

## CATCH RECONSTRUCTION FOR LITHUANIA IN THE BALTIC SEA FROM 1950–2007<sup>1</sup>

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### ABSTRACT

Total marine fisheries catches by Lithuania (or its equivalent entity during the USSR period) in the Baltic Sea were estimated from 1950–2007. Since 1992, ICES landing statistics have been reporting commercial landings for independent Lithuania, but have not retroactively adjusted their data to attribute landings to Lithuania during the USSR period. Our catch reconstruction used the ICES landing statistics database as a reported data baseline for commercial catches. Additional sources were used to provide data source ‘adjustments’ to ICES landing statistics, as well as estimates of unreported landings, discards, and recreational catches. The resultant reconstructed catch totaled approximately 1.2 million tonnes, which is 1 million tonnes higher than the catch attributed to Lithuania by ICES since 1950. For comparison, from 1992–2007 our reconstructed catch was 48% higher than ICES reported landings of 200,000 tonnes. The main species targeted were cod (*Gadus morhua*), herring (*Clupea harengus*), and sprat (*Sprattus sprattus*). We believe that our reconstruction is a conservative estimate of the total level of exploitation. Increased data collection, transparency, and accessibility to information would have a positive effect on management of the Baltic Sea marine ecosystem.

### INTRODUCTION

Lithuania is the southernmost of the three Baltic republics, has an area of 65,300 km<sup>2</sup> and shares a border to the north with Latvia, a southeast border with Belarus, and Poland and Russia (Kaliningrad exclave) to the southwest (Figure 1). Lithuania declared its independence from the USSR in 1990, in 1991 joined the UN and the World Trade Organization (WTO), and subsequently joined the European Union (EU) in 2004 (Vycius and Radzevicius, 2009). In 2005, the population was estimated at 3,416,000 (UN, 2007), which accounts for approximately 1.2% of the total population of the Baltic. Lithuania has a 12 nautical mile territorial limit (within which only Lithuania is licensed to fish), although Lithuanian fishers have access to areas beyond this boundary. In recent years, the most important fisheries species have been herring (*Clupea harengus*), sprat (*Sprattus sprattus*), and Atlantic cod (*Gadus morhua*).

Lithuania’s fisheries can be divided into four sectors: 1) Baltic open-sea fishing (trawling); 2) Baltic coastal small-scale fishing; 3) Distant Water Fleet fishing outside the Baltic Sea; and 4) inland freshwater fishing.

1. The open-sea fishing fleet in the Baltic is composed mostly of trawlers, mainly targeting herring and sprat in ICES subdivision 26 (Figure 1), and less importantly cod, flounder (*Platichthys flesus*), salmon (*Salmo salar*), bream (*Abramis brama*), sea trout (*Salmo trutta*), and other miscellaneous fishes (ICES, 2007). As of 2004, there were 45 trawlers between 24 – 40 m in length and 15 vessels between 12 – 24 m long using otter bottom or otter pelagic trawls. There were also 15 gillnet vessels, although some of the larger “trawl” vessels also use gillnets, and less occasionally, drift nets and longlines for targeting cod (ICES, 2007). Drift gillnets have been prohibited for use in the Baltic Sea by the EU since January 2008.

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2. An estimated 200 small fishing vessels operate in Lithuania's coastal areas (FAO, 2009). The Baltic coastal small-scale fishing fleet has traditionally been important for coastal people, and although it does not contribute significantly to GDP or exports, continues to have local importance. Species such as cod, herring, smelt (*Osmerus eperlanus*), pikeperch (*Sander lucioperca*), perch (*Perca fluviatilis*), and vimba (*Vimba vimba*) are targeted with boats under 12 m (ICES, 2007).

3. The Distant Water Fleet was developed during the Soviet period. Landings decreased in 1990 from 300,000 tonnes to only 33,000 tonnes in 1997 as a result of increased fuel prices, ageing vessels, and competition from foreign markets. More recently, landings have been increasing, but in 2006 were still only about 30% of the 1990 landings (Vycius and Radzevicius, 2009). This fishery will not be considered further in this report.

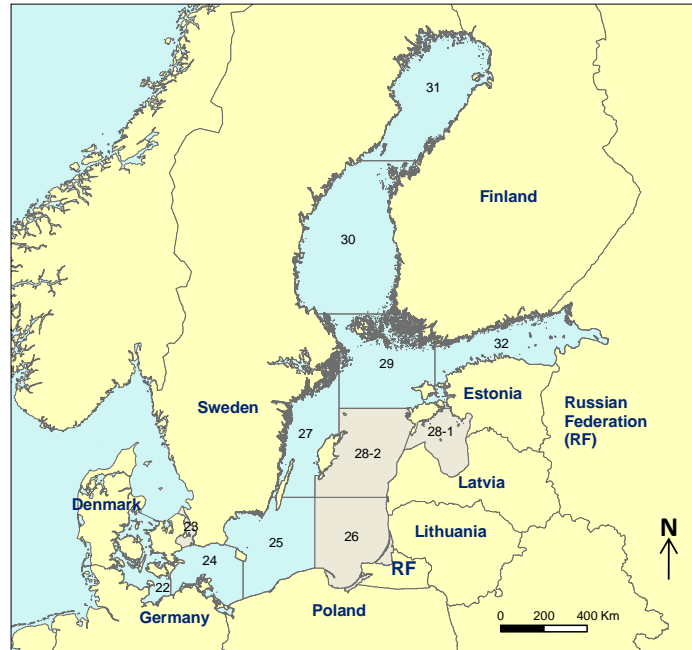
4. The inland freshwater fishery is mainly based around the Curonian Lagoon, the Kaunas, Antaliepte, and Elektrenai reservoirs; and the Lower Nemunas basin. Landings accounted for approximately 2% of total reported landings in 2006. This fishery is not accounted for in the following analysis.

In 2006, landings from the Baltic Sea and its coastal fisheries accounted for approximately 10% of the total fish landed in Lithuania, while approximately 88% came from the Distant Water Fleet, and 2% from inland fisheries (Vycius and Radzevicius, 2009). Lithuania's reported landings presently account for approximately 1.3% of total reported landings in the Baltic Sea, and during the 1950 – 2007 time period have on average accounted for approximately 1.7%. The Lithuanian Fisheries Department distributes Lithuania's quota (allocated by the EU's Common Fisheries Policy [CFP]) to fishing companies, but for a variety of reasons Lithuania's allocated quota is not always fully utilized (Vycius and Radzevicius, 2009).

The objective of the present study is to estimate total catches (in contrast to reported landings) for Lithuania, from 1950 – 2007, which includes time-series estimates of Illegal, Unreported and Unregulated (IUU) catches, discards, and recreational catches. The focus is on utilizing available knowledge and information sources to derive estimated catch time series for all components, for Baltic Sea waters. The general methodology used relies heavily on previously described approaches for catch data reconstruction (Zeller *et al.*, 2006; Zeller *et al.*, 2007; Zeller and Pauly, 2007).

## METHODS

ICES landings statistics were used as the baseline for our reconstruction of Lithuania's total fisheries catches in the Baltic Sea from 1950-2007 (ICES, 2009). ICES landings statistics present fisheries catches for Lithuania, as a separate entity, only from 1992 onward. Prior to 1990, Lithuania was part of the USSR and fisheries catches for what is now Lithuania were presented as part of USSR landings. ICES has not made retroactive adjustments to the landings statistics to account for the dismantling of the USSR. Therefore, landings data obtained from our collaborators at the Latvian Fish Resource Agency (LATFRA) were used for the 1950-1991 time period. Landings data were provided for the former USSR, disaggregated by country, with separate landings data for Lithuania, Latvia, Estonia and Russia (M. Plikshs, pers. comm., LATFRA).



**Figure 1.** Map of the Baltic Sea with ICES subdivisions and surrounding countries. Lithuania's coastline borders ICES subdivision 26.

All catches that are not included in the ICES landings statistics were considered part of Illegal, Unreported and Unregulated fishing (IUU). Here, IUU catches comprised of four components: a) ‘adjustments’ to ICES landings statistics based on time series data from ICES stock assessment working group data or national government data (i.e., LATFRA); b) ‘unreported’ landings (referred to as ‘unallocated’ catches by ICES); c) ‘discards’ being fish that are caught but not retained; and d) ‘recreational’ catches. The sum of these components plus the officially reported ICES landings statistics provided our total reconstructed catch for Lithuania from 1950-2007.

Our reconstruction represented the main species or groups targeted commercially by Lithuania including cod (eastern stock only; *Gadus morhua*); herring (*Clupea harengus*); sprat (*Sprattus sprattus*); salmon (*Salmo salar*); the flatfishes, which included European flounder (*Platichthys flesus*), European plaice (*Pleuronectes platessa*), and turbot (*Psetta maxima*); and an additional 27 taxa included in a grouping called ‘others’.

### *Illegal, Unreported, and Unregulated (IUU) catches*

These IUU components included a) ‘adjustments’ to ICES landings statistics to estimate to make the best estimate of commercial landings; b) ‘unreported’ landings that did not form a part of ICES landings statistics; c) ‘discards’, which were comprised of four categories, each estimated separately; d) ‘recreational’ catches. Below we provide the data and sources for these components, which together formed the basis for our reconstruction of Lithuania’s total fisheries catches from 1950-2007.

#### Adjustments to ICES landings statistics

Adjustments were made to the publicly available ICES landing statistics using national data obtained from LATFRA and information contained in ICES stock assessment working group reports. The disaggregated landings data obtained from LATFRA were the only source of landings data for Lithuania from 1950-1989. As these were not presented in ICES landings statistics, they were considered adjustments to landings (Table 1). Species specific adjustments were made to landings using ICES stock assessment working group data for salmon from 1990-1996 (ICES, 2008b), for cod from 1991-2007 (ICES, 2007; 2008a) and turbot, a part of our flatfishes group, from 1991-2007 (ICES, 2008a). Landings for 1990 and 1991 were estimated for all other taxa by linear interpolation between the last year of data provided by LATFRA (1989) and the first year that ICES landings statistics presents data for Lithuania as a separate entity (1992).

**Table 1.** Sources of adjustments to ICES landings statistics for Lithuania from 1950-2007.

<b>Common names</b>	<b>Years</b>	<b>Source</b>
Cod	1950-1989	LATFRA
	1990-1991	Interpolated
	1992-2007	ICES (2007, 2008a)
Herring	1950-1989	LATFRA
	1990-1991	Interpolated
Sprat	1950-1989	LATFRA
	1990-1991	Interpolated
Salmon	1950-1989	LATFRA
	1990-1996	ICES (2008b)
Flatfishes	1950-1989	LATFRA
	1991-2007	ICES (2008a)
‘Others’	1950-1989	LATFRA
	1990-1991	Interpolated

#### Unreported landings

Unreported landings for Lithuania were assumed to be zero from 1950-1990 as this was our assumption for all eastern bloc countries (see ‘Methods’ in Zeller *et al.*, this volume). For the time period 1993-2007, unreported landings were based on information provided by LATFRA and ICES stock assessment working group data. Rates for 1991 and 1992 were derived through linear interpolation from 0% in 1990 to the first anchor point in 1993. These estimates were interpolated to reflect the transition from a state-controlled economy to a market-based economy. Unreported landings for eastern cod from 1993-2007 were estimated to be 75%, which was based on the average range of 50-100%. (Anon., pers. comm., LATFRA).<sup>2</sup> Salmon’s unreported landings for the period 1993-2007 were derived from ICES stock assessment working group data (see ‘Methods’ in Zeller *et al.*, this volume, Table 2). Anchor point rates for other taxa besides cod and salmon were estimated using an average rate based on the default Baltic-wide rates for salmon and cod for the years 1993, 1994, 2004, and 2005 (see ‘Methods’ in Zeller *et al.*, this volume). Linear interpolations between years of anchor points were done to estimate the rates in missing years, and the

<sup>2</sup>This source within LATFRA was interviewed but requested to remain anonymous for personal reasons.

2005 rate was carried forward until 2007 (Table 2). Rates for 1991-1992 were derived through linear interpolation from 0% in 1990 to the first anchor point in 1993.

### Discards

Four separate categories of discards were estimated for Lithuania, each estimated as a rate and then applied to the landings data (ICES landings + adjustments + unreported landings) for each respective taxon or group. The sum of discards in all categories gave us an estimate of total discarded catches for Lithuania. The four categories considered were: a) 'underwater discards' accounting for the mortality of fish lost from gear while deployed and actively fishing; b) 'ghostfishing' due to lost or abandoned gear; c) 'boat-based discards' usually resulting from fisher's behavior after the catch is brought to the surface/on board; and d) 'seal-damaged discards' representing the portion of the catch discarded due to seal damage.

'Underwater discards': An underwater discard rate was applied to herring and sprat only as underwater discarding is mainly a problem associated with pelagic fisheries. Our estimates for underwater discards of herring and sprat were based on a Finnish trawl study by Rahikainen (2004) from which we estimated an underwater discard rate for herring of approximately 9% (see 'Methods' in Zeller *et al.*, this volume). Herring and sprat are both pelagic species that are caught in a mixed fishery using similar gear-types. This led us to apply the same underwater discard rate to both species. Since herring and sprat landings for Lithuania are not reported by gear-type, the estimated rate of 9% was reduced to a more conservative estimate of 5% and applied to all landings of these two species between 1950 and 2007.

'Ghostfishing': Estimates of ghostfishing discards were based on a Swedish study by Tschernij and Larsson (2003) that estimated the amount of cod caught by lost gear and related it to commercial catches in Sweden. Using these data, Brown *et al.* (2005) estimated the range of ghostfishing rates by lost gear to be between 0.01% and 3.2% and here, we used the average of 1.65% applied to all taxa, except herring and sprat, for all years from 1950-2007. Herring and sprat were not considered as ghostfishing is of minimal concern for pelagic species.

'Boat-based discards': A boat-based discard rate of 2% was applied to all taxa, except herring and sprat, from 1950-1990. Sources indicate that herring and sprat account for a negligible proportion of boat-based discards (ICES, 2005; 2007). For the period 1993-2007 boat-based discard data for cod (ICES, 2008a) and salmon (ICES, 2008b) were calculated for Lithuania from the Baltic-wide discards presented in the ICES stock assessment working group data as a fraction of the total landings presented in the same ICES report (see 'Methods' in Zeller *et al.*, this volume). The ICES stock assessment reports present a minimum, mode and maximum for salmon discards. Here we used the mode, as it was the assumed default for countries where recreational catches are not included in reported ICES landings (see 'Methods' in Zeller *et al.*, this volume). Boat-based discard rates for 2004, obtained from a Danish study (Anon., 2006) for European flounder, plaice, turbot, whiting, and other taxa were 48.0%, 34.0%, 38.5%, 36.1%, and 6.2%, respectively. These

**Table 2.** Anchor points for unreported landings (%) for cod (LATFRA), salmon (Table 2.1.1. in ICES, 2008b) and all other taxa (Tables 2.3.1 and 2.4.1 in ICES, 2007; Table 2.3.1. and 2.4.1 in ICES, 2008a; and Table 2.1.1 in ICES, 2008a). Dashed lines (-) indicate years when the rates were derived through linear interpolation.

Year	Cod	Salmon	Other taxa <sup>a</sup>
1950-1990	0.0	0.0	0.0
1991-1992	-	-	-
1993	75.0	19.4	20.3
1994	75.0	18.7	26.9
1995	75.0	19.5	-
1996	75.0	20.4	-
1997	75.0	20.8	-
1998	75.0	20.1	-
1999	75.0	20.4	-
2000	75.0	19.9	-
2001	75.0	20.4	-
2002	75.0	20.5	-
2003	75.0	20.1	-
2004	75.0	20.6	12.3
2005	75.0	20.7	11.2
2006	75.0	22.2	11.2 <sup>b</sup>
2007	75.0	21.4	11.2 <sup>b</sup>

<sup>a</sup> includes all taxa other than cod and salmon. <sup>b</sup> 2005 rate carried forward.

**Table 3.** Anchor points (%) used for estimating boat based discards for eastern cod and salmon based on sources (Tables 2.4.1, 2.4.5b in ICES, 2007; Table 2.4.1, 2.4.5b and 2.4.20 in ICES, 2008a; and Table 2.1.2 in ICES, 2008b). Dashed lines (-) indicate years when linear interpolations were used.

Year	Eastern cod	Salmon
1950-1990	2.0	2.0
1991-1992	-	-
1993	3.4	14.1
1994	2.1	12.9
1995	1.7	13.9
1996	1.2	15.1
1997	3.9	14.9
1998	3.4	14.2
1999	2.5	14.8
2000	6.8	10.3
2001	3.2	15.0
2002	2.2	15.8
2003	2.8	15.4
2004	1.8	15.6
2005	3.0	15.2
2006	13.2	17.4
2007	11.3	14.2

values were used as a constant rate for all years from 1993-2007. The 1991-1992 rates were estimated from the default rate of 2% in 1990 to the first anchor point in 1993 by linear interpolation.

'*Seal-damaged discards*': Seal-damaged discards have been a concern in the Baltic Sea since the 1980s when seals started to recover from historically low population levels (Österblom *et al.*, 2007). Seal-damaged discard data were used in place of boat-based discards when seal-damaged discard rates were higher than the boat-based discard rates. This was done to avoid the possibility of double accounting since we assumed that some seal-damaged discards may have been included in estimates of boat-based discards.

Seal-damaged discards in Lithuania were only considered for cod. Seal-damaged discards were estimated to be 20% of Lithuania's cod landings for 2007 (S. Toliušis, unpubl. data). The rates for 1981-2006 were then derived through linear interpolation between the assumed rate of 0% in 1980 and the anchor point for 2007 of 20%. These seal-discard rates were higher than the boat-based discard rates from 1983-2007 and therefore replaced the default boat-based discard rate for these years. The interpolated rate for 1983 (2.2%) was the first year that the seal-damaged discard rate was higher than the default boat-based discard rate (2%).

### Recreational catches

Recreational catches were assumed to be zero until the 1990s as recreational fishing was forbidden during the USSR period, except for in Poland and Russia. From 1990-2007, the years of transition from a state-controlled to a market-based economy, little information regarding Lithuania's recreational catches exists. We therefore estimated catches for this period based on the number of fishers and the catch rates of the nearest neighboring countries.

The proportion of Lithuania's coastal population that engages in recreational fishing was based on the proportion of Kaliningrad's coastal population that fishes recreationally (Harper *et al.*, this volume). Using 2002 census data for Kaliningrad and the number of fishers for Kaliningrad, we derived a recreational fishing participation rate for Lithuania. We combined this with the coastal population of Lithuania and estimated that there were 49,000 recreational fishers in Lithuania in 2002. The coastal population of Lithuania was estimated as the sum of the three coastal administrative districts, Klaipėdos, Telsiu and Taurages. Assuming the same catch composition as Germany and half of Germany's catch rate (kg-fisher<sup>-1</sup>) for 2005/2006, as a conservative estimate for Lithuania, we applied this catch rate to the number of recreational fishers in Lithuania and derived recreational catch estimates for cod, herring and flounder. To get a complete time series from 1990-2007, we carried the 2005 values forward, unaltered to 2007 and estimated values for 1990-2005 through linear interpolation.

Overall, total reconstructed catches were obtained as the sum of ICES landings statistics, adjustments, unreported landings estimates, discard estimates, and recreational catch estimates. The estimated total reconstructed catch was then compared to the officially reported data, defined here as the ICES landings statistics.

## RESULTS

ICES landing statistics for Lithuania have only been recorded since 1992, prior to this time they were included in the landing statistics of the USSR. In 1992, ICES landings statistics reports that Lithuania reported landings of 11,217 t, which increased to 20,470 t in 1996 (Figure 2). Following this, landings decreased and averaged 9,500 t annually from 1999-2003, then increased to end the time period at 26,743 t. From 1992-2007, ICES landing statistics reported a total catch of 206,850 t (Table 4).

Sprat landings comprise the majority of these landings, with a total of 93,434 t from 1992-2007, or 45% of the total ICES landing statistics for Lithuania. Sprat landings were 3,279 t in 1992, and increased to 10,165 t in 1996. Landings decreased in the following years, to an average of 4,340 t annually from 1997-2005. At the end of the time period, sprat landings increased to 19,745 t in 2007. Cod landings contributed the next

**Table 4.** ICES landing statistics presented as totals for Lithuania (t) from 1992-2007, prior to which catches were not reported independently but rather as part of 'former USSR'.

<b>Common name</b>	<b>1990-1999<sup>a</sup></b>	<b>2000-2007</b>
Cod	26,111	27,048
Herring	32,857	13,842
Sprat	37,406	56,028
Flatfishes	2,966	6,646
Salmon	67	30
Others	906	2,943

<sup>a</sup> no ICES landings statistics for independent Lithuania prior to 1991.

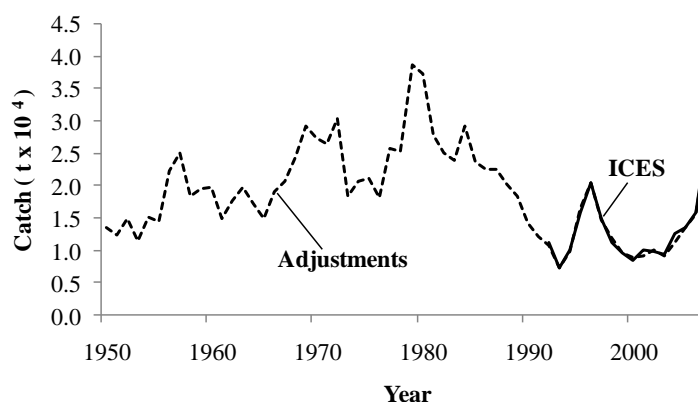
largest amount to the total, with 53,159 t from 1992-2007, or 26% of ICES landings. Cod landings were reported to be 2,141 t in 1992, increased to a maximum of 5,520 t in 1996, before decreasing to an average 3,583 t from 1997-2007. Herring landings were reported to be approximately half of sprat catches, with a total of around 46,700 t from 1992-2007, or 23% of total ICES landings for the period. Herring landings were approximately 5,800 t in 1992, increased to 7,000 t in 1995, and then decreased to an average 2,000 t annually from 1996-2007. Flatfish had the next largest landing, with a total of about 9,600 t from 1992-2007, or 5% of total ICES landings. Flatfish landings were 9 t in 1992, and increased to 1,155 t in 2001. From 2001-2005, flatfish landings were on average 1,000 t annually, yet this decreased at the end of the time period to 375 t in 2007. Salmon landings totaled almost 100 t from 1992-2007. All other reported species (the 'others' category, recorded by ICES since 1993) landings totaled 3,850 t from 1993-2007, or 2% of total ICES landings. 'Others' landings were 10 t in 1993, increased to 1,500 t in 2002, and then decreased to end the time period at around 100 t. Time series data for all species and taxon groups, by catch component, is available in Appendix A1-A7.

### *Illegal, Unreported and Unregulated (IUU) catches*

IUU is used in this report to quantify any catches made by a country but not included in their official catch statistics. Adjustments to ICES landing statistics, unreported landings, discards, and recreational catches make up our IUU adjustments.

#### Adjustments to ICES landings statistics

A total 895,941 t of adjustments were made to ICES landing statistics for Lithuania from 1950-2007 (Figure 2; Table 5). The majority of these adjustments are due to the fact that prior to 1992, Lithuanian landings were recorded as part of the USSR, and ICES landing statistics have not been adjusted retroactively to account for this. Landings from 1950-1991 were adjusted from zero using national data and ICES Working Group reports (see Methods for all sources), as ICES landing statistics were not reported separately for Lithuania for this period.



**Figure 2.** ICES landings statistics and Adjustments to ICES landings statistics for Lithuania from 1950-2007

Looking first at the time period before ICES landing statistics were recorded independently for Lithuania, cod's adjustments to landings accounted for 58% of the total adjustments, totaling 516,305 t from 1950-1991. Adjusted herring landings contributed 19% to total adjustments, with a total of 169,874 t during the period. Adjusted sprat landings contributed 16% to total adjustments, with a total of 145,247 t from 1950-1991. Adjustments of 'others' accounted for 6% of total adjustments, with a total of 55,818 t caught over the time period. Adjustments to salmon catches contributed a negligible amount to total adjustments, with an additional 602 t added over the time period.

**Table 5.** Total decadal adjustments to ICES landing statistics for Lithuania (t).

<b>Common names</b>	<b>1950-1959</b>	<b>1960-1969</b>	<b>1970-1979</b>	<b>1980-1989</b>	<b>1990-1999</b>	<b>2000-2007</b>
Cod	128,240	133,780	108,550	140,662	5,905	-2,127
Herring	13,260	24,260	60,664	58,482	13,208	0
Sprat	4,810	33,270	69,288	30,112	7,767	0
Flatfishes	1,430	3,100	2,781	1,400	790	-118
Salmon	10	0	11	453	132	0
Others	20,110	3,720	11,742	20,105	143	2

From 1992-2007, there was a net -903 t of adjustments to ICES landing statistics (2,530 t added; 3,433 t subtracted). Cod had the largest adjustments with a net adjustment of -1,295 t. Flatfish had a net adjustment of 384 t, and the 'others' group and salmon had net adjustments of 4 t each. No adjustments were made to the ICES landing statistics for herring and sprat.

### Unreported landings

Unallocated catches are described for some species in ICES working group reports, and form the basis of this section of our unreported landings estimates (see Methods section for details). Unreported landings are estimated to have begun following Lithuania's independence, and in 1991, estimated unreported landings were 1,195 t (Table 6). This then increased to a peak of 7,750 t in 1996, before decreasing overall to 2,660 t in 2004 (Figure 3). For the remainder of the time period, unreported landings showed an increasing trend, and ended the time period at 4,531 t. Total unreported landings from 1991-2007 were an estimated 66,322 t, or 20% of our reconstructed total from 1991-2007.

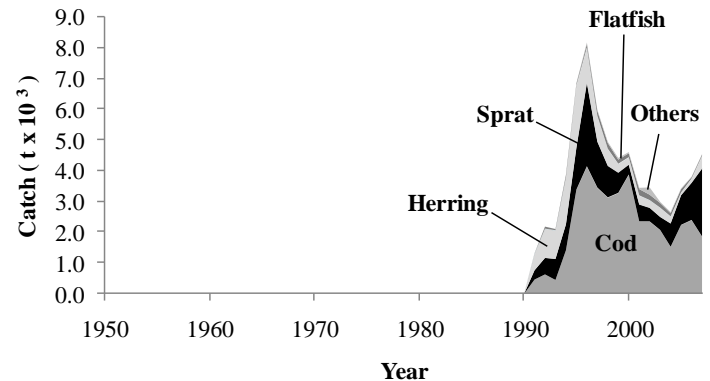


Figure 3. Lithuania's unreported landings by taxa, 1950-2007.

Cod was the largest contributor to unreported landings, and totaled an estimated 39,048 t from 1991-2007. It was estimated that unreported cod landings added an additional 19% of reported cod landings to our reconstruction. Starting with an estimated 466 t in 1991, unreported cod landings peaked at an estimated 4,143 t in 1996, and then decreased for the remainder of the time period, ending at 1,865 t in 2007. The next largest contribution to unreported landings was sprat, which totaled 15,411 t from 1991-2007, or an additional 7% to reported landings. Unreported sprat landings were estimated to have been 258 t in 1991, increasing to 2,440 t in 1996, decreasing at the end of the 1990s, and then showed an increasing trend for the rest of the time period, with 2,211 t in 2007. Unreported herring landings were estimated to have contributed the third greatest amount to overall unreported landings, with an estimated total of 9,547 t for the time series, or an additional 5% of reported landings. In 1991, estimated unreported herring landings were 455 t, and this increased to a peak of 1,793 t in 1995. Following this, unreported herring landings decreased to a low of 84 t in 2005, and ended the time period at 402 t. Unreported flatfish landings contributed 1,663 t to the total over the time period (an additional 1% on top of reported landings), with a maximum annual catch of 191 t in 2001. Unreported landings of 'others' contributed 669 t, or an additional 1% of reported landings. Unreported salmon catches were an estimated 23 t, or an additional 0.01% of reported landings.

Table 6. Decadal totals of the estimated unreported landings for Lithuania (t).

Common name	1950-1989	1990-1999	2000-2007
Cod	0	20,357	18,691
Herring	0	7,689	1,858
Sprat	0	8,591	6,819
Flatfishes	0	745	918
Salmon	0	17	6
Others	0	204	427

<sup>a</sup> assumption based.

### Discards

Discards are comprised of four components (ghostfishing, underwater discards, boat-based discards and seal-damaged discards; for details see Methods section). Discards were estimated to be 496 t at the beginning of the time series, and until 1967 averaged 671 t annually (with a peak of 932 t in 1957; Figure 4). This then increased during the following time period, to an average of 1,084 t annually from 1967-1994 (with a peak of 1,595 t in 1979). For the remainder of the time series, the annual discards averaged 2,038 t annually (with a peak of 2,462 t in 1996). Over the entire time series, discards totaled approx. 68,000 t (Table 7).

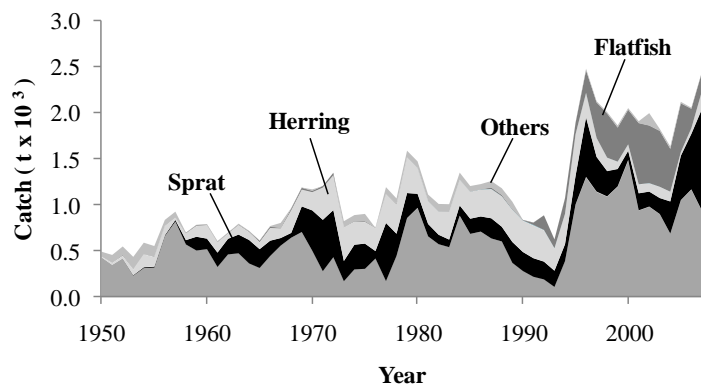


Figure 4. Lithuania's discards by taxa, 1950-2007.

The largest contributor to overall discards was cod, with an estimated total of 35,400 t from 1950-2007, which is an average discard rate of 5.8%. Cod discards were estimated to be 434 t in 1950, and fluctuated below 1,000 t until 1995 (average cod discards for the period 1950-1994, were 477 t-year<sup>-1</sup>).

Cod discards were estimated to have risen to 1,488 t in 2000, and from 1995-2007, average cod discards were estimated at 1,072 t-year<sup>-1</sup>. The next largest contributors to discards were sprat and herring, with totals of 12,705 t and 11,306 t respectively, over the entire time series. Herring and sprat discards rates averaged approximately 5%.

Sprat discards were estimated at 3 t in 1953, and increased to an average annual discard rate of 232 t-year<sup>-1</sup> (with a peak value of 1,098 t in 2007). Herring discards were estimated at 9 t in 1950, and averaged 196 t annually throughout the time series (with a peak of 454 t in 1995).

Flatfish discards contributed the next largest amount to the total, with an estimated 6,030 t over the time series. The discard rate for flatfish is the highest out of all the species categories, with an average discard rate of 29%. Flatfish discards were estimated to have been 5 t in 1950 and averaged approximately 8 t annually from 1950-1990. For 1991-2007, average annual flatfish discards rose to an estimated 339 t (range from 26 t in 1991, to 667 t in 2001).

'Others' discards were an estimated 2,395 t over the time period, with an average discard rate of 4%. Salmon discards are estimated to have totaled 43 t over the time period, with an average discard rate of 6%.

### Recreational catches

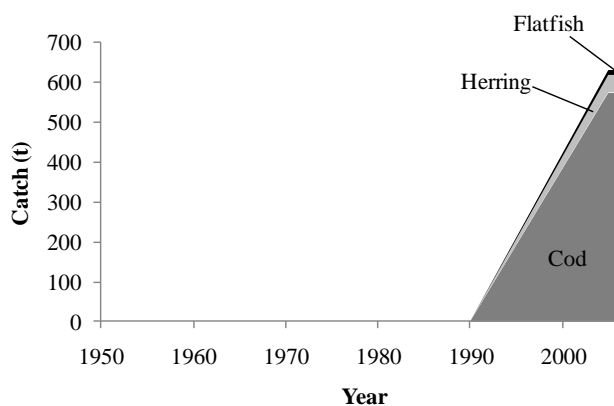
It is assumed that there were no recreational catches in Lithuania prior to 1991. In 1991, the total recreational catch was approximately 42 t (Figure 5; Table 8), then increased to 633 t in 2005 and remained stable at this value for the rest of the time period. The total recreational catch for the time period was estimated to be 6,326 t. Cod was the most important species targeted in the recreational fishery, and contributed 5,756 t, or 91% of the recreational catch total. The species with the next largest recreational catch was herring, with a total of 447 t, followed by flatfish with a catch of 123 t for the time period.

### *Total Reconstructed Catches*

The total reconstructed catch was estimated to be 14,016 t in 1950, and showed an increasing trend to a peak of 40,383 t in 1979. Following this there was a decreasing trend to 9,896 t in 1993, a large peak of 31,021 t in 1996, and another increase at the end of the time period to 33,911 t in 2007. Total reconstructed catches from 1950-2007 were estimated to be 1,243,301 t (Figure 6; Table 9; see Appendix Table A1 for complete time series data on all additions to catch by taxonomic group). ICES landing statistics report 206,850 t of catches from 1992-2007. Our total reconstructed catch for the same time period is 306,287 t, an increase of 48%. In all of the components of the adjustments for this reconstruction, cod catches contributed the most, followed by sprat and herring.

**Table 7.** Decadal totals of the estimated discards for Lithuania (t).

Common name	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2007
Cod	4,681	4,883	3,962	6,685	6,993	8,184
Herring	663	1,213	3,033	2,924	2,688	785
Sprat	241	1,664	3,464	1,506	2,688	3,146
Flatfishes	52	113	102	51	2,027	3,686
Salmon	0	0	0	17	20	6
Others	734	136	429	734	93	266



**Figure 5.** Lithuania's recreational catches by taxa from 1950-2007.

**Table 8.** Decadal totals of the estimated recreational catch for Lithuania (t).

Common name	1950-1989	1990-1999	2000-2007
Cod	0	1,727	4,029
Herring	0	134	313
Flatfishes	0	37	86
Salmon	0	0	0
Others	0	0	0



A total of 72% of our reconstructed time series is due to adjustments to ICES landing statistics, the majority of that to disaggregate Lithuania's catches from the USSR from 1950-1991. Discards accounted for 5% of our total reconstructed time series data. Unreported and recreational catches accounted for 21% and 2% of our reconstructed catch from 1991-2007 (the period that they are estimated to have been operating during).

Cod contributed the most to the reconstructed catch, approximately 52%, with an estimated total of 648,359 t from 1950-2007. Cod catches were estimated to be 12,324 t in 1950, and had peaks of over 20,000 t in 1957, 1969, 1979, 1980, and 1984. Between these peaks, reconstructed cod catches averaged 11,233 t·year<sup>-1</sup> from 1950-1956, increased to 13,580 t·year<sup>-1</sup> from 1958-1968, decreased to 9,784 t·year<sup>-1</sup> from 1970-1978, remained high from 1981-1983 at 16,663 t·year<sup>-1</sup>, and finally showed a decreasing trend from 1985-2007 with an average 7,083 t·year<sup>-1</sup>.

Sprat contributed the next largest amount to the reconstructed catch, approximately 22%, with an estimated total of 266,796 t from 1950-2007. Sprat is estimated to not have been caught by Lithuania until 1953, when 63 t were reported. Sprat catches throughout the time period had periods of higher and lower catches. Periods with lower catches (< 5,000 t) include 1953-1968 with average catches of 2,136 t·year<sup>-1</sup>, 1980-1994 with average catches of 3,436 t·year<sup>-1</sup>, and 1999-2003 with average catches of 3,398 t·year<sup>-1</sup>. Periods with higher catches (with peaks over 5,000 t) include 1969-1979 with average catches of 7,142 t·year<sup>-1</sup>, 1995-1998 with average catches of 8,414 t·year<sup>-1</sup>, and 2004-2007 with average catches of 13,263 t·year<sup>-1</sup>.

Total herring catches were almost as high as sprat catches – approximately 19% of the total reconstructed catch, with an estimated 237,872 from 1950-2007. Herring catches are estimated to have been 179 t in 1950, and continued with an average 2,072 t·year<sup>-1</sup> from 1950-1970. For 1971-1996, average catches increased to 6,517 t·year<sup>-1</sup>, with peaks of 7,928 t in 1972, 8,250 t in 1979, and 9,308 t in 1995. From 1997-2007, the average annual catches decreased to approx. 2,350 t.

Catches of species in the 'Others' category contributed the fourth highest amount to the total reconstructed catch, approximately 5%, with an estimated 62,693 t from 1950-2007. From 1950-1957 average catches were 2,561 t·year<sup>-1</sup>, and then decreased from 1958-1972 to an average catch of 315 t·year<sup>-1</sup>, with a peak of 1,586 t in 1967. 'Others' catches increased again from 1973-1989, when average catches were

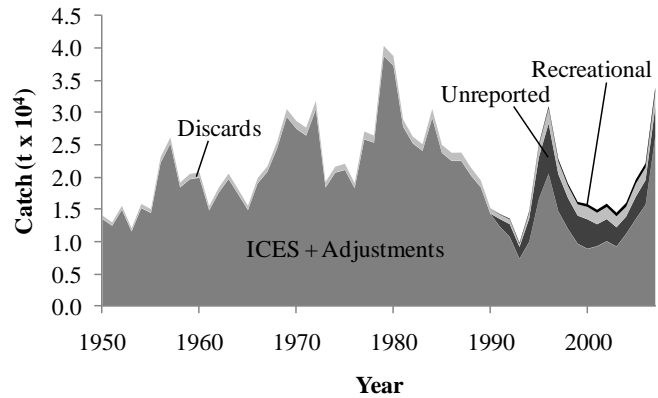


Figure 6. Total reconstructed catch by component for Lithuania from 1950-2007.

Table 9. Total catch (tonnes) by decade by each component of catch reconstruction.

Component	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2007
ICES landing statistics	n/a	n/a	n/a	n/a	100,313	106,537
Adjustments to ICES	167,860	198,130	253,036	251,214	27,944	-2,243
Unreported	0	0	0	0	37,603	28,719
Discards	6,371	8,008	10,990	11,915	14,508	16,069
Recreational	n/a	n/a	n/a	n/a	1,898	4,428
<b>Total reconstructed</b>	<b>174,231</b>	<b>206,138</b>	<b>264,026</b>	<b>263,026</b>	<b>182,266</b>	<b>153,511</b>

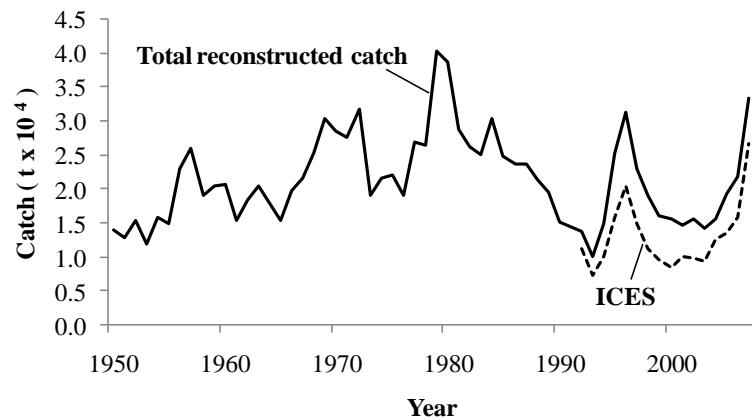


Figure 7. Total reconstructed catch for Lithuania from 1950-2007 and ICES landings statistics from 1991-2007.

1,911 t-year<sup>-1</sup>, with a low of 3 t in 1976. For the remainder of the time period, catches decreased to 279 t-year<sup>-1</sup>, although with a peak of 1,865 t in 2002.

Flatfish catches contributed approximately 2% to the reconstructed catch, with a total of 26,811 t from 1950-2007. From 1950-1995, average flatfish catches were estimated to be 243 t-year<sup>-1</sup>, with a peak of 757 t in 1972. Catches increased in the latter part of the time series, and were on average 1,312 t-year<sup>-1</sup> from 1996-2007, with a peak of 2,007 t in 2001.

**Table 10.** Decadal totals of the estimated total reconstructed catch for Lithuania (t).

<b>Common name</b>	<b>1950-1959</b>	<b>1960-1969</b>	<b>1970-1979</b>	<b>1980-1989</b>	<b>1990-1999</b>	<b>2000-2007</b>
Cod	132,921	138,663	112,512	147,346	61,092	55,825
Herring	13,923	25,473	63,697	61,406	56,575	16,798
Sprat	5,051	34,934	72,752	31,618	56,453	65,990
Flatfishes	1,482	3,213	2,883	1,451	6,564	11,218
Salmon	10	0	11	470	236	42
Others	20,844	3,856	12,171	20,839	1,346	3,638

Salmon catches made the smallest contribution to overall reconstructed catch, approximately 0.1%, or 769 t from 1950-2007. Catches were sporadic until 1979, with up to 10 t in 1955 but zero for the majority of years. From 1979-2007 average salmon catches were an estimated 26 t-year<sup>-1</sup>.

## DISCUSSION

Lithuania's total catches from the Baltic Sea from 1950-2007, as estimated in our reconstruction, were approximately 1.2 million t. For the period 1992-2007, ICES on behalf of Lithuania reported a total of approximately 200,000 t, since prior to 1990 Lithuania's landings were reported as part of the USSR's landings. Over the time period 1992-2007, our reconstructed catch was approximately 300,000 t, an increase of 48%. The IUU component that had that greatest contribution to the reconstruction was adjustments to ICES landing statistics (approximately 70%), mainly during the period that ICES landing statistics were not recorded independently for Lithuania (1950-1991).

Unreported landings contributed approximately 21% to our reconstructed catch from the time they are estimated to have begun in 1991 to 2007. The largest contribution to unreported landings was cod, with an estimated 40,000 t during that time period (and added 19% to estimated commercial landings). Discards are assumed to have been occurring throughout the entire time period at an average rate of 5%. Due to cod having the highest landings, they also have the highest discards, approximately 35,000 t; however, flatfish have the highest discard rate at 29%. Recreational catches contributed approximately 6,300 t for the 1991-2007 time period.

Our reconstruction of Lithuania's fisheries catches from the Baltic Sea most likely represents a conservative estimate, because, other than unreported landings of cod, we were using Baltic-wide estimates. Our rates of unreported cod landings were estimated by the Latvian Fish Resource Agency (LATFRA), and extended to apply to Lithuania. This led to a better region-specific estimate, and is approximately 35% higher than the ICES reported estimate (of unreported catches of eastern cod stock) based on Baltic-wide data. For all other species (except salmon, which we derived from ICES stock assessment working group data), we used ICES data, but these should be seen as minimum estimates (leading to a conservative reconstruction), as it is known that not all countries report IUU estimates to ICES, yet the total is given as a Baltic-wide average. Although we have corrected for the estimates of unreported landings for countries that are known to not submit estimates to ICES (e.g. Sweden, Persson, this volume), it is probable that other countries do not report estimates of these catches to ICES either. This uncertainty is due to confidentiality agreements that prevent disclosure of information related to which countries are reporting IUU and discard data, and what those values are. However, there is still a way of improving the quality of data on IUU catches while maintaining the confidentiality clause; this could be achieved by reporting the amount of IUU and discards, and the proportion of Baltic-wide landings that they relate to. The total landings by the countries that do not report estimates of these values could be reported separately, but still anonymously. This would allow for a better representation of the resources being exploited, and allow for more accurate extrapolation to cover the entire Baltic fishery.

This lack of transparency about which countries collect and report IUU and discard data makes it difficult to estimate in a statistically robust manner the amount of IUU catches. However, our conservative

estimates are better than using the alternative assumption of zero catches for IUU components. Three basic ways have been identified to change the current system to a more transparent one (Veem *et al.*, 2009). The first regards the fact that due to the confidentiality clause, information on which countries report IUU and discard data is not available to the public or to other researchers. One of the few legitimate reasons a country could have for not reporting this data is a lack of resources. Limited resources may be one of the reasons for countries not collecting this data, therefore the establishment of an EU Baltic-wide protocol to help countries that currently lack an information collection system. The second area that requires greater transparency is the decision-making process and the allocation of TACs. Significant energy and resources are spent on ICES stock assessments, with the goal of presenting science-based recommendations to the EU council (prior to 2005 these were given to the International Baltic Sea Fishery Commission) on biologically ‘safe’ levels of exploitation of Baltic Sea stocks, yet this advice is frequently over-ridden and in the past has contributed to the decline of many stock’s abundance (Aps *et al.*, 2007; Cardinale and Svedäng, 2008). The third way that transparency could be increased is to make the reasons and results of decision making available to the public (and scientific community). As fisheries are a public resource, catch information should be easily accessible to the general public (in addition to the agreements that govern their exploitation).

Many of the stocks throughout the world are classified as over-fished or depleted; in a recent study it was found that over half of the 232 populations in the study had exhibited declines of 80% or more (Hutchings and Reynolds, 2004). However, it is a risky endeavor to wait until stocks have become depleted to introduce measures that attempt to allow stocks to recover. In fact, there is still much to be discovered about what factors determine how long marine fish populations will take to recover, and some studies have shown that the only thing that is within human’s ability to control, fishing pressure, may not be enough to facilitate recovery of collapsed or severely depleted stocks (Hutchings and Reynolds, 2004). The most prudent course of action, following the precautionary principle, is not to allow stocks to become severely depleted by setting sustainable TACs, and ensuring that fishing vessels are complying with the regulations. The only way to ensure that fishing operations are in compliance is with 100% on-board observer (or video) coverage (Branch, 2006) and with constant satellite Vessel Monitoring Systems (VMS; Veem *et al.*, 2009).

Many countries, including Lithuania, could improve the knowledge of stocks in their area by monitoring and reported data from their recreational fisheries. Very little information was found regarding recreational fisheries in Lithuania, and this lack of knowledge prevents a true assessment of this sector’s impacts. Consistent monitoring of recreational fisheries would help determine levels of fishing mortality, and could provide information on possible conservation measures that should be taken to ensure that future generations can enjoy recreational fishing.

Our catch reconstruction for Lithuania, though likely a conservative estimate of true catches, is still more accurate than the current assumption of zero catch when no “hard” data are available. This method of reconstruction, accounting comprehensively for IUU, been used successfully elsewhere (Zeller *et al.*, 2006; Zeller *et al.*, 2007; Zeller and Pauly, 2007). A more complete analysis of the true level of exploitation occurring in the Baltic Sea will better our understanding of resource use and together with more transparent decision making processes, regulatory legislation, and shareholder compliance, ensure that the fish stocks in the Baltic Sea will continue to support local fishing activities for Lithuanians.

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## APPENDIX A

**Appendix Table A1.** ICES landing statistics, adjustments to ICES landing statistics, unreported landings, discards, recreational catch, and reconstructed total for Lithuania (t). N/A: part of ICES category 'former USSR'.

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	13,520	0	496	0	14,016
1951	N/A	12,490	0	461	0	12,951
1952	N/A	14,970	0	553	0	15,523
1953	N/A	11,600	0	440	0	12,040
1954	N/A	15,220	0	595	0	15,815
1955	N/A	14,470	0	558	0	15,028
1956	N/A	22,270	0	842	0	23,112
1957	N/A	25,210	0	932	0	26,142
1958	N/A	18,420	0	703	0	19,123
1959	N/A	19,690	0	790	0	20,480
1960	N/A	19,930	0	797	0	20,727
1961	N/A	14,860	0	613	0	15,473
1962	N/A	17,660	0	704	0	18,364
1963	N/A	19,720	0	801	0	20,521
1964	N/A	17,340	0	723	0	18,063
1965	N/A	14,920	0	618	0	15,538
1966	N/A	19,050	0	776	0	19,826
1967	N/A	20,850	0	810	0	21,660
1968	N/A	24,450	0	972	0	25,422
1969	N/A	29,350	0	1,195	0	30,545
1970	N/A	27,500	0	1,174	0	28,674
1971	N/A	26,460	0	1,209	0	27,669
1972	N/A	30,490	0	1,352	0	31,842
1973	N/A	18,410	0	828	0	19,238
1974	N/A	20,717	0	895	0	21,612
1975	N/A	21,141	0	907	0	22,048
1976	N/A	18,293	0	756	0	19,049
1977	N/A	25,872	0	1,198	0	27,070
1978	N/A	25,365	0	1,075	0	26,440
1979	N/A	38,788	0	1,595	0	40,383
1980	N/A	37,294	0	1,479	0	38,773
1981	N/A	27,811	0	1,118	0	28,929
1982	N/A	25,248	0	1,016	0	26,264
1983	N/A	24,086	0	1,013	0	25,099
1984	N/A	29,202	0	1,356	0	30,558
1985	N/A	23,785	0	1,210	0	24,995
1986	N/A	22,533	0	1,231	0	23,764
1987	N/A	22,530	0	1,265	0	23,795
1988	N/A	20,259	0	1,187	0	21,446
1989	N/A	18,466	0	1,040	0	19,506
1990	N/A	14,323	0	842	0	15,165
1991	N/A	12,281	1,195	806	42	14,324
1992	11,217	-485	1,958	875	84	13,649
1993	7,273	66	1,821	610	127	9,896
1994	9,975	1	3,591	1,061	169	14,796
1995	15,751	884	6,464	1,879	211	25,189
1996	20,470	86	7,750	2,462	253	31,021
1997	14,824	-93	5,730	2,115	295	22,871
1998	11,105	881	4,772	1,999	337	19,094
1999	9,698	0	4,322	1,860	380	16,260
2000	8,456	444	4,550	2,052	422	15,923
2001	10,024	-725	3,382	1,908	464	15,053
2002	9,906	168	3,408	1,998	506	15,986
2003	9,415	-169	2,963	1,829	548	14,586
2004	12,625	-1,407	2,660	1,641	590	16,109
2005	13,547	-5	3,423	2,127	633	19,725
2006	15,821	-100	3,802	2,063	633	22,219
2007	26,743	-449	4,531	2,453	633	33,911

**Appendix Table A2.** ICES landing statistics, adjustments to ICES landing statistics, unreported landings, discards, recreational catch, and reconstructed total for cod (*Gadus morhua*) for Lithuania (t). N/A: part of ICES category 'former USSR'.

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	11,890	0	434	0	12,324
1951	N/A	9,690	0	354	0	10,044
1952	N/A	11,630	0	424	0	12,054
1953	N/A	6,610	0	241	0	6,851
1954	N/A	8,820	0	322	0	9,142
1955	N/A	8,960	0	327	0	9,287
1956	N/A	18,260	0	666	0	18,926
1957	N/A	22,570	0	824	0	23,394
1958	N/A	15,800	0	577	0	16,377
1959	N/A	14,010	0	511	0	14,521
1960	N/A	14,410	0	526	0	14,936
1961	N/A	9,150	0	334	0	9,484
1962	N/A	12,870	0	470	0	13,340
1963	N/A	13,180	0	481	0	13,661
1964	N/A	10,190	0	372	0	10,562
1965	N/A	8,860	0	323	0	9,183
1966	N/A	12,390	0	452	0	12,842
1967	N/A	15,460	0	564	0	16,024
1968	N/A	17,800	0	650	0	18,450
1969	N/A	19,470	0	711	0	20,181
1970	N/A	13,940	0	509	0	14,449
1971	N/A	7,910	0	289	0	8,199
1972	N/A	12,040	0	439	0	12,479
1973	N/A	4,950	0	181	0	5,131
1974	N/A	8,443	0	308	0	8,751
1975	N/A	8,598	0	314	0	8,912
1976	N/A	11,650	0	425	0	12,075
1977	N/A	4,999	0	182	0	5,181
1978	N/A	12,428	0	454	0	12,882
1979	N/A	23,592	0	861	0	24,453
1980	N/A	26,621	0	972	0	27,593
1981	N/A	18,184	0	664	0	18,848
1982	N/A	15,874	0	579	0	16,453
1983	N/A	14,139	0	547	0	14,686
1984	N/A	19,227	0	886	0	20,113
1985	N/A	12,900	0	690	0	13,590
1986	N/A	11,736	0	715	0	12,451
1987	N/A	9,386	0	642	0	10,028
1988	N/A	8,044	0	610	0	8,654
1989	N/A	4,551	0	379	0	4,930
1990	N/A	3,208	0	291	0	3,499
1991	N/A	1,865	466	228	38	2,598
1992	2,141	-875	633	200	77	2,176
1993	574	31	454	119	115	1,293
1994	1,886	1	1,415	397	154	3,853
1995	3,629	884	3,385	1,008	192	9,097
1996	5,520	4	4,143	1,305	230	11,202
1997	4,694	-93	3,451	1,147	269	9,467
1998	3,296	880	3,132	1,095	307	8,710
1999	4,371	0	3,278	1,202	345	9,197
2000	4,721	444	3,874	1,488	384	10,910
2001	3,852	-715	2,353	945	422	6,857
2002	2,964	173	2,353	985	461	6,936
2003	2,900	-133	2,075	905	499	6,246
2004	3,382	-1,341	1,531	694	537	4,803
2005	2,993	-5	2,241	1,055	576	6,859
2006	3,301	-101	2,400	1,171	576	7,347
2007	2,935	-449	1,865	942	576	5,868

**Appendix Table A3.** ICES landing statistics, adjustments to ICES landing statistics, unreported landings, discards, recreational catch, and reconstructed total for herring (*Clupea harengus*) for Lithuania (t). N/A: part of ICES category 'former USSR'.

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	170	0	9	0	179
1951	N/A	400	0	20	0	420
1952	N/A	520	0	26	0	546
1953	N/A	1,190	0	60	0	1,250
1954	N/A	2,750	0	138	0	2,888
1955	N/A	2,020	0	101	0	2,121
1956	N/A	2,010	0	101	0	2,111
1957	N/A	530	0	27	0	557
1958	N/A	1,380	0	69	0	1,449
1959	N/A	2,290	0	115	0	2,405
1960	N/A	2,860	0	143	0	3,003
1961	N/A	2,130	0	107	0	2,237
1962	N/A	1,080	0	54	0	1,134
1963	N/A	2,010	0	101	0	2,111
1964	N/A	1,650	0	83	0	1,733
1965	N/A	1,430	0	72	0	1,502
1966	N/A	2,650	0	133	0	2,783
1967	N/A	2,000	0	100	0	2,100
1968	N/A	4,840	0	242	0	5,082
1969	N/A	3,610	0	181	0	3,791
1970	N/A	3,920	0	196	0	4,116
1971	N/A	6,950	0	348	0	7,298
1972	N/A	7,550	0	378	0	7,928
1973	N/A	7,240	0	362	0	7,602
1974	N/A	4,969	0	248	0	5,217
1975	N/A	4,630	0	232	0	4,862
1976	N/A	4,927	0	246	0	5,173
1977	N/A	6,300	0	315	0	6,615
1978	N/A	6,320	0	316	0	6,636
1979	N/A	7,858	0	393	0	8,251
1980	N/A	5,651	0	283	0	5,934
1981	N/A	4,933	0	247	0	5,180
1982	N/A	4,962	0	248	0	5,210
1983	N/A	5,967	0	298	0	6,265
1984	N/A	5,613	0	281	0	5,894
1985	N/A	5,810	0	291	0	6,101
1986	N/A	5,804	0	290	0	6,094
1987	N/A	6,280	0	314	0	6,594
1988	N/A	6,547	0	327	0	6,874
1989	N/A	6,915	0	346	0	7,261
1990	N/A	6,708	0	335	0	7,043
1991	N/A	6,500	455	348	3	7,306
1992	5,768	0	808	329	6	6,910
1993	3,775	0	766	227	9	4,777
1994	4,988	0	1,342	316	12	6,658
1995	7,058	0	1,793	443	15	9,308
1996	4,257	0	1,022	264	18	5,561
1997	3,330	0	749	204	21	4,304
1998	2,368	0	497	143	24	3,032
1999	1,313	0	257	79	27	1,676
2000	1,198	0	217	71	30	1,515
2001	1,639	0	274	96	33	2,041
2002	1,539	0	234	89	36	1,897
2003	2,109	0	289	120	39	2,557
2004	1,845	0	227	104	42	2,217
2005	748	0	84	42	45	918
2006	1,172	0	131	65	45	1,413
2007	3,592	0	402	200	45	4,239

**Appendix Table A4.** ICES landing statistics, adjustments to ICES landing statistics, unreported landings, discards, recreational catch, and reconstructed total for sprat (*Sprattus sprattus*) for Lithuania (t). N/A: part of ICES category 'former USSR'.

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	0	0	0	0	0
1951	N/A	0	0	0	0	0
1952	N/A	0	0	0	0	0
1953	N/A	60	0	3	0	63
1954	N/A	150	0	8	0	158
1955	N/A	190	0	10	0	200
1956	N/A	180	0	9	0	189
1957	N/A	350	0	18	0	368
1958	N/A	920	0	46	0	966
1959	N/A	2,960	0	148	0	3,108
1960	N/A	2,260	0	113	0	2,373
1961	N/A	3,080	0	154	0	3,234
1962	N/A	3,350	0	168	0	3,518
1963	N/A	4,030	0	202	0	4,232
1964	N/A	5,050	0	253	0	5,303
1965	N/A	4,040	0	202	0	4,242
1966	N/A	3,290	0	165	0	3,455
1967	N/A	1,620	0	81	0	1,701
1968	N/A	1,020	0	51	0	1,071
1969	N/A	5,530	0	277	0	5,807
1970	N/A	8,710	0	436	0	9,146
1971	N/A	11,070	0	554	0	11,624
1972	N/A	10,160	0	508	0	10,668
1973	N/A	4,330	0	217	0	4,547
1974	N/A	5,302	0	265	0	5,567
1975	N/A	5,428	0	271	0	5,699
1976	N/A	1,591	0	80	0	1,671
1977	N/A	12,520	0	626	0	13,146
1978	N/A	4,766	0	238	0	5,004
1979	N/A	5,411	0	271	0	5,682
1980	N/A	3,039	0	152	0	3,191
1981	N/A	2,671	0	134	0	2,805
1982	N/A	2,028	0	101	0	2,129
1983	N/A	1,624	0	81	0	1,705
1984	N/A	2,210	0	111	0	2,321
1985	N/A	3,279	0	164	0	3,443
1986	N/A	3,266	0	163	0	3,429
1987	N/A	4,348	0	217	0	4,565
1988	N/A	3,159	0	158	0	3,317
1989	N/A	4,488	0	224	0	4,712
1990	N/A	4,085	0	204	0	4,289
1991	N/A	3,682	258	197	0	4,137
1992	3,279	0	459	187	0	3,925
1993	2,779	0	564	167	0	3,510
1994	2,789	0	750	177	0	3,716
1995	4,799	0	1,219	301	0	6,319
1996	10,165	0	2,440	630	0	13,235
1997	6,018	0	1,354	369	0	7,741
1998	4,460	0	937	270	0	5,666
1999	3,117	0	611	186	0	3,914
2000	1,682	0	304	99	0	2,086
2001	3,135	0	524	183	0	3,841
2002	2,800	0	426	161	0	3,387
2003	3,032	0	415	172	0	3,620
2004	6,185	0	761	347	0	7,293
2005	8,635	0	967	480	0	10,082
2006	10,814	0	1,211	601	0	12,626
2007	19,745	0	2,211	1,098	0	23,054



**Appendix Table A5.** ICES landing statistics, adjustments to ICES landing statistics, unreported landings, discards, recreational catch, and reconstructed total for salmon (*Salmo salar*) for Lithuania (t). N/A: part of ICES category 'former USSR'.

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	0	0	0	0	0
1951	N/A	0	0	0	0	0
1952	N/A	0	0	0	0	0
1953	N/A	0	0	0	0	0
1954	N/A	0	0	0	0	0
1955	N/A	10	0	0	0	10
1956	N/A	0	0	0	0	0
1957	N/A	0	0	0	0	0
1958	N/A	0	0	0	0	0
1959	N/A	0	0	0	0	0
1960	N/A	0	0	0	0	0
1961	N/A	0	0	0	0	0
1962	N/A	0	0	0	0	0
1963	N/A	0	0	0	0	0
1964	N/A	0	0	0	0	0
1965	N/A	0	0	0	0	0
1966	N/A	0	0	0	0	0
1967	N/A	0	0	0	0	0
1968	N/A	0	0	0	0	0
1969	N/A	0	0	0	0	0
1970	N/A	0	0	0	0	0
1971	N/A	0	0	0	0	0
1972	N/A	0	0	0	0	0
1973	N/A	0	0	0	0	0
1974	N/A	6	0	0	0	6
1975	N/A	1	0	0	0	1
1976	N/A	0	0	0	0	0
1977	N/A	0	0	0	0	0
1978	N/A	0	0	0	0	0
1979	N/A	4	0	0	0	4
1980	N/A	33	0	1	0	34
1981	N/A	36	0	1	0	37
1982	N/A	30	0	1	0	31
1983	N/A	33	0	1	0	34
1984	N/A	43	0	2	0	45
1985	N/A	41	0	1	0	42
1986	N/A	57	0	2	0	59
1987	N/A	62	0	2	0	64
1988	N/A	48	0	2	0	50
1989	N/A	70	0	3	0	73
1990	N/A	66	0	2	0	68
1991	N/A	62	4	5	0	71
1992	20	0	3	3	0	25
1993	15	0	3	3	0	21
1994	5	0	1	1	0	7
1995	2	0	0	0	0	3
1996	10	4	3	3	0	20
1997	4	0	1	1	0	6
1998	5	0	1	1	0	7
1999	6	0	1	1	0	8
2000	6	0	1	1	0	8
2001	4	0	1	1	0	6
2002	11	0	2	2	0	16
2003	3	0	1	1	0	4
2004	2	0	0	0	0	3
2005	2	0	0	0	0	3
2006	1	0	0	0	0	1
2007	1	0	0	0	0	1

**Appendix Table A6.** ICES landing statistics, adjustments to ICES landing statistics, unreported landings, discards, recreational catch, and reconstructed total for the category 'flatfish' for Lithuania (t). N/A: part of ICES category 'former USSR'.

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	130	0	5	0	135
1951	N/A	80	0	3	0	83
1952	N/A	230	0	8	0	238
1953	N/A	110	0	4	0	114
1954	N/A	60	0	2	0	62
1955	N/A	150	0	5	0	155
1956	N/A	130	0	5	0	135
1957	N/A	130	0	5	0	135
1958	N/A	170	0	6	0	176
1959	N/A	240	0	9	0	249
1960	N/A	140	0	5	0	145
1961	N/A	110	0	4	0	114
1962	N/A	180	0	7	0	187
1963	N/A	170	0	6	0	176
1964	N/A	200	0	7	0	207
1965	N/A	420	0	15	0	435
1966	N/A	480	0	18	0	498
1967	N/A	240	0	9	0	249
1968	N/A	560	0	20	0	580
1969	N/A	600	0	22	0	622
1970	N/A	460	0	17	0	477
1971	N/A	510	0	19	0	529
1972	N/A	730	0	27	0	757
1973	N/A	80	0	3	0	83
1974	N/A	201	0	7	0	208
1975	N/A	252	0	9	0	261
1976	N/A	122	0	4	0	126
1977	N/A	99	0	4	0	103
1978	N/A	221	0	8	0	229
1979	N/A	106	0	4	0	110
1980	N/A	72	0	3	0	75
1981	N/A	49	0	2	0	51
1982	N/A	41	0	1	0	42
1983	N/A	25	0	1	0	26
1984	N/A	14	0	1	0	15
1985	N/A	32	0	1	0	33
1986	N/A	87	0	3	0	90
1987	N/A	471	0	17	0	488
1988	N/A	409	0	15	0	424
1989	N/A	200	0	7	0	207
1990	N/A	163	0	6	0	168
1991	N/A	125	9	25	1	160
1992	9	390	56	156	2	613
1993	120	35	31	93	3	282
1994	262	0	70	165	3	501
1995	194	0	49	121	4	368
1996	330	76	97	241	5	749
1997	624	0	140	380	6	1,150
1998	798	1	168	473	7	1,446
1999	629	0	123	367	7	1,127
2000	641	0	116	373	8	1,139
2001	1,155	-10	191	662	9	2,007
2002	1,100	-5	166	625	10	1,896
2003	1,115	-36	148	608	11	1,845
2004	909	-67	104	469	12	1,426
2005	967	0	108	532	12	1,620
2006	386	0	43	212	12	654
2007	373	0	42	205	12	632

**Appendix Table A7.** ICES landing statistics, adjustments to ICES landing statistics, unreported landings, discards, recreational catch, and reconstructed total for the category 'others' for Lithuania (t). N/A: part of ICES category 'former USSR'.

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	1,330	0	49	0	1,379
1951	N/A	2,320	0	85	0	2,405
1952	N/A	2,590	0	95	0	2,685
1953	N/A	3,630	0	132	0	3,762
1954	N/A	3,440	0	126	0	3,566
1955	N/A	3,140	0	115	0	3,255
1956	N/A	1,690	0	62	0	1,752
1957	N/A	1,630	0	59	0	1,689
1958	N/A	150	0	5	0	155
1959	N/A	190	0	7	0	197
1960	N/A	260	0	9	0	269
1961	N/A	390	0	14	0	404
1962	N/A	180	0	7	0	187
1963	N/A	330	0	12	0	342
1964	N/A	250	0	9	0	259
1965	N/A	170	0	6	0	176
1966	N/A	240	0	9	0	249
1967	N/A	1,530	0	56	0	1,586
1968	N/A	230	0	8	0	238
1969	N/A	140	0	5	0	145
1970	N/A	470	0	17	0	487
1971	N/A	20	0	1	0	21
1972	N/A	10	0	0	0	10
1973	N/A	1,810	0	66	0	1,876
1974	N/A	1,796	0	66	0	1,862
1975	N/A	2,232	0	81	0	2,313
1976	N/A	3	0	0	0	3
1977	N/A	1,954	0	71	0	2,025
1978	N/A	1,630	0	59	0	1,689
1979	N/A	1,817	0	66	0	1,883
1980	N/A	1,878	0	69	0	1,947
1981	N/A	1,938	0	71	0	2,009
1982	N/A	2,313	0	84	0	2,397
1983	N/A	2,298	0	84	0	2,382
1984	N/A	2,095	0	76	0	2,171
1985	N/A	1,723	0	63	0	1,786
1986	N/A	1,583	0	58	0	1,641
1987	N/A	1,983	0	72	0	2,055
1988	N/A	2,052	0	75	0	2,127
1989	N/A	2,242	0	82	0	2,324
1990	N/A	94	0	3	0	97
1991	N/A	47	3	3	0	53
1992	0	0	0	0	0	0
1993	10	0	2	1	0	13
1994	45	0	12	5	0	62
1995	69	0	18	7	0	93
1996	188	2	46	19	0	254
1997	154	0	35	15	0	204
1998	178	0	37	17	0	232
1999	262	0	51	25	0	338
2000	208	0	38	19	0	265
2001	239	0	40	22	0	301
2002	1,492	0	227	136	0	1,854
2003	256	0	35	23	0	314
2004	302	1	37	27	0	367
2005	202	0	23	18	0	242
2006	147	1	17	13	0	178
2007	97	0	11	9	0	116

