigesse ruutu): kaluri kalapüügiluba [X] piiratud kalapüügiluba

Loa omanik: Nimi (ärinimi või ees- ja perekonnanimi)

Kalur: ... Ees- ja perekonnanimi

Kalapüügiluba: Number:

Loa väljaandja: LÄÄNEMAA K.T.

Kuupäev: Püügile	Kuupäev: Nõudmine	Püügikoht	Püünis: Liik	Püünis: Arv	Kalakogused liikide kaupa: HAUG	NURG	VIHB	KOGER	AHVEN			
1	2	3	4	5	6	7	8	9	10	11	12	13
12.07.	13.07	171	8-1	7	8kg	20kg	5kg					
13.07.	14.07	171	8-1	10	7kg	25kg	18kg	3kg	10kg			
14.07.	15.07	171	8-1	10	3kg	30kg	20kg	1kg	3kg			

KOKKU:	Püügikoht	Liik	Arv	Kalakogused liikide, püügivahendite ja püügikohtade kaupa							
	171	8-1	27	18kg	75kg	45kg	4kg	13kg			

Täidab aruande esitaja:

Esitamise kuupäev

Esitaja ees- ja perekonnanimi

Allkiri

Vastu võtnud (vastuvõtmise kuupäev ja vastuvõtja allkiri): 01.08.2005

Figure 1. Fishermen's diary.

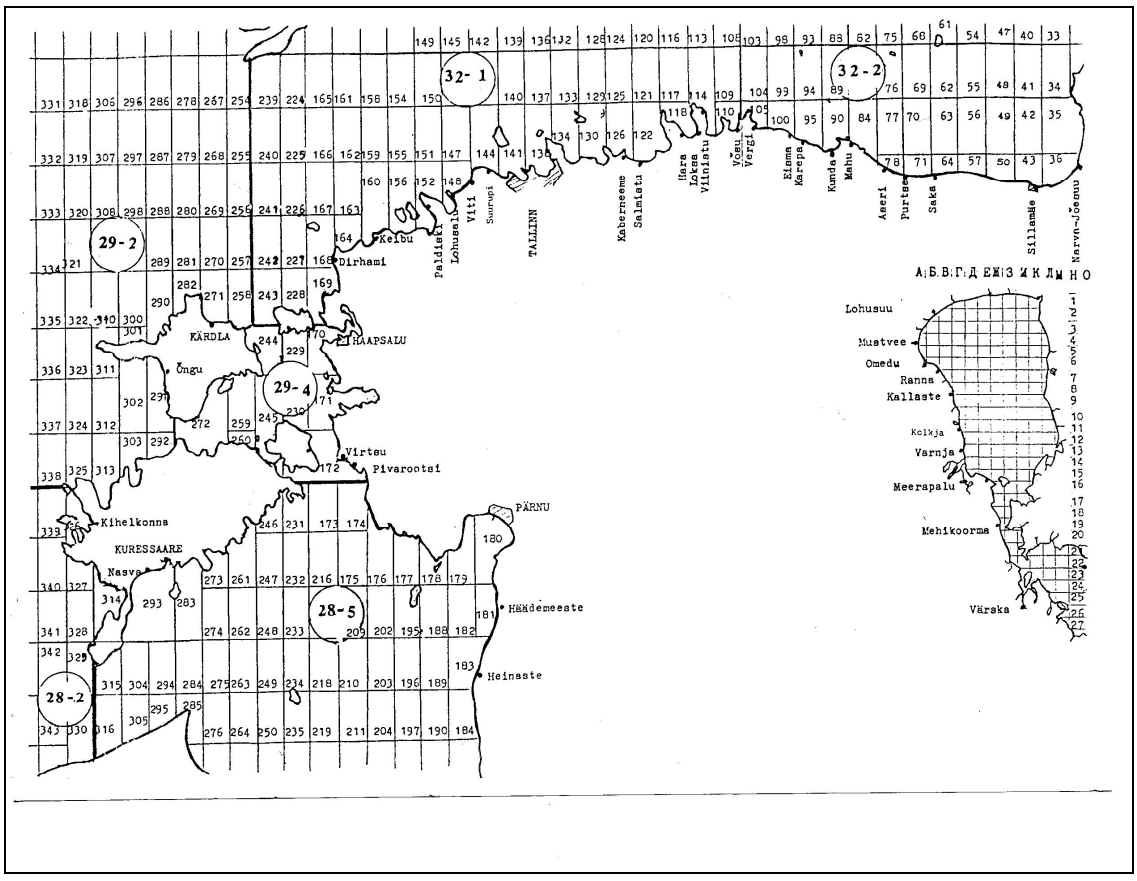


Figure 2. Map of the fishing areas for coastal fishery.

TACs, quotas, allocations and technical measures

The history of the Estonian fish resource allocation system is rather interesting. During the Soviet period, all water-bodies belonged to the state and all commercial fishing activities were carried out by collective farms. Hence, the Estonian fishery was simply a sector of the soviet economy that functioned under the typical framework of those days, governed by the so-called "soviet plan management" and characterised by cheap fuel, government salaries, subsidies, etc. As there was no private ownership, fishermen were ordinary employees receiving a salary for their job from the state (fishing collective farms were in fact just a part of the economic framework of the state), and they did not have any rights to the fish resources themselves.

The re-establishment of independence in Estonia in 1991 was followed by a rapid transition to a market economy. In the first years the Estonian fisheries sector was somewhat "chaotic" and based on many and sometimes contradictory regulations. However, the new Fishing Act (1995) set a new and firm structural framework. The fishing pressure in the coastal fisheries was already high and the new Act was designed to manage it successfully.

In the trawling fisheries segment the situation was different. In 1995–1996 fishing possibilities were greater than the catch and the new Fishing Act didn't provide any efficient mechanism to solve possible conflicts. Until 1997 all fishing vessels received licenses for all they could fish, i.e. fishing was in principle not regulated. In theory, the system was designed so that the administration registered all catches and closed the trawling for the remainder of the year when the national quota was exhausted. As it has been shown in the theoretical literature such "olympic fishing" leads to an increase of fishing capacity, over exploitation and overcapitalisation.

Until 2001 the Estonian fishing was based on the Fishing Act adopted by the Parliament in 1995. As at that time the fishing possibilities were higher than catches, this legislation didn't formulate the mechanism to solve possible conflicts in an efficient manner. In order to solve conflicts, an amendment of the Fishing Act was adopted in January 2000 stating that if the fish stocks do not permit the use of all available catch capacity, fishing gear or fishing days in professional fishing, then the fishing rights (fishing possibilities) shall be decreased for all applicants depending on the applicant's actual catch during the previous calendar year, the amount of fishing gear or the number of fishing days actually used. So, with that amendment, fishing rights based on the historical track record were established in Estonia. This so-called historical fishing right was used in all Estonian fisheries (Atlantic, Baltic open-water and coastal, and inland) in 2000. Its main idea was to "freeze" the *status quo* in fishing. However, such a system preventing all changes in allocation of fishing rights between different enterprises was heavily criticised by many stakeholders including fishermen themselves. At first, the opponents pointed out that since the fish stocks are public property, there should be a mechanism by which all interested enterprises could enter the fishing industry (like any other sector of national economy) and that the freezing of a rather accidental proportion of catches taken, or gears used in 1999, for an indefinite time would not be fair. Additionally, it was also argued that such a system would exclude all elements of economic competition and would act against the need to increase efficiency. Then the idea of auctioning fishing possibilities arose.

The new legislation set the basis of the very unique fishing rights auctioning system, which has not been used in rest of the world. In order to deal with excessive fishing capacity, a part (10%) of the fishing rights, both volume quotas and gear use rights, in all Estonian fisheries was, in 2001–2004, allocated each year through auctions, while the remainder (90%) was allocated on the basis of recent fishing rights use history. So, all fishing rights depreciated from year to year in a geometric fashion, by 10% yearly.

The auction system was unpopular among fishermen, because it increased their costs. Also, a drastic increase of gear fees during the auctions indicated that fishing must be profitable. So, fishermen were very afraid that the high price increase in the auctions would finally provide the

argument to increase the official fishing fees. Secondly, the auctions brought more people into the fishery. Fishermen argued that this would lower their profitability even more. In 2002, when the debates on abolishing the auction system were raging, Estonia was scheduled to join the European Union. In the EU member states, the fishing sector was "subsidised" through structural funds. In Estonia this was not the case; before accession to EU in 2005 there was no financial support to fishermen. Fishermen complained that while most EU countries support their fishermen, Estonia on the contrary auctioned the rights, taking all profits out of the fishing sector, seriously hindering new investments, modernisation, etc. All these arguments were put forward as well before the creation of the auction system, but without success.

What finally brought the auction system down was political expediency. The auction system was put in place after the 1999 Parliament elections. However, before the next elections (2003), the two main fishermen's organisations made a strong campaign to change the fisheries law and abolish the auction system. As a result, the Parliament abolished the auction system unanimously shortly before the 2003 elections.

Today, all fishing rights in Estonia are based on historic usage principle and are fully transferable. Main management measures in Estonia are volume quotas (ITQs) in the open water fisheries (both Baltic and Atlantic trawling) and gear usage quotas in the Baltic coastal and inland fisheries.

FISHERY OVERVIEW: LATVIA

Administration, governance of Latvian fisheries

Ministry of Agriculture is the responsible institution for all fisheries issues. Until 2008 In the Ministry of Agriculture the Fisheries Board was the responsible organisation for fisheries management. In 2008 it was reorganised and Department of Fisheries under the Ministry of Agriculture was formed.

Main fisheries and fishing fleets

Latvian fishing fleet has four main segments: offshore fishery in Atlantic Ocean, offshore fishery in the Baltic Sea and Gulf of Riga, coastal fishery in the Baltic Sea and Gulf of Riga, fishery in the inland waters.
When Latvia joined EU on May 1, 2004 the total size and capacity of Latvian fishing fleet was 898 fishing vessels (including small coastal vessels), gross tonnage (GT) – 44,452 t, total engine power – 75,836 kW. Since 2005 Latvian fishing enterprises started to actively take part in fishery adjustment programme financed by EU and the fleet capacity was reduced by 5,872 GT (9,626 kW). In 2008 total number of vessels has decreased to 875, capacity – 33,406 GT and 56,509 kW.

Offshore fishery in the Atlantic Ocean

Fishing in Atlantic Ocean is carried out by Latvian pelagic or bottom trawlers and takes place mainly in Regulatory areas of NAFO and NEAFC. Some landings come also from EEZ of Mauritania. There are fishing possibilities available also in the waters of Morocco. Only trawlers with length greater than 40m operate in this fishing segment. The size of this fleet has decreased from 11 vessels in 1996 to 8 vessels in 2008 with the total capacity: 19987 GT, 20707 kW. Main target species are Atlantic horse mackerel, Round sardinella, Atlantic mackerel, shrimp and Red fish. Total landing in 2007 was 63349t.
This fishery segment does not cause any bird or sea mammal bycatch.

<u>Offshore fishery in the Baltic Sea and Riga Gulf</u>

Because it is necessary to have a special licence for fishing in the offshore areas of Riga Gulf this fishery segment is made of 2 separate fleets and most of the ships operate either in open Baltic Sea or Riga Gulf. By the May 1, 2004 there were 221 vessels in this segment with total capacity of 17007.6 GT and 41898 kW engine power. The problem was that most of the ships were already physically old (built during 1970s) and old-fashioned and much less cost-effective than modern vessels from other Baltic Sea countries like Sweden, Germany etc. Around 2000 several small seiners (6-12m in length) were bought from Sweden and Finland and started to operate both in coastal and offshore waters targeting mainly cod. Rising operation costs, excessive fragmentation of individual fishing quotas and relatively low income from fishing led to significant decrease of the fleet. Until 2008 more than 70 vessels were scrapped within the framework of EU fishery adjustment programme. The current size and capacity of the fleet by length groups is shown in Table 3. The declining trend of the offshore fishing fleet is obvious and the number of vessels will continue to decrease during coming years.
Biggest part of the fleet is trawlers that use both – pelagic and bottom trawls. Remaining vessels are gillnetters that presently use only bottom set gillnets, but in 1990s and early 2000s occasionally also used driftnets to catch salmon until this type of gear was fully banned in the Baltic Sea starting with 2008. The main target species of the fishery segment by means of landing size and revenue are sprat (in open Baltic) and herring (in Gulf of Riga). Other less important target species are cod and flounder.

Trawlers do not cause any bycatch of birds or mammals. However the gillnetters, especially the smaller ones that usually operate closer to the shore occasionally can have rather big number of birds in the nets. Bycatch of sea mammals is rare.

Table 3. Number and capacity of offshore fishing fleet operating in open Baltic Sea and Riga Gulf in 2008

Vessel length (m)	Type	Number of vessels	GT	kW
0–12	Gillnetters	12	69.9	431.87
	Trawlers	5	20.46	178.7
12–24	Gillnetters	2	151	404
	Trawlers	33	1,203	5,281
>24	Gillnetters	29	2,411	4,847
	Trawlers	67	8,411	18,020.5
Total		148	12,266.36	29,163.07

Coastal fishery in the Baltic Sea and Gulf of Riga

This is the biggest segment of Latvian fishing fleet in terms of number of vessels and fishermen involved. In 2006 there were 755 boats in the fleet. Since then the number has slightly decreased and was 737 in 2008 (528 in the Riga Gulf, 209 in Baltic Sea).

Around half of them are rowing boats without engines. The rest has engines with average power of 20 kW.

The development and starting point for the coastal fishery was not equal if we compare Riga Gulf and Baltic Sea coast. In first case there already was strong fishing traditions and several big collective coastal fishery farms during Soviet period. After the reestablishment of Latvian independence in 1991, most of the property of those collective farms including boats, large fishing gears like fykenets and herring trapnets and also netting material, was cheaply privatised by former employees. On the other hand the Baltic Sea coast was mostly a closed military area because of the border of Soviet Union and the presence at the sea by non-military people was greatly limited. So in 1991 when all the restrictions disappeared, mostly all fishing equipment had to be bought somewhere and it did cost much more.

Official statistics based on fishing logbook information show, that the total number of coastal fishermen is high and has continuously increased in the last 5 years (Fig. 3) and since the development of the sector. It can be explained by 2 main factors: first – more people have got summer houses by the sea and thus gained access to fishing licenses, second – the fishing control have become significantly better and forced number of people living by the sea to start fishing legally (obtain licenses and thus enter into official statistics). This is more relevant regarding more economically active coast of Riga Gulf where the number of fishermen has increased. On Baltic Sea coast the number of fishermen during the last 5 years has been stable and has even a little bit decreased (Fig. 3).

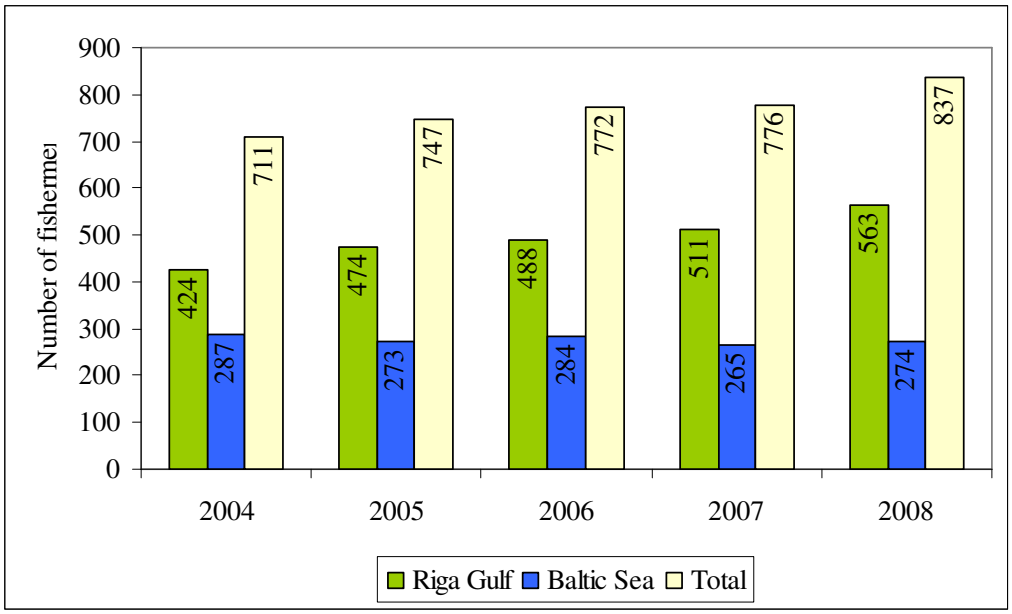


Figure 3. Number of fishermen in Latvian coastal fishery.

Deeper analyses show, that the coastal fishery segment is strongly dominated by recreational or amateur fishery – persons that rarely go in the sea (Fig. 4). Professional fishermen usually have 70–100 or even more fishing days depending on wind conditions in particular years. Recreational fishermen have only 20–40 fishing days in a year. We can see that the number of professional fishermen has decreased in the last 5 years in Baltic Sea as well as in the Riga Gulf. The main reason for that is decreasing profitability of fishing due to higher fuel prices, worsening of situation in local and external fish markets and rather poor condition of some most valuable target fish species. Significant increase of Grey seal population in Baltic has significantly reduced fishing effort during several periods in a year as well. Currently only few persons have fishery as their only source of income. We think that the tendency of professional fishery to slowly disappear will continue in coming years.

Fishing in coastal waters is done mainly by passive gears like gillnets, fykenets, herring trapnets and longlines. The only active fishing methods in Latvian coastal fishery are seines that are used for catching flounder in Irbe strait and in some coastal villages in Baltic Sea near Lithuanian border. The main target species are herring, flounder, cod and several freshwater species like perch, bream and vimba that also occur in coastal waters.

Fishing with herring trapnets and fykenets in Riga Gulf strongly dominate by means of landing sizes and revenues, however recent developments in the fishery - decrease of numbers of professional fishermen – gradually diminish the role of big passive gears in Latvian coastal fishery. In the Baltic Sea gillnet fishery dominate because of prevailing of unstable weather. In such conditions big passive gears can easily become damaged or lost in the sea but gillnets can be set in and taken out much more quickly.

Bycatch of birds is common in gillnet fishery but its amount can be very different between seasons, coastal regions and water depths. Occasions of bycatch of mammals (only seals) in gillnets are rare. Fishing with fykenets on the other hand can lead to death of seals and is harmless to birds. Bycatch of birds or mammals have never been observed in seining or using longlines.

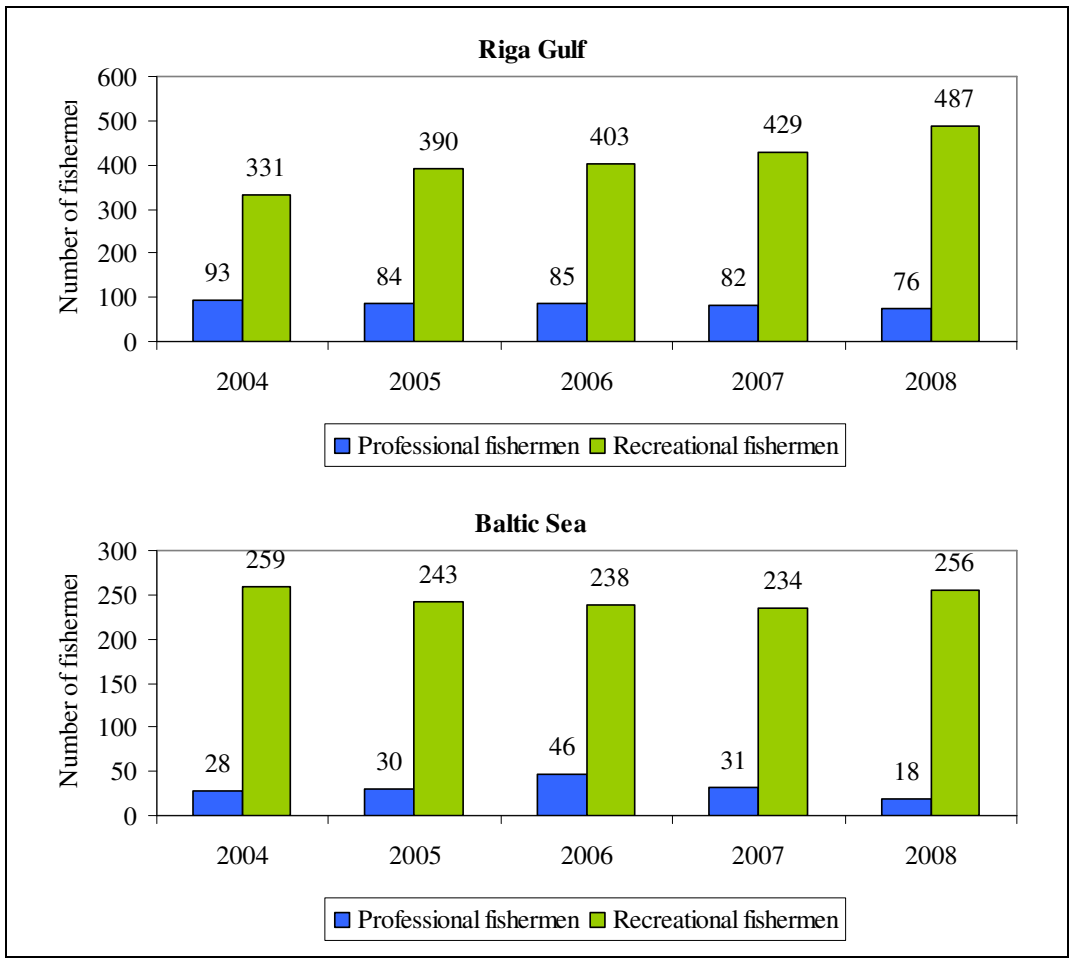


Figure 4. Number of professional (>60 fishing days per year) and recreational fishermen (<60 fishing days per year) in coastal fishery if Riga Gulf and Baltic Sea.

Quotas and technical measures

There are two types of fisheries regulation in Latvia. Fishing of herring, sprat, cod and salmon is regulated by TACs (Total Allowable Catch) and quotas. In offshore fishery and coastal cod fishery quotas are divided to each fishing enterprise. For herring – a fixed percentage from the state quota is reserved for coastal fishery in Riga Gulf and Baltic Sea.
Coastal fishery is regulated by maximum number of fishing gears that is divided by coastal municipalities. Stock sizes for coastal fish populations are not being calculated and the appropriate fishing effort is estimated based on size distribution within population and long-term changes of CPUE values.

Fishing restrictions

Fishery in the Baltic Sea and Gulf of Riga is regulated by both – EU and national legal acts. The main legislation that regulates fishing in the sea is EU Regulation No.2187/2005 Council Regulation for the conservation of fishery resources through technical measures in the Baltic Sea, the Belts and the Sound, amending Regulation (EC) No.1434/98 and repealing Regulation (EC) No.99/98. In addition to that a Regulation that determines fishing quotas of Member states for the coming year is being adopted at the end of each year. These regulations are relevant mostly for the fishing in EEZ waters of all Member states around Baltic Sea. Fishing in the coastal waters in Latvia is regulated by two main legal acts – Fishery Law and Regulation of Cabinet of Ministers No.296 adopted on May 2, 2007 “Regulations regarding Commercial Fishing in Territorial Waters and Economic Zone Waters”. According to them main fishing restrictions are following:

In the Baltic Sea coastal waters

- Summer ban for specialised cod fishery from July 1 till August 31, in addition to that a number of "out of harbour" days for cod fishery is determined for each coming year (for example 160 days in 2008);
- Prohibited specialised flounder fishery from February 15 till May 15;
- Prohibited trawling in depths less than 20m;
- Prohibited turbot fishery from June 1 till July 31;
- Prohibited specialised fishery of eelpout with trawls all year, with fykenets – from October 1 till April 30;
- Prohibited fishing in 200m radius around inlets of rivers or channels and in 1000m radius around inlet of Venta river;
- Prohibition of all fishery in coastal waters except specialised flounder fishery with seines, gillnets and longlines and specialised herring fishery with gillnets;
- Prohibited specialised salmon and sea trout fishery with driftnets and drifting longlines;
- Minimal landing sizes and maximal allowed bycatch is set for several fish species, these may vary depending on season.

In Riga Gulf coastal waters

- Prohibited fishing with trawls in depths less than 20m;
- Prohibited specialised fishery of eelpout with trawls all year, with fykenets – from October 1 till April 30;
- Prohibited fishing in 200m radius around inlets of rivers or channels and in 1000m radius around inlets of rivers Daugava, Lielupe, Gauja and Salaca;
- Prohibited fishery with gillnets from January 1 till April 30 and from October 1 till November 30 in 3000m radius around inlets of rivers Gauja, Lielupe, Salaca and in 500m radius around inlets of rivers Aģe, Pēterupe, Roja, Svētupe, Vitrupe;
- Prohibited all fishery from April 16 till May 15 except specialised herring fishery with trapnets and specialised eelpout fishery with eelpout fykenets;
- Prohibited gillnet and fykenet fishery from October 1 till November 15;
- Prohibited specialised flounder fishery with seines in depths less than 5m;
- Prohibited specialised salmon and sea trout fishery with driftnets and drifting longlines.

There is an initiative to make changes in the fishing regulations in the coastal waters starting with 2010 to allow fishing with fykenets all year, but prohibit landing of some fish species during certain periods.

FISHERY OVERVIEW: LITUANIA

Administration and governance of the sector: Organization

According to the Fishery law of the Republic of Lithuania (27 June 2000, No. VIII-1756), fishery sector's state regulation is implementing by:

- Ministry of Agriculture – participates in Lithuanian fishery policy formation and implements it, executes fishery sector's state control, realizes European Union common fishery policy, organizes and implements fish resources exploitation and control in marine waters; implements commercial fishery regulation and issues licences for fishery in marine waters; disposes, administrates and uses marine fishery statistics data system (landings, users, economical and biological data etc.).
- Ministry of Environment – participates in formation of fish resources conservation and control policy, implements it, prosecutes inland waters fishery sector's state management; develops commercial and recreational fishery regulations and issues licences (except private aquaculture ponds); disposes, administrates and uses inland waters fishery statistics data system (landings, users, economical and biological data etc.).

The Ministry of Agriculture and the Ministry of Environment organizes fish stock recovery and fishery research within their competence.

Main fisheries and fishing fleets

Lithuanian fishing fleet has four main segments: offshore fishery in the Atlantic and Pacific Oceans, offshore fishery in the Baltic Sea, coastal fishery in the Baltic Sea and fishery in the inland waters.

When Lithuania joined the EU on 1 May 2004 the total size and capacity of Lithuanian fishing fleet was 309 fishing vessels (including small coastal vessels), gross tonnage (GT) – 76,738 t, total engine power – 80,718 kW. The most GT and engine power of Lithuanian fleet (23 vessels) was employed in the Atlantic Ocean, 90.6% and 78.8% accordingly. 67 and 219 boats were fishing at the offshore Baltic Sea and coastal waters respectively.

Since 2005 Lithuanian fishing companies started actively to take part in fishery adjustment programme financed by the EU and the fleet capacity was reduced by 13,236 GT and 14,189 kW. Total number of vessels has decreased to 229, capacity – to 63,502 GT and to 66,529 kW in 2008.

Offshore fishery in the Atlantic and Pacific Oceans

Fishing in Atlantic and Pacific Oceans is carried out by Lithuanian pelagic or bottom trawlers and takes place mainly in Regulatory areas of NAFO and NEAFC, Svalbard zone (Norway EEZ), Mauritania and Morocco EEZs, South pacific (outside national EEZs). The size of the fleet has decreased from 18 vessels in 2001 to 13 vessels in 2008. In 2005 the ocean fleet caught 87.9% of total fish catch (142,000 tones) by Lithuanian fishery fleet. Five main target species in 2006 were Jack and Horse mackerels (56,259 t), Anchovy (25,791 t), Round sardinella (24,846 t), Sprat (10,814 t), Pilchard (8,711 t)

Offshore fishery in the Baltic Sea

The territorial waters and maritime exclusive economic zone comprise 7,000 km², which is about 2% of the Baltic Sea. Fishery in the offshore areas of the Baltic Sea is separated from the coastal fishery (coastal fishery operates at depths up to 20 m). Such vessels as fishing trawlers, medium-sized Black Sea seiners, fishing boats and trawler boats operating in the offshore areas; they are 22–30 m length and tonnage of 40–200 GT. At the offshore areas 66 vessels were operating in 2001, 64 in 2002, 67 in 2003, however since 2004 the number started to decrease – 57 in 2004, 38 in 2005. 34 vessels were operating in 2008. During 2004–2008 Lithuanian fisheries fleet in the offshore Baltic Sea was reduced by 40% of fishing capacity. Cod, herring, Baltic sprat and

salmon fishery is quoted. The main target species of the fishery are sprat, herring, cod and flounder. Trawlers do not cause any bycatch of birds or mammals. Possible bycatch caused by gillnetters, especially the smaller ones that usually operate closer to the shore is not estimated, however should be not essential. Moreover, only 3 vessels fishing as gillnetters in the offshore areas were registered in 2007.

Coastal fishery in the Baltic Sea

Lithuania has a very short coastline (less than 100 km), on its western border. Coastal zone is defined as a zone from the shoreline to 20 m depth isobath. The area of the coastal zone is about 430 km². Klaipeda channel connects Baltic Sea with the Curonian Lagoon, which is the largest water body for the inland fishery (413 km²). The fisheries sector, in the coastal waters became important (since 1992) after the restoration of Lithuania's independence. During the Soviet occupation, three collective farms were operating in the Baltic Sea. Two farms were smaller (in Šventoji and Nida) and more often were fishing in the coastal waters, while the largest (in Klaipėda) was operating at the offshore mostly. Nowadays coastal fishery is the largest segment of Lithuanian fishing fleet in terms of number of vessels and companies involved. 98 companies were operating in the coastal waters full- or part-time in 2008, compared to 101 in 2007. 201 small boats were registered in 2006 (446 GT), 213 in 2008 and 174 in 2009. Most of these boats are small, some are rowing boats, occasionally equipped with external engine: in 2009, 134 boats were <8 m in length and 40 boats – 8–15 m in length. According to the Operational Programme for the Lithuanian Fisheries Sector for the period 2007–2013, the number of boats should be reduced using compensation system for fishermen to leave the coastal fishery sector. The aim is to reduce the fleet by about 50% (from 450 GT). About 300 people are involved into activities related to coastal fishery business (fishing, fish processing, trade).

Landings of the coastal fishery (313 t) comprised only 1.2% of the total catch of the Lithuanian fishery in the Baltic Sea in 2007. Main target species in the coastal fishery in 2007 were: cod (138 t, 44%), smelt (55 t, 18%), herring (44 t, 14%) and river flounder (22 t, 7%) (Fig. 5).

Features of the Lithuanian coastal fishery are the following: numerous small companies and little automated operation. Essence of the incomes related to the fishery activities is various: for some fishermen it is the main income, however, most often it is part time activity. Most fishermen have additional jobs and incomes (especially during summer), since coastal fishery is seasonal due to fish presence close to the coast, weather conditions (autumn – winter). Even seasonal presence of seals (winter – spring) in the fishing area effects fishing activities.

Most often used gear in the coastal fishery is gillnets. More than 95% of all caught fish is obtained using gillnets. Such alternative gears as trapnets and longlines are becoming more popular, however, the share of fish caught using these gears in the total catch of the coastal fishery is still insignificant.

Bycatch of birds is common in gillnet fishery but numbers are very different between seasons, net mesh sizes and water depths. Cases of mammals (seals) bycatch in gillnets are very rare but according to unofficial information takes place occasionally. Development of alternative fishery using such gears as fykenets can lead to death of seals despite the gear is harmless to birds. Bycatch of birds or mammals have never been observed using longlines; however hooks might cause some damage for seals. Coastal fishermen are not obliged to register bycatch of birds and mammals; however, this is proposed and is under discussion currently.

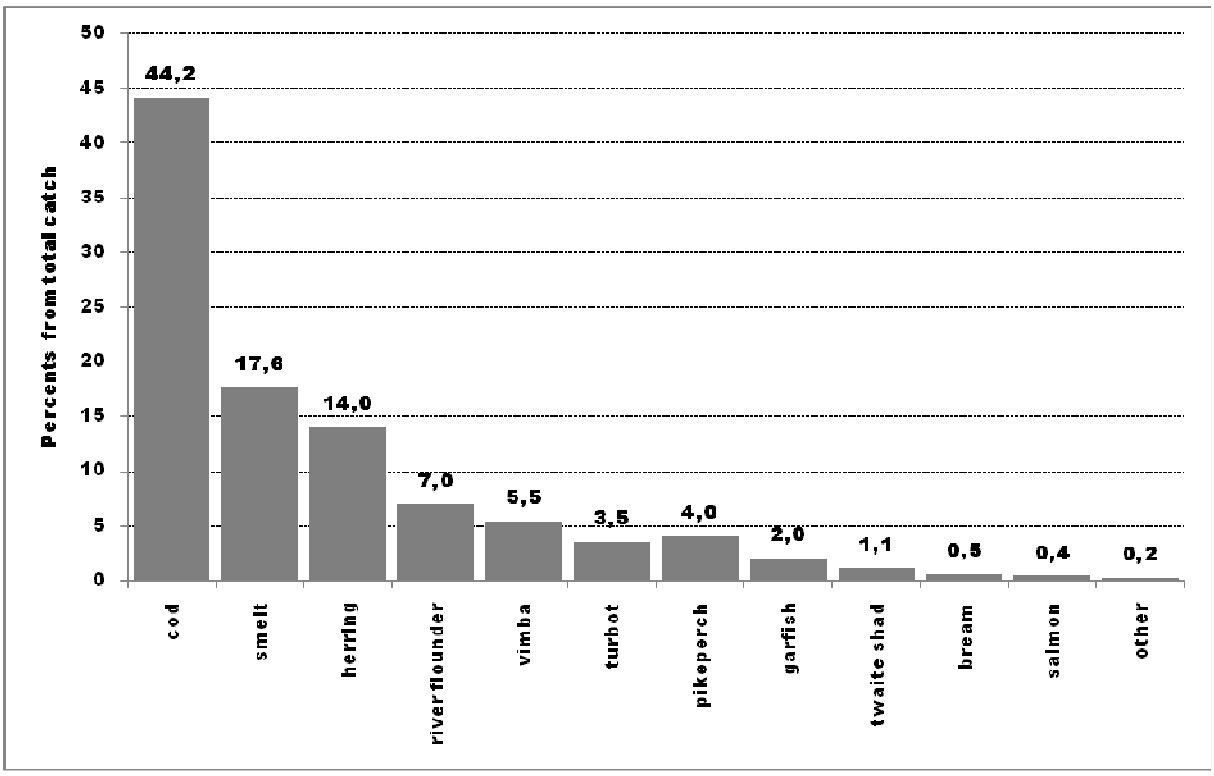


Figure 5.Landings by species in percents from the total catch (313 t) in Lithuanian coastal fishery in 2008.

Quotas, control and regulation of the coastal fishery

Fishery in the coastal waters is divided into 29 fishery sectors (Fig. 6). Companies operating in the coastal waters must obtain fishery licence from the Fisheries Department under the Ministry of Agriculture. Coastal fishery is monitored on the basis of fishermen's logbooks (Fig. 7). Fishermen must register every single fishing event, i.e. note on each fishing case the date, the number of different gears used and catches taken by fishing sector. This information must be sent to the administration on the monthly basis, where it is entered into electronic form is stored at the Fisheries Department. Inspectors of the Fisheries Department enforce the fishery control in the coastal waters.

Coastal fishery in Lithuania is regulated in the following way: herring, sprat, cod and salmon fishery is regulated by TACs (Total Allowable Catch) and quotas. In addition, there are limits for gears per boat: boats of ≤12 m length are allowed to use up to 4,000 m of nets, boats of >12 m length – up to 6,000 m.

In addition there are special regulations for fishing gears, closed seasons, fishing areas and targeted species. Fishery in the Baltic Sea is regulated by both EU and national legal acts. The main legislation that regulates fishery at sea is the EU Regulation No.2187/2005 Council Regulation for the conservation of fishery resources through technical measures in the Baltic Sea, the Belts and the Sound, amending Regulation (EC) No.1434/98 and repealing Regulation (EC) No.99/98. In addition to that, a regulation that determines fishing quotas of Member States for the coming year is adopted at the end of each year. These regulations are relevant mostly for the fishing in EEZ waters of all Member States around the Baltic Sea. Fishing in the Lithuanian coastal waters is regulated mainly by the order No. 3D-20 „On determination of a specific requirements for commercial fishery in the territorial waters of the Republic of Lithuania in the Baltic sea and small scale fishery in the coastal waters" (2 January 2005) issued by the Ministry of Agriculture and the latest version updated by the Ministers of Agriculture order No. 3D-83 (10 February 2009). According to this order, the main fishing restrictions are as follows:

It is not allowed to use the following fishing gears:

- trawls;
- all mesh size trammel nets;
- 25–69 mm mesh size drifting gillnets;
- 24–44 mm mesh size gillnets.

Seasonal restrictions for using gears are as follows:

- 18–24 mm mesh size gillnets from the 1 June till 15 November;
- 45–49 mesh size gillnets from 1 January till 15 July and from 1 November till 31 December. One fishermen's squad (subdivision of fishing company, using one logbook) can use not more than 150 m of 45–49 mm mesh size gillnets;
- 50–59 mm mesh size gillnets from 1 May till 1 July and from 1 November till 31 December. 55 mm mesh size gillnets are allowed for fishing cod at depth more than 15 m during the allowable period;
- 80–109 mm mesh gillnets from 1 May till 31 July;
- 110 mm mesh gillnets from 1 June till 31 July.

Restrictions for fishing method, gear quantity and vessels are as follows:

- it is not allowed to set gillnets chequerwise;
- length of connected gillnets can not exceed 300 m, distance between connected gillnets in a line must be at least 300 m, distance between the lines – at least 200 m;
- the total number of smelt fishing fishermen squads can not exceed 102. One squad cannot use more than 1,500 m length of 18–20 mm mesh size gillnets from 1 January till 31 March and from 15 November till 31 December;
- it is not allowed to fish with the boats which length exceeds 12 m, except those which were used before 31 December 1999.

Seasonal restrictions for fishery are as follows:

from 15 August until 31 October it is not allowed to fish salmon and sea trout in the zone of 3 km from the gates of the Klaipėda port. During this period it is not allowed to use surface nets of any mesh size.

from 15 August until 31 October it is not allowed to fish in the zone of 0.5 km from the mouth of the Šventoji River.

In cases of targeted fishery, mesh sizes of gillnets must be not smaller than following:

Sprat ..... 12 mm
Bream, pikeperch, flounder ..... 70 mm
Roach, perch ..... 45 mm
Turbot ..... 110 mm
Whitefish ..... 50 mm
Smelt ..... 18 mm
Herring ..... 20 mm
Sea trout ..... 80 mm
Vimba ..... 45 mm.

In cases of targeted fishery mesh sizes of seines must be not smaller than following:

Fish species	Mesh size (mm)		
	Trap	Connecting part	Leaders
Salmon, sea trout	40	50	60
Bream, pikeperch, vimba	30	36	40
Herring, smelt	12	16	20
Sprat	10	14	18
Eel	20	24	30

Minimum commercial size limit is following (L):
Perch, roach ..... 18 cm
Bream ..... 35 cm
Smelt..... 16 cm
Whitefish ..... 36 cm
Pikeperch ..... 46 cm
Eel 45 cm
Vimba ..... 28 cm

Bycatch of fish bellow the size limit:
eel, 35–44 cm, ≤10% of caught eel (by numbers). <35 cm must be released;
other fish species:

- ≤10% of caught fish (by numbers) in gillnet and longlining fishery;
- ≤8% of caught fish (by numbers) in trawling and seining fishery;
- ≤5% of caught fish (by numbers) in trapnet fishery;

bycatch of turbot bellow the size limit is not allowed (commercial size is 30 cm according to the EC regulation).

It is not allowed to:
use more than 4,000 m of gillnets for boats ≤12 m;
use more than 6,000 m of gillnets for boats >12 m.
fish using trawls in the area between 20°50′E longitude in the west, 56°00′N latitude in the north, 55°40′N latitude in the south and the coastline from 1 June to 1 October if the mesh size of the codend of the trawl is:

- <130 mm – if the net is made from <6 mm monofilament or double thread (<4 mm);
- <105 mm – if a „BACOMA“ window (mesh size >110 mm) is installed at the codend.

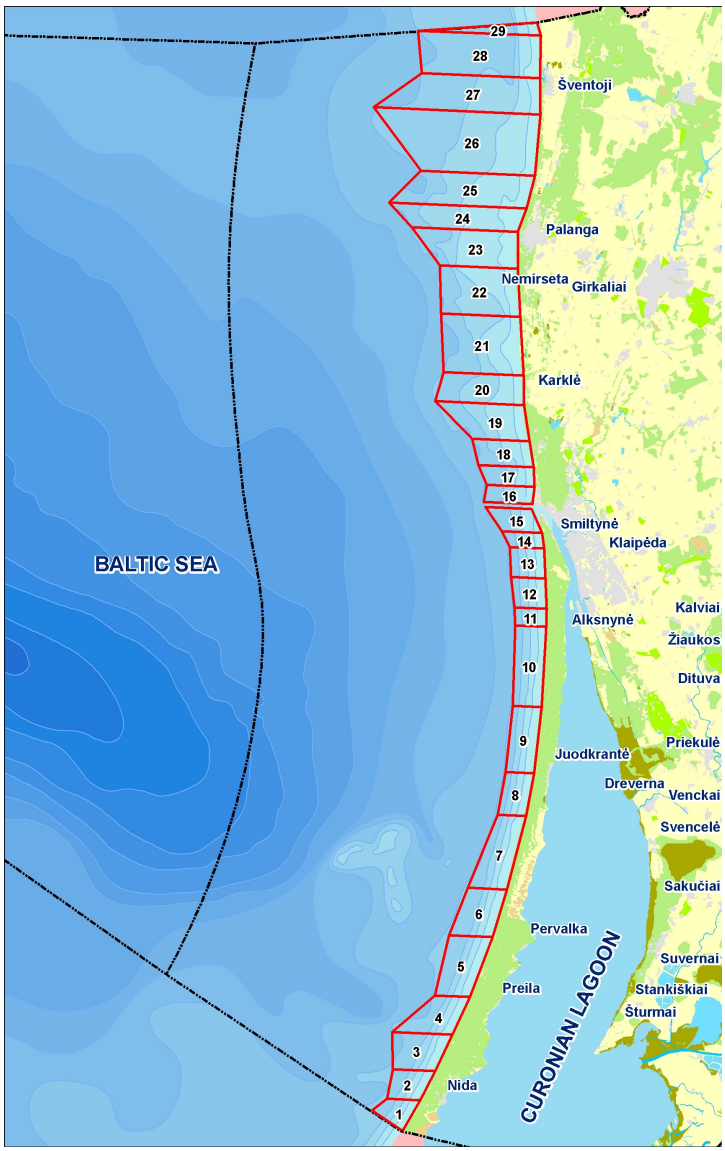
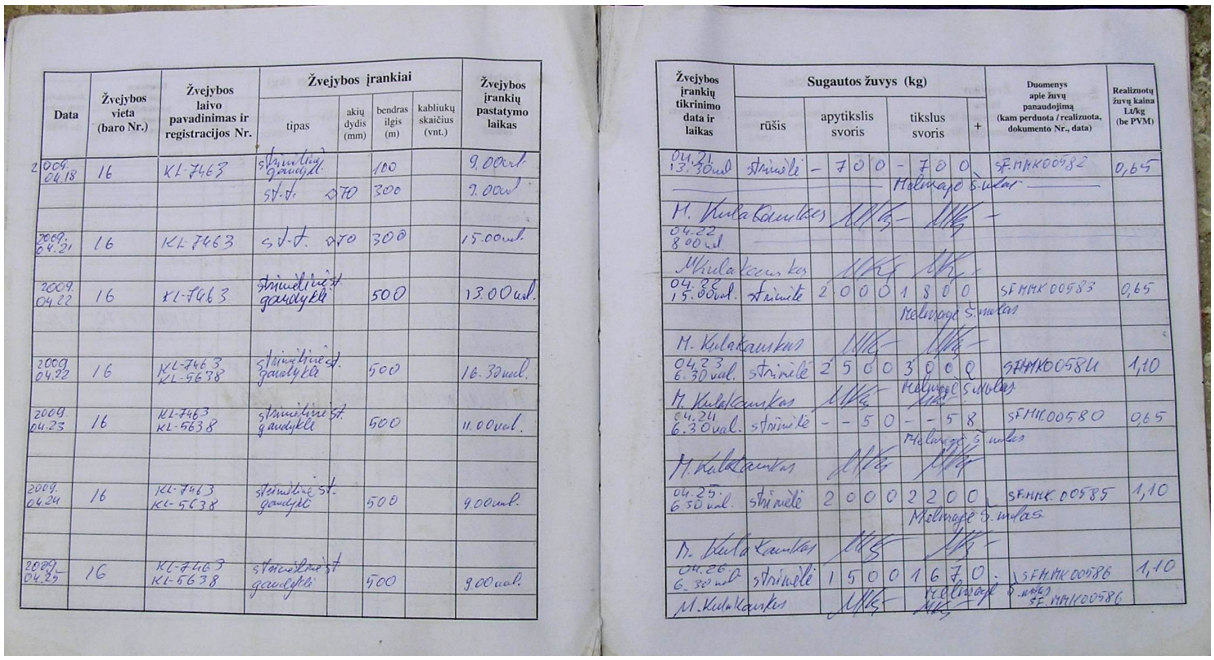


Figure 6. Fishery sectors at the coastal waters of the Baltic Sea



Data	Žvejybos vieta (baro Nr.)	Žvejybos laivo pavadinimas ir registracijos Nr.	Žvejybos įrankiai: tipas	akių dydis (mm)	bendras ilgis (m)	kabliukų skaičius (vnt.)	Žvejybos įrankių pastatymo laikas
2009 04.18	16	KL-7463	stiminių gaudyklė		100		9.00val.
			st-d.	70	300		9.00val.
2009 04.21	16	KL-7463	st-d.	70	300		15.00val.
2009 04.22	16	KL-7463	stiminių gaudyklė		500		13.00val.
2009 04.22	16	KL-7463 KL-5638	stiminių gaudyklė		500		16.30val.
2009 04.23	16	KL-7463 KL-5638	stiminių gaudyklė		500		11.00val.
2009 04.24	16	KL-7463 KL-5638	stiminių gaudyklė		500		9.00val.
2009 04.25	16	KL-7463 KL-5638	stiminių gaudyklė		500		9.00val.

Žvejybos įrankių tikrinimo data ir laikas	Sugautos žuvys (kg): rūšis	apytikslis svoris	tikslus svoris	+	Duomenys apie žuvų panaudojimą (kam perduota / realizuota, dokumento Nr., data)	Realizuotų žuvų kaina Lt/kg (be PVM)
04.21 13.30val.	stintelė	700	700		SFMMK00582	0,65
			Malkvaga S.			
M. Kulakauskas						
04.22 8.00val.						
M. Kulakauskas						
04.22 15.30val.	stintelė	2000	1800		SFMMK00583	0,65
			Malkvaga S.			
M. Kulakauskas						
04.23 6.30val.	stintelė	2500	3000		SFMMK00584	1,10
M. Kulakauskas			Malkvaga S.			
04.24 6.30val.	stintelė	-	50	-	58	SFMMK00580	0,65
			Malkvaga S.			
M. Kulakauskas						
04.25 6.30val.	stintelė	2000	2200		SFMMK00585	1,10
			Malkvaga S.			
M. Kulakauskas						
04.26 6.30val.	stintelė	1500	1670		SFMMK00586	1,10
M. Kulakauskas						

Figure 7. Fishermen's logbook.

SEAL BYCATCH ASSESSMENT IN ESTONIAN FISHERIES

Markus Vetemaa, Estonian Marine Institute, University of Tartu.

Introduction

Archaeological findings tell that Baltic Sea has been populated by seals during the whole post-glacial period (Kriiska 1998). Today, three seal species can be found: common seal, ringed seal and grey seal. A hundred years ago, unlike today, there was more ringed than grey seals in the Baltic Sea. Kokko and coauthors (1999) estimated that at the beginning of 20th century the number of ringed seals was probably around 150,000 (confidence interval 50,000–450,000). Hårding and Härkonen (1999) suggest a bit higher figure: 190,000–220,000 animals. The same authors, Hårding and Härkönen (1999) analysed also the population of grey seals and concluded that it was around 100,000 at the beginning of the 20th century.

The main reason for the dramatic stock decline of Baltic Sea grey and ringed seals in the second half of the 20th century was environmental pollution and hunting. Both stocks decreased just to few thousands at the end of 1970s and beginning of 1980s. However, after the total ban of hunting and prohibition of some toxicants (DDT etc.) seal populations started to grow due to the improving health status (Nyman et al. 2002). In 2002 the stock of Baltic ringed seals was estimated at 4,498 houled-out animals. In 2007 the number was already 6,670 and it was believed to represent around 60% of the population. While a century ago the abundance of ringed seals was higher than grey seals, then after the stock collapses the population of grey seals has grown faster. In 2007 there were 22,700 grey seals counted in the Baltic Sea (the number excluded young-of-the-year, as it was conducted on houl-out sites). Around 2,900 were counted in Estonia.

Figure 8. By-caught ringed seal.

In parallel to the growing number of seals also conflicts between fisheries and seals emerged. This conflict has two main sides: 1) damage of seals to fishing gears and catch, and 2) bycatch of seals (Figs 8–9). There are several analyses dealing with the seal-induced losses in the fisheries

(e.g. Westerberg et al. 2000; Köningson et al. 2003; Kauppinen et al. 2005). As this is not the topic of the present report they will not be referred here.

According to the data by Lunneryd et al. (2002, 2003) in the Swedish Baltic fisheries the bycatch of seals in 2001 was as follows: 462 grey seals (95% confidence interval 247–749); 52 ringed seals (95% confidence interval 10–102) and 461 common seals (95% confidence interval: 190–692). So, the ratio of grey and ringed seals in the bycatch was around 9:1. This study was based on telephone interviews which included 16% of Swedish coastal fishermen.

Methods of the current study

Theoretically, the easiest way to get information about seal bycatch could be to conduct telephone interviews with sufficiently high number of fishermen (like done e.g. in Sweden by Lunneryd et al. 2002), i.e. to create a sample, and then extrapolate the result to the whole population. However, all face-to-face interviews with fishermen revealed that they are very reluctant to talk about this topic. The reason was fear that by-caught seals in their fishing area could be a reason for fishing restrictions in future. Basically, it seemed that it was almost the same as to ask „how often you conduct illegal fishing operations“ or „how often you don't obey fishing rules“. In conclusion, even if the telephone interview could be relatively easy to carry out, it was decided that such method will create only useless information. While fishermen tried to hide this information even in longer face-to-face interviews with subjects whom they know beforehand, then it was clear that in telephone interview most will not give reliable data.

Figure 9. By-caught grey seal.

The method used in the current study was to create a network of so-called „trusted fishermen“ (Estonian: *„usalduskalurid“*). Most of these fishermen were also included into the action D1, i.e. they got seal-proof netting material „Dyneema“ to modify their gears. This made them very motivated to cooperate with the current LIFE project. Moreover, only such fishermen were selected with whom Estonian Marine Institute had some earlier working contacts with positive results. Naturally, the number of these fishermen was not high, around 30–40. However, small number enabled very tight contacts, ichthyologists followed many of them to sea, and during longer conversations fishermen understood that their information will be kept confidential and this is not going to hinder their fishing possibilities in future. Besides their own bycatch data most of these men had also very usual information about seal conflicts in their counties in

general, because typically all fishery-related information (also bycatch data) spreads quickly between fishermen. Finally, it must be mentioned that the information was collected by ichthyologists, who are considered by fishermen more like „allies“, while teriologists working with seals are often considered to be „enemies“: fishermen believe that teriologists are interested only in „protection of seals“ and „enlargement of seal sanctuaries“.

Interviews with fishermen revealed that in spite of their belief that they can distinguish two seal species, many of them actually could not. Typically, big seals were identified as grey seals and small seals as ringed seals. Since big part of drowned grey seals are young animals, the data to be collected was in danger. In aim to guarantee the reliability of the raw data, a leaflet was distributed between fishermen with key identification features (Fig. 10). Also, most important fishermen (i.e. with the highest expected catch) were provided with freezers for storage of the by-caught animals. So, the animals could be handed over to the project team.

Results: seal bycatch in Estonian fisheries

In Estonia, first serious attempt to estimate seal bycatch was made in 2000 by Ivar Jüssi (Table 4). The author conducted a large number of face-to-face interviews and collected firm data about 87 drowned seals. On he base of that, and additional information received during the interviews with fishermen, he concluded that totally 215 seals might have been drowned in fishing gears in Estonia (Jüssi 2000). He presumed that the share of more endangered ringed seal in the total catch was 5–10%.

Table 4. Bycatch of seals in the fishing gear of Estonian fishermen in 2000. Source: Ivar Jüssi; report compiled in the framework of the program of the Estonian National Environmental Monitoring (“Bioloogilise mitmekesisuse ja maastike seire”, Riiklik Keskkonnaseire Programm).

County	Detailed area	Known/estimated bycatch
Ida-Virumaa		0/<5
Lääne-Virumaa	Mahu...Toolse	0/<5
	Toolse...Vainupea	3/<5
	Vainupea...Vihasoo	0/<5
Harjumaa		0/<10
Läänemaa	Nõva...Riguldi	1/<5
	Riguldi...Puise	5/<10
	Matsalu laht	3/<10
	Matsalu laht...Paatsalu	1/<5
Pärnumaa	Paatsalu...Lao	0/<5
	Kihnu	?
	Pärnu laht	7/<15
	Võiste...Ikla	0/<5
Hiiumaa	Lehtma...Heltermaa	6/<15
	Heltermaa...Sõru	0/<10
	Sõru...Ristna	0/<5
	Ristna...Lehtma	3/<5
Saaremaa ja Muhu	Koguva...Kuivastu	10/<15
	Kuivastu...Koguva	15/<20
	Orissaare...Panga	0/<5
	Panga...Karala	0/<5
	Karala...Sõrve	14/<20
	Sõrve...Kuressaare	15/<20
	Kuressaare...Orissaare	0/<10
Total		87/<215

In 2005 Estonian Marine Institute carried out a project to investigate the conflict between seals and fishery (Vetemaa 2006a). This work included also similar bycatch study (Table 5). Shortly, the results were rather analogous with the data collected by Ivar Jüssi in 2000. However, as the seal numbers grew by around 5% yearly between years 2000 and 2005 (Halkka et al. 2005), the bycatch estimation got in 2005 was also slightly higher. Also in this study the share of the ringed seals was estimated to be around or slightly less than 10%.

The data collected in the framework of the present project is presented in Table 5. The bulk of the bycatch was taken by fyke nets. However, fishery in different parts of Estonia is not similar. While in the western Estonia there is many shallow bays enabling to set trap nets, then in Gulf of Finland fyke net fishery is not typical. In this part of sea, however, salmonids are abundant. Therefore, in the Gulf of Finland a part of fishery is targeted to salmon using very strong gill nets with large mesh sizes. Some small drowned seals were found also in these gears. Bigger animals, however, are too strong to entangle into this gear. In other parts of Estonia there was no information about bycatch in gill nets.

Discussion and conclusions

What makes it hard to get reliable estimations of the seal bycatch is its very high randomness. In other words, seal bycatch is far from being stable between years and by the areas. For example, one fishermen included into the current study on Saaremaa reported following bycatch numbers in years 2005–2009: 5, 0, 4, 14. When this data and all background information was discussed with this particular fishermen, it was finally concluded, that unusually high number of by-caught seals in 2009 was probably the result of the different climatic conditions this year. In early spring 2009 sea ice was driven by prevailing winds to the bay where this particular fishermen had his gears, while large areas around were without ice. So, this created unusually high concentration of females with pups and later on many pups died in the fykes.

Another problem causing its randomness is the dissimilarities of fishery between years. Main reason for that it varying climatic conditions and market situation. Fish prices fluctuate a lot causing sometimes sharp changes in fishing intensity.

Table 5. Bycatch data collected by Ivar Jüssi (2000), Markus Vetemaa (2005) and the current LIFE project (2007–2008). It is estimated that *ca*. 90–95% are grey seals.

County	Bycatch data 2000 (I. Jüssi; Table 1)	Bycatch data 2005	Bycatch data 2007 (this LIFE project)	Bycatch data 2008 (this LIFE project)
Saaremaa	<95	120	~110	~100
Hiiumaa	<35	20	~20	~15
Läänemaa	<30	15	~10	~5
Harjumaa	<10	25	~35	~35
Lääne-Virumaa	<15	15	~10	~10
Ida-Virumaa	<5	15	~15	~15
Pärnumaa	<25 (without Kihnu island)	50	~150 (108 counted, stranded)	~100 (?)
Total	<215	260	~350–370	~260–300

The number of by-caught seals in the Estonian fisheries is impacted by two factors: the number of seals and the fishing effort. Number of seals has been growing year by year. Fishing effort, in contrary, has been decreasing due to the steadily declining profitability of the fisheries (Vetemaa 2006b). Especially significant is the decrease of effort in trap net fisheries (including fyke nets). There are also geographical differences: while a decade ago Hiiumaa county created one of the highest bycatches, then in the last years there have been only few drowned animals. The reason

is that fishery has almost died out and only very few fishermen use this gear today. So, in spite of the remarkably bigger population size today than a decade ago, the number of by-caught animals has not risen much.

Very roughly, annually 280 seals drown in the fishing gears of the Estonian fishermen. How to interpret this figure – is this too high, or can this be tolerated? It is not easy to answer this question. First, the populations of both seal species have been increasing during the last two decades. The growth of the grey seal population has been clear and significant, while the ringed seal population has grown only slowly. So, straightforward negative impacts leading to the stocks decline, or impacting biodiversity, are probably excluded. Also, it can not be forgotten that in Finland and Sweden grey seals are hunted. Annual quotas are higher than the estimated bycatch in Estonia. Still, keeping in mind that there are around 3,000 grey seals in Estonia, the annual bycatch of 240–280 grey seals (Table 5, ringed seals excluded) could hardly allow estimated population growth of *ca*. 7% per year (Ivar Jüssi, personal communication). How can this relatively high bycatch number be coped with observed strong population growth? Most likely, the key factor is the fact that the bulk of the bycatch is made by the young of the year animals. These animals would anyway bear high natural mortality. At the same time, adult specimens responsible for the reproduction, are bycaught only seldom. So, in conclusion, the bycatch has not stopped the clear growth of the grey seal population, and therefore this should not raise too high concern. Naturally, the last point of view is valid only strictly in the sense of population dynamics. However, from another perspective it is clear that (probably) painful death of these highly intelligent mammals in fishing gears is ethically hardly acceptable.

The ringed seal population is growing very slowly and is still in the danger zone. Is this the effect of too high bycatch rate? It is not very likely, because the ringed seals are far less seldom seen in the vicinity of the fishing gears and bycaught. So, the problems connected to this population are probably caused by some other factor. There are, for example, evidences that this species is more impacted by environmental pollution. Naturally, warm iceless winters (ringed seal pups need ice at least during 6 weeks) result in death of almost all born young.

The current LIFE project had an action dealing with modified fishing gears (D.1). One of the aims of this action was to mitigate the fishery-seal conflict by elaborating seal-safe fishing gears. Such gears were built using very strong netting material (Dyneema), which can sustain the seal attacks. Also, modified fykes had panels at entrance, which closed this way to seals. So, these gears created a situation that fishermen could have their catch untouched and seals could not drown. Basically, such gears have been used already for some years in Finland and Sweden (Lunneryd et al. 2003; Kauppinen et al. 2005). However, due to the differences in the fishing details (like targeted species etc.), some essential modifications were suggested for the Estonian conditions. Shortly, the results of the conducted experiments were good and it can be expected that seal-fishery conflict can be reduced in future. In 2009 the national program will be launched in Estonia (for the period 2009–2013) to compensate the costs of these fishermen who will change their fykes towards more environmentally friendly gears creating less bycatch.

When the application for the current LIFE project was written in 2003–2004, the conflict between seals and fishery was yet very marginal in Latvia and Lithuania. Even if there were some reports of seal attacks on fishing gears, and also some notices about seals drowned in the fykes, it was still not significant in comparison to the situation in Estonia. Therefore, the project planned to deal with mitigation of seal bycatch in Estonia only. However, in parallel to the permanently growing number of seals in the Baltic Sea, the problems with grey seals grew quickly also in Latvia and Lithuania. The pilot study made in the framework of the current project (data by Atis Minde, Latvian Fish Resources agency) revealed that already in 2005 around 180 seal might have been by-caught in the gears of commercial fishermen in Latvia. Even if some seals stayed alive and were released, the death count still might have been around 100.

Figure 10A. Leaflet distributed for fishermen: help for identification of grey and ringed seals (page 1).

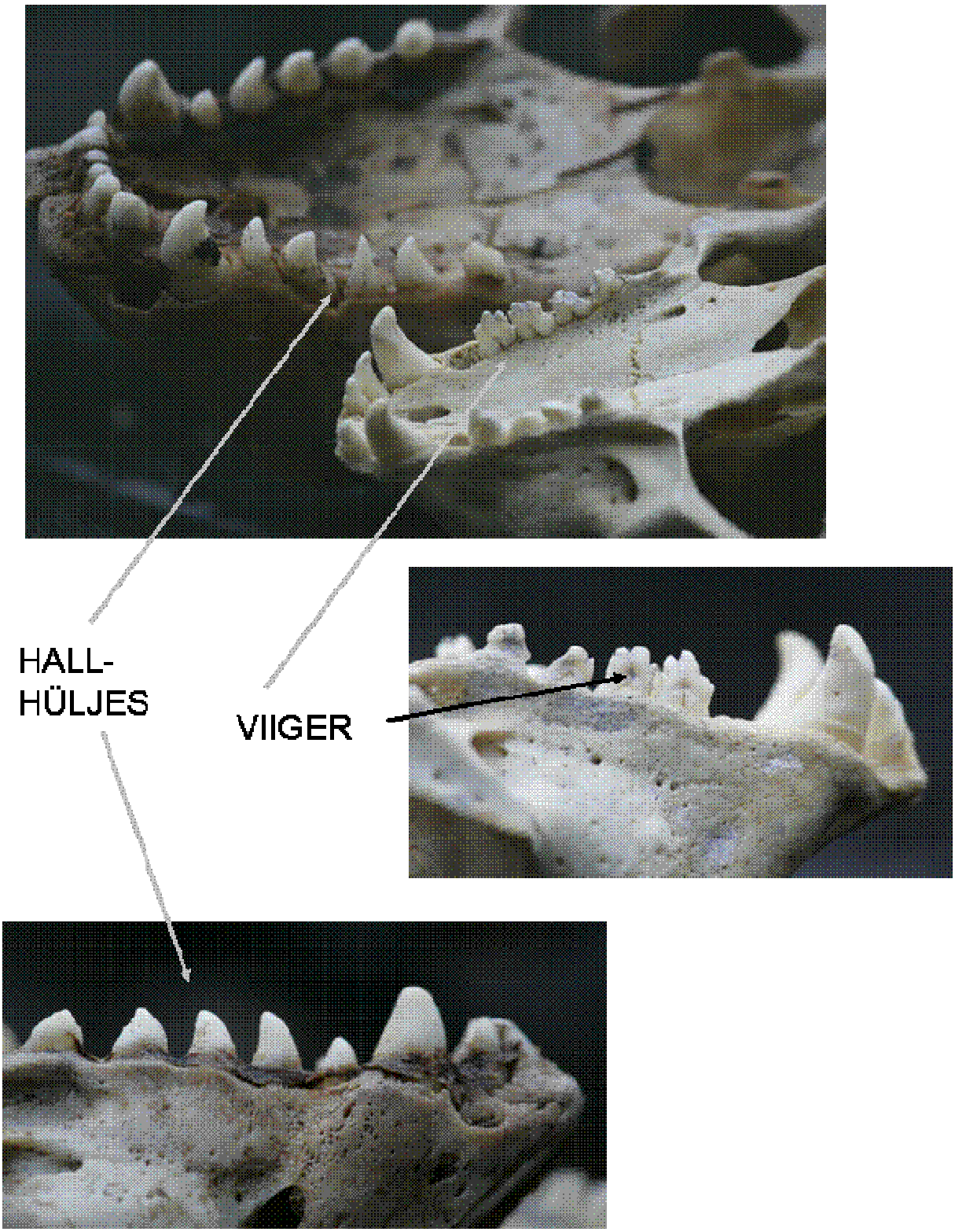


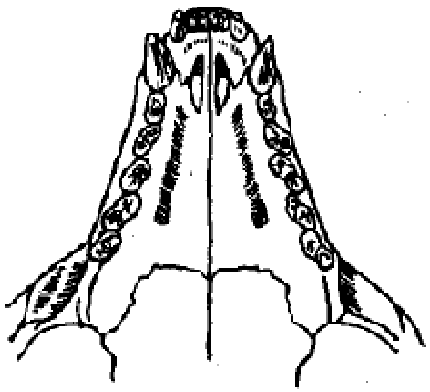
Figure 10B. Leaflet distributed for fishermen: help for identification of grey and ringed seals (page 2).

Selts: LOIVALISED

Ninaluude suurim summaarne laius moodustab liigikaudu pool või üle poole nende pikkusest. Ülalõua purihambad ühekühmulised või osal neist 2 vähe silmapaistvat kühmu

H a l l h ü l j e s
Halichoerus grypus
Eesti vetes tavaline

Ninaluude suurim summaarne laius tunduvalt väiksem kui pool nende pikkusest. Kõik ülalõua purihambad 2-4-kühmulised

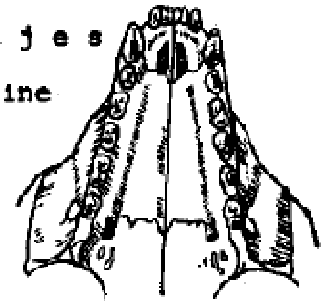


Ülemised purihambad asetsevad lõualuu serva suhtes nurga all. Purihammaste, eriti 2. ja 3. kõrgus tunduvalt väiksem pikkusest. Alalõua purihammaste külgkühmud peamise tipuga kokku kasvanud

R a n d a l h ü l j e s
Phoca vitulina
Eesti vetes leidmata

Ülemised purihambad asetsevad lõualuu servaga paralleelselt. Lõualuu kõrgus suurem või enam-vähem võrdne pikkusega. Alalõua purihambad 3-4 juurega

V i i g e r h ü l j e s
Pusa hispida
Eesti vetes tavaline



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WATERBIRD BYCATCH ASSESSMENT

ESTONIA

Data collection

Initially, 23 commercial fishermen were selected – their fishing locations are indicated in Figure 11 below. However, two of them stopped fishing due to the very bad economic profitability in 2006. In the Gulf of Finland, most widespread gill net mesh size in commercial fisheries is 50–60 mm from knot to knot, because this fishery mainly targets salmonids (sea trout, salmon, whitefish), in other areas it is smaller: 36–50 mm (targeting mainly percids, cyprinids), but at some extent also 50–60 mm (targeting mainly flounder). The contracted fishermen registered fishing site, date, duration of net exposure and in case of bycatch event collected and preserved bird corpses for proper species identification. In some cases, while corpses were easily detectable (Long-tailed Ducks). Since the Estonian Fisheries Information System (EFIS) enables to see effort of all registered fishermen, they just registered events of bycatch, and their total fishing pressure was taken from the database. Since EFIS registers all fishing by relatively small fishing areas (*see map below, the one dividing Estonian seas by red lines*), it is possible to get sufficiently detailed total commercial gill net fishing effort data by small areas. Using this, the Table 7 was compiled.

Main seasons for the bycatch

While in the Gulf of Finland the most important fishing season is autumn and spring, in other areas the peak is shifted more towards warmer season; this means, there is a lot of fishery also in summer and less during colder months. Väinameri area is special, because this is mostly ice-covered from late autumn until *ca*. April. Therefore, most of the fishing takes place in summer and earlier autumn. In this area, however, bycatch was very low. For the first glance it is strange, because there are several very important bird sanctuaries. But it seems that fishing areas and bird areas do not overlap much.
In general, however, commercial fishing in all areas is severely impacted by climate – e.g. in some years the Gulf of Finland is ice-covered already east from Tallinn, while in other years there is almost no ice all the way to the Estonian-Russian border.

Main conclusion

In Estonia the most dangerous area for waterbirds is the Gulf of Finland, where most of bycatch takes place. This occurs during the cold period when targeting salmonids with mesh-sizes 50–60 mm. Nets are often high, 2.4–6 m and they often cover the whole water column from bottom to surface. As seen from the results, by far the most affected waterbird species is the Long-tailed Duck. Even if it is still very abundant in Estonia, the whole population shows some decline. Therefore, the bycatch issue is not meaningless.

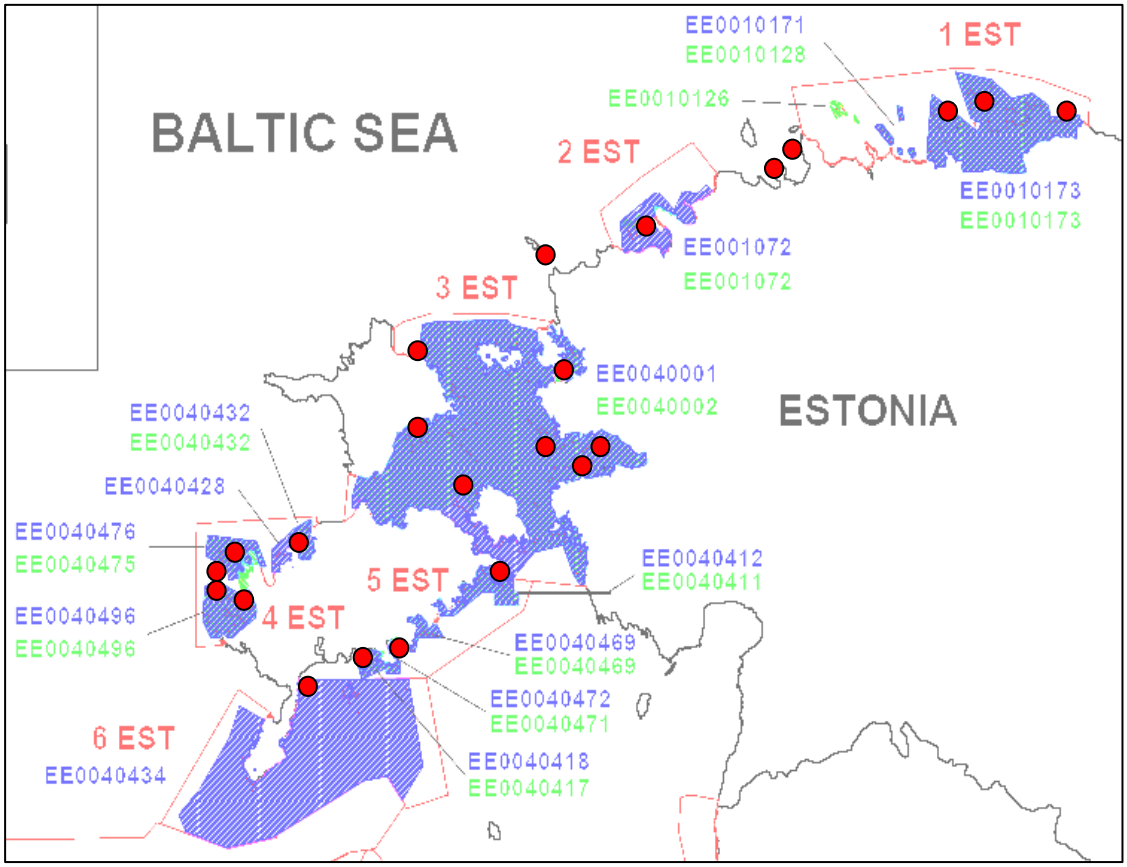

Figure 11. Locations (red circles) of waterbird bycatch data collection in Estonia.

Table 6. Data on waterbird bycatch in fishing gear, collected in Estonia in 2005–2009 from contracted fishermen.

Species	Gill nets,		Fyke nets,		Total
	Gulf of Finland	Other areas	Gulf of Finland	Other areas	
Long-tailed Duck (*Clangula hyemalis*)	161	12			173
Tufted Duck (*Aythya fuligula*)	9	21			30
Red-breasted Merganser (*Mergus serrator*)				10	10
Great Crested Grebe (*Podiceps cristatus*)	6	5		2	13
Cormorant (*Phalacrocorax carbo*)	9	4		3	16
Eider (*Somateria molissima*)	6	4			10
Steller's Eider (*Polysticta stelleri*)		6			6
Common Goldeneye (*Bucephala clangula*)		8			8
Black-throated Diver (*Gavia arctica*)	4	2			6
Goosander (*Mergus merganser*)	4	4		1	9
Black Guillemot (*Cepphus grille*)	3	2			5
Common Scoter (*Melanitta nigra*)		2			2
Razorbill (*Alca torda*)	1				1
Total	203	70	0	16	289

Table 7. Estimated annual waterbird bycatch in Estonia, extrapolated from the collected waterbird bycatch data.

Species	Gill nets,		Fyke nets,		Total
	Gulf of Finland	Other areas	Gulf of Finland	Other areas	
Long-tailed Duck (*Clangula hyemalis*)	1,000	300			1,300
Tufted Duck (*Aythya fuligula*)	60	150			210
Red-breasted Merganser (*Mergus serrator*)	10	30		10	50
Great Crested Grebe (*Podiceps cristatus*)	50	50		2	102
Cormorant (*Phalacrocorax carbo*)	50	60		3	113
Eider (*Somateria molissima*)	40	50			90
Steller's Eider (*Polysticta stelleri*)		5			5
Common Goldeneye (*Bucephala clangula*)	5	70			75
Black-throated Diver (*Gavia arctica*)	30	20			50
Goosander (*Mergus merganser*)	30	50		1	81
Black Guillemot (*Cepphus grille*)	20	30			50
Common Scoter (*Melanitta nigra*)	5	20			25
Razorbill (*Alca torda*)	3				3
Total	1,303	835	0	16	2,154

Test fishing

In the following text, test fishing in Estonia has been divided between 4 main sea areas:

- Väinameri (29-4);
- Gulf of Finland (32-1; 32-2);
- Gulf of Riga (28-5);
- Baltic Proper (28-2; 29-2).

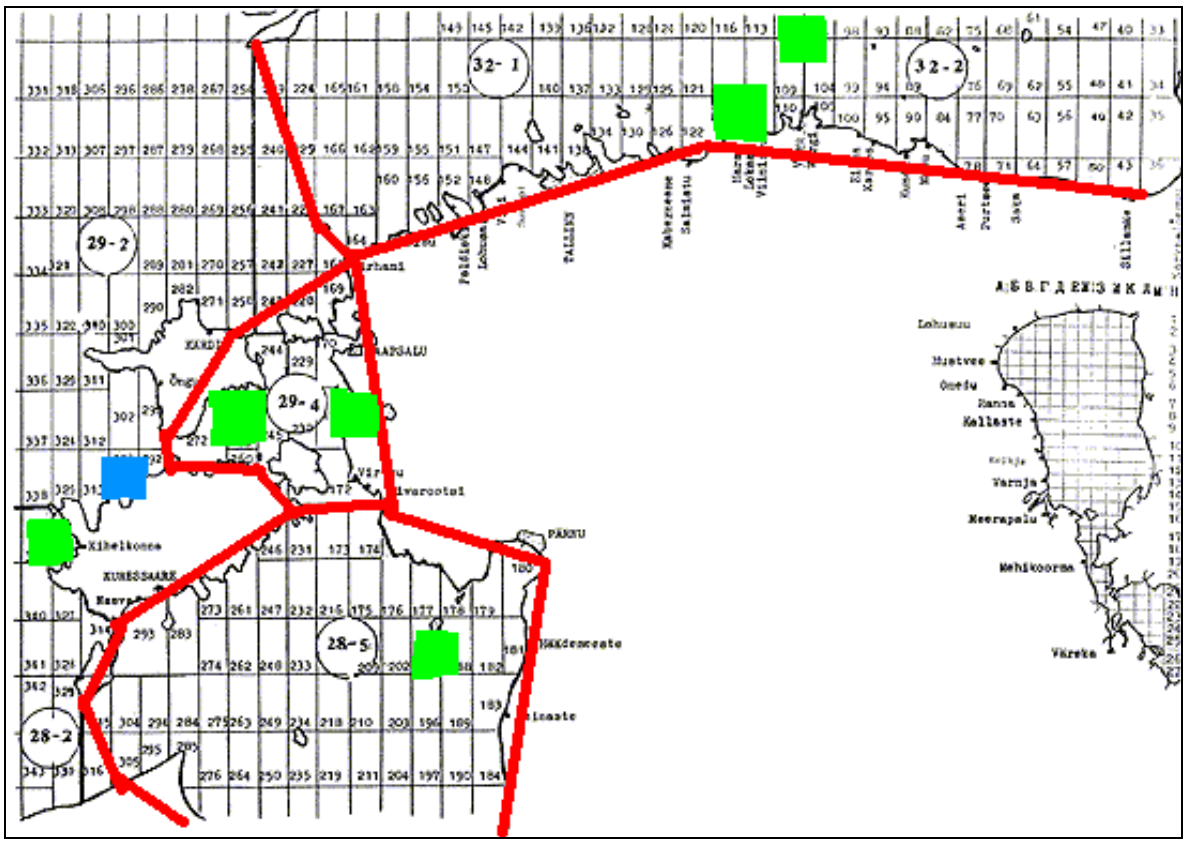

Figure 12. Main sea areas, where test fishing took place in Estonian waters.

The aim of the test fishing was to register all bycatch in all our fishing attempts during the LIFE project period. Therefore, test fishing in Estonia includes all the fishing made for other purposes (routine monitoring, EIAs, etc.). The total length of fishing nets (in metres) by years and main sea areas are presented in Table 8 and the numbers of birds caught in those nets are summarised in Table 9. Figure 12 indicates the main monitoring areas (coloured squares) in each of the abovementioned sea areas, although significant effort was made in the total of 16 areas.

Table 8. Test fishing effort in different sea areas in Estonia in 2005–2009.

Sea area	2005	2006	2007	2008	2009
Väinameri total	16,730	23,520	23,520	38,220	14,700
Gulf of Finland total	5,690	13,680	19,680	37,080	20,760
Gulf of Riga total	5,600	12,390	17,250	21,000	32,610
Baltic Proper total	4,560	7,920	7,920	16,620	11,400

Our test fishing results reveal that bird bycatch is rather random, which makes bycatch estimations very difficult and somewhat arbitrary. In some areas fishing with hundreds of nets results in no birds at all, while in other areas and/or other seasons some birds get caught in just some tens of nets. However, these areas are not always the same. As a rough generalisation, most waterbirds during test fishing were caught in shallow bays in nature protection areas where

fishermen are not allowed to fish. Therefore, it can be considered, that test fishing actually resulted in more bycatch per net/km than in case of a “typical” fisherman.

Table 9. Number of birds caught during test fishing in different sea areas in 2005–2009.

Sea area	2005	2006	2007	2008	2009	Total
Väinameri total	3	0	2	0	0	5
Gulf of Finland total	1	6	4	0	0	11
Gulf of Riga total	0	0	9	2	0	11
Baltic Proper total	2	1	2	4	0	9
Total	6	7	17	6	0	36

LATVIA

Data collection

Waterbird bycatch assessment was carried out in project areas 8LAT, 9LAT, 10LAT, 11LAT and 2 spots near but outside the project areas – Jūrkalne and Užava (Fig. 13). Fishermen with regular fishing activity and previous experience of bycatch registration (in total 8 fishermen enterprises) were chosen. The contracted fishermen registered fishing site, date, duration of net exposition and in case of bycatch event collected and preserved bird corpses for proper species identification.

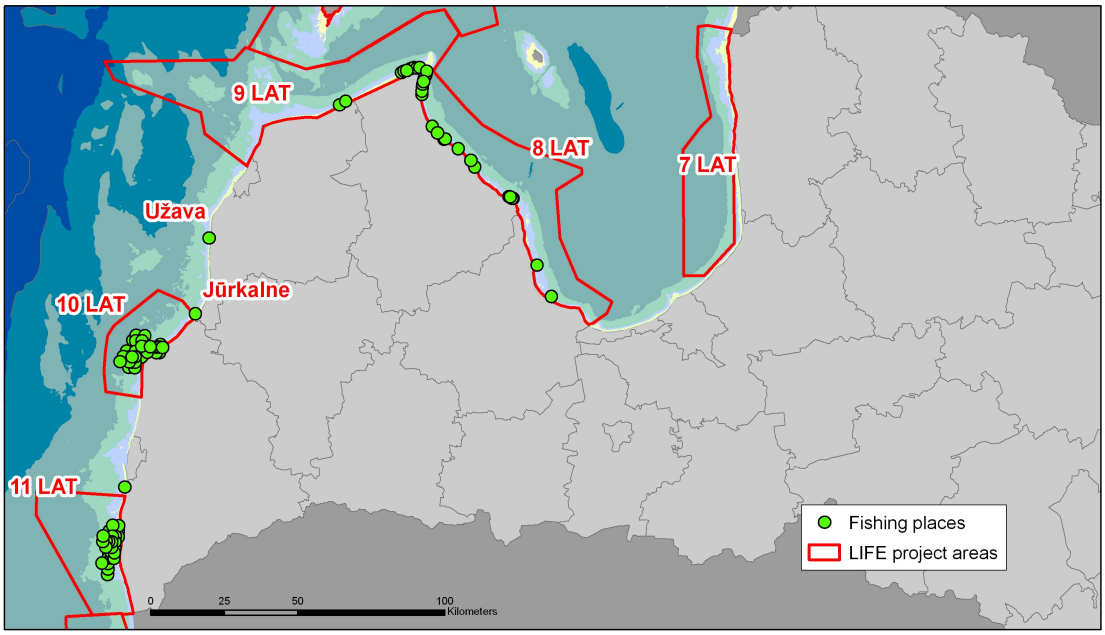

Figure 13. Fishing sites for fishing effort and bycatch registration during the project.

In total, 929 fishing events were reported with the total exposure of gill nets of 16,978 net days (average exposure – 30.9 hours), 82 trapping days of fish traps and one case of pond net use. Fish traps and pond net were used only in one site in the Gulf of Riga – Roja in spring 2006.

According to the contract fishermen had to provide data for period October – May for 2 years – 2006–2007. In 8LAT registration was continued also in spring 2008. Due to severe weather conditions the fishing was impossible in many sites in autumn 2006. The fishing activity increases in spring months when weather is much calmer (Fig. 14).

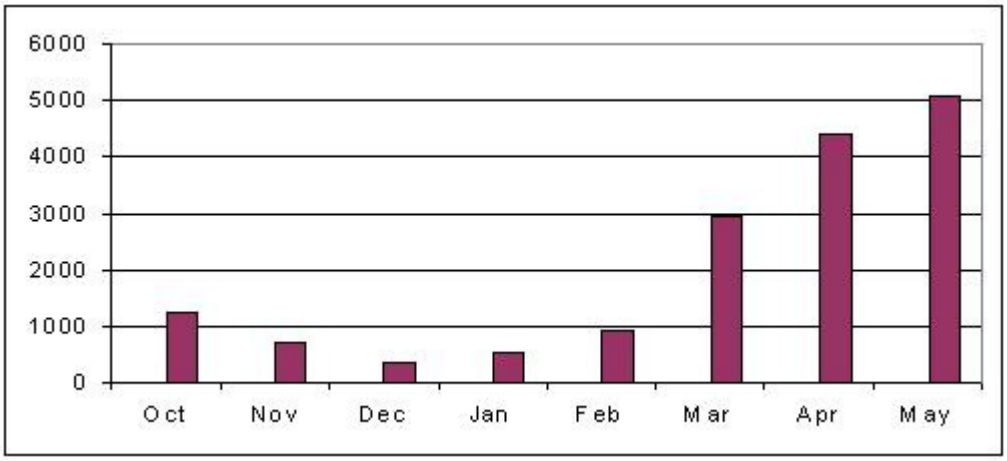

Figure 14. Seasonal distribution of fishing effort (net days) during the project.

Byctach species composition and bycatch rates

In total, 238 dead and 67 alive birds were encountered. The most common victim was Long-tailed Duck, which comprises almost half of all the victims. The next most numerous victims were divers (12% of all victims) and Velvet Scoter (11% of victims; Fig. 15).

Victim composition varied according to fishing site (Table 10). Almost all Velvet Scoters caught perished in the northern part of 8LAT where their high concentrations observed during bird inventory overlapped with fishing activity of our contract fishermen. Similarly, Long-tailed Duck, although present all along the coast and dying at every bycatch registration site, reached the peak of victim numbers in 8LAT, where internationally important concentrations of the species are present in spring. Divers were caught mainly along the open Baltic coast, but auks – in 10LAT and 11LAT where contract fishermen worked also in deeper waters.

Table 10. Bycatch victim species composition at different registration sites in Latvia.

Species	Site						
	11LAT	10LAT	Jurkalne	Uzava	9LAT	8LAT	Total
Gavia arctica	8	0	1	0	0	0	9
Gavia stellata	5	2	8	2	1	0	18
Podiceps grisegena	2	0	4	0	0	0	6
Phalacrocorax carbo	2	0	0	0	0	1	3
Aythya marila	0	0	0	0	0	1	1
Bucephala clangula	0	0	0	5	0	1	6
Clangula hyemalis	7	1	18	19	7	55	107
Melanitta fusca	1	0	0	0	0	25	26
Melanitta nigra	0	0	1	1	2	3	7
Somateria mollissima	0	0	0	0	0	1	1
Mergus merganser	2	1	0	0	0	1	4
Mergus serrator	0	0	2	0	0	0	2
Fulica atra	0	0	1	0	0	0	1
Alca torda	1	0	0	0	0	0	1
Uria aalge	9	8	0	0	0	1	18
Cepphus grylle	16	1	0	0	0	0	17
Larus argentatus	0	0	0	0	0	1	1
Unidentified	0	0	0	4	1	5	10
Total	45	13	35	31	11	95	238

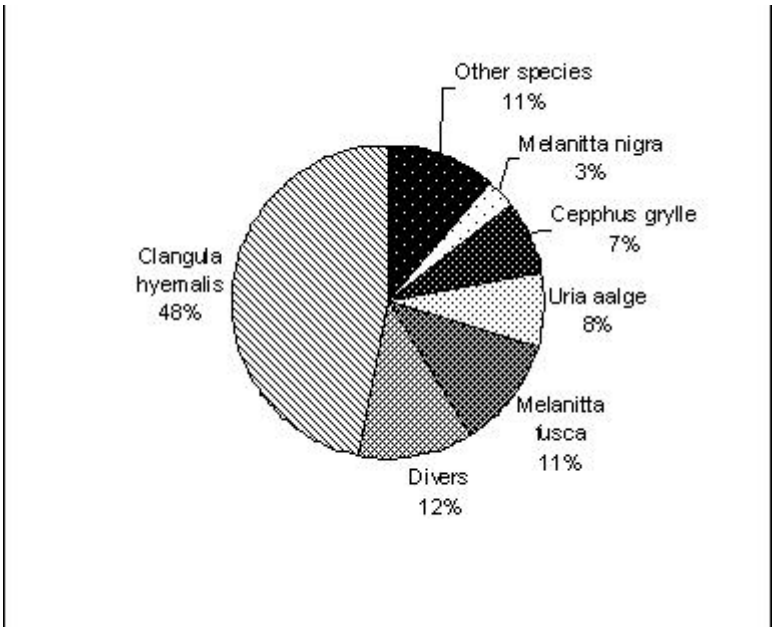

Figure 15. Bycatch victim species composition.

Gill nets of different mesh size were used. Mesh size >60 mm was used most often (570 fishing events) while the small mesh size <30 mm meant for herring was least used by our contract fishermen during winter time (only 10 fishing events). Table 11 shows the bycatch occurrence and bycatch rate in different gill nets during the project.

Table 11. Bird bycatch rate in gill nets of different mesh size.

Parameter	Gill net mesh size			
	<30 mm	50–60 mm	>60 mm	Mixed classes
Number of fishing events	10	256	570	80
Number of bycatch events	0	36	88	11
Bycatch occurrence %	0.0	14.1	15.4	13.8
Average bycatch rate (birds per 1,000 NMD)	0.00	0.36	0.39	0.34
Bycatch rate standard deviation	0.00	1.39	1.52	1.04

Both gill nets and trap nets were used only at one fishing site – Roja. At this particular site there are high bird concentrations and both types of gear caused bird mortality. In total, 5 dead Long-tailed Ducks were collected from trap nets and 66 birds of different species from gill nets. There was no difference between the bycatch rate in both gear types (0.69 birds per 1,000 NMD, SD = 1.01 for trap nets, 0.55 birds per 1,000 NMD, SD = 1.87).

Bycatch rate differs considerably among different spots. Fishermen working at the open Baltic coast and especially those working more in deeper waters with lower bird densities killed less birds than those with activity in the bird rich coastal waters of 8LAT (Figs 16–17). Also within 8LAT bycatch rate differed among sites. At the more southern sites Ķesterciems and Lapmežciems, where two fishermen registering effort and bycatch caught no birds during the non-breeding season.

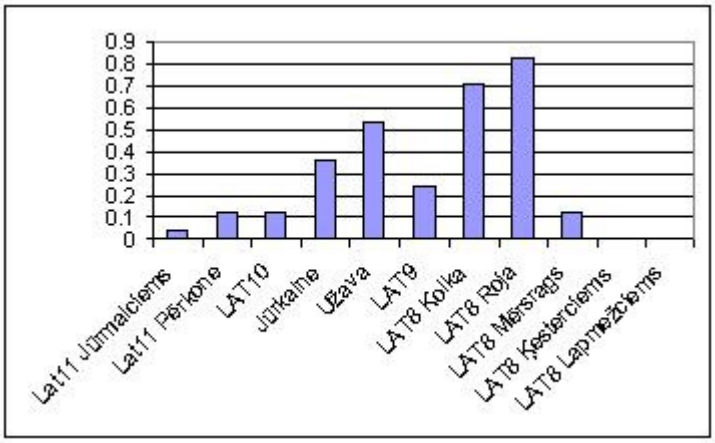

Figure 16. Bycatch rate at different fishing sites in Latvia.

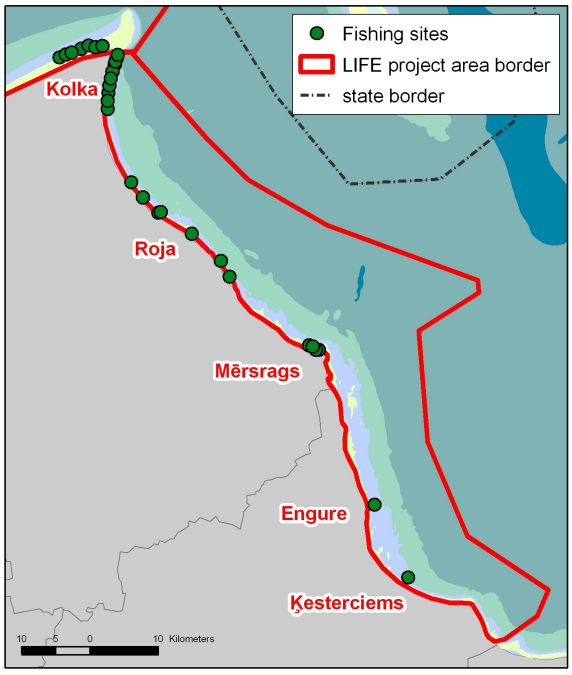

Figure 17. Bycatch registration site location in 8LAT.

Increase of fishing effort in spring coincides with the rise of bird numbers present at the sites due to the ongoing migration. Therefore, it is not surprising that most victims have been registered in March and April (Fig. 18). Most victims during the elevated mortality in October were Velvet Scoters in the northern part of 8LAT. When this mortality is expressed as bycatch rate we see that also winter months can be dangerous if fishing activity were higher (Fig. 19).

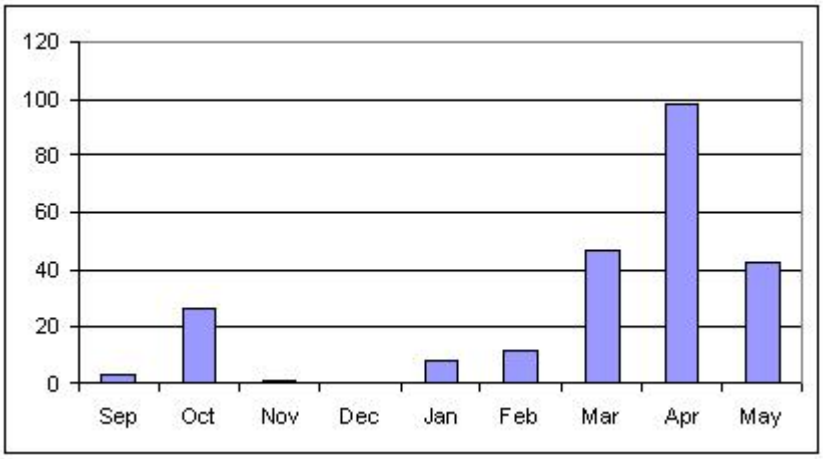

Figure 18. Bycatch victim temporal distribution in Latvia.

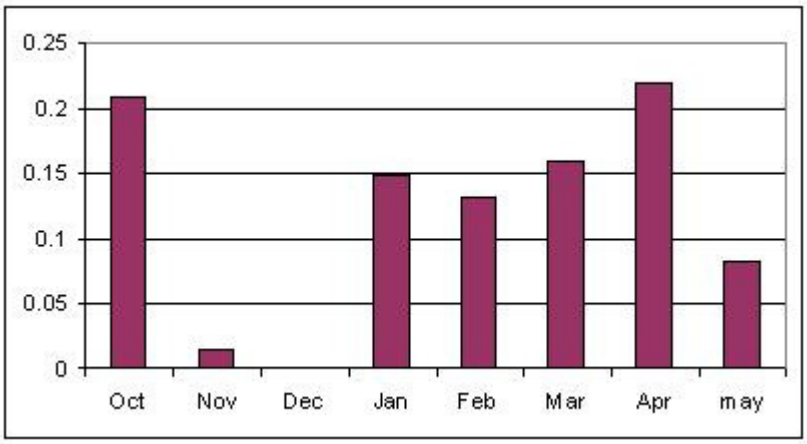

Figure 19. Seasonal differences in bycatch rate in Latvia.

Table 12. Bycatch rates registered at different sites in Latvia.

Site	Bycatch rate, birds per 1,000 NMD		
	This project	2000–2001	2003
11LAT Jūrmalciems	0.04		0.18
11LAT Pērkone	0.12	0.43	0.47
10LAT	0.12	0.3	0
Jūrkalne	0.36	0.85	0
Užava	0.54	0.43	1.37
9LAT	0.25		1.66
8LAT Kolka	0.71	1.3	0.17
8LAT Roja	0.83		0.14
8LAT Mērsrags	0.12		
8LAT Ķesterciems	0		0
8LAT Lapmežciems	0		0

Main conclusion

Latvian fishing effort statistics do not require precise registration of fishing site. Only county is given which in case of e.g. Kolka county can mean either side of Kolka cape having different bird densities. Bird inventory provided counts once per season. Bearing in mind the spatial and temporal variability of bird distributions and lack of precise data about their overlap with fishing

activity it is hard to evaluate total number of birds perishing. If compared to similar registration in previous years, the bycatch rate during the project was lower at most sites along the western coast and Irbe Strait, but higher near Kolka and Roja (Table 12). This can be explained by lack of birds at these sites – the winters were mild and birds had possibility to use wintering/staging sites in the Riga Gulf and waters of Estonia. In a more severe winter bird distribution would change and also 10LAT and 11LAT can face higher bird mortality. With the present trend of mild winters to prevail and fishing fleet to decrease bycatch mortality can cause problems only at separate spots at Latvian coast where the highest bird concentrations occur.

LITHUANIA

Data collection and analysis

In total, data from ca. 556,000 NMD (net meter days) of gillnet exposure (almost 400 fishing events) were available for the analysis of by-catch effect on waterbirds in the Lithuanian LIFE project sites 12LIT and 13LIT. All the available data were compiled from this LIFE project and previous by-catch assessment efforts in the LIFE project areas during the period 2002–2008.

For the purpose of evaluation of the differences in threat posed by gill nets of different mesh size to waterbirds wintering in the project area, gill nets used in the Lithuanian coastal waters were subdivided into the following three size categories:

- 16–25 mm (target fish species – smelt, herring);
- 50–60 mm (main target fish species – cod);
- >60 mm (main target fish species – salmon).

Two main parameters were calculated to describe the bycatch of waterbirds in coastal gillnets in Lithuania from the collected data – frequency of occurrence of bycatch (%) and bycatch rate (birds/1,000 NMD).

Frequency of occurrence indicates the proportion of fishing events that result in bird bycatch out of the total number of fishing events – it disregards both the number of birds caught per fishing event and the amount of nets set per fishing event. Thus, the frequency of occurrence of bycatch is a measure of how frequent is bird bycatch in gill nets.

Bycatch rate indicates the amount of birds caught in a certain amount of nets per time unit. Thus it allows relating the fishing intensity to the number of birds that can be potentially killed in those nets. Here bycatch rate is expressed as the number of birds caught per 1,000 NMD (net meter days), i.e. the number of birds caught in 1,000 meters of nest set for one day. Average bycatch rates (for all birds and nets, different categories of nets or different bird species, etc.) are calculated by averaging bycatch rates of individual fishing events.

Bycatch rates and species composition

Overall, more than a quarter of fishing events in the Lithuanian project areas resulted in bycatch of waterbirds (26.7%; Table 13). The amount of gillnets (of all sizes combined) set per one fishing event varied from 100 m to 6,480 m, 1414 m on average, and the number of birds caught during a fishing event that resulted in bird bycatch varied from 1 to 22. When considering the different gill net mesh size categories, bird bycatch was the most frequent in large mesh size nets (>60 mm) – 28.6% of fishing events resulted in bird casualties. All but one case of the largest numbers of birds caught during one fishing event (>10 birds per one fishing event) occurred in this mesh size category. Frequency of occurrence of bycatch decreased with decreasing mesh size – it was 19.4% in gill nets of 50–60 mm mesh size and 16.4% in gill nets of 16–25 mm mesh size (Table 13)

Table 13. Bycatch rate and frequency of occurrence of waterbirds of all species combined in gill nets of different mesh sizes.

Mesh size, mm	Bycatch rate, birds/1,000 NMD		Number of fishing events	Number of bycatch events	Frequency of occurrence, %
	Average	SD			
16–25	0.42	1.60	330	54	16.4
50–60	1.03	3.04	175	34	19.4
>60	5.10	13.96	98	28	28.6
All mesh sizes	1.36	6.18	393	105	26.7

The fact that large mesh size nets are considerably more dangerous to waterbirds was even more evident from bycatch rates (Table 13). Gillnets of large mesh size (>60 mm) were almost 5 times more efficient at catching waterbirds than those of mesh sizes of 50–60 mm and even ten times more efficient than gill nets of small mesh sizes (16–25 mm). Average bycatch rate in large mesh size nets (>60 mm) was 5.10 birds/1000 NMD, i.e. approximately 5 birds are likely to die in 1,000 meters of nets left at sea for one day, whereas in case of small mesh size, one bird can be expected to be caught in 2,000 meters of nets left at sea for one day (Table 13).

The most common victim caught in gillnets in Lithuania was the Long-tailed Duck (*Clangula hyemalis*) – it comprised more than half (57%) of all the waterbirds caught in fishing nets (Fig. 20). Velvet Scoter (*Melanitta fusca*), divers (*Gavia* sp.) and alcids (*Alcidae*) comprised 13%, 10% and 8% respectively. All other species of waterbirds comprised less than 5% each of the total number of birds caught.

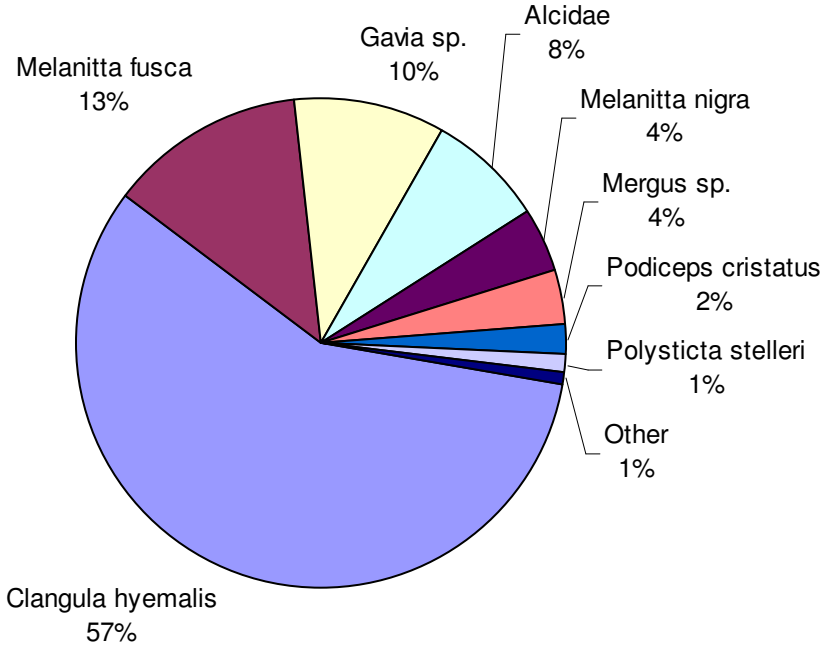

Figure 20. Species composition of birds caught in fishing nets in project areas in Lithuania.

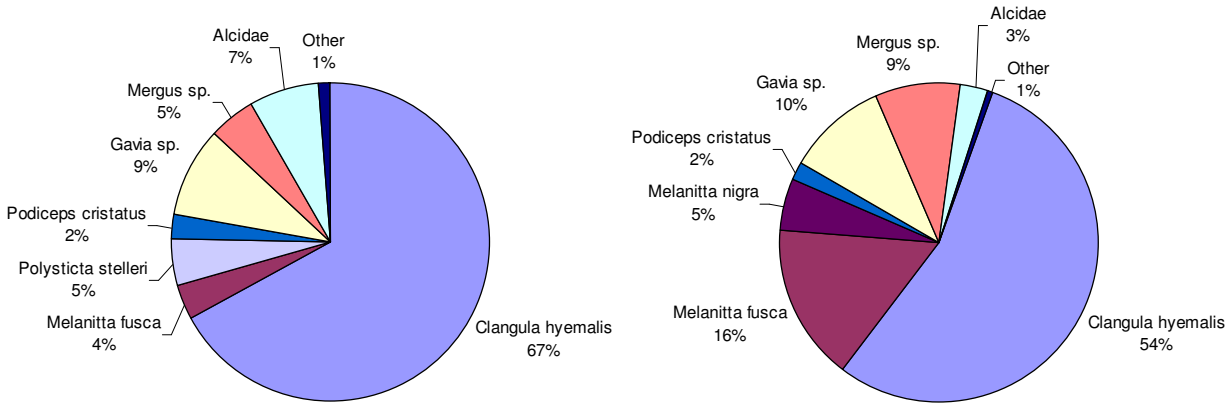

Figure 21. Species composition of birds caught in fishing nets in project areas 12LIT (left) and 13LIT (right).

Species composition of bycatch victims differed somewhat in the two Lithuanian project sites (Fig. 21). While Long-tailed Duck was the most common waterbird species caught in fishing

nets in both project areas, in the project area 13LIT it comprised just over a half of all the caught birds, while in the project area 12LIT – two thirds of all the victims. On the other hand, most of the Velvet Scoters were caught in the project site 13LIT, where they comprised 16% of all the caught birds, and only 4% in the project area 12LIT. This is not surprising, since this species usually does not occur in near-shore waters along the continental coast in the project site 12LIT. Steller's Eiders were caught exclusively in the project area 12LIT, while Black Scoters – in the area 13LIT. Other species of waterbirds occurred in gill nets in both project sites, albeit at slightly different frequencies (Fig. 21).

It should also be pointed out that gill net fishing effort differed greatly between the two Lithuanian project sites. The overall fishing effort in the project area 12 LIT was 3–4 times higher than fishing effort in the project site 13LIT (Fig. 22). It also had a more stable tendency to decrease during the last few years in the project site 13LIT than in 12LIT, where it fluctuated considerably (Fig. 22). Another pronounced feature of the Lithuanian coastal gill net fishery is its seasonal distribution. Fishing effort is greatest during the period October–May and decreases significantly during the holiday season (June–September) (Fig. 23). Unfortunately, this high fishing intensity period overlaps completely with the presence of migrating and wintering waterbird aggregations in the Lithuanian waters (mid-November – mid-April).

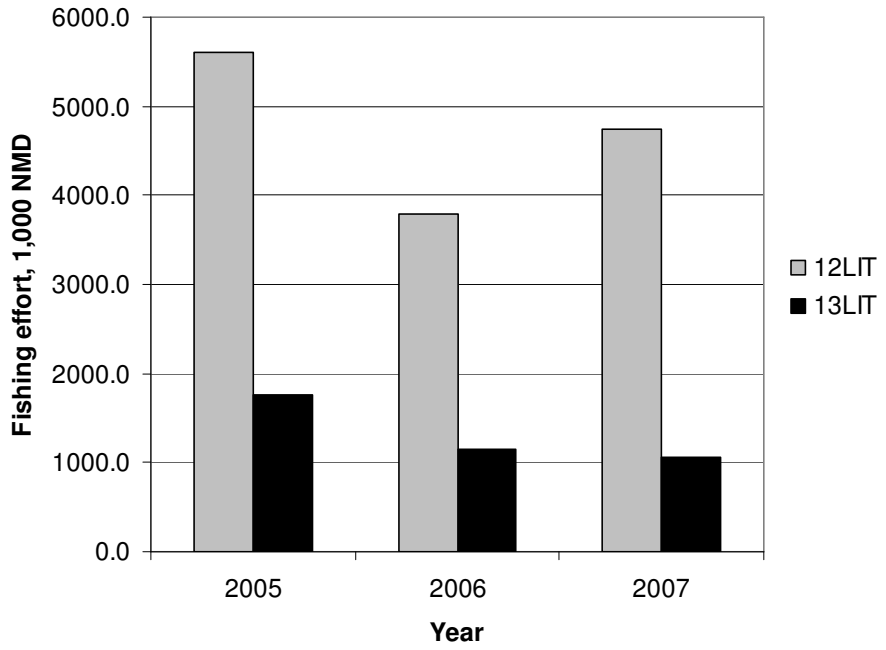

Figure 22. Overall fishing effort in project areas 12LIT and 13LIT in 2005–2007.

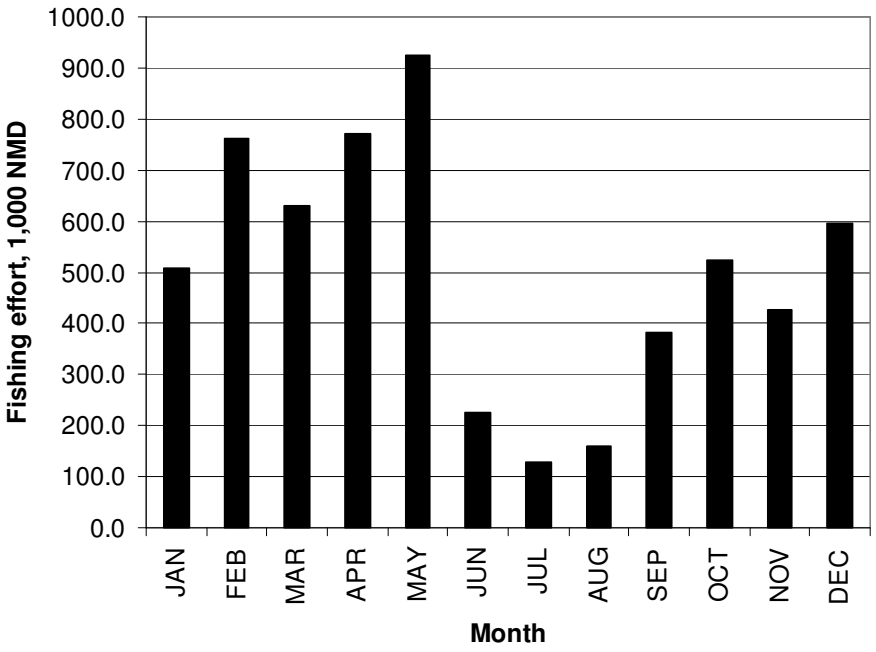

Figure 23. Average monthly fishing effort in both LIFE project areas in Lithuania in 2005–2007.

Main conclusion

It is very difficult to estimate with any degree of certainty the total number of birds actually dying in the fishing nets every year, since it depends greatly on the numbers of birds aggregating in Lithuanian waters (which, in turn, may depend on weather conditions, i.e. the severity of winters), overall fishing intensity, mesh sizes used by fishermen, etc. However, taking into consideration the calculated average bycatch rate of waterbirds in Lithuanian gill net fishery, temporal (seasonal) and spatial distribution of fishery, as a very rough estimate, it could be assessed that up to 3,000–5,000 waterbirds of different species may die in gill nets in Lithuanian project sites every wintering season. This bycatch should not be ignored and may be significant for certain particularly vulnerable waterbird species. Therefore, appropriate bycatch reduction measures have been proposed to be included into the nature management plans for the both Lithuanian project sites. These measures include seasonal (mid-November – mid-April) restrictions on large mesh size gill nets (55 mm and larger) in depths most commonly used by wintering waterbirds (up to 15 m).

Test fishing

In Lithuania, professional ichthyologists during the project implementation performed fishing with fishing gears (gill nets), which are traditionally used in the coastal fishery, aiming to investigate the occurring by-catch of wintering birds in the fishery. To ensure comparability with data provided by co-operating fishermen, net types, net setting locations, depths and times were corresponding to those used by the co-operating fishermen. Moreover, ichthyologists during each survey used all possible mesh sizes allowed by fisheries regulations in the coastal waters and including all mesh sizes used during different seasons (including summer time). Used nets were made from the monofilament and are traditionally used in fishery for fishing traditional fish species – smelt, herring, vimba, pikeperch, cod, flounder and turbot. The test fishing nets were comprised of the following mesh sizes in each net set (mm from knot to knot): 17.5, 18.5, 20, 21.5, 22, 24, 50, 55, 60, 70, 80, 90, 110 mm. At least 600 m of nets were used in each case of experimental fishing. Usually, in each fishing location, one set of nets was set out in deeper water (about 15 m) another in more shallow (about 6–8 m); before setting nets depth was measured using echosounder. Nets were set out one day and taken out next. Surveys were performed during each survey in both project areas 12LIT and 13LIT.

Experimental surveys of wintering birds' by-catch using traditional gill nets resulted only one case of the by-catch: in 12LIT territory two Long-tailed Ducks (*Clangula hyemalis*) were caught. The number of caught birds was much smaller than initially anticipated. Results of the experimental survey and discussions with coastal fishermen on the bycatch issue suggest that the nature of wintering waterbird bycatch is rather random – while bycatch may be uncommon, on some occasions numbers of caught birds may be very high (if large group of birds dives into set of nets); it often largely depends on the exact location even within the same fishing sector. According to coastal fishermen, they usually know such sites and try to avoid setting nets in such locations, i.e. try to avoid untargeted by-catch of birds first of all due to time consuming process of taking out birds and damage to the gears as well as try to minimize harm for wintering birds.