ESTONIAN FISHERY 2014–2015

FISHERIES INFORMATION CENTRE

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Estonian Fishery 2014–2015

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Table of contents

Foreword 6
Abbreviations 8

Distant-water fishery 9

9 Fleet
10 State of fish stocks and fishing opportunities
13 Catches
16 Outlook

Baltic Sea fisheries 17

17 COASTAL FISHERY IN THE BALTIC SEA
22 Dynamics of coastal fishing catches in different parts of the Baltic Sea
- Gulf of Finland 22
- High seas 23
- Väinameri Sea 24
- Gulf of Riga 25
- Pärnu Bay 26

38 TRAWL FISHERY IN THE BALTIC SEA
38 Stocks and catches of herring, sprat and cod, and future outlooks
- Herring 38
- Central Baltic herring (subdivisions 25–27, 28.2, 29 and 32) 41
- Gulf of Riga herring 43
- Sprat 46
- Cod in subdivisions 25–32 (Eastern Baltic) 50

52 ESTONIA'S TRAWL FLEET IN THE BALTIC SEA
52 General overview of sector
56 Basic indicators of 12–18 m length class trawlers
56 Basic and economic indicators of 24–40 m length class trawlers

Inland fisheries 59

59 LAKE VÕRTSJÄRV FISHERY
- Eel 61
- Pikeperch 62
- Pike 64
- Bream 64

65 LAKE PEIPSI FISHERIES
- State of fish stocks 65
- Fisheries management 66
- Catch and its value 67
- Problems 71

72 LAMPREY FISHING ON ESTONIAN RIVERS

Recreational fishing 76

76 Fishing gear
76 Recreational fishing permits
78 Fishing fees
78 Number of recreational fishermen

Aquaculture 80

80 Overview of sector
83 Aquaculture Strategy 2014–2020
83 Fish restocking
84 Research and development
84 Grants

Estonian fish processing industry 85

85 General overview of sector
86 Basic and economic indicators and trends of companies whose main business is fish processing
87 Basic and economic indicators in 2014
87 Basic and economic indicators in 2015
89 Production and sales
91 Aid granted to fish processing industry

Grants 92

References 94

Foreword

Dear reader,

The Fisheries Information Centre has prepared this overview of the Estonian fishery sector for the period 2014–2015. Since there was a nearly year-long pause in the activities of the Information Centre between two budgetary periods, information for 2014 was not published on time; however, we cover that information with the data for 2015 in this publication. This gives an opportunity to compare these two years, as well as collate the data for these years with information on previous years, in order to provide a longer-term review of fish stocks and economic indicators.

While we have customarily emphasised that fishery as an economic sector is largely dependent on natural conditions, in 2014 we had to acknowledge that politics plays no smaller role in the wellbeing of the sector. During the years under review in this book, Russia imposed import restrictions on our fish and fishery products in response to the EU's embargo. Therefore, Estonian fishermen and processors were forced to overhaul their export strategies in a short time and start to look for new markets. Ukraine became the main foreign partner in the new political situation. The successful response of our fish processing industry to the difficult situation is borne out by the fact that most of the companies managed to close each year with a profit.

As always, distant-water fishery was the most lucrative segment of the Estonian fishery sector, and sprat and herring were the backbone of the local trawling sector. In coastal fishery, fishing for perch, herring and pikeperch provided the highest revenues, and Pärnu Bay remains our key area in this segment. Fishery is a field of activity where processes depend on resources, and abrupt changes, therefore, are negative and undesirable.

As regards aquaculture in Estonia, we have to admit yet again that the long-awaited output growth that had been expected in strategies did not occur, but fortunately there were no significant setbacks either. Our eastern neighbour's trade restrictions took their toll on this sector, too. Sturgeon farmers who were oriented to the Russian market had to seek domestic consumers for their production.

Fishery has been, is and will certainly remain for a long time a field of activity with long traditions and characteristic of the Estonian economy. We must not forget that one man on the water provides work for several people ashore. Recent surveys show that fish consumption is once again on the rise among Estonians and there are increasingly more of those who prefer to eat healthily and can appreciate fish as an irreplaceable source of high-quality food. This yearbook, with its laconic text and a lot of inanimate numbers, is in fact a reflection of the day-to-day work of a great deal of good people, without which we would not be able to boast being a maritime nation.

Toomas Armulik
Head of Fisheries Information Centre

Abbreviations

B_{lim}	The biomass limit, reaching which should be prevented by fisheries management, as below this level the risk of stock collapse increases significantly
CPUE	Catch per unit effort, i.e. yield; for example kg/h or kg/net
EFF	European Fisheries Fund
EIER	Estonian Institute of Economic Research
EU	European Union
EULS	Estonian University of Life Sciences
EULS IAE	Institute of Agricultural and Environmental Sciences at the Estonian University of Life Sciences
EULS IVA	Institute of Veterinary Medicine and Animal Sciences at the Estonian University of Life Sciences
F	Fishing mortality
F_{med}	The fishing mortality rate, which secures a balanced ratio of spawning stock and recruitment
F_{MGT}	International management plan-based fishing mortality rate target level
F_{MSY}	Maximum fishing mortality for sustainable yield
F_{PA}	Sustainable mortality rate, i.e. maximum sustainable exploitation intensity (fishing mortality precautionary approach)
F_{sq}	Fishing mortality status quo
GT	Gross tonnage
ICES	International Council for the Exploration of the Sea
EIC	Environmental Investment Centre
MoE	Ministry of the Environment
M	Natural mortality
MoRA	Ministry of Rural Affairs
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	North East Atlantic Fisheries Commission
NIPAG	Joint NAFO/ICES *Pandalus* Assessment Working Group
NPUE	Number per unit effort
ARIB	Agricultural Registers and Information Board
RFMO	Regional Fisheries Management Organisation
SE	Statistics Estonia
SL	Standard length; the length of a fish measured from the tip of the snout to the end of scale cover
SSB	Spawning stock biomass
STECF	European Commission's Scientific, Technical and Economic Committee for Fisheries
TAC	Total allowable catch
TL	Total length; the length of a fish measured from the tip of the snout to the end of the caudal fin
TW	Total weight of a fish
UT EMI	Estonian Marine Institute of the University of Tartu
WPUE	Weight per unit effort
Z	Total mortality

Distant-water fishery

Distant-water fishery means fishing outside of the Baltic Sea. Distant-water fishing vessels flying the Estonian flag have fishing rights on three fishing grounds: Svalbard; North West Atlantic (NAFO); and North East Atlantic (NEAFC) (Figure 1). After acceding to the European Union, Estonia retained fishing rights as a member of these international organisations on the basis of the principle of relative stability and as a share of the fishing quota of the European Union (Aps *et al.*, 2005).

Fleet

The distant-water fishing fleet still consists solely of trawlers on board which fish or shrimp undergo primary or final processing. In general, demersal trawls are used. However, pelagic trawls are occasionally used as well. A crew typically consists of around 20 people.

According to the data of the Estonian Fishing Vessel Register (as of 31 December 2015), there were five vessels owned by three companies in the distant-

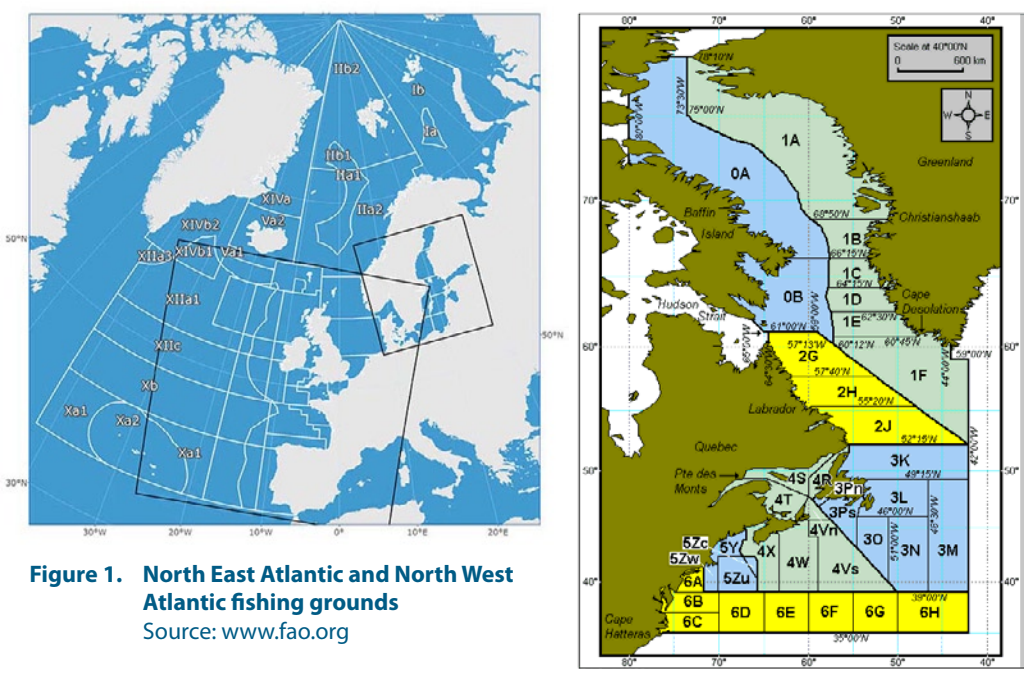


Figure 1. North East Atlantic and North West Atlantic fishing grounds
Source: www.fao.org

Table 1. Main characteristics of Estonian distant-water fishing fleet, 2005–2015

Year	Number of vessels	Combined power of main engines (kW)	Combined gross tonnage (GT)
2005	10	18 605	11 520
2006	11	21 413	12 923
2007	10	19 923	12 215
2008	8	15 634	10 331
2009	6	12 670	8 281
2010	6	12 670	8 281
2011	6	12 670	8 281
2012	6	15 982	9 100
2013	5	13 174	7 697
2014	5	13 174	7 697
2015	5	13 174	7 697

Source: MoRA

water fishing segment. Three vessels catch shrimp (Northern prawn) as the main target species and less frequently also fish, and two vessels only catch fish as the main target species. The average length of the vessels is 60 metres; the average age in 2015 is 29 years; the combined power of the vessels' main engines is 13,174 kW; and the combined gross tonnage (GT) is 7697 tonnes (Table 1). All the vessels were actually engaged in fishing.

State of fish stocks and fishing opportunities

The state of fish stocks in the **NAFO area** is assessed by the Scientific Council of NAFO on the basis of exploratory trips and/or comnmercial fishing data. NAFO observers on board vessels help collect information on Estonia's commercial fishing. The state of fish stocks and fishing opportunities are generally closely related – to determine the total allowable catch (TAC), the precautionary approach is applied in the NAFO area, which should ensure the preservation of stocks and the ecosystem.

The impact of environmental conditions and interaction between species is increasingly taken into account when assessing stocks, i.e. the ecosystem approach to fisheries management is used and vulnerable marine ecosystems are protected. Therefore, 18 fishing grounds in the NAFO area were closed in 2012 to commercial fishing with demersal trawls either because of an abundance of coral and sponges which exceeded the established reference level or because of seamounts regarding which more information on the operation of ecosystems is needed (NAFO, 2011). In 2013 a decision was made to expand the closed fishing grounds, adding one ground (NAFO, 2013). In 2014 it was decided to keep those grounds closed for fishing until 2020 and two more grounds were added (NAFO, 2014a). In 2015 a decision was made to prohibit exploratory bottom trawling in protected marine areas, thereby making all NAFO protected areas closed to all kinds of bottom fishing activity (NAFO, 2015a).

Fishing quotas are agreed between member states at the annual meetings of NAFO and NEAFC. The current moratoria on the fishing of certain stocks

(Atlantic cod (*Gadus morhua*) in divisions 3L and 3NO; American plaice (*Hippoglossoides platessoides*) in divisions 3LNO and 3M; witch flounder (*Glyptocephalus cynoglossus*) in divisions 3L and 3NO; capelin (*Mallotus villosus*) in division 3NO; and shrimp (*Pandalus borealis*) in divisions 3NO and 3M) were continued in NAFO fishing grounds in 2014 (NAFO, 2014a). For 2015, the moratorium on fishing for witch flounder in division 3NO was lifted and a moratorium on fishing for shrimp in division 3L was established; other moratoria remained unchanged (NAFO, 2014a, 2015a).

As the stocks of many species are in a poor state, recovery plans have been established for certain stocks that determine the conditions for the opening of the stocks for commercial fishing and for the careful management of freshly opened stocks. For example, a 15-year recovery plan for Greenland halibut (*Reinhardtius hippoglossoides*) stocks has been implemented since 2003, and a plan for recovery of cod stocks in NAFO division 3NO has been implemented since 2007 (NAFO, 2011a). In addition, a stock recovery plan for American plaice is in place from 2010, and a similar plan is being prepared for witch flounder. Stock recovery plans are also intended to be drawn up for 3LN redfish (*Sebastes* spp), which was reopened for commercial fishing some years ago after a moratorium that lasted from 1998–2009, and 3M cod, which was under a moratorium from 1999–2009 (NAFO, 2012a, 2012b).

The Greenland halibut recovery plan has been successful and fishing quotas were stable during the period 2013–2015 (NAFO, 2013, 2014a). Fishing for witch flounder in division 3NO was prohibited in 1994, but its biomass has been increasing since 2010 and limited fishing activity is allowed again from 2015 (NAFO, 2014b). The biomass of 3LN redfish has also increased, and fishing mortality is not likely to exceed a critical level (NAFO, 2014b, 2015b). Therefore, 3LN redfish fishing quotas have improved considerably: 8% in 2013, 7% in 2014 and 49% in 2015 (Table 2). The quota for 3M cod was increased by 52% in 2013. Quotas for 2014 and 2015 remained on the same level, but are intended to be reduced in the years to come (NAFO, 2014a, 2015a, 2015b). The stocks of yellowtail flounder (*Limanda ferruginea*) in division 3LNO are in a good state and the fishing mortality rate is below a critical level (NAFO, 2015b).

Species are interrelated through dietary relationships. As the biomass of shrimp-eating fish has increased and environmental conditions have probably become less favourable for shrimp, the stock of shrimp in NAFO division 3M is in a poor state. There are no signs of the stock recovering, and therefore the moratorium on commercial fishing for 3M shrimp established in 2011 has not been lifted. In 2015 a moratorium was established on fishing for shrimp in division 3L (NAFO, 2014a). Shrimp fishing in division 3NO is prohibited, as well (NAFO, 2012a, 2014a). Thus, shrimp fishing has been under a moratorium in the entire third division since 2015.

The state of fish stocks in the **NEAFC fishing grounds** is assessed by the ICES. Shrimp is the most important species for Estonia in the North East Atlantic, as it is an unregulated species in the Barents Sea. The largest quotas have been allocated for mackerel and redfish. Fishing opportunities in the North East Atlantic are usually exchanged for fishing opportunities in the North West Atlantic, while the shrimp quota is retained. The shrimp stock continues to be in

Table 2. Estonia's distant-water fishing quotas for 2005–2015, before charter arrangements and quota transfers, in tonnes and fishing days, by fishing ground, and year-on-year changes (%) in 2014 and 2015

Species, scientific name and code	Unit	Fishing ground	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change in quota (%)	
														2014/2013	2015/2014
Shrimp or northern prawn, *Pandalus borealis*, PRA	fishing day	NAFO 3M	1667	1667	1667	1667	1667	834	0	0	0	0	0	0	0
	tonne	NAFO 3L	144	245	245	278	334	334	214	134	96	48	0	–50	–100
Atlantic redfish nei, *Sebastes* spp, RED	tonne	NAFO 3M	1571	1571	1571	1571	1571	1571[1]	1571	1571	1571	1571	1571	0	0
	tonne	NAFO 3LN	0	0	0	0	0	173	297	297	322	346	514	7	49
Northern shortfin squid, *Illex illecebrosus*, SQI	tonne	NAFO 3 and 4	128	128	128	128	128	128	128	128	128	128[6]	128[6]	0	0
Greenland halibut, *Reinhardtius hippoglossoides*, GHL	tonne	NAFO 3LMNO	380	371	321	321	321	321	345	328	312	310	313	–1	1
Raja rays nei, *Rajidae,* SKA	tonne	NAFO 3LNO	546	546	546	546	546	485	485	343	283	283	283	0	0
Atlantic cod, *Gadus morhua*, COD	tonne	NAFO 3M	0	0	0	0	0	61	111	103	157	161	153	3	–5
Mackerel, *Scomber scombrus*, MAC	tonne	NEAFC	115	119	135	124	165	107	172	137	128	163	223	27	37
Roundnose grenadier, *Coryphaenoides rupestris*, RNG	tonne	NEAFC	77	77	67	67	57	49	43	38	63	63	59	0	–6
Black scabbardfish, *Aphanopus carbo*, BSF	tonne	NEAFC	17	17	17	17	15	14	13	12	17	22	20	29	–9
Dogfish shark nei, *Squalidae* spp, DGX	tonne	NEAFC	10	10	4	2	1[2]	0[3]	0[4]	0	0	0	0	0	0
Blue ling, *Molva dypterygia*, BLI	tonne	NEAFC	5	5	4	3	3	3	5	3	4	4	8	0	100
Atlantic redfish nei, *Sebastes* spp, RED	tonne	NEAFC	344	284	210	210	210	210	177	149[4]	121[4]	93[5]	44[5]	–23	–53
Greenland halibut, *Reinhardtius hippoglossoides*, GHL	tonne	NEAFC	10	8	6	6	4	3	2	2	16	11	17	–31	55
Raja rays nei, *Rajidae,* SKA[5] / skates and rays, *Rajiformes*, SRX	tonne	NEAFC					8	7	6	5	5	4	4	–20	0
Shrimp or northern prawn, *Pandalus borealis*, PRA	fishing day	Svalbard	377	377	377	377	377	377	377	377	377	377	377		
Total	tonne		**3347**	**3381**	**3254**	**3273**	**3740**	**3843**	**3946**	**3627**	**3600**	**3584**	**3714**		
	fishing day		**2044**	**2044**	**2044**	**2044**	**2044**	**1211**	**377**	**377**	**377**	**377**	**377**		
Change in tonne quotas from 2014	%		**–7**	**–6**	**–9**	**–9**	**4**	**7**	**10**	**1**	**<1**	**0**	**4**		

[1] Estonia's actual quota was 841 tonnes, as the catches in 2009 exceeded the permitted quantity and the overfished quantity was counted against the quota for 2010.
[2] Exclusively for by-catches. No directed fishing for deep-sea shark is permitted.
[3] By-catches are permitted to up to 10% of the quotas for 2009.
[4] By-catches are permitted to up to 3% of the quotas for 2009.
[5] Fishing permitted only from 10 May until 1 July 2015.
[6] Fishing permitted from 1 July to 31 December 2014 and 2015.

Sources: MoE, Regulations of the Council of the European Union (EC) No. 1359/2008, 43/2009 and (EU) No. 53/2010, 1225/2010, 57/2011, 43/2012, 44/2012, 1262/2012, 39/2013, 40/2013, 297/2013, 43/2014, 1367/2014, 2015/104.

good condition in the North East Atlantic fishing grounds and is not threatened by current catches. However, some vessels find fishing for this stock unattractive due to area closures intended to protect young fish and due the movement of shrimp away from the traditional fishing grounds, forcing the vessels to sail long distances without fishing. Stock indicators have not changed a great deal – the fishing mortality rate is low and stable, the biomass index also remains stable and close to the mean value of historical biomass levels, while the recruitment index has varied from 2004–2015 with no specific trend (NIPAG, 2015).

Assessment and scientific advice concerning stocks in NAFO fishing grounds are available on the website of NAFO (www.nafo.int). Materials on NEAFC fishing grounds can be found on the websites of NEAFC (www.neafc.org) and ICES (www.ices.dk).

Estonian vessels can fish for unregulated species in international waters outside of the closed areas. Thus it is possible to fish in, e.g. the South West Atlantic, where there is no regional fisheries management organisation (RFMO) and where no quotas have been allocated to Estonia. Estonian vessels used this opportunity in 2005, 2006, 2010, 2011 and 2012, but not since 2013.

Catches

From 2005–2015, distant-water fishing vessels flying the flag of Estonia only fished in the Atlantic Ocean, with shrimp and various fish being the target species. In 2014 and 2015, shrimp produced the biggest catches, followed by redfish and American plaice in 2014 and by redfish and Atlantic cod in 2015 (Figure 2, Table 3). Catches of cod grew from 60 tonnes in 2012 to 681 tonnes in 2015 in the North West Atlantic and from 225 tonnes to 308 tonnes in the North East Atlantic, which shows an improvement in the cod stocks in these areas. In this area Estonia generally only uses shrimp, cod and American plaice quotas, the latter two species being caught as by-catches in shrimp fishing (Table 4). Atlantic mackerel was no longer fished in 2014 and 2015.

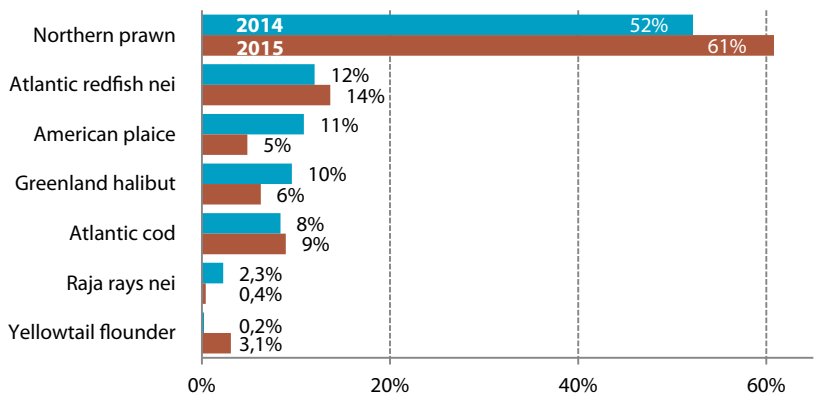


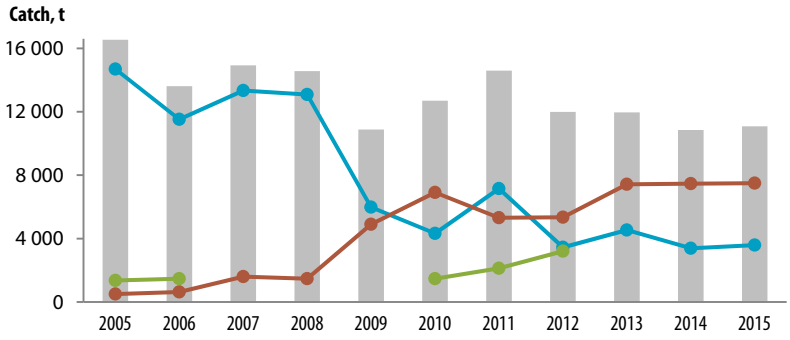
Figure 2. **Proportion (%) of catch by main species in distant-water fishery sector in 2014 and 2015**
Source: MoRA

Table 3. Estonia's distant-water fishery catches (t) by species, 2005–2015

Species and scientific name	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Aesop shrimp, *Pandalus montagui*							858				
American anglerfish, *Lophius americanus*									<1	27	2
Blue antimora, *Antimora rostrata*			3								
Argentine shortfin squid, *Illex argentinus*	581	499				42	329	1 248			
Argentine hake, *Merluccius hubbsi*		700				1 125	1 395	1 571			
Patagonian grenadier, *Macruronus magellanicus*		73				135	92	<1			
Greenland shark, *Somniosus microcephalus*	9										
Baird's slickhead, *Alepocephalus bairdii*	64	158	9								
Rabbit fish, *Chimaera monstrosa*	4	2									
Atlantic halibut, *Hippoglossus hippoglossus*				3		3	3	10	11	25	22
American plaice, *Hippoglossoides platessoides*	47	34	33	77	29	9	36	37	226	1 177	537
Splendid alfonsino, *Beryx splendens*		4									
Atlantic mackerel, *Scomber scombrus*									1 367		
Atlantic wolffish, *Anarhichas lupus*				12	5						
Northern prawn, *Pandalus borealis*	12 381	9 242	12 076	12 742	8 587	9 037	9 919	7 576	6 653	5 665	6 740
Silver hake, *Merluccius bilinearis*								<1		151	114
Roundnose grenadier, *Coryphaenoides rupestris*	154	104	140							4	
Mediterranean slimehead, *Hoplostethus mediterraneus*		1									
Haddock, *Melanogrammus aeglefinus*	<1							8	19	79	30
Cusk-eels nei, *Genypterus* spp	17	1									
Golden redfish, *Sebastes marinus*		104									
Alfonsinos nei, *Beryx* spp			1								
Pink cusk-eel, *Genypterus blacodes*		22					127	90			
Southern blue whiting, *Micromesistius australis*							<1	<1			
Northern shortfin squid, *Illex illecebrosus*		24			5	1		<1			
Atlantic redfish nei, *Sebastes* spp	1 111	1 156	1 040	1 003	1 748	1 340	1 075	368	1 573	1 300	1 512
Wolffish nei, *Anarhichas* spp	74	63	10	2					1	14	1
Lumpfish, *Cyclopterus lumpus*									<1		
Hakes nei, *Merluccius* spp	700	6									
Black cardinal fish, *Epigonus telescopus*		<1									
Black dogfish, *Centroscyllium fabricii*		4	6								
Beaked redfish, *Sebastes mentella*		396	684								
Antarctic rockcods, noties nei, *Nototheniidae*	56	127				58	76	57			
Dogfish shark nei, *Squalidae*	6		3	3		<1					
Patagonian squid, *Loligo gahi*						44	69	175			
Patagonian toothfish, *Dissostichus eleginoides*		<1									
Tadpole codling, *Salilota australis*		32				1	2	1			
Longnose velvet dogfish, *Centroscymnus crepidater*			3								
Witch flounder, *Glyptocephalus cynoglossus*	31	28	24	38	8	11	14	33	16	40	22
Portuguese dogfish, *Centroscymnus coelolpis*	7	7									
Red hake, *Urophycis chuss*	47	26	2			19					
Roughhead grenadier, *Macrourus berglax*	103	95	69	132	41	93	116	72	110	136	26
Raja rays nei, *Raja* spp	62	258	366	123	29	228	82	161	155	246	47
Rays, stingrays, mantas nei, *Rajiformes*	479										
Yellowtail flounder, *Limanda ferruginea*	20	6	25	33		4	13	31	350	24	342
Blue ling, *Molva dypterygia*	5	3	7								
Black scabbardfish, *Aphanopus carbo*	11	6	7								
Greenland halibut, *Reinhardtius hippoglossoides*	534	373	365	299	300	441	279	266	727	1 037	694
Threebearded rockling, *Gaidropsarus ensis*					1	3					
Lanternshark, *Etmopterus* spp										2	
Cod, *Gadus morhua*	33	52	25	73	128	93	105	285	730	907	989
Spotted wolffish, *Anarhichas minor*						12			16	14	7
White hake, *Urophycis tenuis*	1		32	19				<1	<1	2	
Sharks, rays, skates, etc. nei, *Elasmobranchii*		11									
Total	**16539**	**13617**	**14930**	**14559**	**10881**	**12699**	**14590**	**11990**	**11956**	**10850**	**11084**

Source: MoRA, MoE

Catches from the North West Atlantic area have changed the most: around 15,000 tonnes in 2005, relatively persistently around 5100 tonnes in the period 2009–2013, but 3500 tonnes in both 2014 and 2015 (Figure 3, Table 4). The quantities caught in the North East Atlantic increased from 2005–2015, reaching more or less the same levels as in the North West Atlantic in the period 2009–2011, but were more than twice as high in 2014 and 2015. The North East



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	16 539	13 617	14 930	14 559	10 881	12 699	14 590	11 990	11 956	10 850	11 084
North West Atlantic	14 690	11 515	13 332	13 086	5 979	4 329	7 146	3 444	4 533	3 387	3 586
North East Atlantic	494	633	1 598	1 473	4 903	6 906	5 318	5 340	7 422	7 463	7 498
South West Atlantic	1 355	1 469				1 464	2 126	3 206			

Figure 3. Estonia's total distant-water fishery catches (t) by fishing ground, 2005–2015
Source: MoRA

Table 4. Estonia's distant-water fishery catches (t) by fishing ground and species, 2014 and 2015

Species, scientific name and code	North West Atlantic		North East Atlantic		Total	
	2014	2015	2014	2015	2014	2015
Atlantic cod, *Gadus morhua,* COD	657.5	680.7	249.3	308.4	906.8	989.0
American anglerfish, *Lophius americanus*, ANG	27.0	1.7			27.0	1.7
Spotted wolffish, *Spotted wolffish,* CAS	8.5	2.2	5.8	4.4	14.3	6.5
Wolffish nei, *Anarhichas* spp, CAT		0.9	14.1		14.1	0.9
Greenland halibut, *Reinhardtius hippoglossoides,* GHL	607.9	693.9	429.3		1 037.2	693.9
Haddock, *Melanogrammus aeglefinus,* HAD	78.9	29.6			78.9	29.6
White hake, *Urophycis tenuis,* HKW	1.6				1.6	0.0
Atlantic halibut, *Hippoglossus hippoglossus,* HAL	25.0	21.9			25.0	21.9
Silver hake, *Merluccius bilinearis,* HKS	150.9	114.3			150.9	114.3
Roundnose grenadier, *Coryphaenoides rupestris,* RNG			3.8		3.8	0.0
Raja rays nei, *Raja* spp, SKA	246.0	46.6			246.0	46.6
Northern prawn, *Pandalus borealis,* PRA	7.3		5 657.8	6 739.7	5 665.1	6 739.7
American plaice, *Hippoglossoides platessoides,* PLA	75.5	91.1	1 101.1	445.5	1 176.7	536.6
Atlantic redfish nei, *Sebastes* spp, RED	1 299.9	1 512.2	0.2		1 300.1	1 512.2
Lanternshark, *Etmopterus* spp, SHL			1.9		1.9	0.0
Witch flounder, *Glyptocephalus cynoglossus,* WIT	40.4	22.3			40.4	22.3
Yellowtail flounder, *Limanda ferruginea,* YEL	24.2	342.2			24.2	342.2
Roughhead grenadier, *Macrourus berglax,* RHG	136.4	26.0			136.4	26.0
Total	**3 387.0**	**3 585.7**	**7 463.3**	**7 497.9**	**10 850.3**	**11 083.6**

Source: MoRA

Atlantic fishing grounds are thus currently important to Estonian distant-water fishers. Catches taken in the South West Atlantic grew from 2010–2012, but our vessels have not been fishing there since 2013. Estonian vessels' total catches for 2014 and 2015 were at the average level of the period 2009–2013. Catches are usually landed in ports of Canada, Iceland, Spain and Norway.

Outlook

By 2015, the state of shrimp stock in the third division of the North West Atlantic warranted a moratorium, and shrimp fishing is prohibited in that fishing ground from said year. Estonian shrimp-fishers are increasingly shifting their fishing efforts to the Barents Sea. This is also demonstrated by the fact that in 2013 Estonian distant-water fishers obtained a certificate for shrimp fishing in the Barents Sea from the Marine Stewardship Council, having successfully completed a full assessment that lasted around ten months. This certificate will probably be needed for other species as well, and it enhances the competitiveness of the sector on the global market. In the North West Atlantic fishing grounds some of the fish stocks are showing signs of recovery, which will allow the relevant quotas to be increased. The South West Atlantic fishing grounds will offer fishing opportunities should these opportunities shrink in the North West and North East Atlantic.

Baltic Sea fisheries

COASTAL FISHERY IN THE BALTIC SEA

From 2010–2013, the number of coastal fishermen fishing in the Baltic Sea remained broadly at the same level, standing at between 1808 and 1865. In 2014 and 2015, their numbers were 2156 and 2075, respectively. This suggests that while the number of coastal fishermen declined during the period of booming economic growth as fishermen found better-paid jobs, it started to increase again when the recession hit (Figure 4). The number of coastal fishermen has grown in all counties (Table 5), but instead of the emergence of new fishermen this probably means that holders of a fisherman's professional certificate had themselves entered on fisherman's fishing permits. It is estimated that fishing is the main source of income for no more than 10% of coastal fishermen.

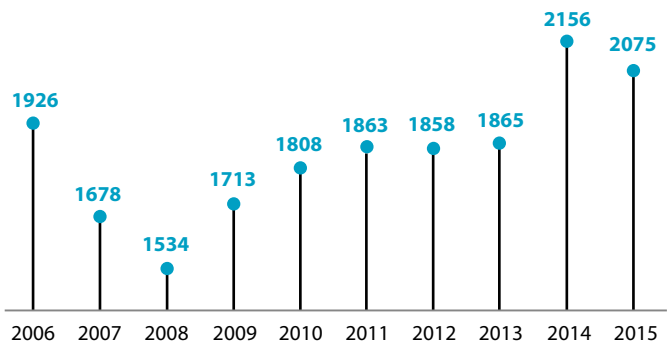


Figure 4. Number of coastal fishermen fishing in Baltic Sea, 2006–2015
Sources: MoE, MoRA

Tabel 5. Number of coastal fishermen entered on fishing permits by county, 2013–2015

County	2013	2014	2015
Ida-Viru County (excl. Lake Peipsi)	125	145	138
Lääne-Viru County	135	161	154
Harju County	306	354	335
Hiiu County	291	346	338
Lääne County (incl. Vormsi)	261	308	295
Saare County (incl. Ruhnu)	409	483	464
Pärnu County (incl. Kihnu and Manija)	380	434	409
Total	**1865**	**2156**	**2075**

Source: Fisheries Information System of the MoRA

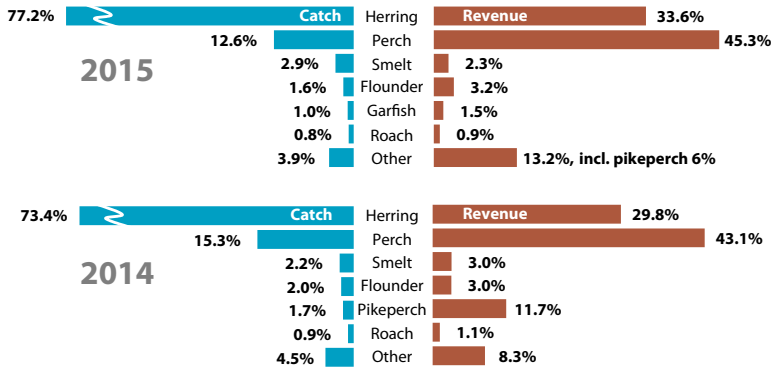


Figure 5. Proportion (%) of catch and revenue in coastal fishing by species in 2014 and 2015
Source: MoRA

According to the Fisheries Information System of the MoRA, the number of vessels with a length of less than 12 metres used by our coastal fishermen in the Baltic Sea amounted to 1500 in 2014 and 1507 in 2015. The number of registered vessels has grown steadily in the past four years.

As in previous years, the biggest catches taken in 2014 and 2015 in Estonian coastal fishery were those of herring, followed by perch, smelt and flounder. Fifth place in terms of the catch volume was held by pikeperch in 2014 and by garfish in 2015 (Figure 5). The pikeperch catch increased from around 122 tonnes in 2013 to around 173 tonnes in 2014, but then dropped to around 83 tonnes in 2015 (Table 6). Coastal fishermen caught a total of around 10,300 tonnes of fish in 2014, which is more than in 2013. The total catch for 2015 was significantly higher – around 12,000 tonnes. Compared to 2013, perch and herring catches grew the most.

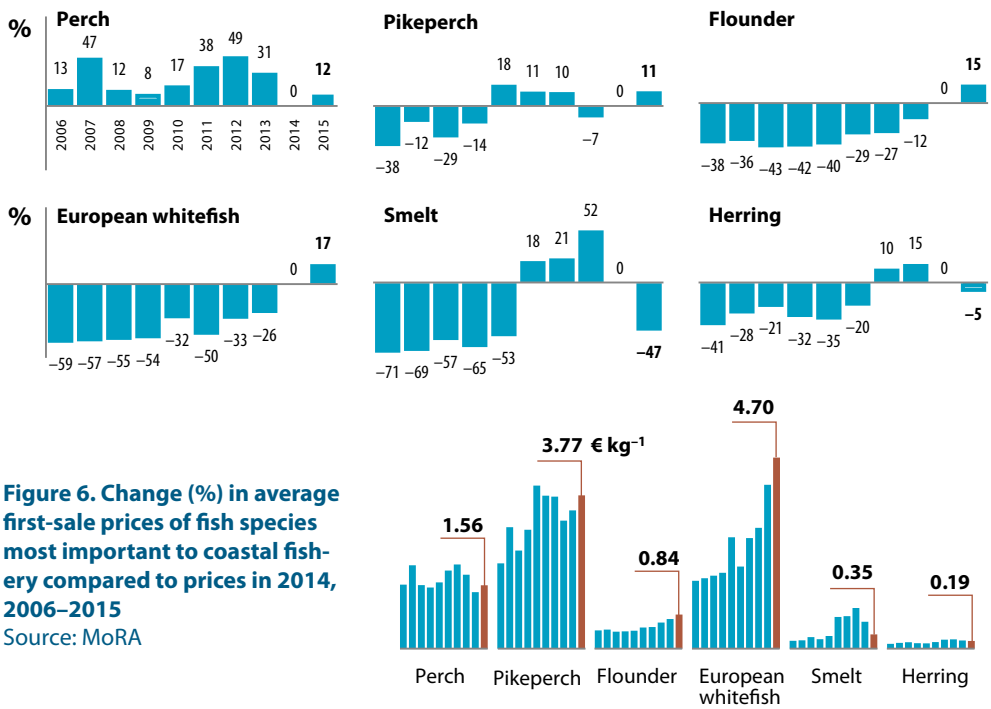


Figure 6. Change (%) in average first-sale prices of fish species most important to coastal fishery compared to prices in 2014, 2006–2015
Source: MoRA

Table 6. Coastal fishing catches (t) and proportion (%) of total catch from Baltic Sea, 2010–2015, by species

Liik	2010		2011		2012		2013		2014		2015	
	Catch	%	Catch	%	Catch	%	Catch	%	Catch	%	Catch	%
Perch	878.76	7.8	795.84	7.7	549.85	6.3	1 216.99	12.6	1 566.68	15.3	1 522.82	12.6
Eel	3.45	<0.1	2.21	<0.1	1.91	0.0	1.65	<0.1	1.06	<0.1	0.84	<0.1
Atlantic sturgeon									<0.01	<0.1		
Eelpout	0.81	<0.1	0.09	<0.1	0.39	0.0	1.15	<0.1	0.18	<0.1	0.77	<0.1
Turbot	0.18	<0.1	0.10	<0.1	0.08	0.00	0.04	<0.1	0.10	<0.1	0.05	<0.1
Atlantic mackerel	<0.01	<0.1	0.00	<0.1	0.00	0.0	<0.01	<0.1			<0.01	<0.1
Pike	22.77	0.2	32.07	0.3	35.38	0.4	65.90	0.7	65.44	0.6	51.79	0.4
Gibel carp	51.32	0.5	47.64	0.5	59.66	0.7	56.54	0.6	87.75	0.9	70.00	0.6
Lamprey	0.57	<0.1	0.89	<0.1	0.36	0.0	1.00	<0.1	0.31	<0.1	0.21	<0.1
Carp	0.14	<0.1	0.08	<0.1	0.12	0.0	0.30	<0.1	0.20	<0.1	0.38	<0.1
Ruff	32.36	0.3	60.80	0.6	51.18	0.6	38.76	0.4	35.30	0.3	24.17	0.2
Sprat	0.15	<0.1	0.64	<0.1	0.14	0.0	1.18	<0.1	0.58	<0.1	0.01	<0.1
Bighead carp											0.01	<0.1
Pikeperch	73.36	0.7	110.52	1.1	146.83	1.7	122.16	1.3	173.27	1.7	83.02	0.7
Bream	3.58	<0.1	7.55	0.1	11.10	0.1	8.77	0.1	12.93	0.1	8.23	0.1
Flounder	269.77	2.4	244.99	2.4	212.93	2.4	250.03	2.6	204.10	2.0	198.38	1.6
Tench	2.26	<0.1	2.96	<0.1	3.32	0.0	4.00	<0.1	6.88	0.1	5.02	<0.1
Burbot	1.30	<0.1	1.62	<0.1	1.66	0.0	2.80	<0.1	4.95	<0.1	5.09	<0.1
Salmon	3.80	<0.1	4.42	<0.1	5.31	0.1	6.82	0.1	5.22	0.1	5.59	<0.1
Baltic prawn	0.03	<0.1	0.00	<0.1								
Sea trout	12.21	0.1	13.40	0.1	17.14	0.2	14.67	0.2	14.59	0.1	16.14	0.1
Four-horned sculpin	0.03	<0.1	0.02	<0.1	0.07	0.0	0.03	<0.1	0.04	<0.1	0.29	<0.1
European whitefish	15.54	0.1	14.62	0.1	20.60	0.2	25.76	0.3	25.86	0.3	19.49	0.2
Sea lamprey	0.03	<0.1	0.00	<0.1	0.00	0.0						
Smelt	417.31	3.7	120.36	1.2	298.34	3.4	506.41	5.2	228.68	2.2	346.82	2.9
Lumpfish	<0.01	<0.1	0.00	<0.1	0.00	0.0	<0.01	<0.1				
Sabre carp	<0.01	<0.1	0.00	<0.1	0.00	0.0						
Silver bream	21.60	0.2	22.53	0.2	33.25	0.4	30.91	0.4	30.44	0.3	29.77	0.2
Thicklip grey mullet							<0.01	<0.1				
Stickleback	0.02	<0.1	0.04	<0.1	0.00	0.0						
Rudd	1.19	<0.1	4.86	<0.1	1.62	0.0	1.76	<0.1	2.67	<0.1	2.22	<0.1
Herring	9 236.65	82.2	8 597.27	83.1	7 088.92	81.2	7 087.77	73.7	7 535.63	73.4	9 290.67	77.2
Ide	6.30	0.1	6.13	0.1	4.47	0.1	7.05	0.1	11.96	0.1	15.97	0.1
Roach	66.48	0.6	83.24	0.8	77.80	0.9	71.08	0.7	93.30	0.9	95.06	0.8
Dwarf mud crab											0.01	<0.1
Dace	<0.01	<0.1	0.02	<0.1	0.00	0.0	<0.01	<0.1			0.06	<0.1
European chub											0.05	<0.1
Cod (Atlantic cod)	3.69	<0.1	3.50	<0.1	3.41	0.0	5.26	0.1	7.02	0.1	3.92	<0.1
Garfish	86.05	0.8	117.74	1.1	25.04	0.3	19.14	0.2	43.84	0.4	115.94	1.0
Bleak	0.11	<0.1	0.06	<0.1	0.34	0.0	0.10	<0.1	0.15	<0.1	1.36	<0.1
Rainbow trout	0.09	<0.1	0.14	<0.1	0.07	0.0	0.19	<0.1	0.16	<0.1	0.06	<0.1
Vimba bream	29.82	0.3	50.08	0.5	53.26	0.6	56.41	0.6	83.97	0.8	92.93	0.8
Twaite shad	0.03	<0.1	0.00	<0.1	0.01	0.0			<0.01	<0.1	<0.01	<0.1
Lesser sand eel							0.74	<0.1	0.04	<0.1	0.33	<0.1
Round goby	1.12	<0.1	4.05	<0.1	16.91	0.2	9.08	0.1	19.18	0.2	30.63	0.3
Total	**11 242.89**	**100.0**	**10 350.50**	**100.0**	**8 721.48**	**100.0**	**9 614.47**	**100.0**	**10 262.46**	**100.0**	**12 038.26**	**100.0**

Source: MoRA

As in 2013, coastal fishermen earned the most from perch fishing: around 2.18 million euros in 2014 and around 2.38 million euros in 2015 (Table 7). In terms of profitability, perch was followed by herring (around 1.5 million euros in 2014 and around 1.8 million euros in 2015) and pikeperch (around 0.59 and 0.31 million euros, respectively). Sales of smelt generated around 0.15 million euros in 2014 and around 0.12 million euros in 2015; the amounts received for flounder were around 0.15 and 0.17 million euros, respectively.

Based on first-sale prices, the sales revenues of coastal fishermen are estimated to have amounted to 5.0 million euros in 2014 and 5.2 million euros

Table 7. Value (10^3 euros) of coastal fishing catches from Baltic Sea and proportion (%) of total value from 2011–2015, by species

Species	2011		2012		2013		2014		2015	
	Value	%	Value	%	Value	%	Value	%	Value	%
Perch	1 528.02	39.5	1 138.04	29.0	2 214.93	41.8	2 177.68	43.1	2 375.59	45.3
Eel	14.48	0.4	14.02	0.4	0.19	<0.1	7.82	0.2	6.18	0.1
Eelpout	0.01	<0.1	0.08	<0.1	4.84	0.1	0.09	<0.1	0.09	<0.1
Turbot			0.04	<0.1			0.07	<0.1	0.03	<0.1
Pike	42.65	1.1	50.63	1.3	7.35	0.1	78.53	1.6	77.17	1.5
Gibel carp	5.24	0.1	8.03	0.2	28.21	0.5	14.04	0.3	16.10	0.3
Lamprey	2.62	0.1	1.32	<0.1			1.41	<0.1	1.16	<0.1
Carp	0.09	<0.1	0.10	<0.1	0.26	<0.1	0.28	<0.1	0.34	<0.1
Ruff	9.73	0.3	10.24	0.3	81.06	1.5	4.59	0.1	4.59	0.1
Sprat	0.11	<0.1	0.03	<0.1	0.53	<0.1	0.12	<0.1	0.06	<0.1
Pikeperch	415.54	10.7	549.10	14.0	384.79	7.3	589.13	11.7	312.98	6.0
Bream	4.23	0.1	6.44	0.2	4.82	0.1	9.44	0.2	5.68	0.1
Flounder	127.39	3.3	112.83	2.9	160.02	3.0	148.99	3.0	166.64	3.2
Tench	3.23	0.1	3.35	0.1	5.53	0.1	8.81	0.2	7.23	0.1
Burbot	1.23	<0.1	1.28	<0.1	13.83	0.3	4.31	0.1	4.89	0.1
Salmon	17.47	0.5	21.82	0.6	4.37	0.1	22.96	0.5	27.77	0.5
Sea trout	40.20	1.0	61.18	1.6	58.52	1.1	41.88	0.8	79.73	1.5
Four-horned sculpin					<0.01	<0.1				
European whitefish	29.54	0.8	55.56	1.4	27.36	0.5	104.20	2.1	91.60	1.7
Smelt	93.88	2.4	238.63	6.1	506.41	9.6	150.93	3.0	121.39	2.3
Silver bream	2.70	0.1	3.66	0.1	3.09	0.1	3.96	0.1	3.28	0.1
Stickleback					<0.01	<0.1				
Rudd	0.29	<0.1	0.10	<0.1	2.55	<0.1	0.29	<0.1	0.22	<0.1
Herring	1 375.56	35.6	1 559.56	39.7	1 630.19	30.8	1 507.13	29.8	1 765.23	33.6
Ide	3.92	0.1	2.14	0.1	30.03	0.6	7.89	0.2	7.35	0.1
Roach	39.96	1.0	38.90	1.0	39.09	0.7	56.91	1.1	49.43	0.9
European chub									0.03	<0.1
Atlantic cod	3.60	0.1	3.24	0.1	5.41	0.1	8.77	0.2	2.67	0.1
Garfish	83.60	2.2	22.28	0.6	76.50	1.4	50.86	1.0	78.84	1.5
Bleak			0.03	<0.1					0.14	<0.1
Vimba bream	21.54	0.6	22.90	0.6	7.36	0.1	44.50	0.9	39.96	0.8
Twaite shad							<0.01	<0.1	<0.01	<0.1
Round goby	1.58	<0.1	3.38	0.1	1.27	<0.1	3.84	0.1	1.84	<0.1
Total	**3 868.42**	**100.0**	**3 928.91**	**100.0**	**5 298.78**	**100.0**	**5 049.43**	**100.0**	**5 248.18**	**100.0**

Source: MoRA

in 2015. Compared to 5.3 million euros earned in 2013, the sales revenues of fishermen, calculated on the basis of average first-sale prices, have declined, because the first-sale prices of the most lucrative species (perch and herring) have decreased (Table 8).

A noticeable increase in the quantities caught has not offset the reduction in revenues caused by declining first-sale prices. The average first-sale prices of the key species, as published in the official publication *Ametlikud Teadaanded*, changed from 2014 as follows: perch +12%; pikeperch +11%; smelt –47%; flounder +15%; and herring –5% (Table 8, Figure 6).

Table 8. Average first-sale prices of fish (€ kg^{-1}), 2006–2015

Species	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Perch	1.58	2.05	1.56	1.50	1.63	1.92	2.07	1.82	1.39	1.56
Eel	5.92	5.68	5.58	5.14	5.72	6.56	7.35	8.36	7.41	7.34
Eelpout	0.06		0.13		0.36	0.14	0.21	0.46	0.50	0.12
Pike	0.84	0.92	0.98	1.05	1.05	1.33	1.43	1.23	1.20	1.49
Gibel carp	0.14	0.12	0.14	0.12	0.11	0.11	0.12	0.13	0.16	0.23
Lamprey	1.95	1.96	1.88	1.76	1.68	2.96	3.64	4.86	4.63	5.39
Carp	0.40	0.31	0.27	0.74	0.94	1.11	0.78	0.84	1.38	0.89
Ruff	0.06	0.10	0.08	0.09	0.13	0.16	0.20	0.19	0.13	0.19
Sprat	0.12	0.15	0.17	0.15	0.13	0.17	0.20	0.22	0.21	0.33
Crucian carp	0.11	0.04		0.32	0.30	0.25	0.21	0.24	0.27	0.33
Pikeperch	2.10	2.99	2.41	2.92	4.01	3.76	3.74	3.15	3.40	3.77
Bream	0.35	0.38	0.40	0.49	0.45	0.56	0.58	0.55	0.73	0.69
Flounder	0.45	0.47	0.42	0.42	0.44	0.52	0.53	0.64	0.73	0.84
Tench	0.73	0.76	0.95	0.80	0.86	1.09	1.01	1.38	1.28	1.44
Burbot	0.55	0.52	0.56	0.61	0.63	0.76	0.77	0.91	0.87	0.96
Salmon	2.79	1.35	3.29	1.64	2.63	3.95	4.09	4.40	4.40	4.97
Baltic prawn				2.36						
Sea trout	1.87	2.55	2.05	1.47	1.68	3.00	3.54	3.99	2.87	4.94
Four-horned sculpin								0.25		
European whitefish	1.67	1.73	1.79	1.87	2.74	2.02	2.72	2.97	4.03	4.70
Smelt	0.19	0.20	0.28	0.23	0.31	0.78	0.80	1.00	0.66	0.35
Silver bream	0.07	0.07	0.07	0.07	0.09	0.12	0.11	0.10	0.13	0.11
Stickleback									0.24	
Lake Peipsi whitefish	1.31	0.81	0.99	1.04	0.94	1.00	1.92	2.12	1.29	1.00
Lake Peipsi (dwarf) smelt	0.41								0.40	
Rudd	0.11	0.03	0.13	0.07	0.04	0.06	0.06	0.11	0.11	0.10
Herring	0.12	0.14	0.16	0.14	0.13	0.16	0.22	0.23	0.20	0.19
Vendace		1.04	1.01	1.43	2.88		3.44	3.32	3.33	3.42
Ide	0.28	0.40	0.39	0.42	0.46	0.64	0.48	0.62	0.66	0.46
Roach	0.16	0.28	0.39	0.39	0.44	0.48	0.50	0.55	0.61	0.52
European chub				0.19				0.30		0.50
Atlantic cod	1.43	0.80	0.55	1.10	0.92	1.03	0.95	1.03	1.25	0.68
Garfish	0.28	0.37	0.38	0.43	0.47	0.71	0.89	1.43	1.16	0.68
Bleak			0.13	0.03	0.13		0.10			0.10
Rainbow trout				1.92						
Vimba bream	0.20	0.28	0.23	0.23	0.38	0.43	0.43	0.50	0.53	0.43
Round goby		0.20	0.25	0.34	0.32	0.39	0.20	0.14	0.20	0.06

Source: official publication *Ametlikud Teadaanded*

Dynamics of coastal fishing catches in different parts of the Baltic Sea

Gulf of Finland

Gill nets and trap nets are the main fishing gear in coastal fishing. The biggest catches taken from the Gulf of Finland with these nets are those of herring, but also of flounder, perch, smelt, European whitefish, sea trout, Gibel carp, garfish, round goby and salmon. Among key species, the catch of herring grew significantly and the catch of smelt grew a little, while the catches of perch and European whitefish declined considerably and the catch of flounder declined slightly in 2014 and 2015 in comparison with previous years (Table 9). While in 2013 and 2014 the quantities of garfish caught were small due to specific features of fishery management (garfish cannot be caught in the most appropriate time, as pound net fishing is closed when the herring quota is used up early), the catch of that species reached its normal level in 2015.

Herring produced the biggest sales revenues in the Gulf of Finland in both 2014 and 2015 (around 250,700 and 314,700 euros, respectively), which exceeded the revenue for 2013 (around 226,000 euros). While perch held second place in 2014 in terms of profitability (around 60,000 euros), it dropped to fifth place in 2015 (around 28,200 euros) and its place was taken by sea trout (around 56,400 euros), which, in turn, held fifth place in 2014 (around 28,000 euros). Flounder held third place in terms of sales revenue in both years (around 47,900 euros in 2014 and around 53,600 euros in 2015). Flounder was followed by European whitefish (around 44,500 and 33,000 euros), salmon (around 16,400 and 19,600 euros) and smelt (around 11,700 euros and 7000 euros).

Herring is caught in the Gulf of Finland mainly using trap nets. Herring catches were bigger from 2009–2015 than in 2007–2008. The highest catch of the period was taken in 2015 (1657 tonnes); the catches of 2013 and 2014 amounted to 983 and 1254 tonnes, respectively. **Flounder** is usually caught using gill nets in the western part of the gulf. Catches of flounder taken in 2014 and 2015 were the lowest of the aforementioned period (66 and 64 tonnes, respectively), and flounder stock is not expected to grow in the coming years. **Perch** is mostly caught using gill nets, with the proportion of trap net catches varying from year to year. In 2013 the catch of perch, which had been declining since 2009, exceeded the catch taken in the previous year by more than twice, but dropped to below the average of the data series in 2014 (43 tonnes). The catch taken in 2015, in turn, was more than twice lower than the catch of (18 tonnes). **European whitefish** is caught in the Gulf of Finland mainly with gill nets. Whitefish catches were large in 2007, 2008 and 2014 (11 tonnes), but the catch taken in 2015 (7 tonnes) was the lowest of the data series. **Smelt** is generally also caught using gill nets. Catches have increased in four consecutive years (2012–2015) and, following the recession of 2010–2012, exceeded the average of the period 2007–2015 three years in a row. Smelt catches amounted to 18 tonnes in 2014 and 20 tonnes in 2015. **Sea trout** and **salmon** are mainly caught with gill nets as well. Compared to the catch figures for 2014 (10 tonnes of sea trout and 4 tonnes of salmon), catches of these valuable species were a little higher in 2015 (11 and 4 tonnes, respectively), exceeding the average of the period under review. The catch of

round goby, an invasive alien species, decreased for the first time in 2013 almost two-fold after a consistent and rapid increase in preceding years, grew again in 2014, while not exceeding the record catch of 2012, but declined in 2015 yet again. Whereas in 2012 round goby held fourth place in terms of catch volume in the Gulf of Finland, it fell to sixth in the catch statistics of 2015. Then again, the catch statistics of round goby is not indicative of the abundance of this species in the sea, because (due to its low sales value) fishermen have learned how to reduce the quantity of round goby that get caught in fishing gear.

In summary, the total catch taken in 2014 (1437 tonnes) exceeded the catches of previous years and increased further in 2015 (1815 tonnes). It exceeded the average catch of the period 2007–2014, but, excluding herring as the mass fish, it was the lowest of the period as far as all the other species go.

High seas

Fishing gear used in coastal regions towards the Central Baltic near Saaremaa and Hiiumaa includes gill nets, trap nets, longlines and seine nets. The species caught in 2015 were dominated by flounder, followed by perch, herring, garfish, roach, ide and European whitefish (Table 10). While the catch of flounder was the highest in each year during the period 2007–2015, the ranking of other species has varied. Flounder also produced the biggest sales revenues for fishermen in both 2014 and 2015 (around 81,400 and 85,200 euros, respectively), followed by perch (around 32,300 and 18,800 euros), European whitefish (around 18,500 and 17,700 euros) and sea trout (around 9400 and 14,700 euros). Sales revenues generated by other species were rather modest in both years.

In **flounder** fishing the main fishing gear included gill nets (62% of the catch), seine nets (31%) and trap nets (7%) over the last nine years. All in all, flounder catch has shrunk during that period. Having risen above the average of the period in 2013, the catch dropped to the lowest levels of the period in 2014 (112 tonnes) and 2015 (101 tonnes). Until 2010, the second and third positions in terms of catch volume were shared by **garfish** and herring in this area. Both species are mostly caught using trap nets. Garfish catches continue to be low in this part of the sea, although the catch of 2015 (7 tonnes) was more than twice the quantity caught in 2014 (3 tonnes). **Herring** is mainly caught with trap nets, but gill nets are also used and their share is higher in high seas than in coastal waters. Herring catch was the highest of the period in 2014 (18 tonnes), with the quantity taken in 2015 (10 tonnes) being almost two times lower. In terms of catch volume, herring held third place during the period 2013–2015. Among freshwater fish, **perch** continued to be the most important species in terms of catch volume, but the quantity landed in 2015 (12 tonnes) was only around half the catch of 2014 (23 tonnes). Of the record **roach** catch of 2014 (8 tonnes), around a half remained in 2015 (5 tonnes). **Ide** and **round goby** catches were higher in 2015 than in the preceding eight years (4 and 0.1 tonnes in 2014, and 5 and 0.8 tonnes in 2015, respectively). The catch of **European whitefish** declined in 2015 (4 tonnes) in comparison with the preceding year (5 tonnes), but it was still higher than the average of the period under review. Catches of **sea trout** and **salmon** taken in 2015 were at the average level of the data series (3 and 0.6 tonnes, respectively).

In summary, total catches taken in 2014 and 2015 from coastal regions towards the Central Baltic near Saaremaa and Hiiumaa were the lowest of the period under review (2007–2015).

Väinameri Sea

Fishing gear used in the Väinameri Sea includes mostly gill nets and trap nets. The relative importance of longlines in fishery is small; in 2013 and 2014, seine nets were also used to some extent. Catches taken from the Väinameri Sea are dominated by freshwater fish species. In both 2014 and 2015, the biggest catches were produced by perch, followed by herring, pike, Gibel carp and roach (Table 11). The sequence of these species has varied during the years under review.

In recent years, perch has been the most lucrative species in the Väinameri Sea, generating increasingly higher sales revenues each year (around 67,000 euros in 2012, around 277,000 euros in 2013, around 343,000 euros in 2014 and around 353,000 euros in 2015). In terms of sales revenue, pikeperch held second place (around 56,700 euros) and pike held third place (around 54,000 euros) in 2014, while in 2015 the situation was the other way round (pike generated around 55,200 euros and pikeperch generated around 38,900 euros). Herring sales generated around 24,500 euros in 2014 and only around 18,500 euros in 2015, while the revenue figures for European whitefish were around 17,000 euros and 22,400 euros, respectively. These species were followed by roach, garfish and Gibel carp.

Catches of **perch** as the most important coastal fishery species were the largest during the years 2013–2015 in the Väinameri Sea (247 tonnes in 2014 and 227 tonnes in 2015). Perch is fished mainly using gill nets, but in 2014 and 2015 almost equivalent quantities were taken with trap nets. Catches fluctuated strongly from 2007–2015, as fishing for perch relied on just a few year classes. In 2013, the perch catch taken from the Väinameri Sea grew several times, and the figure for 2014 was the highest since the perch stock crisis in the early 1990s. Fishermen were not able to respond to the improvement of the stock in 2013, but in 2014 and 2015 they re-employed the trap nets that had been set aside during the intervening years when the abundance of fish was low. This is why the proportion of trap nets increased in the catches. The official perch catch landed in 2015 was in the same order of magnitude as the record catch of 2014. **Pike** is caught using both trap nets and gill nets, with the proportion of the latter in the catch accounting for around two-thirds. Pike catches taken from the Väinameri Sea increased in five consecutive years (amounting to 45 tonnes in 2014), but the result for 2015 (37 tonnes) was the poorest of the last three years. **Herring** is mostly caught using trap nets. Catches of this species were large in 2009 and 2010, but then decreased continuously during five years. Catches taken in 2014 and 2015 (122 and 97 tonnes, respectively) fell short of the catches taken in the previous six years and were also lower than the average of the period 2007–2015. **Gibel carp** is caught mostly using gill nets. The record catch of the period 2007–2015 was taken in 2014 (40 tonnes); the figure for 2015 was lower (29 tonnes), but still higher than the average of the period under review. The catch of **garfish**, which is caught mostly using trap nets, grew in 2015 (23 tonnes) compared to

2014 (6 tonnes), exceeding the average of the data series after a three-year slump. While the proportion of gill nets has been increasing in **roach** fishing, the use of trap nets has intensified from 2014 on. The roach catch of 2015 (28 tonnes compared to 27 tonnes in 2014) was the best during the years under review. The **eel** catch of 2015 was the lowest in the period under review. The catch of **smelt** was still very poor in 2015, although higher than a year ago. The **pikeperch** catch taken in 2015 was considerably lower than in the previous year, but it exceeded the average of the data series by more than twice. Catches of the more valuable species such as **burbot**, **ide**, **European whitefish** and **vimba bream** were higher in 2015 than in the other years of the period under review.

In summary, catches taken in the Väinameri Sea were much higher during the years 2009–2015 than in 2007 and 2008. Improved catches of, at first, herring and later also of perch and other species contributed to the increase. The best total catch of the period 2007–2015 was taken in 2014, which is the highest even if the catch of herring is not taken into account.

Gulf of Riga

The most common fishing gear used in the Gulf of Riga (except Pärnu Bay) is gill net and trap net, with seine nets and longlines being used to a lesser extent. From 2007–2015, the biggest catches taken in the Gulf of Riga were those of herring, followed by perch, roach, garfish and flounder. In 2015, round goby held fifth place after garfish (Table 12). In 2014 and 2015, the biggest sales revenues were generated for fishermen in the Gulf of Riga by perch (around 276,000 euros in 2014 and around 347,000 euros in 2015), herring (around 170,400 and 166,400 euros) and garfish (around 28,900 and 22,700 euros).

Herring is caught in the Gulf of Riga mostly with trap nets and less so with gill nets. The herring catch of 2015 (876 tonnes) was poorer than the average of 2007–2015, but higher than in the previous two years (852 tonnes in 2014). **Garfish** is caught using the same fishing gear as in the case of herring. The catch of 2015 (33 tonnes) exceeded the average of the data series and increased significantly from the preceding year (25 tonnes in 2014). In addition to stocks, garfish catches taken in coastal waters also depend to a very large extent on the time when the herring quota is exhausted and on the weather conditions prevailing during the fishing period. Gill nets are preferred in **perch** fishing, but considerable quantities are also caught using trap nets. The perch catch of 2015 (222 tonnes) was larger than a year ago (199 tonnes) and reached a record level compared to other years in the period under review. The catch of **roach** (42 tonnes) also set a record in 2015. Unlike in previous years, gill nets were preferred over trap nets in roach fishery from 2012–2015. **Flounder** is mostly caught with trap nets in the Gulf of Riga, but during the last five years of the period under review considerable quantities were also taken with seine nets. The flounder catch of 2015 increased (to 21 tonnes), exceeding the total annual catches of the last nine years. According to official statistics, **ruff** is mainly caught with gill nets, particularly near the island of Kihnu. Trap nets are used on a much smaller scale. The ruff catch of 2015 was meagre (5 tonnes), but even this quantity is probably too high for nets with the permitted mesh size. The by-catch of ruff indicates that gill

nets with a smaller than permitted mesh size are used in perch fishery. The catch of **Gibel carp** was record high in this part of the sea in 2014 (14 tonnes), with the quantity landed in 2015 being a little lower (13 tonnes). The proportions of nets and traps are more or less equal in pike fishery. Pike catches increased in five consecutive years (amounting to 11 tonnes in 2014), but the catch of 2015 (7 tonnes) was the lowest of the last three years, while still exceeding the average of the period. **Vimba bream** is caught mainly with gill nets and on a considerably smaller scale also with trap nets. While the catch of vimba bream was record high in 2013, the catch figures were lower in 2014 and 2015 (6 and 5 tonnes, respectively). **European whitefish** is caught in the Gulf of Riga mostly with gill nets. The catch of this species (2 tonnes) was a little lower in 2015 than a year ago, but still higher than the average of nine years. The catch of **round goby**, which is caught mainly using trap nets, increased by more than twice in 2015 compared to the previous year (from 8 tonnes to 21 tonnes). **Eel** catches are declining steadily in the Gulf of Riga, as in other fishing grounds.

In summary, the total catch taken in the Gulf of Riga in 2015 was lower than the average of the period under review, but the highest of the period excluding herring as the mass fish. Compared to the figure for 2013 (884 tonnes), the total catch was higher in both 2014 and 2015 (1175 and 1259 tonnes, respectively).

Pärnu Bay

Fishing gear used in Pärnu Bay includes gill nets, trap nets, seines and longlines. From 2011–2015 the biggest catches were produced by herring, followed by perch, smelt, pikeperch, vimba bream and ruff (Table 13). In terms of catch volumes and sales revenue, Pärnu Bay is undeniably the most important coastal fishing area in Estonia.

A significant change was introduced to the management of the fisheries of Pärnu Bay in 2015. Namely, competitive fishing was replaced by gear-based quotas in herring fishery with pound nets. Until that year, the entire county (excluding the islands of Kihnu and Manilaid) used a common herring quota, which was exhausted rather quickly – and before herring shoals had reached the historic fishing grounds of all the coastal fishermen. This meant that a large quantity of catches was placed on the raw fish market during a limited period of time, which lowered first-sale prices and degraded the quality of fish. As garfish is caught in the same pound nets that are used for catching herring, it happened in several years that fishery ended – due to the herring quota having been exhausted – before garfish, whose market value is much higher, had even reached Pärnu Bay. As a result, fishermen lost significant revenues. Since the time factor is decisive in competitive fishing, fishermen had to go to sea in any weather, putting their health and lives at risk. They also used all the pound nets indicated in permits. With the new management arrangements, the quota is distributed between fishermen on the basis of fishing gear and fishing grounds. A fisherman is now able to use a lower number of fishing gear, until his personal quota is used up. In 2015, the herring quota of the coastal fishermen of Pärnu County (excluding Kihnu and Manilaid) amounted to 6716 tonnes (88.5% of the quota was used by the end of the year). The quota was distributed equally

between 151 pound nets, i.e. 44.5 tonnes per pound net. The herring quota of Kihnu and Manilaid was 1239 tonnes (and it was fully exhausted), distributed between 24 pound nets.

From 2013 onwards, perch has produced the largest sales revenues for fishermen in Pärnu Bay. These revenues have increased over the years, amounting to around 1,386,000 euros in 2013, around 1,466,400 euros in 2014 and around 1,627,700 euros in 2015. Herring held second place in terms of sales revenue in the last two years (around 1,057,900 euros in 2014 and around 1,263,800 euros in 2015). These species were followed by pikeperch (around 525,900 euros in 2014), whose sales revenues declined sharply in 2015 (to around 270,300 euros), and smelt (around 139,200 euros in 2014 and around 123,500 euros in 2015). In 2014, when individual pound net herring fishery quotas had not been introduced yet, the sales revenues generated by garfish were very low due to an early closure of the fishing season (around 9600 euros). In 2015, however, the change introduced to fisheries management enabled fishermen to earn more income from garfish catches (around 30,900 euros). Fishing for vimba bream provides rather substantial revenues in Pärnu Bay as well (around 35,900 euros in 2014 and around 29,800 euros in 2015).

Herring is caught mainly using trap nets and its catches fluctuated to a great extent in the period 2007–2015. The catch figure for 2015 (6652 tonnes) was higher than in the previous five years (e.g. 5290 tonnes in 2014) and even surpassed the nine-year average. Catches depend on coastal fishing quotas as well as on the weather prevailing in the fishing period and the price of fish. **Perch** is caught mainly with gill nets and trap nets, with the proportions of the fishing gear in catch differing from year to year. A record high catch of perch (1055 tonnes) was landed in 2014; it was the first year when the perch catch exceeded a thousand tonnes during the period under review.

The result for 2015 was in the same order of magnitude, albeit slightly lower (1043 tonnes). Perch stocks can be considered sustainable. Perch and pikeperch reproduce more frequently in Pärnu Bay than elsewhere in coastal waters, and this situation could be further improved by intensifying verification of adherence to fishing restrictions (especially as regards landing undersized fish). The **smelt** catch of 2015 (329 tonnes) exceeded the low result of 2014 (211 tonnes), while still remaining below the average of the period under review.

In addition to the state of stocks, commercial fishing catches of smelt during the spawning period also depend to a great extent on the hydro-meteorological conditions (including ice conditions) prevailing at the time of fishing. Unlike the Gulf of Finland, where gill nets represent the main fishing gear, in Pärnu Bay almost all of the smelt catch is taken using trap nets. Smelt stocks showed a growing trend until 2009, but changes in the age structure of the spawning stock observed in recent years refer clearly to overfishing, which, combined with the less favourable spawning conditions (including hummock ice in the spawning grounds of the Pärnu River during the spawning season of 2011), has resulted in an unstable state of stocks. A slight reduction in fishing pressure and lower by-catches of juveniles in commercial herring trawling would probably cause stocks to recover relatively quickly. **Garfish** is mostly caught using trap nets.

Continued on p 38 →

Table 9. Species composition and catches (kg) of commercial fishing in Gulf of Finland (ICES subdivision 32) by coastal fishing gear type, 2007–2015

Species	2007	2008	2009	2010	2011				2012			
	Total	Total	Total	Total	Trap nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Total
Perch	36 000	77 005	72 473	50 066	16 609	20 544		37 153	11 289		13 103	24 392
Eel	2 444	2 113	1 721	1 373	760	10	1	772	646		14	660
Eelpout	48	1	18	9	3	8		11	15		1	16
Grayling			1									
Pike	1 664	1 564	1 337	1 766	280	1 764		2 043	360		1 972	2 332
Gibel carp	5 260	5 926	4 688	5 614	309	4 352	4	4 665	1 148		7 137	8 284
Brown trout											5	5
Lamprey	46					14		14			3	3
Turbot	12	32	53	73	1	10		11	1		34	35
Carp		1	8	16		11		11			23	23
Ruff	97	157	182	41	68	61		129	93		127	220
Sprat		213	81	2	599			599	12	10	12	34
Pikeperch	2 420	11 222	973	1 025	260	4 362		4 622	119		579	697
Bream	2 970	3 032	1 831	918	445	409		855	310		604	914
Flounder	104 294	86 139	101 557	95 867	4 950	78 438	2	83 390	4 655		62 883	67 538
Tench	5	4	79	144	78	34		112	49		13	62
Burbot	92	48	22	10	5	7		12	7		19	26
Salmon	3 822	4 108	3 611	2 493	371	2 330		2 701	779		2 724	3 504
Mackerel				1	1			1				
Sea trout	13 189	8 271	9 055	9 182	1 558	8 296		9 854	924		9 774	10 698
Four-horned sculpin		9		31		11		11	11		56	67
Longspined bullhead						2		2				
European whitefish	21 758	23 112	14 973	10 791	530	8 322		8 852	428		10 976	11 404
Smelt	15 527	21 777	20 838	9 831	128	3 511		3 639	427		11 664	12 090
Lumpfish				1								
Sabre carp				1								
Silver bream	855	786	1000	482	58	448		506	345		182	527
Thicklip grey mullet											2	2
Rudd	24	68	24	239	415	92		507	125		162	287
Herring	613 002	555 992	1 139 971	1 098 454	799 189	1 912		801 101	696 207	5	2 274	698 486
Ide	213	403	310	208	88	39		127	7		58	64
Roach	2 662	2 817	4 771	2 828	1 118	2 906		4 024	642		2 470	3 112
Dace		1										
European chub												
Atlantic cod	86	854	1 882	2 124	11	2 054		2 065	20		1 431	1 451
Garfish	9 567	1 349	6 729	13 160	11 067	126		11 194	5 061		72	5 134
Bleak	44	62	27	31	27			27	57		70	127
Rainbow trout	110	224	181	76	3	82		85	3		36	38
Vimba bream	4 000	2 991	1 823	1 613	420	927		1 347	107		1 169	1 277
Twaite shad				13							6	6
Round goby	89	364	492	1 121	3 557	485	9	4 051	16 026		783	16 809
Total	**840 300**	**810 644**	**1 390 708**	**1 309 600**	**842 908**	**141 566**	**16**	**984 490**	**739 873**	**15**	**130 433**	**870 321**

Source: MoRA

	2013				2014				2015				2007–2015 Average
	Trap nets	Gill nets	Lon-glines	Total	Trap nets	Gill nets	Lon-glines	Total	Trap nets	Gill nets	Lon-glines	Total	
	26 714	41 725		68 438	15 395	27 646		43 041	5 070	13 036		18 106	47 408
	601	9		609	342	46	1	388	325	6		330	1 157
	30	20		49	7	2		9	10			10	19
													0
	665	2 307		2 972	448	2 434		2 882	284	2 268		2 552	2 123
	802	6 131		6 933	1 367	6 881		8 249	970	7 201		8 171	6 421
													1
						2		2		14		14	9
		16		16	2	20		22		18		18	30
		13		13		16		16	4	5		9	11
	31	154		185	117	3		121	35	8		43	130
	802			802	390	44		434	19	5		24	243
	981	1 146		2 127	63	222		285	7	279		286	2 629
	426	526		952	368	129		497	185	377		562	1 392
	5 713	69 466	35	75 213	2 181	63 473	2	65 655	2 147	61 669	7	63 823	82 608
	7	6		13	18	19		37	3	35		38	55
	4	35		39	7	38		44	6	42		48	38
	1 139	4 136	6	5 281	501	3 219		3 720	563	3 385		3 948	3 687
	0			0									0
	692	8 274	2	8 968	893	8 877		9 769	1 335	10 079		11 414	10 044
		26		26		27		27		264		264	48
													0
	690	13 317		14 007	392	10 635		11 027	424	6 610		7 034	13 662
	1 096	14 159		15 255	218	17 531		17 749	35	20 014		20 049	15 195
													0
													0,1
	1 007	54		1 061		226		226		209		209	628
													0,3
	12	70		82	33	243		276	20	147		167	186
	979 782	2 756		982 538	1 243 166	10 378		1 253 544	1 654 298	2 233		1 656 531	977 735
	11	83		94	4	257		261	27	520		547	247
	665	1 577		2 243	660	1 978		2 638	342	1 837		2 179	3 030
										55		55	6
										50		50	6
	17	2 387		2 404	12	3 317		3 329	6	1 782		1 787	1 776
	664	1		665	838	133		971	6 167	214		6 381	6 127
	38	14		52		1		1					41
	9	33		42	3	29		32	2	24		26	90
	240	1 072		1 312	72	825		896	148	886		1 034	1 810
													2
	7 528	1 038		8 565	7 505	3 663		11 169	7 254	1 648		8 902	5 729
	1 030 364	**170 548**	**43**	**1 200 955**	**1 275 000**	**162 312**	**3**	**1 437 314**	**1 679 684**	**134 918**	**7**	**1 814 609**	**1 184 327**

Table 10. Species composition and catches (kg) of commercial fishing in Central Baltic (ICES subdivisions 28.2 and 29.2) by coastal fishing gear type, 2007–2015

Species	2007	2008	2009	2010	2011					2012				
	Total	Total	Total	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total
Perch	2 540	1 974	5 123	3 875	2 113		8 936	3	11 052	1 673		4 238		5 911
Eel	687	456	560	391	254			5	259	347				347
Atlantic sturgeon														
Eelpout	19	6	24	19	1				1	3				3
Pike	1 079	1 470	1 169	2 242	1 185		1 472	5	2 661	758		595		1 353
Gibel carp	1 260	1 008	1 643	1 580	953		2 010		2 963	947		2 169		3 116
Turbot			1	109			91		91			47		47
Carp	13						15		15					
Ruff	41	25	43	23	87		55		142	132		2		135
Sprat	0		15		8		15		23					
Pikeperch		2					1		1					
Bream	7	1	4	2	3		124		127	1				1
Flounder	181 146	160 621	161 291	143 877	14 139	29 850	92 284	2	136 275	8 085	36 810	77 935	1	122 831
Tench	8	3	10	31	16		204		220	7		23		29
Burbot	1 176	536	660	674	613		399		1 012	420		84		504
Salmon	900	781	971	381	8		359		366	6		521		527
Mackerel														
Sea trout	3 193	2 831	3 900	1 979	141		2 237		2 378	70	40	4 447		4 557
Four-horned sculpin	7	4	5				1		1					
European whitefish	2 563	2 203	1 396	1 208	22		2 013		2 036	182		2 476		2 658
Smelt	2	30	3	7			14		14	2				2
Lumpfish	1	2					1		1					
Sabre carp				1										
Silver bream	1		1				5		5	0		190		190
Thicklip grey mullet	3													
Rudd	22	29	21	39	87		94		181	193		90		283
Herring	6 226	7 351	14 638	7 645	3 418		1 846		5 264	6 123		3 468		9 591
Gudgeon					1				1					
Ide	1 850	3 614	2 557	2 629	827		2 820		3 646	571		1 683		2 253
Roach	4 345	5 085	5 192	5 729	3 313		3 584		6 897	3 071		2 197		5 269
Dace	0													
Atlantic cod	579	1 028	1 679	1 108	258		819	13	1 089	251		1 208		1 460
Garfish	16 359	9 325	6 592	8 090	4 559		427		4 986	1 865		298	27	2 190
Bleak	17	30	13	45	2		5		7	9		1		10
Rainbow trout	77	85	61	18	8		27		35	12		19		31
Vimba bream	4	4	4	12	21		34		55	0		7		7
Twaite shad	1			12										
Round goby												1		1
Total	**224 123**	**198 504**	**207 576**	**181 725**	**32 033**	**29 850**	**119 891**	**28**	**181 802**	**24 727**	**36 850**	**101 699**	**28**	**163 304**

Source: MoRA

2013					2014					2015					2007–2015 average
Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	
4 982	1 475	16 221	13	22 691	5 005	1 420	16 782	1	23 208	2 532	315	9 224		12 072	9 827
249		2		251	143		1		144	130				130	358
							1		1						0
23				23	28				28	13				13	15
1 846		1 857		3 703	1 782	6	1 511		3 299	644		1 937		2 581	2 173
698		1 713		2 412	884	5	2 095		2 984	555		2 799		3 354	2 258
4		16		20			67		67			25		25	40
															3
594		109		703	403		28		431	379		24		403	216
		5		5						1				1	5
		5		5	2		2		4						1
3		2		5	3		6		9	1				1	17
9 669	49 968	85 983	0	145 620	11 580	29 350	70 600		111 530	6 312	19 435	75 703		101 450	140 516
32		13		45	23		12		35	10		14		24	45
508		57	2	567	361		107		468	290		149		439	671
18		440		458	18		471		488	9		629		638	612
												0		0	0
106		3 524		3 630	77		3 210		3 287	33	2	2 942		2 977	3 192
0		5		5			10		10			10		10	5
273		4 386		4 658	33		4 542		4 575	12		3 753		3 765	2 785
															6
		1		1											1
															0
1		2		3		2			2						22
2				2											0
51		28		79	56		17		72	6		2		8	81
11 503		1 765		13 267	17 133		1 209		18 341	8 356		1 310		9 666	10 221
															0
889		2 877	2	3 768	1 022		3 225		4 247	810		3 747		4 557	3 236
3 264		1 560		4 824	6 284		1 974		8 258	3 258		1 712		4 970	5 619
															0
363		1 550		1 913	605		2 098		2 704	269		1 146		1 415	1 442
1 955		250		2 204	2 121		1 036	5	3 162	6 092		1 165	6	7 263	6 686
13				13	7		2		9	5				5	16
73		48		120	6		103		109	4		20		24	62
19		17		36	36		35		71	9		37		46	27
					1				1	1				1	2
10				10	75		28		103	720		57		778	99
37 147	**51 443**	**122 434**	**17**	**211 041**	**47 686**	**30 783**	**109 173**	**6**	**187 647**	**30 448**	**19 752**	**106 408**	**6**	**156 614**	**190 260**

Table 11. Species composition and catches (kg) of commercial fishing in Väinameri Sea (ICES subdivision 29.4) by coastal fishing gear type, 2007–2015

Species	2007	2008	2009	2010	2011				2012				
	Total	Total	Total	Total	Trap nets	Gill nets	Lon-glines	Total	Trap nets	Gill nets	Lon-glines	Total	
Perch	20 673	11 608	14 577	23 655	2 234	14 965	9	17 208	7 458	25 075	22	32 555	
Eel	662	662	447	384	264	26	3	293	169	2		171	
Eelpout	10	14		19					2			2	
Pike	7 787	8 449	7 840	12 251	5 069	14 127		19 196	6 865	17 346		24 211	
Gibel carp	17 115	24 922	19 337	21 990	3 983	19 859	5	23 847	5 802	19 845		25 647	
Turbot													
Carp	19	38	40	24		1		1	17	6		23	
Ruff	4 497	4 433	1 228	811	1 269	200		1 469	3 847	147	1	3 994	
Sprat	25	21	7	68		11		11		2		2	
Pikeperch	132	128	139	388	99	378		477	80	314	1	395	
Bream	418	244	193	316	409	385		794	426	57		483	
Flounder	8 667	8 358	10 215	11 260	1 352	7 453		8 805	2 732	6 346	1	9 080	
Tench	1 819	1 682	1 751	1 282	1 272	198		1 470	2 118	204		2 321	
Burbot	1 253	503	496	424	153	194		347	412	468		880	
Salmon	100	106	132	121		56		56	40	189		229	
Sea trout	313	212	295	246	17	419		436	45	689		734	
European whitefish	3 227	1 998	1 933	1 408	30	1 981		2 011	31	2 683		2 714	
Smelt	1 057	497	305	167	27	9		36	77	4		81	
Silver bream	9 449	8 888	8 192	7 804	1 043	9 078		10 121	1 662	13 236	4	14 902	
Stickleback	213	8											
Rudd	1 988	1 365	991	914	1 006	737		1 743	306	748		1 054	
Herring	42 896	38 191	219 552	231 432	178 818	2 885		181 703	139 637	2 998		142 635	
Ide	6 747	6 696	5 447	3 241	1 007	1 261		2 267	775	1 327	5	2 107	
Roach	14 639	13 781	13 716	13 699	7 692	11 342		19 034	6 881	12 477	1	19 359	
Dace		3											
European chub		15	20										
Atlantic cod	6	7	42	56	12	47		59	12	43	3	58	
Garfish	38 570	21 353	20 485	19 601	30 303	691	10	31 004	8 246	379	80	8 705	
Bleak	116	55	31	33	27			27	131	51		182	
Rainbow trout	10		6			8		8					
Vimba bream	1 255	827	1 938	3 063	754	3 023		3 777	725	3 196		3 921	
Twaite shad						1		1					
Round goby										13		13	
Total	**183 659**	**155 061**	**329 351**	**354 656**	**236 839**	**89 335**	**27**	**326 201**	**188 493**	**107 844**	**118**	**296 454**	

Source: MoRA

	2013					2014					2015				2007–2015 average
	Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Gill nets	Lon-glines	Total	
	41 030	10	111 017	17	152 074	114 614	70	132 006	48	246 738	105 762	120 921	106	226 789	82 875
	122		1		123	115		8		123	80			80	327
						4				4	149			149	22
	14 214		29 078		43 292	14 842		30 051	62	44 955	11 264	25 771	25	37 059	22 782
	4 007		19 131		23 138	9 990		30 726		40 716	9 479	20 062		29 541	25 139
	1		3		4			8		8		3		3	2
	23		3		26	23		6		29	9	3		12	24
	4 107		569		4 676	13 348		217		13 565	7 928	232		8 160	4 759
	30		2		32	3		1		4					19
	3 024		5 021		8 044	8 691		7 983		16 674	3 974	6 334		10 308	4 076
	381		650		1 031	1 506		2 014		3 520	656	1 960		2 615	1 068
	2 682		5 450		8 131	1 521		4 230		5 751	1 443	3 178		4 620	8 321
	2 171		515		2 686	2 915		1 275		4 189	1 530	519		2 049	2 139
	512		1 258		1 769	1 286		1 861		3 146	1 086	2 387		3 473	1 366
	8		119		127	9		129		138	2	54		57	118
	27		672		698	29		304		334	62	241		303	397
	47		2 803		2 850	74		4 123		4 197	189	4 573		4 762	2 789
	40		20		60	17				17	27	2		29	250
	4 308		13 240		17 548	6 152		16 830		22 982	4 871	18 943		23 814	13 744
															25
	622		968		1 590	994		1 330		2 324	547	1 452		1 999	1 552
	130 842	650	1 665		133 157	120 794		1 666		122 460	95 557	1 772		97 329	134 373
	947		2 137	2	3 086	2 662		4 395	4	7 061	3 844	6 372	38	10 253	5 212
	7 895		15 444		23 339	10 076	20	16 438	2	26 536	12 461	15 508	11	27 980	19 120
	3				3										1
			14		14							1		1	6
	5		74		78	20		87		107	66	100		166	64
	3 649		396	43	4 088	4 851		1 562	75	6 488	22 042	1 393	52	23 486	19 309
						54				54	818	1		819	146
						1				1	7	7		14	4
	1 223		4 550		5 773	2 568		7 044		9 612	6 177	11 026		17 203	5 263
															0
			0		0						49			49	7
	221 915	**660**	**214 800**	**62**	**437 437**	**317 158**	**90**	**264 292**	**191**	**581 732**	**290 077**	**242 812**	**231**	**533 120**	**355 297**

Table 12. Species composition and catches (kg) of commercial fishing in Gulf of Riga (ICES subdivision 28.1, except Pärnu Bay) by coastal fishing gear type, 2007–2015

Species	2007	2008	2009	2010	2011					2012				
	Total	Total	Total	Total	Trap nets	Seine nets	Gill nets	LL*	Total	Trap nets	Seine nets	Gill nets	LL*	Total
Perch	211 359	183 475	214 290	187 959	25 668		140 799	18	166 484	17 964	15	129 080	1 024	148 083
Eel	2 116	1 703	1 459	1 230	795		2		797	600			3	603
Atlantic sturgeon														
Eelpout	73	92	29	2	29		1		30	2				2
Pike	2 640	2 874	2 542	4 834	3 695		2 746		6 440	2 856		3 572	26	6 454
Gibel carp	9 755	9 187	10 980	8 618	2 625		6 264		8 889	3 084		7 178	55	10 316
Lamprey			2	4						10				10
Carp	144	30	17	6	1		8		9					
Ruff	4 278	6 721	11 737	10 335	199		7 277		7 476	3 738	2	4 236		7 976
Sprat	42		8	80			10		10			105		105
Pikeperch	1 963	1 585	683	1 011	190		4 027		4 217	53		2 504	43	2 600
Bream	22	205	75	49	128		86		214	157		93		250
Flounder	20 404	20 222	13 089	17 204	8 931	1 773	4 578		15 282	8 647	720	3 012	24	12 403
Tench	186	292	494	796	1 042		61		1 103	373		528		901
Burbot	521	164	159	171	217		13		230	192		24		216
Salmon	609	453	611	741	53		467		520	48		751		799
Sea trout	399	605	688	784	98		645		743	153		987		1 140
Four-horned sculpin		1	1				12		12			1		1
European whitefish	2 115	2 142	3 615	1 286	53		900		953	20		1 605		1 625
Sea lamprey	1													
Smelt	773	1 413	5 424	1 098	529		25		554	376		20		396
Lumpfish		1												
Silver bream	448	380	218	439	235		233	15	483	114		307		421
Stickleback		9	40		42				42					
Rudd	145	21												
Herring	1 174 901	1 636 331	1 356 769	1 570 761	1 307 801		18 640			752 869		40 490		793 359
Ide	316	292	417	219	45		44		89	10		34		44
Roach	22 313	18 372	23 857	31 645	15 661		10 258	15	25 933	12 834		13 647	19	26 501
Dace	12			2			1		1					
European chub														
Atlantic cod	163	502	324	391	118		154		272	193		250		443
Garfish	26 729	39 721	22 527	24 007	21 102		106		21 208	8 725		152	5	8 882
Bleak	12	6	38							21				21
Rainbow trout	12	14	6				11		11					
Vimba bream	4 267	3 113	3 023	3 188	131		2 845		2 976	147		3 440		3 587
Twaite shad	1													
Round goby			0							87		1		88
Total	**1 486 716**	**1 929 922**	**1 673 118**	**1 866 859**	**1 389 386**	**1 773**	**200 210**	**48**	**1 591 418**	**813 272**	**737**	**212 015**	**1 199**	**1 027 223**

* LL – Longlines

Source: MoRA

2013					2014					2015					2007–2015
Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	average
25 028		186 807	207	212 042	29 078		169 642	1	198 721	44 158	1 530	176 506	233	222 426	193 871
532		7		539	334			1	335	204			1	205	998
							1		1						0
10				10	3				3						27
5 044		4 921		9 964	6 133		4 446	1	10 579	3 392	59	3 934		7 385	5 968
3 144		7 285		10 428	5 902		8 177	5	14 083	4 524	8	8 306		12 838	10 566
															2
3		8		11	3		6		9	24		33		57	31
471		4 240		4 711	2 292		1 789		4 081	1 849		2 915		4 764	6 897
3		333		336			138		138	3		151		154	97
83		2 552	17	2 652	253		1 378		1 631	188		532		720	1 896
73		99		172	78		98		176	136		65		201	151
11 103	2 312	5 210	12	18 637	9 899	2 650	5 307		17 856	13 222	1 168	6 332	8	20 730	17 314
860		332		1 192	1 595		1 024		2 619	2 322		534		2 855	1 160
293		34		327	936		99		1 035	653		127		780	400
32		226		257	58		323		382	46		427		473	538
167		940		1 107	72		940		1 011	86		1 153		1 239	857
												15		15	3
16		1 806	6	1 827	12		2 141		2 153	22		2 107		2 129	1 983
															0
845		57		902	15		8		23	1		880		881	1 274
															0
182		149		331	316		521		837	1 504	135	799		2 438	666
															10
2				2						40		1		41	23
559 673		20 465		580 137	836 955		14 806		851 761	862 883		12 672		875 555	1 129 557
44		53		97	103		252		355	345		265		610	271
8 978		10 917		19 895	12 239		15 774		28 013	17 586	5 352	19 324	1	42 263	26 532
															2
												1		1	0
483		321		804	308		548		856	280		253		533	476
11 407		114		11 521	24 432		474		24 906	32 486		873		33 359	23 651
30				30						21				21	14
		32		32			18		18						10
267		5 807		6 074	359		5 225		5 584	805		4 585		5 390	4 133
															0
504		2		506	7 876		28	3	7 906	20 417		442		20 859	3 262
629 273	**2 312**	**252 714**	**242**	**884 542**	**939 249**	**2 650**	**233 160**	**11**	**1 175 069**	**1 007 195**	**8 252**	**243 230**	**243**	**1 258 919**	**1 432 643**

Table 13. Species composition and catches (kg) of commercial fishing in Pärnu Bay (fishing squares 178–180) by coastal fishing gear type, 2007–2015

Species	2007	2008	2009	2010	2011					2012				
	Total	Total	Total	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total
Perch	506 183	429 190	505 998	613 732	391 777	31	172 031	479	564 317	185 925		151 751	1 291	338 967
Eel	198	148	115	74	84		2		86	108			20	128
Eelpout	4	60	47	765	50				50	366		6		372
Pike	531	1 436	466	1 702	1 185		537		1 722	584		473		1 057
Gibel carp	23 217	18 576	13 235	13 516	5 943		6 833		12 776	13 146		6 300	350	19 796
Lamprey	505	17	148	567	868		3		871	348		1		349
Carp	60	272	134	93	11		35		46	16		62		78
Ruff	7 967	8 715	13 268	21 137	41 184		10 398		51 582	34 744		4 111		38 855
Bighead carp														
Pikeperch	94 666	51 084	64 969	70 946	48 233	135	52 699	133	101 200	36 289		104 794	2 057	143 140
Bream	5 609	3 740	2 411	2 291	5 240		324		5 564	9 091		359		9 450
Flounder	1 327	1 186	1 783	1 587	887		304		1 191	1 024		188	20	1 232
Tench		13	14	38	45		12		57	8				8
Burbot	23	8	13	21	19				19	34		2		36
Salmon	18	141	76	59	102		32		134	311		11		322
Sea trout	8	8	20	13	3				3	101		31		132
Four-horned sculpin		1												
European whitefish	1 090	391	727	853	53		731		784	656		1 397		2 053
Sea lamprey				31										
Smelt	463 585	625 661	745 601	404 077	115 864		257		116 121	285 340		381		285 721
Silver bream	28 015	23 081	13 570	12 874	9 795		1 615		11 410	16 335		868	12	17 215
Stickleback				16										
Rudd	3		7											
Herring	4 627 555	8 339 085	9 030 968	6 328 372	6 282 647		110		6 282 757	5 444 736		140		5 444 876
Ide	48	8	5	8										
Roach	18 900	11 017	10 700	12 664	23 662		3 695		27 356	21 544		1 998	14	23 556
Dace					20		1		21					
Atlantic cod	1	9	3	15	3		7		10	2		7		9
Garfish	18 308	10 190	14 804	21 188	49 137		212		49 349	11		116		127
Bleak		10												
Vimba bream	25 801	25 214	16 405	21 942	32 022		9 905		41 927	31 737		12 731		44 468
Lesser sand eel		80				52			52		192			192
Round goby														
Total	**5 823 620**	**9 549 339**	**10 435 484**	**7 528 579**	**7 008 832**	**218**	**259 742**	**612**	**7 269 403**	**6 082 456**	**192**	**285 725**	**3 764**	**6 372 136**

Source: MoRA

	2013					2014					2015					2007–2015
	Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	Trap nets	Seine nets	Gill nets	Lon-glines	Total	average
	458 026	62	302 647	871	761 605	690 453		364 404	111	1 054 968	775 516		267 408	499	1 043 423	646 487
	116		15	1	132	66				66	97			1	98	116
	1 072				1 072	136				136	598				598	345
	3 795		2 140	34	5 969	2 871		856		3 726	1 286		926		2 212	2 091
	8 410		5 211	13	13 634	13 828		7 895		21 722	10 459		5 634		16 093	16 952
	996				996	303		1		304	201				201	440
	41		205		246	75		76		151	107		193		300	153
	24 009		4 479		28 488	12 678		4 424		17 102	9 686		1 112		10 798	21 990
											9				9	1
	51 278		55 547	2 502	109 327	82 236		72 242	206	154 683	35 721		35 401	584	71 705	95 747
	5 997		613	2	6 612	8 361		367		8 728	4 697		157		4 854	5 473
	1 584		800	21	2 405	2 457		864		3 320	6 318		1 434	4	7 756	2 421
	8		60		68						2		53		55	28
	92		9		101	249		10		259	344		10		354	93
	653		47		700	355		137		492	415		57		471	268
	256		8		264	177		14		191	145		62		207	94
											1				1	0
	205		2 209		2 414	538		3 366		3 904	116		1 684		1 800	1 557
																3
	489 218		979		490 197	210 655		234		210 889	325 577		288		325 865	407 524
	10 917		1 037	13	11 967	5 159		1 234		6 393	2 196		1 117		3 313	14 204
																2
				8	8						5				5	3
	5 378 563		107		5 378 670	5 289 471		51		5 289 522	6 651 498		90		6 651 588	6 374 821
	1				1	8		30		38	3				3	12
	18 872		1 855	54	20 781	26 643		1 214		27 857	16 888		785		17 673	18 945
																2
	25		32		57	17		5		22	17		6		23	17
	658				658	8 123		194		8 317	45 447		5		45 452	18 710
						85				85	513				513	68
	28 201		15 011	7	43 219	58 627		9 180		67 807	59 923		9 337		69 260	39 560
		735			735		37			37		325			325	158
											34		4		38	4
	6 482 993	**797**	**393 010**	**3 526**	**6 880 325**	**6 413 568**	**37**	**466 795**	**317**	**6 880 717**	**7 947 816**	**325**	**325 761**	**1 088**	**8 274 990**	**7 668 288**

The largest garfish catch in the period 2007–2015 was taken in Pärnu Bay in 2011 (50 tonnes). It was in the same order of magnitude as the catch figure for 2015 (45 tonnes) and more than five times higher than the catch landed in 2014 (8 tonnes). The sharp increase in the catch of garfish is attributable to the transfer to individual herring quotas described above, which prolonged the period of pound net fishing until the spawning migration of garfish. The **pikeperch** catch of 2014 was 155 tonnes, which declined to 72 tonnes in 2015. The state of the stocks of pikeperch and vimba bream as the main commercial fish species of the Pärnu Bay remains poor, and there are a lot of undersized or recently matured individuals in pikeperch catches. Therefore, and as a result of negotiations with fishermen, the minimum size of pikeperch is going to be gradually increased by 2 cm. A more efficient pikeperch stock management plan should be developed, which focuses on decisive limitation of the landings of undersized fish in both commercial and recreational fishing. The stocks of **vimba bream** depend mainly on the situation in spawning rivers, most of which are probably Latvian rivers flowing into the Gulf of Riga. Vimba bream catches amounted to 68 tonnes in 2014 and 69 tonnes in 2015.

In summary, catches taken from Pärnu Bay have fluctuated greatly. The total catch of 2015 was the highest in the last six years and exceeded the average of the period 2007–2015. The total catch is most affected by mass species – herring and smelt. If these species are not taken into account, the total catch of all other fish species was the highest of the period in 2014 and came second in 2015.

TRAWL FISHERY IN THE BALTIC SEA

Stocks and catches of herring, sprat and cod, and future outlooks

Herring, sprat and cod are internationally regulated/managed fish species regarding which the International Council for the Exploration of the Sea (ICES) issues annual stock assessments and management recommendations for different fishing grounds and stock units. The location of these stocks in the fourth quarter of 2015 is shown in Figure 7.

Herring

Herring (*Clupea harengus membras* L.) is a subspecies of Atlantic herring that inhabits the whole of the Baltic Sea, forming local populations. Based on the time of spawning, a distinction is made between spring-spawning herring, which spawn from March to June, and autumn-spawning herring, which spawn in August and September and whose proportion has been less than 5% since the 1970s in all areas. In recent years, however, the share of autumn-spawning herring has slightly increased e.g. on the south coast of the island of Saaremaa and in spawning grounds in the north-east part of the Gulf of Riga.

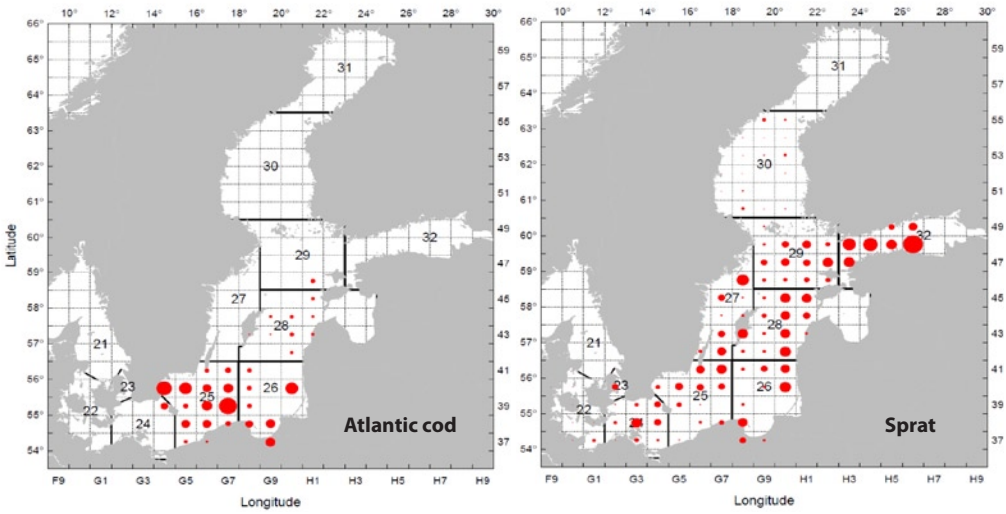


Figure 7. Location of Eastern Baltic cod, sprat and Central Baltic herring in 2015 Q4
Source: Data from ICES' test trawling (BITS) and acoustic surveys (BIAS). ICES, 2016

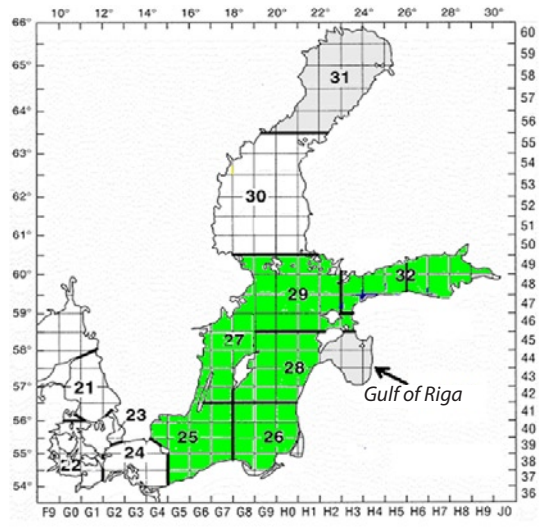


Figure 8. Agreed stock and management units for herring in Baltic Sea:
- Central Baltic herring (also referred to as open sea herring) (ICES subdivisions 25–27, 28.2, 29 and 32)
- Gulf of Riga herring (subdivision 28.1)
- Bothnian Sea herring (subdivision 30)
- Bothnian Bay herring (subdivision 31)

Source: ICES, 2016

Since 2009, herring and sprat stocks have been assessed in accordance with the methodology of the ICES, while biological material is collected under EU Council Regulation (EC) No. 199/2008, Commission Regulation (EC) No. 949/2008 and Commission Decision 949/2008/EC.

Unlike sprat, which is treated as a single stock unit, i.e. population across the Baltic Sea, in the case of herring the state of stocks is assessed and advice for exploitation is given for four stock units (Figure 8):

- Central Baltic herring (subdivisions 25–27, 28.2, 29 and 32),
- Gulf of Riga herring (subdivision 28.1),
- Bothnian Sea herring (subdivision 30), and
- Bothnian Bay herring (subdivision 31)

Table 14. Central Baltic herring: catches by country (10^3 t), 1977–2015

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	Total
1977	11.9		33.7	0.0			57.2	112.8	48.7	**264.3**
1978	13.9		38.3	0.1			61.3	113.9	55.4	**282.9**
1979	19.4		40.4	0.0			70.4	101.0	71.3	**302.5**
1980	10.6		44.0	0.0			58.3	103.0	72.5	**288.4**
1981	14.1		42.5	1.0			51.2	93.4	72.9	**275.1**
1982	15.3		47.5	1.3			63.0	86.4	83.8	**297.3**
1983	10.5		59.1	1.0			67.1	69.1	78.6	**285.4**
1984	6.5		54.1	0.0			65.8	89.8	56.9	**273.1**
1985	7.6		54.2	0.0			72.8	95.2	42.5	**272.3**
1986	3.9		49.4	0.0			67.8	98.8	29.7	**249.6**
1987	4.2		50.4	0.0			55.5	100.9	25.4	**236.4**
1988	10.8		58.1	0.0			57.2	106.0	33.4	**265.5**
1989	7.3		50.0	0.0			51.8	105.0	55.4	**269.5**
1990	4.6		26.9	0.0			52.3	101.3	44.2	**229.3**
1991	6.8	27.0	18.1	0.0	20.7	6.5	47.1	31.9	36.5	**194.6**
1992	8.1	22.3	30.0	0.0	12.5	4.6	39.2	29.5	43.0	**189.2**
1993	8.9	25.4	32.3	0.0	9.6	3.0	41.1	21.6	66.4	**208.3**
1994	11.3	26.3	38.2	3.7	9.8	4.9	46.1	16.7	61.6	**218.6**
1995	11.4	30.7	31.4	0.0	9.3	3.6	38.7	17.0	47.2	**189.3**
1996	12.1	35.9	31.5	0.0	11.6	4.2	30.7	14.6	25.9	**166.7**
1997	9.4	42.6	23.7	0.0	10.1	3.3	26.2	12.5	44.1	**172.0**
1998	13.9	34.0	24.8	0.0	10.0	2.4	19.3	10.5	71.0	**185.9**
1999	6.2	35.4	17.9	0.0	8.3	1.3	18.1	12.7	48.9	**148.7**
2000	15.8	30.1	23.3	0.0	6.7	1.1	23.1	14.8	60.2	**175.1**
2001	15.8	27.4	26.1	0.0	5.2	1.6	28.4	15.8	29.8	**150.2**
2002	4.6	21.0	25.7	0.3	3.9	1.5	28.5	14.2	29.4	**129.1**
2003	5.3	13.3	14.7	3.9	3.1	2.1	26.3	13.4	31.8	**113.8**
2004	0.2	10.9	14.5	4.3	2.7	1.8	22.8	6.5	29.3	**93.0**
2005	3.1	10.8	6.4	3.7	2.0	0.7	18.5	7.0	39.4	**91.6**
2006	0.1	13.4	9.6	3.2	3.0	1.2	16.8	7.6	55.3	**110.4**
2007	1.4	14.0	13.9	1.7	3.2	3.5	19.8	8.8	49.9	**116.0**
2008	1.2	21.6	19.1	3.4	3.5	1.7	13.3	8.6	53.7	**126.2**
2009	1.5	19.9	23.3	1.3	4.1	3.6	18.4	12	50.2	**134.1**
2010	5.4	17.9	21.6	2.2	3.9	1.5	25.0	9.1	50.0	**136.7**
2011	1.8	14.9	19.2	2.7	3.4	2.0	28.0	8.5	36.2	**116.8**
2012	1.4	11.4	18.0	0.9	2.6	1.8	25.5	13.0	26.2	**100.9**
2013	3.4	12.6	18.2	1.4	3.5	1.7	20.6	10.0	29.5	**101.0**
2014	2.7	15.3	27.9	1.7	4.9	2.1	27.3	15.9	34.9	**132.7**
2015*	0.3	18.8	31.6	2.9	5.7	4.7	39.0	20.9	50.6	**174.5**

* Data for 2015 are preliminary and subject to change

Source: ICES, 2016

The Gulf of Riga and the Bothnian Sea (and possibly also the Bothnian Bay) are inhabited by local natural herring populations, but Central Baltic herring (in subdivisions 25–27, 28.2, 29 and 32) comprises different populations (Gulf of Finland herring, Swedish coastal herring *et al.*).

The following overview primarily discusses the first two stock units, as these are of the main interest to Estonian fishermen.

Central Baltic herring (subdivisions 25–27, 28.2, 29 and 32)

The years 2014 and 2015 saw an improvement in both fishing opportunities and herring catches, which amounted to 133,000 and 174,000 tonnes, respectively. As in previous years, Sweden (26% and 29% of the total catch, respectively), Poland (21% and 22%) and Finland (21 and 18%) landed the largest catches in 2014 and 2015. Estonia's catch was 15,300 tonnes or 12% in 2014 and 18,800 tonnes or 11% in 2015 (Table 14). In terms of catch weight, the most of herring was caught in subdivisions 25, 26, 28.2 and 29, while subdivisions 29 and 32 dominated in terms of numbers. This can be explained by geographical differences in the mean body weight of herring (Figure 9).

The average age composition of herring catches has been relatively similar over time: age groups 1–3 prevail, representing around 60% of catches. This can be explained by the domination of pelagic schools mainly composed of younger herring in trawl catches (Figure 10). Unlike sprat, greater stability of age composition has been observed in herring catches, which is due to a smaller variation in the strength of herring year classes.

The mean body weight of herring has decreased considerably over the past 25–30 years, accounting for just 40–50% of the weight level observed in the 1970s and 1980s in the age groups that are more abundant today. The mean body weight of age groups has been at a low level since 2006 (Figure 11).

At the beginning of 2015 and 2016, the spawning stock biomass of the Central Baltic herring amounted to 1.02 and 1.01 million tonnes, respectively, exceeding the 1974–2015 average (927,094 tonnes) by 11% and 9%, respectively (Figure 12). The recent increase in herring stock can be explained by two reasons. On the one hand, more abundant year classes have appeared, and on the other hand, the fishing mortality rate has been relatively low due to the active implementation of the fisheries legislation. From 2002 to today, six year classes

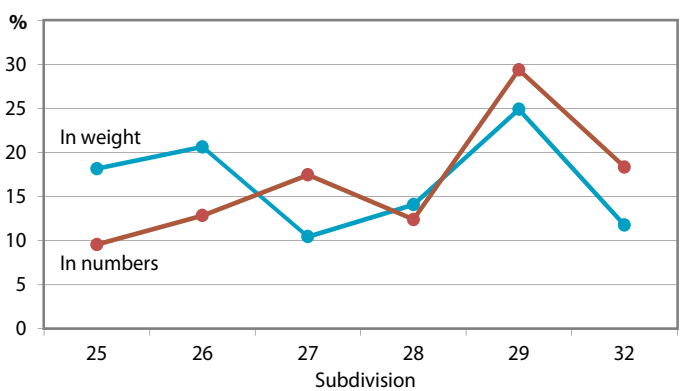


Figure 9. Central Baltic herring: proportion of catch in weight and numbers by subdivision in 2015
Source: ICES, 2016

Figure 10. Central Baltic herring: average age composition of catches, 1974–2015
1: age 1
2: age 2, etc.
6+: age 6 and older
Source: ICES, 2016

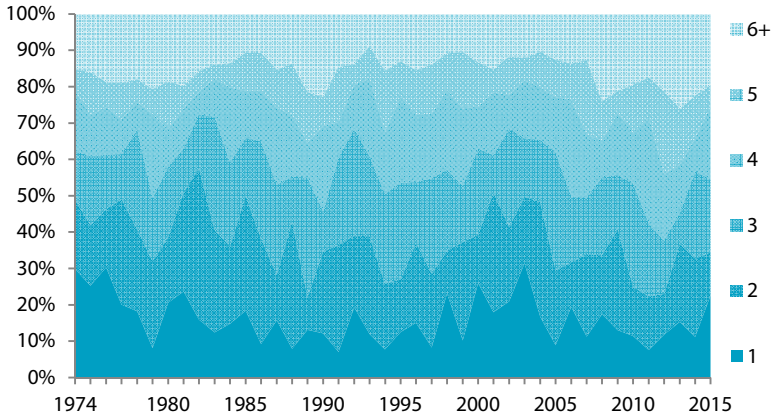


Figure 11. Central Baltic herring: dynamics of mean body weight of herring aged 2–5, 1974–2015
Source: ICES, 2016

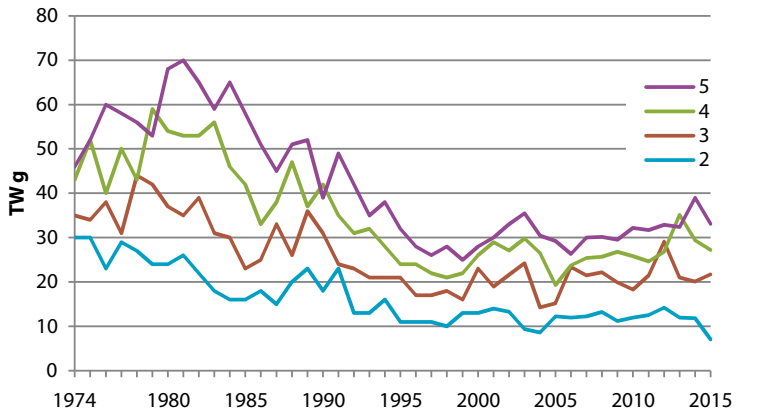


Figure 12. Central Baltic herring: spawning stock biomass (SSB) and fishing mortality in age groups 3–6 ($F_{3–6}$), 1974–2015
The horizontal line represents the level of F_{MSY} = 0.22 and the dotted line indicates the sustainable fishing mortality rate F_{PA} = 0.41.
Source: ICES, 2016

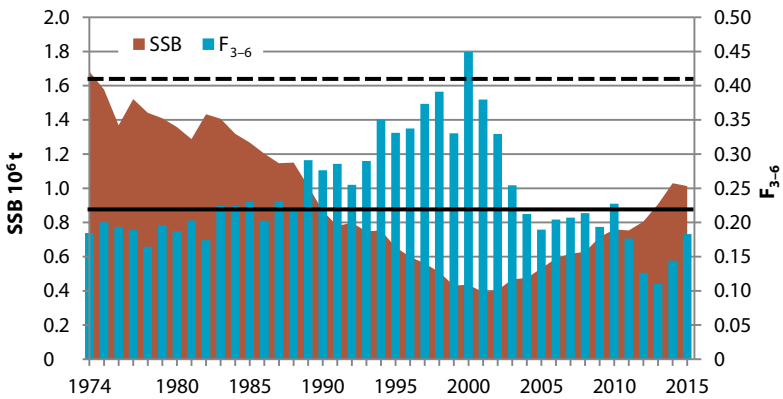
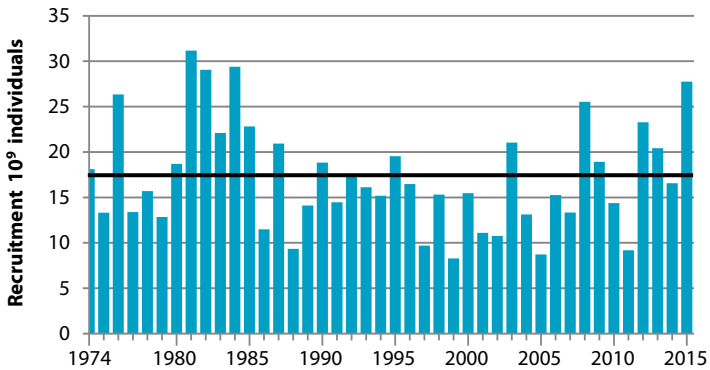


Figure 13. Central Baltic herring: dynamics of abundance of recruitment (age 1), 1974–2015
The horizontal line marks the long-term average.
Source: ICES, 2016



have been observed whose abundance considerably exceeded the long-term average, with the most recent such year class being that of 2014 (Figure 13). The outlook for the coming years depends on the abundance of cohorts of 2011–2015, which will account for most of the catch in 2016 and 2017, when they will be 2–6 years of age.

The stock status of Central Baltic herring is assessed against two reference levels of fishing mortality:

1) precautionary fishing mortality rate $F_{PA} = 0.41$: the maximum fishing mortality rate that can be implemented without directly endangering stock reproduction potential, but which should be avoided in accordance with responsible fishing principles; and
2) maximum fishing mortality for sustainable yield $F_{MSY} = 0.22$: enables maximum catches to be taken in the long run without endangering stocks.

Actual fishing mortality has been lower than F_{MSY} since 2004. Looking at herring fishing mortality in the Central Baltic since 1974, there appears to be a period of particularly high mortality (1994–2002) when the actual mortality rate significantly exceeded the recommended level. This was one of the reasons for the decline in stocks (Figure 12).

According to the ICES advice, which is based on the maximum sustainable yield approach, catches of Central Baltic herring should not exceed a total of 216,000 tonnes in 2017. (For 2016, the ICES recommended a total catch of up to 201,000 tonnes, and the EU total allowable catch TAC_{2016} was 207,000 tonnes.)

It should be noted that the ICES gives its advice regarding stock units, while the EU's total allowable catch (TAC) is calculated for management units, i.e. fishing grounds. To determine the TAC, therefore, catches of open sea herring traditionally taken from the Gulf of Riga should be deducted from, and catches of gulf herring caught in the Central Baltic should be added to, the quantity recommended by the ICES. As a result, the total allowable catch of herring in subdivisions 25–27, 28.2, 29 and 32 should not exceed 211,600 tonnes.

Gulf of Riga herring

Gulf of Riga herring are only fished by Estonian and Latvian fishermen. The proportion of Latvia's catches has been 60–70% in the last couple of decades. According to Latvian researchers, a significant part of Latvian herring catches (around 10–20%) was not reflected in official statistics until 2010 (Table 15).

In addition to local gulf herring, catches also include Central Baltic herring that spawns in the Gulf of Riga. Both varieties come under a single catch quota applied for the Gulf of Riga area. The proportion of Central Baltic herring in the total herring catch taken from the Gulf of Riga has been less than 5% in recent years.

The long-term age structure of herring catches from the Gulf of Riga is generally similar to that of Central Baltic herring catches. The only difference is the greater variation in the abundance of the Gulf of Riga year classes, especially since the 1990s (Figure 14).

Similar to Central Baltic herring, the mean body weight of different age groups of herring caught in the Gulf of Riga has decreased significantly compared

to the early 1980s. A relatively significant change in body weight could also be observed during the 1990s and 2000s. After a slight increase during the period 2010–2013, body weight has been declining again in major age groups during the last three years (Figure 15).

The spawning stock biomass of Gulf of Riga herring is up to twice the level of the 1970s (Figure 16). The good condition of the stock is mostly due to the abundance of the year classes 1996–2006. Only the cohorts that were born after the cold winters of 1996, 2003 and 2006 were smaller than the long-term average in the Gulf of Riga (Figure 17). The year-class strength of herring seems to be influenced by the severity of the winter and the abundance of zooplankton in spring which determines the feeding conditions of juveniles in spring and thus their survival. The mild winters in the last couple of decades have apparently been favourable for the reproduction of Gulf of Riga herring. However, looking at the abundance of the last five year classes, it appears that those of 2011 and 2012 exceeded the average, but these of 2010, 2013 and 2014 have proved weak. This will certainly have an unfavourable impact on fishing prospects in near future (Figure 17).

In early 2014, the spawning stock biomass exceeded the long-term average by 16% (SSB_{2013} = 95,377 tonnes). The spawning stock biomass increased to 111,654 tonnes over the year, mainly thanks to the cohorts of 2011 and 2012.

Table 15. Gulf of Riga herring: Estonian, Latvian and unreported landings (10^3 t), 1991–2015

Year	Estonia	Latvia	Unreported (Latvia)	Total
1991	7.4	13.5	–	**20.9**
1992	9.7	14.2	–	**23.9**
1993	9.5	13.6	3.4	**26.5**
1994	9.6	14.1	3.5	**27.2**
1995	16.0	17.0	3.4	**36.4**
1996	11.8	17.4	3.5	**32.6**
1997	15.8	21.1	4.2	**41.2**
1998	11.3	16.1	3.2	**30.7**
1999	10.2	20.5	3.1	**33.8**
2000	12.5	21.6	3.2	**37.4**
2001	14.3	22.8	3.4	**40.5**
2002	17.0	22.4	3.4	**42.8**
2003	19.6	21.8	3.3	**44.7**
2004	18.2	20.9	3.1	**42.3**
2005	11.2	19.7	3.0	**33.9**
2006	11.9	19.2	2.9	**34.0**
2007	12.8	19.4	2.9	**35.1**
2008	15.9	19.3	1.9	**37.1**
2009	17.2	18.3	1.8	**37.3**
2010	15.4	17.8	1.8	**34.9**
2011	14.7	20.2	–	**35.0**
2012	13.8	17.9	–	**31.7**
2013	11.9	18.5	–	**30.4**
2014	10.6	20.1	–	**30.6**
2015	16.5	21.0	–	**37.5**

Source: ICES 2016

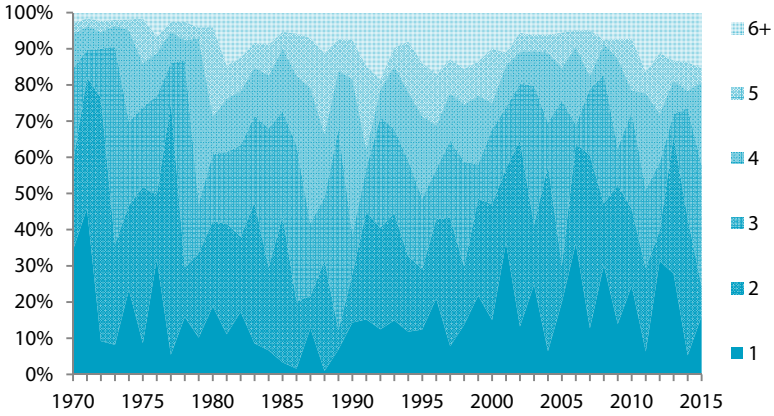


Figure 14. Gulf of Riga herring: age composition of catches, 1970–2015
1: age 1
2: age 2, etc.
6+: age 6 and older
Source: ICES, 2015

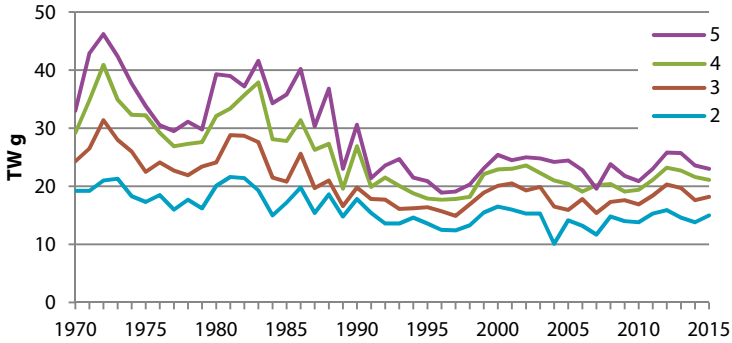


Figure 15. Gulf of Riga herring: dynamics of mean body weight of herring aged 2–5, 1970–2015
Source: ICES, 2015

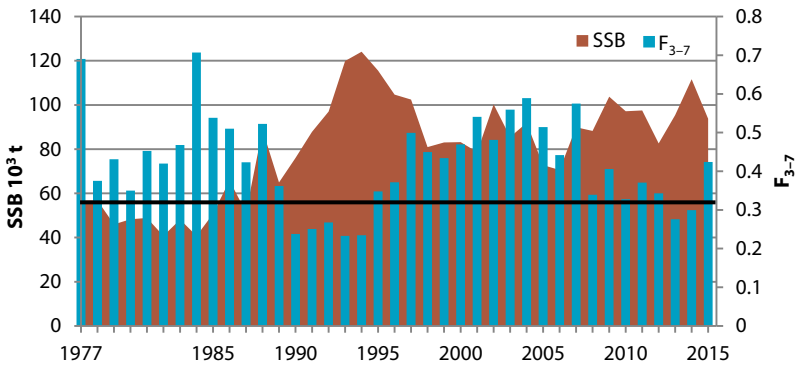


Figure 16. Gulf of Riga herring: spawning stock biomass (SSB) and fishing mortality in age groups 3–7 ($F_{3–7}$), 1977–2015
The horizontal line represents the maximum sustainable exploitation intensity if the maximum fishing mortality for sustainable yield $F_{MSY} = 0.32$.
Source: ICES, 2016

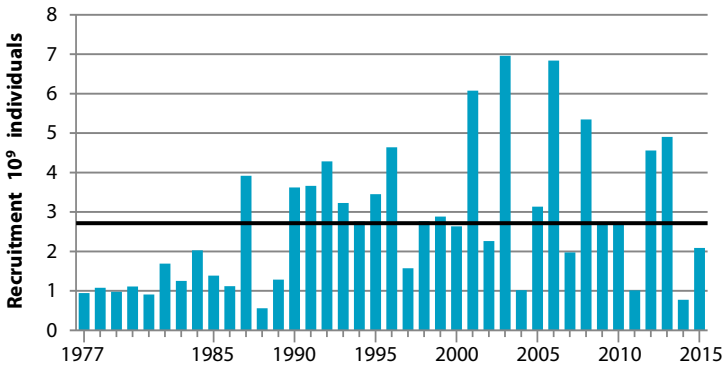


Figure 17. Gulf of Riga herring: dynamics of abundance of recruitment (age 1), 1977–2015
The horizontal line marks the long-term average.
Source: ICES, 2016

The SSB decreased slightly in 2015 and amounted to 93,762 tonnes in early 2016, i.e. 16% over the long-term average once again. The dynamics of herring catches in the Gulf of Riga have been similar to that of spawning stock biomass: the catches have ranged from 30,000–40,000 tonnes since the second half of the 1990s, which is two times higher than in the 1970s and 1980s (ICES, 2016). It should be remembered that catches of Gulf of Riga herring are limited by the TAC. Although management of the stock has generally been sustainable in the Gulf of Riga in the recent past, high fishing mortality is a concern. This phenomenon can probably be explained by the low body weight of the herring.

The status of Gulf of Riga herring stock is assessed against the two reference levels of fishing mortality mentioned above. According to the current estimations, the sustainable fishing mortality F_{PA} is 0.4 and the maximum sustainable yield fishing mortality F_{MSY} is 0.32 for Gulf of Riga herring.

According to the ICES advice, which is based on the maximum sustainable yield approach, the fishing mortality rate of Gulf of Riga herring for 2017 should not exceed the level of $F_{MSY} = 0.32$. This implies that the total catch of Estonia and Latvia should not exceed 23,100 tonnes (for 2016 the ICES advised a total catch of up to 26,200 tonnes). Since the ICES' advice applies only to the gulf herring, the TAC for herring to be caught in the Gulf of Riga in 2017 is estimated to amount to around 27,400 tonnes.

The condition of Central Baltic herring and, to a lesser extent, possibly also of the Gulf of Riga herring may improve if sprat stocks decrease, as this would reduce food competition between sprat and herring and lead to an increase in the mean body weight of herring. This would contribute to a reduction in the fishing mortality of both stock units, which in turn would create preconditions for increased fishing opportunities – provided, of course, that the recommended fishing mortality level is respected. Long-term fishing mortality dynamics indicate, however, that despite the high biomass of the Gulf of Riga herring the fishing mortality of this stock unit did not exceed the F_{MSY} level in eight years only (Figure 16).

Sprat

Sprat (*Sprattus sprattus balticus*) is a pelagic fish, like herring. The main biological difference lies in the high fecundity and pelagic spawning of sprat: its spawn roe develops while floating in water, whereas herring mostly spawns on benthic vegetation. Also, sprat is a so-called batch spawner, which means that unlike herring it spawns over a longer period of time. These characteristics cause a remarkable variation in the reproduction of sprat, which depends on whether the environmental conditions prevailing in a particular year are conducive to the development of roe.

The main spawning grounds of sprat in the Baltic Sea are located on the slopes of the Bornholm and Gotland Deeps, as well as in the Gdansk Deep, partly overlapping with the spawning grounds of cod. In periods when sprat abundance is high, sprat move out of these reproduction centres, which are characterised by the best environmental conditions, and spread throughout the Baltic Sea, except in freshwater areas in the northern part of Bothnian Bay and the eastern part of the Gulf of Finland.

Sprat are also present in the Gulf of Riga in relatively low numbers. The state of sprat stocks is primarily influenced by the abundance of its main natural enemy – the cod. During periods when cod abundance is high there are few sprat in the Baltic Sea, and vice versa. Some researchers believe, however, that sprat may also act as a "predatory fish" for cod, feeding on its pelagic roe. Of course, this situation only occurs on the spawning grounds of cod.

The large variability in the abundance and biomass of sprat is also reflected in its total catch, which has varied over the last 39 years from just 37,000 tonnes in 1983 to 529,000 tonnes in 1997 (Table 16). In the last five years the catches of

Table 16. Sprat catches in Baltic Sea by country (10^3 t), 1977–2015

Year	Denmark	Estonia	Finland	GDR	FRG	Latvia	Lithuania	Poland	Russia*	Sweden	Total
1977	7.2		6.7	17.2	0.8			38.8	109.7	0.4	**180.8**
1978	10.8		6.1	13.7	0.8			24.7	75.5	0.8	**132.4**
1979	5.5		7.1	4.0	0.7			12.4	45.1	2.2	**77.0**
1980	4.7		6.2	0.1	0.5			12.7	31.4	2.8	**58.4**
1981	8.4		6.0	0.1	0.6			8.9	23.9	1.6	**49.5**
1982	6.7		4.5	1.0	0.6			14.2	18.9	2.8	**48.7**
1983	6.2		3.4	2.7	0.6			7.1	13.7	3.6	**37.3**
1984	3.2		2.4	2.8	0.7			9.3	25.9	8.4	**52.7**
1985	4.1		3.0	2.0	0.9			18.5	34.0	7.1	**69.6**
1986	6.0		3.2	2.5	0.5			23.7	36.5	3.5	**75.9**
1987	2.6		2.8	1.3	1.1			32.0	44.9	3.5	**88.2**
1988	2.0		3.0	1.2	0.3			22.2	44.2	7.3	**80.2**
1989	5.2		2.8	1.2	0.6			18.6	54.0	3.5	**85.9**
1990	0.8		2.7	0.5	0.8			13.3	60.0	7.5	**85.6**
1991	10.0		1.6		0.7			22.5	59.7	8.7	**103.2**
1992	24.3	4.1	1.8		0.6	17.4	3.3	28.3	8.1	54.2	**142.1**
1993	18.4	5.8	1.7		0.6	12.6	3.3	31.8	11.2	92.7	**178.1**
1994	60.6	9.6	1.9		0.3	20.1	2.3	41.2	17.6	135.2	**288.8**
1995	64.1	13.1	5.2		0.2	24.4	2.9	44.2	14.8	143.7	**312.6**
1996	109.1	21.1	17.4		0.2	34.2	10.2	72.4	18.2	158.2	**441.0**
1997	137.4	38.9	24.4		0.4	49.3	4.8	99.9	22.4	151.9	**529.4**
1998	91.8	32.3	25.7		4.6	44.9	4.5	55.1	20.9	191.1	**470.9**
1999	90.2	33.2	18.9		0.2	42.8	2.3	66.3	31.5	137.3	**422.7**
2000	51.5	39.4	20.2		0.0	46.2	1.7	79.2	30.4	120.6	**389.2**
2001	39.7	37.5	15.4		0.8	42.8	3.0	85.8	32.0	85.4	**342.4**
2002	42.0	41.3	17.2		1.0	47.5	2.8	81.2	32.9	77.3	**343.2**
2003	32.0	29.2	9.0		18.0	41.7	2.2	84.1	28.7	63.4	**308.3**
2004	44.3	30.2	16.6		28.5	52.4	1.6	96.7	25.1	78.3	**373.7**
2005	46.5	49.8	17.9		29.0	64.7	8.6	71.4	29.7	87.8	**405.2**
2006	42.1	46.8	19.0		30.8	54.6	7.5	54.3	28.2	68.7	**352.1**
2007	37.6	51.0	24.6		30.8	60.5	20.3	58.7	24.8	80.7	**388.9**
2008	45.9	48.6	24.3		30.4	57.2	18.7	53.3	21.0	81.1	**380.5**
2009	59.7	47.3	23.1		26.3	49.5	18.8	81.9	25.2	75.3	**407.1**
2010	43.6	47.9	24.4		17.8	45.9	0.2	56.7	56.2	19.5	**312.1**
2011	31.4	35.0	15.8		7.7	33.1	9.9	55.3	19.5	56.2	**263.8**
2012	11.4	27.7	9.0		7.2	30.7	11.3	62.1	25.0	46.5	**230.8**
2013	25.6	29.8	11.10		10.3	33.3	10.4	79.7	49.7	22.6	**272.4**
2014	66.6	28.5	11.7		10.2	30.8	9.6	56.9	23.4	46.0	**243.8**
2015	22.5	24.0	12.0		10.3	30.5	11.0	62.2	30.7	44.1	**247.2**

* Until 1991, the Soviet Union

Source: ICES, 2016

Figure 18. Average age composition of sprat catches, 1974–2015
1: age 1
2: age 2, etc.
6+: age 6 and older
Source: ICES, 2016

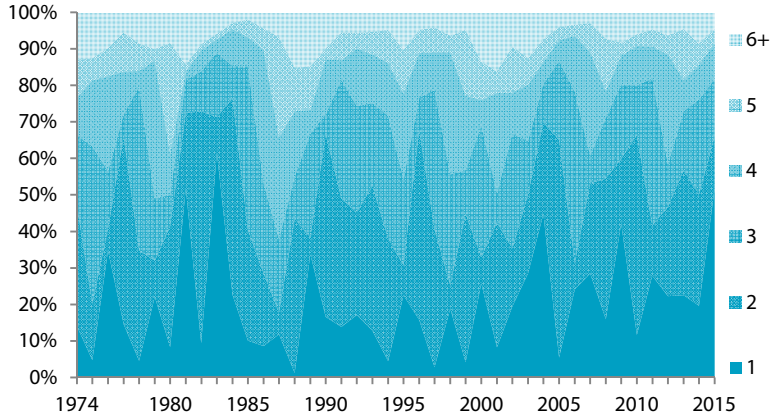


Figure 19. Dynamics of mean body weight of sprats aged 2–5, 1974–2015
Source: ICES, 2016

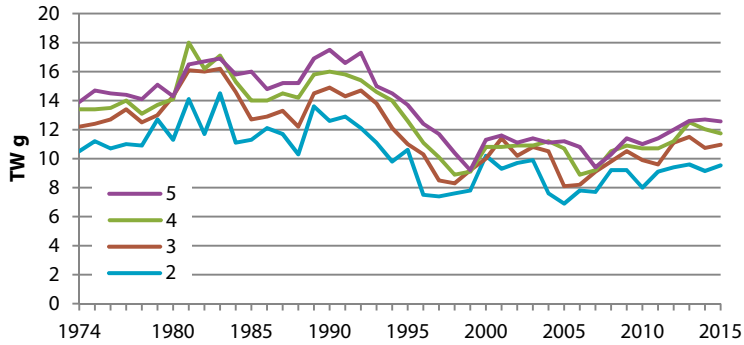


Figure 20. Sprat spawning stock biomass (SSB) and fishing mortality in age groups 3–5 ($F_{3–5}$), 1974–2015
The horizontal line represents the level of F_{MSY} = 0.26 and the dotted line indicates the sustainable fishing mortality rate F_{PA} = 0.32.
Source: ICES, 2016

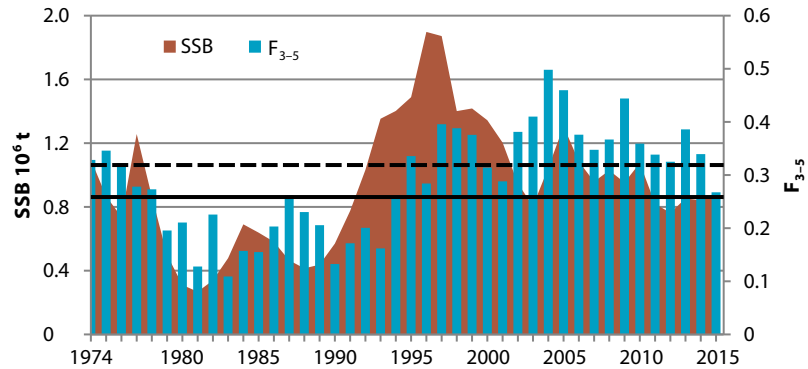
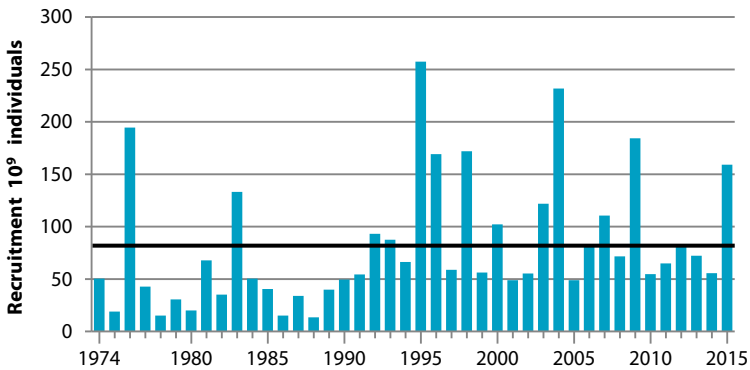


Figure 21. Dynamics of sprat recruitment (age 1), 1974–2015
The horizontal line marks the long-term average.
Source: ICES, 2016



Baltic sprat have ranged from 240,000 to 270,000 tonnes depending on the total allowable catch. In 2014 and 2015, total catches of sprat amounted to 244,000 and 247,000 tonnes, respectively. Poland (23% and 25% of the total catch, respectively), Sweden (19% and 18%), Latvia (13% and 12%) and Russia (10% and 12%) landed the largest catches of sprat in 2014. Estonia's catch was 28,500 tonnes or 12% in 2014 and 24,000 tonnes or slightly less than 10% of the total catch in 2015.

The stock and age composition of sprat is characterised by the dominance of younger age groups: the 1–2 age groups account for up to 80% of catches, depending on their abundance (Figure 18).

Changes in the body weight of sprat generally followed the corresponding trend of herring in the 1990s and 2000s. However, the decline in the mean body weight of sprat was significantly slower compared to that of herring in the 1990s, and the mean body weight of sprats of the same age currently amounts to 70–75% of the figure from the first half of the 1980s. The mean body weight increased somewhat in 2012 and 2013, but declined again in 2014 and 2015 (Figure 19).

Sprat in the Baltic Sea is treated as a single stock unit and therefore a single total allowable catch (TAC) is specified for sprat, which covers the entire Baltic Sea.

As the abundance of sprat's main natural enemy – the cod – declined significantly in the second half of the 1980s, the abundance and biomass of sprat started to increase rapidly. In 1995, the total biomass of sprat exceeded 2.6 million tonnes (the spawning stock biomass amounted to 1.49 million tonnes). On account of the strong year classes of 1994 and 1995, the spawning stock biomass of sprat reached a record level of 1.9 million tonnes in 1996 and 1997, after which it declined again until 2003. From 2004, the SSB has ranged between 0.8 and 1.3 million tonnes. The SSB declined from 2010–2012 because of the weak year classes of 2004, 2007 and 2009 and due to high fishing mortality from 2002–2010 (Figures 20 and 21). The fishing mortality figure was high in 2013, as well. At the beginning of 2015 and 2016, the ICES estimated the SSB of sprat to amount to 842,000 and 889,000 tonnes, respectively, which is 5–10% less than the long-term average (Figure 20).

International acoustic surveys of pelagic fish stocks conducted in the Baltic Sea in recent years show that the lion's share of the sprat stock is currently located in the central and north-eastern parts of the sea (Figure 7; ICES, 2016). Thus, the current status of the sprat stock in the economic zone of Estonia can currently be regarded as relatively satisfactory. However, it should be noted that fishing prospects still depend on the overall status of the stock in the Baltic Sea, i.e. the relatively better situation in our waters does not automatically mean better fishing opportunities for our fishermen. In its advice of 2016 the ICES classified the current level of exploitation of the Baltic sprat stock as sustainable because, while exceeding the FMSY level (0.26), the fishing mortality rate for 2015 (0.27) was less than the FPA level (0.32) (Figure 20).

Since the 2009 and 2010 year classes of sprat were weak, the stock and catches of sprat currently mainly depend on year classes 2012–2015. Among these, only the 2014 year class exceeds the long-term average level of abundance (ICES, 2016). As sprat stocks are extremely dependent on recruitment, any assessment of the prospects of stocks is plagued by considerable uncertainties.

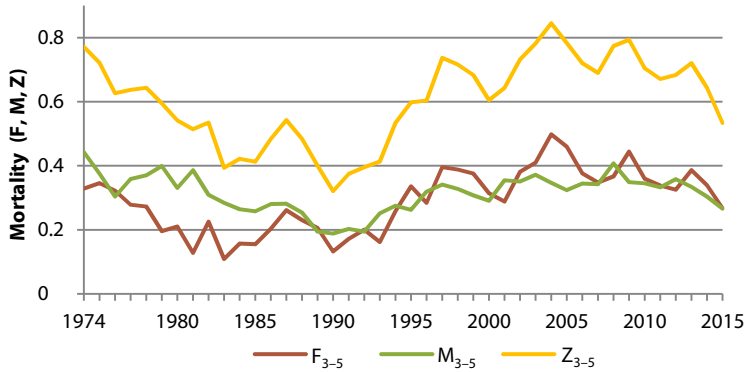


Figure 22. Fishing mortality ($F_{3–5}$), natural mortality ($M_{3–5}$) and total mortality ($Z_{3–5}$) of sprat, 1974–2015
Source: ICES, 2016

Since 1994 the total mortality of sprat has mostly been influenced by fishing mortality (Figure 22). Natural mortality prevailed, in particular, from 1978–1986, when the spawning stock biomass of cod was high (from over 250,000 to 300,000 tonnes; ICES, 2013). This shows that with current low cod stock levels the key to the management of sprat stock still mainly lies in influencing the fishing mortality of sprat; all the more so as the spatial overlap between cod and sprat stocks has decreased considerably in recent years (Figure 7).

According to the ICES advice, which is based on the maximum sustainable yield approach, the quota of sprat for 2017 should be 314,000 tonnes (for 2016, the ICES advised a catch of up to 205,000 tonnes; TAC_{2016} of EU Member States is 243,000 tonnes.)

Cod in subdivisions 25–32 (Eastern Baltic)

Being a marine fish species, the distribution and abundance of cod (*Gadus morhua callarias*) in the Baltic Sea depend on suitable reproduction conditions. The low salinity of the Baltic Sea is generally not conducive to the wide distribution of cod. The main spawning grounds of cod are located on the slopes of the Bornholm, Gdansk and Gotland Deeps. Like in the case of sprat, subject to the availability of favourable salinity, oxygen and temperature conditions, the high fecundity of cod may rapidly increase its abundance. This last occurred in the late 1970s when the spawning stock biomass of cod tripled in less than a decade. However, a lack of suitable reproduction conditions (no inflow of saline water from the North Sea) and intense and at times uncontrollable fishing, especially in the early 1990s, led to the depletion of the biomass at the same pace. Cod stocks have remained at low levels in the eastern part of the Baltic Sea since the 1990s. Catches of cod declined sharply in 2013 and 2014 – from around 50,000 tonnes during the years 2010–2012 to 31,400 tonnes in 2013 and just 29,000 tonnes in 2014. The last two catch figures are the lowest since 1987 (ICES, 2016). The total catch increased somewhat in 2015, amounting to 37,341 tonnes, including discards. Germany, Denmark and Sweden contributed the most to the increase of the total catch (Table 17).

In previous years the ICES' advice for exploitation of Eastern Baltic cod was based on the EU Multi-annual Management Plan for Cod Stocks in the Bal-

Table 17. Catches of Eastern Baltic cod by country (t), 1992–2015

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	Unreported	Total
1992	18 025	1 368	485	2 793	1 250	1 266	13 314	1 793	13 995	0	**54 882**
1993	8 000	70	225	1 042	1 333	605	8 909	892	10 099	18 978	**50 711**
1994	9 901	952	594	3 056	2 831	1 887	14 335	1 257	21 264	44 000	**100 856**
1995	16 895	1 049	1 729	5 496	6 638	4 513	25 000	1 612	24 723	18 993	**107 718**
1996	17 549	1 338	3 089	7 340	8 709	5 524	34 855	3 306	30 669	10 815	**124 189**
1997	9 776	1 414	1 536	5 215	6 187	4 601	31 396	2 803	25 072	0	**88 600**
1998	7 818	1 188	1 026	1 270	7 765	4 176	25 155	4 599	14 431	0	**67 428**
1999	12 170	1 052	1 456	2 215	6 889	4 371	25 920	5 202	13 720	0	**72 995**
2000	9 715	604	1 648	1 508	6 196	5 165	21 194	4 231	15 910	23 118	**89 289**
2001	9 580	765	1 526	2 159	6 252	3 137	21 346	5 032	17 854	23 677	**91 328**
2002	7 831	37	1 526	1 445	4 796	3 137	15 106	3 793	12 507	17 562	**67 740**
2003	7 655	591	1 092	1 354	3 493	2 767	15 374	3 707	11 297	22 147	**69 476**
2004	7 394	1 192	859	2 659	4 835	2 041	14 582	3 410	12 043	19 563	**68 578**
2005	7 270	833	278	2 339	3 513	2 988	11 669	3 411	7 740	14 991	**55 032**
2006	9 766	616	427	2 025	3 980	3 200	14 290	3 719	9 672	17 836	**65 532**
2007	7 280	877	615	1 529	3 996	2 486	8 599	3 383	9 660	12 418	**50 843**
2008	7 374	841	670	2 341	3 990	2 835	8 721	3 888	8 901	2 673	**42 235**
2009	8 295	623		3 665	4 588	2 789	10 625	4 482	10 182	3 189	**48 439**
2010	10 739	796	826	3 908	5 001	3 140	11 433	4 264	10 169	0	**50 277**
2011	10 842	1 180	958	3 054	4 916	3 017	11 348	5 022	10 031	0	**50 368**
2012	12 102	686	1 201	2 432	4 269	2 212	14 007	3 954	10 109	0	**50 972**
2013	6 052	249	399	541	2 441	1 744	11 760	2 870	5 299	0	**31 355**
2014	6 035	165	349	676	2 000	1 088	11 026	3 444	4 125	0	**28 908**
2015	9 652	188	387	1 477	2 586	1 974	12 937	3 512	4 628	0	**37 341**

Source: ICES 2016

tic Sea, according to which the recommended fishing mortality of cod (F_{MGT}) is 0.3. Implementation of the Management Plan requires an analytical assessment of stocks (fishing mortality rate). Unfortunately, the ICES has not been able to provide an analytical assessment for cod in recent years. There are several reasons for this, the main one being as follows.

An international bottom trawl survey (BITS) conducted by the ICES indicated that there has been strong recruitment of cod in some places in recent years. However, this recruitment does not end up in commercial fishing catches as adult fish. In addition, the mean body weight and growth rate of cod have shrunk dramatically in recent years. This means that a large proportion of cod no longer reaches the minimum catch length, i.e. 35 cm (TL). From 2015, in the absence of an analytical assessment of stocks, the ICES has been giving its advice for exploitation of Eastern Baltic cod on the basis of its approach to Data-Limited Stocks (DLS), i.e. the rules that the ICES applies when no realistic scientific information on a stock unit is available. According to the DLS approach, advice is given on the basis of the dynamics of an index describing the size of biomass. In the case of cod it was decided to use the average CPUE (kg/h) of fish longer than 30 cm in BITS test trawling catches as the index.

In order to formulate the advice for exploitation, the average yield of the last two years is compared with that of the preceding three years. The advised catch figure is then either proportionately increased or reduced, as appropriate. For

example, the average yield index of 2013 and 2014 was around 20% lower than the average of the preceding three years (2010–2012) (ICES, 2014). According to the DLS rules, the exploitation advice for 2015 had to accordingly provide for a catch figure that was 20% lower than the catch of 2013 (29,085 tonnes).

For 2016 and 2017 the ICES applied the same methodology and advised total catches of cod not exceeding 29,220 and 26,994 tonnes, respectively. In its advice for exploitation, the ICES also presumes that some of the Eastern Baltic cod is caught in subdivision 24 (approximately 6000–7000 tonnes).

There is still no commercial cod resource in Estonian waters, and directed fishing for this species is not economically feasible. However, Estonian vessels fish for cod in the Southern Baltic in small quantities. In 2015 and 2016, total (EU and Russia) allowable catches of Eastern Baltic cod amounted to 55,800 and 46,900 tonnes, respectively.

ESTONIA'S TRAWL FLEET IN THE BALTIC SEA

General overview of sector

In 2015, catches were reported for a total of 34 trawlers with a combined main engine power of 9449 kW and a combined gross tonnage (GT) of 3667. The average age of the vessels was 29 years, and a total of 172 people were employed on them. Compared to 2014, the number of trawlers engaged in fishing decreased by four in 2015 (Figure 23). The number of vessels, which had been on a downward trend since 2008, increased in 2014, but declined again in 2015. The temporary rise was caused by an increase in the number small trawlers (12–18 meters) engaged in fishing.

In 2015 the Estonian trawl fleet's final sprat and herring quotas (after quota transfers) were 26,204 and 25,598 tonnes, respectively (Figure 24). After years of decline, the sprat quota started to increase in 2013 and amounted to 30,126 tonnes in 2014, but was reduced in 2015 by 13%, falling to the lowest level in the last decade. The herring quota, on the other hand, increased by as much as

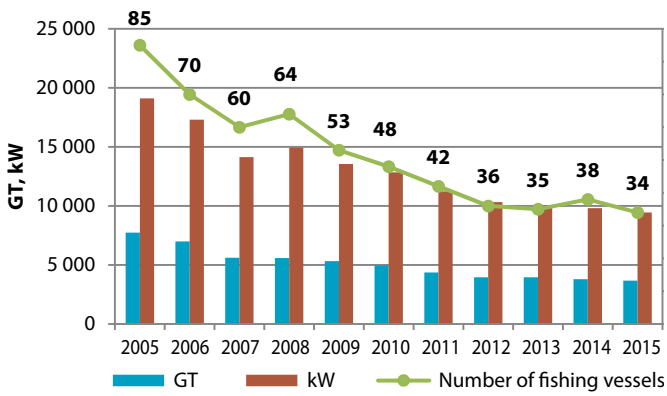


Figure 23. Number, combined gross tonnage (GT) and combined power of main engines (kW) of fishing vessels engaged in fishing, 2005–2015
Source: MoRA

55% over the year. Unlike the previous two years, when sprat and herring quota uptake levels were close to the maximum, they declined slightly in 2014 and 2015, but did not fall below 90%. This is still a high figure, considering the difficulties in the marketing of fish. For cod, the quota uptake levels of 2014 and 2015 were only 10% and 13%, respectively. The poor uptake was explained by scarcity of cod, which made it economically unreasonable to fish for it.

In 2014 the rights to catch sprat, herring and cod in the Baltic Sea on the basis of fishing vessels' fishing permits were distributed between 21, 22 and 14 companies, respectively. In 2015 the corresponding figures were 23, 24 and 14. The total catch of Estonian trawlers in the Baltic Sea amounted to 44,365 tonnes in 2014. Based on average first-sale prices, the value of the catch was 9.5 million euros. While in 2015 the total catch amounted to 47,288 tonnes, its value was 4% lower than a year ago, or 9.1 million euros. In terms of species, sprat and herring prevailed in catches, but small amounts of cod, flounder, smelt and eelpout were also caught (Figure 25). The proportion of trawlers in Estonian fishers' commercial fishing in the Baltic Sea was 81% in 2014 and 80% in 2015.

Sprat and herring were mainly landed at Estonian ports, where the catch was sold to fish freezing or processing companies, unless the fishing company itself was engaged in the processing and marketing of fish. Fish was also landed at ports in Latvia, Sweden, Denmark, Poland and Finland (Table 18). Compared to 2014, the proportion of fish landed at foreign parts increased, rising from 3% to 10% of the catch in 2015. The rise was primarily caused by an increase in the quantities of herring landed at Latvian ports. The quantities of sprat and herring

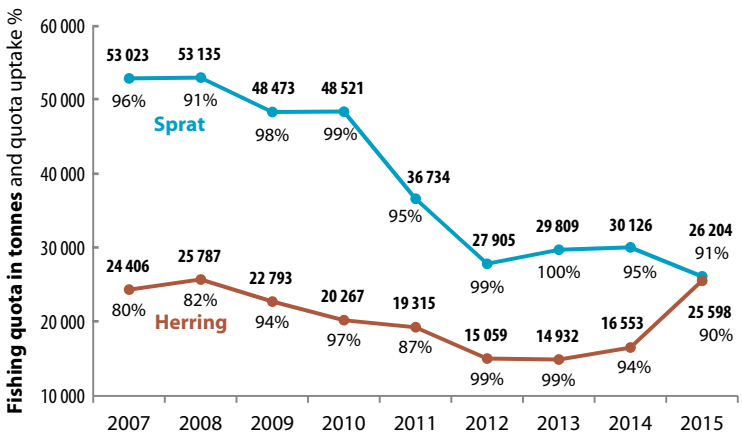
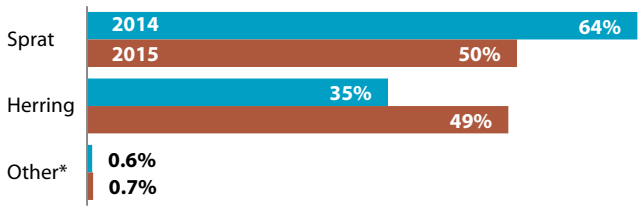


Figure 24. Estonian trawl fleet's final sprat and herring quotas (after quota transfers) and quota uptake levels (%), 2007–2015
Source: MoRA



* Cod, smelt, flounder, eelpout, stickleback

Figure 25. Proportion of fish species caught from Baltic Sea in catches of Estonia's Baltic trawl fleet in 2014 and 2015
Source: MoRA

landed in Sweden also increased and, unlike in the preceding years, these species were landed in Denmark and Finland, too. In 2014 and 2015, Estonian trawlers landed fish at 17 and 21 Estonian ports, respectively (Tables 19 and 20). The largest quantities of catch were landed at Dirhami, Miiduranna and Veere, where more than half of the fish caught by Estonian trawlers was brought ashore. Most of the sprat and herring caught by the Estonian trawl fleet in 2014 and 2015 were sold on the eastern market in frozen form. While in 2014 Russia and Ukraine

Table 18. Landings (t) in different countries of fish caught from Baltic Sea by Estonian trawlers in 2014 and 2015

Species	Year	Estonia	Latvia	Sweden	Denmark	Poland	Finland
Sprat	2014	28 391	77	31			
	2015	22 682	22	745	484		21
Herring	2014	14 640	860	95			
	2015	19 942	2 325	534	211		15
Cod	2014	2	27		1	105	
	2015	<1	15		<1	138	
Smelt	2014	5					
	2015	88	<1				
Flounder	2014	<1	43			64	
	2015		<1		<1	40	
Eelpout	2014						
	2015	<1					
Stickleback	2014	<1					
	2015						
Total	**2014**	**43 039**	**1 007**	**125**	**1**	**169**	**0**
	2015	**42 712**	**2 364**	**1 279**	**696**	**178**	**36**

Souce: MoRA

Table 19. Landings in Estonian ports of fish caught from Baltic Sea by Estonian trawlers in 2014

County	Place of landing	Landings, t	Proportion (%) of total landings of trawles
Lääne County	Dirhami	13 929	32.36
Harju County	Miiduranna	7 857	18.25
Saare County	Veere	6 999	16.26
Harju County	Meeruse	3 475	8.07
Hiiu County	Lehtma	2 308	5.36
Lääne County	Virtsu	1 807	4.20
Harju County	Paldiski South Habour	1 678	3.90
Saare County	Saaremaa	1 610	3.74
Saare County	Roomassaare	1 275	2.96
Harju County	Leppneeme	724	1.68
Lääne County	Westmeri	653	1.52
Saare County	Mõntu	558	1.30
Ida-Viru County	Toila	94	0.22
Lääne County	Virtsu fish port	32	0.07
Harju County	Tapurla	21	0.05
Lääne-Viru County	Kunda	21	0.05
Harju County	Leppneeme fish port	0.1	<0.01

Souce: MoRA

were the main two export partners, in 2015 Belarus replaced Russia. Cod and flounder were landed and sold at foreign ports (mostly Poland and Latvia).

2014 and 2015 can be regarded as difficult years for the trawling sector. At the end of 2013 and beginning of 2014, the Russian Federal Service for Veterinary and Phytosanitary Surveillance imposed temporary restrictions on imports of fish and fishery products from eight companies operating in the fisheries sector, referring to shortcomings in ensuring food safety. The situation became even more difficult in August 2014 when, in response to the EU's sanctions, Russia enforced an embargo on most food products originating from the EU, including fish and fishery products. For some time, the Russian border was open only to fish preserves and spiced sprats. Given that Russia had been the main market for frozen sprat and herring, our fish processing companies were forced to actively look for new markets, leaving the fish in cold storage. The foreign trade data of Statistics Estonia for 2014 and 2015 show that Estonian companies have been relatively successful in finding new clients: in 2014 and 2015, exports of frozen fish originating from Estonia amounted to 53,000 and 46,000 tonnes, respectively.

The proportion of the Russian market dropped from 41% in 2014 to less than 1% in 2015. At the same time, exports to Ukraine increased by 54%, which means that 61% of frozen fish originating from Estonia was exported to Ukraine in 2015. Larger quantities of fish were also exported to Belarus, Kazakhstan, Denmark, Latvia and Moldova. In search of new partners, Asian and African countries were considered, as well. While our companies experienced difficulties in marketing their sprat and herring, in 2014 the quantity of fish caught was

Table 20. Landings in Estonian ports of fish caught from Baltic Sea by Estonian trawlers in 2015

County	Place of landing	Landings, t	Proportion (%) of total landings of trawles
Lääne County	Dirhami	10 953	25.64
Harju County	Miiduranna	8 356	19.56
Saare County	Veere	5 763	13.49
Lääne County	Virtsu	4 555	10.67
Harju County	Meeruse	4 166	9.75
Saare County	Roomassaare	1 834	4.30
Saare County	Saaremaa	1 681	3.93
Hiiu County	Lehtma	1 528	3.58
Harju County	Paldiski South Habour	1 039	2.43
Saare County	Mõntu	842	1.97
Harju County	Leppneeme	703	1.65
Lääne County	Westmeri	378	0.89
Pärnu County	Munalaiu	256	0.60
Ida-Viru County	Toila	209	0.49
Lääne County	Virtsu old port	111	0.26
Harju County	Bekkeri	109	0.25
Pärnu County	Pärnu	102	0.24
Harju County	Tapurla	45	0.11
Lääne County	Virtsu fish port	35	0.08
Harju County	Lahesuu	32	0.07
Lääne-Viru County	Kunda	16	0.04

Souce: MoRA

at the same level as in the two preceding years, and in 2015 it was even higher than that. The loss of the Russian market influenced the price of sprat and herring. In 2013 the average first-sale prices of herring and sprat had been 23 and 22 cents per kilogram, respectively, but in 2015 an average of 19 cents per kilogram was paid for either species. On the other hand, declining fuel prices helped fishermen save some costs in 2014 and 2015.

According to the data of the ARIB, fisheries subsidies paid in 2014 to fishing companies for permanent cessation of fishing activities by scrapping or permanent reassignment of fishing vessels amounted to 1,995,490 euros. In addition, 155,747 euros was paid for investments in fishing vessels. No fisheries subsidies for scrapping or permanent reassignment of fishing vessels were paid in 2015, but 110,793 euros was paid for investments in fishing vessels.

On 6 November 2008, Decision 2008/949/EC of the European Commission took effect by which a multiannual programme for establishing a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy was adopted. According to the Commission Decision, Estonia's Baltic trawlers can generally be divided into two length classes: 12–18 m and 24–40 m[1)]. In 2014 and 2015, large trawlers prevailed. The preference for large trawlers in fishing can be explained by their efficiency. Greater efficiency enables, e.g. higher wages to be paid to the crew.

Basic indicators of 12–18 m length class trawlers

Six and five companies, respectively, were engaged in fishing with small trawlers in 2014 and 2015. In 2015, eight vessels were used for fishing, i.e. two fewer than the year before (Table 21). In 2014 and 2015, the trawlers caught a total of 839 tonnes and 998 tonnes of fish, respectively, which represented just 2% of the total catch of the Estonian trawl fleet in the Baltic Sea. While the volume of the fish catch increased by 19% over the year, the first-sale value of the catch increased only by 7% in 2015 (due to lower first-sale prices), amounting to 189,605 euros. In 2014, the proportions of sprat and herring caught by small trawlers were equal, but in 2015 the proportion of herring grew considerably, representing 71% of the total catch (Figure 26). On average[2)], 15 and 14 fishermen were employed on small trawlers in 2014 and 2015, respectively.

Basic and economic indicators of 24–40 m length class trawlers

In 2014, catches were reported for 28 large trawlers owned by 16 companies. These trawlers caught 43,525 tonnes of fish, whose estimated total value amounted to around 9.3 million euros based on average first-sale prices. In 2015, 26 large trawlers owned by 15 companies were engaged in fishing. Their total catch amounted to 46,290 tonnes and the total value of the catch is estimated to amount to around 9 million euros. In 2015 the total catch increased by 6%, but the first-sale value of the catch decreased by 4% compared to 2014. While sprat and herring accounted for 65% and 35%, respectively, of the catch of large trawl-

1) In order to facilitate the analysis of the fleet, this length class also includes the few 18–24 m vessels that should belong to the group of large trawlers in terms of their engine power and gross tonnage.
2) Average number of employees during the year.

ers in 2014, these species were represented in almost equal proportions (51% and 48%, respectively) in the catch of 2015 (Figure 27).

As in preceding years, the number of large trawlers engaged in fishing continued to decline in 2014 and 2015 (Table 22). The average number of employees also decreased: from 160 in 2014 to 158 in 2015. Since the number of vessels

Table 21. Basic indicators related to fishing operations of 12–18 m length class trawlers, 2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015
Number of fishing vessels	23	14	12	10	7	6	10	8
Catch, 10^3 t	2	1.5	2.2	1.2	1.1	0.9	0.8	1.0
Value of catch based on first-sale prices, €10^3	322	207	285	204	208	198	177	190
Average number of employees	37	22	20	17	14	13	15	14
Average number of trawling hours per vessel	154	163	178	118	162	153	63	87

Sources: MoRA, UT EMI

Table 22. Basic and economic indicators related to fishing operations of 24–40 m length class trawlers, 2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015
Number of fishing vessels	41	39	36	32	29	29	28	26
Catch, 10^3 t	68.9	68.0	66.1	51.8	42.4	44.0	43.5	46.3
Value of catch based on first-sale prices, €10^6	11.9	10.7	9.2	9.9	9.0	9.6	9.3	9.0
Average number of employees	236	227	207	199	174	170	160	158
Average annual wage cost per employee, €	12 057	12 129	12 510	12 368	15 083	14 793	16 959	18 130
Average number of trawling hours per vessel	1 152	1 025	812	1 080	1174	725	779	824
Average fuel price per litre, €	0.503	0.377	0.486	0.709	0.770	0.684	0.601	0.460
Gross value added, €10^6	7.3	6.7	5.2	5.2	4.5	5.9	6.6	6.1

Sources: MoRA, UT EMI

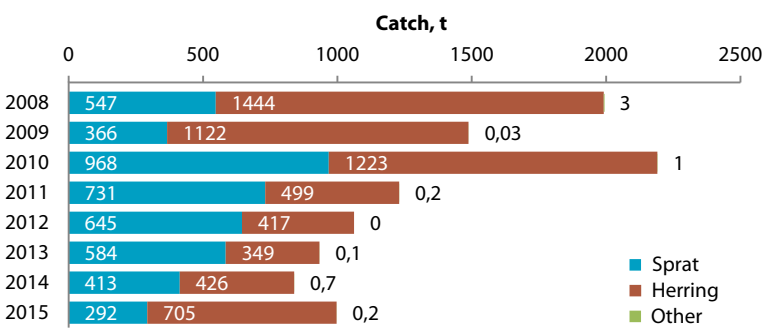


Figure 26. Sprat and herring catches (t) of 12–18 m length class trawlers, 2008–2015
Source: MoRA

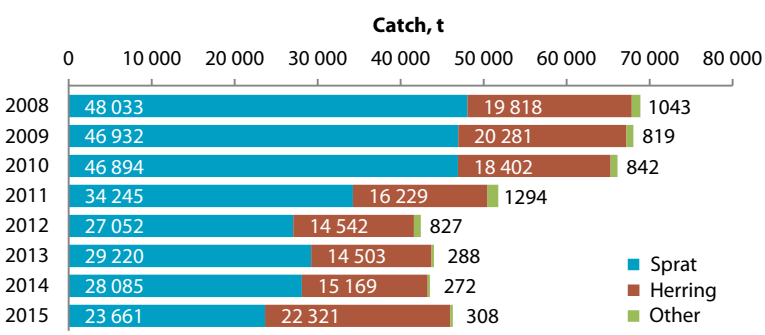


Figure 27. Catches of sprat, herring and other species (t) of 24–40 m length class trawlers, 2008–2015
Source: MoRA

decreased, but the herring quota increased, the average number of trawling hours per vessel grew in 2015. The average annual wage cost per employee was 18,130 euros in 2015, which was 7% more than in 2014. The gross value added of the segment of large trawlers amounted to around 6.6 and 6.1 million euros, respectively, in 2014 and 2015. The fishing-related operating costs of trawlers in the 24–40 m length class amounted to 6.7 million euros in 2015, which indicates an increase of 6% compared to 2014. Labour (57%) and fuel (18%) made up the largest proportions of the costs (Figure 28). The increase in costs was caused by higher repair and maintenance costs, as well as labour costs. As the average fuel price per litre was lower in 2015, companies were able to save on fuel costs.

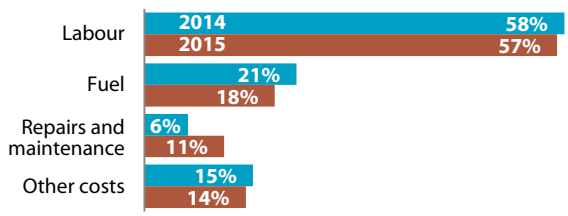


Figure 28. Distribution of various operating costs related to fishing operations of trawlers of 24–40 m length class in 2014 and 2015
Source: UT EMI

Inland fisheries

LAKE VÕRTSJÄRV FISHERY

Stocks of the key fish species of Lake Võrtsjärv have been at a good level and, for some species, even at a very good level in recent years. The outlook for coming years is also favourable for most important species. Pikeperch cohorts have been particularly abundant in recent years. Eel catches are directly dependent on restocking levels and prices of restocking material 6–12 years ago.

Due to a very low water level, 2014 and 2015 were unusual for Lake Võrtsjärv. In October 2015, the water level was half a meter lower than the long-term average at the Rannu-Jõesuu measuring point. A lack of spring flood affects, in particular, pike's and bream's spawning conditions in littoral floodplains, which were downright dry in the spring of 2014. In addition, the low water level has caused a rapid expansion of reed-beds, which also affects the fish fauna. Namely, reed has become so thick at places that fish cannot swim through it, causing a substantial part of the littoral zone being inaccessible to fish.

Catches taken in Lake Võrtsjärv in 2015 totalled 199.7 tonnes, which is comparable to the average catch level of the last five years. The total catch declined primarily on account of pike and pikeperch whose catches amounted to 44.2 and 44.1 tonnes, respectively, or 20 and 16 tonnes less than in 2014. By volume, the biggest catch was produced by bream – 80.8 tonnes, which represented 40% of the total catch. Both pike and pikeperch accounted for 22% of the total catch (Table 23).

Trap nets were the main fishing gear and provided 74% of the total catch. Fifty-two tonnes or 26% of the total catch were taken with gill nets. Pikeperch, pike and bream accounted for 73%, 18% and 7%, respectively, of the gill net catch. The proportion of other fish species was just 2%.

The amount of fishing gear and the fishing effort have been the same on Lake Võrtsjärv in recent years. In 2015, permits were issued for fishing with 324 trap nets and 320 gill nets, plus 40 recreational gill net permits. Permitted com-

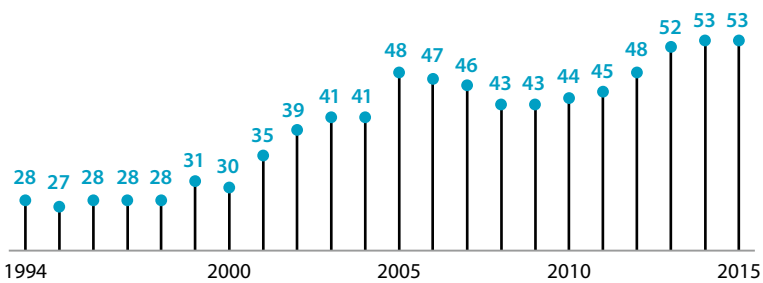


Figure 29. Number of commercial fishing permits issued for Lake Võrtsjärv, 1994–2015
Source: Fisheries Information System of the MoRA; EULS

mercial fishing was distributed between 53 permit holders in 2015. The number of permit holders has increased in connection with the sale of a part of fishing rights (Figure 29).

Table 23. Catches (t) from Lake Võrtsjärv, 1971–2015

Year	Eel	Pike-perch	Pike	Bream	Burbot	Perch	Other	Second-rate fish	Total
1971	6.5	28.1	12.9	20.1	2.7	4.5	0.5	75.3	**150.6**
1972	16.4	32.3	14.0	21.4	2.4	3.3	0.8	80.7	**161.4**
1973	21.3	43.0	11.5	16.0	1.2	3.8	0.4	92.3	**184.6**
1974	18.7	50.7	17.6	25.9	2.7	0.9	0.2	42.6	**161.9**
1975	36.9	51.8	12.3	23.8	1.3	1.6	0.3	41.3	**151.1**
1976	41.6	46.3	9.0	27.1	1.6	1.0	0.1	33.1	**155.1**
1977	50.0	45.3	12.8	33.2	1.7	0.6	0.3	20.8	**156.3**
1978	45.0	62.0	17.8	31.7	2.6	2.7	0.3	42.1	**209.2**
1979	19.0	73.0	19.0	26.1	3.0	3.0	0.8	40.3	**210.2**
1980	17.8	50.9	24.8	42.0	11.2	9.1	0.6	53.1	**210.7**
1981	16.4	42.4	29.3	63.0	17.9	7.9	0.4	68.4	**247.1**
1982	10.8	55.2	34.5	45.8	8.8	9.2	0.3	72.0	**242.2**
1983	24.6	50.5	51.4	60.0	7.4	8.8	0.6	85.3	**274.8**
1984	66.7	36.9	50.4	59.9	8.9	7.2	0.3	104.0	**292.2**
1985	71.9	59.0	39.0	100.1	7.4	5.4	0.3	168.4	**446.3**
1986	55.6	68.2	61.4	74.7	6.9	9.4	0.6	205.4	**498.5**
1987	61.2	45.5	35.0	76.9	6.6	7.0	1.2	163.3	**391.1**
1988	103.7	53.4	48.7	127.0	6.6	6.3	1.2	330.4	**634.8**
1989	47.6	44.5	56.4	196.7	5.9	7.4	1.4	303.6	**719.6**
1990	56.1	18.8	45.8	194.4	2.5	4.4	1.0	147.8	**414.7**
1991	48.5	26.7	30.5	139.4	4.8	3.7	1.4	212.5	**419.0**
1992	31.0	14.0	25.0	100.0	3.3	6.2	0.3	97.7	**246.5**
1993	49.0	36.0	32.0	81.0	7.0	8.0	0.8	107.0	**271.8**
1994	36.9	25.5	23.4	87.8	4.2	5.4	1.4	79.1	**226.8**
1995	38.8	28.3	19.4	68.7	1.4	5.2	0.1	112.8	**235.9**
1996	34.1	22.3	28.1	69.1	3.0	2.1	0	88.2	**212.8**
1997	40.3	20.7	19.3	92.3	3.4	2.4	0.1	98.0	**236.2**
1998	21.8	43.7	16.1	70.5	3.8	2.9	0.1	81.9	**219.0**
1999	37.4	34.5	24.9	47.8	2.6	12.1		116.7	**275.9**
2000	38.8	29.5	40.7	54.4	3.8	18.3	2.0	150.1	**337.6**
2001	37.6	32.8	50.8	56.8	4.0	12.6	0.2	191.7	**376.5**
2002	20.4	25.2	44.8	30.5	3.5	9.7	0.1	184.3	**318.8**
2003	26.4	19.2	49.8	42.3	6.0	14.2	0.1	157.9	**315.9**
2004	20.1	27.3	55.5	59.1	4.1	10.1	0.1	176.9	**353.2**
2005	17.6	46.7	52.6	57.3	2.5	15.4		192.5	**379.1**
2006	19.9	42.3	79.5	65.5	2.8	44.1	0.1	127.9	**381.7**
2007	21.5	29.7	57.0	105.2	3.6	17.1	0.1	174.6	**407.3**
2008	20.5	48.3	31.6	158.2	7.8	10.8	1.7	229.0	**507.9**
2009	13.6	74.1	33.0	81.5	2.9	9.0	1.6	131.9	**347.6**
2010	10.3	29.1	34.3	56.9	2.3	13.7	0.8	119.2	**266.6**
2011	11.2	40.7	32.2	77.9	2.3	16.9	1.2		**182.4**
2012	12.2	37.8	46.6	87.2	3.8	13.4	7.7		**208.7**
2013	12.7	40.5	70.1	79.3	5.2	9.7	47.8*		**264.9**
2014	13.3	60.1	64.2	79.1	2.7	5.5	12.6		**237.5**
2015	12.3	44.1	44.2	80.8	2.4	2.8	13.1		**199.7**

* Mostly Gibel carp Note: The figures for 2000-2010 also include catches from restricted and recreational fishing in addition to commercial fishing Source: EULS

Commercial fishing rights were most needed for lakeside tourism operators to be able to apply for support under the regional measure from the Fisheries Fund. Some fishermen have sold part of their historic fishing rights, because they decided to engage primarily in fish processing and selling.

Eel

Eel catches have been relatively steadily in the range of 10–13 tonnes since 2009. The catch figures for 2014 and 2015 were 13.3 tonnes and 12.3 tonnes, respectively, which represented just over a third of the long-term average (32 tonnes) (Figure 30). Recreational fishing produced another 280 kg of eel in 2015. Based on the long-term restocking volume and catch ratio and the mark-recapture data, it is estimated that eel catches from Lake Võrtsjärv could actually amount to more than 30 tonnes per year.

The main reason for the decrease in the catch is the sharp decline in the number of eels introduced into the lake since the beginning of the 2000s when the price of restocking material rose dramatically on the world market. The price levels of glass eels were in the range of €500–700/kg for ten or so years, until 2014. The increasing abundance of glass eels reaching the coast of Europe in recent years and the ban on exports from the EU have significantly lowered the market price of glass eels. The price determines the restocking volume. The sharp drop in the price in 2014 (€168/kg) enabled 2.7 million glass eels to be introduced in Lake Võrtsjärv, plus another approximately 200,000 farmed eels.

The restocking of Lake Võrtsjärv and other lakes with glass eels is organised by NGO Lake Võrtsjärv Fisheries Development Agency. The Environmental Investment Centre supports the project. The European Fisheries Fund also supported the introduction of farmed eels during the period 2011–2014.

Around 150,000 euros was envisaged for eel restocking in 2015, for which a total of 562 kg or nearly 1.9 million glass eels (3300 individuals per kg) were introduced in Estonian lakes. Of that amount, 485 kg (1.6 million individuals) or 86% were introduced in Lake Võrtsjärv and 78 kg were introduced in small lakes. The price of glass eels was 265 euros per kg, i.e. 8 cents per individual. It was the first time in 15 years when no farmed eels were introduced in lakes.

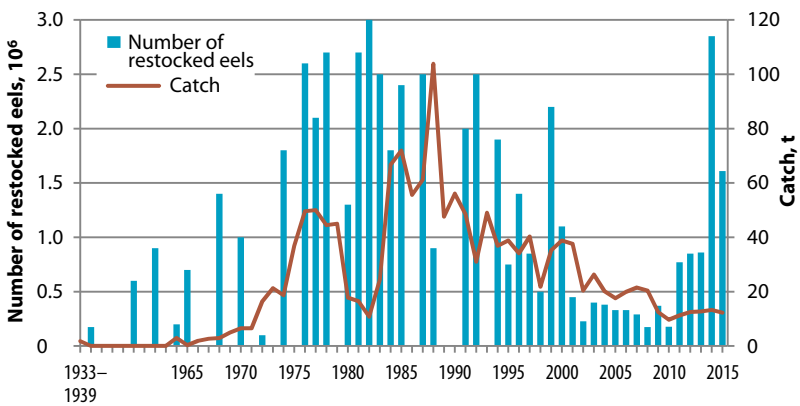


Figure 30. Eel restocking (number of individuals) and catches (t) in Lake Võrtsjärv, 1933–2015
Source: EULS

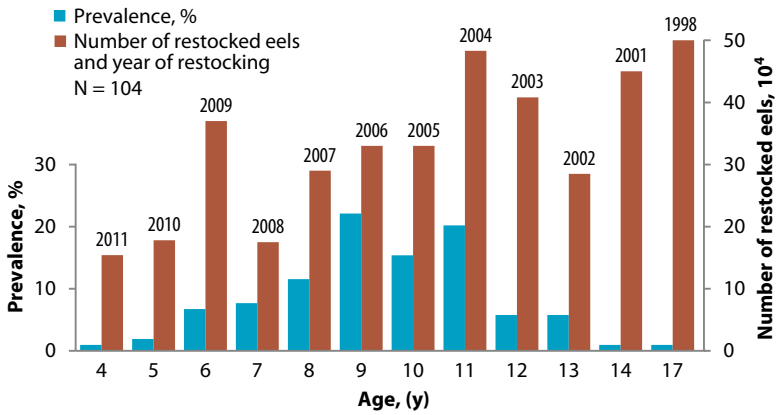


Figure 31. Age composition of eel catches taken in Lake Võrtsjärv using trap nets in 2015. The blue bars represent the prevalence of different age groups (%), and the brown bars represent the number of farmed and restocked eels (10^4). Source: EULS

All the glass eels introduced in Lake Võrtsjärv and small lakes were mass-marked, using an enriched stable isotope.

Catches are generally dominated by farmed eels of 7–11 years of age, because emigration increases later in life and older fish get caught less frequently. The small pre-farmed cohort of 2008 (175,000 individuals) has been caught from 2014. The forecast for coming years, unfortunately, does not point to an improvement in catches: although the abundance of the farmed cohort restocked in 2009 is above average (370,000 individuals), the next cohort is very small again, consisting of 178,000 farmed eels (Figure 31). Given that catches are dominated by age groups 7–10 and that two small cohorts will be in that age range in the coming years, the catches are bound to decline a little.

Eel catches are significantly also impacted by weather – when it is possible to start fishing in the spring, how long is the fishing period in the autumn, and how high is the water level. Eel catches are usually highest in May and September.

According to the data for 2015, the first-sale price of eel was 7.34 euros. In home yard sales the price of fresh eel is nearly twice the official first-sale price, which helps fishermen increase their earnings. Fishermen are increasingly adding value to their catches locally, selling smoked or pickled eels in tins or glass jars.

Pikeperch

Pikeperch is one of the most important fish species in Lake Võrtsjärv and its stocks largely determine the livelihood of local fishermen. Pikeperch stock and catches have been strong in Lake Võrtsjärv for years. Thanks to a remarkable demand and a high first-sale price, pikeperch has provided the lion's share of fishermen's income in recent years. While the catch taken in Lake Võrtsjärv in 2015 was considerably lower than in 2014 (around 44 and 60 tonnes, respectively), it was still higher than the average of the last 40 years (around 41 tonnes).

The first months of under-ice gill net fishing are crucial in pikeperch fishery, regardless of when the lake freezes over. Sometimes nearly 50% of the annual catch is taken during that period. Winter fishing was a success also in 2015: more than 21 tonnes of pikeperch were caught in January and February. In contrast, the catch landed in the preceding December was – due to the warm autumn – half the

catch taken a year ago. Having taken out their trap nets, some fishermen decided not to use gill nets at all, because water tends to contain substantial quantities of parts of spiked water-milfoil pulled up from the lake bottom in windy weather, which clog nets and significantly reduce their catching ability. One windy day is enough to cause a need to replace the entire line of nets. The catch landed in autumn 2015 was also nearly 11 tonnes lower compared to 2014.

The largest pikeperch catches are usually taken with gill nets: such catches accounted for 86% in 2015. Recreational fishermen caught 2.7 tonnes of pikeperch on the basis of fishing cards during the year; thus the total catch of pikeperch taken from Lake Võrtsjärv amounted to more than 46 tonnes (Table 23). The annual catch of pikeperch per net permit was 67.5 kg in recreational fishing and 119 kg in commercial fishing.

The fact that pikeperch year classes remain in commercial fishing catches for up to ten years reflects balanced fishing intensity. Unlike in other lakes, the minimum size of pikeperch, measured from the tip of the snout to the end of the caudal fin (TL), is 51 cm in Lake Võrtsjärv, which enables pikeperch to reproduce for at least a couple of years before being caught. As the natural mortality rate of this predatory fish at the top of the food chain is low, each pikeperch puts on 300–500 g in weight each year. This ultimately means higher catches of each year class.

The size of a pikeperch cohort is determined by numerous factors, with two of them being more relevant to the survival of juveniles. First, the summer water temperature affects directly the growth rate of fry and thus the transition of juvenile pikeperch from zooplankter diet to feeding on fry, i.e. predation. Test trawling data indicate that in autumn 2015 almost all of the pikeperch born in the summer of that year and with the average length (TL) of more than 13 cm in autumn had made the transition to predation. The other important factor is the abundance of the main food of pikeperch born in a given year – lake (dwarf) smelt. The abundance of that species has grown exponentially in the last few years and reached an absolute maximum of the last 30 years in 2015 (NPUE 1221 individuals per trawling hour, Table 24).

Table 24. Species composition, abundance and weight (number of individuals per trawling hour and weight in grams) of trawling catches from Lake Võrtsjärv in 2015

Species	WPUE (g/h)		NPUE (ind./h)		Average weight of fish, g
	TW g	%	No. of ind.	%	
Lake Peipsi (dwarf) smelt	2 041	0.5	1 221	9.7	2
Pike	7 699	1.8	5	0.0	1 453
Roach	70 323	16.5	5 214	41.6	13
Bleak	2 137	0.5	276	2.2	8
Bream	273 219	64.1	2 932	23.4	93
Silver bream	12 071	2.8	668	5.3	18
Gibel carp	594	0.1	1	0.0	918
Burbot	282	0.1	0	0.0	872
Perch	998	0.2	29	0.2	34
Pikeperch	38 628	9.1	52	0.4	743
Ruff	18 013	4.2	2 146	17.1	8
Total	**426 006**	**100**	**12 544**	**100**	**34**

Source: EULS

Pike

Catches of pike were at their peak in the mid-2000s: the year 2006 was marked by the biggest ever catch of 79.5 tonnes (Table 23). Thereafter catches declined significantly, amounting to around 30 tonnes, i.e. the long-term average (35.8 tonnes) for several consecutive years. From 2012 onwards, the average pike catch has increased considerably (46.6 tonnes). The commercial fishing catch of pike taken from Lake Võrtsjärv amounted to as much as 70 tonnes in 2013. The catch of 2014 was also much higher than the average, amounting to more than 64 tonnes. While still exceeding the long-term average, the catch landed in 2015 (44.2 tonnes) was significantly lower than in previous years.

Trap nets are the main fishing gear in pike fishing and provided 80% of the catch. The share of gill nets is usually in the range of just 15–25%. Trap net fishing was the most successful in May, when over 11 tonnes of pike was caught. A little over a tonne of pike was caught using gill nets on the basis of fishing cards.

Bream

Bream continues to produce the biggest catches in Lake Võrtsjärv. The catch of bream increased dramatically in 2008, when a total of 158 tonnes of large bream (TL over 36 cm) was caught. The period 2009–2011 was characterised by a significant decline, with around 82 tonnes of bream caught in 2009 and only around 57 tonnes in 2010 (Table 23). According to official statistics, around 80–90 tonnes of bream was caught annually from Lake Võrtsjärv in the period 2011–2015 (around 79 tonnes in 2014 and around 81 tonnes in 2015). In winter fishing, the proportion of bream is very modest, totalling 1–2 tonnes. In a longer-term comparison, the abundance of large bream is currently moderate in Lake Võrtsjärv, the stock is in good state and the size and mean weight of fish are above the average.

Second-rate fish taken as by-catch in trap net fishing, of which small bream accounts for 70–80%, is no longer registered since 2011. For bream, therefore, the catch figures do not represent actual statistics that could be compared with the figures from previous years. Some fishermen who have found an opportunity to sell small bream have registered all the second-rate fish as bream in their log books. Most of them do not register second-rate fish at all, because it is not landed.

Table 25. General assessment of state of stocks and fishing mortality in Lake Võrtsjärv in 2015 and the near future, by key species

Species	State of stocks			Fishing mortality
	2015	until 2016	until 2018	
Eel	2	3	2	A
Pikeperch	1	1	1	B
Pike	1	1	2	B
Bream	2	2	3	A
Perch	3	3	3	B
Burbot	3	3	2	A
Lake Peipsi (dwarf) smelt	1	1		—

Note: state of stocks – 1: good; 2: moderate; 3: poor; 4: depleted; fishing mortality – A: low; B: moderate; C: high; D: insufficient data

Source: EULS

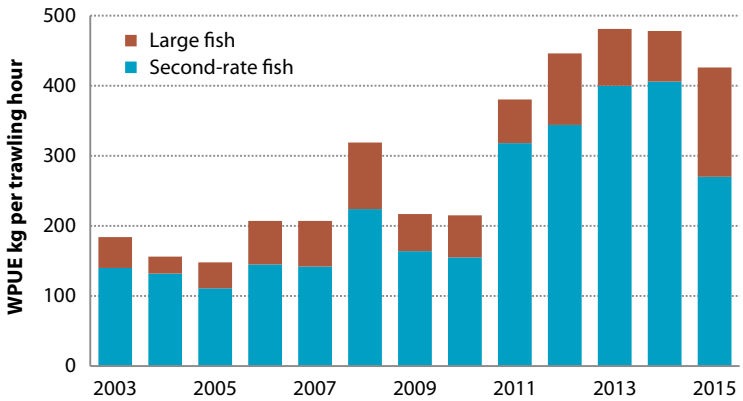


Figure 32. Trawling catch kg/trawling hour in Lake Võrtsjärv, 2003–2015
Source: EULS

The fast growth in the abundance of second-rate fish of little value in Lake Võrtsjärv (Figure 32) is a consequence of discarding second-rate fish for several consecutive years. The sharp rise in the proportion of second-rate fish threatens the health of Lake Võrtsjärv, resulting in a deterioration of the quality of water and impairing food competition among fish. The food competition is becoming tighter in particular among benthivorous fish (eel, bream, ruff, silver bream). Therefore, efforts should be made to add value to second-rate fish, which would ensure that all fishermen are interested in bringing it ashore.

The prospects of catches from Lake Võrtsjärv for the next few years continue to be good or even very good for most key species (Table 25).

LAKE PEIPSI FISHERIES

State of fish stocks

In 2014 and 2015 the fish stocks of Lakes Peipsi and Lämmijärv and thus also the fishing quotas were a little lower than in previous years (Table 26). Perch and pike quota declined the most, while the quota for bream was higher than usual, and the quotas for roach and vendace moved up and down. The quota for pikeperch as the most valuable target species remained almost unchanged. Perch, pikeperch and bream quotas were the highest, as in previous years. The quota for smelt was intended only for test fishing in both years. While in 2014 the cohorts of 2009 accounted for the bulk of both pikeperch and perch stocks, in 2015 these were replaced by fish born in 2012. No strong cohorts appeared in 2014, but in 2015 the recruitment of pikeperch was of a medium abundance and that of perch was very abundant. In both 2014 and 2015 the bream stock consisted mainly of fish born in 2005 and 2006. The recruitment of this species has been more stable, with year classes 2009 and 2010 being stronger. In general, the stocks of fish that prefer warm or temperate water were in a moderate or good state, while the stocks of coldwater fish were in a poor or depleted state in 2014 and 2015 (Table 27).

Table 26. Estonian national quotas (t) on Lakes Peipsi and Lämmijärv from 2011–2015 and the average for the period

Species	2011	2012	2013	2014	2015	Average
Pikeperch	672	714	650	650	650	667
Perch	900	1400	1000	800	850	990
Pike	110	160	165	120	125	136
Bream	600	614	650	750	710	665
Roach	305	300	280	350	275	302
Whitefish	5	3	2	1	1	2
Smelt*	5	5	5	5	5	5
Vendace	10	15	15	25	15	16
Burbot	50	50	50	50	50	50
Ruff	300	300	150	150	150	210
Other species	50	50	25	25	25	35
Total	**3007**	**3611**	**2992**	**2926**	**2856**	**3078**

* The smelt quota is intended only for test fishing. Source: UT EMI

Table 27. State of stocks and fishing mortality of commercial species in Lakes Peipsi and Lämmijärv in 2014 and 2015

Species	2014		2015	
	State of stocks	Fishing mortality	State of stocks	Fishing mortality
Pikeperch	2	C	2	C, B
Perch	1	B	1	B
Pike	2	B	2	B
Bream	1	B	1	B
Roach	2	B	2	B
Burbot	3	B	3	B
Ruff	3	A	3	A
Whitefish	3, 4	B, D	4	B, D
Smelt	4	A	4, 3	A
Vendace	3	B, D	3	B, D
Other species	5	D	5	D

Note: state of stocks – 1: good, 2: moderate, 3: poor, 4: depleted; fishing mortality – A: low, B: moderate, C: high, D: insufficient data Source: UT EMI

Fisheries management

In 2014 and 2015 the fisheries management of the lake was broadly similar to that of previous years, but there were also a few differences. In the entire chain of lakes (Lakes Peipsi, Lämmijärv and Pskov) the moratorium on fishing for pikeperch and bream and in Lakes Lämmijärv and Pskov the general moratorium on fishing with trap nets were applied from an earlier date: instead of 15 May the closed period started on 5 May and it lasted until 10 June. As the half-year quota for perch was exhausted, the period of spring fishing with trap nets was also shortened on Lake Peipsi.

During the period of short-term autumn fishing with small-mesh seines and trap nets, the minimum size of pikeperch was 25/30 cm in 2014 and 28/33 cm in 2015. Since the permitted (excessive) fishing capacity was at the same level as in previous years, its use had to be discontinued before the end of the year. In 2014, fishing ended in early October, and in 2015 only gill nets were permitted

Table 28. Estonian catches and quotas (t) and quota uptake levels (%) on Lakes Peipsi and Lämmijärv in 2014 and 2015

Species	2014			2015		
	Catch	Quota	Uptake	Catch	Quota	Uptake
Pikeperch	599	650	92	420	650	65
Perch	787	800	98	818	850	96
Pike	120	120	100	94	125	75
Bream	748	750	100	676	710	95
Roach	217	350	62	211	275	77
Whitefish	0,5	1	53	0	1	36
Smelt	0,4	5	8	0	5	2
Vendace	22	25	89	13	15	85
Burbot	20	50	40	17	50	34
Ruff	1,6	150	1	4	150	3
Other species	4,2	25	17	4	25	17
Total	**2521**	**2926**	**86**	**2256**	**2856**	**79**

Source: MoRA

Table 29. Number of companies and fishermen related to Lake Peipsi, 2006–2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Companies	96	94	87	68	69	70	68	66	69	71
Fishermen	530	490	300	336	365	405	383	367	367	325

Source: MoRA

to be used for fishing after October. The shortening of the fishing season did not hinder the exhaustion of quotas much (Table 28).

The number of companies engaged in fishing on the lake is almost the same as in previous years, but the number of fishermen is lower from 2015 (Table 29). Fish caught from the lake was landed in more than 40 places. Around 100–200 tonnes of fish are annually landed in the ten largest of them (Mehikoorma, Laaksaare, Piirissaare, Varnja, Kallaste, Omedu, Kalmaküla, Lohusuu, Alajõe and Vasknarva). Some of the fish caught from the lake was landed in the ports of the Emajõgi River.

Catch and its value

The catch of 2014 was at the average level of recent years, but a record high quantity of bream – 748 tonnes – was caught. The catch of 2015, however, was a few hundred tonnes lower than the average of recent years (Table 30). The total catch declined primarily on account of pikeperch, perch and pike, but to some extent the decline was offset by the remarkable catch of bream. While the decline in perch and pike catches was primarily related to stocks (quotas), for pikeperch the decrease was mostly attributable to the weather and to fishing restrictions resulting from the exhaustion of the quotas for other target species. For example, underwater gill net fishing was only possible during one month of the winter of 2014, and during a few weeks near the coastal zone of the lake in 2015. In 2014, perch, bream and pike quotas were used up early. In 2015, the quota for perch and generally also for bream was used up ahead of time.

The highest catches are traditionally taken in September (Figures 33 and 34), when all the key types of fishing gear are used on the lake at the same time. Over 800 tonnes of fish (i.e. a third of the annual catch) were landed in September 2014 and around 600 tonnes (a quarter of the annual catch) were caught in September 2015, although in the latter year more intensive fishing efforts were applied from 15 September, not 1 September.

Trap nets and lines of trap nets produce the biggest catches, currently accounting for more than a half of the annual catch (Table 31, Figure 35). Perch and bream are the key target species in trap net fishing (Figure 36).

While trap net catches have increased, catches taken with Danish seines (comprising mostly perch – Figure 37) have declined (Table 31, Figure 35). The total catch taken with large-mesh gill nets was relatively high in 2014, but rather low in 2015 (Table 31, Figure 35). Pikeperch, bream and pike are caught with large-mesh gill nets (Figure 38). Fish caught in small-mesh gill nets (mostly roach) amounted to nearly 100 tonnes in said years (Table 31).

Declining catches of pikeperch and perch caused the value of catches taken from the lake to decrease. In 2015, the catch value dropped to below 4 million euros (Figure 39). Pikeperch and perch continue to generate the bulk of the total catch value, with pikeperch accounting for 51% and 45% and perch accounting for 27% and 35% of the catch value in 2014 and 2015, respectively. Trap nets in lines of trap nets, and large-mesh gill nets produce the biggest revenues (Figure 40).

Table 30. Estonian catches (t) from Lakes Peipsi and Lämmijärv from 2011–2015 and the average for the period

Kalaliik	2011	2012	2013	2014	2015	Average
Pikeperch	672	646	637	599	420	595
Perch	757	1061	914	787	818	867
Pike	100	153	143	120	94	122
Bream	578	577	604	748	676	637
Roach	225	207	185	217	211	209
Smelt	0,0	0,0	0,0	0,4	0,1	0,1
Whitefish	0,2	0,2	0,4	0,5	0,4	0,3
Vendace	1	3	10	22	13	10
Burbot	30	21	23	20	17	22
Other species	9	3	5	6	8	6
Total	**2371**	**2671**	**2520**	**2521**	**2256**	**2468**

Source: MoRA

Table 31. Catches (t) from Lakes Peipsi and Lämmijärv from 2010–2015 by fishing gear type, the average for the period and proportion (%)

	2011	2012	2013	2014	2015	Average	%
Nets, LM	673	553	779	798	617	684	28
Nets, SM	77	60	57	99	93	77	3
Traps	671	403	458	539	629	540	22
Lines of traps	635	564	664	733	657	651	27
Danish seines	287	1058	524	320	225	483	20
Other fishing gear	10	13	8	11	12	11	0
Total	**2353**	**2651**	**2490**	**2500**	**2232**	**2445**	**100**

Abbreviations: LM – large-mesh, SM – small-mesh

Source: MoRA

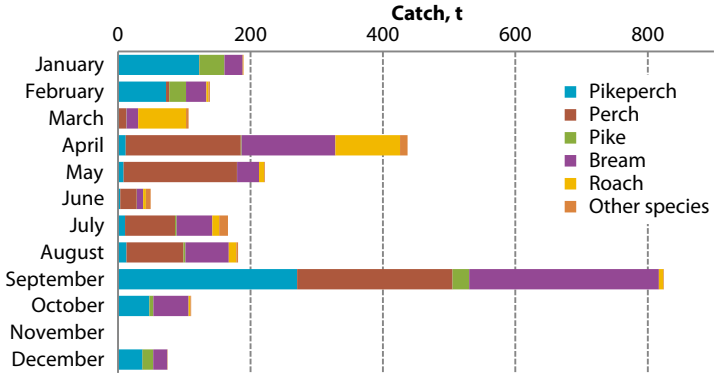


Figure 33. Dynamics of catches from Lakes Peipsi and Lämmijärv by species in 2014
Source: UT EMI

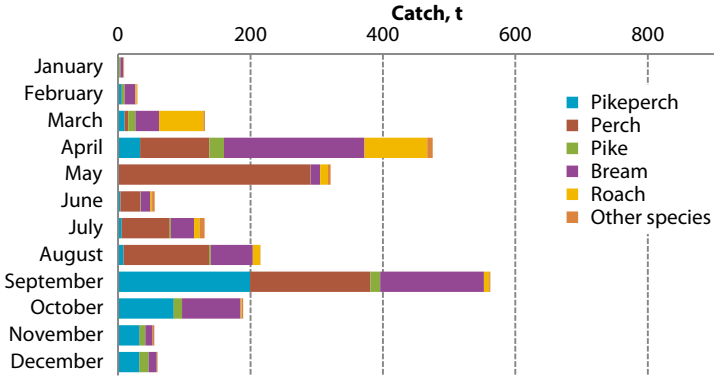


Figure 34. Dynamics of catches from Lakes Peipsi and Lämmijärv by species in 2015
Source: UT EMI

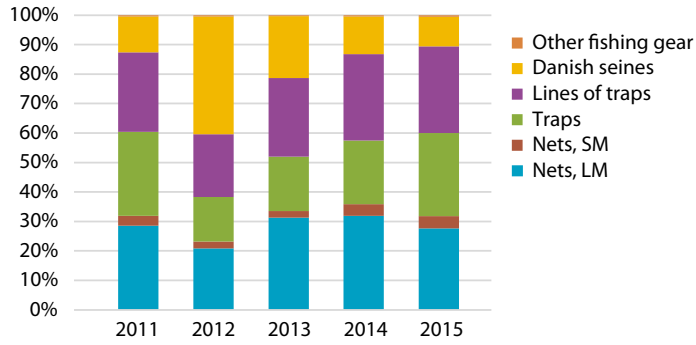


Figure 35. Distribution (%) of catches from Lakes Peipsi and Lämmijärv between fishing gear types, 2011–2015
Abbreviations:
LM – large-mesh,
SM – small-mesh
Source: UT EMI

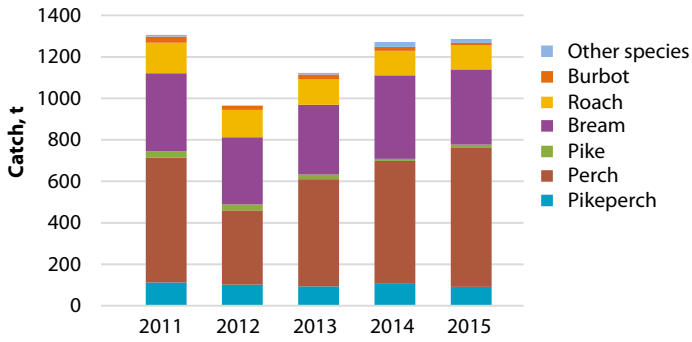


Figure 36. Trap net catches (t) from Lakes Peipsi and Lämmijärv, by species, 2011–2015
Source: MoRA

Figure 37. Danish seine catches (t) from Lake Peipsi, by species, 2011–2015
Source: MoRA

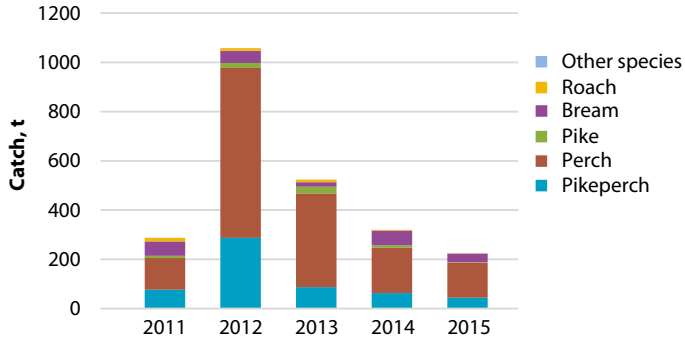


Figure 38. Large-mesh gill net catches (t) from Lakes Peipsi and Lämmijärv, by species, 2011–2015
Source: MoRA

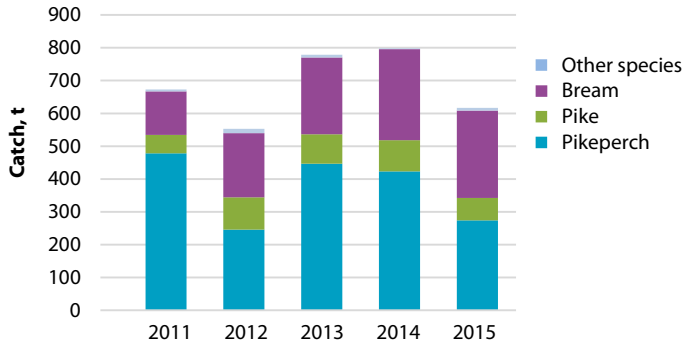


Figure 39. Revenue from catches, in millions of euros, by species, 2011–2015
Source: UT EMI

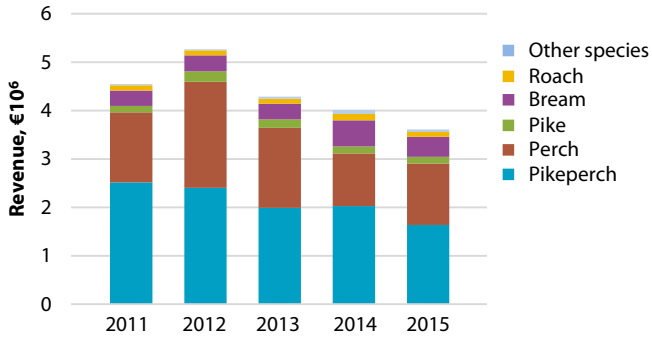
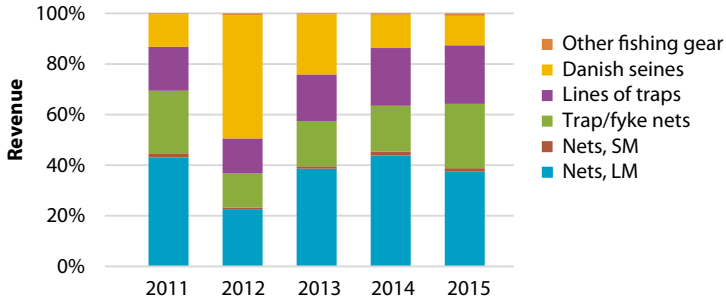


Figure 40. Proportions of revenue from catches, by fishing gear type, 2011–2015
Abbreviations:
LM – large-mesh,
SM – small-mesh
Source: UT EMI



Problems

Danish seines (20 seines in total) were used for fishing on 315 days in 2014 and on just 168 days in 2015. Small-mesh (48 mm) cod ends were used on 289 days in 2014 and on 120 days in 2015, with large-mesh (110 mm) cod ends being used on the rest of the fishing days due to the moratorium on perch fishing.

Intensive and efficient trap net fishing is the reason why the perch quota is exhausted in autumn during a week or couple of weeks. According to fishermen's log books, this fishing method still has untapped potential. Considering the permitted fishing capacity (approximately 900 trap nets and lines thereof), the fishing effort did not achieve the maximum level in 2015. In no fishing month did the number of trap net fishing days reach the permitted number (27,000, or 900 × 30 days) (Figure 41). As trap net fishing develops, it is possible that Estonian fishermen will no longer need to use small-mesh seines. This will eliminate the need to reduce the minimum size of pikeperch. This would be beneficial in terms of sustainable exploitation of pikeperch stocks, but trap net fishing has problems of its own. First, it is a relatively expensive and labour-intensive method of fishing, and second, large quantities of undersized pikeperch get caught also in trap nets (Figure 42). The mortality rate of discarded pikeperch can be very high, especially with high summer water temperatures and if old-fashioned fishing methods are used.

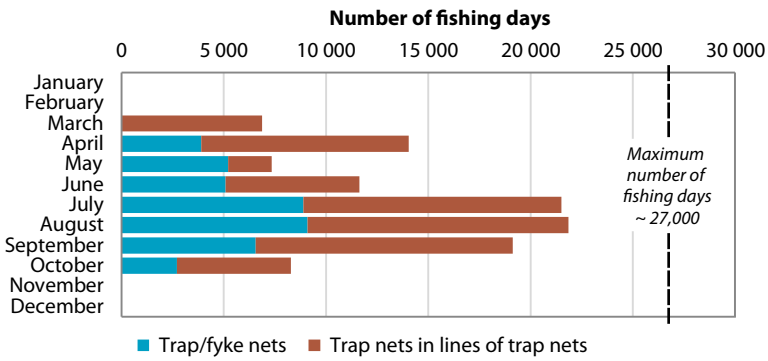


Figure 41. Number of days (24-hour periods) of fishing with trap/fyke nets and with trap nets in lines of trap nets in 2015
Source: MoRA

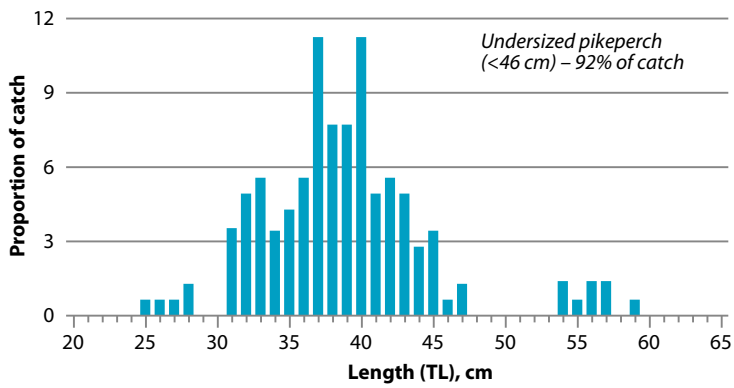


Figure 42. Proportions of the composition of pikeperch catch in trap net fishing in September 2015
Source: UT EMI

LAMPREY FISHING ON ESTONIAN RIVERS

Lamprey fishing has not been discussed in previous yearbooks, because fishing for this species has not been registered under coastal fishery or inland fishery. Lamprey is addressed separately in this yearbook.

Traditionally, lamprey has been highly valued in Estonia and in our neighbouring countries. Recent developments, such as price dynamics, point to growing popularity of lamprey. The estimated first-sale price of lamprey has almost tripled over the last ten years (Table 8). In terms of price per kilogram, lamprey held second place in Estonian fishermen's catches in 2014 and 2015, following eel and being followed by salmon, trout and pikeperch.

Lamprey is fished for on 26 rivers in Estonia (Table 32), and in a negligible quantity also in the coastal sea. Only commercial fishing is allowed. According to official data, lamprey catches amounted to 30.0 and 46.7 tonnes in Estonia in 2014 and 2015, respectively (around 430,000 and 660,000 individuals). Thus, there has been a significant increase. The biggest catches were taken in the Narva River, but the Jägala, Pärnu, Reiu, Rannametsa, Pirita and Kunda Rivers are important lamprey rivers, as well. Lamprey catches taken in these rivers represent nearly 90% of the total catch in Estonia. The catch of 2015 exceeded that of 2014 in nine of the ten most important lamprey rivers (the Reiu River was the only exception). On the other hand, the yield trend was reversed in six of smaller rivers. This indicates that changes in the catch do not necessarily concern a number of small rivers.

Table 32. Commercial lamprey catches (kg) taken from Estonian water bodies in 2014 and 2015 according to official data

	Year	
	2014	2015
Narva River	**20 805**	**34 517**
Other inland bodies of water	**8 903**	**12 012**
Jägala River	1 710	2 480
Pärnu River	1 418	2 059
Reiu River	1 256	1 037
Rannametsa River	1 048	1 156
Pirita River	675	813
Kunda River	564	717
Vääna River	364	535
Valgejõgi River	246	551
Selja River	263	517
Lemme River	404	290
Pudisoo River	125	565
Häädemeeste River	234	215
Loode Stream	185	183
Keila River	84	248
Mustoja River	64	195
Audru River	59	126
Nõva River	61	121
Pada River	53	105
Riguldi River	28	35
Priivitsa Stream	35	21
Vainupea River	7	22
Treimani Stream	4	19
Loobu River	9	4
Timmkanal Channel	9	0
Catches from coastal sea	**306**	**215**
Gulf of Riga	304	201
Gulf of Finland	2	14
Total	**30 014**	**46 743**

Source: MoRA

Looking at the official lamprey catches over the last decade, one could argue that the catch of 2014 was weak and the figure for 2015 was average. Table 33 details lamprey catches taken from the Narva River, because this large river provides the bulk of Estonia's total catch each year and changes occurring there might overshadow the rest of the trends. The average proportion of lamprey catches from the Narva River has been 74.3% (58.5–82.3%) during ten years. Only around 1% of the total catch is taken from the coastal sea.

Annual lamprey catches have fluctuated between 3 tonnes and 68 tonnes in Estonia during the past fifty years. Accord-

ing to the available historical data, the highest catch amounted to as much as 100 tonnes. This instability is due primarily to the fact that individuals of one year class are fished for and the catch depends on the abundance the particular year class. Against this backdrop, catches taken in the past decade have been relatively stable.

The estimated revenue from lamprey sales, based on first-sale prices, amounted to around 139,000 euros in 2014 and around 252,000 euros in 2015. The revenue was distributed unevenly between regions. The lion's share of the sales revenue (around 186,000 euros in 2015) was earned by fishermen operating on the Narva River and it has significant economic importance in the region.

Lamprey is caught using cone traps and lamprey fyke nets in Estonian rivers. The maximum number of fishing gear was the same in 2014 and 2015 (Table 34). The bulk of the maximum number of cone traps (15,000) was allocated to the Narva River, but lamprey fyke nets were not used in that river in these years.

Most of the catch is taken with cone traps in other rivers, as well (Table 35). The proportion of lamprey fyke nets in the total catch is less than 10%.

Table 33. Official lamprey catches (t) in Estonia, 2006–2015

Year	Total catch	Narva River	Other inland bodies of water	Coastal sea
2006	44.0	35.7	7.1	1.2
2007	62.5	49.5	12.5	0.6
2008	66.7	54.9	11.8	<0.1
2009	59.1	46.2	12.8	0.2
2010	41.0	30.9	9.6	0.6
2011	39.6	23.1	15.6	0.9
2012	45.0	32.0	12.6	0.4
2013	41.2	30.5	9.6	1.0
2014	30.0	20.8	8.9	0.3
2015	46.7	34.5	12.0	0.2
Total	**475.9**	**358.3**	**112.4**	**5.2**

Source: MoRA

Table 34. Maximum number of lamprey fishing gear permitted to be used in inland water bodies in 2014 and 2015 under commercial fishermen's permits

County	Cone trap	Lamprey fyke net
Ida-Viru County	15 000	
Pärnu County	2 000	15
Harju County	700	45
Lääne-Viru County	500	17
Lääne County	100	
Saare County		4
Total	**18 300**	**81**

Source: MoRA

Table 35. Official commercial lamprey catches (kg) in 2014 and 2015, by fishing gear

Fishing ground and gear	Year	
	2014	2015
Narva River	**20 805**	**34 517**
cone trap	20 805	34 517
Other inland bodies of water	**8 903**	**12 012**
cone trap	6 678	8 506
lamprey fyke net	2 201	3 506
gill net	24	0
Coastal fishery	**306**	**215**
fyke net with a mouth height of 1–3 m	173	126
fyke net with a mouth height of up to 1 m	57	56
trap net with a mouth height from 3 m	73	19
gill net	3	14
Total	**30 014**	**46 743**

Souce: MoRA

The largest share of the lamprey catch taken with fyke nets (nearly 97% of the total lamprey fyke net catch) originates from four rivers – the Jägala, Valgejõgi, Pudisoo and Vääna Rivers. In 2015, these rivers contributed to the lamprey fyke net catch as follows: the Jägala River 61%, the Valgejõgi River 16%, the Pudisoo River 16% and the Vääna River 4%. Fyke nets were the only fishing gear on the Valgejõgi and Pudisoo Rivers, but accounted for 85% of the total lamprey catch on the Jägala River and 26% on the Vääna River.

The temporal distribution of lamprey fishery is described in Figure 43. In both 2014 and 2015 the biggest catches were taken in autumn and in the first half of winter, from September to January. A comparison between the Narva River and other rivers points to a similar fluctuation.

For consumers, lamprey is of the best quality in autumn. It has just finished eating and is migrating to wintering grounds at that time. Lamprey will spawn in the spring and it will not eat in the meantime; thus, its weight and body length begin to decline due to starvation and generation of reproductive products. Its weight and length will decrease by approximately 20% and 15%, respectively, and its fat content will decline as well. In view of rational exploitation of stocks, therefore, the current temporal restriction on fishing serves its purpose (fishing in rivers is prohibited from 1 March to 30 June).

Most of the conclusions set out in this chapter are based on official catch statistics. However, as far as fishery goes, it is admittedly short-sighted to assume that official data reflect the actual situation precisely. This is a general problem, which has been amply demonstrated by a number of significant cases in the lamprey fishery sector of Estonia. The difference between permitted and actual fishing gear used in the Narva River has been the most conspicuous problem.

In 2014 and 2015, it was permitted to use 15,000 cone traps in the Narva River, and this number was also reported in statistics. The fact that the Environmental Inspectorate removed 17,483 illegal cone traps from the Narva River in

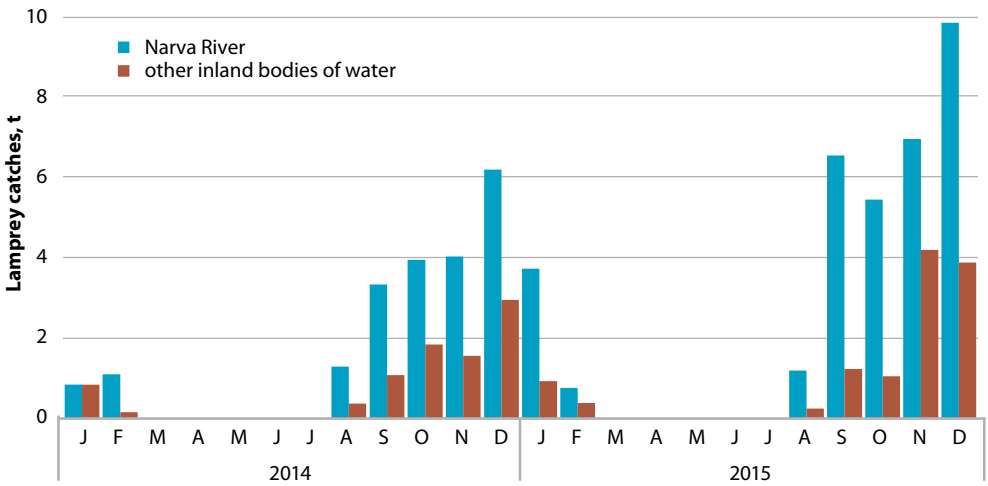


Figure 43. Dynamics of official lamprey catches taken from Estonian inland water bodies in the different months of 2014 and 2015
Source: MoRA

2014 gives an idea of the number of fishing gear actually used. It is to be concluded that the actual number of fishing gear used in the river was approximately twice the permitted number. In 2015, the inspectorate removed another 7378 illegal cone traps from the Narva River. How the illegal catch was reflected in official statistics is not known.

Violations of rules are not limited to non-compliance with the maximum number of permitted fishing gear. For example, illegal transformation of the riverbed with a view to attaining higher catch efficiency is a problem in small rivers. Excessive fishing efforts and impairment of the quality of habitats may cause significant damage to lamprey stocks.

For decades, shrinking spawning grounds have been the main factor behind the decrease in the abundance of lamprey in Estonia. Lamprey can spawn only in rapid sections of rivers, but access to these is severely limited due to dams. The situation has begun to improve in recent years, because the state has initiated the construction of fish passes in dams. The passes have been built on many rivers and are about to be completed on a number of larger rivers in the near future. The plan to open the Sindi dam for migration of fish on the Pärnu River is worth highlighting. When the plan is implemented, lamprey stocks of the region are expected to grow by an order of magnitude. Hopefully, the water supply problem of the currently dry Narva River canyon will also be solved in the coming years. This would enable the lamprey stocks of the Narva River to be increased considerably.

Lamprey has a special conservation status in the European Union – while being one of the species in need of protection according to the Habitats Directive (92/43/EEC), it may be caught in a manner and volume that does not jeopardise a good conservation status of populations. Thus, overfishing of lamprey must be avoided and its habitats must be improved for stock management as well as conservation purposes.

In summary, fishing for lamprey is important in Estonia. Lamprey is still in good enough condition to provide fishing opportunities in Estonia. The situation is expected to improve further in the coming years thanks to the restoration of the quality of river habitats.

Recreational fishing

An estimated 80,000 people are engaged in fishing for recreational purposes in Estonia at least once a year. Recreational fishing is a hobby. It is not allowed to sell the catch caught as a recreational fisherman. So, recreational fishing cannot be interpreted as an occupation for income.

Fishing gear

The range of fishing tackle used by recreational fishermen is dominated by various hook gear, but traps, entangling nets and seine nets can also be used in certain cases. There are a total of 17 types of fishing gear to choose from. Of course, using each of these types is subject to certain restrictions, and the entire range cannot be used simultaneously.

According to the Fishing Act, hook gear include spinning reel, trolling line, pulling device, fly hook, bottom line, unanchored trimmer, hand line, longline, harpoon gun, harpoon, and herring hook. In addition, recreational fishermen are allowed to use mini-trap nets, gill nets, hoopnets and dragnets. In recreational crayfish fishing, crayfish traps and dipnets are permitted to be used.

Mini-trap nets were included in the list of permitted fishing gear for recreational fishermen by the new Fishing Act that entered into force on 1 July 2015. It is a very popular fishing gear among Finns, our northern neighbours, which is intended for catching second-rate fish primarily in shallow water. For the time being, mini-trap nets may be used only in lakes in Estonia. It is still prohibited to use them in the sea, in Lakes Võrtsjärv and Peipsi, in rivers and in water bodies with abundant crayfish stocks – as crayfish often tend to be get caught in the traps. Initially, three types of mini-trap nets (Rampo, Mutter and Weke) are authorised for use.

Permits for fishing with mini-trap nets (fishing cards) have been issued since 2016, and fishing is permitted from 21 July to 30 November. The price of one fishing card for 24 hours is 2 euros.

Recreational fishing permits

Recreational fishing with one simple hand line is free for everyone, because it is considered to be a perpetual right or everyman's right. A fishing fee must be paid for using other recreational fishing gear.

Some categories of people are exempted from paying the fishing fee when using hook gear. These categories include children, students under 16 years of

age, pensioners, unlawfully repressed persons and disabled persons. During the period 2001–2003, when every person (whether or not exempted from the obligation to pay a fee) had to hold a permit to prove the right to fish, persons with preferential rights accounted for about a third of all fishermen using hook gear.

People using traps, entangling nets, seine nets and gear for catching crayfish must always have a fishing card. A fishing card is also required for fishing with spinning reels and fly hooks on a number of trout rivers in Central Estonia and salmon or sea trout rivers in Northern Estonia, as well as in Endla and Silma Nature Reserves and in Matsalu National Park. A fishing card is issued for a fee to each person on equal grounds.

In 2014 and 2015, a recreational fishing right could be bought for four periods: for one day, seven days, 182 days (half a year) and 365 days (a year). In 2014, an effective fishing right was bought on 95,273 occasions and in 2015 on 95,871 occasions (Figure 44). "Effective" means that the permit was in effect for at least one day in a given year. For example, most of the permits issued for a year (365 days) are in effect in two years. In order to assess the number of recreational fishermen who have a right to fish in a particular year, it is necessary to apply the approach where all persons with a permit are taken into account each year.

Compared to 2014, the number of one-day permits increased the most in 2015 (by around 4.5%), while the number of one-year permits remained almost the same, and the number of 6-month and 7-day permits declined by more than 10%. Whereas one-day permits are mostly bought by beginner hobbyists who go fishing once or twice a year, long-term (annual, semi-annual) permits are used by more "serious" recreational fishermen.

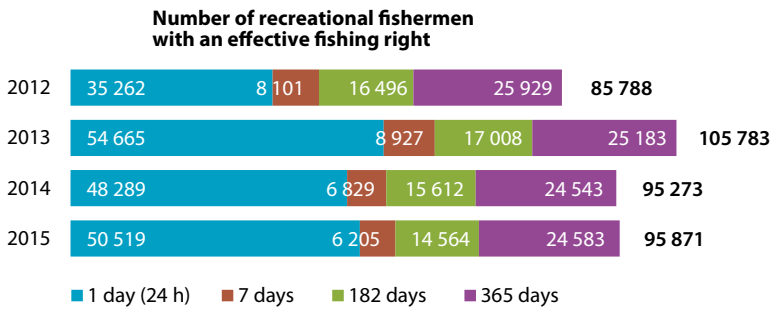


Figure 44. Number of persons with an effective recreational fishing right, 2012–2015
Source: MoE

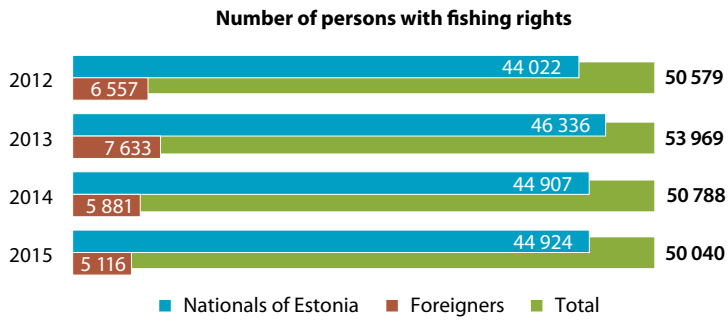


Figure 45. Number of persons with a recreational fishing right, 2012–2015
Source: MoE

A person can buy shorter-term permits several times a year. This is why the number of effective fishing rights does not show the actual number of recreational fishermen. According to data sorted on the basis of personal ID codes, there were 50,788 and 50,040 different persons in Estonia who fished for a fee in 2014 and 2015, respectively. The number of foreigners was 5881 in 2014 and 5116 in 2015 (Figure 45).

The number of fishing cards issued for 2014 and 2015 was 17,078 and 17,571, respectively (Table 36). The majority (around 85) of the fishing cards were purchased on the Internet at pilet.ee (incl. using a mobile phone), and the remaining 15% were issued by the Environmental Board and by local authorities of small islands. Traditionally, the highest number of fishing cards was issued for fishing with gill nets, followed by permits for fishing with hook gear in nature reserves, and crayfish fishing permits.

Fishing fees

In 2015, 495,409 euros was received for recreational fishing rights and 279,454 euros for fishing cards. A total of 774,863 euros was thus received for recreational fishing (Table 37). A year earlier, the sum received was by 75,000 lower. For commercial fishing rights 765,915 euros and 751,220 euros was received in 2014 and 2015, respectively.

Some of the proceeds from fishing rights are transferred to the state budget and the rest are allocated to the Environmental Investment Centre (EIC). In 2015, the EIC granted 1,204,272 euros to projects implemented under the Fisheries Programme, which was nearly 700,000 euros less than a year ago.

Number of recreational fishermen

The number of fishing right holders with an Estonian ID was 44,916 in 2014 and 44,924 in 2015. With the recreational fishermen who fish for free (around 30%), the total number of recreational fishermen fishing with hook gear is approximately 58,000. To get the total number of fishermen, fishing cardholders must be added to that figure. A fishing card was acquired by 8545 people in 2014 and 9093 people in 2015. As part of the fishing cardholders also fished under a fishing right, the repetitions (those fishing on the basis of both a fishing right and a fishing card) must be deducted in order to arrive at the correct number of recreational fishermen. The number of people fishing on the basis of both a fishing right and a fishing card was 3779 in 2014 and 4593 in 2015.

Once we deduct all the repetitions, the number of recreational fishermen is around 63,000 in both 2014 and 2015 (Table 38). If we include in the calculation the people who fish with a simple hand line for free and the people who failed to pay for their fishing rights, it can be assumed that some 75,000–80,000 people engage in recreational fishing at least once a year.

Table 36. Number of fishing cards issued, by fishing gear and ground, in 2014

Fishing gear	Fishing ground	2014	2015
Gill net	**Total**	**7673**	**7700**
	Sea	6204	6271
	Lakes Peipsi, Pskov and Lämmijärv	864	820
	Rivers and small lakes	605	609
Simple hand line, hand line, spinning reel, fly hook, pulling device	**Total**	**3867**	**4629**
	Endla Nature Reserve	755	1272
	Matsalu National Park	1347	1802
	Silma Nature Reserve	1765	1555
Spinning reel, fly hook	**Total**	**2982**	**2722**
	Trout fishing grounds	1087	1069
	Salmon fishing grounds	1895	1653
Longline (100 hooks)	**Total**	**1159**	**1140**
	Sea	263	288
	Lakes Peipsi, Pskov and Lämmijärv	61	50
	Lake Võrtsjärv	225	291
	Emajõgi River	136	102
	Other lakes and rivers	474	409
Crayfish trap, dip-net	Lakes, rivers	**946**	**906**
Harpoon gun and harpoon	Lakes Kuremaa and Saadjärv	**409**	**401**
Hoopnet, dragnet	Small lakes	**42**	**73**
	Total number of fishing cards	**17 078**	**17 571**

Source: MoE

Table 37. Proceeds from commercial and recreational fishing fees (10^6 €), 2010–2015

		2010	2011	2012	2013	2014	2015
Commercial	Trawling	0.290	0.197	0.188	0.204	0.226	0.217
	Coastal fishery	0.318	0.373	0.282	0.318	0.346	0.356
	Distant-water fishery	0.231	0.170	0.215	0.174	0.194	0.179
	Total commercial fishery	**0.839**	**0.740**	**0.685**	**0.696**	**0.766**	**0.751**
Recreational	Fishing card	0.152	0.214	0.198	0.267	0.186	0.279
	Fishing fees	0.364	0.360	0.502	0.514	0.513	0.495
	Total recreational fishing	**0.516**	**0.574**	**0.700**	**0.781**	**0.699**	**0.775**
Total		**1.356**	**1.314**	**1.385**	**1.477**	**1.465**	**1.526**

Source: MoE, MoRA, Environmental Board

Table 38. Number of recreational fishermen, 2012–2015

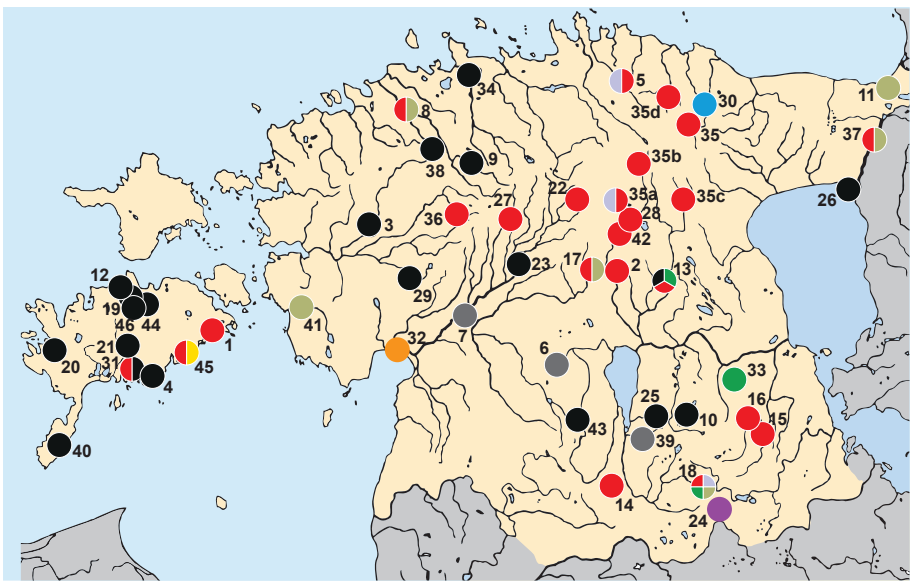
	2012	2013	2014	2015
Fishing right holders with an Estonian ID code	44 029	46 339	44 916	44 924
Holders of free fishing rights (30% of those fishing for a fee)	13 209	13 902	13 475	13 477
Fishing cardholders with an Estonian ID code	7 260	8 341	8 545	9 093
Total	**64 498**	**68 582**	**66 936**	**67 494**
Number of both fishing right and fishing cardholders	3 430	4 072	3 779	4 593
Number of Estonian recreational fishermen	61 068	64 510	63 157	62 901

Note: only fishermen with an Estonian ID code have been taken into account. The proportion of persons with preferential rights to recreational fishing is estimated to be 30% of those who bought a fishing right. Persons who acquired both a recreational fishing right and a fishing card were excluded from the total number.

Aquaculture

Overview of sector

According to the data of the Veterinary and Food Board, 50 licensed (recognised) companies operated in the aquaculture sector in 2014; 30 of them farmed fish and 20 were engaged in crayfish farming. In 2015, the number of such companies was 54, incl. 32 engaged in fish farming and 22 in crayfish farming (Figure 46).



1 Aquamyk OÜ
2 Aravuse Kalakasvandus OÜ
3 Arkadel Invest OÜ
4 Astacus OÜ
5 Aviiso OÜ
6 BM Trade OÜ
7 For Angula OÜ
8 Forellipüük OÜ
9 Heiki Peterson's Õunapuu farm
10 Ironfish OÜ
11 Joala Fish OÜ
12 Jüri Lest FIE
13 Härjanurme fish farm
14 Kalme mill trout fishing
15 Karilatsi kalamajand OÜ
16 Krei-Jõe OÜ
17 Lapavira OÜ
18 Leokitalu OÜ
19 Liki Mõis OÜ
20 Lõukapõllu OÜ
21 Metsa Johani farm
22 Neli Elementi OÜ
23 Nõmme Puhkebaas OÜ
24 Paadi Talu OÜ
25 Palupera-Agro
26 Peipus OÜ
27 Piscor OÜ
28 Purekkari Rand OÜ
29 Põlde Vähk OÜ
30 Põlula Fish Farm
31 Pähkla Vähi- ja Kalakasvatus OÜ
32 Pärnu Laht AS
33 Riina Kalda's fish holding Carpio
34 Selimäe OÜ
35 Fish farms of Simuna Ivax OÜ:
a. Nõmmeveski
b. Äntu
c. Käruveski
d. Mõdriku
36 SK Trade OÜ
37 Störfisch OÜ
38 TP Invest OÜ
39 Triton PR AS
40 Vana-Tooma talu OÜ
41 Varbla Kalakasvatuse OÜ
42 Vikerkala OÜ
43 Vorites OÜ
44 Vähilakk OÜ
45 Ösel Harvest OÜ
46 Ülejõe Vähi- ja Kalakasvatus OÜ

Figure 46. Major Estonian fish and crayfish farms in 2015
Source: EULS, VFB

The number of active fish and crayfish farms has increased steadily in recent years and their production has become more diverse. The aquaculture sector of Estonia is united by the Estonian Association of Fish and Crayfish Farmers. Aquaculture operators also have a producer organisation – fish breeders' association Ecofarm. The number and composition of the members of the organisation have changed significantly over time. In 2014, Ecofarm completed the construction of a modern production facility in Audru.

Based on the data of Statistics Estonia, fish production was at a high level in 2014, with the sales volume of commercial fish amounting to around 865 tonnes. That figure declined slightly in 2015 (to around 795 tonnes, Table 39), but – looking at a longer timeframe – it seems that fish farmers have recovered from a trough. While definite changes cannot be assessed until after a couple of years, the data available for 2014 and 2015 suggest that aquaculture is a developing sector whose production and trends are constantly evolving.

The existing fish production capacity of Estonia is rated at more than 4000 tonnes per year, but actual production accounts for around one-fifth of that figure. In this context, it should be taken into account that the impact of an investment will usually manifest itself only after some five years.

In 2016, the National Audit Office completed an analysis of the impact of aquaculture grants received from the EFF, which focused on the use and effectiveness of grants paid during the period 2004–2015. The analysis showed that the grants have not yet had an impact on the economic position of aquaculture companies. A comparison of the beneficiaries with the companies that have not applied for aid does not point to a statistically relevant impact of grants on the economic indicators of any of the beneficiaries. The analysis also pointed to companies' limited product development and joint action, which should be boosted for the companies to be better able to enter domestic and foreign markets (Figure 47).

Assuming that aquaculture could and perhaps even should reduce pressure on natural fish stocks, the farming of red-meat fish, which has become popular in the trade network, should be accompanied by a greater prominence of our local species, such as perch and pikeperch, given that the sales channels for production of these species on the basis of natural stocks are already well established in European countries.

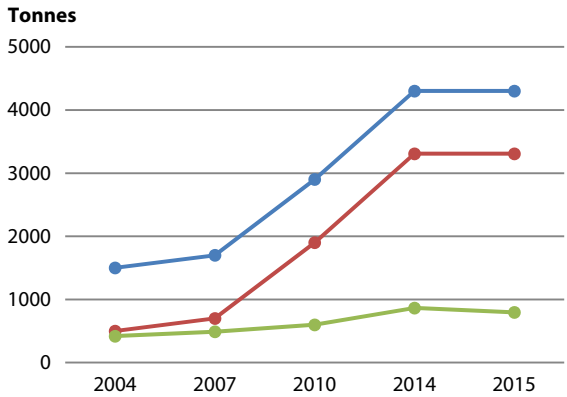
Table 39. Sales volume of Estonian fish farms' raw fish (t), 2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015
Eel	46.0	30.0	20.3	2.0	*	*	127.0	*
Crayfish	0.7	2	0.4	0.6	0.1	0.4	0.2	0.6
Carp	52.3	45.4	39.4	37.5	38.2	43.7	*	*
Rainbow trout	333.8	549	487.5	333.8	455.3	465.5	569.6	559.0
Other fish	50.9	28.4	50.9	18.7	87.2	223.5	168.1	235.1
Total	**483.7**	**654.8**	**598.5**	**392.6**	**580.8**	**733.2**	**864.9**	**794.7**
Fish roe for human consumption	6.7	7.4	4.5	0.1	4.1	5.0	3.1	7.3

* Data cannot be published due to the data protection principle

Source: Statistics Estonia

Figure 47. Production capacity and sales volume of the aquaculture sector (t), 2004–2015
Source: National Audit Office, based on the data of Statistics Estonia and the ARIB



	2004	2007	2010	2014	2015
Total production capacity	1500	1700	2900	4300	4300
Production capacity created with the help of grants	500	700	1900	3307	3307
Aquaculture production sold	418	488	599	865	795

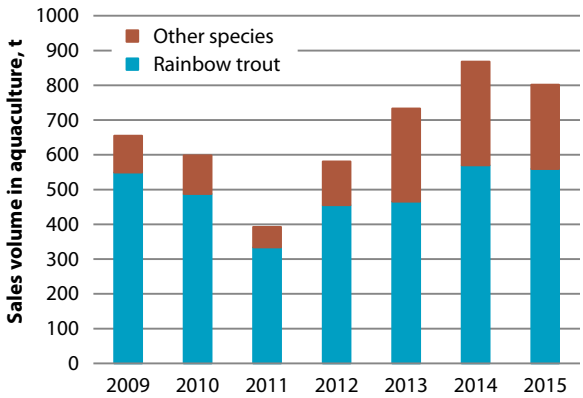


Figure 48. Dynamics of sales volume, 2009–2015
Source: Statistics Estonia

Rainbow trout. The production volume has grown steadily and the sales volume returned to the level of 2009 in 2014, having recovered from the devastating effects of the extreme summer of 2010 on Estonian fish farming. In 2015, rainbow trout was farmed by 17 companies that accounted for nearly 70% of the total fish farming production (Figure 48). The sales volume of rainbow trout (raw fish) amounted to around 570 tonnes in 2014 and around 560 tonnes in 2015 (Table 39). The proportion of rainbow trout in the sector has definitely been influenced by the farming of new species, such as African catfish and Arctic char, as well as the increase in the sales volume of eel farming.

Sturgeon. Siberian sturgeon and Russian sturgeon are farmed in Estonia. The farming of various species of the Acipenser family had gained momentum in a number of Estonian regions in 2013, but production and sales volumes have been affected by farmers' focus on the eastern market and the strict marketing restrictions established there due to the current political situation. Sturgeon farming, therefore, did not achieve the expected proportion in the sector by 2015, even though there are four holdings that provide the production.

Eel. In 2015 there were two eel farming companies in Estonia, both of which market their production in domestic as well as foreign markets.

Carp. Three holdings farm carp in considerable quantities. The data of Statistics Estonia on carp production are limited because of the data protection principles.

Perch. Perch has been farmed in Pärnu since 2013, using a recirculation system. So far, perch farming can be regarded as successful and supporting the natural stocks.

The production of fish roe for human production is definitely also worth mentioning. By 2015, marketing of fish roe for human consumption recovered to the level of 2009: while the sales volume was 3.1 tonnes in 2014, it reached as much as 7.3 tonnes in 2015.

Unfortunately, the data of Statistics Estonia are generalised, which is why a number of promising and interesting species have been included in "Other fish".

Aquaculture Strategy 2014–2020

In 2013 the Estonian Aquaculture Development Strategy 2014–2020 was completed. It had been developed from October 2012 to August 2013 by the Estonian Institute for Future Studies of Tallinn University, the Aquaculture Department of the Institute of Veterinary Medicine and Animal Sciences at the Estonian University of Life Sciences, the aquaculture sector, and representatives of organisations related to the sector.

There are several reasons why a separate strategy was prepared for the aquaculture sector for the first time. First, it was required under the European Maritime and Fisheries Fund Regulation (EU) No 508/2014, and second, aquaculture is characterised by fundamentally different problems compared to fisheries.

The substantive part of the strategy consists of an analysis, the vision, objectives and activities, which are grouped into seven main courses of action.

The vision of the strategy is "to build up a leading position in the domestic market of Estonia and become a successful exporter of species that suit local farming conditions and have a high demand in foreign markets". To accomplish the vision, two objectives have been set:

1. to gain a larger than 50% market share in the domestic market of aquaculture products;
2. to increase the sector's export sales to a level exceeding five million euros.

A need for competent and coordinated leadership and a lack of cooperation between different parties are seen as the most significant bottlenecks in the implementation of the strategy.

Fish restocking

Mainly salmon, sea trout and in smaller quantities also brown trout are farmed on the Põlula Fish Farm of the State Forest Management Centre. Juveniles are released into rivers to replenish Estonia's fish stocks. This means that the main tasks of the farm are to rear and restock coldwater fish species, particularly juvenile salmon, in order to restore destroyed or weak populations, and to collect

Table 40. Number of fish restocked by Põlula Fish Farm by age, 1997–2015

Species	Age		
	One-summer-old	One-year-old and two-summer-old	Two-year-old
Salmon	1 294 000	1 965 000	827 000
Sea trout	391 000	187 000	106 000
Brown trout	6 000	47 000	3 000

Source: MoE

and store their genetic material. Additional tasks include participation in pilot work for research purposes, and organising field training for students.

A total of over five million juvenile fish have been released into natural bodies of water – salmon since 1997, sea trout since 2001 and brown trout during the years 2001–2005 (Table 40). Pilot work has been started to acquire experience in farming other endangered coldwater fish species (whitefish, grayling) besides salmon.

Research and development

Formal education in fish farming is currently offered at two educational institutions: Estonian University of Life Sciences and Järva County Vocational Training Centre. While the University of Life Sciences focuses on research and studies and organising post-graduate training in fish farming, Järva County Vocational Training Centre, with its functional testing and training facilities, trains fish farm workers (qualification level 4).

Grants

2014 The budget of investment support for aquaculture (EFF measure 2.1) was 2,000,000 euros. As a result of the call for applications, 16 applications were submitted for a total of 2,036,393 euros. Thirteen applications were granted aid in a total amount of 994,734 euros.

2015 The budget of aid for cooperation between researchers and aquaculture companies for the 2014–2020 programming period (EMFF measure 2.6) is 1,121,880 euros. One application was submitted for 1,121,880 euros and it was granted in full.

The budget of aid for educating producers or processors of fishery or aquaculture products is 5000 euros in 2015. Eight applications were submitted and were all granted. The aid granted totalled 4790.04 euros.

The budget of aid for practical training of producers or processors of fishery or aquaculture products is 15,000 euros in 2015. Two applications were submitted for reimbursement of costs related to two trainees, and both were granted.

Estonian fish processing industry

General overview of sector

According to the data entered in the Commercial Register, in 2014 and 2015 there were 64 and 66 companies, respectively, in Estonia whose main business comprised the processing and canning of fish, crustaceans and molluscs. Based on the classification given in Commission Recommendation 2003/361/EC,[1] the majority of Estonian fish processing companies were small, as their average number of employees was less than 50. Compared with 2014, the number of small enterprises decreased and the number of micro and medium-sized enterprises increased in 2015. A more detailed overview of the classes of enterprises is presented in Figure 49.

The number of people employed in fish processing companies totalled 1972 in 2014 on average,[2] but declined in 2015 by 2%, to 1923. Looking at the age structure of the companies, 49 (74%) of the 66 companies had been operating for more than ten years in 2015. In 2014, the total sales revenue of the companies amounted to 187 million euros, with processing and canning of fish, crustaceans and molluscs accounting for 92% of the revenue, i.e. 173 million euros.

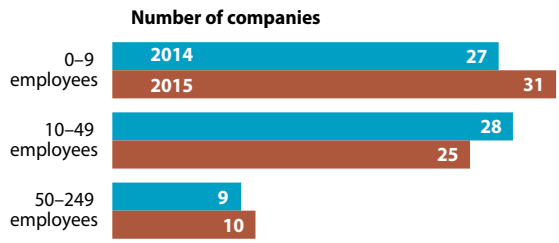


Figure 49. Number of companies whose main business comprised processing and canning of fish, crustaceans and molluscs based on average number of employees in 2014 and 2015
Source: Commercial Register

[1] Commission Recommendation 2003/361/EC divides enterprises into four groups based on the number of employees: 1) micro-enterprises – 0 to 9 employees; 2) small enterprises – 10 to 49 employees; 3) medium-sized enterprises – 50 to 249 employees; 4) large enterprises – 250 or more employees.

[2] Average number of full-time employees (full-time equivalent).

Table 41. Number of processing facilities of fish processing companies in 2014 and 2015 by county

County	Number of processing facilities	
	2014	2015
Harju County	26	25
Pärnu County	19	20
Tartu County	9	10
Saare County	9	9
Ida-Viru County	7	6
Lääne County	6	5
Jõgeva County	4	4
Lääne-Viru County	3	2
Viljandi County	2	1
Põlva County	1	1
Total	**86**	**83**

Sources: Commercial Register, Veterinary and Food Board

In 2015, the total sales revenue of the companies declined by 6% to 177 million euros, with processing and canning of fish, crustaceans and molluscs accounting for 94% of the revenue, i.e. 166 million euros.

Processing and canning of fish, crustaceans and molluscs was an auxiliary activity for 15 and 12 companies, respectively, in 2014 and 2015. Their sales revenue from this segment amounted to 1.2 million euros in 2014, but only half that amount or 0.6 million euros in 2015.

Most (more than a half) of the companies' processing facilities were located in Harju and Pärnu Counties (Table 41).

Basic and economic indicators and trends of companies whose main business is fish processing

Years 2014 and 2015 were characterised by tightening competition and a difficult market situation. When comparing 2013 and 2014, the number of fish processing companies increased slightly in the latter year (Table 42). The total sales revenue increased by 7% and the average number of employees grew by 18. The average annual wage cost per employee was 8701 euros in 2014, or 7% more than in 2013. Although two new fish processing companies started to operate in 2015, both the total sales revenue and the average number of employees declined in comparison with 2014. At the same time, the average annual wage cost per employee continued to rise and amounted to 8938 euros in 2015.

Of the 64 fish processing companies, 22 (34%) closed the financial year 2014 with a loss. However, the sector's total net profit amounted to 2.4 million euros

Table 42. Basic and economic indicators of companies whose main business is fish processing, 2010–2015

	2010	2011	2012	2013	2014	2015
Number of companies	56	59	66	60	64	66
Total sales revenue, €10^6	111	137	156	175	187	177
Average number of employees	1891	1871	1907	1954	1972	1923
Average annual wage cost per employee, €	6300	6957	7568	8113	8701	8938
Gross value added, €10^6	21	20	27	27	26	24
Investments in fixed assets, €10^6	11	11	6	6	10	11
Debt ratio,%	49	50	53	51	54	53

Sources: Statistics Estonia, Commercial Register

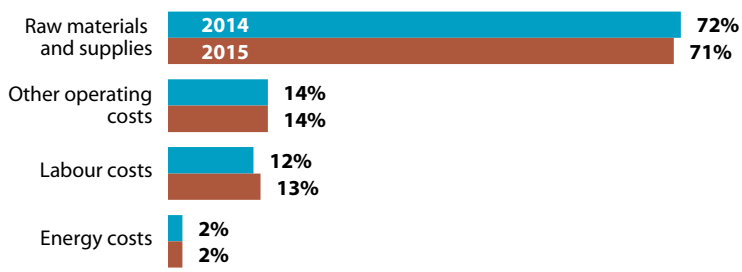


Figure 50. Proportions (%) of operating costs of companies whose main business is fish processing, 2014 and 2015
Source: Commercial Register

and the gross value added totalled 26 million euros. In 2015, too, 22 companies (33% of the 66 companies) closed the year with a loss. The sector's total net profit was 1.9 million euros and the gross value added amounted to 24 million euros.

The combined assets of fish processing companies amounted to 125 million and 124 million euros in 2014 and 2015, respectively, with fixed assets accounting for 51% and 55% (63 and 68 million euros). Compared to 2013, investments in fixed assets grew by 71% in 2014, and this trend continued in 2015. The amount invested in fixed assets was 6 million euros in 2013, 10 million euros in 2014 and 11 million euros in 2015. The debt ratio, which shows the share of debt (liabilities) in the funding of the assets of companies, was 54% in 2014 and 53% in 2015.

The operating costs of fish processing companies totalled 185 million euros in 2014 and 175 million euros in 2015. Raw materials and supplies accounted for the bulk of the costs (72% and 71%, respectively) and their proportion declined in 2015 due to a decrease in prices of raw materials (Figure 50).

Basic and economic indicators in 2014

If we compare the basic and economic indicators in the different size classes of fish processing companies (Table 43), it appears that over a half (65%) of the total sales revenue of the fish processing industry in 2014 came from nine medium-sized enterprises, which accounted for just 14% of the total number of companies. This size class also employs the highest number of people (63% of the total number of employees) and has the highest wage cost per employee. Moreover, medium-sized enterprises produced 54% of the gross value added. Based on the debt ratio, however, these enterprises were characterised by a high risk level.

The total operating costs of fish processing companies (185 million euros) were divided as follows in 2014: microenterprises – 5.8 million euros; small enterprises – 55.3 million euros and medium-sized enterprises – 123.4 million euros. The distribution of operating costs was broadly similar in these size classes (Figure 51), but a higher proportion of costs of raw materials and supplies in medium-sized enterprises can be observed.

Basic and economic indicators in 2015

As in 2014, medium-sized enterprises, which represented 15% of the total number of companies, generated more than half (70%) of the total sales revenues of the fish processing industry in 2015 (Table 44). This size class also employed the highest number of people (65% of the total number of employees) and had the highest wage cost per employee. Moreover, medium-sized enterprises produced 57% of the gross value added.

The total operating costs of fish processing companies (175 million euros) were divided as follows in 2015: microenterprises – 9.2 million euros; small enterprises – 40.8 million euros and medium-sized enterprises – 125.1 million euros. The proportions of operating costs were roughly similar in different size classes (Figure 52), although the costs of raw materials and supplies were higher in the segment of medium-sized enterprises.

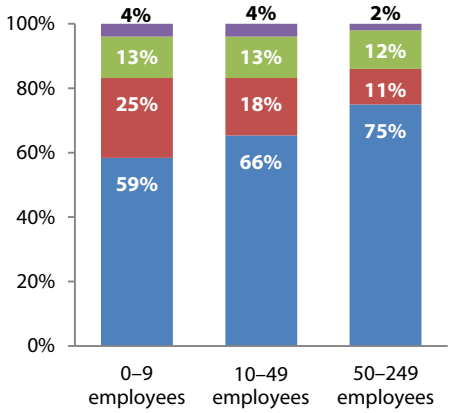


Figure 51. Proportions (%) of operating costs in different size classes of fish processing companies in 2014
Source: Commercial Register

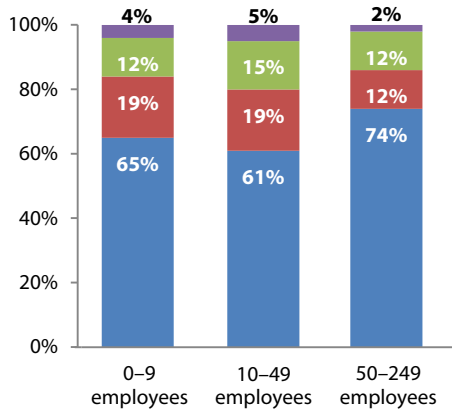


Figure 52. Proportions (%) of operating costs in different size classes of fish processing companies in 2015
Source: Commercial Register

Table 43. Basic and economic indicators in different size classes of fish processing companies in 2014

Size class	Number of companies	Sales revenue, €10⁶	Average number of employees	Average annual wage cost per employee, €	Fixed assets, €10⁶	Investments in fixed assets, 10⁶ €	Gross value added, €10⁶	Debt ratio,%
0–9 employees	27	6.1	80	6621	1.9	0.8	1.0	52
10–49 employees	28	58.9	656	8131	29.8	5.5	10.7	47
50–249 employees	9	122.1	1236	9138	31.7	3.8	13.8	60

Source: Commercial Register

Table 44. Basic and economic indicators in different size classes of fish processing companies in 2015

Size class	Number of companies	Sales revenue, €10⁶	Average number of employees	Average annual wage cost per employee, €	Fixed assets, €10⁶	Investments in fixed assets, 10⁶ €	Gross value added, €10⁶	Debt ratio,%
0–9 employees	31	9.9	106	7662	3.6	1.2	1.8	51
10–49 employees	25	43.2	565	8512	30.3	5.3	8.7	46
50–249 employees	10	123.4	1252	9238	34.4	4.3	13.7	58

Source: Commercial Register

Production and sales

According to the data of Statistics Estonia, Estonian fish processing industry sold 61,100 tonnes of fishery products in 2014 and 59,400 tonnes in 2015. Frozen, salted, spiced, dried, deep-frozen and breaded fish accounted for the bulk of production (Table 45). Compared to 2013, the quantity of production sold in 2014 decreased by 10%. The fall can primarily be attributed to the decline in the sales of frozen fish (sprat and herring). In 2015, the sales of salted, spiced, dried, deep-frozen and breaded fish shrank as well.

The proportion of exports in fish processing companies' total sales revenue accounted for 71% in 2014 and 70% in 2015, which is lower than in previous years, but still indicates the high dependence of the Estonian fish processing industry on exports (Table 46). Tables 47 and 48 set out the top ten countries in exports and imports of fish and fishery products (based on quantities) in 2014 and 2015. While in 2013 the quantity of fish and fishery products exported to Russia amounted to 36,844 tonnes, that figure fell to 28,573 tonnes in 2014 and just 5596 tonnes in 2015. Thus, in 2015 exports to Russia declined by 85% compared to 2013. The decline was due to Russia's import restrictions on fish and fishery products. At the end of 2013 and beginning of 2014, the Russian Federal Service for Veterinary and Phytosanitary Surveillance imposed temporary restrictions on eight Estonian companies operating in the fisheries sector, referring to shortcomings in ensuring food safety. The situation became even more difficult in August 2014 when, in response to the EU's sanctions, Russia established an embargo on most food products originating from the EU, including fish and fishery products. For some time, the Russian border was open only to fish preserves and spiced sprats, but imports of these products were stopped on

Table 45. Sales of the production (10^3 t) of Estonian fish processing industry by product type, 2010–2015

Fishery products	2010	2011	2012	2013	2014	2015
Fresh and chilled fish meat, fish fillets, minced fish meat	3.7	2.5	2.6	2.3	2.4	2.6
Frozen fish	35.5	32.8	44.2	41.3	34.0	35.7
Smoked fish	1.4	1.9	2.3	1.9	2.5	2.5
Salted, spiced, dried, deep-frozen and breaded fish	19.8	16.5	17.3	14.1	14.1	10.9
Culinary fishery products in oil, marinade or sauce	1.5	1.3	4.7	4.5	5.5	4.9
Fish preserves	5.1	3.8	3.7	3.9	2.6	2.8
Total	**67.0**	**58.8**	**74.8**	**68.0**	**61.1**	**59.4**

Source: Statistics Estonia

Table 46. Total sales in the domestic market and exports of companies whose main business is fish processing, 2010–2015

	2010	2011	2012	2013	2014	2015
Total sales, €10^6	111	137	156	175	187	177
Domestic market, €10^6	30	36	41	47	55	53
Exports, €10^6	81	101	115	128	132	124
Proportion of exports, (%)	72	74	74	73	71	70

Source: Commercial Register

Table 47. **Top ten countries in exports and imports of fish and fishery products in 2014. In addition to local production, the table includes all the fish and fishery products that passed through Estonia.**

Country	Exports in tonnes
Ukraine	29 835
Russia	28 573
Latvia	6 620
Belarus	5 063
Finland	4 763
Lithuania	3 288
Germany	2 875
Moldova	2 607
Iceland	2 341
Sweden	2 308

Country	Imports in tonnes
Finland	11 023
Sweden	10 621
Latvia	8 092
Lithuania	6 955
Denmark	2 762
Great Britain	2 285
Faroe Islands	1 905
USA	1 625
Germany	1 358
The Netherlands	1 070

Source: Statistics Estonia

Table 48. **Top ten countries in exports and imports of fish and fishery products in 2015. In addition to local production, the table includes all the fish and fishery products that passed through Estonia.**

Country	Exports in tonnes
Ukraine	40 026
Belarus	10 818
Russia	5 596
Finland	5 563
Latvia	4 813
Lithuania	3 533
Moldova	3 133
Sweden	3 001
Denmark	2 941
Germany	2 108

Country	Imports in tonnes
Sweden	9 230
Latvia	8 069
Finland	7 073
Lithuania	7 043
Denmark	1 844
Germany	1 412
Great Britain	1 072
Republic of Korea	1 002
Norway	968
Czech Republic	963

Source: Statistics Estonia

4 June 2015. Following the example of Russia, Kazakhstan also set temporary restrictions on the imports of fish processing companies' production. The loss of the Russian market forced fish processing companies to actively look for new trading partners, including in Asia and Africa.

Ukraine became the major export market for fish and fishery products. While 26,050 tonnes of fish and fishery products were exported to Ukraine in 2013, the export volume increased to 29,835 tonnes in 2014 and 40,026 tonnes in 2015. Thus, in 2015 exports to Ukraine grew by 54% compared to 2013. Exports of fish and fishery products to Belarus (10,818 tonnes) increased significantly that year, as well. As in 2013 (15,138 tonnes), Finland was the main country of import in 2014 with 11,023 tonnes. In 2015, however, imports of fish and fishery products from Finland decreased considerably (to 7073 tonnes). The two main import countries ahead of Finland were Sweden and Latvia with 9230 and 8069 tonnes, respectively, in 2015.

Aid granted to fish processing industry

In both 2014 and 2015, fish processing companies and producer organisations received fisheries aid to a total value of 3.9 million euros (Table 49). Aid intended for investments in processing and marketing of fish and development of producer organisations increased significantly compared to 2013.

Table 49. Aid granted to fish processing companies, 2013–2015

Aid	Purpose	Amount paid, €		
		2013	2014	2015
Investments in processing and marketing of fish (measure 2.3)	To develop and modernise the processing of fishery products or aquatic plants	552 579	1 716 432	2 167 437
Collective investments by producer organisations (measure 3.1.1)	To improve the quality of fishery products and increase year-round stability of supplies through the development of producer organisations	329 474	1 580 669	1 118 874
Development of new markets and promotional campaigns (measure 3.4)	To promote the consumption of fishery products and new products and find new market outlets for fishery and aquaculture products	776 843	567 169	611 771
Practical training support for producers or processors of fishery products	To partially compensate producers or processors of fishery products for the costs of practical training of students in fisheries-related disciplines, which is arranged in the enterprises of the producers or processors	15 603	32 458	6 240
Training support for producers or processors of fishery products	To partially compensate producers or processors of fishery products for the costs of training of the producers or processors or their employees	4 038	2 809	4 790

Source: ARIB

Grants

Aid has been granted under the European Fisheries Fund measures in Estonia since 2008 when 13 projects were supported. The number of supported projects has grown since then (Table 50).

By county, the largest amounts of aid were granted in Harju, Pärnu, Saare and Tartu Counties, and the biggest disbursements were made to projects carried out in Harju County in 2014 and 2015 (Figure 53).

Table 50. Number of applications for aid from EFF 2007–2013 for which disbursements were made, by year of disbursement

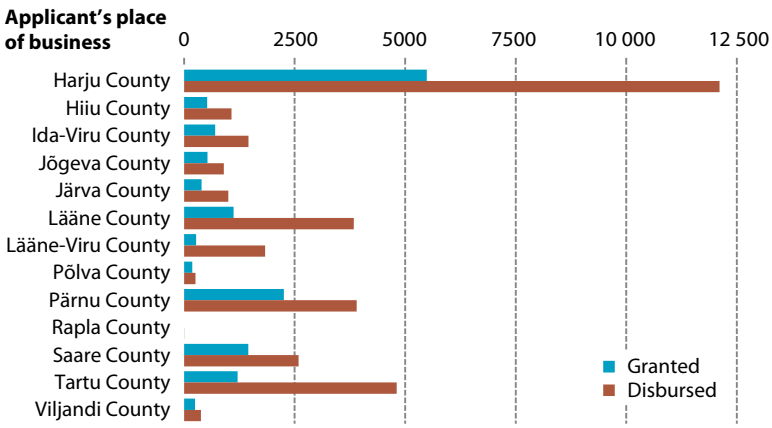
Year of disbursement	Number of projects to which disbursements were made
2008	9
2009	61
2010	216
2011	269
2012	383
2013	443
2014	529
2015	335
2016	53

Source: ARIB

Figure 53. Aid granted and disbursed in 2014 and 2015 (€10³) as at 21.11.2016, by county

Note: the amounts disbursed include the contribution of the European Union, Estonia's cofinancing, as well as funds from the state budget of Estonia, but exclude recoveries.

Source: ARIB



In 2014, aid was granted under the following EFF measures:

Measure 2.1 (*investment support for aquaculture*)

Budget of the call for applications:	2,000,000 euros
16 applications were submitted for:	2,036,393 euros
13 applications were granted for the total amount of:	994,734 euros

Measure 3.1 (*collective actions, 'Other collective actions' action*)

Budget of the call for applications:	832,810 euros
4 applications were submitted for:	832,810 euros

Measure 3.1.1 (*collective investments*)

Budget:	2,409,840 euros
4 applications were submitted for:	2,409,840 euros
All applications were granted for the total amount of:	2,395,608 euros

Measure 3.4 (*development of new markets and promotional campaigns*)

Budget of the call for applications:	111,771 euros
1 application was submitted and granted for:	111,771 euros

Measure 4.1 (*sustainable development of fisheries areas*)

47 applicants were granted aid in the amount of:	596,271 euros

In 2015, aid was granted under the following EFF measures:

Measure 2.3 (*investments in processing and marketing*)

Budget of the call for applications:	3,794,309 euros
47 applications were submitted for:	4,412,821 euros
40 applications were granted for the total amount of:	3,770,837.58 euros

Measure 3.4 (*development of new markets and promotional campaigns*)

Budget of the call for applications:	593,000 euros

5 applications were submitted and granted for the total budget volume.

In 2015, the European Maritime and Fisheries Fund (EMFF) was set up for the 2014–2020 programming period. In that year, aid was granted under the following EMFF measures:

Measure 1.3 (*aid for cooperation between researchers and fishermen*)

Budget for the programming period:	5,833,013 euros
1 application was submitted and granted for:	5,833,013 euros

Measure 2.6 (*aid for cooperation between researchers and aquaculture companies*)

Budget for the programming period:	1,121,880 euros
1 application was submitted and granted for:	1,121,880 euros

Measure 6.2 (*aid for collection of fisheries data*)

Total budget for the programming period:	7,035,510 euros
1 application was granted for:	1,550,000 euros

Measure 7.1 (*technical assistance*)

Total budget for the programming period:	7,765,450 euros
1 application was granted for:	85,257 euros

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