

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

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### ABSTRACT

Total marine fisheries catches by Latvia in the Baltic Sea (or its equivalent entity prior to separation from the USSR in 1991) were estimated from 1950–2007 using an approach called ‘catch reconstruction’. ICES landing statistics (which only report commercial landings) formed the baseline of the reconstruction, to which we added ‘adjustments to ICES landing statistics’ (particularly disaggregated data from when Latvia was part of the USSR), estimates of unreported landings, estimates of discards, and estimates of recreational catches. The reconstructed catch from 1950–2007 is approximately 4.7 million tonnes, attributing an additional 3.5 million tonnes to Latvia above catches reported by ICES for independent Latvia. From 1991–2007 when ICES landing statistics were reported for Latvia independently, our reconstructed catch was 28% higher than their reported 1.2 million tonnes. The most commercially important species are herring (*Clupea harengus*), sprat (*Sprattus sprattus*), and cod (*Gadus morhua*). We believe that this reconstruction represents a conservative estimate.

### INTRODUCTION

Latvia is on the eastern edge of the Baltic Sea, located between Estonia and Lithuania, and is bordered on the east by Russia and Belarus (Figure 1). Latvia declared its independence from the USSR in 1991, and joined NATO and the European Union in 2004. In 2007, the estimated Latvian population was 2,292,000 (UN, 2008). Latvia has an area of 64,589 km<sup>2</sup> with a 12 nautical mile territorial limit in the Baltic Sea, although Latvian fishers have access to areas beyond this boundary (FAO, 2009). The main species caught are herring (*Clupea harengus*), sprat (*Sprattus sprattus*), and Atlantic cod (*Gadus morhua*).

Latvia’s fisheries can be divided into four sectors: 1) a Baltic Sea and Gulf of Riga fleet; 2) coastal vessels; 3) a high seas fleet; and 4) inland waters.

1) In 2006, there were 115 trawlers and 48 gillnet vessels fishing in the Baltic Sea and



**Figure 1.** Map of the Baltic Sea with ICES subdivisions and surrounding countries. Latvia’s coastline borders ICES subdivisions 26, 28-1 and 28-2.

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the Gulf of Riga outside of coastal areas (Anon., 2008). Fishing in this area accounts for approximately 55% of annual total landings by Latvia (Anon., 2008). When Latvia was part of the USSR, it fished in most parts of the Baltic Sea. Since the 1990s, Latvia has reported its landings independent of the former USSR. The trawlers target herring all year round (with a mesh size of 28 mm), except during a 30-day ban in May/June (during the peak spawning time for herring), or if there is ice coverage in the Gulf of Riga. The trawlers also target sprat (with a mesh size of 16 mm) in the Baltic Sea year-round, with a lower intensity during the summer months. The number of trawlers and the total engine power has not been allowed to increase since the end of the 1990s, and the number of trawlers is now decreasing due to decommissioning of vessels. The gillnet vessels target mainly cod (using bottom gillnets), and in 2006 contributed approximately 57% of total Latvian cod landings (Anon., 2008). The trap-net fishery targets spawning herring from mid-April through July. The number of nets has been stable since the mid-1990s, and contributes much less to total landings than the trawler fleet (e.g., 15% of herring landings are taken with trap-nets, and 85% with trawlers, ICES, 2007a). Atlantic salmon (*Salmo salar*) has also been targeted with drift gillnets by 9 vessels. Drift gillnets have been prohibited for use in the Baltic Sea by the EU since January 2008.

2) The coastal fishery consisted of approximately 740 boats under 12 m in 2003, and mainly targets herring, trout (*Salmo trutta*), vimba-bream (*Vimba vimba*), flounder (*Platichthys flesus*), European eel (*Anguilla anguilla*), and pikeperch (*Sander lucioperca*), small catches of sprat and cod, and Atlantic salmon. However, landing and selling of Atlantic salmon was banned in 2005 (ICES, 2007b). This fishery uses mainly passive gears such as trapnets, poundnets, gillnets, and hooks, although Danish seines are used to catch flatfishes (Anon., 2008). Coastal catches only account for approximately 4–6 % of the total reported landings for the Baltic Sea and the Gulf of Riga, yet they are important to coastal dwellers.

3) The high seas fleet is comprised of approximately 13 vessels that fish in the Northern and Central Atlantic Ocean under three international conventions (NAFO, NEAFC, and CACAF), and in 2006 contributed 45% to total Latvian landings (Anon., 2008). The high seas fleet is not considered further in this report.

4) There are approximately 800 lakes over 10 hectares within Latvia (with a total area of 91,500 ha), as well as rivers and reservoirs that are available for inland fishery exploitation. The commercial landings from these inland waters are between 500 and 600 t annually (FAO, 2009), approximately 0.5% of total landings. The inland fishery is not considered further in this report.

Although Latvia accounts for only approximately 0.8% of the total population in Baltic coastal countries, recent landings accounted for approximately 10% of the total Baltic landings. The fisheries administration in Latvia is through the National Board of Fisheries of the Ministry of Agriculture, which is responsible for overall management of the fisheries sector, quota management, sector development, strategies and legislation (FAO, 2009). The Latvian portion of the total Baltic quota has since 2004 been allocated by the EU's Common Fisheries Policy (CFP), and then distributed to Latvian fishers by the government. Latvia's utilization of their allocated quota has been increasing, and reached 99.6% in 2003 (FAO, 2009).

The objective of the present work is to estimate total catches (in contrast to reported landings) for Latvia, from 1950 – 2007. ICES landings statistics were taken here to represent officially reported data. Hence, all other additions and modifications are deemed Illegal, Unreported and Unregulated (IUU) data. Four IUU components were addressed: 1) reported landings data source adjustments from sources such as ICES stock assessment working group reports, national data and published scientific papers; 2) unreported landings; 3) discards; and 4) recreational catches. The focus was on utilizing available knowledge and information sources to derive estimated complete 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 (ICES, 2009) were used as the baseline for our reconstruction of Latvia's fisheries catches in the Baltic Sea from 1950–2007. However, landings data for Latvia are presented in ICES landings statistics only from 1991 onward. Prior to 1991, Latvia's fisheries catches were presented as a component of ICES landings statistics for the USSR, which combined landings for Latvia, Estonia, Lithuania, and Russia. Thus, for the time period 1950–1989, landings data were obtained from the Latvian

Fish Resource Agency (M. Plikshs, unpubl. data), which provided the ‘former’ USSR landings disaggregated by country, for each of the former Baltic States (Latvia, Estonia, and Lithuania) and Russia. While these landings were previously reported to ICES as landings by USSR, ICES has not retroactively adjusted its earlier landings statistics to create separate landings data for each country. Thus, landings obtained from LATFRA for the time period 1950–1989 were considered as ‘adjustments’ to ICES landings statistics since there are no separate ICES landings statistics for Latvia for this time period. Other adjustments to ICES landings included taxa specific information contained within ICES stock assessment working group reports (ICES, 2009). In order to account for total catches (as opposed to landings), unreported landings (referred to as ‘unallocated’ catches by ICES), discards, and recreational catches were estimated. The resulting sum of ICES landings statistics, adjustments, unreported landings, discards, and recreational catches represents total reconstructed catches for Latvia from 1950–2007.

Our reconstruction represented the main taxa targeted by Latvia including cod (eastern and western stocks; *Gadus morhua*); herring (*Clupea harengus*); sprat (*Sprattus sprattus*); salmon (*Salmo salar*); flatfishes, which included European flounder (*Platichthys flesus*), European plaice (*Pleuronectes platessa*), and turbot (*Psetta maxima*); and another 30 taxonomic groups included in a grouping called ‘others’.

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

Catches that were not included in the ICES landings statistics for Latvia were considered as Illegal, Unreported or Unregulated (IUU) catches. Components included in our estimates of IUU catches were: a) ‘adjustments’ to ICES landings statistics from other reliable sources such as ICES stock assessment working group data or national data sources; b) ‘unreported’ landings (referred to by ICES as ‘unallocated’); c) ‘discards’, which included four categories; and d) ‘recreational’ catches. When combined with ICES landings statistics, these components formed our catch reconstruction for Latvia.

#### Adjustments to ICES landings statistics

ICES landings statistics were adjusted using data obtained from LATFRA and information contained in ICES stock assessment working group reports (Table 1). As ICES landings data for Latvia were not available prior to the 1990s, the national landings data provided by LATFRA for the period 1950–1989 were considered adjustments to ICES data. From 1991–2007, ICES stock assessment working group data provided information to make adjustments to landings of cod (ICES, 2007a; 2008a) and flatfishes (ICES, 2008a). The ICES working group data provided better accounting for cod, since landings were reported for the eastern and western stocks separately. Flatfish data, rather than being grouped together, were presented by individual species.

**Table 1.** Sources of adjustments to ICES landings statistics for Latvia from 1950–2007.

<b>Common name</b>	<b>Years</b>	<b>Source</b>
Cod	1950–1990	LATFRA
	1994–2007	ICES (2007, 2008a)
Herring	1950–1990	LATFRA
Sprat	1950–1990	LATFRA
Salmon	1950–1990	LATFRA
Flatfishes	1950–1990	LATFRA
	1991–2005	ICES (2008a)
‘Others’	1950–1990	LATFRA

#### Unreported landings

Unreported landings were estimated as a rate (%) for all taxa, which was applied to ICES landings statistics + adjustments from 1990 to 2007. Rates of unreported landings for Latvia from 1950–1989 were assumed to be 0%, following our assumption for all eastern bloc countries (see ‘Methods’ in Zeller *et al.*, this volume). For the period from 1993–2007, unreported landings were based on information provided by LATFRA for cod and ICES stock assessment working group data for salmon, herring and other taxa (ICES, 2007a; 2008a; 2008b). To estimate unreported landings for 1991 and 1992, which reflected the transition from a state-controlled economy to a market-based economy, a linear interpolation was done between the assumed rate of 0% in 1990 and the first anchor point in 1993 (Table 2).

Anonymous sources within LATFRA provided an estimated range (50–100% of reported landings) for unreported landings of cod. We applied the average of this range (75%) for all years between 1993 and 2007 (Table 2). Unreported landings of salmon, herring, and other taxa for the period 1993–2007 were

derived from ICES stock assessment working group data using our default, assumption based methodology (Table 2; see 'Methods' in Zeller *et al.*, this volume).

From 1993 to 2007, unreported landings of herring caught in the Gulf of Riga were presented by ICES as a combined total tonnage for Latvia and Estonia (ICES, 2008a). However, sources indicated that these unreported landings were from Latvian fisheries only (Anon., pers. comm.).<sup>2</sup> The rate was determined by dividing all of the unreported landings from ICES (2008a) by Latvia's catches in subdivision 28-2. To estimate rates for 1991 and 1992, a linear interpolation was done between 0% in 1990 and the 1993 rate. We applied this rate to all herring catches in Latvia.

### Discards

Discards for Latvia were considered as four separate categories; each estimated as a rate and then applied to total landings (i.e., ICES landings + adjustments + unreported landings) for each respective species or group. The sum of discards in all categories gave us the total discarded catches for Latvia. The four categories considered were: 1) underwater discards accounting for the mortality of fish lost from gear while deployed and actively fishing; 2) ghostfishing due to lost gear; 3) boat based discards usually resulting from fisher's behavior after the catch is brought to the surface/on board; and 4) seal-damaged discards representing the fraction of catch discarded because of seal-damage. Seal-damaged discard data were used in place of boat based discards in subdivisions where seal-discard data were available and only when the seal-discard rates were higher than the boat-based discard rates. This was done to avoid the possibility of double accounting, as we could not determine whether seal-discards had already been included in estimates of boat based discards.

'Underwater discards': An underwater discard rate was applied to herring and sprat only. Our estimate of underwater discards for herring and sprat was based on a Finnish trawl study from which we estimated an underwater discard rate for herring of approximately 9% (Rahikainen *et al.*, 2004). 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 Latvia are not reported by gear type, the estimated rate of 9% was reduced to a more conservative estimate of 5% and then applied to all years 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 in Sweden by lost gear and related it to commercial landings 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%. Here, we used the average of 1.65% applied to all taxa, except herring and sprat, for all years during the period of study (1950-2007).

'Boat-based discards': A boat-based discard rate of 2% was applied to all taxa, except herring and sprat, from 1950-1990. For the period 1993-2007, boat-based discard data for western and eastern cod stocks

**Table 2.** Anchor points (%) for unreported landings of cod (LATFRA), herring (Table 6.3.1a in ICES, 2008a), 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). The dashed lines (-) indicate years when the rates were derived through linear interpolation.

Year	Cod	Salmon <sup>a</sup>	Herring	Other taxa <sup>b</sup>
1950-1990	0.00 <sup>c</sup>	0.0 <sup>c</sup>	0.0 <sup>c</sup>	0.0 <sup>c</sup>
1991-1992	-	-	-	-
1993	75.0	19.4	25.4	20.3
1994	75.0	18.7	25.0	26.9
1995	75.0	19.5	20.0	-
1996	75.0	20.4	21.6	-
1997	75.0	20.8	20.0	-
1998	75.0	20.1	20.0	-
1999	75.0	20.4	15.0	-
2000	75.0	19.9	15.0	-
2001	75.0	20.4	15.0	-
2002	75.0	20.5	15.0	-
2003	75.0	20.1	15.0	-
2004	75.0	20.6	15.0	12.3
2005	75.0	20.7	15.0	11.2
2006	75.0	22.2	15.0	11.2 <sup>d</sup>
2007	75.0	21.4	15.0	11.2 <sup>d</sup>

<sup>a</sup> based on the reported mode value by ICES. <sup>b</sup> derived from the default values for cod and salmon (Zeller *et al.*, this volume) <sup>c</sup> default assumption based rate. <sup>d</sup> rate carried forward.

<sup>2</sup> This reliable source was interviewed personally by the lead author, and wished to remain unnamed due to personal considerations.

(ICES; 2007a; 2008a), and for salmon (ICES, 2008b) were obtained from ICES stock assessment working group data (Table 3). Discards rates for eastern and western cod were our default values calculated as Baltic wide-estimates (see 'Methods' in Zeller *et al.*, this volume). For salmon, the Baltic-wide, boat-based discard rate based on the mode estimate presented in ICES (2008b) was used, as it was the default assumption for countries whose recreational catches of salmon were not reported to ICES (see 'Methods' in Zeller *et al.*, this volume).

For all other taxa, excluding cod and salmon, boat-based discards were derived from a Danish government study (Anon., 2006a) that examined boat-based discard practices for their entire fleet over a one year period. Discards were estimated from the discard tonnages presented for flounder (48%), plaice (34%), turbot (39%), whiting (36%), and 'others' (6%). The Danish study provided information for a species-specific discard rate for whiting (normally group with 'others') of 36% (see 'Methods' in Zeller *et al.*, this volume). These rates were applied to total landings (ICES landings statistics + adjustments + unreported landings) of flatfishes, whiting, and 'others' in all years between 1993 and 2007, while linear interpolation estimated discards between 1990 (2%) and 1993 (our first anchor point).

Seal-damaged discards have been a concern in the Baltic Sea since the 1980s, when seal populations started to recover from a previously depleted state (Österblom *et al.*, 2007). Seal-damaged discard data were only calculated and applied to herring caught in pound nets by Latvia in subdivision 28. Prior to the 1980s, our assumed default rate for seal-damaged discards was zero. To estimate seal-discard rates from 1980 onwards, we calculated an anchor point for seal-damaged discards based on the Estonian data for 2005. Since the proportion of herring caught in pound nets relative to other gear-types for Latvian fisheries was not known, we assumed the same value as that of Estonia. The proportion of herring caught in pound nets in Estonia relative to Estonia's total herring catch for subdivision 28, was estimated to be 45%. Seal-damaged discard rates for herring caught in subdivision 28 were estimated to be up to 50% of catches taken using pound nets. Here, we used half of Estonia's discard rate (25%) in combination with the assumption that 45% of herring in Latvia is caught with pound nets, to estimate seal-damaged discards of herring. The anchor point for 2000 was assumed to be half the rate for 2005 as seal populations were thought to have doubled between 2000 and 2005 (Ifremer, 2007). A linear interpolation was done to estimate seal-discard rates between anchor points established in 1980 and 2000, and the 2005 rate was carried forward unaltered to 2007. This seal-discard rate for herring was used in place of boat-based discards from 1980-2007 for subdivision 28 (Table 4).

### Recreational catches

Almost no data for recreational catches exist for Latvia except for cod. Therefore, we relied on recreational catch rates from Estonia, and applied these to the coastal population of Latvia to estimate recreational catches for species from 1991-2007.

**Table 3.** Boat-based discard rates (%) of reported landings for the eastern cod stock (Tables 2.4.1, 2.4.5b in ICES, 2007; Tables 2.4.1, 2.4.5b and 2.4.20 in ICES, 2008), the western cod stock (Tables 2.3.6 in ICES, 2007; Tables 2.3.1, 2.3.6 and Figure 2.3.1 in ICES, 2008a) and salmon (Table 2.1.2 in ICES, 2008b). Dashed lines (-) indicate interpolated rates.

Year	Western cod	Eastern cod	Salmon
1950-1990	2.0 <sup>a</sup>	2.0 <sup>a</sup>	2.0 <sup>a</sup>
1991-1992	-	-	-
1993	14.5	3.4	14.1 <sup>b</sup>
1994	10.6	2.1	12.9 <sup>b</sup>
1995	11.3	1.7	13.9 <sup>b</sup>
1996	15.7	1.2	15.1 <sup>b</sup>
1997	10.0	3.9	14.9 <sup>b</sup>
1998	17.3	3.4	14.2 <sup>b</sup>
1999	11.6	2.5	14.8 <sup>b</sup>
2000	12.5	6.8	10.3 <sup>b</sup>
2001	11.2	3.2	15.0 <sup>b</sup>
2002	10.4	2.2	15.8 <sup>b</sup>
2003	15.8	2.8	15.4 <sup>b</sup>
2004	10.1	1.8	15.6 <sup>b</sup>
2005	18.6	3.0	15.2 <sup>b</sup>
2006	8.6	13.2	17.4 <sup>b</sup>
2007	8.3	11.3	14.2 <sup>b</sup>

<sup>a</sup> assumed default rate for eastern bloc countries (see 'Methods' in Zeller *et al.*, this volume); <sup>b</sup> based on the reported mode value from ICES (see 'Methods' in Zeller *et al.*, this volume).

**Table 4.** Anchor points of seal-damaged discards (%) for herring caught in subdivision 28. Dashed line (-) indicates interpolated rate based on Ifremer (2007).

Year	Seal-damaged discard
1980	0.00
1981-1999	-
2000	1.88
2001-2004	-
2005	3.75 <sup>a</sup>
2006	3.75 <sup>a</sup>
2007	3.75 <sup>a</sup>

<sup>a</sup>2005 rate carried forward

Three ports have offered boat charters to catch cod recreationally since 2004. In one harbor, Liepaja, 15 boats were estimated to catch between 3-5 tonnes in 2007 (M. Plikshs, unpubl. data). Assuming the same catch rates for the other two harbors, we estimated the recreational catch of cod to be 12 tonnes per year since 2004.

LATFRA reported that Latvian recreational fishers also caught herring, salmon, flounder, garfish, seatrout, perch and smelt. We relied on recreational catch information from Estonia to estimate these catches from 2004-2007. To remain conservative, we used half of the average reported recreational catch rates from Estonia. These were transformed into *per capita* catch rates for the coastal population (see Methods in Veitch *et al.*, this volume). We estimated the coastal population for Latvia as the total population of coastal districts to be approximately 1,676,000 inhabitants (Anon., 2006c). Multiplying the estimated coastal population of Latvia with the *per capita* catch rates, we estimated Latvia's recreational catches for the above species from 2004-2007 (Table 5). For all species, including cod, we assumed a recreational catch of zero in 1990. Linear interpolations for all Latvian recreational catches were performed in the intervening years from 1991-2003.

## RESULTS

ICES landing statistics for Latvia have only been incorporated since 1991, prior to that they were included in the landing statistics of the USSR (Table 6). In 1991, the ICES landings statistics reported landings of 55,461 t, which decreased slightly for the following two years, but then increased to reach 86,123 t in 1997. From 1998-2007, the average annual ICES landing statistics were 81,144 t, with a peak of 93,088 t in 2005. The time series ended with landings of 89,366 t in 2007. From 1991-2007, ICES landing statistics report a total catch of 1,211,724 t for Latvia (Figure 2).

**Table 6.** ICES landing statistics presented as totals for Latvia (t) from 1992-2007, prior to which catches are not reported independently (see text for details).

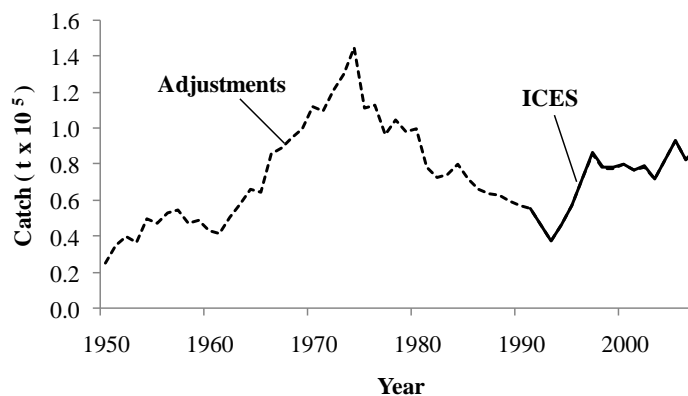
Common name	1950-1989	1990-1999	2000-2007
Cod	n/a	43,680	39,937
Herring	n/a	237,265	192,818
Sprat	n/a	263,669	410,376
Salmon	n/a	1,882	531
Flatfishes	n/a	4,004	7,065
'Others'	n/a	6,044	4,453

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

IUU is used in this report to quantify any catches made by a country that are not included in the ICES landing statistics. Adjustments to ICES landing statistics, unreported ('unallocated') landings, discards, and recreational catches account for our IUU adjustments (see Methods for details and sources).

#### Adjustments to ICES landing statistics

Overall, there were a total of 3,063,556 t of adjustments to ICES landing statistics from 1950-2007 (Table 7). The majority of these adjustments were due to the fact that prior to 1991, Latvian landings were reported as part of the former USSR, and there has been no retroactive adjustment to ICES landing statistics (Figure 2). For the time period from 1950-1990, a total 3,062,720 t of adjustments were made. Herring and cod adjustments had the largest proportions of adjustments, accounting for 43% (1,317,909 t) and 28% (863,759 t), respectively. Sprat and the group 'others' accounted for 16% (496,191 t) and 11%



**Figure 2.** ICES landing statistics and adjustments to ICES landing statistics for Latvia from 1950-2007

**Table 5.** Anchor points for Latvia's recreational catch for the period 2004-2007, based on half the average Estonian reported recreational catch for 2004 and 2007 (Anon., 2006b; 2007). See Veitch *et al.* (this volume).

Common Name	Recreational catch 2004-2007 t·year <sup>-1</sup>
Herring	1.24
Salmon	2.04
Flounder	50.67
Garfish	30.73
Sea trout	1.65
Perch	2.17
Smelt	35.48

(323,414 t) of the adjustments, respectively. Flatfish and salmon had minor adjustments made to the ICES landing statistics, with flatfish accounting for 2% (54,866 t) and salmon 0.2% (7,414 t).

From 1991-2007, there was a total of 836 t in adjustments to ICES landing statistics. The majority of this was explained by adjustments to cod data, which had a net increase of 656 t. Flatfishes were the group with the next largest adjustment to ICES landing statistics, with a total of 112 t. The group 'others' had a total adjustment of 48 t, and salmon had an increase of 20 t. Herring and sprat data had no adjustments during this time period.

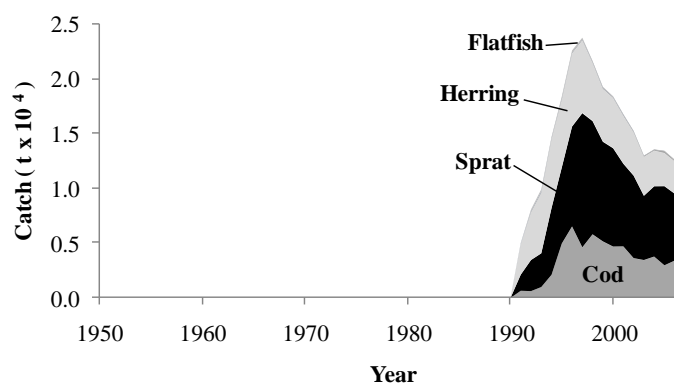
**Table 7.** Decadal totals of adjustments to ICES landing statistics for Latvia (t).

Common name	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2007
Cod	181,990	171,990	227,550	276,192	6,015	22
Herring	206,340	331,000	396,766	349,485	34,318	0
Sprat	18,910	83,950	293,056	83,863	16,412	0
Salmon	660	1,410	1,433	3,287	621	6
Flatfishes	12,580	23,010	15,469	3,165	625	16
'Others'	17,460	83,500	207,109	14,304	1,027	14

### Unreported landings

Unreported landings were assumed to have begun in Latvia following their separation from the USSR, and in 1991, the estimated unreported landings were 4,846 t (Figure 3). This increased to a peak of 21,890 t in 1997, and by 2007 had decreased to 13,586 t (Figure 3). The total unreported landings for 1991-2007 was estimated to be 248,608 t and accounted for approximately 6% of our reconstructed total for the same period.

Sprat had the highest estimated unreported landings, with an estimated total of approximately 110,000 t from 1991-2007 (Table 8), adding an additional 16% to the reported sprat landings. In 1991, the estimated unreported sprat landings were 1,260 t. This increased to 11,096 t in 1997, and decreased to 6,771 t by 2007. The species with the next largest contribution to unreported landings was herring with 74,679 t from 1991-2007, which added an additional 17% to reported herring landings. Unreported herring landings were estimated to have been 2,820 t in 1991, rose to a peak of 5,866 t in 1996, and then declined to 3,361 t by 2007. Unreported cod landings contributed almost as



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

**Table 8.** Decadal totals of unreported landings for Latvia (t).

Common name	1950-1989	1990-1999	2000-2007
Cod	0	31,610	29,969
Herring	0	44,218	28,923
Sprat	0	54,973	55,023
Salmon	0	293	109
Flatfishes	0	794	907
'Others'	0	1,198	590

much as herring to total unreported landings, with an estimated 61,579 t from 1991-2007 (Table 8), but this corresponded to an additional 74% of reported cod landings. Unreported cod landings were an estimated 657 t in 1991, increased to a peak of 6,556 t in 1996, and then decreased to 3,202 t at the end of the time series. The group 'others' (totaling 1,788 t) and flatfish (totaling 1,701 t) contributed an additional 17% and 15% to reported landings for these two groups, respectively. Salmon contributed the least with 403 t from 1991-2007, adding an additional 17% to reported salmon landings.

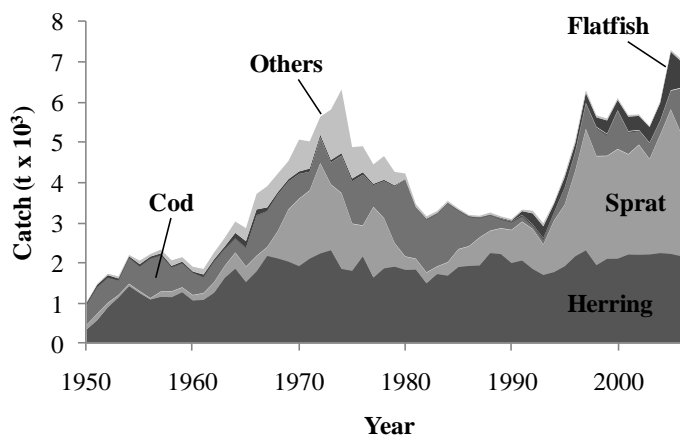
### Discards

Discards are comprised of four components (ghostfishing, underwater discards, boat-based discards and seal-damaged discards), and these were estimated to total 228,270 t throughout the time series (Figure 4). Discards were estimated to be 1,044 t at the beginning of the time series, and increased to a first peak of 6,303 t in 1974. From 1975-1994, discards averaged 3,662 t-year<sup>-1</sup>. For the most recent period, discards increased again, and averaged 5,940 t annually from 1995-2007, with a peak of 7,280 t in 2005 (Figure 4).

The largest contributor to discards was herring, with 103,002 t estimated for the period 1950-2007 (Table 9), which is an average discard rate of 5% of total reconstructed herring catches. Herring discards were estimated to be 349 t in 1950, and this increased to an average of 1,579 t·year<sup>-1</sup> from 1950-1984. From 1985-2007, herring discards increased to an average 2,075 t annually (with a peak of 2,316 t in 1997). Sprat was the next largest contributor, with an estimated 64,012 t discarded over the time period (Table 9). Sprat discards were estimated to have been 109 t in 1950, averaged 202 t annually from 1950-1968, and then increased to average 1,537 t·year<sup>-1</sup> from 1969-1978 (Figure 4). Sprat discards were lower from 1979-1993, at an average 554 t annually, but then increased again to average 2,607 t annually from 1994-2007 (with a peak of 3,594 t in 2005, Figure 4). Cod discards were estimated to be 39,750 t from 1950-2007 (Table 9). Starting at an estimated 527 t in 1950, cod discards reached a peak of 1,902 t in 1980, and during the last year under consideration were estimated to be 957 t. 'Others' contributed the next largest amount, an estimated 12,749 t over the time period, which is an average discard rate of 3.8%. 'Others' discards were estimated to be 20 t in 1950, increased to a peak of 1,577 t in 1974, and then decreased to an average of 50 t annually from 1981-2007. Flatfish discards were estimated to be 8,093 t over the time period, beginning with an estimated 35 t in 1950, increasing to a peak of 952 t in 2005, before decreasing to end the time series at an estimated 583 t. Flatfish had the highest discard rate with an average of 11% of total reconstructed flatfish catches. Salmon discards contributed the least to overall discards, with a total of 665 t over the time period (with a peak of 48 t in 1993), and an average discard rate of 6%.

### Recreational catches

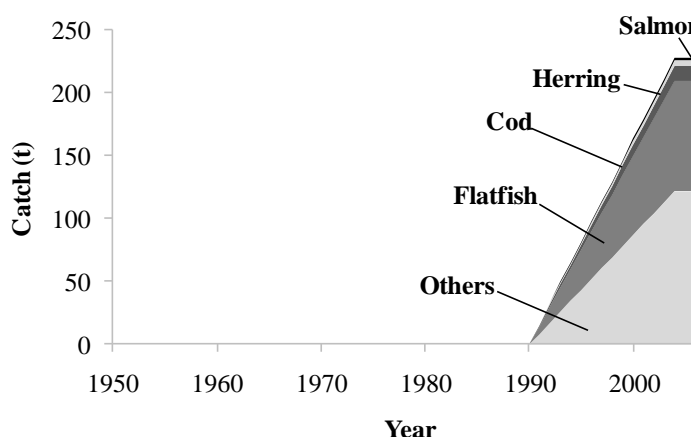
It was assumed that there were no recreational catches in Latvia prior to 1991 (Figure 5), and in 1991 the total recreational catch was estimated as 16 t. This increased to a peak of 228 t in 2004-2007 (Figure 5). The total estimated recreational catch from 1991-2007 is 2,386 t (Table 10), and the two groups that made up the majority were 'others' and flatfishes, with overall catches of 1,275 t (53% of recreational catch) and 925 t (39% of recreational catch), respectively (Table 10). Recreational catches of 'other' fishes were estimated to be 8 t in 1991, increasing to a peak of 122 t in 2004-2007.



**Figure 4.** Latvia's discards by taxa, 1950-2007. Discards of Salmon were too small to show at present scale (See Table 9).

**Table 9.** Decadal totals of estimated discards for Latvia (t).

Common name	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2007
Cod	6,643	6,278	8,306	10,081	3,364	5,079
Herring	10,317	16,550	19,838	18,819	19,443	17,626
Sprat	946	4,198	14,653	4,193	16,753	23,270
Salmon	24	51	52	120	316	101
Flatfishes	459	840	565	116	2,153	3,961
'Others'	637	3,048	7,559	522	575	407



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



Recreational catches of flatfishes were estimated to have been 6 t in 1991, increasing to a peak of 88 t in 2004-2007. The estimated total recreational catch for cod were 126 t, salmon 38 t and herring 23 t for the period 1991-2007 (Table 10).

### Total Reconstructed Catch

Total reconstructed catches from 1950-2007 were estimated to be 4,754,544 t (Figure 6; Table 11). See Appendix Table A1 for complete time series data on all additions to catch by taxonomic group. In 1950, the reconstructed catch was an estimated 26,274 t, and increased to a peak of 151,329 t in 1974 (Figure 6). Reconstructed catches decreased to 49,852 t in 1993, increased to average 98,775 t-year<sup>-1</sup> for the remainder of the time period, and were estimated to end the time period with 110,423 t in 2007 (Figure 6). Herring had the largest adjustments to ICES landing statistics, as well as the most discards, while sprat had the highest amount of unreported landings. 'Others' and flatfish had the highest amount of recreational catch.

ICES landing statistics report 1,211,724 t from 1991-2007, our total reconstructed catch for the same time period was 1,553,914 t, an increase of 28% (Figure 7). For the entire 1950-2007 time period, unreported landings, discards, recreational catches and ICES data source adjustments accounted for 7%, 6%, 0.1% and 87% of total reconstructed IUU (Table 11). The same components accounted for 69%, 30%, 1% and 0.03% for the 2000-2007 time period.

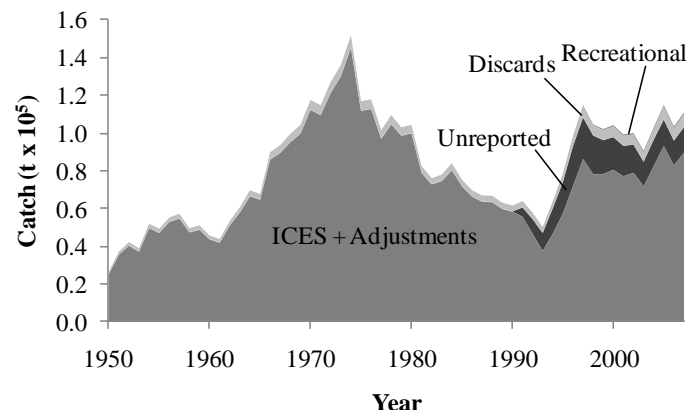
Herring had the highest reconstructed catch, 40% of the total reconstructed catch, with an estimated catch of 1,924,158 t from 1950-2007 (Table 12). Reconstructed herring catches were an estimated 7,319 t in 1950, increased to a peak of 48,720 t in 1973, then averaged 34,562 t-year<sup>-1</sup> for the remainder of the time period, ending in 2007 at 28,003 t.

Sprat had the next highest reconstructed catch, 28% of the total reconstructed catch, with an estimated 1,344,243 t from 1950-2007 (Table 12). Sprat catches went through two periods of high catches, and two periods of lower catches. In 1950 sprat catches were an estimated 2,289 t and from 1950-1967 averaged approximately 3,700 t-year<sup>-1</sup>. The 1980s were the other period of lower catches between two peaks, and from 1980-1988 sprat catches averaged 8,292 t-year<sup>-1</sup>. From 1968-1979 sprat catches increased to average 29,094 t-year<sup>-1</sup> with a peak of 47,124 t in 1972, and during the other period of high catches, 1989-2007, sprat catches averaged 44,942 t-year<sup>-1</sup> with an overall peak of 75,482 t in 2005.

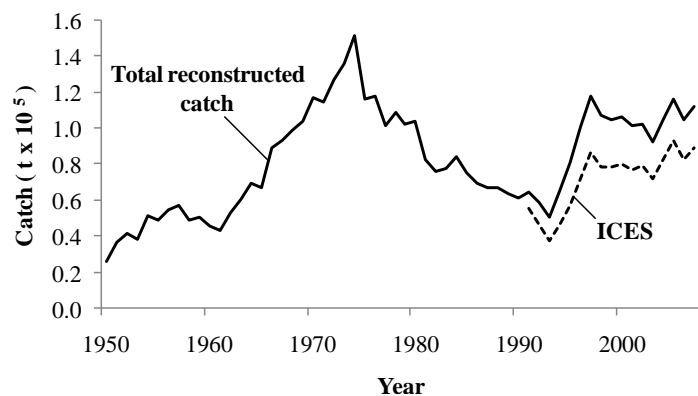
Cod accounted for 22% of the total reconstructed catch, with an estimated total of 1,048,830 t from 1950-2007 (Table 12). In 1950, reconstructed cod catches were an estimated 14,967 t, and averaged 19,410 t-year<sup>-1</sup> until 1978. Catches increased from 1979-1986 and averaged 36,868 t-year<sup>-1</sup> with an overall peak of

**Table 10.** Decadal totals of estimated recreational catch for Latvia (t).

Common name	1950-1989	1990-1999	2000-2007
Cod	0	39	87
Herring	0	7	16
Salmon	0	12	26
Flatfishes	0	283	642
'Others'	0	389	886



**Figure 6.** Latvia's total reconstructed catch by component from 1950-2007.



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

54,001 t in 1980. In the latter part of the time series reconstructed cod catches decreased to an average 9,095 t·year<sup>-1</sup> from 1987-2007, ending the time period with 8,440 t in 2007.

The group 'others' contributed the next largest amount to our total reconstruction, 7%, with an estimated total of 379,723 t from 1950-2007. 'Others' catches increased from 580 t in 1950 to a peak of 44,780 t in 1974, then decreased to average 981 t·year<sup>-1</sup> from 1981-2007. Flatfishes make up 1.6% of our reconstructed catch, with an estimated total of 76,654 t from 1950-2007. From an estimated 995 t in 1950, flatfish catches rose to peak at 4,695 t in 1965. From 1966-2007, reconstructed flatfish catches averaged 1,182 t·year<sup>-1</sup> and had another, smaller peak of 2,958 t in 2005. Salmon contributed 0.2% to our reconstructed catch, with an estimated total of 10,935 t from 1950-2007, and an average of 189 t·year<sup>-1</sup>.

## DISCUSSION

ICES landing statistics reported approximately 1.2 million t of catches from 1991-2007. For the same period, our reconstructed catch was nearly 1.6 million t, i.e., an additional 28%. From 1950-2007, our reconstructed catch was approximately 4,755,000 t, four times larger than the catches attributed to Latvia directly by ICES landing statistics for the period (however, this ignores the entity of the 'former USSR', and is thus misleading). The IUU component with the greatest contribution to our reconstruction was adjustments to ICES landing statistics, mainly from the period when ICES landing statistics were not reported independently for Latvia (1950-1990).

Unreported landings and discards represented 7% and 6% of total IUU respectively; yet unreported landings are assumed to have only begun in 1991, whereas discards are assumed to have been occurring throughout the time period, therefore unreported landings are occurring at a higher rate than discards. The species that contributed the most to unreported landings was sprat, with an estimated total of 109,996 t from 1991-2007 (adding 16% to reported sprat landings), but unreported cod landings accounted for the greatest increase to reported landings, an additional 74%. The largest contributor to discards was herring, with an estimated 103,002 t from 1950-2007. Flatfish discards were 8,093 t from 1950-2007. Recreational catches contributed the least to the reconstruction, with an estimated 2,386 t from 1991-2007.

We believe our reconstruction represents a conservative estimation of Latvia's total fisheries catches from the Baltic Sea, because we consistently used minimum estimates. Our rates of unreported cod catches from 1993 onwards were provided by LATFRA, and were country-specific. LATFRA estimated that unreported cod catches added an additional 75% to reported cod landings in 1993, which, compared to ICES estimate of 40.2% in 1993 for western cod stocks (ICES, 2008a), is much higher. For all other taxonomic groups, we used ICES data in absence of other information, but these should all be seen as minimum estimates, as it is known that only some countries report IUU catches to ICES, yet the total is split between all the countries. Although we have been able to correct for the estimates of unreported landings and discards for countries that are known to not submit estimates to ICES (e.g., Sweden does not submit unreported landing estimates, see Persson, this volume), it is likely that other countries do not report estimates of these catches to ICES either. If countries insisted on maintaining the confidentiality clause, there would still be a way of improving the quality of data of these catches, and that would be by providing two sets of data: one set from countries that do report IUU catches and discard estimates, along with their landings, and one set from countries that do not report such catch estimates, and their landings.

**Table 11.** Latvia's total catch (tonnes) by decade by catch component.

Component	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2007
ICES landing statistics	n/a	n/a	n/a	n/a	556,544	655,180
Adjustments	437,940	694,860	1,141,383	730,296	59,019	58
Unreported landings	n/a	n/a	n/a	n/a	126,232	115,522
Discards	19,026	30,964	50,973	33,851	42,603	50,044
Recreational catches	n/a	n/a	n/a	n/a	729	1,657
Total reconstruction	456,966	725,824	1,192,356	767,147	785,127	822,860

**Table 12.** Decadal totals of the estimated total reconstructed catch for Latvia (t).

Common name	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2007
Cod	188,633	178,268	235,856	286,273	84,707	75,095
Herring	216,657	347,550	416,604	368,304	328,397	239,383
Sprat	19,856	88,148	307,709	88,056	351,807	488,669
Salmon	684	1,461	1,485	3,407	3,124	773
Flatfishes	13,039	23,850	16,034	3,281	7,860	12,591
'Others'	18,097	86,548	214,668	14,826	9,233	6,350

This would allow for a better idea of the proportions that these fishery sectors contribute to overall catches in the Baltic Sea.

It would also be beneficial for most countries to increase the level of monitoring and reporting of recreational fisheries, and Latvia is no exception. Very little information was found regarding recreational fisheries, resulting in approximate estimates. Long-term monitoring would help determine fishing pressure and possible conservation measures that should be taken to ensure that all fish species will be available for recreational fishing for generations.

Our catch reconstruction for Latvia, though a conservative estimate that mostly likely underestimates true catches, is still more accurate than the current assumption of zero (or close to zero) IUU catch when there are no 'hard' data. This method of reconstruction that accounts for all fishery sectors, has been used successfully elsewhere (Zeller *et al.*, 2006; Zeller *et al.*, 2007; Zeller and Pauly, 2007).

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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 Latvia (t). N/A: part of ICES category 'former USSR'.

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	25,230	0	1,044	0	26,274
1951	N/A	35,440	0	1,492	0	36,932
1952	N/A	40,300	0	1,743	0	42,043
1953	N/A	37,030	0	1,676	0	38,706
1954	N/A	49,510	0	2,207	0	51,717
1955	N/A	47,030	0	2,066	0	49,096
1956	N/A	52,760	0	2,229	0	54,989
1957	N/A	54,660	0	2,343	0	57,003
1958	N/A	47,290	0	2,074	0	49,364
1959	N/A	48,690	0	2,153	0	50,843
1960	N/A	43,580	0	1,914	0	45,494
1961	N/A	41,780	0	1,862	0	43,642
1962	N/A	50,920	0	2,269	0	53,189
1963	N/A	57,810	0	2,630	0	60,440
1964	N/A	66,440	0	3,034	0	69,474
1965	N/A	64,550	0	2,871	0	67,421
1966	N/A	85,820	0	3,720	0	89,540
1967	N/A	89,390	0	3,909	0	93,299
1968	N/A	95,020	0	4,222	0	99,242
1969	N/A	99,550	0	4,533	0	104,083
1970	N/A	112,130	0	5,064	0	117,194
1971	N/A	109,360	0	5,019	0	114,379
1972	N/A	121,120	0	5,631	0	126,751
1973	N/A	129,850	0	5,807	0	135,657
1974	N/A	145,026	0	6,303	0	151,329
1975	N/A	111,567	0	4,876	0	116,443
1976	N/A	112,619	0	4,902	0	117,521
1977	N/A	96,772	0	4,449	0	101,221
1978	N/A	104,529	0	4,656	0	109,185
1979	N/A	98,410	0	4,265	0	102,675
1980	N/A	99,759	0	4,224	0	103,983
1981	N/A	78,776	0	3,464	0	82,240
1982	N/A	72,670	0	3,164	0	75,834
1983	N/A	74,460	0	3,294	0	77,754
1984	N/A	80,210	0	3,548	0	83,758
1985	N/A	71,719	0	3,358	0	75,077
1986	N/A	66,237	0	3,198	0	69,435
1987	N/A	63,542	0	3,178	0	66,720
1988	N/A	63,244	0	3,259	0	66,503
1989	N/A	59,679	0	3,163	0	62,842
1990	N/A	58,241	0	3,095	0	61,336
1991	55,461	34	4,846	3,329	16	63,686
1992	46,404	67	7,719	3,303	32	57,525
1993	37,346	26	9,438	2,993	49	49,852
1994	46,056	452	13,430	3,511	65	63,514
1995	57,112	194	16,496	4,198	81	78,081
1996	71,786	3	21,010	5,045	97	97,941
1997	86,123	2	21,890	6,287	114	114,416
1998	78,109	0	20,358	5,665	130	104,261
1999	78,147	0	17,899	5,584	146	101,777
2000	80,329	0	17,286	6,090	162	103,867
2001	76,930	3	16,071	5,673	179	98,856
2002	78,802	14	14,846	5,687	195	99,544
2003	71,609	0	12,969	5,401	211	90,190
2004	82,296	40	13,937	6,015	227	102,515
2005	93,088	1	13,817	7,280	228	114,414
2006	82,760	0	13,011	7,054	228	103,052
2007	89,366	0	13,586	7,243	228	110,423

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

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	14,440	0	527	0	14,967
1951	N/A	18,700	0	683	0	19,383
1952	N/A	17,480	0	638	0	18,118
1953	N/A	10,400	0	380	0	10,780
1954	N/A	17,980	0	656	0	18,636
1955	N/A	17,190	0	627	0	17,817
1956	N/A	27,330	0	998	0	28,328
1957	N/A	24,900	0	909	0	25,809
1958	N/A	16,820	0	614	0	17,434
1959	N/A	16,750	0	611	0	17,361
1960	N/A	15,640	0	571	0	16,211
1961	N/A	11,280	0	412	0	11,692
1962	N/A	14,420	0	526	0	14,946
1963	N/A	11,830	0	432	0	12,262
1964	N/A	9,830	0	359	0	10,189
1965	N/A	12,890	0	470	0	13,360
1966	N/A	27,660	0	1,010	0	28,670
1967	N/A	24,610	0	898	0	25,508
1968	N/A	24,940	0	910	0	25,850
1969	N/A	18,890	0	689	0	19,579
1970	N/A	16,780	0	612	0	17,392
1971	N/A	12,560	0	458	0	13,018
1972	N/A	17,290	0	631	0	17,921
1973	N/A	14,670	0	535	0	15,205
1974	N/A	25,217	0	920	0	26,137
1975	N/A	28,632	0	1,045	0	29,677
1976	N/A	34,258	0	1,250	0	35,508
1977	N/A	14,601	0	533	0	15,134
1978	N/A	25,077	0	915	0	25,992
1979	N/A	38,465	0	1,404	0	39,869
1980	N/A	52,099	0	1,902	0	54,001
1981	N/A	34,927	0	1,275	0	36,202
1982	N/A	36,135	0	1,319	0	37,454
1983	N/A	35,956	0	1,312	0	37,268
1984	N/A	40,291	0	1,471	0	41,762
1985	N/A	26,511	0	968	0	27,479
1986	N/A	20,172	0	736	0	20,908
1987	N/A	13,308	0	486	0	13,794
1988	N/A	10,665	0	389	0	11,054
1989	N/A	6,128	0	224	0	6,352
1990	N/A	5,381	0	196	0	5,577
1991	2,627	0	657	136	1	3,420
1992	1,250	0	625	87	2	1,963
1993	1,333	0	1,000	119	3	2,454
1994	2,379	452	2,123	186	3	5,143
1995	6,471	182	4,990	397	4	12,044
1996	8,741	0	6,556	442	5	15,744
1997	6,187	0	4,640	602	6	11,435
1998	7,778	0	5,834	692	7	14,310
1999	6,914	0	5,186	508	8	12,616
2000	6,280	0	4,710	932	9	11,930
2001	6,298	0	4,724	537	9	11,568
2002	4,867	0	3,650	335	10	8,862
2003	4,634	0	3,476	392	11	8,513
2004	5,027	29	3,792	335	12	9,195
2005	3,996	-7	2,992	456	12	7,449
2006	4,566	0	3,425	1,136	12	9,139
2007	4,269	0	3,202	957	12	8,440

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

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	6,970	0	349	0	7,319
1951	N/A	11,580	0	579	0	12,159
1952	N/A	17,960	0	898	0	18,858
1953	N/A	22,840	0	1,142	0	23,982
1954	N/A	28,500	0	1,425	0	29,925
1955	N/A	24,980	0	1,249	0	26,229
1956	N/A	21,820	0	1,091	0	22,911
1957	N/A	23,210	0	1,161	0	24,371
1958	N/A	22,990	0	1,150	0	24,140
1959	N/A	25,490	0	1,275	0	26,765
1960	N/A	21,360	0	1,068	0	22,428
1961	N/A	21,640	0	1,082	0	22,722
1962	N/A	25,180	0	1,259	0	26,439
1963	N/A	32,600	0	1,630	0	34,230
1964	N/A	37,190	0	1,860	0	39,050
1965	N/A	30,550	0	1,528	0	32,078
1966	N/A	35,870	0	1,794	0	37,664
1967	N/A	43,580	0	2,179	0	45,759
1968	N/A	42,300	0	2,115	0	44,415
1969	N/A	40,730	0	2,037	0	42,767
1970	N/A	38,480	0	1,924	0	40,404
1971	N/A	42,180	0	2,109	0	44,289
1972	N/A	44,790	0	2,240	0	47,030
1973	N/A	46,400	0	2,320	0	48,720
1974	N/A	37,104	0	1,855	0	38,959
1975	N/A	36,149	0	1,807	0	37,956
1976	N/A	43,342	0	2,167	0	45,509
1977	N/A	32,754	0	1,638	0	34,392
1978	N/A	37,361	0	1,868	0	39,229
1979	N/A	38,206	0	1,910	0	40,116
1980	N/A	36,631	0	1,832	0	38,463
1981	N/A	36,148	0	1,836	0	37,984
1982	N/A	28,916	0	1,495	0	30,411
1983	N/A	32,883	0	1,726	0	34,609
1984	N/A	31,629	0	1,686	0	33,315
1985	N/A	35,087	0	1,902	0	36,989
1986	N/A	35,081	0	1,929	0	37,010
1987	N/A	34,760	0	1,940	0	36,700
1988	N/A	39,671	0	2,249	0	41,920
1989	N/A	38,679	0	2,224	0	40,903
1990	N/A	34,318	0	2,001	0	36,319
1991	33,270	0	2,820	2,064	0	38,154
1992	25,965	0	4,401	1,852	0	32,219
1993	21,949	0	5,580	1,704	1	29,234
1994	22,676	0	5,668	1,774	1	30,119
1995	24,972	0	4,991	1,918	1	31,882
1996	27,523	0	5,934	2,168	1	35,625
1997	29,330	0	5,866	2,316	1	37,513
1998	24,417	0	4,883	1,948	1	31,250
1999	27,163	0	4,075	2,105	1	33,345
2000	26,768	0	4,016	2,109	2	32,894
2001	26,652	0	3,998	2,213	2	32,864
2002	25,284	0	3,792	2,207	2	31,285
2003	24,187	0	3,628	2,214	2	30,031
2004	23,559	0	3,534	2,249	2	29,344
2005	22,202	0	3,330	2,229	2	27,763
2006	21,762	0	3,264	2,170	2	27,198
2007	22,404	0	3,361	2,236	2	28,003

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

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	2,180	0	109	0	2,289
1951	N/A	3,110	0	156	0	3,266
1952	N/A	2,170	0	109	0	2,279
1953	N/A	1,170	0	59	0	1,229
1954	N/A	1,100	0	55	0	1,155
1955	N/A	920	0	46	0	966
1956	N/A	620	0	31	0	651
1957	N/A	2,540	0	127	0	2,667
1958	N/A	2,780	0	139	0	2,919
1959	N/A	2,320	0	116	0	2,436
1960	N/A	2,610	0	131	0	2,741
1961	N/A	3,310	0	166	0	3,476
1962	N/A	5,190	0	260	0	5,450
1963	N/A	5,890	0	295	0	6,185
1964	N/A	7,950	0	398	0	8,348
1965	N/A	7,620	0	381	0	8,001
1966	N/A	7,620	0	381	0	8,001
1967	N/A	4,310	0	216	0	4,526
1968	N/A	13,530	0	677	0	14,207
1969	N/A	25,920	0	1,296	0	27,216
1970	N/A	33,470	0	1,674	0	35,144
1971	N/A	33,950	0	1,698	0	35,648
1972	N/A	44,880	0	2,244	0	47,124
1973	N/A	32,690	0	1,635	0	34,325
1974	N/A	37,680	0	1,884	0	39,564
1975	N/A	23,399	0	1,170	0	24,569
1976	N/A	15,281	0	764	0	16,045
1977	N/A	35,163	0	1,758	0	36,921
1978	N/A	24,887	0	1,244	0	26,131
1979	N/A	11,656	0	583	0	12,239
1980	N/A	6,571	0	329	0	6,900
1981	N/A	5,331	0	267	0	5,598
1982	N/A	5,349	0	267	0	5,616
1983	N/A	3,695	0	185	0	3,880
1984	N/A	6,625	0	331	0	6,956
1985	N/A	8,827	0	441	0	9,268
1986	N/A	9,737	0	487	0	10,224
1987	N/A	13,900	0	695	0	14,595
1988	N/A	11,039	0	552	0	11,591
1989	N/A	12,789	0	639	0	13,428
1990	N/A	16,412	0	821	0	17,233
1991	17,996	0	1,260	963	0	20,219
1992	17,388	0	2,434	991	0	20,813
1993	12,553	0	2,548	755	0	15,856
1994	20,132	0	5,416	1,277	0	26,825
1995	24,383	0	6,193	1,529	0	32,105
1996	34,211	0	8,211	2,121	0	44,543
1997	49,314	0	11,096	3,020	0	63,430
1998	44,858	0	9,420	2,714	0	56,992
1999	42,834	0	8,395	2,561	0	53,791
2000	46,186	0	8,360	2,727	0	57,273
2001	42,769	0	7,142	2,496	0	52,407
2002	47,540	0	7,226	2,738	0	57,504
2003	41,743	0	5,719	2,373	0	49,835
2004	52,399	0	6,445	2,942	0	61,786
2005	64,647	0	7,240	3,594	0	75,482
2006	54,638	0	6,119	3,038	0	63,795
2007	60,454	0	6,771	3,361	0	70,586

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

Year	ICES landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	120	16	5	0	141
1951	N/A	40	0	1	0	41
1952	N/A	100	0	4	0	104
1953	N/A	60	0	2	0	62
1954	N/A	60	0	2	0	62
1955	N/A	70	0	3	0	73
1956	N/A	50	0	2	0	52
1957	N/A	40	0	1	0	41
1958	N/A	50	0	2	0	52
1959	N/A	70	0	3	0	73
1960	N/A	80	0	3	0	83
1961	N/A	120	0	4	0	124
1962	N/A	160	0	6	0	166
1963	N/A	170	0	6	0	176
1964	N/A	170	0	6	0	176
1965	N/A	190	0	7	0	197
1966	N/A	160	0	6	0	166
1967	N/A	110	0	4	0	114
1968	N/A	130	0	5	0	135
1969	N/A	120	0	4	0	124
1970	N/A	80	0	3	0	83
1971	N/A	80	0	3	0	83
1972	N/A	90	0	3	0	93
1973	N/A	100	0	4	0	104
1974	N/A	177	0	6	0	183
1975	N/A	219	0	8	0	227
1976	N/A	210	0	8	0	218
1977	N/A	164	0	6	0	170
1978	N/A	136	0	5	0	141
1979	N/A	177	0	6	0	183
1980	N/A	245	0	9	0	254
1981	N/A	184	0	7	0	191
1982	N/A	174	0	6	0	180
1983	N/A	286	0	10	0	296
1984	N/A	372	0	14	0	386
1985	N/A	333	0	12	0	345
1986	N/A	416	0	15	0	431
1987	N/A	395	0	14	0	409
1988	N/A	349	0	13	0	362
1989	N/A	533	0	19	0	552
1990	N/A	607	0	22	0	629
1991	481	0	31	39	0	552
1992	278	0	36	37	1	351
1993	243	13	50	48	1	355
1994	130	0	24	22	1	178
1995	139	0	27	26	1	193
1996	151	0	31	31	2	214
1997	169	1	35	34	2	241
1998	125	0	25	24	2	176
1999	166	0	34	33	2	235
2000	150	0	30	22	3	204
2001	135	2	28	27	3	195
2002	110	0	23	23	3	159
2003	49	0	10	10	3	72
2004	31	1	7	7	4	49
2005	20	3	5	5	4	36
2006	16	0	4	4	4	27
2007	20	0	4	4	4	32



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

Year	ICES Landing statistics	Adjustments	Un-reported	Dis-cards	Re-creational	Total
1950	N/A	960	0	35	0	995
1951	N/A	1,460	0	53	0	1,513
1952	N/A	1,670	0	61	0	1,731
1953	N/A	1,230	0	45	0	1,275
1954	N/A	1,010	0	37	0	1,047
1955	N/A	1,510	0	55	0	1,565
1956	N/A	1,290	0	47	0	1,337
1957	N/A	1,410	0	51	0	1,461
1958	N/A	950	0	35	0	985
1959	N/A	1,090	0	40	0	1,130
1960	N/A	750	0	27	0	777
1961	N/A	1,670	0	61	0	1,731
1962	N/A	1,380	0	50	0	1,430
1963	N/A	1,520	0	55	0	1,575
1964	N/A	3,640	0	133	0	3,773
1965	N/A	4,530	0	165	0	4,695
1966	N/A	3,980	0	145	0	4,125
1967	N/A	2,430	0	89	0	2,519
1968	N/A	1,560	0	57	0	1,617
1969	N/A	1,550	0	57	0	1,607
1970	N/A	1,690	0	62	0	1,752
1971	N/A	2,150	0	78	0	2,228
1972	N/A	1,830	0	67	0	1,897
1973	N/A	1,780	0	65	0	1,845
1974	N/A	1,645	0	60	0	1,705
1975	N/A	1,903	0	69	0	1,972
1976	N/A	1,817	0	66	0	1,883
1977	N/A	907	0	33	0	940
1978	N/A	1,001	0	37	0	1,038
1979	N/A	746	0	27	0	773
1980	N/A	417	0	15	0	432
1981	N/A	311	0	11	0	322
1982	N/A	509	0	19	0	528
1983	N/A	376	0	14	0	390
1984	N/A	159	0	6	0	165
1985	N/A	169	0	6	0	175
1986	N/A	139	0	5	0	144
1987	N/A	320	0	12	0	332
1988	N/A	252	0	9	0	261
1989	N/A	513	0	19	0	532
1990	N/A	530	0	19	0	549
1991	445	1	31	91	6	574
1992	624	66	97	270	13	1,069
1993	475	13	99	292	19	898
1994	337	0	91	211	25	664
1995	411	12	107	256	32	818
1996	336	3	81	203	38	662
1997	413	1	93	246	44	798
1998	400	0	84	236	50	771
1999	563	0	110	328	57	1,058
2000	434	0	79	253	63	828
2001	619	0	103	358	69	1,150
2002	608	1	93	347	76	1,124
2003	682	0	93	384	82	1,241
2004	777	10	97	438	88	1,410
2005	1,720	5	193	952	88	2,958
2006	1,169	0	131	645	88	2,033
2007	1,056	0	118	583	88	1,846

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

Year	ICES landing statistics	Adjustments	Un-reported	Discards	Re-ational	Total
1950	N/A	560	0	20	0	580
1951	N/A	550	0	20	0	570
1952	N/A	920	0	34	0	954
1953	N/A	1,330	0	49	0	1,379
1954	N/A	860	0	31	0	891
1955	N/A	2,360	0	86	0	2,446
1956	N/A	1,650	0	60	0	1,710
1957	N/A	2,560	0	93	0	2,653
1958	N/A	3,700	0	135	0	3,835
1959	N/A	2,970	0	108	0	3,078
1960	N/A	3,140	0	115	0	3,255
1961	N/A	3,760	0	137	0	3,897
1962	N/A	4,590	0	168	0	4,758
1963	N/A	5,800	0	212	0	6,012
1964	N/A	7,660	0	280	0	7,940
1965	N/A	8,770	0	320	0	9,090
1966	N/A	10,530	0	384	0	10,914
1967	N/A	14,350	0	524	0	14,874
1968	N/A	12,560	0	458	0	13,018
1969	N/A	12,340	0	450	0	12,790
1970	N/A	21,630	0	789	0	22,419
1971	N/A	18,440	0	673	0	19,113
1972	N/A	12,240	0	447	0	12,687
1973	N/A	34,210	0	1,249	0	35,459
1974	N/A	43,203	0	1,577	0	44,780
1975	N/A	21,265	0	776	0	22,041
1976	N/A	17,711	0	646	0	18,357
1977	N/A	13,183	0	481	0	13,664
1978	N/A	16,067	0	586	0	16,653
1979	N/A	9,160	0	334	0	9,494
1980	N/A	3,796	0	139	0	3,935
1981	N/A	1,875	0	68	0	1,943
1982	N/A	1,587	0	58	0	1,645
1983	N/A	1,264	0	46	0	1,310
1984	N/A	1,134	0	41	0	1,175
1985	N/A	792	0	29	0	821
1986	N/A	692	0	25	0	717
1987	N/A	859	0	31	0	890
1988	N/A	1,268	0	46	0	1,314
1989	N/A	1,037	0	38	0	1,075
1990	N/A	993	0	36	0	1,029
1991	642	33	47	37	8	767
1992	899	1	126	66	17	1,110
1993	793	0	161	75	26	1,055
1994	402	0	108	40	35	585
1995	736	0	187	73	43	1,039
1996	824	0	198	81	52	1,154
1997	710	0	160	69	61	999
1998	531	0	112	51	69	763
1999	507	0	99	48	78	732
2000	511	0	92	48	87	738
2001	457	1	76	42	96	672
2002	393	13	62	37	104	609
2003	314	0	43	28	113	498
2004	503	0	62	45	122	731
2005	503	0	56	44	122	725
2006	609	0	68	61	122	860
2007	1,163	0	130	102	122	1,517