ESTONIAN FISHERY 2018

FISHERIES INFORMATION CENTRE

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Foreword

Dear Reader,

This is the eighth yearbook compiled by the Fisheries Information Centre, this time containing the data on the fisheries sector for 2018. Instead of a new foreword we would like to refer to the foreword to the 2017 Yearbook, as no significant changes occurred in 2018. Nevertheless, let us repeat the basic information.

Estonian trawling relies on sprat and herring. The lion's share of catches is exported and Ukraine remains the main destination. When the start-up difficulties of the Paldiski component plant are overcome, more value could be added to the raw material in Estonia and more expensive fish suitable for human consumption could be sent to foreign markets for a higher price. Higher revenues in the trawling sector might also allow us to consider modernising of our fishing fleet, given that no modern trawlers have been built in Estonia for a long time and the existing fleet is inevitably becoming obsolete.

Coastal fishery did not see any major changes compared to 2017. The main sources of income are still perch and herring in coastal waters and perch and pikeperch in Lake Peipsi. Eight local coastal fishery action groups are making significant efforts on a daily basis to add more value to fish caught in Estonia and to bolster fishermen's seasonal income with other sources of revenue through diversification. The low number of new active young people (we are deliberately not using the word 'men', as young active women are also welcome) in the sector remains a concern. The community of fishermen is aging.

While the number of fish processing companies and the sector's profit as a whole declined somewhat in 2018, investments in fixed assets increased considerably. Although in 2018 the total output of fish farms was the highest of the period following Estonia's re-independence, it still does not amount to a leap in development. The exceptionally hot summer and disease outbreaks affecting two farms destroyed what hope of success there was. Time will tell whether trout farming in sea cages can help the sector overcome stagnation in the coming years. Rapid development would require swift legislative measures.

Dear reader, this yearbook is not some bestseller that you grab and do not put aside before the last page is read. The hundred or so pages of the book present tables and figures describing one of Estonia's characteristic and important industries in 2018 and comparing it with previous years. Let me stress once again that behind all these dry numbers is the work of real people and that we all should hope for the continuous improvement of the numbers. The easiest way to ensure this is to eat domestic fish.

Eat fish and, whenever possible, Estonian fish!

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

$B_{trigger}$ – the minimum spawning stock biomass that ensures the maximum possible yield in a long run at the F_{MSY} fishing mortality

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)

FPI – Fish Pool Index of Nasdaq OMX Oslo Stock Exchange

F_{sq} – fishing mortality status quo

GT – combined gross tonnage

ICES – International Council for the Exploration of the Sea

IHN – infectious haematopoietic necrosis of fish

EIC – Environmental Investment Centre

EI – Environmental Inspectorate

MoE – Ministry of the Environment

M – natural mortality

MoRA – Ministry of Rural Affairs

MSC – Marine Stewardship Council

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 – Estonian 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 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 EU Fleet Register, there were five vessels owned by three companies in the distant-water fishing segment as at 31 December 2018. Three vessels catch shrimp (northern prawn) as the main target species, and two

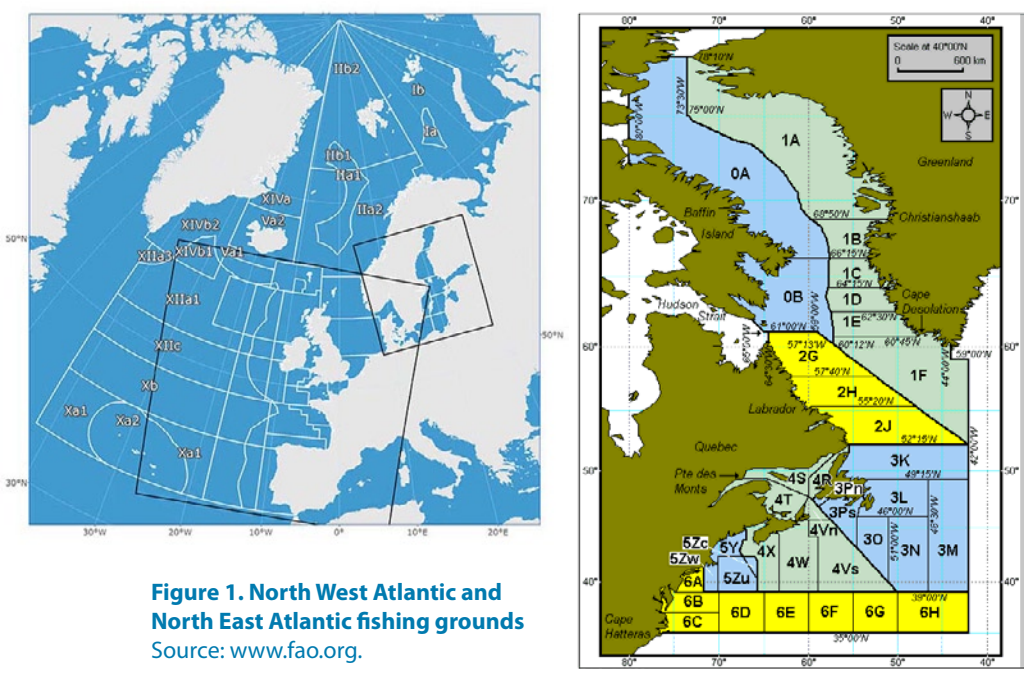


Figure 1. North West Atlantic and North East Atlantic fishing grounds
Source: www.fao.org.

Table 1. Main characteristics of Estonian distant-water fishing fleet, 2005-2018

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	8281
2010	6	12 670	8281
2011	6	12 670	8281
2012	6	15 982	9100
2013	5	13 174	7697
2014	5	13 174	7697
2015	5	13 174	7697
2016	5	13 941	8472
2017	5	13 941	8472
2018	5	15 385	9834

Source: MoRA.

vessels only catch fish. The average length of the vessels was 65 metres; the average age in 2018 was 24 years; the combined power of the vessels' main engines was 15,385 kW (3077 kW on average) and the combined gross tonnage (GT) was 9834 tonnes (1967 tonnes on average; Table 1). All the vessels were actually engaged in fishing in 2018.

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 commercial fishing data. NAFO observers on board vessels help collect information on Estonia's commercial fishing. Fishing opportunities depend above all on the state of fish stocks: in the determination of 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 interaction between environmental conditions and species is increasingly taken into account in the assessment of 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 have been closed to commercial fishing with demersal trawlers since 2010, either because of an abundance of coral and sponges which exceed the established reference levels or because of seamounts regarding which information on the operation of ecosystems is needed (NAFO, 2011). In 2013 a decision was taken to expand the closed fishing grounds, adding one ground (NAFO, 2014a). In 2014 it was decided to keep those grounds closed for fishing until 2020 and two more grounds were added (NAFO, 2015a). A year later the decision to prohibit exploratory bottom trawling in protected marine areas was taken, thereby making all 21 NAFO protected areas closed to all kinds of bottom fishing activity (NAFO, 2016a and 2018). In

2019, the protection zone of vulnerable marine ecosystems makes up 10.3% of the NAFO Regulatory Area (NRA), and exploratory fishing is allowed in 85.4% of the NRA, leaving 4.3% of the NRA open to bottom trawling (NAFO, 2019).

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 division 3L, capelin (*Mallotus villosus*) in division 3NO and shrimp (*Pandalus borealis*) in divisions 3NO and 3M were continued in NAFO fishing grounds in 2016. A moratorium on fishing for shrimp in division 3L was established in 2015 and extended in 2016 (NAFO, 2015a, 2016a and 2017). All the existing moratoria were extended in 2017 and 2018 (NAFO, 2018 and 2019).

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 reopened stocks.

A 15-year recovery plan for **Greenland halibut** (*Reinhardtius hippoglossoides*) was implemented during the period 2003-2018 and a new plan was adopted in 2017. The plan will be in force from 2018 to 2023 and the TAC for this stock will be adjusted annually under the plan depending on the agreed Harvest Control Rule (NAFO, 2018). The Greenland halibut recovery plan has been successful and fishing quotas were stable during the period 2013-2017 (NAFO, 2014a, 2015a, 2017, 2018).

Fishing for **witch flounder** in division 3NO was prohibited in 1994. Given that its biomass had been increasing and the fishing mortality had been low since 2010, limited fishing activity was reopened in 2015 (NAFO, 2014b and 2017). However, as the condition of witch flounder stock has been deteriorating since 2013, the total allowable catch of the species was reduced in 2018 and the scientific recommendation is to not permit directed fishing on this stock in 2019 and 2020 (NAFO, 2019). Fishing for this stock in division 3L was also subject to a moratorium during the years 2017-2019 (NAFO, 2018 and 2019).

After a 12-year moratorium (1998-2009), the biomass of **redfish** in division 3LN has recovered and the fishing mortality is below the critical limit (NAFO, 2014b, 2015b and 2017). Quotas for fishing for redfish in this division have therefore been increased every two years since 2014. In 2017, the quota increased by 37% and the TAC for 2018 remained on the same level (NAFO, 2018). Estonia's largest quota in NAFO fishing grounds is for redfish fishery (Table 2).

A plan for recovery of **cod** stocks in division 3NO has been implemented since 2007 (NAFO, 2011). In 2013 the quota for 3M cod was increased by 52%. Quotas for the period 2014-2017 remained on the same level, but the TAC for 2018 was reduced by around 20% (NAFO, 2015a, 2015b, 2016 and 2018).

The population of **yellowtail flounder** (*Limanda ferruginea*) in division 3LNO is in a good state, the fishing mortality rate is below the critical level and fishing quotas have been stable in recent years (NAFO, 2015b, 2018 and 2019). A stock recovery plan has also been developed for **American plaice** in division 3LNO (NAFO, 2016b).

Table 2. Estonia's distant-water fishing quotas for 2008-2018, before charter arrangements and quota transfers, in tonnes and fishing days, by fishing ground, and change (%) between 2017 and 2018

Species, scientific name and code	Unit	Fishing ground	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change (%) in quota from 2017 to 2018
Shrimp or northern prawn, *Pandalus borealis*, PRA	fishing day	NAFO 3M	1667	1667	834	0	0	0	0	0	0	0	0	0
	Tonne	NAFO 3L	278	334	334	214	134	96	48	0	0	0	0	0
Atlantic redfishes nei, *Sebastes* spp, RED	Tonne	NAFO 3M	1571	1571	1571[1]	1571	1571	1571	1571	1571	1571	1571	1571	0
	Tonne	NAFO 3LN	0	0	173	297	297	322	346	514	514	702	702	0
Northern shortfin squid, *Illex illecebrosus*, SQI	Tonne	NAFO 3 and 4	128	128	128	128	128	128	128[5]	128[5]	128[5]	128[5]	128[5]	0
Greenland halibut, *Reinhardtius hippoglossoides*, GHL	Tonne	NAFO 3LMNO	321	321	321	345	328	312	310	313	297	297	331	11
Skates, *Rajidae*, SKA	Tonne	NAFO 3LNO	546	546	485	485	343	283	283	283	283	283	283	0
Atlantic cod, *Gadus morhua*, COD	Tonne	NAFO 3M	0	0	61	111	103	157	161	153	155	155	124	–20
Witch flounder, *Glyptocephalus cynoglossus*, WIT	Tonne	NAFO 3NO	0	0	0	0	0	0	0	0	96	98	49	–50
Mackerel, *Scomber scombrus*, MAC	Tonne	NEAFC	124	165	107	172	137	128	163	223	189	216	172	–20
Roundnose grenadier, *Coryphaenoides rupestris*, RNG	Tonne	NEAFC	67	57	49	43	38	63	63	59[2]	60[2]	45[2]	46	2
Black scabbardfish, *Aphanopus carbo*, BSF	Tonne	NEAFC	17	15	14	13	12	17	22	20	19	17	15	–12
Blue ling, *Molva dypterygia*, BLI	Tonne	NEAFC	3	3	3	5	3	4	4	8	8	18	17	–6
Atlantic redfishes nei, *Sebastes* spp, RED	Tonne	NEAFC	210	210	210	177	149[3]	121[3]	93	44[4]	39[4]	35[4]	30[6]	–14
Greenland halibut, *Reinhardtius hippoglossoides*, GHL	Tonne	NEAFC	6	4	3	2	2	16	11	17	16	16	16	0
Skates, *Rajidae*, SKA[5] / skates and rays, *Rajiformes*, SRX	Tonne	NEAFC		8	7	6	5	5	4	4	4	4	5	25
Shrimp or northern prawn, *Pandalus borealis*, PRA	fishing day	Svalbard	377	377	377	377	377	377	377	377	377	377	377	0
Total	Tonne		3273	3740	3843	3946	3627	3600	3584	3714	3756	3942	3866	–2
	fishing day		2044	2044	1211	377	377	377	377	377	377	377	377	0
Change in tonne quotas from 2017	%		–12.9	–0.4	32.3	5.1	–3.4	–4.2	–4.6	–1.1	0	5.0	–2.4	

[1] Estonia's actual quota was 841 tonnes, as the catch landed in 2009 exceeded the permitted quantity and the overfished quantity was counted against the quota for 2010.

[2] Only by-catches; targeted fishing is not permitted. Landings of roundnose grenadier may not exceed 95% of the quota allocated to each Member State.

[3] By-catches are permitted to up to 3% of the quotas for 2009.

[4] Fishing permitted from 10 May to 1 July 2015-2017.

[5] Fishing permitted from 1 July to 31 December 2014-2018.

[6] Fishing permitted from 10 May to 31 December 2018.

Sources: MoE, MoRA, EU Council Regulations (EC) No 1359/2008, 43/2009 and (EU) 53/2010, 1225/2010, 57/2011, 43/2012, 44/2012, 1262/2012, 39/2013, 40/2013, 297/2013, 43/2014, 1367/2014, 2015/104, 2016/72, 2017/127, 2018/120.

Species are interrelated through dietary relationships. The biomass of fish feeding on shrimp has increased, and environmental conditions have probably become less favourable for shrimp. Recent studies suggest that predation by cod and redfish, in conjunction with commercial fishing, are the main factors leading to the collapse of shrimp stock (Perez-Rodriguez et al., 2016). Shrimp biomass has increased in division 3M in recent years to some extent, probably due to a slight decrease in the biomass of cod and redfish, but it is still below the critical limit due to low recruitment. Fishing for shrimp was therefore prohibited in division 3M in 2018 and 2019 (NIPAG, 2017 and 2018; NAFO, 2018 and 2019). In 2015 a moratorium was also established on fishing for shrimp in division 3L (NAFO, 2015a). Shrimp fishing in division 3NO has been prohibited for a long time, as well (NAFO, 2017). Thus, shrimp fishing is under a moratorium in the entire third division since 2015, and it has been proposed to extend the moratorium until at least 2019 (NAFO, 2018 and 2019). For 2020, the Scientific Council recommended reopening of shrimp fishery in division 3M, but the total catch should not exceed the 2009 level (5448 tonnes; NAFO, 2019a).

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 quota has been allocated for mackerel (Table 2). Estonian distant-water fishers generally seek to exchange North East Atlantic fish quotas for North West Atlantic fish quotas, while the shrimp quotas are retained. The shrimp stock continues to be in 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 and the biomass index also stays close to the historical mean value (NIPAG, 2017 and 2018).

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).

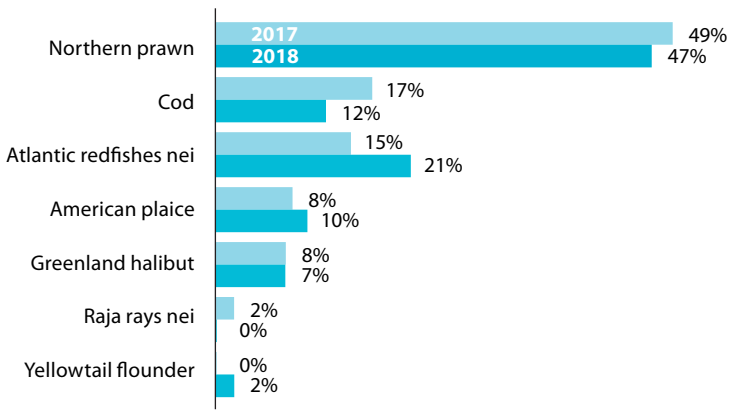


Figure 2. Proportion (%) of catch by main species in distant-water fishery sector in 2017 and 2018
Source: MoRA.

Table 3. Estonia's distant-water fishery catches (t) by species, 2008-2018

Species, scientific name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Aesop shrimp, *Pandalus montagui*				858							
American anglerfish, *Lophius americanus*						<1	27	2	7	<1	<1
Blue antimora, *Antimora rostrata*											
Argentine shortfin squid, *Illex argentinus*			42	329	1248						
Argentine hake, *Merluccius hubbsi*			1125	1395	1571						
Patagonian grenadier, *Macruronus magellanicus*			135	92	<1						
Greenland shark, *Somniosus microcephalus*											
Baird's slickhead, *Alepocephalus bairdii*											
Rabbit fish, *Chimaera monstrosa*											
Atlantic halibut, *Hippoglossus hippoglossus*	3		3	3	10	11	25	22	30	41	44
American plaice *Hippoglossoides platessoides*	77	29	9	36	37	226	1177	537	1105	1249	1689
Splendid alfonsino, *Beryx splendens*											
Atlantic mackerel, *Scomber scombrus*						1 367					
Atlantic wolffish, *Anarhichas lupus*	12	5									
Northern prawn, *Pandalus borealis*	12 742	8587	9037	9919	7576	6653	5665	6740	6954	7413	8019
Silver hake, *Merluccius bilinearis*					<1		151	114	57	55	21
Roundnose grenadier, *Coryphaenoides rupestris*							4				
Mediterranean slimehead, *Hoplostethus mediterraneus*											
Haddock, *Melanogrammus aeglefinus*					8	19	79	30	24	30	<1
Cusk-eels nei, *Genypterus* spp											
Golden redfish, *Sebastes marinus*											
Alfonsinos nei, *Beryx* spp											
Pink cusk-eel, *Genypterus blacodes*				127	90						
Southern blue whiting, *Micromesistius australis*				<1	<1						
Northern shortfin squid, *Illex illecebrosus*		5	1		<1					<1	
Atlantic redfishes nei, *Sebastes* spp	1003	1748	1340	1075	368	1573	1300	1512	1656	2198	3590
Wolffishes nei, *Anarhichas* spp	2					1	14	1			
Lumpfish, *Cyclopterus lumpus*						<1					
Hakes nei, *Merluccius* spp											
Black cardinal fish, *Epigonus telescopus*											
Black dogfish, *Centroscyllium fabricii*											
Beaked redfish, *Sebastes mentella*											
Antarctic rockcods, noties nei, *Nototheniidae*			58	76	57						
Dogfish sharks nei, *Squalidae*	3		<1								
Patagonian squid, *Loligo gahi*			44	69	175						
Patagonian toothfish, *Dissostichus eleginoides*											
Tadpole codling, *Salilota australis*			1	2	1						
Longnose velvet dogfish, *Centroscymnus crepidater*											
Witch flounder, *Glyptocephalus cynoglossus*	38	8	11	14	33	16	40	22	40	66	31
Portuguese dogfish, *Centroscymnus coelolpis*											
Red hake, *Urophycis chuss*			19								
Roughhead grenadier, *Macrourus berglax*	132	41	93	116	72	110	136	26	13	23	12
Raja rays nei, *Raja* spp	123	29	228	82	161	155	246	47	162	304	46
Skates and rays, *Rajiformes*											
Yellowtail flounder, *Limanda ferruginea*	33		4	13	31	350	24	342	351	39	347
Blue ling, *Molva dypterygia*											
Black scabbardfish, *Aphanopus carbo*											
Greenland halibut, *Reinhardtius hippoglossoides*	299	300	441	279	266	727	1 037	694	1092	1141	1286
Threebearded rockling, *Gaidropsarus ensis*		1	3								
Lanternsharks, *Etmopterus* spp							2				
Atlantic cod, *Gadus morhua*	73	128	93	105	285	730	907	989	529	2544	2031
Spotted wolffish, *Anarhichas minor*			12			16	14	7	8	30	36
White hake, *Urophycis tenuis*	19				<1	<1	2			<1	<1
Sharks, rays, skates, etc. nei, *Elasmobranchii*											
Total	14 559	10 881	12 699	14 590	11 990	11 956	10 850	11 084	12 027	15 135	17 154

Source: MoRA, MoE.

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 2005-2018, 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 2018, shrimp produced the biggest catch (47% of the total catch), followed by redfish and cod (21% and 12%, respectively; Figure 2, Table 3).

Redfish was the key species in the North West Atlantic, producing a catch that was 61% higher in 2018 than the year before. Among the other major species, the catches of Greenland halibut, yellowtail flounder and American plaice also increased in 2018 compared to 2017. Cod catches decreased in both the North West and North East Atlantic compared to 2017.

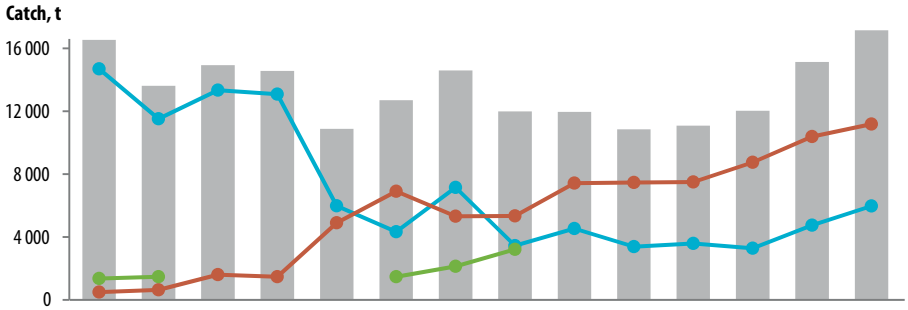
In the North East Atlantic, Estonia generally only uses shrimp, cod and American plaice quotas, the latter two species being caught as by-catches in shrimp fishery with combined gear. In 2018, considerable quantities of Greenland halibut were landed, as well (Table 4). Catches of both shrimp and American plaice increased in the North East Atlantic in 2018. Shrimp catches have steadily grown in this fishing ground, with most of the shrimp being caught in division Ia.

Catches from the North West Atlantic area have decreased considerably since 2005, being around 15,000 tonnes in 2005, relatively persistently around 5100 tonnes from 2009 to 2013, but only around 3500 tonnes during the period

Table 4. Estonia's distant-water fishery catches (t) by fishing ground and species, 2018

Species, scientific name and code	NE Atlantic	NW Atlantic	Total
American anglerfish, *Lophius americanus,* ANG		0.153	0.153
Spotted wolffish, *Anarhichas minor*, CAS	35.979		35.979
Atlantic cod, *Gadus morhua*, COD	1025.330	1005.708	2031.038
Greenland halibut, *Reinhardtius hippoglossoides*, GHL	574.107	712.061	1286.168
Haddock, *Melanogrammus aeglefinus*, HAD		0.134	0.134
Atlantic halibut, *Hippoglossus hippoglossus*, HAL		43.609	43.609
Silver hake, *Merluccius bilinearis*, HKS		21.392	21.392
White hake, *Urophycis tenuis*, HKW		0.769	0.769
American plaice, *Hippoglossoides platessoides*, PLA	1528.783	161.678	1690.461
Northern prawn, *Pandalus borealis*, PRA	8018.558		8018.558
Atlantic redfishes nei, *Sebastes* spp, RED		3590.354	3590.354
Roughhead grenadier, *Macrourus berglax*, RHG		11.684	11.684
Raja rays nei, *Raja* spp, SKA		46.364	46.364
Witch flounder, *Glyptocephalus cynoglossus,* WIT		30.593	30.593
Yellowtail flounder, *Limanda ferruginea,* YEL		346.750	346.750
TOTAL tonnes	**11 182.756**	**5971.250**	**17 154.006**

Source: MoRA.



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total	16,539	13,617	14,930	14,559	10,881	12,699	14,590	11,990	11,956	10,850	11,084	12,027	15,135	17,154
NW Atlantic	14,690	11,515	13,332	13,086	5979	4329	7146	3444	4533	3387	3586	3283	4744	5971
NE-Atlantic	494	633	1598	1473	4903	6906	5318	5340	7422	7463	7498	8744	10,390	11,183
SE-Atlantic	1355	1469				1464	2126	3206						

Figure 3. **Estonia's total distant-water fishery catches (t) by fishing ground, 2005-2018**
Source: MoRA.

2014-2016. However, the total catch increased slightly in 2017 and 2018, amounting to 4744 and 5971 tonnes, respectively (Figure 3, Table 4). The quantities caught in the North East Atlantic, on the other hand, increased continuously from 2005 to 2018, 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 the period 2014-2018. The North East Atlantic fishing grounds are thus currently very 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 catch for 2018 (17,154 tonnes) was the highest of the period 2005-2018. Catches are usually landed in ports of Canada, Iceland, Spain, Portugal and Norway.

Outlook

By 2015, the state of the 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 due to the recession of the shrimp stock. Estonian shrimp-fishers are increasingly shifting their fishing efforts to the Barents Sea where the shrimp stock is in good condition and total annual catches amount to less than a half of the recommended quantity. 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. From 2017, the certificate covers cod taken as a by-catch in shrimp fishing. 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

While in recent years the number of fishermen operating in the Baltic Sea has shown a slight upward trend, their number decreased somewhat in 2018 (Figure 4). The number of coastal fishermen entered on fishing permits for the coastal sea of Estonia was 1905.

The number of fishermen is the highest in Saare County, followed by Hiiu, Pärnu and Harju counties (Table 5). It is estimated that fishing is the main source of income for no more than 10% of coastal fishermen. There were 43 women among the coastal fishermen and inland fishermen entered on fishing permits in 2018, or slightly less than the year before (46). The oldest fisherman is 93 years old, and in all counties the average age of fishermen engaged in coastal fishery is over 50 years (Table 6).

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 1679 in 2018, or slightly more than in previous years (1516 in 2016 and 1557 in 2017). The number of vessels used in inland waters also continued to grow: from 489 in 2017 to 494 in 2018.

Figure 4. Number of coastal fishermen fishing in the Baltic Sea, 2009-2018
Sources: MoE, MoRA.

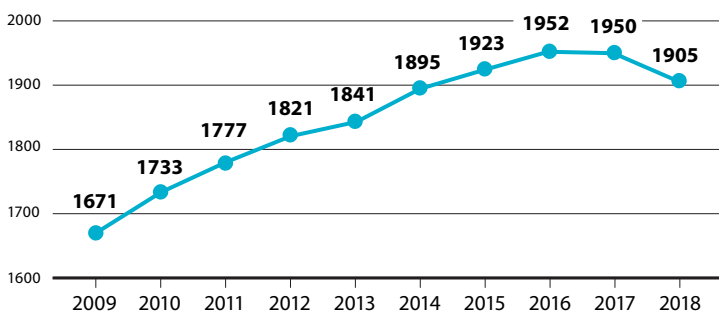


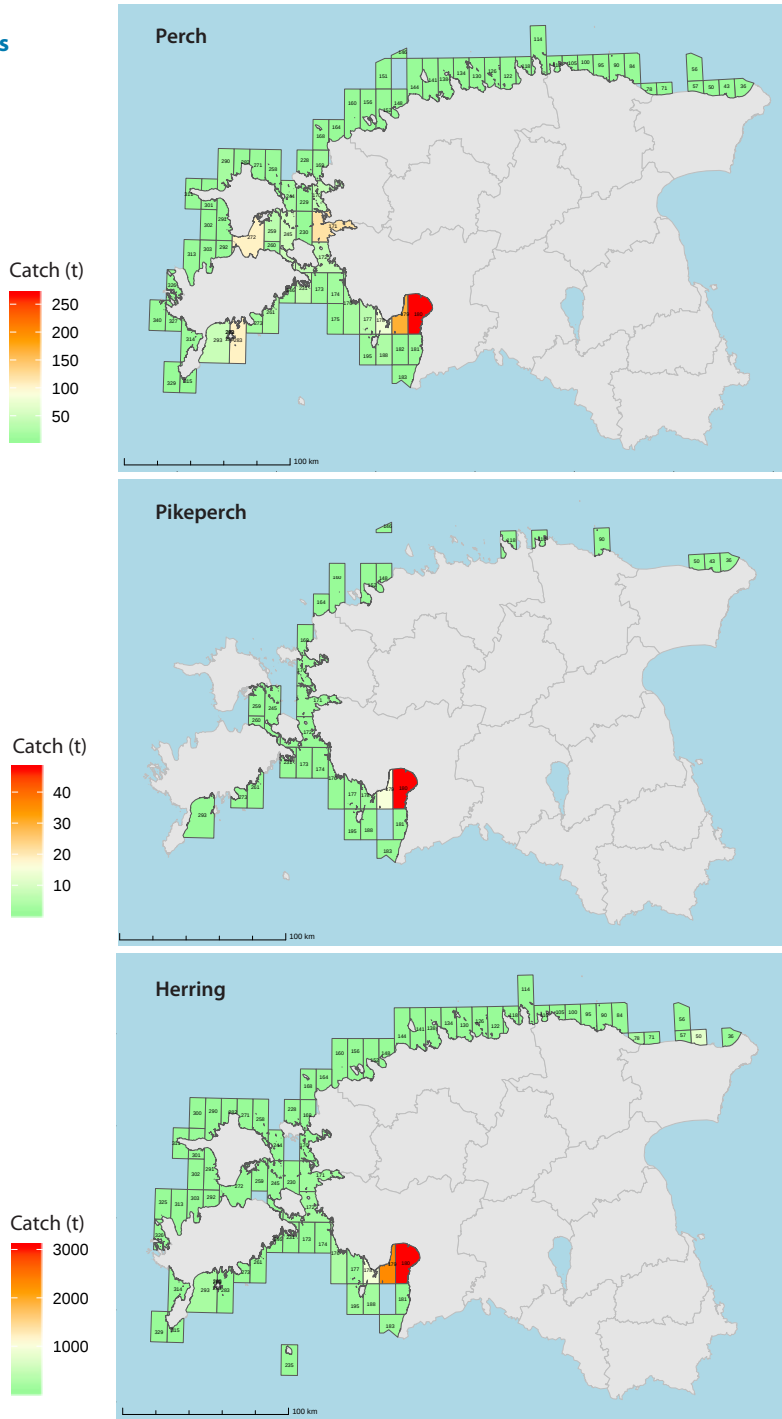
Table 5. Number of coastal fishermen entered on fishing permits, by county, 2009-2018

County	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Harju County	265	286	285	298	303	307	314	316	309	310
Hiiu County	242	253	273	288	294	311	319	329	333	333
Ida-Viru County	99	100	91	87	91	92	97	100	98	93
Lääne County (incl. Vormsi)	225	239	251	261	267	282	274	288	279	270
Lääne-Viru County	118	120	129	134	135	133	140	147	141	145
Pärnu County (incl. Kihnu and Manija)	393	390	394	395	393	401	399	402	413	326
Saare County (incl. Ruhnu)	368	385	396	403	415	431	445	442	448	428
Total	1671	1733	1777	1821	1841	1895	1923	1952	1950	1905

Source: MoRA.

As in previous years, the biggest catches taken in 2018 in Estonian coastal fishery were those of herring (around 8064 tonnes), followed by perch (around 1137 tonnes), smelt (around 284 tonnes), flounder (around 169 tonnes), round goby (around 119 tonnes) and vimba bream (around 97 tonnes) (Table 7, Figure 6).

Figure 5. Catches (t) of key target species in different fishing squares, 2018
Source: MoRA, UT.



The regional distribution of the key target species is shown in Figure 5.

When looking at the value of catches, the top three species in coastal fishery have not changed over the last three years. As in previous years, perch generated the highest revenue (around 2.5 million euros in 2017 and around 2.6

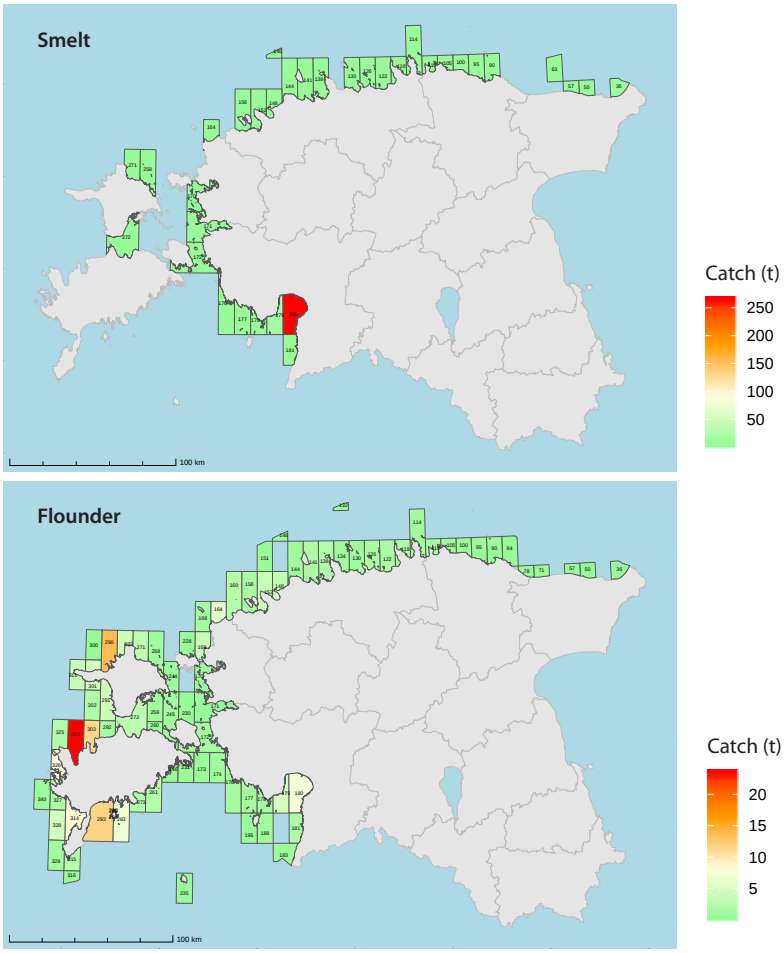


Table 6. Age of fishermen by counties, 2018

County	Oldest fisherman	Average age of fishermen	Number of female fishermen
Harju (Baltic Sea)	93	57	3
Hiiu (Baltic Sea)	88	52	9
Ida-Viru (Baltic Sea)	74	54	3
Lääne (Baltic Sea)	84	55	6
Lääne-Viru (Baltic Sea)	88	56	3
Pärnu (Baltic Sea)	88	52	6
Saare (Baltic Sea)	89	56	8
Lakes Peipsi, Lämmijärv and Pihkva	81	48	4
Lake Võrtsjärv	75	51	1

Source: MoRA.

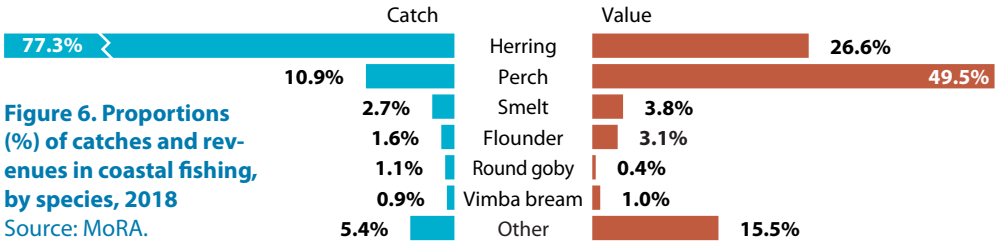
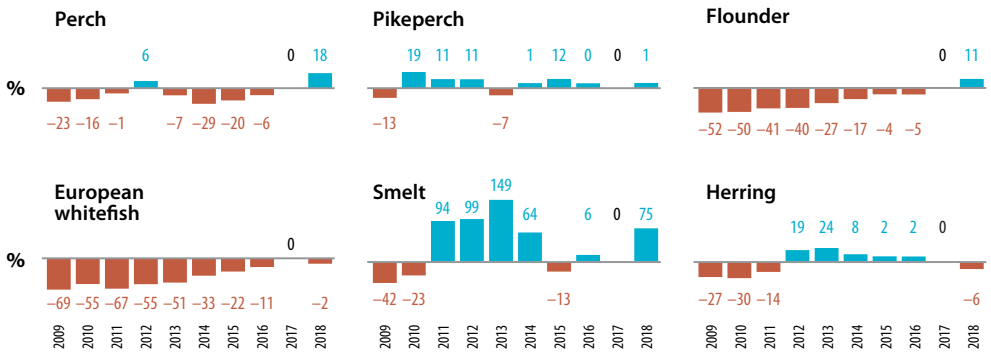


Figure 6. Proportions (%) of catches and revenues in coastal fishing, by species, 2018
Source: MoRA.

million euros in 2018), followed by herring (around 1.6 million euros in 2017 and around 1.4 million euros in 2018) and pikeperch (around 0.19 million euros in 2017 and around 0.23 million euros in 2018). Smelt and flounder also produced relatively high catch values in 2018: both around 0.2 million euros based on first-sale prices (Table 8, Figure 6).

Based on first-sale prices, the total revenue earned in coastal fishery is estimated to have amounted to around 5.3 million euros in 2018, which is the average level of the last five years (around 5.0, 5.2, 5.4 and 5.2 million euros in 2014, 2015, 2016 and 2017, respectively). Among the most profitable target species, the first-sale price of perch increased by 18% in 2018 (2015: €1.56/kg, 2016: €1.83/kg, 2017: €1.95/kg, 2018: €2.30/kg), while that of herring decreased by 6% (2017: €0.19/kg, 2018: €0.17/kg) and that of pikeperch remained nearly the same (2015: €3.77/kg, 2016 and 2017: €3.37/kg, 2018: €3.42/kg, Table 9). When comparing the average first-sale prices published in the official publication Ametlikud Teadaanded, it appears that the average price of all target species of coastal fishery has increased by 30% from 2017 (Figure 7).

Fishing efforts decline in years when the abundance of fish is low, as well as when fishermen find better-paid jobs. However, an increase in the cost-effectiveness or relative cost-effectiveness of fishing is immediately followed by an increase in fishing efforts because the maximum amount of permitted fishing



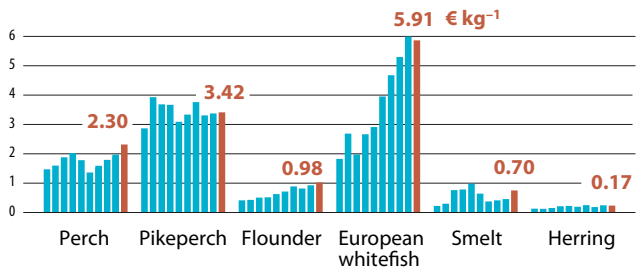


Figure 7. Change (%) in average first-sale prices of fish species most important to coastal fishery compared to prices in 2017, 2009-2018
Source: MoRA.

Table 7. Coastal fishery catches (t) and proportions (%) of total catch from the Baltic Sea, 2013-2018, by species

Species	2013		2014		2015		2016		2017		2018	
	Catch	%	Catch	%	Catch	%	Catch	%	Catch	%	Catch	%
Perch	1216.99	12.6	1566.68	15.3	1522.82	12.6	1373.57	11.9	1290.55	11.9	1136.73	10.9
Eel	1.65	<0.1	1.06	<0.1	0.84	<0.1	0.79	<0.1	0.69	<0.1	0.50	<0.1
Atlantic sturgeon			<0.01	<0.1					<0.01	<0.1		
Eelpout	1.15	<0.1	0.18	<0.1	0.77	<0.1	0.06	<0.1	0.27	<0.1	0.52	<0.1
Turbot	0.04	<0.1	0.10	<0.1	0.05	<0.1	0.19	<0.1	0.39	<0.1	0.67	<0.1
Atlantic mackerel	<0.01	<0.1			<0.01	<0.1			<0.01	<0.1	<0.01	<0.1
Pike	65.90	0.7	65.44	0.6	51.79	0.4	41.61	0.4	40.36	0.4	68.07	0.7
Chinese mitten crab											<0.01	<0.1
Gibel carp	56.54	0.6	87.75	0.9	70.00	0.6	60.84	0.5	64.74	0.6	64.55	0.6
Lamprey	1.00	<0.1	0.31	<0.1	0.21	<0.1	0.09	<0.1	0.12	<0.1	0.08	<0.1
Carp	0.30	<0.1	0.20	<0.1	0.38	<0.1	0.20	<0.1	0.10	<0.1	0.08	<0.1
Ruff	38.76	0.4	35.30	0.3	24.17	0.2	37.36	0.3	42.46	0.4	48.73	0.5
Sprat	1.18	<0.1	0.58	<0.1	0.01	<0.1	0.36	<0.1	0.14	<0.1	0.61	<0.1
Bighead carp					0.01	<0.1	<0.01	<0.1		<0.1		
Crucian carp									<0.01	<0.1	<0.01	<0.1
Pikeperch	122.16	1.3	173.27	1.7	83.02	0.7	106.71	0.9	56.08	0.5	65.96	0.6
Bream	8.77	0.1	12.93	0.1	8.23	0.1	6.61	0.1	7.63	0.1	9.44	0.1
Flounder	250.03	2.6	204.10	2.0	198.38	1.6	200.61	1.7	186.53	1.7	168.90	1.6
Tench	4.00	<0.1	6.88	0.1	5.02	<0.1	3.51	<0.1	2.46	<0.1	4.69	<0.1
Burbot	2.80	<0.1	4.95	<0.1	5.09	<0.1	3.82	<0.1	3.16	<0.1	2.25	<0.1
Salmon	6.82	0.1	5.22	0.1	5.59	<0.1	6.83	0.1	8.89	0.1	8.15	0.1
Baltic prawn												
Sea trout	14.67	0.2	14.59	0.1	16.14	0.1	19.93	0.2	17.29	0.2	16.29	0.2
Four-horned sculpin	0.03	<0.1	0.04	<0.1	0.29	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1
European whitefish	25.76	0.3	25.86	0.3	19.49	0.2	18.27	0.2	16.20	0.1	17.39	0.2
Sea lamprey												
Smelt	506.41	5.2	228.68	2.2	346.82	2.9	357.83	3.1	171.57	1.6	283.92	2.7
Lumpfish	<0.01	<0.1										
Sabre carp							<0.01	<0.1	<0.01	<0.1		
Silver bream	30.91	0.4	30.44	0.3	29.77	0.2	29.26	0.3	31.96	0.3	36.71	0.4
Thicklip grey mullet	<0.01	<0.1										
Rudd	1.76	<0.1	2.67	<0.1	2.22	<0.1	2.45	<0.1	1.55	<0.1	1.78	<0.1
Herring	7087.77	73.7	7535.63	73.4	9290.67	77.2	8864.49	77.0	8372.12	77.2	8064.46	77.3
Ide	7.05	0.1	11.96	0.1	15.97	0.1	26.95	0.2	35.76	0.3	49.09	0.5
Roach	71.08	0.7	93.30	0.9	95.06	0.8	110.78	1.0	86.07	0.8	94.06	0.9
Dwarf mud crab					0.01	<0.1						
Dace	<0.01	<0.1			0.06	<0.1	<0.01	<0.1	0.1	<0.1	<0.01	<0.1
European chub					0.05	<0.1	<0.01	<0.1	<0.01	<0.1		
Cod (Atlantic cod)	5.26	0.1	7.02	0.1	3.92	<0.1	1.87	<0.1	0.75	<0.1	0.98	<0.1
Garfish	19.14	0.2	43.84	0.4	115.94	1.0	70.00	0.6	176.76	1.6	74.87	0.7
Bleak	0.10	<0.1	0.15	<0.1	1.36	<0.1	0.11	<0.1	0.03	<0.1	0.13	<0.1
Rainbow trout	0.19	<0.1	0.16	<0.1	0.06	<0.1	0.14	<0.1	0.18	<0.1	0.34	<0.1
Vimba bream	56.41	0.6	83.97	0.8	92.93	0.8	73.43	0.6	88.01	0.8	97.33	0.9
Twaite shad			<0.01	<0.1	<0.01	<0.1					<0.01	<0.1
Lesser sand eel	0.74	<0.1	0.04	<0.1	0.33	<0.1	0.15	<0.1	0.03	<0.1	0.05	<0.1
Round goby	9.08	0.1	19.18	0.2	30.63	0.3	89.41	0.8	139.32	1.3	119.46	1.1
Total	**9614.47**	**100.0**	**10 262.46**	**100.0**	**12 038.26**	**100.0**	**11 508.22**	**100.0**	**10 842.21**	**100.0**	**10 436.78**	**100.0**

Source: MoRA.

gear is high. The maximum amount of permitted fishing gear should be reduced, but opposition from fishermen makes it difficult to achieve this.

As a way of addressing this situation, the state could buy from fishermen their historic fishing rights, which have long constituted the primary basis for determining the maximum amount of permitted fishing gear (i.e. act by analogy to the removal or "scrapping" of trawlers), or link fisheries subsidies to a reduction of fishing efforts.

Table 8. Value (10^3 euros) of coastal fishing catches from Baltic Sea and proportion (%) of total value from 2013-2018, by species

Species	2013		2014		2015		2016		2017		2018	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
Perch	2214.93	41.8	2177.68	43.1	2375.59	45.3	2516.61	46.4	2515.20	48.9	2613.62	49.5
Eel	0.19	<0.1	7.82	0.2	6.18	0.1	5.65	0.1	5.73	0.1	4.71	<0.1
Eelpout	4.84	0.1	0.09	<0.1	0.09	<0.1	<0.01	<0.1	0.05	<0.1	0.10	<0.1
Turbot			0.07	<0.1	0.03	<0.1	0.16	<0.1	0.53	<0.1	0.67	<0.1
Atlantic mackerel											<0.01	<0.1
Pike	7.35	0.1	78.53	1.6	77.17	1.5	63.39	1.2	65.28	1.3	120.99	2.3
Chinese mitten crab											<0.01	<0.1
Gibel carp	28.21	0.5	14.04	0.3	16.10	0.3	15.58	0.3	16.46	0.3	17.38	0.3
Lamprey			1.41	<0.1	1.16	<0.1	0.43	<0.1	0.60	<0.1	0.33	<0.1
Carp	0.26	<0.1	0.28	<0.1	0.34	<0.1	0.21	<0.1	0.17	<0.1	0.15	<0.1
Ruff	81.06	1.5	4.59	0.1	4.59	0.1	5.69	0.1	9.14	0.2	10.08	0.2
Sprat	0.53	<0.1	0.12	<0.1	0.06	<0.1	0.07	<0.1	0.02	<0.1	0.11	<0.1
Crucian carp									<0.01	<0.1	0.00	<0.1
Pikeperch	384.79	7.3	589.13	11.7	312.98	6.0	360.11	6.6	189.18	3.7	225.32	4.3
Bream	4.82	0.1	9.44	0.2	5.68	0.1	3.50	0.1	3.62	0.1	4.48	<0.1
Flounder	160.02	3.0	148.99	3.0	166.64	3.2	167.74	3.1	163.79	3.2	165.16	3.1
Tench	5.53	0.1	8.81	0.2	7.23	0.1	5.14	0.1	3.46	0.1	7.51	0.1
Burbot	13.83	0.3	4.31	0.1	4.89	0.1	2.84	0.1	2.37	<0.1	1.72	<0.1
Salmon	4.37	0.1	22.96	0.5	27.77	0.5	40.45	0.7	60.34	1.2	61.12	1.2
Sea trout	58.52	1.1	41.88	0.8	79.73	1.5	96.46	1.8	120.00	2.3	116.85	2.2
Four-horned sculpin	<0,01	<0.1							<0.01	<0.1	0.00	<0.1
European whitefish	27.36	0.5	104.20	2.1	91.60	1.7	98.71	1.8	97.82	1.9	102.86	1.9
Smelt	506.41	9.6	150.93	3.0	121.39	2.3	152.98	2.8	68.97	1.3	199.98	3.8
Silver bream	3.09	0.1	3.96	0.1	3.28	0.1	2.24	<0.1	3.04	0.1	3.26	<0.1
Stickleback	<0.01	<0.1							<0.01	<0.1	<0.01	<0.1
Rudd	2.55	<0.1	0.29	<0.1	0.22	<0.1	0.28	<0.1	0.26	<0.1	0.37	<0.1
Herring	1630.19	30.8	1507.13	29.8	1765.23	33.6	1677.36	30.9	1552.21	30.2	1406.57	26.6
Ide	30.03	0.6	7.89	0.2	7.35	0.1	14.99	0.3	20.90	0.4	27.79	0.5
Roach	39.09	0.7	56.91	1.1	49.43	0.9	67.31	1.2	47.69	0.9	59.41	1.1
European chub					0.03	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1
Dace											<0.01	<0.1
Cod	5.41	0.1	8.77	0.2	2.67	0.1	1.83	<0.1	1.13	<0.1	0.93	<0.1
Garfish	76.50	1.4	50.86	1.0	78.84	1.5	74.33	1.4	127.93	2.5	50.96	1.0
Bleak					0.14	<0.1	0.01	<0.1	<0.01	<0.1	0.10	<0.1
Rainbow trout							0.68	<0.1	<0.01	<0.1	2.31	<0.1
Vimba bream	7.36	0.1	44.50	0.9	39.96	0.8	33.94	0.6	41.97	0.8	50.79	1.0
Twaite shad			<0.01	<0.1	<0.01	<0.1			<0.01	<0.1	<0.01	<0.1
Lesser sand eel											<0.01	<0.1
Round goby	1.27	<0.1	3.84	0.1	1.84	<0.1	13.31	0.2	22.27	0.4	22.37	0.4
Total	**5298.78**	**100.0**	**5049.43**	**100.0**	**5248.18**	**100.0**	**5421.98**	**100.0**	**5140.14**	**100.0**	**5278.01**	**100.0**

Source: MoRA.

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, round goby, gibel carp, garfish and salmon. Among these species,

Table 9. Average first-sale prices of fish (€ kg^{-1}), 2008-2018, and changes thereof (%)

Species	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change
Perch	1.56	1.50	1.63	1.92	2.07	1.82	1.39	1.56	1.83	1.95	2.30	+18
Eel	5.58	5.14	5.72	6.56	7.35	8.36	7.41	7.34	7.20	8.35	9.43	+13
Eelpout	0.13		0.36	0.14	0.21	0.46	0.50	0.12	0.04	0.18	0.19	+6
Turbot										1.35	1.00	–26
Pike	0.98	1.05	1.05	1.33	1.43	1.23	1.20	1.49	1.52	1.62	1.78	+10
Gibel carp	0.14	0.12	0.11	0.11	0.12	0.13	0.16	0.23	0.26	0.25	0.27	+6
Brown trout												
Lamprey	1.88	1.76	1.68	2.96	3.64	4.86	4.63	5.39	4.94	4.98	4.37	–12
Carp	0.27	0.74	0.94	1.11	0.78	0.84	1.38	0.89	1.05	1.66	1.87	+13
Ruff	0.08	0.09	0.13	0.16	0.20	0.19	0.13	0.19	0.15	0.22	0.21	–4
Sprat	0.17	0.15	0.13	0.17	0.20	0.22	0.21	0.33	0.18	0.18	0.17	–1
Crucian carp		0.32	0.30	0.25	0.21	0.24	0.27	0.33	0.49	0.38	0.75	+99
Pikeperch	2.41	2.92	4.01	3.76	3.74	3.15	3.40	3.77	3.37	3.37	3.42	+1
Bream	0.40	0.49	0.45	0.56	0.58	0.55	0.73	0.69	0.53	0.47	0.47	0
Flounder	0.42	0.42	0.44	0.52	0.53	0.64	0.73	0.84	0.84	0.88	0.98	+11
Tench	0.95	0.80	0.86	1.09	1.01	1.38	1.28	1.44	1.46	1.40	1.60	+14
Burbot	0.56	0.61	0.63	0.76	0.77	0.91	0.87	0.96	0.74	0.75	0.77	+2
Salmon	3.29	1.64	2.63	3.95	4.09	4.40	4.40	4.97	5.93	6.79	7.50	+10
Baltic prawn		2.36										
Sea trout	2.05	1.47	1.68	3.00	3.54	3.99	2.87	4.94	4.84	6.94	7.17	+3
Four-horned sculpin						0.25					0.15	0
European whitefish	1.79	1.87	2.74	2.02	2.72	2.97	4.03	4.70	5.40	6.04	5.91	–2
Smelt	0.28	0.23	0.31	0.78	0.80	1.00	0.66	0.35	0.43	0.40	0.70	+75
Silver bream	0.07	0.07	0.09	0.12	0.11	0.10	0.13	0.11	0.08	0.10	0.09	–7
Stickleback							0.24					
Lake Peipsi whitefish	0.99	1.04	0.94	1.00	1.92	2.12	1.29	1.00		1.00	1.69	+69
Lake Peipsi (dwarf) smelt							0.40		0.24	0.25	0.57	+127
Rudd	0.13	0.07	0.04	0.06	0.06	0.11	0.11	0.10	0.12	0.17	0.21	+22
Herring	0.16	0.14	0.13	0.16	0.22	0.23	0.20	0.19	0.19	0.19	0.17	–6
Vendace	1.01	1.43	2.88		3.44	3.32	3.33	3.42	3.15	2.43	1.61	–34
Ide	0.39	0.42	0.46	0.64	0.48	0.62	0.66	0.46	0.56	0.58	0.57	–3
Roach	0.39	0.39	0.44	0.48	0.50	0.55	0.61	0.52	0.61	0.55	0.63	14
European chub		0.19				0.30		0.50	0.23	0.10		–100
Cod	0.55	1.10	0.92	1.03	0.95	1.03	1.25	0.68	0.98	1.50	0.95	–37
Garfish	0.38	0.43	0.47	0.71	0.89	1.43	1.16	0.68	1.06	0.72	0.68	–6
Bleak	0.13	0.03	0.13		0.10			0.10		0.10	0.80	+700
Rainbow trout		1.92							5.00		6.88	0
Vimba bream	0.23	0.23	0.38	0.43	0.43	0.50	0.53	0.43	0.46	0.48	0.52	+9
Round goby	0.25	0.34	0.32	0.39	0.20	0.14	0.20	0.06	0.15	0.16	0.19	+17

Source: Official publication *Ametlikud Teadaanded*.

only the catch of European whitefish increased in 2018 year-on-year, while the catches of all other key commercial species decreased (Table 10).

As in previous years, herring catch generated the highest revenue in 2018 (around 166,000 euros), but it declined considerably in comparison with 2017 (around 226,000 euros). In terms of profitability, herring was followed by sea trout (around 70,000 euros), European whitefish (around 53,000 euros), salmon (around 48,000 euros) and flounder (around 30,000 euros).

Herring is caught in the Gulf of Finland mainly using trap nets. The highest catch of the period 2007-2018 was landed in 2015 (1657 tonnes). The catch of 2017 was 1189 tonnes, while the catch of 2018 amounted to just 952 tonnes, which is the lowest in the last six years and below the data series average. **Flounder** is usually caught using gill nets and mainly in the western part of the gulf. Catches of flounder have been declining since 2014, and the catch landed in 2018 (31 tonnes) was the lowest of the period observed. 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. Perch catches have been declining since 2013, and the catch taken in 2018 was yet again the lowest of the data series (10 tonnes). **European whitefish** is caught in the Gulf of Finland mainly with gill nets. The catch of whitefish has exceeded the 20-tonne limit in two years (2007 and 2008). Although the catch landed in 2018 (9 tonnes) exceeded the quantities taken in the past three years, it remained below the average of the data series. **Smelt** is generally also caught using gill nets. Catches increased in four consecutive years (2012-2015) and have since declined steadily. In 2018, 4 tonnes of smelt were landed. Only the catch of 2011 was lower than that. **Sea trout** and **salmon** are mainly caught with gill nets as well. Compared to the catch figures of 2017 (sea trout 12.9 tonnes and salmon 7.1 tonnes), the catches of these valuable species were lower in 2018: 9.8 tonnes for sea trout, which is lower than the average of the years 2007-2018, and 6.5 tonnes for salmon, which exceeds the average of the period observed. The largest catch of sea trout was landed in 2016 and the catch of salmon was the largest in 2017. 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, and has thereafter both declined and increased, while still not exceeding the record catch of 2012. Whereas in 2017 round goby held the third position in terms of catch volume in the Gulf of Finland, it fell to the sixth place in the catch statistics of 2018. Catches declined in almost the entire coastal sea, as round gobies perished massively due to a disease outbreak in early summer. It should also be noted that catch statistics have not been indicative of the abundance of this species in the sea in recent years, because (due to the low sales value of round goby) fishermen have learned to use fishing methods that limit the quantity that is get caught in fishing gear. However, if a market is found for this fish species, its catch will certainly increase.

In summary, the total catch of 2018 amounted to 1042 tonnes, which is lower than in the preceding year and below the average catch of the period 2007-2018. If herring as the mass fish is not taken into account, the catch of 2018 was the lowest of the period. The total catch excluding herring has steadily declined since 2014.

■ **High seas** Fishing gear used in coastal regions towards the Central Baltic near the Saaremaa and Hiiumaa islands includes gill nets, trap nets, seine nets and, to a very little extent, longlines. Longlines used to be employed in eel fishing, but their importance has declined as the eel stock is in a recession. In 2018, the biggest catch was produced by flounder, followed by perch, garfish, ide, roach, herring, round goby, sea trout, pike, gibel carp and European whitefish (Table 11). The catch of flounder has been the highest in each year during the period 2007-2018, but the ranking of other species has varied. While in 2015 round goby held the twelfth place in terms of catch volume, this invasive alien species rose to the second place in 2016 and 2017, following flounder, but dropped to the seventh place in 2018.

In both 2017 and 2018, flounder was the key source of revenue for coastal fishermen fishing in the high seas (around 93,000 euros), followed by perch (around 54,000 euros), sea trout (around 31,000 euros) and garfish (around 15,000 euros).

In **flounder** fishing the main fishing gear have included gill nets (64% of the catch), seine nets (28%) and trap nets (8%) over the past twelve years. All in all, flounder catches declined during the period observed: in 2015, the catch dropped to the lowest level of the period (101 tonnes), increased slightly in the next two years, but decreased again in 2018, this time to a record low (95 tonnes). Until 2010, the second and third positions in terms of catch volume were held by **garfish** and herring in this area. Both species are mostly caught using trap nets. The 2018 catch of garfish was exceptionally high – 22 tonnes, or more than twice the average for the period observed (9 tonnes). **Herring** is mainly caught with trap nets, but gill nets are also used, their share being higher in the high seas than in coastal waters. The herring catch was the period's largest in 2014 (18 tonnes), but the catch of 2018 (9 tonnes) was below the average of the years observed, although it reached almost the same level as the year before. In terms of catch volume, herring was in the third place during the period 2013-2016, but holds the sixth position since 2017. Among freshwater fish, **perch** was the most important species in terms of catch volume in 2018 and its catch (24 tonnes) increased significantly compared to 2017 (11 tonnes). The catch of roach increased as well, from 7 tonnes in 2017 to 10 tonnes in 2018. Catches of **ide** amounted to around 10 tonnes in both 2017 and 2018, exceeding the catches landed during the past eleven years. The catch of **round goby** decreased by more than twice year-on-year (from 17 to 8 tonnes). Catches of **European whitefish** have been declining since 2014, and the catch of 2018 (2 tonnes) was below the average for the period observed. Catches of **sea trout** and **salmon** taken in 2018 rose above the average level of the data series (4.3 and 0.8 tonnes, respectively).

In summary, the total catch taken in 2018 from coastal regions towards the Central Baltic near Saaremaa and Hiiumaa was slightly above the average for the period 2007-2018.

■ **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. The biggest catches

have been produced by perch since 2013. Perch is followed by herring, but the order of other species in terms of catch volume varies. In 2018, the third position was held by pike, followed by ide, pike, silver bream, roach, vimba bream and gibel carp (Table 12).

Traditionally, the perch catch generated the highest value in 2018: around 858,000 euros, or considerably more than the year before (around 535,000 euros).

Like in 2017 (around 43,000 euros), pike held the second place in terms of value (around 74,000 euros), followed by herring (around 34,000 euros) and European whitefish (around 25,000 euros).

Perch as the most important species to coastal fishermen has produced the biggest catches during the last six years (2013-2018) in the Väinameri Sea. Perch is fished mainly using gill nets, but from 2014-2018 almost equivalent quantities were taken with trap nets. Catches fluctuated strongly from 2007-2018, as fishing for perch relied on just a few year classes. In 2013, the perch catch taken from the Väinameri Sea grew several times. Fishermen did not respond immediately, but in 2014 they re-employed the trap nets that had been set aside during the intervening years when the abundance of fish was low. As a result, the proportion of fish caught in trap nets increased. The perch catch of 2018 (373 tonnes) was the largest since the perch stock crisis of the early 1990s. **Pike** is caught using both trap nets and gill nets, with the proportion of the latter in the catch accounting for around two-thirds until 2018 when the catch was divided more or less equally between these types of fishing gear. As in the case of perch, this points to the intensification of trap net fishing in recent years. While pike catches taken in the Väinameri Sea declined since 2015, the catch of 2018 (42 tonnes) increased significantly, exceeding the average for the period observed and the catches of the past three years. Herring is mostly caught using trap nets. **Herring** catches were high in 2009 and 2010, and the figure for 2013 (133 tonnes) also exceeded the average for the period observed, but the catches landed in the intervening years until 2018 (195 tonnes) were below the average for the years 2007-2018. **Gibel carp** is caught mostly using gill nets, but an increase in the share of trap nets in the catch can be observed for this species, too. The record catch of the period 2007-2018 was taken in 2014, but catches declined in subsequent years and the catch of 2018 (19 tonnes) was below the average for the period observed. The catch of **garfish** (11 tonnes), which is mostly taken using trap nets, decreased more than twice from 2017 to 2018 and was below the average of the data series. Catches of **ide** have been growing since 2013, and the catch landed in 2018 (30 tonnes) was the largest of the period observed. For the first time, the quantity of ide caught in trap nets exceeded the catch of ide taken with gill nets. The **vimba bream** catch of 21 tonnes was the record high in 2018. The quantities of vimba bream caught using gill nets continue to be higher than the quantities caught in trap nets. The same can be said for **roach**, which is mainly caught using gill nets. The roach catch of 2015 (28 tonnes) was the best during the years under review, but catches have declined since then. The catch of 2018 (23 tonnes), however, was above the average. The **eel** catch, which had not increased since 2007, grew from 39 kg in 2016 to 42 kg in 2017, but dropped to a remarkably low level in 2018 (32 kg). **Pikeperch** catches have decreased for four

years in a row, and the catch taken in 2018 (1.4 tonnes) was well below the average of the data series.

In summary, catches taken in the Väinameri Sea have increased in recent years. Improved catches of herring and later also of perch and some other species contributed to the increase. The best total catch of the period 2007-2018 was taken in 2018, which is the highest even if the catch of herring is not taken into account. Similar record levels were achieved in the Väinameri Sea also in 2016 and 2017.

■ **Gulf of Riga** The most common fishing gear used in the Gulf of Riga (except Pärnu Bay) include gill nets and trap nets, with seine nets and longlines being used to a lesser extent. The biggest catches taken in the Gulf of Riga during the period 2007-2018 were those of herring, followed by perch, garfish, roach and flounder.

In 2018, round goby rose to the third position in terms of catch volume, followed by roach, garfish, flounder and gibel carp (Table 13).

The value of the perch catch taken in the Gulf of Riga (around 497,000 euros) increased significantly in 2018 (2016: around 364,000 euros, 2017: around 303,000 euros). Herring was the second best species in terms of profitability (around 100,000 euros), but it produced less revenue than in two preceding years (2016: around 146,000 euros, 2017: around 124,000 euros). In terms of catch value, the third place was held by pike (around 31,000 euros) and the fourth by garfish (around 27,000 euros).

Herring is caught in the Gulf of Riga mostly with trap nets and less so with gill nets. The herring catch of 2018 (575 tonnes) was nearly half the average for the years 2007-2018 (1014 tonnes) and also the lowest of the period observed. **Garfish** is caught using the same fishing gear as in the case of herring. While the catch landed in 2017 (87 tonnes) was the highest of the data series, the catch of 2018 (39 tonnes) was less than a half of that, but still exceeded the average of the period observed. In addition to stocks, garfish catches taken in coastal waters also depend to a considerable extent on herring quotas 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 2018 (216 tonnes) was higher than in the two preceding years and exceeded the average for the period observed (193 tonnes). A record catch of **roach** (58 tonnes) was landed in 2016. The catch of 2018 (42 tonnes) was lower, but still above the average (31 tonnes). While gill nets were preferred over trap nets in roach fishery from 2012-2015 and in 2017, trap nets prevailed in other years of the period. **Flounder** is mostly caught with trap nets and less so with gill nets in the Gulf of Riga, but considerable quantities were also taken with seine nets in some years. The flounder catch landed in 2018 (25 tonnes) was the highest in twelve years and, for the first time ever, gill net fishing accounted for a large proportion of the total catch. The catch of **gibel carp** was record high in this part of the sea for the third year in a row (20 tonnes). The proportions of gill nets and trap nets are more or less equal in **pike** fishery. The total catch of pike was unprecedented in 2018 (17 tonnes), more than double the average catch of the period observed (7 tonnes).

According to official statistics, **ruff** has mainly been caught with gill nets and mostly near the island of Kihnu in the past few years. However, since 2016, the lion's share of ruff catches have been reported as trap net catches. The ruff catch of 2017 amounted to 6 tonnes, with 5 tonnes caught using trap nets. In contrast, the ruff catch landed in 2018 was very small (1.6 tonnes) and the proportion of the total catch taken with gill nets was again higher: 43%. The by-catches of ruff in gill net fishing for perch indicate that gill nets with a smaller than permitted mesh size are used in perch fishery. **Vimba bream** is caught mainly with gill nets and on a considerably smaller scale with trap nets. While the catch of vimba bream was record high in 2013 (6 tonnes), the catch figures have declined since then and the catch landed in 2018 amounted to 3.5 tonnes. **European whitefish** is caught in the Gulf of Riga mostly with gill nets. While the average catch taken in preceding years amounted to around 2 tonnes, the catch landed in 2017 was less than 1.5 tonnes and the catch of 2018 was less than a tonne. The catch of **round goby**, which is caught mainly using trap nets, decreased to 56 tonnes in 2018 from 69 tonnes taken the year before, but the drop was not as sharp as in other regions of the sea.

In summary, the total catch taken in the Gulf of Riga in 2018 was lower than the average of the period observed. Compared to the figure for 2017 (1064 tonnes), the catch of 2018 (1013 tonnes) decreased. However, the total catch excluding herring as the mass fish was the highest of the years observed.

■ **Pärnu Bay** Fishing gear used in Pärnu Bay includes gill nets, trap nets, seine nets and longlines. From 2011-2018 the biggest catches were produced by herring, followed by perch, smelt, pikeperch, vimba bream and ruff (Table 14). In terms of catch volumes and sales revenue, Pärnu Bay is undeniably the most important coastal fishing area in Estonia.

Perch has remained the species generating the highest catch values in Pärnu Bay in recent years (2016: 1,552,000 euros, 2017: around 1,623,000 euros), but the revenue earned has fallen sharply (around 1,180,000 euros). Herring was the second best species in terms of catch value (around 1,111,000 euros), producing somewhat less revenue than in preceding years (2016: around 1,301,700 euros, 2017: around 1,216,000 euros). Perch and herring were followed by pikeperch, whose catch value increased from around 175,000 euros in 2017 to around 219,000 euros. The catch value of smelt made a big leap: from just around 66,000 euros in 2017 to around 197,000 euros in 2018.

A significant change was introduced in the management of the fisheries of Pärnu Bay in 2015. Namely, competitive fishing was replaced by individual 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 used up rather quickly – and before herring shoals had reached the historic fishing grounds of all the coastal fishermen. Therefore 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 price is much higher, had even reached Pärnu Bay. With the new

management arrangements, the quota is distributed between fishermen on the basis of fishing gear and areas. A fisherman can use a smaller number of fishing gear until his personal quota is used up.

Herring is caught mainly using trap nets, and its catches fluctuated to a great extent in the period 2007-2017. The catch landed in 2018 (6370 tonnes) was slightly lower than the catch taken a year ago (6397 tonnes) and also lower than the average for the last twelve years. 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 these types of 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 perch catch exceeded a thousand tonnes during the period observed. Catches decreased in subsequent years, and the catch of 2018 (513 tonnes) was below the average for the years observed. Perch and pikeperch reproduce more frequently in Pärnu Bay than elsewhere in coastal waters, and this situation should be further improved by intensifying verification of adherence to fishing restrictions (especially as regards landing undersized fish). The **smelt** catch of 2018 (280 tonnes) was considerably larger than in 2017 (164 tonnes), but still well below the average for the period observed. 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 has led to a decline in the stocks. However, a reduction in fishing pressure and lower by-catches of juveniles in herring trawling are likely to cause stocks to recover relatively quickly. The catch of **pikeperch** increased from just 52 tonnes in 2017 to 64 tonnes in 2018. Apart from the poor state of pikeperch stock in Pärnu Bay, which has not improved yet, the meagre catches of recent years have also been due to the fishing restrictions applied during the spawning period, the increase of the minimum size and the unfavourable conditions prevailing during winter fishing. A temporary reduction of catches is inevitable in order to restore the normal composition of the pikeperch population and then stabilise catches at a higher level. The stock of **vimba bream** depends mainly on the situation in spawning rivers, most of which are Latvian rivers flowing into the Gulf of Riga. The removal of the Sindi dam from the Pärnu River will certainly have a very good effect on the stock of vimba bream. Vimba bream catches amounted to 64 tonnes in 2017 and as much as 71 tonnes in 2018. **Garfish** is mostly caught using trap nets. The largest garfish catch of the period 2007-2018 was taken in Pärnu Bay in 2011 (49 tonnes). The catch figure for 2018 was just 4 tonnes.

In summary, catches taken from Pärnu Bay fluctuate greatly. The total catch landed in 2018 was below the average for the period 2007-2018. 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, while the figure for 2018 was below the average.

Table 10. Species composition and catches (kg) of commercial fishing in Gulf of Finland (ICES subdivision 32) by coastal fishing gear type, 2007-2018

Species	2007 Total	2008 Total	2009 Total	2010 Total	2011 Total	2012 Total	2013 Total	2014 Total	2015 Total	
Perch	36 000	77 005	72 473	50 066	37 153	24 392	68 438	43 041	18 106	
Eel	2444	2113	1721	1373	772	660	609	388	330	
Eelpout	48	1	18	9	11	16	49	9	10	
Grayling			1							
Pike	1664	1564	1337	1766	2043	2332	2972	2882	2552	
Gibel carp	5260	5926	4688	5614	4665	8284	6933	8249	8171	
Brown trout						5				
Lamprey	46				14	3		2	14	
Turbot	12	32	53	73	11	35	16	22	18	
Carp		1	8	16	11	23	13	16	9	
Ruff	97	157	182	41	129	220	185	121	43	
Sprat		213	81	2	599	34	802	434	24	
Pikeperch	2420	11 222	973	1025	4622	697	2127	285	286	
Bream	2970	3032	1831	918	855	914	952	497	562	
Flounder	104 294	86 139	101 557	95 867	83 390	67 538	75 213	65 655	63 823	
Tench	5	4	79	144	112	62	13	37	38	
Burbot	92	48	22	10	12	26	39	44	48	
Salmon	3822	4108	3611	2493	2701	3504	5281	3720	3948	
Mackerel				1	1		0			
Sea trout	13 189	8 271	9055	9182	9854	10 698	8968	9769	11 414	
Four-horned sculpin		9		31	11	67	26	27	264	
Longspined bullhead					2					
European whitefish	21 758	23 112	14 973	10 791	8852	11 404	14 007	11 027	7034	
Smelt	15 527	21 777	20 838	9831	3639	12 090	15 255	17 749	20 049	
Lumpfish				1						
Sabre carp				1						
Silver bream	855	786	1000	482	506	527	1061	226	209	
Thicklip grey mullet						2				
Rudd	24	68	24	239	507	287	82	276	167	
Herring	613 002	555 992	1 139 971	1 098 454	801 101	698 486	982 538	1 253 544	1 656 531	
Ide	213	403	310	208	127	64	94	261	547	
Roach	2662	2817	4771	2828	4024	3112	2243	2638	2179	
Dace		1							55	
European chub									50	
Cod	86	854	1882	2124	2065	1451	2404	3329	1787	
Garfish	9567	1349	6729	13 160	11 194	5134	665	971	6381	
Bleak	44	62	27	31	27	127	52	1		
Rainbow trout	110	224	181	76	85	38	42	32	26	
Vimba bream	4000	2991	1823	1613	1347	1277	1312	896	1034	
Twaite shad				13		6				
Round goby	89	364	492	1121	4051	16 809	8565	11 169	8902	
Total	**840 300**	**810 644**	**1 390 708**	**1 309 600**	**984 490**	**870 321**	**1 200 955**	**1 437 314**	**1 814 609**	

Source: MoRA.

Fishing gear: TN – trap net, GN – gill net, LL – longline

2016				2017				2018				2007–2018
TN	GN	LL	Total	TN	GN	LL	Total	TN	GN	LL	Total	Average
5135	12 961	2	18 098	2446	13 024	1	15 471	1597	8580	9	10 186	39 201
316	14		330	112	20		132	56	1		57	911
	2		2	0.4	6		6		9		9	15
												0.1
159	1878		2036	120	1247		1367	139	2046		2185	2058
712	6901		7612	514	5700		6213	210	5050		5260	6405
												0.4
												6
1	78		79	2	136		138	3	216		219	59
	9		9						6		6	9
26	25		51	2	17		19		6		6	104
81	10		91	7	42		49	35	71		106	203
73	115		188	9	57		66	27	161		188	2008
238	356		595	51	121		172	67	116	1	184	1123
1608	50 303	15	51 926	1261	31 702	10	32 973	1276	29 636	5	30 921	71 609
5	32		37	4	29		33	2	154		156	60
1	23		24		27		27		13		13	33
1091	3612		4703	2942	4120		7062	2441	4012		6453	4284
								1			1	0.2
889	12 572		13 461	1357	11 512	4	12 872	942	8844		9786	10 543
	10		10		15		15		2		2	39
												0.2
269	7028		7297	370	5997		6367	191	8796		8986	12 134
160	13 941		14 101	475	6540		7015	49	3659		3708	13 465
												0.04
1			1									0.2
10	104		114		506		506		183		183	537
												0.2
27	23		50	70	103		182	32	7		39	162
1 110 568	2431		1 112 999	1 187 466	1540		1 189 006	950 403	1451		951 854	1 004 456
56	714	3	774	73	1310		1384	71	1119		1190	464
372	2279		2 651	383	1878		2261	167	1078	0.2	1245	2784
					8		8					5
												4
	854		854		315		315		321		321	1456
2533	94		2626	5081	317		5398	285	57		342	5293
31			31					5			5	34
2	68		70		65		65	3	51		54	84
254	1787		2041	148	1736		1883	100	1117	2	1229	1786
									0.2		0.2	2
9596	2293		11 888	13 331	2635		15 965	5459	1464		6923	7195
1 134 212	**120 514**	**20**	**1 254 746**	**1 216 231**	**90 721**	**15**	**1 306 967**	**963 563**	**78 223**	**17**	**1 041 803**	**1 188 533**

Table 11. Species composition and catches (kg) of commercial fishing in Central Baltic (ICES subdivisions 28.2 and 29.2) by coastal fishing gear type, 2007-2018

Species	2007 Total	2008 Total	2009 Total	2010 Total	2011 Total	2012 Total	2013 Total	2014 Total	2015 Total
Perch	2540	1974	5123	3875	11 052	5911	22 691	23 208	12 072
Eel	687	456	560	391	259	347	251	144	130
Atlantic sturgeon								1	
Eelpout	19	6	24	19	1	3	23	28	13
Pike	1079	1470	1169	2242	2661	1353	3703	3299	2581
Gibel carp	1260	1008	1643	1580	2963	3116	2412	2984	3354
Turbot			1	109	91	47	20	67	25
Carp	13				15				
Ruff	41	25	43	23	142	135	703	431	403
Sprat	0		15		23		5		1
Pikeperch		2			1		5	4	
Bream	7	1	4	2	127	1	5	9	1
Flounder	181 146	160 621	161 291	143 877	136 275	122 831	145 620	111 530	101 450
Tench	8	3	10	31	220	29	45	35	24
Burbot	1 176	536	660	674	1 012	504	567	468	439
Salmon	900	781	971	381	366	527	458	488	638
Mackerel									0
Sea trout	3193	2831	3900	1979	2378	4557	3630	3287	2977
Four-horned sculpin	7	4	5		1		5	10	10
European whitefish	2563	2203	1396	1208	2036	2658	4658	4575	3765
Smelt	2	30	3	7	14	2			
Lumpfish	1	2			1		1		
Sabre carp				1					
Silver bream	1		1		5	190	3	2	
Thicklip grey mullet	3						2		
Rudd	22	29	21	39	181	283	79	72	8
Herring	6226	7351	14 638	7645	5264	9591	13 267	18 341	9666
Gudgeon					1				
Ide	1850	3614	2557	2629	3646	2253	3768	4247	4557
Roach	4345	5085	5192	5729	6897	5269	4824	8258	4970
Dace	0								
Cod	579	1028	1679	1108	1089	1460	1913	2704	1415
Garfish	16 359	9325	6592	8090	4986	2190	2204	3162	7263
Bleak	17	30	13	45	7	10	13	9	5
Rainbow trout	77	85	61	18	35	31	120	109	24
Vimba bream	4	4	4	12	55	7	36	71	46
Twaite shad	1			12				1	1
Round goby						1	10	103	778
Total	**224 123**	**198 504**	**207 576**	**181 725**	**181 802**	**163 304**	**211 041**	**187 647**	**156 614**

Source: MoRA.

Fishing gear: TN – trap net, SN – seine net, GN – gill net, LL – longline

	2016				2017					2018					2007–2018
	TN	SN	GN	Total	TN	SN	GN	LL	Total	TN	SN	GN	LL	Total	Average
	3580	407	12 332	16 319	3534		7912		11 447	11 979		11 575	1	23 554	11 731
	96			96	53			2	55	44				44	291
	1			1	7				7	0,4				0,4	12
	1 244	3	1 053	2 300	789		1052		1841	1759		2355		4114	2349
	992	2	2 331	3 325	854		2842		3697	1415		2602		4017	2668
			80	80			169		169	13		269		282	74
	325		25	349	288		14		301	352		13		365	247
	86			86			1		1	105				105	20
	1		4	5											
					3		10		13	1				1	14
	6738	36 323	76 087	119 147	11 363	21 595	87 772	1	120 730	15 810	4900	74 451		95 162	133 310
	17		305	322	6		17		23	263		245		508	113
	224		146	369	307		69		377	369		130		499	607
	19		1228	1246	14		596		610	23		750		773	678
							1		1						0,1
	53		4373	4426	74		2674		2749	85		4231		4316	3352
			1	1			1		1			0,4		0,4	4
	17		3379	3396	3		2893		2896	27		2211		2238	2800
			1	1	23		1		24	48		8		56	12
															0,4
					1				1						
	25		70	95	1		4		5	11		3		14	29
															0,4
	1		5	6	2		4		6			6		6	66
	11 942		837	12 779	8110		936		9045	8137		635		8772	10 262
															0,1
	1990		4856	6846	3113		6823		9936	3763		6110		9923	4654
	6633		1574	8206	4063		2516		6579	8071		1508		9580	6331
															0,003
	91		527	619	53		241		294	117		389		506	1200
	9214		2738	11 952	10 932		3831		14 763	17 008		4958		21 966	9073
	13			13	13		3		16	7				7	15
	8		41	49	6		51		57	10		241		250	76
	37		88	125	4		22		26	27		57		84	40
															1
	20 894		245	21 140	16 400		113		16 514	7268		552		7820	3864
	64 241	**36 735**	**112 323**	**213 300**	**60 015**	**21 595**	**120 568**	**3**	**202 181**	**76 711**	**4900**	**113 347**	**1**	**194 959**	**193 897**

Table 12. Species composition and catches (kg) of commercial fishing in Väinameri Sea (ICES subdivision 29.4) by coastal fishing gear type, 2007-2018

Species	2007 Total	2008 Total	2009 Total	2010 Total	2011 Total	2012 Total	2013 Total	2014 Total	2015 Total	
Perch	20 673	11 608	14 577	23 655	17 208	32 555	152 074	246 738	226 789	
Eel	662	662	447	384	293	171	123	123	80	
Atlantic sturgeon										
Eelpout	10	14		19		2		4	149	
Pike	7787	8449	7840	12 251	19 196	24 211	43 292	44 955	37 059	
Gibel carp	17 115	24 922	19 337	21 990	23 847	25 647	23 138	40 716	29 541	
Turbot							4	8	3	
Carp	19	38	40	24	1	23	26	29	12	
Ruff	4497	4433	1228	811	1469	3994	4676	13 565	8160	
Sprat	25	21	7	68	11	2	32	4		
Pikeperch	132	128	139	388	477	395	8044	16 674	10 308	
Bream	418	244	193	316	794	483	1031	3520	2615	
Flounder	8667	8358	10 215	11 260	8805	9080	8131	5751	4620	
Tench	1819	1682	1751	1282	1470	2321	2686	4189	2049	
Burbot	1253	503	496	424	347	880	1769	3146	3473	
Salmon	100	106	132	121	56	229	127	138	57	
Sea trout	313	212	295	246	436	734	698	334	303	
European whitefish	3227	1998	1933	1408	2011	2714	2850	4197	4762	
Smelt	1057	497	305	167	36	81	60	17	29	
Silver bream	9449	8888	8192	7804	10 121	14 902	17 548	22 982	23 814	
Stickleback	213	8								
Rudd	1988	1365	991	914	1743	1054	1590	2324	1999	
Herring	42 896	38 191	219 552	231 432	181 703	142 635	133 157	122 460	97 329	
Ide	6747	6696	5447	3241	2267	2107	3086	7061	10 253	
Roach	14 639	13 781	13 716	13 699	19 034	19 359	23 339	26 536	27 980	
Dace		3					3			
European chub		15	20				14		1	
Cod	6	7	42	56	59	58	78	107	166	
Garfish	38 570	21 353	20 485	19 601	31 004	8705	4088	6488	23 486	
Bleak	116	55	31	33	27	182		54	819	
Rainbow trout	10		6		8			1	14	
Vimba bream	1255	827	1938	3063	3777	3921	5773	9612	17203	
Twaite shad					1					
Round goby						13	0		49	
Total	**183 659**	**155 061**	**329 351**	**354 656**	**326 201**	**296 454**	**437 437**	**581 732**	**533 120**	

Source: MoRA.

Fishing gear: TN – trap net, GN – gill net, LL – longline

	2016				2017				2018				2007–2018
	TN	GN	LL	Total	TN	GN	LL	Total	TN	GN	LL	Total	Average
	145 893	146 199	55	292 148	101 353	173 019	135	274 507	185 851	187 134	74	373 060	140 466
	38	1		39	42			42	32			32	255
						2		2					0,2
	2			2	1			1					17
	10 224	16 559	27	26 810	7918	18 654	50	26 622	20 357	21 392	44	41 792	25 022
	9038	16 657		25 694	5308	13 553	12	18873	8693	9863		18 556	24 115
	25	2		27	42	40		82	4	164		168	24
	14	5		19		6		6	5	5		10	21
	14 323	406		14 728	10 937	567		11 504	12 576	916		13 491	6880
	5	10		15		20		20	32	11		43	21
	2233	4750		6983	566	3366		3932	344	1056		1400	4083
	501	800		1301	405	1581		1986	592	443		1035	1161
	1195	3011		4206	1431	3642		5073	1788	4109	2	5899	7505
	1138	263		1401	952	148		1100	1433	143		1576	1944
	974	1995		2969	501	1995		2496	588	1005		1592	1612
	10	81		91	6	77		83	24	66		90	111
	36	341		377	33	212		245	43	227		270	372
	118	3509		3626	155	4563		4718	242	3960		4201	3137
	62			62	72	539		611	58	36		94	251
	3304	16 000		19 304	5021	22 147		27168	8132	18 155		26 287	16 371
													18
	799	1035		1833	273	922		1195	248	778		1026	1502
	118 901	1 059		119 960	121 401	1377		122 778	194 127	890		195 017	137 259
	6514	11 056	20	17 590	7860	13 463	66	21 389	18 365	11 376	35	29 776	9638
	8573	17 657	21	26 251	10 254	15 170	14	25 438	11 651	11 373	10	23 034	20 567
													1
					1			1					4
	6	11		17		9		9	6	13		19	52
	8511	2199	17	10 726	18 907	4555	65	23 527	7163	4299	25	11 487	18 293
	60			60	15			15	33			33	119
	2	2		4	5	43		48	13	4		16	9
	3953	9044		12 997	3234	15 710		18 944	6106	15 253		21 359	8389
													0,1
	73	20		93	4556	472		5028	11 609	576		12 185	1447
	336 520	**252 671**	**140**	**589 331**	**301 247**	**295 852**	**342**	**597 441**	**490 111**	**293 246**	**190**	**783 546**	**430 666**

Table 13. Species composition and catches (kg) of commercial fishing in Gulf of Riga (ICES subdivision 28.1, except Pärnu Bay) by coastal fishing gear type, 2007-2018

Species	2007 Total	2008 Total	2009 Total	2010 Total	2011 Total	2012 Total	2013 Total	2014 Total	2015 Total	
Perch	211 359	183 475	214 290	187 959	166 484	148 083	212 042	198 721	222 426	
Eel	2116	1703	1459	1230	797	603	539	335	205	
Atlantic sturgeon								1		
Eelpout	73	92	29	2	30	2	10	3		
Pike	2640	2874	2542	4834	6440	6454	9964	10 579	7385	
Gibel carp	9755	9187	10 980	8618	8889	10 316	10 428	14 083	12 838	
Lamprey			2	4		10				
Turbot										
Carp	144	30	17	6	9		11	9	57	
Ruff	4278	6721	11 737	10 335	7476	7976	4711	4081	4764	
Sprat	42		8	80	10	105	336	138	154	
Bighead carp										
Crucian carp										
Pikeperch	1963	1585	683	1011	4217	2600	2652	1631	720	
Bream	22	205	75	49	214	250	172	176	201	
Flounder	20 404	20 222	13 089	17 204	15 282	12 403	18 637	17 856	20 730	
Tench	186	292	494	796	1103	901	1192	2619	2855	
Burbot	521	164	159	171	230	216	327	1035	780	
Salmon	609	453	611	741	520	799	257	382	473	
Sea trout	399	605	688	784	743	1140	1107	1011	1239	
Four-horned sculpin		1	1		12	1			15	
European whitefish	2115	2142	3615	1286	953	1625	1827	2153	2129	
Sea lamprey	1									
Smelt	773	1413	5424	1098	554	396	902	23	881	
Lumpfish		1								
Silver bream	448	380	218	439	483	421	331	837	2 438	
Stickleback		9	40		42					
Rudd	145	21					2		41	
Herring	1 174 901	1 636 331	1 356 769	1 570 761	1 326 441	793 359	580 137	851 761	875 555	
Ide	316	292	417	219	89	44	97	355	610	
Roach	22 313	18 372	23 857	31 645	25 933	26 501	19 895	28 013	42 263	
Dace	12			2	1					
European chub									1	
Cod	163	502	324	391	272	443	804	856	533	
Garfish	26 729	39 721	22 527	24 007	21 208	8 882	11 521	24 906	33 359	
Bleak	12	6	38			21	30		21	
Rainbow trout	12	14	6		11		32	18		
Vimba bream	4267	3113	3023	3188	2976	3587	6074	5584	5390	
Twaite shad	1									
Round goby			0			88	506	7906	20 859	
Total	**1 486 716**	**1 929 922**	**1 673 118**	**1 866 859**	**1 591 418**	**1 027 223**	**884 542**	**1 175 069**	**1 258 919**	

Source: MoRA.

Fishing gear: TN – trap net, SN – seine net, GN – gill net, LL – longline

2016					2017					2018				2007–2018
TN	SN	GN	LL	Total	TN	SN	GN	LL	Total	TN	SN	GN	Total	Average
38 747	3388	156 738	54	198 927	40 665	1695	112 870	68	155 297	68 768	1142	151 193	216 103	192 848
213			5	218	222				222	152			152	792
														0.1
9				9										21
3751	9	3972		7732	3118		4794		7912	8479	74	8769	17 322	7192
3695	104	12 674		16 473	6001		12 732		18 732	5565		14 575	20 141	12 483
2				2										2
		1		1										0.1
2		1		3								5	5	27
4108	120	1506		5734	5239		407		5646	889		672	1561	6251
		168		168			71		71			346	346	122
4				4										0.3
					2				2	1			1	0.3
52		612		664	14		287		301	33		318	351	1531
282		50		332	257		11		268	105		36	141	175
11 127	1914	5325	22	18 388	8601		8705	9	17 315	9934		14 783	24 716	18 017
1449		286		1735	477		833		1310	1083		1365	2448	1319
237		50		286	88		62		150	104		10	113	345
69		420		489	43		347		390	51		290	341	505
59		1488		1548	65		1118		1183	74		1503	1576	1002
		6		6			2		2	9		11	20	5
14		2196		2209	30		1301		1331	65		828	893	1856
														0.1
16		6		22	1		11		12	50		5	55	963
														0.1
5644		1409		7053	1523		698		2221	1022		952	1974	1435
														8
256		301		557	49		116		164	269		394	663	129
758 790		9327		768 117	643 884		10817		654 702	568 750		6668	575 418	1 013 642
878	30	807		1715	1684		1323		3007	4684		3412	8096	1269
32 767	1419	23 465		57 650	16 050	567	16 598		33 215	22 638	141	19 330	42 109	30 895
														1
														0.1
186		163		349	15		108		123	61		65	125	407
32 453		796		33 249	84 346		2839	28	87121	37 422		1695	39 117	31 035
7				7						86			86	18
4		9		13	3		2		5	3		9	12	10
372		3961		4332	311		3742		4053	848		2605	3453	4087
														0.1
47 832		1430		49 262	64 079		4699		68 778	49 886		6098	55 984	16 949
943 023	**6 984**	**227 165**	**81**	**1 177 252**	**876 766**	**2262**	**184 522**	**105**	**1 063 654**	**776 031**	**1357**	**235 933**	**1 013 320**	**1 345 342**

Table 14. Species composition and catches (kg) of commercial fishing in Pärnu Bay (fishing squares 178-180) by coastal fishing gear type, 2007-2018

Species	2007 Total	2008 Total	2009 Total	2010 Total	2011 Total	2012 Total	2013 Total	2014 Total	2015 Total
Perch	506 183	429 190	505 998	613 732	564 317	338 967	761 605	1 054 968	1 043 423
Eel	198	148	115	74	86	128	132	66	98
Eelpout	4	60	47	765	50	372	1 072	136	598
Pike	531	1436	466	1702	1722	1057	5969	3726	2212
Gibel carp	23 217	18 576	13 235	13 516	12 776	19 796	13 634	21 722	16 093
Lamprey	505	17	148	567	871	349	996	304	201
Carp	60	272	134	93	46	78	246	151	300
Ruff	7967	8715	13 268	21 137	51 582	38 855	28 488	17 102	10 798
Bighead carp									9
Pikeperch	94 666	51 084	64 969	70 946	101 200	143 140	109 327	154 683	71 705
Bream	5609	3740	2411	2291	5564	9450	6612	8728	4854
Flounder	1327	1186	1783	1587	1191	1232	2405	3320	7756
Tench		13	14	38	57	8	68		55
Burbot	23	8	13	21	19	36	101	259	354
Salmon	18	141	76	59	134	322	700	492	471
Sea trout	8	8	20	13	3	132	264	191	207
Four-horned sculpin		1							1
European whitefish	1090	391	727	853	784	2053	2414	3904	1800
Sea lamprey				31					
Smelt	463 585	625 661	745 601	404 077	116 121	285 721	490 197	210 889	325 865
Silver bream	28 015	23 081	13 570	12 874	11 410	17 215	11 967	6393	3313
Stickleback				16					
Rudd	3		7				8		5
Herring	4 627 555	8 339 085	9 030 968	6 328 372	6 282 757	5 444 876	5 378 670	5 289 522	6 651 588
Ide	48	8	5	8			1	38	3
Roach	18 900	11 017	10 700	12 664	27 356	23 556	20 781	27 857	17 673
Dace					21				
European chub									
Cod	1	9	3	15	10	9	57	22	23
Garfish	18 308	10 190	14 804	21 188	49 349	127	658	8317	45 452
Bleak		10						85	513
Rainbow trout									
Vimba bream	25 801	25 214	16 405	21 942	41 927	44 468	43 219	67 807	69 260
Lesser sand eel		80			52	192	735	37	325
Round goby									38
Total	**5 823 620**	**9 549 339**	**10 435 484**	**7 528 579**	**7 269 403**	**6 372 136**	**6 880 325**	**6 880 717**	**8 274 990**

Source: MoRA.

Fishing gear: TN – trap net, SN – seine net, GN – gill net, LL – longline

2016					2017					2018					2007–2018
TN	SN	GN	LL	Total	TN	SN	GN	LL	Total	TN	SN	GN	LL	Total	Average
598 633		249 050	219	847 901	594 138		238 375		832 607	395 720		117 521	76	513 317	667 684
102				102	235				235	211			3	214	133
41				41	253				253	510				510	326
1653		1066		2719	1726		899		2614	2148		468		2616	2231
3350		4215		7565	9232		7999		17 231	11 322		5219	3	16 544	16 159
85				85	120				120	75				75	353
164				164	35		30		65	26		32		58	139
14 472		2001		16 473	22 903		2083		24 986	30 629		2678		33 307	22 723
															1
13 761		84 950	159	98 870	7025		44 743	15	51 783	7532		56 437	21	63 990	89 697
4112		262		4374	5095		93		5188	7692		388		8080	5575
5917		977	7	6901	8351		2056	1	10 408	9767		2449	1	12 217	4276
7		10		17						2		3		5	23
141		32		173	97		17		114	21		8		29	96
265		32		297	661		87		748	430		69		499	330
26		85		111	149		87		235	185		155		340	128
															0.2
115		1623	1	1739	17		861		878	109		961		1070	1475
															3
343 327		318		343 645	163 405		478		163 883	279 246		636		279 882	371 260
2144		532		2676	1766		302		2068	7768		476		8244	11 735
															1
												45		45	6
6 850 884		220		6 851 104	6 398 428		251		6 398 679	6 369 813		295		6 370 108	6 416 107
1		19		20	2		52		54	43		48		91	23
14 453		1542		15 995	15 708		2902		16 610	16 519		1515	8	18 042	18 596
6				6			1		1	2				2	3
1				1											0.1
23		4		27	6		5		11	4		4		8	16
11 484		26		11 510	45 598		96		45 694	3476		35		3511	19 092
															51
										3				3	0.3
40 405		13 534		53 938	49 172		13 937		63 109	56 879		14 339		71 218	45 359
	145			145		32			32		50			50	137
6554		472		7026	26 883		6071		32 954	30 339		5411		35 750	6314
7 912 125	**145**	**360 969**	**386**	**8 273 624**	**7 351 003**	**32**	**321 413**	**110**	**7 672 558**	**7 230 468**	**50**	**209 191**	**112**	**7 439 821**	**7 700 050**

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 2018 is shown in Figure 8.

■ 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 1970s in all areas. During the last decade, 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.

Herring and sprat stocks are assessed in accordance with the methodology of the ICES, while biological material is collected under Decisions (EU) 2016/1701 and 2016/1251 of the European Commission.

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, as shown in Figure 9.

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 (for example, Gulf of Finland herring and Swedish coast herring).

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) In 2005, the herring catch taken from the Central Baltic was at a low of 92,000 tonnes. The catch grew to 137,000 tonnes in 2010 but then decreased to 101,000 tonnes in 2012 and 2013 due to a reduction of the total allowable catch. Both fishing opportunities and catches improved during the period 2014-2018, with the herring catch of 2018 amounting to 245,365 tonnes.

As in previous years, Sweden (27%), Poland (20%) and Finland (18%) landed the largest herring catches in 2018. Estonia's catch was 24,300 tonnes, which accounted for approximately 10% of the total catch (Table 15). 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 10).

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

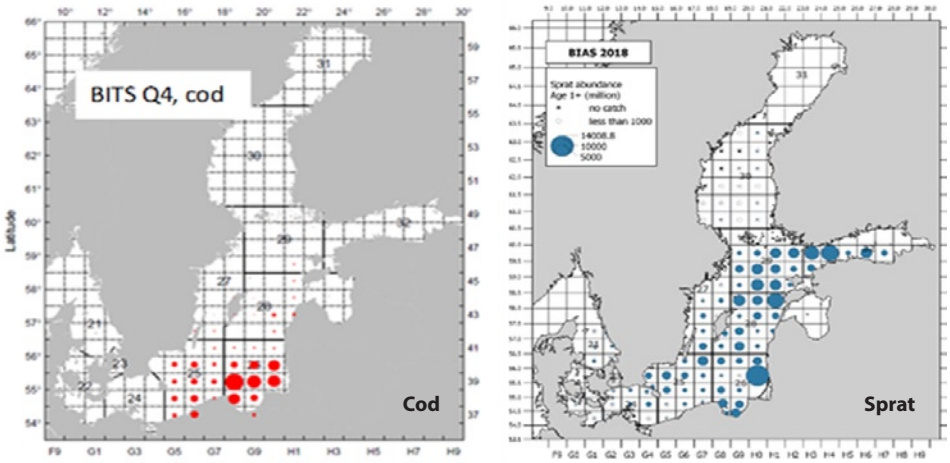


Figure 8. Location of Eastern Baltic cod, sprat and Central Baltic herring in the third and fourth quarters of 2018
Data from ICES' test trawling (BITS) and acoustic surveys (BIAS). Source: ICES, 2019.

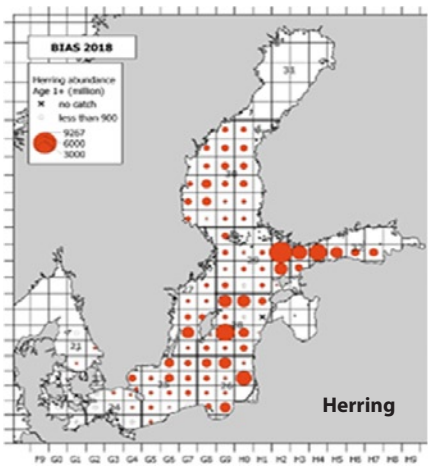
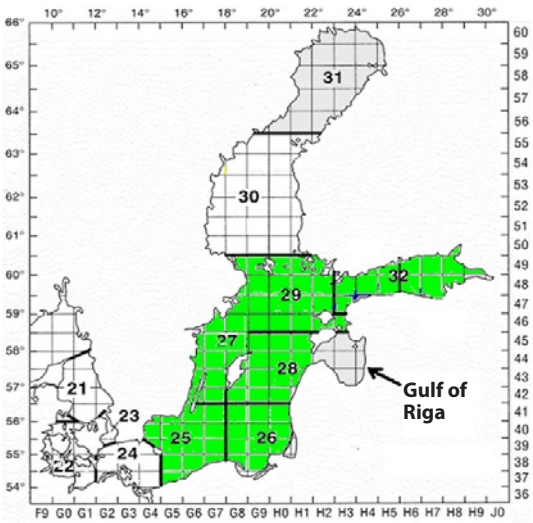


Figure 9. Agreed stock and management units for herring in the Baltic Sea (ICES 2019):

- **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)**



be attributed to the domination of pelagic cohorts mainly composed of younger herring in trawl catches (Figure 11). Unlike sprat, greater stability of age composition has been observed in herring catches, which is due to a smaller variation in the abundance of herring year classes.

The mean body weight of herring has decreased considerably over the past 20-30 years throughout the Baltic Sea, accounting for just 40-50% of the weight figure observed in the 1970s and 1980s in the age groups that are more abun-

Table 15. Central Baltic herring: catches by country (10^3 t), 1977-2018

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	**100.8**
2013	3.4	12.6	18.2	1.4	3.5	1.7	20.6	10.0	29.5	**100.9**
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**
2016	4.0	20.1	28.9	4.3	8.4	5.2	41.0	24.2	56.0	**192.1**
2017	9.3	23.3	40.7	3.6	7.9	4.0	40.1	22.3	51.2	**202.5**
2018*	11.4	24.3	45.4	4.0	11.2	6.6	49.3	25.4	66.9	**244.4**

* Data for 2018 are preliminary and subject to change.

Source: ICES, 2019.

dant today. The mean body weight of different age groups has stabilised at a low level since 2006 (Figure 12).

At the beginning of 2019, the spawning stock biomass of the Central Baltic herring amounted to 938,281 tonnes, which was 3% higher than the long-term average and roughly equal to the level of 1989 (Figure 13). There are two reasons for the increase observed in recent years: on the one hand, more abundant year classes have appeared, and on the other hand, the fishing mortality rate has

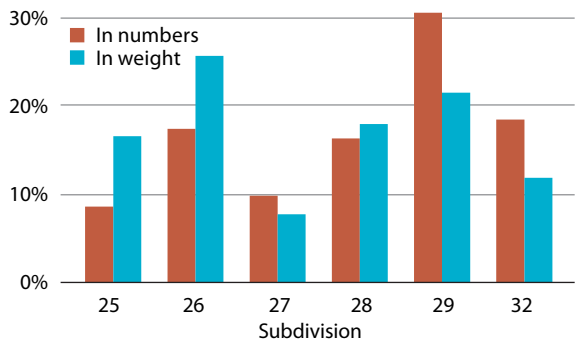


Figure 10. Central Baltic herring: proportion of catch in weight and numbers in 2018
Source: ICES, 2019.

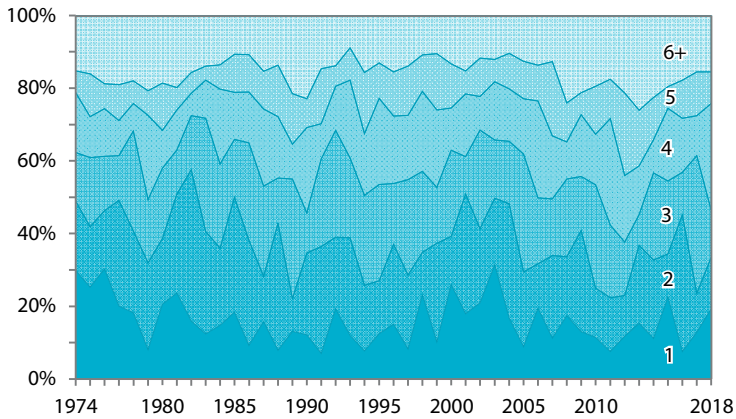


Figure 11. Central Baltic herring: average age composition of catches, 1974-2018
1: age 1, 2: age 2 etc., 6+: age 6 and older
Source: ICES, 2019.

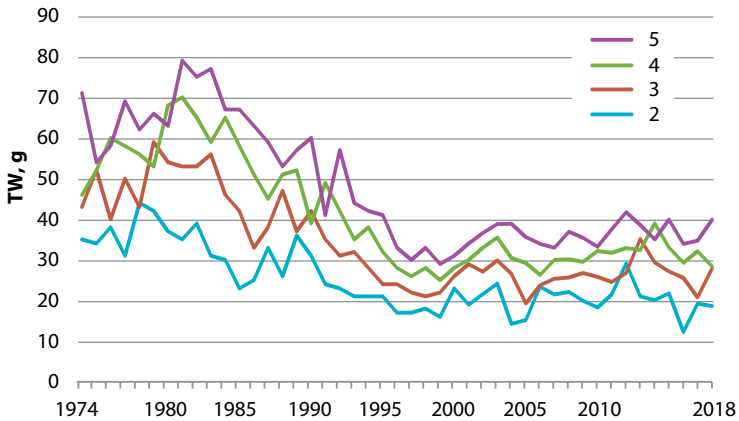


Figure 12. Central Baltic herring: dynamics of mean body weight of herring aged 2–5, 1974-2018
Source: ICES, 2019.

been relatively low due to the active implementation of the fisheries legislation. From 2005 to today, four year classes have emerged whose abundance at the age of 1 year considerably exceeded the long-term average, with the most recent such year classes being these of 2012 and 2014 (Figure 14). The outlook for the coming years depends on the actual abundance of cohorts of 2015-2018, which will account for most of the spawning stock and catch in 2020 and 2021, when they will be 2-6 years of age.

The stock status of the Central Baltic herring is mostly assessed against the reference levels of fishing mortality and biomass. The most important of these are the following:

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;
2) maximum fishing mortality for sustainable yield F_{MSY} = 0.22: enables maximum catches to be taken in the long run without endangering stocks;
3) $B_{trigger}$: the minimum spawning stock biomass that ensures the maximum possible yield in a long run at the F_{MSY} fishing mortality.

The actual fishing mortality showed a downward trend during the years 2004-2015. Unfortunately, it then reversed and exceeded the F_{MSY} level from 2016-2018. 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

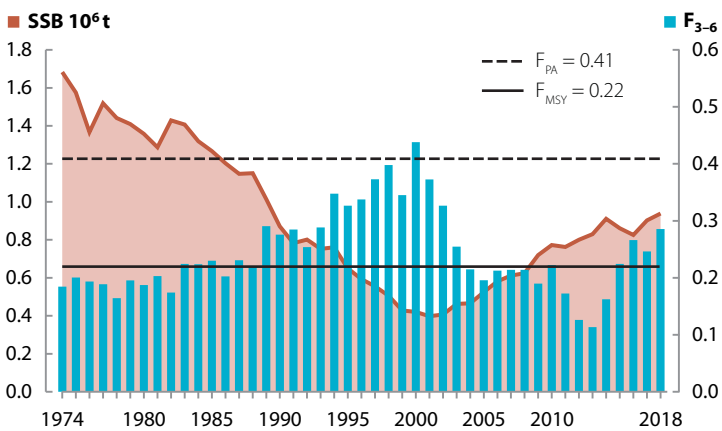


Figure 13. Central Baltic herring: spawning stock biomass (SSB) and fishing mortality in age groups 3-6 (F_{3-6}), 1974-2018
The horizontal line represents the level of F_{MSY} = 0.22 and the dotted line indicates the sustainable fishing mortality rate F_{PA} = 0.41. Source: ICES, 2019.

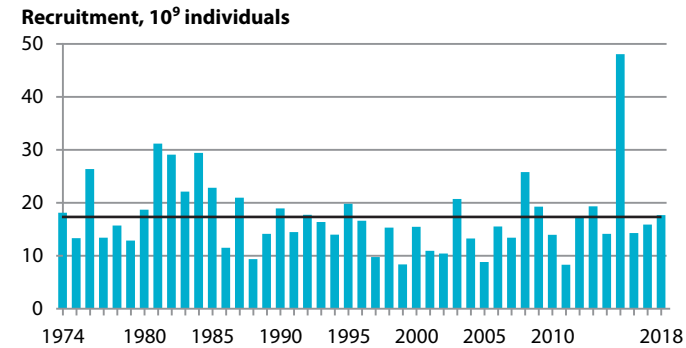


Figure 14. Central Baltic herring: dynamics of abundance of recruitment (age 1), 1974-2018
The horizontal line marks the long-term average. Source: ICES, 2019.

actual mortality rate significantly exceeded the recommended level. This was one of the reasons for the decline in stocks (Figure 13).

According to the EU's multi-annual management plan (MAP), the total catch for 2020 should be in the range of 130,546–214,553 tonnes. A total catch exceeding the level that corresponds to F_{MSY} (0.22), i.e. 179,975 tonnes, can be taken subject to the specific conditions set out in the MAP. For 2019, the ICES recommended a total catch of up to 200,360 tonnes, and the EU total allowable catch TAC_{2019} is 200,360 tonnes. The ICES gives recommendations for the stock unit, which means that catches of the Central Baltic 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 (TAC) of herring in subdivisions 25-27, 28.2, 29 and 32 is expected to amount to 169,912 tonnes in 2019.

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 16).

In addition to local gulf herring, catches include Central Baltic herring that spawns in the Gulf of Riga. Both varieties come under a single catch quota. 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 15).

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. It has stabilised over the last few decades, albeit at a low level (Figure 16).

Since the 1990s, the spawning stock biomass of Gulf of Riga herring is up to twice the level of the 1970s

Table 16. Gulf of Riga herring: Estonian, Latvian and unreported landings (10^3 t), 1991-2018

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**
2016	15.8	19.1	–	**34.9**
2017	17.9	13.8	–	**31.7**
2018	12.5	16.9	–	**29.4**

Source: ICES, 2019.

Figure 15. Gulf of Riga herring: age composition of catches, 1977-2018
1: age 1, 2: age 2 etc., 6+: age 6 and older
Source: ICES, 2019.

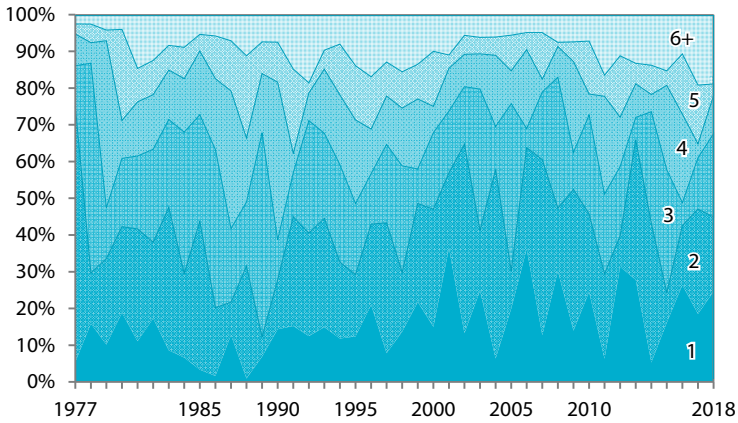


Figure 16. Gulf of Riga herring: dynamics of mean body weight of herring aged 2-5, 1970-2018
Source: ICES 2019.

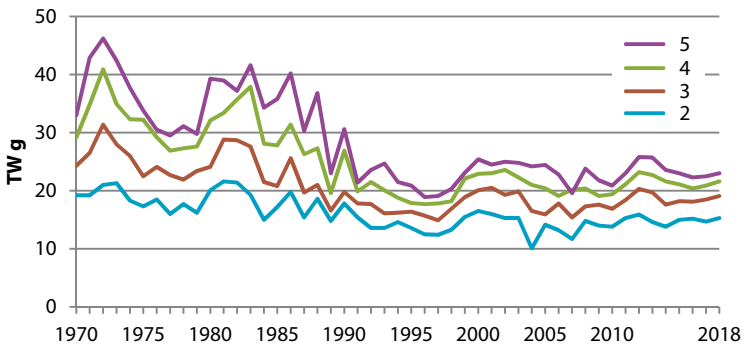


Figure 17. Gulf of Riga herring: spawning stock biomass (SSB) and fishing mortality in age groups 3-7 (F_{3-7}), 1977-2018.
The horizontal line represents the maximum sustainable fishing mortality for sustainable yield $F_{MSY} = 0.32$.
Source: ICES, 2019.

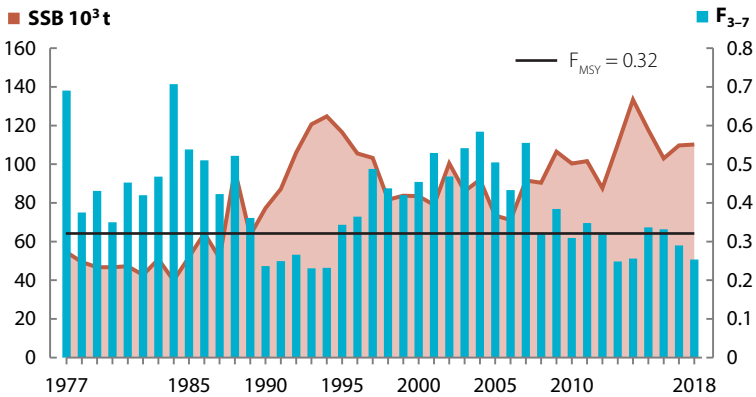
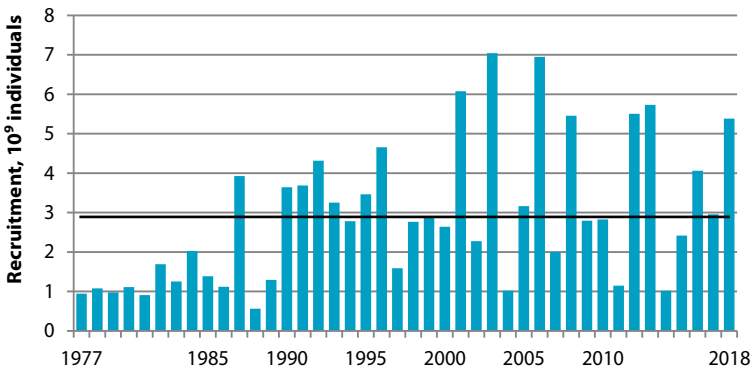


Figure 18. Gulf of Riga herring: dynamics of abundance of recruitment (age 1), 1977-2018. The horizontal line marks the long-term average.
Source: ICES, 2019.



(Figure 17). The good condition of the stock is mostly due to the abundance of the year classes 1990-2006. Only the cohorts that were born after the cold winters of 1996, 2003 and 2006 were of medium or small size in the Gulf of Riga (Figure 18). The year-class strength of Gulf of Riga herring seems to depend on 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 the Gulf of Riga herring. However, looking separately at the past decade, it appears that the abundance of the year classes of 2007, 2011, 2012, 2015 and 2017 exceeded the average, while the year classes of 2010, 2013, 2014 and 2016 have proved weak. This will definitely affect the prospects of fishing in the near future (Figure 18).

At the beginning of 2019, the spawning stock biomass of Gulf of Riga herring amounted to 110,182 tonnes, which exceeded the long-term average (84,768 tonnes) by more than 30%. The dynamics of herring catches in the Gulf of Riga have been similar to changes in spawning stock biomass: catches have ranged from 25,000-40,000 tonnes since the second half of the 1990s, which is two times higher than in the 1970s and 1980s (ICES, 2019). It should be remembered that catches of Gulf of Riga herring are currently mainly dependent on 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 reference levels of fishing mortality mentioned above. According to the current estimations, the sustainable fishing mortality F_{PA} is 0.4, the maximum fishing mortality for sustainable yield F_{MSY} is 0.32 and $B_{trigger}$ is 60,000 tonnes for Gulf of Riga herring.

According to the EU's multi-annual management plan (MAP), the total catch for 2020 should be in the range of 23,395–35,094 tonnes. A total catch exceeding the level that corresponds to F_{MSY} (0.32), i.e. 30,382 tonnes, can be taken subject to the specific conditions set out in the MAP. For 2019, the ICES recommended a total catch of up to 26,932 tonnes.

Since the recommendation of the ICES only concerns gulf herring, the TAC for the Gulf of Riga is to be calculated by deducting the catch of gulf herring assumed to be taken in the Central Baltic from, and adding the average catch of herring from the Central Baltic taken in the Gulf of Riga to, the recommendation for 2020. As a result, the TAC for the Gulf of Riga can be expected to amount to 34,445 tonnes in 2020.

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 dynamics indicate, however, that despite the high biomass of the Gulf of Riga herring the fishing mortality of this stock unit was below the F_{MSY} level in ten years only (Figure 17).

■ **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

Table 17. Sprat catches from the Baltic Sea by country (10^3 t), 1977-2018

Year	Den-mark	Estonia	Finland	GDR	FRG	Latvia	Lithua-nia	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**
2016	19.1	23.7	16.9		10.9	28.1	11.6	59.3	34.6	42.4	**246.5**
2017	27.1	25.3	16.1		13.6	35.7	12.5	38.4	38.7	48.3	**285.7**
2018	24.6	29.3	16.4		15.2	37.1	16.2	79.4	41.4	49.1	**308.8**

* Until 1991, the Soviet Union.

Source: ICES, 2019.

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 favourable for embryonic development.

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 the Bothnian Bay and the eastern part of the Gulf of Finland. Sprat is 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 the periods when cod abundance is high there are few sprats 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 40 years from just 37,000 tonnes in 1983 to 529,000 tonnes in 1997 (Table 17). In recent years the catches of Baltic sprat have ranged from 240,000 to 270,000 tonnes depending on the total allowable catch. In 2018, the sprat catch reached 309,000 tonnes. Poland (26%), Russia (16%) and Sweden (13%) landed the largest catches of sprat in 2018. Estonia's catch was 29,300 tonnes (9.5%).

The stock and age composition of sprat is characterised by the dominance of younger age groups: the 1-3 age groups account for up to 50% of catches, depending on the abundance of cohorts (Figure 19).

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 from 2014 to 2018 (Figure 20).

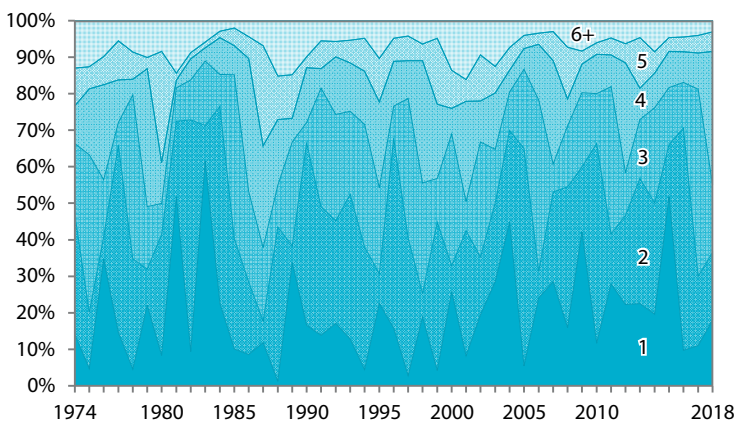


Figure 19. Average age composition of sprat catches, 1974-2018
1: age 1, 2: age 2 etc., 6+: age 6 and older
Source: ICES, 2019.

Figure 20. Dynamics of mean body weight of sprats aged 2-5, 1974-2018
Source: ICES, 2019.

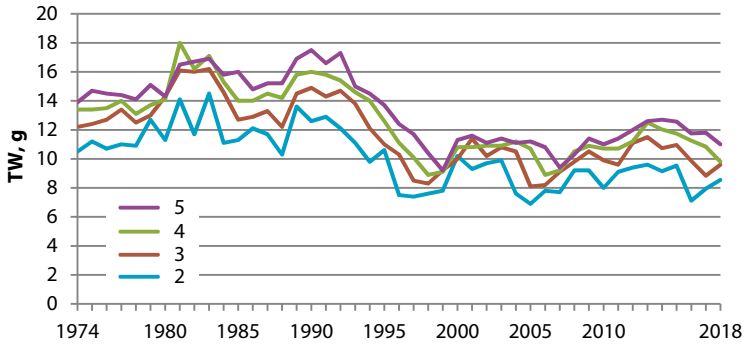


Figure 21. Sprat spawning stock biomass (SSB) and fishing mortality in age groups 3-5 (F_{3-5}), 1974-2018.
The horizontal line represents fishing mortality $F_{MSY} = 0.26$ and the dotted line indicates $F_{PA} = 0.32$
Source: ICES, 2019.

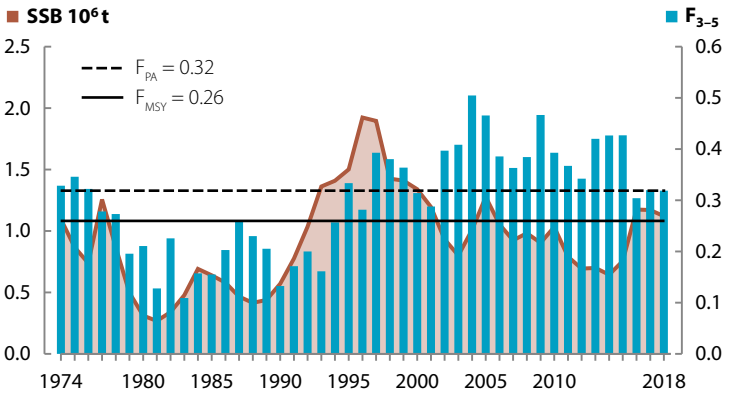


Figure 22. Dynamics of sprat recruitment (age 1), 1974-2018.
The horizontal line marks the long-term average.
Source: ICES, 2019.

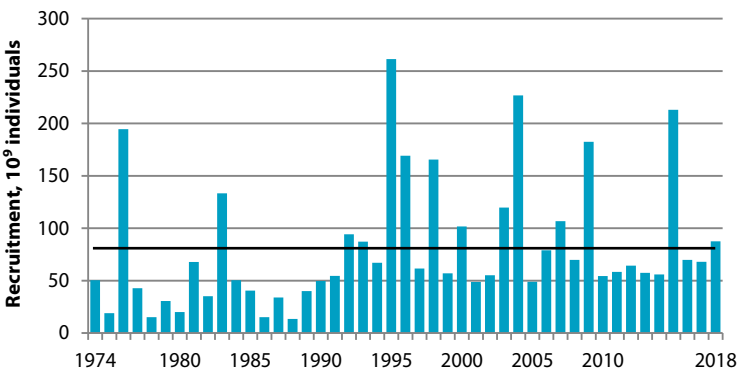
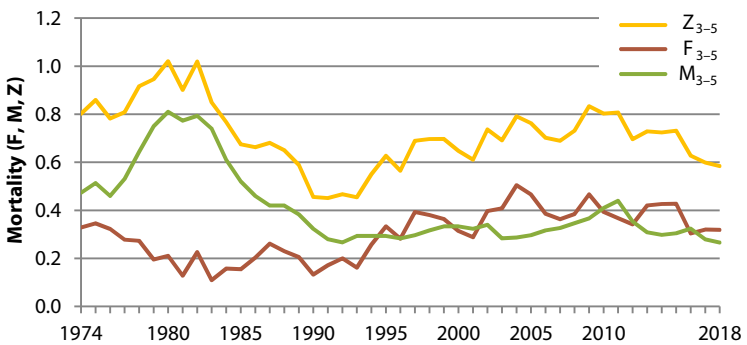


Figure 23. Fishing mortality (F_{3-5}), natural mortality (M_{3-5}) and total mortality (Z_{3-5}) of sprat, 1974-2018
Source: ICES, 2019.



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.

The abundance and biomass of sprat started to increase rapidly in the second half of the 1980s when the abundance of cod declined significantly. 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. From 2004, the SSB has ranged between 0.8 and 1.3 million tonnes. The spawning stock biomass declined from 2011-2015 because of the weak year classes of 2009, 2012 and 2013 and due to high fishing mortality from 2002 (Figures 21 and 22). At the beginning of 2019 the ICES estimated the SSB of sprat to amount to 1,121,000 tonnes, which is 21% higher than the long-term average (Figure 22).

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 (see Figure 8). 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 2019 the ICES classified the current level of exploitation of the Baltic sprat stock as unsustainable, given that the fishing mortality rate for 2018 exceeded F_{MSY} (0.26) (Figure 21).

As regards the prospects of the sprat stock, it is important to bear in mind that the very strong year class of 2014 considerably increased the spawning stock biomass during the period 2016-2018. Fishing efforts will rely on that year class during the next couple of years. However, as the sprat stock is extremely dependent on recruitment, any assessment of the prospects of the stock is plagued by considerable uncertainties.

Since 1994 the total mortality of sprat has mostly been influenced by fishing mortality (Figure 23). 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). This shows that with the 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 greatly decreased in recent years (see Figure 8).

According to the EU's multi-annual management plan (MAP), the total catch of sprat for 2020 should be in the range of 169,965–233,704 tonnes. A total catch exceeding the level that corresponds to F_{MSY} (0.26), i.e. 225,786 tonnes, can be taken subject to the specific conditions set out in the MAP. For 2019, the ICES recommended a total catch of up to 301,125 tonnes; TAC_{2019} is 313,100 tonnes.

■ **Cod in subdivisions 25-32 (Eastern Baltic)** Being a marine fish species, the distribution and abundance of cod (*Gadus morhua callarias*) in the brackish 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.

Catches of cod in subdivisions 25-32 in 2018 were estimated by the ICES at only 15,907 tonnes, or 19,010 tonnes if discards and undersized fish are included. Together with the catch taken in subdivision 24, the total catch of Eastern Baltic cod for 2018 amounts to 21,605 tonnes. The catch was divided mainly between Polish, Russian and Danish fishermen who accounted for 35%, 21% and 17% of

Table 18. Catches of Eastern Baltic cod by country (t), 1992-2018

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	Unreported	Total
1992	18 025	1368	485	2793	1250	1266	13 314	1793	13 995	0	**54 882**
1993	8000	70	225	1042	1333	605	8909	892	10 099	18 978	**50 711**
1994	9901	952	594	3056	2831	1887	14 335	1257	21 264	44 000	**100 856**
1995	16 895	1049	1729	5496	6638	4513	25 000	1612	24 723	18 993	**107 718**
1996	17 549	1338	3089	7340	8709	5524	34 855	3306	30 669	10 815	**124 189**
1997	9776	1414	1536	5215	6187	4601	31 396	2803	25 072	0	**88 600**
1998	7818	1188	1026	1270	7765	4176	25 155	4599	14 431	0	**67 428**
1999	12 170	1052	1456	2215	6889	4371	25 920	5202	13 720	0	**72 995**
2000	9715	604	1648	1508	6196	5165	21 194	4231	15 910	23 118	**89 289**
2001	9580	765	1526	2159	6252	3137	21 346	5032	17 854	23 677	**91 328**
2002	7831	37	1526	1445	4796	3137	15 106	3793	12 507	17 562	**67 740**
2003	7655	591	1092	1354	3493	2767	15 374	3707	11 297	22 147	**69 476**
2004	7394	1192	859	2659	4835	2041	14 582	3410	12 043	19 563	**68 578**
2005	7270	833	278	2339	3513	2988	11 669	3411	7740	14 991	**55 032**
2006	9766	616	427	2025	3980	3200	14 290	3719	9672	17 836	**65 532**
2007	7280	877	615	1529	3996	2486	8599	3383	9660	12 418	**50 843**
2008	7374	841	670	2341	3990	2835	8721	3888	8901	2673	**42 235**
2009	8295	623		3665	4588	2789	10 625	4482	10 182	3189	**48 439**
2010	10 739	796	826	3908	5001	3140	11 433	4264	10 169	0	**50 277**
2011	10 842	1180	958	3054	4916	3017	11 348	5022	10 031	0	**50 368**
2012	12 102	686	1201	2432	4269	2212	14 007	3954	10 109	0	**50 972**
2013	6052	247	399	540	2442	1744	11 761	2870	5299	0	**31 354**
2014	6035	165	349	676	2000	1088	11 026	3444	4125	0	**28 908**
2015	9652	188	387	1477	2586	1974	12 937	3512	4628	0	**37 341**
2016	6756	2	57	918	2717	1698	9583	3392	4189	0	**29 312**
2017	6140	1	191	347	2079	1729	6484	4124	4405	0	**25 497**
2018	2684	1	53	241	1253	694	5695	3376	1912	0	**15 909**

Source: ICES, 2019.

the total catch, respectively (Table 18). The total catch represented just around 55% of the total allowable catch of Eastern Baltic cod (EU and Russia) in subdivisions 25-32 of the Baltic Sea in 2018 (34,288 tonnes).

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 Baltic 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, no analytical assessment of the stock could be made during the period 2015-2018. There are several reasons for this, the most important of which are changes in the reproduction capacity of the cod population and slowdown of growth due to poor oxygen conditions, different distribution patterns of cod and its important food target – sprat (see Figure 8), and probably also a parasitic infection transmitted from gray seals. This has led to a situation where the recruitment of Eastern Baltic cod does not end up in commercial fishing catches as adult fish even in the case of the generations for which the initial abundance estimate from the ICES survey (BITS) was promising. This means that a large proportion of cod no longer reaches the minimum catch length, i.e. 35 cm (TL).

From 2015 to 2018, the ICES gave 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 has been decided to use the average CPUE (kg/h) of individuals 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 resulting advice is then either proportionately increased or reduced, as appropriate. For example, the average yield index of 2017 and 2018 was around 45% lower than the average of the preceding three years (2014-2016).

In 2019, the ICES used the Stock Synthesis Model, which is based on the analysis of the length composition of a given stock and the results of which indicated that the biomass of the stock unit in question is critically low, below Blim. The advice of the ICES for 2020, therefore, is to stop Eastern Baltic cod fishery. This advice also applies to the part of the cod stock that is caught in subdivision 24 (an average of 3200 tonnes in the last three years).

The exploitation advice of ICES for 2019 is a catch of up to 16,685 tonnes; TAC_{2019} = 29,912 tonnes.

There is still no commercial cod resource in Estonian waters, and directed fishing for this species is not economically reasonable.

ESTONIA'S TRAWL FLEET IN THE BALTIC SEA

General overview of sector

In 2018, catches were reported for 26 trawlers with a combined main engine power of 9015 kW and a combined gross tonnage (GT) of 3563. The average age of the vessels was 32 years, and a total of 145 people were employed on them. Compared to 2017, the number of trawlers engaged in fishing decreased by four in 2018 (Figure 24). The decrease happened in the 12-18 m length class.

In 2018 the Estonian trawl fleet's final sprat and herring quotas (after exchanges and transfers) were 31,081 and 31,013 tonnes, respectively (Figure 25). In 2016, the sprat catch quota dropped to the lowest level of the last decade, but it has been growing in the last few years. The herring quota increased by 9% in 2018, reaching the highest level of the last decade.

The catch of sprat landed in 2018 increased by 12% compared to the preceding year, and quota uptake improved from 90% to 95%. Despite the increased quota, the catch of herring remained at the previous year's level and this resulted in a drop of quota uptake to 86%.

As in the previous few years, there was no targeted cod fishery in 2018. The cod quota uptake rate, which was 98% in 2011, declined significantly in subsequent years and was below 1% in 2016.

Figure 24. Number, combined gross tonnage (GT) and combined power of main engines (kW) of fishing vessels engaged in fishing, 2005-2018
Source: MoRA.

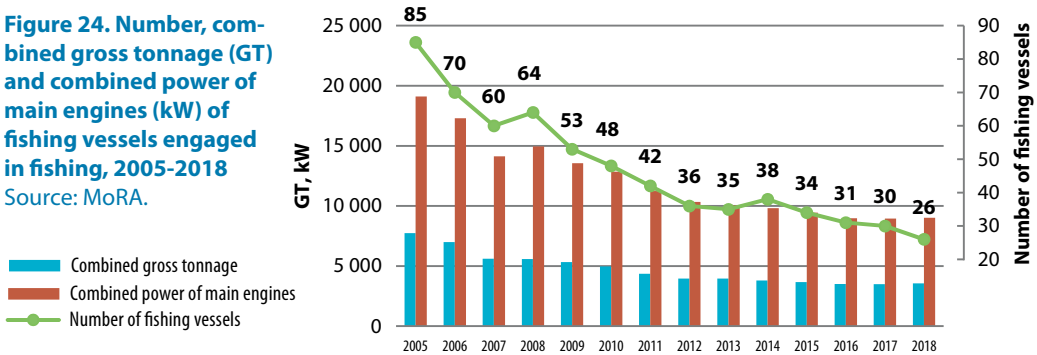
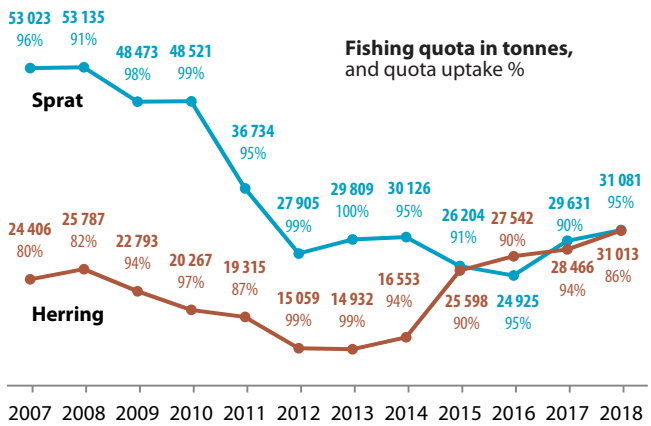


Figure 25. Estonian trawl fleet's final sprat and herring quotas (after exchanges and transfers) and quota uptake (%), 2007-2018
Source: MoRA.



Trawling companies explained the termination of cod fishing by the scarcity of fish, which makes fishing economically unviable.

In 2018 the rights to catch sprat, herring and cod in the Baltic Sea on the basis of fishing vessels' fishing permits were distributed between 20, 21 and 8 companies respectively. The total catch of Estonian trawlers in the Baltic Sea amounted to 56,500 tonnes in 2018. Based on average first-sale prices, the value of the catch was 9.9 million euros. In terms of species, sprat and herring prevailed in catches (accounting for 52% and 47% of the total catch, respectively), but small amounts of smelt, eelpout, four-horned sculpin and round goby were also caught. The proportion of trawlers in Estonian fishers' commercial fishing in the Baltic Sea amounted to 84% in 2018.

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, Finland and Sweden (Table 19). The proportion of fish landed at foreign ports remained at roughly the same level as the year before, representing 12% of the catch in 2018. The quantities of fish landed increased in Latvia but decreased a little in Finland and Sweden. Estonian trawlers landed fish at 18 Estonian ports (Table 20). The largest quantities of catch were landed at Dirhami, Veere and Miiduranna, where just over half (52%) of the fish caught by Estonian trawlers was brought ashore.

2018 can be regarded as a relatively good year for the trawling sector. The total catch of sprat and herring was the largest of the past eight years, accounting

Table 19. Landings (t) in different countries of fish caught from the Baltic Sea by Estonian trawlers in 2017 and 2018

Species	Year	Estonia	Finland	Latvia	Sweden
Sprat	2017	24 053	1392	115	986
	2018	26 846	1030	802	947
Herring	2017	22 949	1142	1897	792
	2018	22 758	1380	1797	727
Smelt	2017	174		65	
	2018	19		123	
Eelpout	2017	43		25	
	2018	3		66	
Four-horned sculpin	2017	<1			
	2018	<1		2	
Round goby	2017				
	2018	<1			
Ruff	2017	<1			
	2018				
Cod	2017	<1			
	2018				
Total	**2017**	**47 220**	**2534**	**2102**	**1779**
	2018	**49 627**	**2410**	**2789**	**1674**

Source: MoRA.

Table 20. Landings in Estonian ports of fish caught from the Baltic Sea by Estonian trawlers in 2018

County	Place of landing	Landings, t	Proportion (%) of total landings of trawlers
Lääne	Dirhami	13 624	27.45
Saare	Veere	7259	14.63
Harju	Miiduranna	5001	10.08
Harju	Meeruse	4172	8.41
Harju	Paldiski South Harbour	3272	6.59
Hiiu	Lehtma	3006	6.06
Saare	Saaremaa	2617	5.27
Pärnu	Virtsu	2416	4.87
Saare	Mõntu	1885	3.80
Lääne-Viru	Kunda	1874	3.78
Saare	Roomassaare	1746	3.52
Harju	Loksa	1060	2.14
Lääne	Westmeri	954	1.92
Harju	Bekkeri	519	1.05
Lääne	Rohuküla	146	0.29
Pärnu	Virtsu fish port	39	0.08
Harju	Leppneeme fish port	36	0.07
Harju	Tapurla	0.3	0.00

Source: MoRA.

for 91% of the total quota. According to Statistics Estonia's foreign trade data, the export volume of frozen fish (mostly sprat and herring) of Estonian origin has started to recover after the loss of the Russian market. While in 2016 the volume of frozen fish exports was nearly 41,000 tonnes (15.8 million euros), in 2017 it amounted to 54,000 (20.3 million euros) and in 2018 to 60,000 tonnes (27.1 million euros). The export volume increased by 10% and the export value increased by 33% year-on-year. Frozen fish of Estonian origin were exported to 34 countries, but mainly to Ukraine and Denmark.

Despite the recovery of exports, the loss of the Russian market continued to cause difficulties for some companies in selling their production and affected the first-sale prices of herring and sprat. While in 2013, before Russia's embargo, the average first-sale prices of herring and sprat had been 23 and 22 cents per kilogram, 17 and 18 cents per kilogram, respectively, were paid in 2018. Compared to 2017, the average first-sale price of sprat remained the same, while the price of herring dropped by one cent.

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

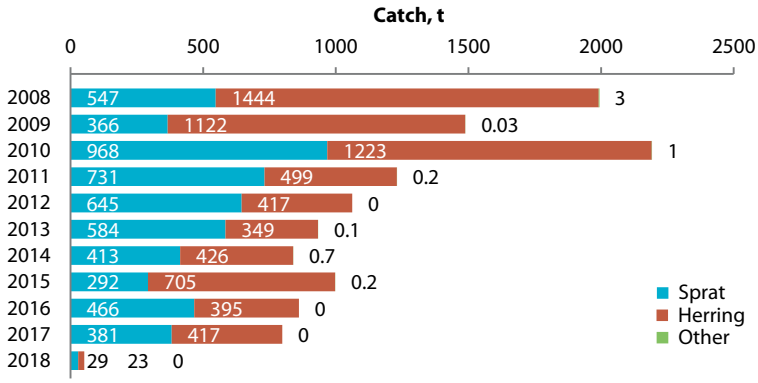


Figure 26. Catches of sprat, herring and other species (t) of 12-18 m length class trawlers, 2008-2018
Source: MoRA.

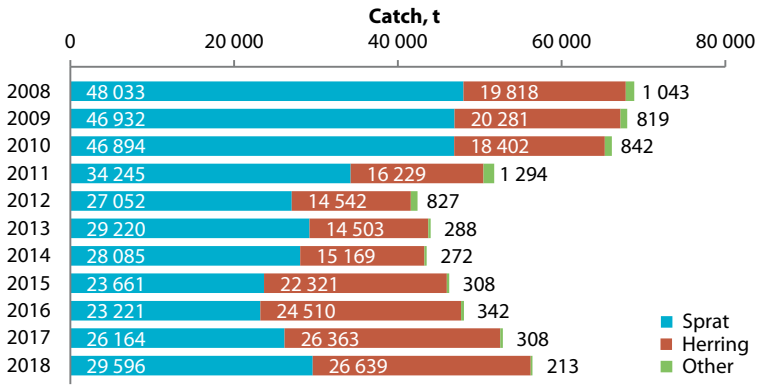


Figure 27. Catches of sprat, herring and other species (t) of 24-40 m length class trawlers, 2008-2018
Source: MoRA.

[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.

2018, large trawlers prevailed. The preference for large trawlers in fishing can be explained by their efficiency. Greater efficiency enables higher wages to be paid to the crew.

■ **Basic indicators of 12-18 m length class trawlers** While in 2017 five companies were engaged in fishery with five small trawlers, in 2018 there was only one company and one trawler (Table 21). A total of 52 tonnes of fish (sprat and herring) were caught, which means a 93% decrease in the total catch of small trawlers. The first-sale value of the catch declined by 94% and amounted to 9,103 euros. Sprat and herring accounted for 56% and 44% of the total catch, respectively (Figure 26). On average, three fishermen[2] were employed on small trawlers in 2018.

■ **Basic indicators of 24-40 m length class trawlers** In 2018, 17 companies were engaged in fishery using 25 large trawlers as in 2017 (Table 22). These trawlers caught a total of 56,448 tonnes of fish, whose estimated total value amounted to around 9.9 million euros based on average first-sale prices.

The total catch increased by 7% and the first-sale value of the catch increased by 4% compared to 2017. Sprat and herring accounted for 52% and 47% of the total catch in 2018, respectively (Figure 27). Due to the increase in quotas, the average number of trawling hours per vessel grew.

On average, 142 fishermen were employed on large trawlers in 2018.

Table 21. Basic indicators related to fishing operations of 12-18 m length class trawlers, 2008-2018

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of fishing vessels	23	14	12	10	7	6	10	8	6	5	1
Catch, t	1995	1488	2192	1230	1062	933	839	998	860	799	52
Value of catch based on first-sale prices, €10^3	322	207	285	204	208	198	177	190	159	144	9
Average number of employees	37	22	20	17	14	13	15	14	12	10	3
Average number of trawling hours per vessel	154	163	178	118	162	153	63	87	103	139	71

Sources: MoRA, UT EMI.

Table 22. Basic indicators related to fishing operations of 24-40 m length class trawlers, 2008-2018

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of fishing vessels	41	39	36	32	29	29	28	26	25	25	25
Catch, t	68.9	68.0	66.1	51.8	42.4	44.0	43.5	46.3	48.1	52.8	56.4
Value of catch based on first-sale prices, €10^3	11.9	10.7	9.2	9.9	9.0	9.6	9.3	9.0	8.9	9.5	9.9
Average number of employees	236	227	207	199	174	170	160	158	143	142	142
Average number of trawling hours per vessel	1152	1025	812	1080	1174	725	779	824	714	941	977

Sources: MoRA, UT EMI.

2 Average number of employees during the year.

Inland fisheries

LAKE VÕRTSJÄRV FISHERY

Stocks of the key fish species of Lake Võrtsjärv have been at a good level over the last decade and no decline in catches is foreseen for the near future. Catches of eel directly depend on the quantities restocked 6-14 years ago.

Commercial fishing catches from Lake Võrtsjärv totalled 182.5 tonnes in 2018 (Table 23). Compared to the result of 2017 (198.8 tonnes), the total catch decreased somewhat (by 8%) and accounted for just 60% of the average for the last twenty years (296 tonnes). The sharp decline observed in recent years is due, in particular, to the absence of second-rate fish of little value in the catch statistics. As there has been no market demand for second-rate fish since 2011, such fish are discarded when emptying trap nets. The average total catch in the last eight years has been 206 tonnes, which means that around 100 tonnes of second-rate fish are not landed each year.

Among key target species the catches of pikeperch and bream decreased by 12% and 18%, respectively, compared to 2017. However, the pikeperch catch of 71.8 tonnes was significantly above the long-term average (42.4 tonnes). In the case of pikeperch, the size of the catch depends on wintertime fishing, when ice conditions determine the success of fishing. January, February and December were the most successful fishing months, in which a total of 35 tonnes of pikeperch, or nearly half of the annual catch, were caught with gill nets under ice. The total catch of bream – 44.9 tonnes – was considerably lower than the average of the last five years (64 tonnes). One of the reasons for the decline in the bream catch is a change in consumer demand – there are increasingly fewer buyers of smaller bream. In May, when the largest bream catches are taken, breams weighing less than one kilogram are often discarded. The catch of pike taken in Lake Võrtsjärv totalled 39.3 tonnes in 2018, which is slightly better than the long-term average (36 tonnes) (Table 23). Pike catches are most affected by the water level in spring, which determines whether floodplains suitable for pike spawning are sufficiently flooded. The latter, in turn, determines whether the roe will hatch and the pike fry will return to the lake. Another important factor is the relation between the time of ice run and the time of pike spawning. The largest catches of pike are taken in May, in most cases immediately after the expiry of the spawning-time ban on fishing. However, if the ice breaks well before the end of the ban period, the catch will be modest. The catch of eel (16.7 tonnes) increased significantly compared to the result of the preceding year and the average catch of the last decade (13 tonnes). The largest quantity of eel was caught in May (6.3 tonnes). The perch catch was only 3.6 tonnes in 2018, compared to the long-term average of 8.1 tonnes, accounting for just 2% of the total

Table 23. Catches (t) from Lake Võrtsjärv, 1971-2018

Year	Eel	Pikeperch	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**
2016	13.0	42.3	45.3	61.2	1.5	5.0	5.2	–	**173.7**
2017	13.8	81.6	34.4	54.6	1.3	7.6	6.0	–	**182.5**
2018	16.7	71.8	39.3	44.9	1.2	3.6	4.5	–	**182.5**
Average	**30.8**	**42.4**	**36.0**	**69.9**	**4.3**	**8.1**	**2.6**	**125**	**289.5**

* Mostly gibel carp. Source: EULS.

Note: the figures for 2000-2010 also include catches from restricted and recreational fishing in addition to commercial fishing.

catch taken in the lake (Table 23). Other species producing considerable catches included tench (2.3 tonnes), roach (1.4 tonnes), burbot (1.2 tonnes) and gibel carp (0.6 tonnes). Fishermen usually record gibel carp as crucian carp (*Carassius carassius*) in their fishing logs.

Trap nets were the most productive fishing gear in 2018, providing 104 tonnes or 57% of the total catch taken in Lake Võrtsjärv (Figure 28). The biggest catches taken with the help of trap nets were those of bream (40.5%), pike (30.8%), eel (16.7%) and pikeperch (6.9%). Pikeperch produced the largest catch taken with gill nets (64.9 tonnes), which accounted for as much as 82.9% of the total catch of gill nets. The catches of pike and bream taken using gill nets amounted to 8.5 and 4.3 tonnes, respectively. The gill net catches of other species were negligible.

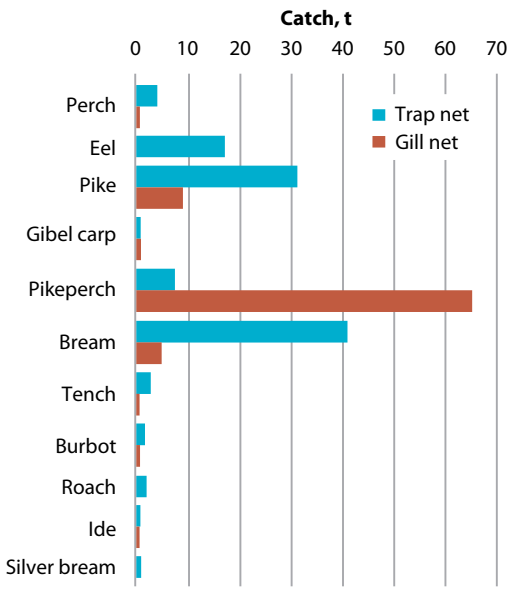
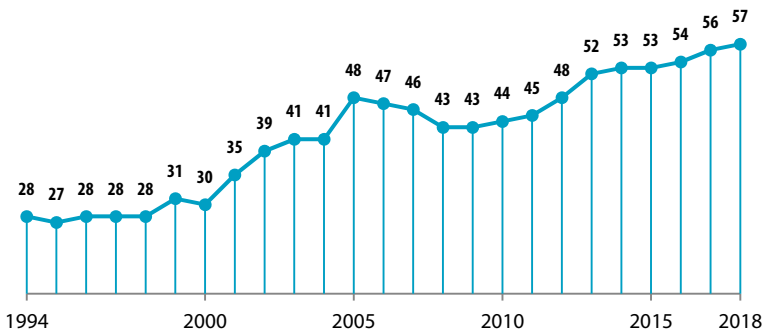


Figure 28. Species composition of commercial fishing catches from Lake Võrtsjärv in 2018 by fishing gear type
Source: EULS.

In 2018, a total of 323 trap nets and 321 gill nets were permitted to be used in Lake Võrtsjärv. In addition, 40 gill net permits were issued for recreational fishing. Intensive trap net fishing usually begins in late April and lasts until mid-October. Gill net fishing is allowed in Lake Võrtsjärv from 1 September until the break-up of ice in early spring next year.

For more than a decade, the amount of fishing gear and the resulting catches have remained relatively stable in Lake Võrtsjärv. Commercial fishing permits were issued to a total of 57 fishing companies and sole proprietors. Based on the reported catches, however, 49 fishermen and companies were actually engaged in fishery in Lake Võrtsjärv in 2018. The holders of

Figure 29. Number of commercial fishing permits issued for Lake Võrtsjärv, 1994-2018
Sources: Fisheries Information System of the MoRA; EULS.



a single trap net or gill net permit usually did not use their fishing opportunities. The number of permit holders has grown steadily in connection with the sale of fishing rights (Figure 29). The fishermen who mainly focus on processing and marketing of fish give up part or all of their historic fishing rights. To some extent, this development is also linked to the aging of fishermen, i.e. fishermen give up some of the fishing gear for health reasons. Based on registered home ports, the number of fishing vessels used on Lake Võrtsjärv was 70 in 2018.

Eel Lake Võrtsjärv has been restocked with eel since 1956. The introduction of eel provides added value to the fisheries sector and also serves the purpose of reproduction of the species. As the dam of the Narva hydroelectric power station prevents eels from naturally migrating to Lake Võrtsjärv and the small lakes of the Narva River basin, restocking is the only way to maintain the eel population in these water bodies. However, the results of recent studies confirm the passage of migratory eels through the turbines of the Narva hydroelectric power station and their arrival in the Gulf of Finland. Figure 30 shows eel restocking volumes (glass eels and pre-farmed eels) and catches in Lake Võrtsjärv.

Annual eel catches have amounted to 10-14 tonnes since 2009, when the catch declined significantly. The catch figures for 2016 and 2017 were 13 tonnes and 13.8 tonnes, respectively, which represented just over a third of the long-term average (30.8 tonnes) (Table 23; Figure 30). The catch of 2018 was considerably higher: 16.7 tonnes of this valuable fish were caught from Lake Võrtsjärv. In addition, recreational fishermen caught 196 kg of eel using bottom lines. However, based on the long-term restocking volume and catch ratio and the data obtained using various methods of assessing abundance, it is estimated that eel catches from Lake Võrtsjärv could actually amount to 25-30 tonnes per year.

The main reason for the decrease in the catches 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 2013. 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

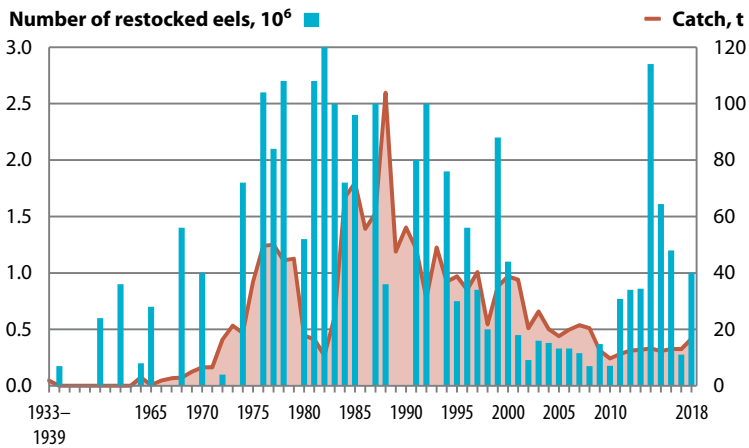


Figure 30. Eel restocking (number of individuals) and catches (t) in Lake Võrtsjärv, 1933-2018
Source: EULS.

the market price of glass eels. The price directly determines the restocking volume. The sharp drop in the price in 2014 (€168/kg) enabled 2.7 million glass eels, plus another approximately 200,000 pre-farmed individuals, to be introduced in Lake Võrtsjärv (Figure 30). In 2016, a procurement procedure was organised with a view to releasing only glass eels in lakes, but since the successful bidder failed to supply the required quantity of eel fry, a little more than half of the amount intended for glass eels was used to buy pre-farmed eels with an average weight of 9.6 g from a Dutch farm, which were released in Lake Võrtsjärv.

An international procurement procedure was announced for the purchase of glass eels in 2017. However, as the French company that had made the best bid was unable to procure the required quantity of glass eels, it was decided to go for restocking with pre-farmed eels yet again. An amount of nearly 136,000 euros was envisaged for eel restocking, for which a total of 1567 kg or nearly 313,000 pre-farmed eels (with an average weight of 5 g) were bought from a Dutch farm and released in Estonian lakes. Of that amount, 88% or 1388 kg (277,600 individuals) were introduced in Lake Võrtsjärv and 179 kg were released in small lakes (lakes Kuremaa, Kaiavere, Saadjärv and Vagula). The time of procurement has been the main reason for the failure to supply the tendered quantity of glass eels. Namely, the quantity of glass eels to be caught during the season and the final market price of the eels are not known when bids are made.

In 2018, 474.37 kg of glass eels were released into Lake Võrtsjärv and small lakes. Of that amount, nearly one million individuals were introduced into Lake Võrtsjärv. The eels were distributed from the harbour of the limnology centre of the Institute of Agricultural and Environmental Sciences at the Estonian University of Life Sciences and dispersed over the lake using fishing boats. The transport loss was estimated at 7 kg, or 1.5%, which the supplier compensated by adding around 15 kg of young eels. For the first time, the successful tenderer – SAS Foucher Maury from France – transported the glass eels on a live fish truck.

The restocking of Lake Võrtsjärv and small lakes with eels is organised by MTÜ Võrtsjärve Kalanduspiirkond. The project is financed by the Environmental Investment Centre, which also collects fishing fees. In 2018, it was decided to stop supporting eel restocking at current levels. Therefore, the fishing fee per trap net charged from commercial fishermen on Lake Võrtsjärv rose from 108.6

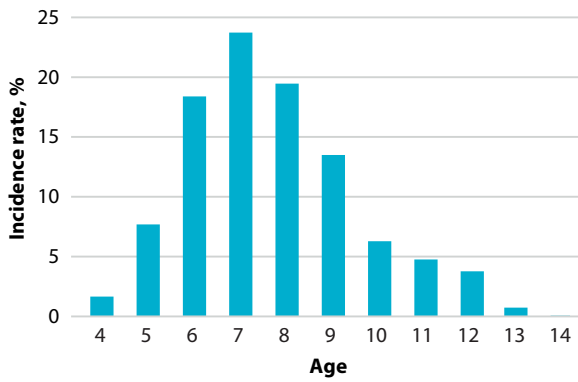


Figure 31. Average incidence (%) of eel age groups in trap net catches taken from Lake Võrtsjärv, 2016-2018
Source: EULS.

euros to 188 euros, which is a significant increase. An average of 52 kg of eel was caught per trap net in 2018.

Eel catches primarily depend on the quantities restocked 6-14 years ago, and to some extent also on the weather conditions and, in the case of Lake Võrtsjärv, on the water level. Eel catches are usually highest in May and September and their bulk comprises 6-12 year-old pre-farmed eels. In May and September 2018, 6.3 and 2.9 tonnes of eel were caught, respectively.

Glass eels released into the lake reach the fishing size during their seventh year in the lake, while pre-farmed eels (average weight 5-10 g) can be fished during their sixth year in the lake. Generally, a year class appears in catches during 7-8 years. Intensive emigration from Lake Võrtsjärv begins in the tenth year since restocking (TL 65-68 cm), after which the abundance of the year class in the lake begins to decline rapidly and older fish get caught in traps less frequently. The impact of fishing on eel abundance is several times lower than the impact of emigration, as described in Figure 31. From the seventh year, when most female eels have reached the fishing size, fishing has a similar impact on all age groups (minimum size 55 cm). Eel catches are expected to grow further in the coming years, as strong year classes will reach the fishing size (see Figure 30).

Apart from eels' fishery-related importance, the reproduction of this endangered species also implies a need to assess how many eels that reach maturity in Lake Võrtsjärv are able to migrate to the Baltic Sea via the Narva River. A special study conducted in 2016 and 2017 using a 1 ha square trap system showed that, at an average restocking volume (380,000 pre-farmed individuals per year from 2002 to 2009), there are approximately half a million eels of fishing size in Lake Võrtsjärv. Test fishing showed that 46% or nearly half of the pre-farmed eels released into the lake reach the fishing size. Official figures suggest, however, that 23,000-30,000 eels with an average weight of 500 g are caught annually. Thus, 50-60 tonnes of silver eel emigrate from Lake Võrtsjärv per year, or two to three times more than are caught from the lake. It should be noted that 12% of these 380,000 individuals are male eels that emigrate from Lake Võrtsjärv before reaching the established minimum size (TL ≥ 55 cm). The preliminary results of the project "Migration of silver eel on the Narva River and possibility to pass through the Narva Hydroelectric Power Plant turbines" indicated that 35 of the 45 acoustically tagged eels released in the Narva Reservoir in October 2018 made it to the sea alive by the end of November. This confirms that eels can successfully pass the turbines.

■ **Pikeperch** Pikeperch is one of the most important fish species in Lake Võrtsjärv and its stocks largely determine the livelihood of fishermen. Pikeperch stock and catches have been very strong in Lake Võrtsjärv for years. Thanks to a remarkable demand and a relatively high first-sale price (the average price was €3.42/kg in 2018), pikeperch has provided a considerable share of fishermen's income in recent years.

In 2018, 71.8 tonnes of pikeperch were caught from Lake Võrtsjärv, incl. 82.9% (64.9 tonnes) with gill nets. In addition, recreational fishermen caught 4 tonnes on the basis of 40 gill net permits. The largest catches of pikeperch are usually recorded in the winter, immediately after the lake freezes over, and in

the autumn. In 2018, too, the largest pikeperch catch was taken with under-ice fishing. February was the most successful month (14.7 tonnes), followed by January (12.9 tonnes) and December (10.2 tonnes). The December catch was significantly higher than in 2017, when it proved to be very modest (1.4 tonnes) due to changeable weather conditions – permanent ice cover was only formed in January 2018. However, as ice conditions were particularly dangerous in the central and northern parts of the lake during the first weeks of January, full-scale fishing could not be started until mid-month and therefore the catch landed in January 2018 can be considered rather small.

Compared to 2017, the annual catch of commercial fishing per gill net permit decreased in 2018, from 254 kg to 201 kg. The catch of recreational fishermen was half that of commercial fishers, or 100 kg per gill net. Only 6.9 tonnes of pikeperch were caught using trap nets during the season. A lot of undersized pikeperch of different year classes were caught in trap nets, which points to the strength of the generations to be targeted in the coming years.

The first month of under-ice gill net fishing is crucial in pikeperch fishery, regardless of when the lake freezes over. In some years, up to 50% of the annual catch is taken during that period, as happened in 2017. As the winter progresses, fish become less mobile and increasingly fewer of them get caught in traps (Figures 32 and 33).

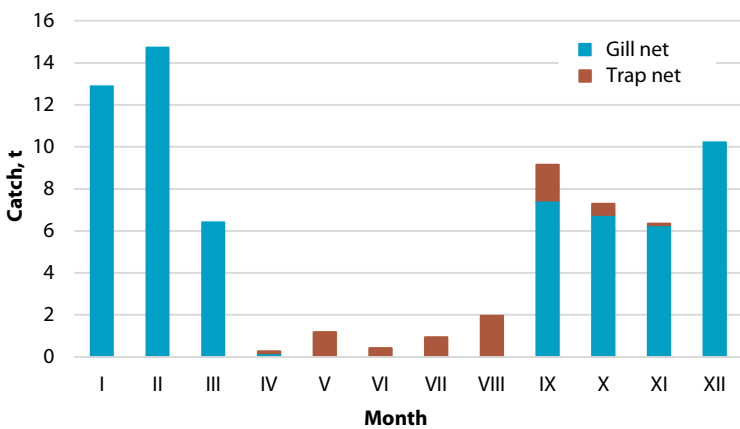


Figure 32. Pikeperch catches by month and fishing gear in 2018
Source: EULS.

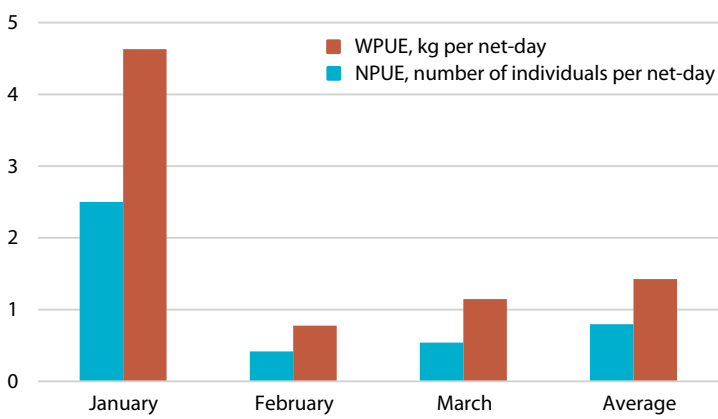


Figure 33. Average pikeperch catch per gill net per day in under-ice fishing in Lake Võrtsjärv in winter and early spring of 2018 based on test fishing
Source: EULS.

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 directly affects the growth rate of fry and thus the transition of juvenile pikeperch from a zooplankter diet to feeding on fry, i.e. predation. 2018 was a very favourable year for the occurrence of a large pikeperch cohort thanks to the long and warm spring and summer. Due to the heat wave at the beginning of May, pikeperch spawned almost three weeks earlier than usual, causing the growth period to be significantly extended.

Secondly, the abundance of a pikeperch cohort depends on the abundance of Lake Peipsi (dwarf) smelt because smelt fry are the only food that small one-summer-old pikeperch can swallow. Test trawling carried out in July showed a very high abundance of Lake Peipsi smelt fry in Lake Võrtsjärv. Thus, the food base was sufficient, and by September almost the entire pikeperch cohort had switched to predation. This means that the growth of pikeperch accelerated significantly. The abundance of one-summer-old smelt was very low in the autumn, indicating that smelt was simply eaten by a strong pikeperch cohort.

In the autumn, the average length of one-summer-old pikeperch, measured up to the end of scale cover (SL), was 11.3 cm and their average total weight (TW) was 15.7 g. Larger 0+ individuals had grown to 14 cm in length (SL) and weighed up to 30 g by late autumn. The situation was different in 2017: one-year-old pikeperch fed only on zooplankton and measured just 4.8 cm (SL) and weighed a little over a gram on average in the autumn. At the same time, they were more abundant than in 2018. Fortunately, the winter of 2018 was relatively mild and the water level was high, and the last year's pikeperch cohort made it through the winter well. By spring 2018, the larvae and fry of many fish species were already suitable for the transition of the pikeperch to predation.

At the time of under-ice gill net fishing in the winter and early spring of 2018, the average length and weight of pikeperch were 47.9 cm and 1878 g, respectively, and the figures in December were 49.8 cm and 2183 g (Figure 34). The bulk of the catch consisted of the strong cohorts of 2012 and 2013. The proportion of undersized pikeperch was 5.6% based on the data of test fishing. The smallest permitted mesh size in Lake Võrtsjärv is 130 mm, or 65 mm from knot to knot.

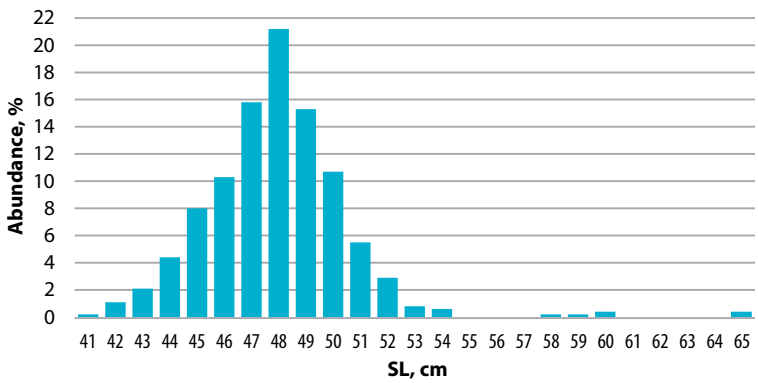


Figure 34. Length of pikeperch in gill net fishing in winter and early spring of 2018
Source: EULS.

Unlike in other lakes, in Lake Võrtsjärv the minimum size of pikeperch is 45 cm in standard length measured up to the end of scale cover (SL) and 51 cm in total length measured up to the end of the caudal fin (TL), 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.

■ **Pike** Pike is the most abundant in the coastal (littoral) zone of Lake Võrtsjärv, as well as in the shallow southern part of the lake, which is rich in vegetation. Eighty percent of the catch is taken with trap nets. May and October are the most productive months (Figure 35). Gill nets are used for pike fishery in late autumn and for under-ice fishing in winter, when pike holds the second place after pikeperch in terms of importance to fishermen. The minimum size of pike (SL) permitted for commercial fishing in Lake Võrtsjärv is 40 cm. Since pikes have tended to spawn earlier every year during the last decade, fishing for pike was allowed to be started on 15 April instead of 1 May in 2017, in order to prevent the repeated discarding of pikes immediately after the spawning period, when they are massively caught in trap nets. Therefore, nearly 4.5 tonnes of pike were caught during two weeks in April 2017. In the spring of 2018, the ice did not break up until mid-April and the ban on pike fishing was extended until May 1.

The total pike catch taken from Lake Võrtsjärv amounted to 39.3 tonnes in 2018 (Table 23), which was slightly higher than the long-term average (36 tonnes).

In 2018, test trap net catches were dominated by pike with the length of 40-54 cm (SL) from age groups 4+ to 6+, i.e. year classes 2012-2014. The spring water level had been significantly above the long-term average in 2012 and 2013, creating suitable conditions for pike spawning. While in 2014 the spring water level was at an absolute low and lakeside floodplains were completely dry, this was offset by the vegetation-rich southern part of the lake, which was so shallow that it served as a convenient spawning ground for pike in its entirety.

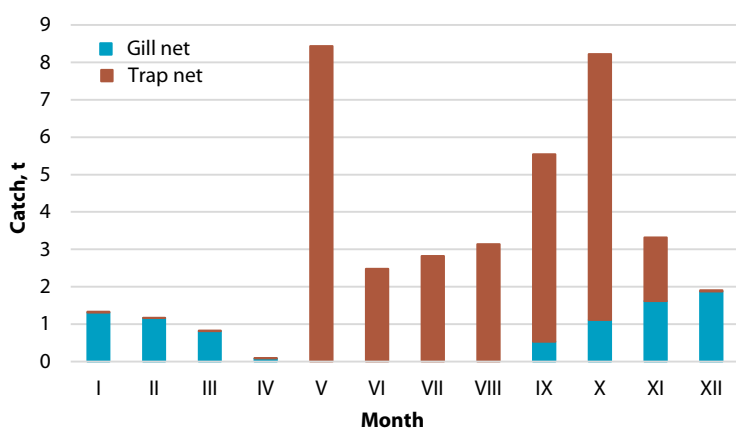


Figure 35. Pike catches by month and fishing gear in 2018
Source: EULS.

Bream Bream definitely accounts for the bulk of the biomass of fish fauna in Lake Võrtsjärv. The bream catch landed in 2018 was the lowest in the last 15 years (44.9 tonnes), although its weight per unit effort in test trawling was one of the highest compared to the average for the same period (WPUE = 205 kg per trawling hour; Table 24) after 2013, when it was 255 kg per trawling hour. Over the last decade, bream catches have fluctuated between 45 and 80 tonnes. Trap nets account for up to 95% of the bream catch, with commercial fishermen taking 87% of the bream catch using this fishing gear. In 2018, the average weight of large bream (SL ≥30 cm) caught in trawling was 900 g and the average length (SL) was 34.2 cm.

Spawning-time migration of large and well-fed breams into the lake through the Emajõgi River is observed in almost every spring. After this period, which lasts for 2-3 weeks, the fish return to the Emajõgi River. In a longer-term comparison, the abundance and catches of large bream are currently moderate in Lake Võrtsjärv, and the size and mean weight of fish are above the long-term average.

Test trawling, which has been carried out on Lake Võrtsjärv since 1978 with the same methodology, provides important information on changes in the abundance and biomass of other fish in addition to the key commercial species. Throughout this period, bream has accounted for the largest proportion – over half in terms of weight – in trawl catches (40-68%). However, in 2018 the share of bream was only 38% due to the surge in the biomass of roach (Table 24). Pikeperch held the third position in trawling thanks to the abundant cohorts of recent years.

Second-rate fish taken as by-catch in trap net fishing, of which small bream accounts for 70-80%, is no longer registered and hasn't been since 2011. For bream, therefore, the catch figures do not represent actual statistics that can be compared with the figures from previous years. The fishermen who have found an opportunity to sell small bream have registered all the second-rate fish as bream in their log-books. However, most fishermen do not register second-rate fish at all, because it is discarded.

While 0.8 kg of second-rate fish was caught per kilogram of commercial fish in test trap net fishing in 2016 and 2017, the result for 2018 was 1.45 kg, representing an increase of almost 81%. Based on this ratio, the total trap net catch of commercial fish of 104 tonnes should have been accompanied by around 145 tonnes of second-rate fish as by-catch, but this by-catch was not reflected in official catch statistics.

The fast growth in the abundance of second-rate fish of little value in Lake Võrtsjärv

Table 24. Species composition, abundance and weight (number of individuals and proportion per trawling hour and weight in grams) of trawling catches from Lake Võrtsjärv in 2018

Species	WPUE (g/h)		NPUE (ind./h)	
	TW, g	%	No. of ind.	%
Lake Peipsi (dwarf) smelt	123	0.0	42	0.1
Vendace	20	0.0	1	0.0
Pike	8153	1.5	6	0.0
Rudd	47	0.0	1	0.0
Roach	189 854	35.9	17 997	56.6
Ide	60	0.0	0.2	0.0
Bleak	4748	0.9	653	2.1
Bream	204 619	38.7	3120	9.8
Silver bream	6166	1.2	259	0.8
Gibel carp	260	0.0	0.5	0.0
Gudgeon	380	0.1	52	0.2
Burbot	467	0.1	1	0.0
Perch	1428	0.3	55	0.2
Pikeperch	63 325	12.2	165	0.5
Ruff	48 492	9.2	9457	29.7
Total	**529 141**	**100**	**31 809**	**100**

Source: EULS.

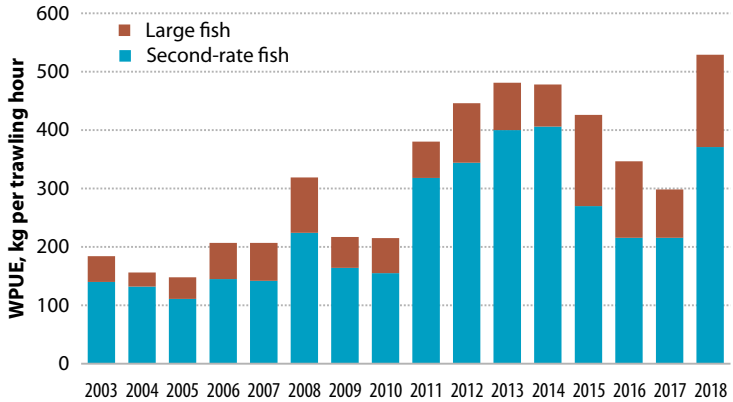


Figure 36. Trawling catches from Lake Võrtsjärv, kg per trawling hour, 2003-2018
Source: EULS.

(Figure 36) 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, it is imperative to find ways of adding value to second-rate fish in order to generate the interest of all fishermen in bringing it ashore. From 2015, a decrease in the weight of second-rate fish had been observed, which was a positive trend. However, in 2018 this figure increased dramatically, rising from 215 kg to 371 kg per trawling hour (Figure 36). A research project was launched in 2017 in order to address various opportunities for adding value to second-rate fish.

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

Table 25. General assessment of state of stocks and fishing mortality in Lake Võrtsjärv in 2018 and the near future, by key species

Species	State of stocks			Fishing mortality
	2018	Until 2019	Until 2021	
Eel	2	2	2	A
Pikeperch	1	1	1	B
Pike	2	2	2	B
Bream	2	1	1	A
Perch	3	3	3	B
Burbot	3	3	3	A
Lake Peipsi (dwarf) smelt	2	3		–

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.

LAKE PEIPSI FISHERY

2018 differed from previous years by two factors. First, the quotas and catches of smelt and vendace were relatively high (Tables 26 and 27). The stocks and catches of other important commercial species changed much less. Secondly, water temperature was high in the summer of 2018, which resulted in occasional oxygen deficit in the bottom water layer of the lake. This caused the perishing of ruff for a limited period of time. No perishing of the key commercial species of the lake was observed.

■ **State of fish stocks and changes** The stock of **pikeperch** – the most important commercial species of the lake – was moderate and consisted mainly of young fish representing year classes 2015 and 2016 whose growth has been fast due to the abundance of smelt and vendace. Thus, four-summer-old fish born in 2015 averaged 51 cm in length and 1455 g in weight in the autumn, while three-summer-old fish born in 2016 averaged 40 cm in length and 645 g in weight. Due to the high abundance and strong growth of the 2016 cohort, the stock of pikeperch should continue to be at least moderate in the next few years, although the cohort of 2017 and – according to the provisional data – of 2018 are also weak (Figure 37). The stock of the other valuable target species – **perch** – was in a good condition but did not reach the estimated level. Like in 2017, the reason for this was the slow growth of the cohort of 2015. In the absence of interest in fishing for small perch (weighing less than 50 g), catches remained relatively modest for the second consecutive year. No new strong perch cohorts emerged during the period 2016-2018. The status of the stock of **bream**, dominated by year classes 2011-2013, was also good in 2018. The stock of **pike** was relatively small but increased considerably during the year. The cohorts of 2012-2015 accounted for the bulk of the stock. The abundance of **roach** was lower than the year before, but its stock was still in good shape with fish born from 2008 to 2011 accounting for the bulk of it. By the end of 2017, **Lake Peipsi (dwarf) smelt** and **vendace** stocks had reached the condition that allowed for larger-scale commercial fishing for these species. While the smelt stock consisted of two year classes (Figure 38), the vendace stock comprised mainly one year class (Figure 39). In 2018, a new but small cohort of Lake Peipsi smelt emerged. Unfortunately, no new cohorts of vendace were born in 2017 or 2018. The stock status of **Lake Peipsi whitefish** and **burbot** was the same as the year before and these species were only allowed to be landed as by-catch. Young fish born in 2014 and 2015 accounted for the bulk of the whitefish stock.

■ **Fisheries management** In 2018, the previous fishing regime continued, with the exception of the introduction of 32 trap nets for catching smelt. The traditional bans on pike fishing from 5 April to 5 May, the bans on fishing for pikeperch and bream and the ban on trap net fishing on Lake Lämmijärv from 5 May to 10 June, the ban on fishing with gill nets from 5 May to 1 September and the ban on fishing with seine nets from 1 January to 14 September were applied. However, some additional fishing limitations were introduced during the year. The first was related to the perishing of fish, which led to a temporary ban on

Table 26. Estonian national quotas (t) on lakes Peipsi and Lämmijärv from 2011-2018 and average quotas for the period

Species	2011	2012	2013	2014	2015	2016	2017	2018	Average
Pikeperch	672	714	650	650	650	758	866	677	**705**
Perch	900	1400	1000	800	850	1032	1182	1288	**1056**
Pike	110	160	165	120	125	121	131	86	**127**
Bream	600	614	650	750	710	761	836	915	**729**
Roach	305	300	280	350	275	300	350	250	**301**
Whitefish	5	3	2	1	1	1	1	1	**2**
Smelt*	5	5	5	5	5	5	5	400	**54**
Vendace	10	15	15	25	15	15	45	400	**68**
Burbot	50	50	50	50	50	50	50	50	**50**
Ruff	300	300	150	150	150	150	150	150	**188**
Other species**	50	50	25	25	25	25	1	0	**25**
Total	**3007**	**3611**	**2992**	**2926**	**2856**	**3217**	**3618**	**4217**	**3305**

* The smelt quota was intended only for test fishing from 2011 to 2017, and also for commercial fishery since 2018.

** Until 2016 – tench, ide, silver bream, vimba bream and eel; in 2017 – only eel; no quota was allocated in 2018.

Source: UT EMI.

Table 27. Estonian catches (t) from lakes Peipsi and Lämmijärv from 2011-2018 (incl. research fishing), and average catches for the period

Species	2011	2012	2013	2014	2015	2016	2017	2018	Average
Pikeperch	672	646	637	599	420	720	839	667	**650**
Perch	757	1061	914	787	818	1 000	661	553	**819**
Pike	100	153	143	120	94	94	97	78	**110**
Bream	578	577	604	748	676	665	758	664	**659**
Roach	225	207	185	217	211	194	191	185	**202**
Smelt	0	0	0	0	0	4	4	355	**45**
Whitefish	0	0	0	1	0	0	0	1	**0**
Vendace	1	3	10	22	13	15	45	313	**53**
Burbot	30	21	23	20	17	26	44	39	**27**
Other species	9	3	5	6	8	5	4	5	**6**
Total	**2371**	**2671**	**2520**	**2521**	**2256**	**2723**	**2644**	**2860**	**2571**

Source: MoRA.

Table 28. Estonian catches (incl. research fishing), quotas and balances (t) and quota uptake levels (%) in lakes Peipsi and Lämmijärv in 2018

Species	Catch	Quota	Uptake	Balance
Pikeperch	667	677	99	10
Perch	553	1288	43	734
Pike	78	86	91	8
Bream	664	915	73	251
Roach	185	250	74	65
Whitefish	1	1	66	0
Smelt	355	400	89	45
Vendace	313	400	78	87
Burbot	39	50	78	11
Ruff	0	150	0	150
Other species	5	–	–	–
Total	**2860**	**4217**	**68**	**1361**

Source: MoRA.

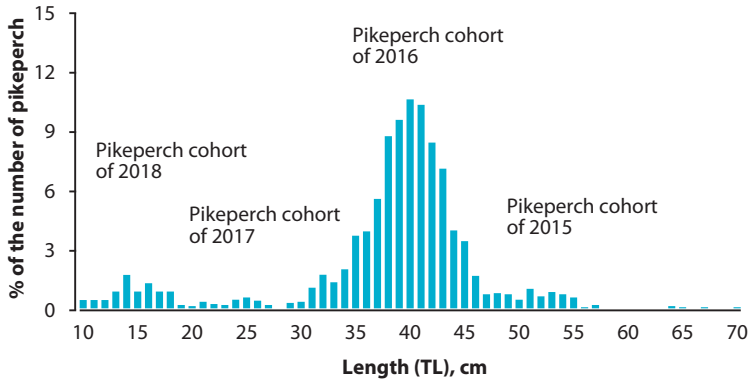


Figure 37. Composition of pikeperch stock in lakes Peipsi and Lämmijärv based on trawling in autumn 2018
Source: UT EMI.

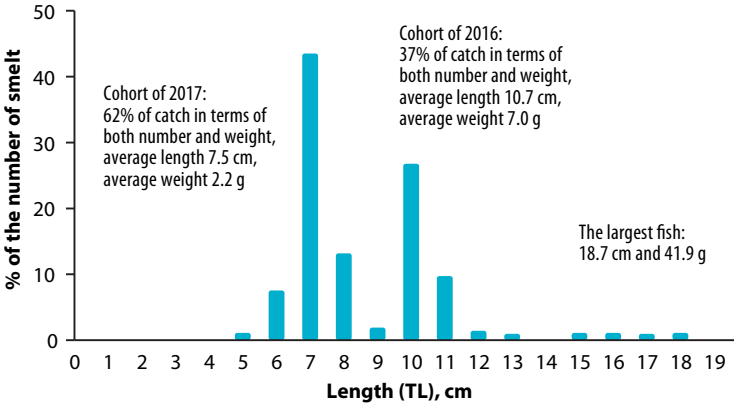


Figure 38. Composition of smelt stock in lakes Peipsi and Lämmijärv based on trawling in autumn 2017
Source: UT EMI.

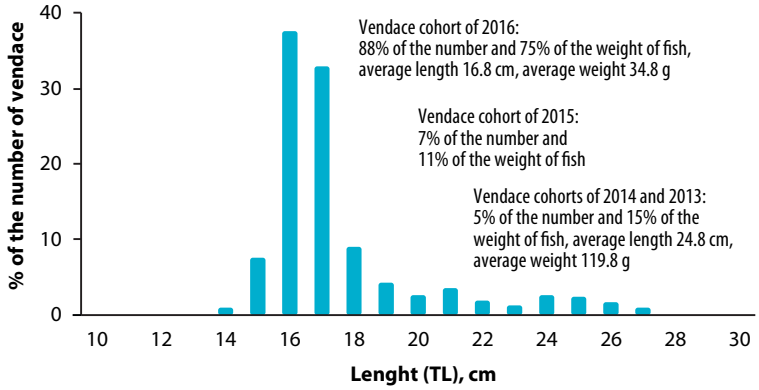


Figure 39. Composition of vendace stock in lakes Peipsi and Lämmijärv based on trawling in autumn 2017
Source: UT EMI.

Table 29. Number of companies and fishermen related to Lake Peipsi, 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018
Companies*	71	68	66	70	71	68	67	66
Fishermen	406	383	367	367	325	302	282	264

* The companies that have claimed their fishing permits and registered a catch. Source: MoRA.

trap net fishing from 4 to 13 August. Others concerned excessive fishing capacity, which resulted in the rapid exhaustion of quotas and the end of larger-scale fishing in October already. The ban on pike fishing came into force on 5 October, and the ban on fishing for pikeperch and the bans on gill net and seine net fishing took effect on 18 October, with just trap net fishing being allowed until the end of the year.

This time the minimum size of pikeperch was 30/35 cm in the autumn (from 15 September to 18 October). On the proposal of fishermen, fishing with offshore gill nets was started in the autumn at the same time as seine fishing (15 September). Of the permitted 700 fishing days, 412 (59%) were used for fishing with Danish seines. Despite a short fishing season, quota uptake rates were high, except for perch and ruff, in whose case the quota uptake rate was low or nil (Table 28). As in earlier years, 5% of the balances of the quotas of key commercial species (pikeperch, perch, pike and bream) could be carried over to the next year.

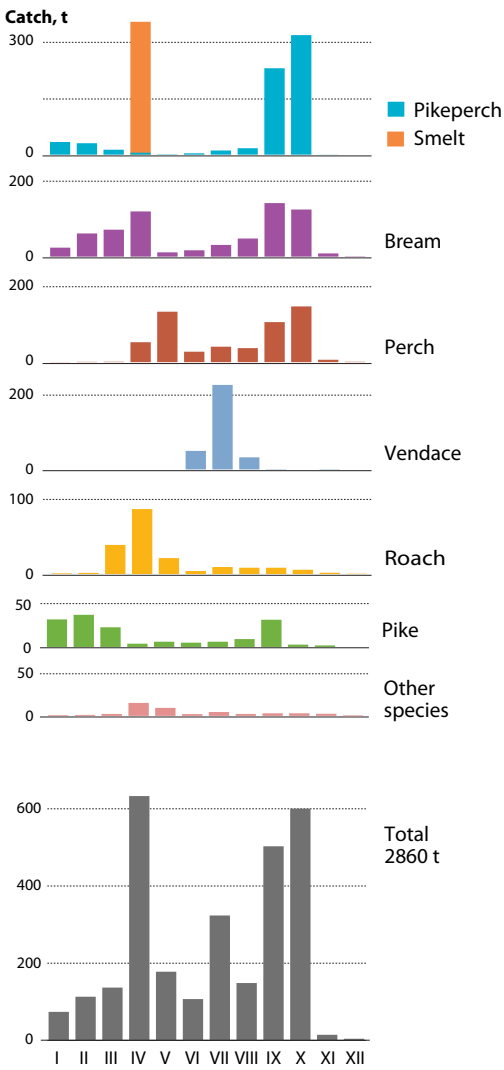


Figure 40. Dynamics of catches from lakes Peipsi and Lämmijärv by species in 2018
Source: UT EMI.

Ninety-two companies have the right to fish on the lake, but 66 of them were actually engaged in fishery (Table 29). The rest of the companies let out or did not use their fishing rights. The number of fishermen operating on the lake is declining and amounted to 264 in 2018 (Table 29).

■ **Catches** In 2018, commercial fishermen caught 2860 tonnes of fish on the Estonian side of lakes Peipsi and Lämmijärv, which is approximately 200 tonnes more than in 2017 and around 300 tonnes more than in previous years on average. The total catch increased on account of high smelt and vendace catches. Catches of all other key commercial species were lower than the year before (Table 27). Catches of predatory fish (pikeperch, perch, pike, burbot), which are mostly intended for export, accounted for only 47% of the total catch, while catches of non-predatory fish (bream, roach, vendace, smelt and ruff) and fish of primarily local importance represented 53% of the total catch taken on the Estonian side. The proportion of plankton-eating fish (vendace, smelt) increased significantly from previous years, rising from 1-2% to 23% of the total catch taken from the lake.

Due to the fishing regime, stock composition, fishing interest and specific natural conditions, fishing in lakes Peipsi and Lämmijärv is very seasonal and is also affected by the exhaustion of quotas (Figure 40). In 2018, April was the most productive fishing month when 355 tonnes of smelt were caught. As usual, a lot of fish was caught in September and October, when all the major fishing gear was used on the lake simultaneously and around 1100 tonnes of fish were landed. That catch accounted for nearly 40% of the total catch taken in the lake during the year, with the catch of pikeperch of around 550 tonnes representing over 80% of the annual pikeperch catch. The total catch of July was also strong on account of the catch of vendace.

Different types of trap nets were by far the most productive fishing gear, catching approximately 1700 tonnes of fish, or 60% of the annual catch. The quantity of fish caught with offshore and inshore gill nets was lower than usual, while the catch taken with Danish seines was higher than usual in 2018 (Table 30). Pikeperch was mainly caught using small-mesh fishing gear (Danish seines, trap nets and lines of trap nets); offshore gill nets were used to catch pike; trap nets, lines of trap nets and Danish seines were used in fishing for perch; bream was caught using offshore gill nets and lines of trap nets; roach was caught using trap nets, lines of trap nets, and inshore gill nets; trap/fyke nets and pound nets were used to catch vendace; smelt was caught using trap nets; and burbot was caught using both trap nets and lines of trap nets (Table 31).

Table 30. Catches (t) from lakes Peipsi and Lämmijärv (without research fishing), average per fishing gear and proportions (%), 2011-2018

Fishing gear	2011	2012	2013	2014	2015	2016	2017	2018	Average	Proportion
Offshore gill nets	673	553	779	798	617	719	814	545	687	27
Inshore gill nets	77	60	57	99	93	83	71	84	78	3
Trap/fyke nets	671	403	458	539	629	712	657	599	583	23
Lines of trap nets	635	564	664	733	657	671	609	585	640	25
Smelt trap nets	0	0	0	0	0	0	0	355	44	2
Pound nets	0	0	0	0	0	4	6	153	20	1
Danish seines	287	1058	524	320	225	494	451	507	483	19
Other fishing gear*	10	13	8	11	12	12	16	8	11	0
Total	**2353**	**2651**	**2490**	**2500**	**2232**	**2695**	**2626**	**2837**	**2548**	**100**

* Mostly catches of anchored seines. Source: MoRA.

Table 31. Catches (t) from lakes Peipsi and Lämmijärv (without research fishing) by species and by fishing gear in 2018

Fishing gear	Pike-perch	Perch	Pike	Bream	Roach	Smelt	Ven-dace	Burbot	Other species	Total
Offshore gill nets	226	2	51	263	0	0	0	3	1	545
Inshore gill nets	0	2	0	1	80	0	0	0	1	84
Trap/fyke nets	75	227	5	73	42	0	152	22	1	599
Lines of trap nets	104	131	14	255	58	0	5	14	2	585
Smelt trap nets	0	0	0	0	0	354	0	0	1	355
Pound nets	0	3	0	0	1	0	149	0	0	153
Danish seines	251	187	5	62	1	0	0	0	0	507
Other fishing gear*	6	0	1	1	0	0	0	0	0	8
Total	**663**	**552**	**77**	**656**	**183**	**355**	**307**	**39**	**6**	**2837**

* Mostly catches of anchored seines. Source: MoRA.

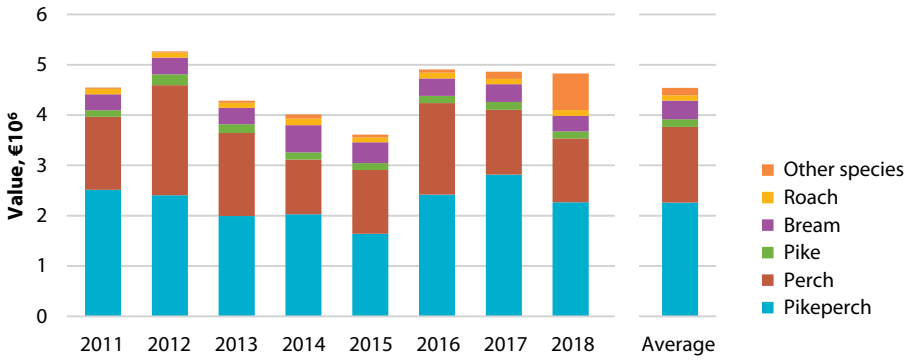


Figure 41. **Values of catches taken from lakes Peipsi and Lämmijärv and the average value (€10⁶) by species, 2011-2018**
Source: UT EMI.

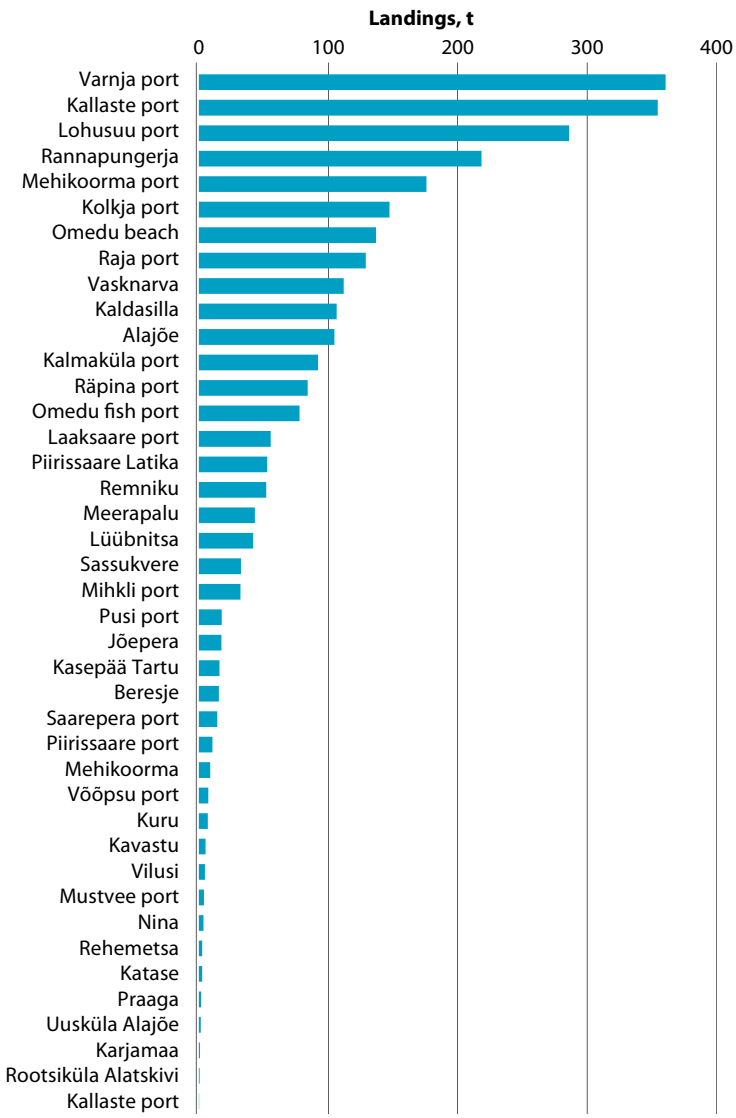


Figure 42. Landings at ports on lakes Peipsi and Lämmijärv in 2018
Source: MoRA.

The total value of the catches taken from the lake was still approximately 5 million euros (Figure 41). Pikeperch accounted for nearly half (47%) of the value of the catches taken from the lake; the share of perch was around a quarter (26%). The vendace catch was worth approximately 0.5 million euros (10% of the total catch value) and the value of the smelt catch was around 200,000 euros (just 4%).

Different types of trap nets were the most profitable fishing gear, generating a total catch value of 2.4 million euros based on average first-sale prices in 2018. Catches taken with seine nets were worth around 1.3 million euros and the value of catches taken using offshore gill nets amounted to around one million euros.

Fish caught from the lake was landed at 40 lakeside ports and two ports on the Emajõgi River. The largest fishing ports are located in Varnja, Kallaste, Lohusuu, Rannapungerja and Mehikoorma (Figure 42). How the Environmental Inspectorate and the Veterinary and Food Board manage to control them all is rather incomprehensible.

■ **Problems and possible solutions** In the autumn of 2018, fishermen encountered a traditional problem in Lake Peipsi fisheries: fishing quotas were exhausted prematurely, this time for pike and pikeperch. While a ban on pike fishing is limited to fishing with offshore gill nets, and even this is not always the case, a ban on pikeperch fishing usually results in the termination of fishing with both offshore gill nets and seine nets. However, these nets are the main fishing gear in the autumn. Reduction of fishing capacity would help alleviate the problem to some extent, but this has proved to be difficult to achieve for a number of reasons. At the end of the year, several fishing companies proposed the introduction of individual quotas as an alternative. These would, in their view, be economically viable and would also strike a balance between fishing capacity and fishing opportunities. In 2019, discussions began on the distribution of national quotas between companies.

EMAJÕGI RIVER FISHERY

The Emajõgi River has always been an important fishing area. Official annual catches of fishermen fishing on the Emajõgi River have fluctuated between 16 and 46.2 tonnes. Annual catches have been increasing for the last seven years, and 2018 was a record year. Recreational fishermen's catches are not consistently recorded, but a survey-based study of recreational fishing capacity in 2011-2012 showed that recreational fishermen's catches may be even higher than those of commercial fishermen (Jalak, Rakko 2012).

The Emajõgi River connects the two largest lakes in Estonia – Lake Peipsi and Lake Võrtsjärv, as well as numerous oxbow lakes, tributaries, etc. As the 100 km river is an important migratory route for fish, migrating fish are the main target for fishermen. Target species are diverse – official catches of commercial fishermen have consistently included ten species during the last decade, and a total of 19 species have been recorded during this period (Table 32). The species composition and abundance of the fish caught and their changes in dif-

ferent months are affected by restrictions pertaining to fishery management and protection of specific species.

Protected fish species – mostly asp and catfish – also get caught in fishing gear, but they are not reflected in the fishermen's catches as these fish must be released alive. Grayling is a stray visitor in the Emajõgi River and usually does not get caught due to its small size. Sturgeon fishing is also prohibited under the current fishing regulations. Then again, as far as is known, only alien and probably farmed sturgeon species have been observed in the Emajõgi River. Our indigenous sturgeon, the Atlantic sturgeon, cannot reach the Emajõgi River from the sea.

Undersized fish must also be released. As of 2019, minimum sizes for bream, pike, tench, pikeperch, burbot, eel and whitefish apply on the Emajõgi River. Some species for which the minimum size has been established (brown trout, vendace, vimba bream) rarely find their way into the Emajõgi River.

Bream prevails in the catches taken from the Emajõgi River, accounting for an average of 80.9% of the annual catches of commercial fishermen and an estimated 51% of the catches of recreational fishermen over the last 10 years. Between 2009 and 2018, the proportion of bream fluctuated by only 11.4% (74.5-85.9%), which means that when the catch of bream is poor, the total catch of other species is generally also low (Figure 43). Fishing conditions on the Emajõgi River are affected by ice conditions, water level, temperature regime, etc.

Commercial fishermen landed the largest bream catch in the last ten years in 2018, when 38.3 tonnes of bream were caught from the Emajõgi River, which was also the largest catch of bream in this millennium. Bream catches had been on a downward trend, reaching the lowest level in 2011 (11.9 tonnes), but then started to rise again (Figure 43).

Table 32. Official commercial fishing catches (kg) from the Emajõgi River by species, 2009-2018

Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bream	17 408	12 824	11 933	15 222	17 715	21 872	26 819	26 195	28 923	38 302
Roach	947	1252	1070	964	1386	3585	2789	3728	7366	3890
Pike	714	885	1069	665	944	860	1701	1064	748	1793
Ide	179	516	320	316	553	660	507	249	361	302
Tench	64	86	318	209	185	607	660	225	299	342
Pikeperch	511	98	168	144	133	240	141	250	487	732
Perch	110	148	61	42	104	181	193	216	289	378
Silver bream	241	211	36	92	215	196	126	35	97	74
Crucian carp		5	3	60	3	155	197	91	62	155
Burbot	39	37	27	69	5	60	45	53	122	163
Ruff	2	136	110	3				2	9	
Rudd	19	17	32		94					15
Eel	7	4	1	15	14	13	4	14	26	34
Carp	13	22	7	1	13	14	3	2	14	
Gibel carp			9		3			30		
Lake Peipsi whitefish							6		1	
Dace						1				
Bleak						1				
Rainbow trout									1	
Total	**20 254**	**16 241**	**15 164**	**17 800**	**21 366**	**28 444**	**33 189**	**32 154**	**38 804**	**46 179**

Source: MoRA.

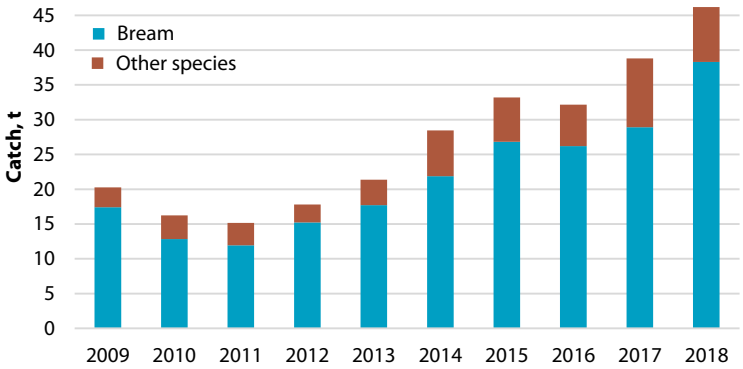


Figure 43. Dynamics of official commercial fishery catches from the Emajõgi River and the proportion of bream in the catches, 2009-2018
Source: MoRA.

In 2010 and 2011, the connections of 18 oxbow lakes of the upper course of the Emajõgi River with the main river were restored. As a result, fish now have better access to spawning grounds and other habitats, the area of spawning grounds has increased and the risk of fish dying from oxygen deficit has been reduced. Therefore, stocks of bream and other fish are expected to increase. The year 2018 saw the completion of the Happyriver project during which the natural lower course of the Laeva River flowing into the Emajõgi River in the Alam-Pedja protected area was restored, which is expected to have a similar positive impact on the Emajõgi River fish fauna. As another result of these projects, fishermen now have better access to good fishing grounds.

In addition to bream, commercial fishermen's catches from the Emajõgi River include considerable quantities of roach (average proportion of 9.1% in the catches landed from 2009-2018) and pike (4.1%), and smaller quantities of ide (1.7%), tench (1.1%), pikeperch (1.1%), perch (0.6%) and silver bream (0.6%). The average proportion of the remaining eleven species has totalled 0.8% (Table 32). Apart from bream, the proportions of other fish in catches have varied during these years. For example, the proportions of roach and pike have fluctuated by around four times. The share of roach in the total catch was highest in 2017 (19%) when 7.3 tonnes of roach were caught, while that of pike was highest in 2011 (7%), although the largest pike catch – 1.7 tonnes – was recorded by commercial fishermen in 2015.

The yields of fish in the Emajõgi River tend to vary by month (Figure 44). For example, the bulk of bream is caught in the first half of the year and it accounts for 61.6% of the annual catch on average, but in 2016, for example, the figure for the first half of the year was as high as 84.4%. Monthly catches are highest in April (43.6% on average) and this has been the case in each year of the last decade.

The large monthly fluctuations in the yields of fish species are mainly due to the different migratory periods of fish (Figure 44) and the fishery management-related restrictions. The largest catches of bream are landed during the migration of this species to the spawning grounds just before the ban on commercial fishing gear takes effect (the ban is in force from 1 May to 20 June). The bulk of pike catches (62.6% on average) are taken in the second half of the year, partly because of the ban on fishing for this species from 15 March to 10 May if the river is not covered with ice. The same applies to pikeperch – as the ban on fishing for pikeperch in ice-free water applies from 15 April to 15 June, the pro-

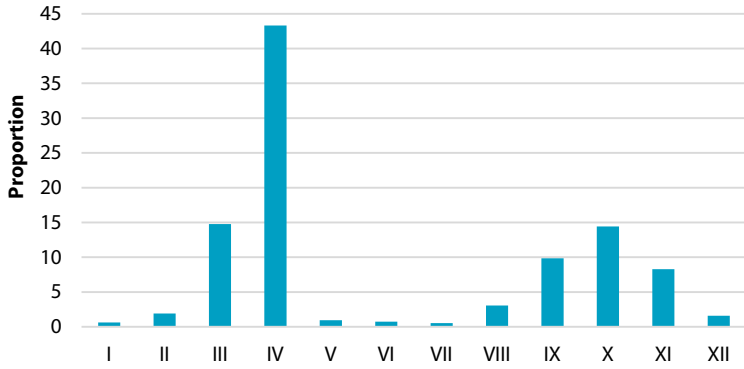


Figure 44. Monthly distribution of official commercial fishery catches (%) from the Emajõgi River, 2009-2018
Source: MoRA.

portion of this species is higher in autumn catches. Tench, which may not be fished with commercial fishing gear from 20 June to 20 July, is also represented in higher numbers in the autumn catches of commercial fishermen (60.2%).

For the purpose of efficient management and conservation of fish stocks, restrictions on fishing have been established for the Emajõgi River which are based on the time and place of concentration of fish. For example, fishing is prohibited from 1 May to 15 June from the mouth of the Emajõgi River up to the beginning of the Koosa River and from 1 April to 30 June in the oxbow lakes of the Emajõgi River from the mouth of the Pedja River up to the Kärevere highway bridge. Fishing with commercial fishing gear is prohibited in the oxbow lakes of the Emajõgi River throughout the year. The all-year ban on using any fishing gear also applies from the source of the Emajõgi River up to the Rannu-Jõesuu highway bridge.

Commercial fishermen used five types of fishing gear on the Emajõgi River from 2009 to 2018. The lion's share of catches – 85.6% on average – was taken using one-wing trap nets (river trap nets), while 11.3% of catches was taken with inshore seines. The share of catches landed with the help of other fishing gear was negligible: trap/fyke nets with a mouth height from 3 m accounted for 1.4%, trap/fyke nets with a mouth height of up to 1 m represented 1.2%, and gill nets accounted for 0.5% of annual catches on average. Pelagic trap nets were used the most infrequently during the years 2009-2018 (in three of the years observed).

In 2018, the value of the registered catches taken by commercial fishermen from the Emajõgi River totalled around 29,000 euros based on first-sale prices, including 20,000 euros for bream. The highest price per kilogram was paid for eel (€10/kg), followed by pikeperch, perch and pike (€2.97, €1.77 and €1.59 per kg, respectively). Bream caught from the Emajõgi River is relatively highly valued (€0.50/kg in 2018), compared to, for example, bream caught in Lake Võrtsjärv, for which the first-sale price was only €0.22/kg in 2018.

Several studies have been conducted with a view to optimising the management of fish stocks in the Emajõgi River. A study focusing on fish fauna, including bream, was conducted from 2015 to 2017. In the final report on the study, Wildlife Estonia assessed the current management of bream fishery as sustainable. A study on asp is under way to gather data on whether fishing for asp could be permitted on a limited basis. In addition, a study of the migration of eel downstream of the Emajõgi River has been launched.

LAMPREY FISHING IN ESTONIAN RIVERS

Lamprey is highly valued in Estonia and in our neighbouring countries. This is also reflected in the estimated first-sale price paid for lamprey (€4.37/kg); in 2018, only the prices paid for eel and for salmonids were higher than that. In terms of the price per kilogram, lamprey outstripped pikeperch, perch and dozens of other fish species.

According to official data, lamprey was caught in 26 watercourses in Estonia (Table 33), and in a negligible amount also in the coastal sea in 2018. Only commercial fishing is allowed. Lamprey catches amounted to 40.9 and 24.9 tonnes in 2017 and 2018, respectively (around 590,000 and 355,000 individuals). The biggest catches continue to be taken from the Narva River, while the sequence of the other lamprey rivers in terms of catches varies from year to year. In 2018, Reiu, Pärnu, Jägala, Rannametsa and Vääna rivers stood out more clearly catchwise: the catch taken in each of these six rivers exceeded half a tonne and represented 88% of the total lamprey catch in Estonia. During two years, higher catches have also been taken in the Pirita River. The catch taken in 2018 was lower than the catch of 2017 in almost all of the lamprey rivers. Among key rivers, lamprey catches declined to a more considerable extent in the Jägala and Pirita rivers, and to a lesser extent in several rivers in southwest Estonia, such as the Pärnu, Reiu and Rannametsa rivers. Catches increased in the Nõva River and in the Uruste Stream, which flows into the Audru River.

Looking at the official lamprey catches over the last decade, one could argue that the catch of 2017 was average and the figure for 2018 was low. Table 34 details lamprey catches taken in 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 70% (58-78%) over ten years. Only around 1% of the total catch is taken in coastal sea.

Lamprey catches have varied: during the unfavourable times of the last century, the lowest annual catch totalled 3 tonnes, while the highest catch amounted to 102 tonnes. This instability is partly due to the fact that individuals of one year class are fished for and the catch depends on the abundance of the particular year class. Against this backdrop, catches taken in the past decade have been relatively stable.

The estimated value of the lamprey catch, based on first-sale prices, amounted to around 204,000 euros in 2017 and around 109,000 euros in 2018. The catch value varied across regions. The lion's share of the revenue (around 70,000 euros in 2018) was earned by fishermen fishing on the Narva River and this revenue 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 2017 and 2018 (Table 35). The bulk of the maximum number of cone traps (15,000) was allocated for 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 inland water bodies, as well (Table 36). The proportion of lamprey fyke nets in the total catch is less than 10%.

Table 33. Commercial lamprey catches (kg) taken in Estonian water bodies in 2017 and 2018 according to official data

Fishing ground	2017	2018
Narva River	**26 874**	**16 492**
Other inland water bodies	**13 944**	**8284**
Reiu River	3168	2180
Pärnu River	1857	1520
Jägala River	2260	615
Pirita River	1058	211
Rannametsa River	626	556
Vääna River	572	522
Kunda River	684	243
Pudisoo River	528	342
Keila River	454	337
Lemme River	469	275
Loode Stream	318	214
Häädemeeste River	312	203
Selja River	335	168
Audru River	278	98
Valgejõgi River	307	64
Uruste River	41	314
Nõva River	88	138
Treimani Stream	125	93
Mustoja River	129	47
Riguldi River	105	70
Pada River	84	24
Kadaka Stream	39	35
Loobu River	37	12
Priivitsa Stream	8	5
Vainupea River	57	–
Vasalemma River	5	–
Toolse River	1	–
Coastal sea	**120**	**75**
Gulf of Riga	120	75
Total	**40 938**	**24 851**

Source: MoRA.

The largest share of the lamprey catch taken with fyke nets (59% of the total fyke net catch) originated from the Pudisoo River in 2018; considerable catches were also taken from the Jägala River, Valgejõgi River and Uruste Stream (32% of the total fyke net catch). The remaining 9% was divided between six watercourses.

The temporal distribution of lamprey fishery is described in Figure 45. The early increase in yield in 2017 could have been due to the abundance of precipitation that began in September and continued in the subsequent autumn months, which increased the flow in rivers and activated lamprey migration. By contrast, the autumn of 2018 was

Table 34. Official lamprey catches (t) in Estonia, 2009-2018

Year	Total catch	Narva River	Other inland water bodies	Coastal sea
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
2016	30.8	21.2	9.5	0.1
2017	40.9	26.9	13.9	0.1
2018	24.9	16.5	8.3	0.1
Total	**399.2**	**282.6**	**112.8**	**3.9**

Source: MoRA.

Table 36. Official commercial lamprey catches (kg) in 2017 and 2018, by fishing gear

Fishing ground and gear	2017	2018
Narva River	**26 874**	**16 492**
cone trap	26 874	16 492
Other inland water bodies	**13 944**	**8284**
cone trap	11 982	7710
lamprey fyke net	1962	574
Coastal sea	**120**	**75**
trap/fyke net with a mouth height of 1-3 m	103	31
trap/fyke net with a mouth height of up to 1 m	11	4
pelagic trap/fyke net	6	40
Total	**40 938**	**24 851**

Source: MoRA.

Table 35. Maximum number of lamprey fishing gear permitted to be used in inland water bodies in 2018 under commercial fishermen's permits

County	Cone trap	Lamprey fyke net
Ida-Viru	15 000	
Pärnu	2000	15
Harju	700	45
Lääne-Viru	500	17
Lääne	100	
Saare		4
Total	**18 300**	**81**

Source: State Gazette.

less rainy than average and catches were therefore smaller.

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 production 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).

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 opening of the Sindi dam for migration of fish in the Pärnu River is worth highlighting in this regard. The first signs have already appeared that lamprey is once again having access to its historical spawning grounds upstream of Sindi in the Pärnu River and its tributaries (e.g. the Navesti and Lintsi Rivers). 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 stock 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 the 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. The situation is expected to improve further in the coming years thanks to the restoration of the quality of river habitats.

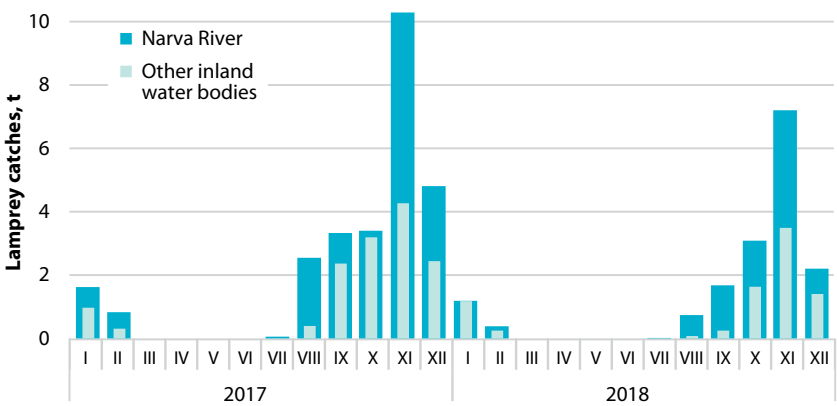


Figure 45. Dynamics of official commercial lamprey catches taken in Estonian inland water bodies in the different months of 2017 and 2018
Source: MoRA.

Recreational fishing

The enhancement of catch data collection was an important change introduced in 2018 in the area of recreational fishing. On 1 January 2018, an amendment to the Fishing Act entered into force prohibiting the issuance of fishing cards to persons who had failed to submit catch data under a fishing permit previously issued to them. Prior to that, such fishermen could only be punished through misdemeanour proceedings. Such proceedings were, however, initiated rather rarely, as other activities were given a much higher priority in terms of monitoring and conservation of fish stocks. Under the new regime, the failure to submit data is automatically reported to the system, resulting in the entry into force of the ban on the purchase of a new fishing card. The change proved quite effective as early as in the first year of its implementation: the proportion of fishermen failing to report their catches dropped from 40% to 13% in 2018.

Recreational fishing in figures

The number of permits attesting to an effective recreational fishing right was 106,053 in 2018 (Figure 46)[1]. This is approximately 500 less than in 2017, which is a marginal change. One-day fishing rights remained the most popular option, followed by annual and six-month fishing rights, with the number of seven-day fishing permits being the lowest.

Foreign nationals have somewhat different preferences: while one-day fishing rights prevail among them, too, their second preference is for seven-day fish-

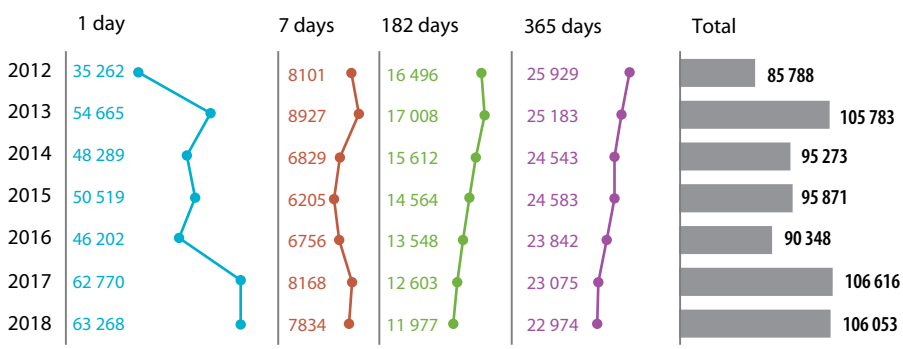


Figure 46. Number of persons with recreational fishing right by duration of the right, 2012-2018 Source: MoE.

[1] Fee for recreational fishing rights payable when fishing with hook gear. A person can purchase several fishing rights with different periods of validity (e.g. one-day permits) during a year.

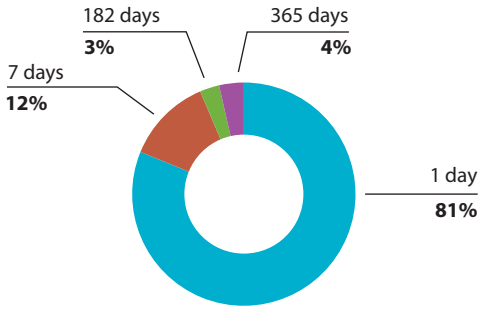


Figure 47. Proportion of persons with recreational fishing right by duration of the right in 2018
Source: MoE.

ing rights (Figure 47), which represented 44% of all weekly fishing rights. People probably come from abroad to fish in Estonia for two or more days. While it would be more advantageous to buy two one-day permits (2.64 euros) for two-day fishing instead of a seven-day permit (3.51 euros), the preference for seven-day permits could be explained by convenience: it is easier to buy one permit for a longer period and then go fishing and not worry about the right to fish. In addition, it is easy to forget to buy a new permit on the second day, as no reminder is sent to the buyer on the expiry of a one-day fishing right.

The number of fishing permits issued to foreign nationals is noteworthy: it exceeded 8000 for the second consecutive year (Figure 48); in 2017 the number of fishing permits purchased increased sharply, by almost 66%. In the absence of data, the reasons for this increase can only be guessed.

In 2018, 21,737 fishing cards were issued for recreational fishing, or nearly 3000 less than a year ago (Table 37). Traditionally, the highest number of fishing cards was issued for fishing with gill nets, followed by permits for fishing with hook gear in protected areas and fishing cards for trout and salmon rivers. The number of fishing cards issued for gill net fishing increased in 2017 and the increase was directly linked to the introduction of weekly permits[2] for fish-

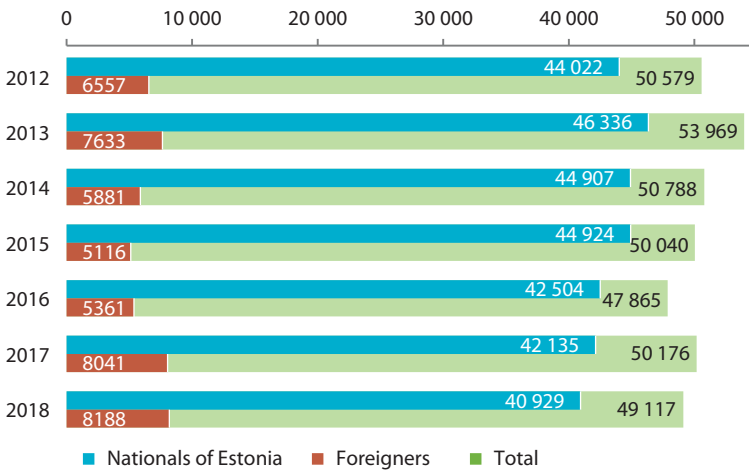


Figure 48. Number of persons with recreational fishing rights by origin, 2012-2018
Source: MoE.

[2] 25% of the opportunities for fishing with gill nets were allocated in the form of weekly fishing cards and the rest in the form of monthly fishing cards.

Table 37. Number of fishing cards issued, by fishing gear and ground, 2014-2018

Fishing gear	Fishing ground	2014	2015	2016	2017	2018
Gill net	**Total**	**7673**	**7700**	**7538**	**11 385**	**11 077**
	Sea	6204	6271	6320	9409	7907
	Lakes Peipsi, Pihkva and Lämmijärv	864	820	815	771	1442
	Rivers and small lakes	605	609	403	1205	1728
Simple hand line, hand line, spinning reel, fly hook, pulling device	**Total**	**3867**	**4629**	**3848**	**4273**	**3701**
	Endla Nature Reserve	755	1272	1055	1158	1138
	Matsalu National Park	1347	1802	1811	1719	1669
	Silma Nature Reserve	1765	1555	982	1396	894
Spinning reel, fly hook	**Total**	**2982**	**2722**	**4587**	**6236**	**4318**
	trout fishing grounds	1087	1069	980	1222	1096
	salmon fishing grounds	1895	1653	3607	5014	3222
Longline (100 hooks)	**Total**	**1159**	**1140**	**924**	**952**	**849**
	Sea	263	288	155	155	93
	Lakes Peipsi, Pihkva and Lämmijärv	61	50	38	36	27
	lake Võrtsjärv	225	291	188	197	215
	Emajõgi River	136	102	114	104	95
	Other lakes and rivers	474	409	429	460	419
Crayfish trap, dip-net	Lakes, rivers	946	906	997	1408	1326
Harpoon gun and harpoon	Lakes Kuremaa and Saadjärv	409	401	451	318	372
Hoopnet, dragnet	Small lakes	42	73	51	43	28
Trap net	Small lakes	–	–	28	62	66
	Total number of fishing cards	**17 078**	**17 571**	**18 424**	**24 677**	**21 737**

Source: research and recreational fishing database.

ing in the sea. There is still little interest in fishing with hoopnets, dragnets and trap nets. As to the latter, the lack of interest is probably due to the fishing season of late summer and autumn, when fish are rarely caught in traps. In Finland, where trap nets originate, they are also used for fishing in spring, and mainly for roach. Trap nets, which are mainly used for catching fish of low value, could be permitted to be used around the year in Estonia. This would help to catch more of non-predatory fish.

There were 40,929 fishermen with a unique Estonian personal identification code in 2018 (Table 38). If we include in the calculation the people who can fish without a charge (pupils, disabled persons, pensioners; around 30% of the above number), then the number of people fishing with hook gear totalled 53,207 in 2018. The number of fishing card holders with an Estonian personal identification code was 9778. Foreigners did not show much interest in fishing cards – there were 47 card buyers. This figure has been in the same order of magnitude in recent years. If we add up the holders of fishing rights and fishing cards with an Estonian personal identification code and deduct the number of those fishing under both rights, the final result is 58,080 Estonian fishermen with unique personal identification codes. To arrive at the total number of recreational fishermen, we have to add around 25% representing those fishing with a simple hand line (they do not have to pay for the fishing right), those who fail to pay for the fishing right, and foreign nationals.

Fishing fees

In 2018, the Ministry of Finance received 450,684 euros for recreational fishing rights and 291,688 euros for fishing cards, thus a total of 742,372 euros for recreational fishing (Table 39). For commercial fishing rights 803,077 euros were received in 2018. In addition, 22,459 euros were paid for special fishing rights (Table 39), mostly comprising fees for the sale of fish caught mainly from Lake Peipsi under special fishing permits. Fees for fishing for breeder fish have been received in some years, but not in 2018. In general, these amounts have been low, below 100 euros.

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 2017, grants totalling 1,678,457 euros were awarded under the environmental programme of the EIC for 53 fisheries-related projects. Of these, 30 projects (319,158 euros) involved, to a lesser or greater extent, recreational fishing.

Table 38. Number of recreational fishermen, 2012-2018

	2012	2013	2014	2015	2016	2017	2018
Fishing right holders with an Estonian personal identification code	44 029	46 339	44 916	44 924	42 504	42 135	40 929
Holders of free fishing rights (30% of those fishing for a fee)	13 209	13 902	13 475	13 477	12 751	12 641	12 279
Fishing card holders with an Estonian personal identification code	7260	8341	8545	9093	9189	9943	9778
Total	**64 498**	**68 582**	**66 936**	**67 494**	**64 444**	**64 719**	**62 986**
Number of both fishing right and fishing card holders	3430	4072	3779	4593	4618	5163	4906
Number of Estonian recreational fishermen	**61 068**	**64 510**	**63 157**	**62 901**	**59 826**	**59 556**	**58 080**

Source: MoE.

Table 39. Fees for commercial, recreational and special fishing rights received from 2010-2018 (€10^6)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Commercial fishing									
trawling fee	0.290	0.197	0.188	0.204	0.226	0.217	0.195	0.218	0.212
coastal fishing fee	0.318	0.373	0.282	0.318	0.346	0.356	0.366	0.404	0.386
distant-water fishing fee	0.231	0.170	0.215	0.174	0.194	0.179	0.199	0.218	0.206
total commercial fishing fees	**0.839**	**0.740**	**0.685**	**0.696**	**0.766**	**0.751**	**0.761**	**0.840**	**0.803**
Recreational fishing									
fishing card fee	0.152	0.214	0.198	0.267	0.186	0.279	0.299	0.310	0.292
fishing fee	0.364	0.337	0.546	0.522	0.488	0.478	0.444	0.460	0.451
total recreational fishing fees	**0.516**	**0.551**	**0.743**	**0.789**	**0.675**	**0.757**	**0.743**	**0.770**	**0.742**
Special fishing									
total special fishing fees		**0.011**	**0.009**	**0.029**	**0.022**	**0.015**	**0.023**	**0.014**	**0.022**
Grand total	**1.356**	**1.302**	**1.437**	**1.514**	**1.463**	**1.523**	**1.527**	**1.624**	**1.568**

Note: the trawling fee is a fishing fee payable by companies fishing in the Baltic Sea under the fishing permit of a fishing vessel; the coastal fishing fee is a fishing fee payable by companies fishing in the Baltic Sea (and inland bodies of water) under the fishing permit of a fisherman; the distant-water fishing fee is a fishing fee payable by companies fishing outside the jurisdiction of Estonia under the fishing permit of a fishing vessel; the special fishing fee comprises a fee payable for the right to fish under a special fishing permit and a fee for the sale of fish caught under a special fishing permit.

Sources: Environmental Board, MoE, MoRA.

Recreational fishing statistics

The amendment introduced to the Fishing Act in 2018 significantly improved the reporting of catches taken under fishing cards[3,4]. While almost half of the reports were not submitted in the past, now nine of ten reports are received. This will enable a more accurate summary of fishing results to be compiled for the first time.

Reporting is a relatively tedious extra obligation for fishermen. For some people, it can mainly be a matter of getting the report submitted and having obstacles to the acquisition of a new fishing card removed. Therefore, they would not pay much attention to the quality of the data set out in the report. The report is often submitted several months later, when it can be difficult to remember the quantities caught. In such reports, catches are often rounded to tens, hundreds, and rarely to thousands (50, 100, 1000). In the absence of parallel control mechanisms, as in the case of commercial fishing (prior notification, first purchasing), it is not possible at present to assess the reliability of recreational fishing data. It can be assumed to be in the range of 20-30%. A separate study should be conducted to obtain a more accurate result.

According to the catch reports submitted to the Environmental Board, recreational fishermen caught 213 tonnes of fish in 2018 (Tables 40, 41 and 42). A total of 46 species of fish were caught from all water bodies. The quantity of roach was the highest (45,288 kg), followed by flounder (43,615 kg), perch (32,364 kg), pike (16,577 kg) and crucian carp (12,496 kg). Crucian carp may

Table 40. Recreational fishing catches (kg) landed from sea on the basis of fishing cards in 2018

Species	Catch	Species	Catch	Species	Catch
Flounder	43 030	Turbot	1003	Turbot	15
Perch	24 545	Pikeperch	953	European chub	12
Crucian carp	11 050	Silver bream	775	Angler	12
Pike	7037	Bream	657	European eel	6
Sea trout	6357	Rudd	437	European eelpout	5
Ide	6242	Tench	425	Salmons (not specified)	5
European whitefish	4934	Smelt	384	European plaice	3
Roach	4297	Cod	302	Four-horned sculpin	3
Vimba bream	3427	Rainbow trout	272	Lake Peipsi (dwarf) smelt	1.6
Salmon	3307	Sprat	241	Twaite shad	1.5
Garfish	3197	Brown trout	126	Vendace	1.3
Herring	2128	Carp	126	Lumpfish	1.2
Gibel carp	2018	Ruff	108	Shorthorn sculpin	0.5
Round goby	1608	Burbot	58	Lamprey	0.1

Allikas: teadus- ja harrastuskalapüügi andmekogu.

3 A fishing card is required for fishing with a gill net, longline, hoopnet, dragnet, crayfish dip-net or trap, trap net and harpoon, as well as for fishing in Silma and Endla nature reserves, Matsalu National Park, Central Estonian trout rivers and North Estonian salmon and sea trout rivers.

4 Until the end of the 1990s, other recreational fishermen (those using hook gear) were also required to submit reports. Later this data was no longer collected.

also have been confused with gibel carp whose incidence has increased recently. The smallest catches were those of twaite shad (1.5 kg), lumpfish (1.2 kg), bleak (0.8 kg), shorthorn sculpin (0.5 kg) and lamprey (0.1 kg).

As expected, the largest quantities were caught using gill nets (90%), followed by hook gear used in protected areas (7%) and spinning reels and fly hooks used in salmon rivers (1%). Trap nets (78 kg) and dragnets (1 kg) were used the most frequently. Among salmon rivers, the largest catches of salmon and sea trout were taken from the Jägala River (400 kg), followed by Purtse River (368 kg), Selja River (44 kg) and Vääna River (198 kg). Among the trout rivers of Järva County, the largest quantities of brown trout were caught in the Esna River (161 kg), Preedi River (137 kg), Prandi River (122 kg) and Pärnu River (81 kg).

In 2018, 32,229 fishing-size crayfish were caught in 87 water bodies[5]. The largest catch was taken from the Võlupe River in Saare County (6838 individuals), followed by Lake Pangodi in Tartu County (3426 individuals), the Punapea River in Saare County (2441 individuals) and Lake Väinjärv in Järva County (1834 individuals). The amount of crayfish caught in the water bodies of Saare County accounted for slightly more than half of the total catch taken in Estonia.

Table 41. Recreational fishing catches (kg) taken from Lakes Peipsi, Pihkva and Lämmijärv on the basis of fishing cards in 2018

Species	Catch	Species	Catch
Roach	35 455	Pikeperch	57
Perch	4168	Lake Peipsi (dwarf) smelt	47
Silver bream	949	Burbot	36
Rudd	811	Lake Peipsi whitefish	21
Crucian carp	756	Carp	9
Bream	522	European chub	9
Pike	514	Dace	8
Ide	145	Tench	6
Gibel carp	127	Vimba bream	5
Ruff	109	Brown trout	1

Source: research and recreational fishing database.

Table 42. Recreational fishing catches (kg) taken from Lake Võrtsjärv on the basis of fishing cards in 2018

Species	Catch	Species	Catch
Pikeperch	4054	Asp	14
Bream	890	Rudd	13
Pike	885	Tench	6
European eel	197	Ide	6
Perch	194	Roach	6
Crucian carp	58	Silver bream	3
Gibel carp	48	Carp	2
Burbot	15	Ruff	1

Source: research and recreational fishing database.

[5] Crayfish is only permitted to be caught using crayfish traps or dip-nets.

Aquaculture

Overview of sector

According to the data of the Veterinary and Food Board, 55 licensed (recognised) companies were operating in the aquaculture sector in 2018; 30 of them farmed fish and 25 were engaged in crayfish farming (Figures 49 and 50). Compared to 2017, production increased by 74 tonnes in 2018 (Table 43). The total production amounted to 943 tonnes, which can be considered a record quantity in the Estonian aquaculture sector since 1992.

The average temperature was relatively high in the summer months of 2018, while rainfall was low in some regions. This caused perishing of fish and other problems in several rainbow trout farms. However, one new farm and farms with cooler water conditions were able to increase their fish production.

Figure 49. Recognised and operating fish farms in 2018
Sources: Land Board, Veterinary and Food Board.

1 Põlula Fish Farm of the State Forest Management Centre
2 Simuna Ivax OÜ Äntu Fish Farm
3 Simuna Ivax OÜ Nõmmeveski Fish Farm
4 Simuna Ivax OÜ Käruveski Fish Farm
5 Simuna Ivax OÜ Mõdriku Fish Farm
6 Aviiso OÜ
7 Aravuse Kalakasvandus OÜ
8 Härjanurme Fish Farm
9 Leokitalu OÜ
10 Riina Kalda, CARPIO fish holding
11 Redstorm OÜ
12 AquaMyk OÜ
13 Pähkla Vähi- ja Kalakasvatus OÜ
14 SK Trade OÜ
15 Karilatsi Kalamajand OÜ
16 Ösel Harvest OÜ
17 Neli Elementi OÜ
18 For Angula OÜ
19 Paadi Talu OÜ
20 Lapavira OÜ
21 BM Trade OÜ
22 Krei-Jõe OÜ
23 Aquaculture training and testing base of Järva County Vocational Training Centre
24 Joala Fish OÜ

Table 43. Sales volume of Estonian fish farms' raw fish (t), 2008-2018

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Eel	46.0	30.0	20.3	2.0	*	*	127.0	*	*	*	*
Crayfish	0.7	2.0	0.4	0.6	0.1	0.4	0.2	0.6	0.7	0.8	0.6
Carp	52.3	45.4	39.4	37.5	38.2	43.7	*	*	33.8	*	*
Rainbow trout	333.8	549.0	487.5	333.8	455.3	465.5	569.6	559.0	680.4	702.2	804.1
Other fish	50.9	26.1	49.6	18.7	86.8	223.4	172.1	238.7	152.9	167.4	139.0
Total	**483.7**	**652.5**	**597.2**	**392.6**	**580.4**	**733.0**	**868.9**	**798.3**	**867.8**	**870.5**	**944.0**
Fish roe for human consumption	6.7	7.4	4.5	0.1	4.1	5.0	3.1	7.3	4.9	3.8	3.2

* Data cannot be published due to the data protection principle. Source: Statistics Estonia.

There were no significant changes in the structure of the farmed species. Rainbow trout continued to account for the bulk (85%) of the production. Other species farmed in larger quantities include eel, carp, sturgeon and African catfish. Data on the sales of eel and carp are also collected by Statistics Estonia, but since there are only few companies that farm these species, their data cannot be published due to data protection requirements.

Figure 50. Crayfish farms recognised by the Veterinary and Food Board, 2018
Sources: Land Board, Veterinaryand Food Board.

1 Härjanurme Fish Farm
2 Astacus OÜ
3 Pähkla Vähi- ja Kalakasvatus OÜ
4 Peipus OÜ
5 Vana-Tooma talu OÜ
6 Ösel Harvest OÜ
7 Metsa Johani Farm
8 TP Invest OÜ
9 Vähilakk OÜ
10 Vorites OÜ
11 Jüri Lest FIE
12 Kitse-Ado Farm
13 Ülejõe Vähi- ja Kalakasvatus OÜ
14 Liki Mõis OÜ
15 Palupera-Agro OÜ
16 Maimar OÜ
17 Selimäe OÜ
18 Põlde Vähk OÜ
19 Nõmme Puhkebaas OÜ
20 Lümanda Lihaveis OÜ
21 Ironfish OÜ
22 Arkadel Invest OÜ
23 Vareste Invest OÜ
24 Peetri A-23 Farm

In 2018, fish farming in net cages was resumed in Estonia. OÜ Red-storm started farming rainbow trout in Tagalahe, Saare County, and plans to farm fish with a maximum increment of 100 tonnes from 2019.

In addition to the high summer temperatures of water, a fish disease was encountered. The Veterinary and Food Board detected an outbreak of infectious haematopoietic necrosis (IHN) in two fish farms. This viral disease, which rapidly kills juvenile salmonids, is primarily found in the fry of rainbow trout and other Pacific salmonids. Fish that have survived IHN can continue to be virus carriers. There is no cure for IHN and all farm fish must be killed and replaced to get rid of the disease. In 2017, IHM was first detected in four Finnish fish farms, as well.

There are two representative organisations in the sector: the Estonian Association of Fish and Crayfish Farmers and the Estonian Aquaculture Association. The Ecofarm Fish Breeders Association acts as a union of five fish farmers. The objective of this producer organisation is to improve the marketing conditions for its members' production and to help promote aquaculture. Products are marketed under the Farmare trademark.

■ **Rainbow trout** The production of rainbow trout as the most common farmed fish species amounted to 804.1 tonnes in 2018, which is the best result since 1992. The average world market price of salmon, which affects the price of rainbow trout, has remained at the same level for three years. In 2018, according to the Fish Pool Index (FPI) of Nasdaq OMX Oslo Stock Exchange, the average price of gutted fish was 6.33 euros per kilogram. A stable price also encourages the farming of rainbow trout in Estonia.

Among salmonids, Arctic char is also farmed in Estonia in growing quantities. The farming of European whitefish and peled (northern whitefish) is being tested on a small scale.

■ **Crayfish farming** There were 25 crayfish farms recognised by the Veterinary and Food Board in Estonia in 2018. The production volume of crayfish decreased by 0.2 tonnes, which means that 0.6 tonnes of crayfish were farmed in total.

■ **Algae and mussel cultivation** There was no commercial algae and mussel production in the Estonian coastal sea in 2018. In the Baltic Sea countries, the large-scale cooperative study "Baltic Blue Growth" is underway with a view to setting up mussel farms to support the Baltic Sea countries' blue growth and to eliminate diffuse pollution. The results of the study will be published in 2019.

■ **Fish restocking** Salmon, European eel, European whitefish, Atlantic sturgeon, asp, pikeperch and crayfish were introduced into Estonian waters in 2018 (Table 44). The largest quantities of salmon were released into the Pärnu and Valgejõgi rivers, 119,100 and 75,300 individuals, respectively. The largest quantities of eel were introduced into lakes Saadjärv (227,300) and Võrtsjärv (108,400). In order to restore the Atlantic sturgeon population, 30,000 young sturgeons were released into the Narva River in 2018. In addition, 3000 crayfish were taken from Lake Pangodi and introduced into other water bodies.

Research and development

Formal education in fish farming is offered at two educational institutions: the 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 (curriculum "Fishery and aquaculture"), Järva County Vocational Training Centre prepares qualified fish farm workers (qualification level 4).

Grants At the end of 2018, the measure "Aid for reducing the negative environmental impact of aquaculture companies" was implemented. The objective of the measure is to increase the energy efficiency of aquaculture companies and encourage the uptake of more sustainable technologies and solutions by such companies, thereby reducing their environmental impact.

With the help of the funds of the European Maritime and Fisheries Fund (EMFF), the Rural Development Foundation offers investment loans to companies starting or engaged in the production of aquaculture products.

Table 44. Fish and crayfish juveniles released in water bodies in 2018

Species	Age/Size	Total (pcs)
European eel	Larvae	602 118
Salmon	two-year-old	25 275
	two-summer-old	9 256
	one-year-old	79 497
	one-summer-old	170 798
	Larvae	75 000
European whitefish	one-summer-old	43 774
Atlantic sturgeon	Fry	30 000
Asp	one-year-old	2 000
Pikeperch	one-summer-old	1 000
Crayfish	fishing-size	3 000

Sources: Ministry of the Environment, Estonian University of Life Sciences.

Estonian fish processing industry

General overview of sector

According to the data entered in the Commercial Register, there were 69 companies in Estonia in 2018 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 enterprises were small, as their average number of employees was less than 50. Compared to 2017, the number of micro- and small enterprises decreased in 2018. A more detailed overview of the groups of enterprises is presented in Figure 51.

On average,[2] 1609 people were employed by fish processing companies in 2018. Looking at the age structure of the companies, 48 (70%) of the 69 companies had been operating for more than ten years. In 2018, the total sales revenue of the companies amounted to 149.8 million euros, with processing and canning of fish, crustaceans and molluscs accounting for 91% of the revenue, i.e. 136.2 million euros. Compared to the previous year, the total sales revenue of companies increased by 1.5%.

Processing and canning of fish, crustaceans and molluscs was an auxiliary activity for 15 companies in 2018. Their sales revenue from this segment

Table 45. Number of processing facilities of fish processing companies in 2017 and 2018 by county

County	Number of processing facilities	
	2017	2018
Pärnu	26	25
Harju	23	23
Tartu	10	10
Saare	8	8
Ida-Viru	6	6
Lääne	6	5
Jõgeva	4	4
Põlva	3	3
Lääne-Viru	2	2
Hiiu	1	1
Viljandi	1	0
Total	**90**	**87**

Sources: Commercial Register, Veterinary and Food Board.

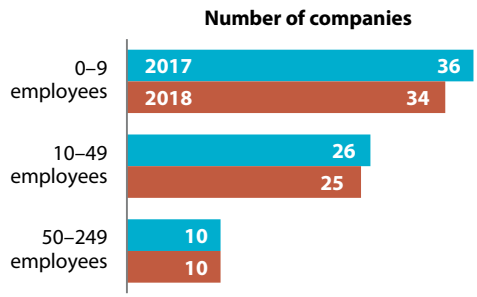


Figure 51. Number of companies whose main business comprised processing and canning of fish, crustaceans and molluscs based on average number of employees in 2017 and 2018
Source: Commercial Register.

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

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

amounted to 981,000 euros. A year before this figure had amounted to 552,000 euros. Most (more than a half) of the fish processing companies' processing facilities were located in Pärnu and Harju counties (Table 45).

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

Compared to 2017, the number of fish processing companies declined slightly (Table 46). The total sales revenue of the companies increased by 1.5% and the average number of employees decreased by 33. The average annual wage cost per employee was 10,720 euros in 2018, up 7% from the preceding year.

Of the 69 fish processing companies, 41 (59%) closed the financial year 2018 with a profit, and the fish processing industry as a whole earned a profit of 1.5 million euros (in 2017, 68% of companies closed the year with a profit and the industry made a profit of 7 million euros). Gross value added amounted to 27 million euros in 2018. The combined assets of fish processing companies were worth 156 million euros, with fixed assets accounting for 64% (99 million euros). Compared to 2017, investments in fixed assets increased by 32% in 2018. The amount invested in fixed assets was 8 million euros in 2017 and nearly 11 million euros in 2018. The debt ratio, which shows the share of debt (liabilities) in the funding of the assets of companies, was 53% in 2018. The production-related operating costs of fish processing companies totalled 146 million euros in 2018. Raw materials and supplies accounted for the bulk of the costs (64%). The proportions of labour and energy costs in operating expenses were 16% and 3%, respectively (Figure 52).

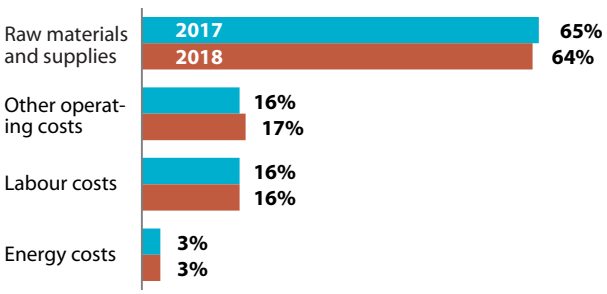


Figure 52. Proportions (%) of operating costs of companies whose main business is fish processing, 2017 and 2018
Source: Commercial Register.

Table 46. Basic and economic indicators of companies whose main business is fish processing, 2010-2018

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of companies	56	59	66	60	64	66	65	73	69
Total sales revenue, €10^6	111	137	156	175	187	187	161	147	150
Average number of employees	1891	1871	1907	1954	1972	1935	1763	1642	1609
Average annual wage cost per employee, €	6300	6957	7568	8113	8701	9122	9545	9999	10 720
Gross value added, €10^6	21	20	27	27	26	34	18	28	27
Investments in fixed assets, €10^6	11	11	6	6	10	11	3	8	11
Debt ratio, %	49	50	53	51	54	54	51	51	53

Sources: Statistics Estonia, Commercial Register.

If we compare the basic and economic indicators in the different size classes of fish processing companies (Table 47), it appears that over a half (65%) of the total sales revenue of the fish processing industry in 2018 came from ten medium-sized enterprises (50-249 employees), which accounted to just 14% of the total number of companies. This size class also employed the highest number of people (58% of the total number of employees) and produced 64% of the gross value added. Medium-sized enterprises also paid the highest average wage. Based on the debt ratio, medium-sized enterprises were characterised by a lower risk level than the other two size classes.

The total operating costs of fish processing companies (145.7 million euros) were divided as follows in 2018: microenterprises – 8.8 million euros; small enterprises – 42.9 million euros and medium-sized enterprises – 93.9 million euros. The distribution of operating costs was similar in these size classes (Figure 53), but a higher proportion of energy costs in micro enterprises and a higher proportion of costs of raw materials and supplies in medium-sized enterprises can be observed.

Production and sales

According to the data of Statistics Estonia, Estonian fish processing industry sold 51,200 tonnes of fishery products in 2018. Frozen, salted, spiced, dried, deep-frozen and breaded fish accounted for the bulk of production (Table 48). Compared to 2017, the quantity of production sold remained more or less the same, but the proportions of products sold slightly changed.

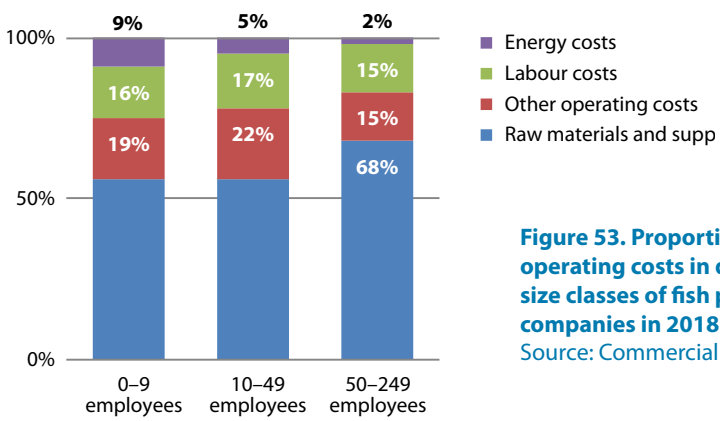


Figure 53. Proportions (%) of operating costs in different size classes of fish processing companies in 2018
Source: Commercial Register.

Table 47. Basic and economic indicators in different size classes of fish processing companies in 2018

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	34	9,1	120	8 890	22,4	1,7	1,7	70
10–49 employees	25	43,7	550	10 108	31,6	2,2	8,2	55
50–249 employees	10	97	939	11 312	44,7	6,9	17,1	46

Source: Commercial Register.

The proportion of exports in the total sales revenue of companies whose main business is fish processing accounted for 59% in 2018, which indicates the high dependence of the Estonian fish processing industry on exports (Table 49). Exports increased by 2.5% compared to the previous year, while domestic sales remained stable.

Table 50 lists the top ten countries in exports and imports of fish and fishery products in 2018 based on the quantities of fish and fishery products. The largest quantities of fish and fishery products were exported to Ukraine: compared to 2017, exports to this country increased by 14%, reaching 40,267 tonnes (35,180 tonnes in 2017). Large quantities of fish were also sold to Belarus, Finland and Denmark in 2018. Estonia imported fish and fishery products mainly from Finland, Latvia, Lithuania and Sweden.

Table 48. Sales of the production (10^3 t) of Estonian fish processing industry by product type, 2010-2018

Fishery products	2010	2011	2012	2013	2014	2015	2016	2017	2018
Fresh and chilled fish meat, fish fillets, minced fish meat	3.7	2.5	2.6	2.3	2.4	2.6	1.7	1.8	2.3
Frozen fish	35.5	32.8	44.2	41.3	34.0	35.7	30.6	33.4	31.8
Smoked fish	1.4	1.9	2.3	1.9	2.5	2.5	1.7	1.8	1.5
Salted, spiced, dried, deep-frozen and breaded fish	19.8	16.5	17.3	14.1	14.1	10.9	10.4	10.1	11.3
Culinary fishery products in oil, marinade or sauce	1.5	1.3	4.7	4.5	5.5	4.9	4.4	4.7	3.8
Fish preserves	5.1	3.8	3.7	3.9	2.6	2.8	0.6	*	0.5
Total	**67.0**	**58.8**	**74.8**	**68.0**	**61.1**	**59.4**	**49.4**	**51.8**	**51.2**

* Data cannot be published due to the data protection principle. Source: Statistics Estonia.

Table 49. Total sales in the domestic market and exports of companies whose main business is fish processing, 2010-2018

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total sales, €10^6	111	137	156	175	187	187	161	148	150
Domestic market, €10^6	30	36	41	47	55	52	58	61	61
Exports, €10^6	81	101	115	128	132	135	103	86	88
Proportion of exports (%)	72	74	74	73	71	72	64	58	59

Source: Commercial Register.

Table 50. Top ten countries in exports and imports (by country of dispatch) of fish and fishery products in 2018. In addition to local production, the table includes the fish and fishery products that passed through Estonia

	Export
Ukraine	40 267
Belarus	11 748
Finland	10 731
Denmark	7 957
Lithuania	4 508
Latvia	4 405
Kazakhstan	2 983
Sweden	2 922
Moldova	2 903
Iceland	2 536

	Import in tonnes
Finland	11 567
Latvia	6 817
Lithuania	5 099
Sweden	4 555
Denmark	1 500
Republic of Korea	1 367
Great Britain	1 197
Czech Republic	1 117
Poland	969
United States of America	868

Source: Statistics Estonia.

Grants

Aid has been granted under the European Fisheries Fund (EFF) measures in Estonia since 2008 when 13 projects were supported. The number of supported projects has continued to grow since then (Table 51). In 2018, aid from the European Maritime and Fisheries Fund (EMFF) was granted in the amount of 12,993,062 euros and paid out in the amount of 17,998,504 euros. A total of 273 grant decisions were made and 366 applicants received payments.

The largest amounts were allocated to Harju, Pärnu and Tartu counties (Table 52). The highest number of aid applications was granted in Pärnu, Harju and Lääne counties. The largest amount of money was paid to applicants from Harju County, followed by Viljandi and Pärnu counties (Table 52). Pärnu, Harju and Lääne counties were the leaders in terms of the number of payments.

Table 51. Number of projects supported by EFF and EMFF from 2008-2018, by year of payment

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of projects for which aid has been granted	9	61	216	269	383	443	259	335	53	221	366

Source: ARIB.

Table 52. Number of grants awarded and disbursed and amounts in euros by county in 2018

County	Awarded		Disbursed	
	number of grants	amount of grants	number of grants	amount of grants
Harju County	43	7 124 416	46	5 652 680
Viljandi County	13	181 867	25	4 322 547
Pärnu County	76	1 963 390	115	2 676 027
Tartu County	19	1 090 467	23	1 588 316
Lääne County	31	659 118	41	819 581
Saare County	21	477 461	24	689 743
Hiiu County	20	215 005	34	502 589
Ida-Viru County	16	755 871	14	494 441
Jõgeva County	18	316 245	28	440 366
Lääne-Viru County	14	158 902	10	407 232
Põlva County	2	50 318	5	389 981
Võru County	0	0	1	15 000
Total	**273**	**12 993 062**	**366**	**17 998 504**

Source: ARIB.

In 2015, the European Maritime and Fisheries Fund (EMFF) was set up for the 2014-2020 programming period. In 2016, the first applications for aid from the EMFF were received and the first payments were made. In 2018, the following grant decisions and disbursements were made.

Measure 1.1. **Aid for fishing innovation**
The budget of the call for applications was 3,000,000 euros. One application was submitted and granted in the amount of 136,568 euros.
Payments totalled 282,481 euros.

Measure 1.15. **Aid for fishing gear improvement**
The budget of the call for applications was 2,121,165 euros. Three applications were submitted for 229,695 euros. Grants were paid to ten applicants in the amount of 316,875 euros.
Payments totalled 1,952,967 euros.

Measure 1.18. **Aid for protection and recovery of marine biodiversity and ecosystems**
The budget of the call for applications was 2,242,465 euros. Eleven applications were submitted for a total amount of 2,242,465 euros. Payments totalled 130,603 euros.

Measure 1.20. **Aid for improving fishing vessels' energy efficiency and for climate change mitigation**
The budget of the call for applications was 3,761,486 euros. One application was submitted, which was granted in the amount of 277,820 euros.

Measure 1.21. **Aid for improving the energy efficiency of coastal fishing vessels**
Three applicants were awarded grants in the amount of 6897 euros.
Payments totalled 9746 euros.

Measure 1.23. **Investment support for fishing ports**
The budget of the call for applications was 620,124 euros.
One application was submitted for an amount of 619,161 euros.

Measure 1.3. **Aid for cooperation between researchers and fishermen**
The total budget for the period is 5,833,013 euros, of which 625,926 euros were paid in 2018.

Measure 2.1. **Aid for aquaculture innovation**
Payments made under the measure totalled 385,594 euros.

Measure 2.2. **Aid for productive investments in aquaculture**
Payments made under the measure totalled 2398 euros.

Measure 2.3. **Aid for reducing the negative environmental impact of aquaculture companies**
The budget of the call for applications was 46,942 euros.
One application was submitted for an amount of 39,374 euros.

Measure 2.6. Aid for cooperation between researchers and aquaculture companies

The total budget for the period is 1,121,880 euros, of which 205,492 euros were paid.

Measure 3.2. Aid for local action groups

The total budget for the period is 2,266,762.62 euros.
Payments made to action groups totalled 549,848 euros.

Measure 3.3. Aid for implementation of local development strategies of fisheries areas

The total budget for the period is 21,207,985 euros. 207 applicants requested a total of 5,599,608 euros. Grants were awarded to 175 applicants in the total amount of 4,036,456 euros. 126 applicants were paid 2,809,043 euros.

Payments totalled 3,985,108 euros.

Measure 3.4. Aid for collaborative activities of action groups

The total budget for the period is 2.5 million euros. 26 applications were submitted for 333,583 euros. 37 applicants were awarded grants in the amount of 432,230 euros. 20 applications were granted in the amount of 300,422 euros.
Payments totalled 344,673 euros.

Measure 4.1. Aid for production and marketing plans

The budget of the call for applications was 303,066 euros. Four applications were submitted for the same amount and were granted in full. Five applicants were awarded grants in the amount of 324,666 euros.
Payments totalled 214,914 euros.

Measure 4.2. Aid for storage of fishery products

Payments totalled 188,862 euros.

Measure 4.3. Aid for finding new markets for fishery and aquaculture products and for promotion campaigns for fishery and aquaculture products

The budget of the call for applications was 400,000 euros. One application was submitted for an amount of 150,000 euros. 11 applicants were awarded grants in the amount of 450,000 euros.
Payments totalled 287,207 euros.

Measure 4.3.2. Aid for the certification of fishery or aquaculture products and for market research

The budget of the call for applications was 33,499 euros.

Two applications were submitted for 29,160 euros.

Measure 4.4.1. Aid for collective investments in the processing of fishery and aquaculture products

Payments totalled 1,554,924 euros.

Measure 4.4.2. Aid for productive investments in the processing of fishery and aquaculture products

Payments totalled 3,811,108 euros.

Measure 4.4.3. Aid for energy and resource audits of fishery and aquaculture product handling companies

The budget of the call for applications was 38,950 euros. Fifteen applications were submitted for a total amount of 60,355 euros, of which five were granted in the amount of 20,915 euros. Nine applicants were awarded grants in the amount of 48,415 euros.

Payments totalled 39,270 euros, incl. 2225 euros for applications submitted in 2018.

Measure 4.4.4. Aid for improving energy and resource efficiency in the processing of fishery and aquaculture products

Two calls for applications have been announced under this measure. The first call was announced in late 2017 and its budget was 9,000,000 euros. Five applications were submitted and granted in the amount of 1,140,529 euros. The budget of the second call for applications was 1,520,655 euros. Six applications were submitted for an amount of 1,005,153 euros. Four applications were granted in the amount of 904,711 euros. Grants in the total amount of 2,503,447 euros were awarded to ten applicants.

Payments totalled 920,337 euros.

Measure 6.1. Aid for fisheries inspection and surveillance

The budget of the call for applications was 1,000,000 euros. Six applications were submitted and granted in the amount of 983,225 euros.

Payments totalled 479,164 euros, incl. 98,036 euros for applications submitted in 2018.

Measure 6.2. Aid for collection of fisheries data

Payments totalled 1,042,270 euros.

Measure 7.1. Technical assistance

The budget of the call for applications was 1,150,620 euros. Two applications were submitted for 1,150,620 euros, of which one was granted in the amount of 774,400 euros. Three applicants were awarded grants in the total amount of 2,014,462 euros.

Payments totalled 728,611 euros.

Measure 8.1. Aid for development of integrated maritime surveillance

The budget of the call for applications was 1,543,708 euros. Two applications were submitted and granted in the amount of 1,462,000 euros.

Measure 8.3. Aid for improvement of knowledge of the marine environment

Payments totalled 257,000 euros.

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