Report on the eel stock and fishery in Germany 2007

DE.A Authors

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DE.B Introduction

In Germany, the European eel *Anguilla anguilla* is an important species for both commercial and recreational fisheries.

Germany is a federation consisting of 16 states, all of them having their own fisheries related legislation. The fisheries legislations include regulations, which are relevant to eel, such as minimum size limits or restrictions for fishing gears. In some states, the fisheries managers (fishers or angling clubs) have to prepare a management plan, which is examined by the responsible authorities. However, there is no general obligation to provide statistics on fishing efforts or landings.

Coastal eel fisheries occur in Niedersachsen, Bremen, Hamburg, Schleswig-Holstein and Mecklenburg-Pomerania.

Coastal marine fishing areas for eel fisheries in the North Sea can be divided into the lower courses and estuaries of rivers and the Wadden Sea. In the Baltic Sea there are lower courses of rivers, the inner part of the coast especially in Mecklenburg-Pomerania, called Bodden or Haff, and the outer coast.

The North Sea coastline of Schleswig-Holstein is in total 553 km long, 256 km of which belong to the islands and 297 to the continent. The Baltic Sea coast is 637 km incl. the island of Fehrmarn. The Schleswig-Holstein Wadden Sea has a surface area of about 1700 km² (Ministerium für ländliche Räume 2001).

The coastline of Mecklenburg-Pomerania is 1712 km long; 1358 km of it belong to the inner coast and 354 km to the outer coast. There are several isles of different sizes between 17 km² (Hiddensee) and 930 km² (Rügen). The total surface area of the fishing districts of the inner part is 171 400 ha and 568 000 ha of the outer part; resulting in a total area of 739 400 ha.

Generally the borderline between inland fisheries and marine fisheries is regulated in the respective state fishery legislations. It can be rather narrow to the coast as for smaller rivers like Eider and Stör or rather inland as with the River Elbe, near to the city of Hamburg, or the River Ems close to the city of Papenburg.

The European Water Framework Directive subdivides Germany into 10 separate River Basin Districts (RBD; Figure 1). Six of them are real international RBDs (Rhine, Danube, Elbe, Meuse, Oder, Ems). The two smaller RBDs Schlei/Trave and Eider mainly belong to Germany with only small parts of the catchment area being located in Denmark. Only two RBDs exclusively belong to Germany.

The Rhine is 1320 km long and has a drainage area of about 185 000 km² from which 106 000 km² belong to Germany. The drainage area is shared with Switzerland (28 000 km²), France (23 300 km²), The Netherlands (22 700 km²), Luxemburg (2520 km²), Austria (2400 km²), Belgium (767 km²), Liechstenstein (160 km²) and Italy (70 km²). The Rhine is draining into the North Sea.

The Elbe has a length of 1094 km and a catchment area of 148 268 km². The German part of the catchment area is 97 175 km² and 49 933 km² belong to the Czech Republic. Austria (921 km²) and Poland (239 km²) contribute less than 1% to the drainage area. Important tributaries in the German part of the catchment area are the rivers Havel, Saale, Mulde and Schwarze Elster. The Elbe is also draining into the North Sea.

The Weser is one of the two RBDs which completely belong to Germany. The total drainage area is 48 800 km² (including coastal waters). The Weser itself results from the confluence of the rivers Werra and Fulda. The main tributaries are Werra, Fulda, Diemel, Aller and Leine. The Weser is draining into the North Sea.

The river Ems is also draining into the North Sea. The total drainage area amounts to 18 000 km² which are shared with The Netherlands. About 15 000 km² belong to Germany and 2400 km² to The Netherlands. The rest results from the Ems-Dollart estuary.

The catchment area of the river Meuse (35 000 km²) is shared with The Netherlands, Belgium, France and Luxemburg. The main tributaries in Germany are the rivers Rur (2338 km²), Niers (1382 km²) and Schwalm (273 km²). The Meuse is draining into the North Sea.

With a total catchment of 4701 km², the Eider is a very small RBD. Only a small proportion of it belongs to Denmark. The Eider is draining into the North Sea.

With a catchment area of 122 512 km² (including the Szczecin Lagoon and its tributaries), which is shared by Poland, the Czech Republic and Germany, and a length of 855 km, the Oder is one of the bigger rivers draining into the Baltic Sea. The main part of the drainage area belongs to Poland (87.6 %), whereas the German part is 7987 km² (6.5 %).

The Warnow/Peene RBD includes a total drainage area of 13 600 km². The main rivers in this RBD are Warnow and Peene with catchment areas of 3300 km² and 5100 km², respectively. About 2900 km² coastal waters are also included. Both rivers are draining directly into the Baltic Sea. This RBD belongs exclusively to Germany.

The Schlei/Trave RBD has a drainage area of 6174 km². Besides Schlei and Trave, it consists of some small rivers and streams, which also drain into the Baltic Sea. The Schlei is no running water (river) but a firth of glacial origin. The RBD is also characterized by 51 lakes with areas of more than 50 hectares.

With 807 827 km² (including coastal waters), the drainage area of the Danube is the second largest European river catchment. The river has a length of 2870 km, and 18 countries contribute to the drainage area. The Danube is draining into the Black Sea and does not belong to the natural distribution area of the European eel.

According to the EU Council Regulation 1100/2007, Germany is preparing Eel Management Plans for its River Basin Districts except for the River Danube. The preparation is close to its final stage. During the process of preparing the plans, many data on the waters and on several aspects of the fishery have been collected by the responsible persons in authorities and scientific institutions. However, so far not all of these data have become available for the author of this report. Therefore, this report lacks

some detailed information for several RBD's but these data will become available for the next report (2008).

DE.C Fishing capacity

DE.C.1 Coastal and marine fishery (if relevant to eel)

The statistics of the German fleet (2005) lists 1624 fishing vessels with lengths of less than 12 m in the North Sea and the Baltic Sea. These vessels mainly fish for groundfish and herring and are probably the most relevant part of the fishing fleet with regard to eel. Additionally, there are 109 trawlers of different size fishing in both the North Sea and the Baltic Sea. 26 vessels with lengths of more than 12 m fish with passive gears, e. g. longlines. They may be partly relevant to eel. Most likely, the number of vessels has slightly decreased since 2005.

The Mecklenburg-Pomerania fishers are using hooped fykenets, eel fykenet chains and longlines for eel in the inner coastal waters and fykenet chains and longlines in the outer part.

Fishery on eel in the North Sea part of Schleswig-Holstein is with fykenets only. There is no more trawl fishery. In the lower course of the River Elbe, a stownet fishery exists. In the Baltic Sea Schleswig-Holstein fishers are often part-time fishers. They are using fykenets of different construction, even big sized ones fixed to piles nearly having the size of poundnets. In recent years more and more pipe eel traps are used, because they provide better catches, are cheaper and easier to protect against theft.

Lower Saxony has a small fishery on eel in the lower courses of the rivers Ems, Weser and Elbe. Trawl fishery has been finished some 10 years ago for economic reasons. On the river Ems there is a traditional fixed stow nets fishery (poles), which has been reduced for economic reasons as well. On the rivers Weser and Elbe an anchored stow net fishery exists. Fishery on yellow and silver eel starts in spring with increasing water temperatures and ends in October. During summertime eel baskets are being used additionally.

Figure 1 River Basin Districts (RBD) in the Federal Republic of Germany: Eider, Schlei/Trave, Elbe, Warnow/Peene, Oder, Weser, Ems, Rhine, Meuse and Danube.

DE.C.2 Inland fishery

Fishing capacity of inland fisheries is not reported in detail.

The total surface area of German inland waters is 845 305 ha, from which at present 536 777 ha are used for fisheries purposes.

In 2006, about 219 000 ha of lakes and reservoirs and 26 000 ha of rivers were managed by nearly 900 companies (including 478 full commercial fisheries and about 400 semi-professional and hobby fisheries). The total economic yield was about 9.4 million €. Data for 2007 are not yet available but most likely do not differ strongly.

DE.D Fishing effort

Landings from vessels less than 10 m which are landing eel need not to report on logbooks. Instead they are using landings declarations in which there is no record for

effort or gear.

Fishing effort is not reported for inland fisheries. However, the EU Council Regulation 1100/2007 requires some more detailed information from the fishers and consequently, the availability of data in this field will improve in the next years.

DE.E Catches and landings

DE.E.1 Coastal fishery

Data on landings of eel from the North Sea and the Baltic Sea have been provided by the relevant bodies of the respective states.

The coastal fishery in Lower Saxony mainly represents fishing activities in the lower reaches and estuaries of rivers by use of stow nets or fykenets.

Schleswig-Holstein reported on trawl fishery in the North Sea around the island of Helgoland during the 1960–1970s. But this fishery ceased in the meantime. Stocking size eel (in Table 1) were exclusively caught in lower parts of the rivers Elbe and Eider. These smaller eels are sold via the *Aalversandstelle* of the German Fisheries Association or directly to lake fishers for restocking of inland waters of this state.

In the Baltic Sea there is no trawl fishery from Schleswig-Holstein vessels for a long time. All landings are from small enterprises at Schlei and Trave. Around the island of Fehmarn and in the Lübeck Bight, catches decreased dramatically during recent years. According to fishers concerned this decrease is at least partly as a consequence of cormorants often sitting on the piles of poundnets and drying their plumage after a successful visit of the catch chambers of the passive gear. During the past five years 2/3 of all poundnets places have been given up as a consequence of a strong decrease of catches.

In the Mecklenburg-Pomeranian part of the Baltic coast, there is still a substantial eel fishery and the catches revealed only a slightly decreasing tendency during the last years.

Table 1 Eel landings from the coastal fishery in North and Baltic Sea by quantities (rounded) and value (transformed in Euro).

	North Sea						Baltic Sea		
Year	Lower Saxony (incl. stocking size eel)		Schleswig-Holstein		Schleswig-Holstein* Stocking size eel		Schleswig-Holstein		Mecklenburg-Pomerania
	t	€	t	€	t	€	t	€	t
1959	83.8	113,706							
1960	50.5	84,143							
1961	47.8	76,854							
1962	66.8	108,019							
1963	55.3	111,128							
1964	56.1	124,742							
1965	56.3	135,596							
1966	67.8	143,672							
1967	92.3	199,788							
1968	102.5	245,202							
1969	85.3	194,871	97.4	313,213			204.5	909.189	
1970	130.3	324,193	94.1	349,148			143.8	682.162	

	North Sea						Baltic Sea		
Year	Lower Saxony (incl. stocking size eel)		Schleswig-Holstein		Schleswig-Holstein* Stocking size eel		Schleswig-Holstein		Mecklenburg-Pomerania
1971	113.9	375,358	130.6	550,216			124.5	679.720	
1972	77.2	71,785	92.3	453,610			146.8	749.918	
1973	77.5	393,541	105.5	510,202			151.2	825.524	
1974	85.9	392,953	113.8	661,990			109.8	679.307	
1975	94.7	509,196	102.6	592,191			123.7	762.290	
1976	104.5	540,277	102.4	599,191			102.6	660.139	
1977	99.3	540,192	135.9	793,559			77.6	546.213	
1978	69.0	432,263	100.7	682,567			62.6	465.377	
1979	81.4	486,924	76.1	569,022			81.6	596.672	
1980	108.9	658,220	73.5	548,177			66.0	474.395	
1981	119.4	787,696	55.4	405,403			75.1	575.250	
1982	107.3	766,437	67.3	502,455			98.3	746.875	
1983	102.9	684,057	72.6	531,814			82.6	636.962	
1984	95.4	617,621	62.2	483,898			51.3	420.048	
1985	65.4	449,844	57.1	442,299			50.4	411.762	
1986	91.7	662,076	39.6	324,351			65.6	564.750	
1987	69.0	485,298	21.0	171,292			57.1	478.490	
1988	45.6	349,384	42.2	363,694			70.1	590.345	
1989	29.3	220,463	31.4	265,244			86.9	751.143	
1990	35.9	283,640	14.7	125,732			82.4	741.405	
1991	24.5	202,558	11.8	94,525			83.5	773.621	
1992	25.7	223,031	6.1	57,957			78.7	701.902	
1993	30.1	227,157	12.8	115,980	1.9	9,690	66.5	624.781	
1994	64.5	492,489	13.3	68,891	10.4	44,146	63.7	567.412	
1995	42.5	322,316	7.7	60,244	3.6	18,496	60.2	542.434	
1996	15.7	135,320	6.3	43,984	3.5	17,850	27.7	267.152	
1997	30.0	238,911	12.0	84,278	3.7	22,452	44.5	417.479	
1998	13.8	114,715	8.5	62,714	3.7	22,289	19.1	186.149	
1999	19.9	161,782	10.5	75,144	6.1	33,233	27.0	254.386	
2000	16.3	141,990	5.7	39,266	5.0	27,756	30.1	284.963	
2001	21.1	186,200	4.7	37,764	4.7	26,266	28.6	278.228	108
2002	35.3	292,198	4.4	38,850	4.0	21,547	28.0	218.217	98
2003	29.8	233,986	4.8	36,067	3.4	19,548	27.4	251.862	93
2004	31.7	246,038	5.4	39,745	4.1		17.3	136.337	94
2005	22.2	198,872	5.0	38,400			17.0	130,560	86
2006	19.1	165,340	4.1	29,247			21.1	141,178	91
2007	23.6	191,278	0.05	388			11.3	67,806	76

*** Catches of stocking size eel result exclusively from the rivers Elbe and Eider (North Sea).**

DE.E.2 Inland fishery

Due to the federal structure of Germany, catches are not reported separately for RBDs but for states (Bundesländer). In the course of the preparation of the EMP's, the data will have to be made available for RBD's, but this information has not become avail-

able yet.

A clear decrease in the yellow and silver eel catches (not distinguished) has been observed for more then 10 years (Table 2). However, there has been no further decline since 2003. In 2006, the most important states with regard to eel fisheries were Brandenburg (96 t) and Mecklenburg-Pomerania (51 t). In 2007, the eel catches of the inland fishery were stable with 206 t (even a slight increase was reported).

In the last years, yields of commercial fisheries were reported or estimated from different regions in the range between 0.8 kg/ha (Brämick *et al*., 2007) and 2.9 kg/ha (S. Spratte, pers. comm.). Leuner, 2007 reported a yield of about 6 kg/ha for the river Main (belonging to the Rhine RBD), but this also included catches of recreational fisheries.

Table 2 Development of eel catches from the inland fishery in the last 13 years. Data represent the sum of catches from Bavaria, Berlin, Brandenburg, Mecklenburg-Pomerania, Saxony-Anhalt and Thuringia.

YEAR	EEL CATCHES (T)
1995	369.3
1996	300.2
1997	280.7
1998	251.9
1999	261.0
2000	276.4
2001	239.3
2002	236.9
2003	170.9
2004	168.6
2005	174,4
2006	185,6
2007	206.0

DE.E.3 Aquaculture

Table 3 Production of eel in recirculation systems.

YEAR	PRODUCTION (T)
1995	186
1996	204
1997	221
1998	appr. 260
1999	appr. 400
2000	422
2001	347
2002	381
2003	372
2004	328
2005	329
2006	567
2007	740
	(440 t for human consumption and 300 t stocking size eel)

In Germany, the eel is an important species for aquaculture in recirculation systems. With a total production of 740 t in 2007, a clear increase compared to the last years was achieved. This increase was mainly caused by the high demand for pre-grown eels for re-stocking, e. g. for a big pilot project for the enhancement of the spawner stock in the catchment of the river Elbe. There are no other aquaculture techniques used for production of eel.

DE.E.4 Recreational fisheries

The number of anglers is assumed to be approximately 1.5 million.

A study revealed that 6.4 % of anglers most frequently took eel home (Arlinghaus, 2004).

Even though some associations and clubs ask their members for catch reports, there exists no general catch statistics from recreational fisheries. Consequently, the order of magnitude of angler catches is not well known. However, by considering the large number of anglers, it is likely that angler catches of eel contribute considerably to total eel mortality in the fresh waters.

The relative importance of catches of the commercial and the recreational fishery differs according to the conditions in the respective area. Whereas in some regions, angler catches are assumed to be twice as high as the yield of the commercial fishery, the opposite is reported from other regions.

During the process of data collection for the eel management plans, the data basis has improved for some regions and it can be expected that this process will continue. E.g. in Schleswig-Holstein, fisheries managers already have to prepare management plans for their waters including data on catches and stocking. In the course of preparing the draft eel management for the river Elbe, the following data were obtained for waters of the Elbe catchment in Schleswig-Holstein:

Mean annual catch of eel per member of angling club 0.53 kg

Mean annual catch of eel per "active" angler 1.09 kg

At a number of 30 000 anglers in this area, the total eel catch was estimated to 15 t (S. Spratte, pers. comm.).

For anglers in waters of the RBD Schlei/Trave, a mean value of 0.84 kg/angler and year was extracted from a management plan database in Schleswig-Holstein (F. Hartmann, pers. comm.) for the years 2001–2004. It was not distinguished between "active" anglers and "all anglers".

For the Elbe RBD, Brämick *et al*., 2007 report angler catches of about 0.5 kg/ha.

DE.E.5 Restocking

Restocking of eel is very common in German waters, but as there is no central database for eel stocking, no representative data are available. Earlier data on restocking, in particular from the area of the former GDR and later from the state Brandenburg, have been presented in former reports of the WGEEL (e.g. 2003, R. Knösche).

Some data exist for certain regions or waters and may describe the situation at least roughly (Data from S. Spratte, personal communication). In the Schleswig-Holstein part of the Elbe River basin district, running waters managed by anglers have been stocked with about 75 glass eel equivalents per ha (mean value for this type of waters) during the last years. In lakes in the same area managed by anglers, the stocking density was between 0.08 kg farmed eels per ha and 1.2 kg "Satzaal" (wild-caught eels of ca. 30g per individual) per hectare.

Lakes managed by commercial fishers received about 1.2 kg *Satzaal* per ha (about 210 Glass eel equivalents). From the same area, stocking densities in the middles of the 1990s were about 75–150 Glass eel equivalents. There was usually no re-stocking at the bigger channels (Elbe-Lübeck-Kanal, Kiel channel).

In 2005, approximately 400 000 bootlace eel equivalents were stocked by commercial fishers in the river Havel (Brämick *et al*., 2006). This results in a mean stocking density of about 13 bootlace eels per hectare for this important tributary of the river Elbe.

At present, there is a project running at the Elbe system (Spawner stock enhancement in the river Elbe, financial support by FIAF) which includes a huge re-stocking programme. For the Elbe system, Brämick *et al*., 2007 stated that about 20 years ago more than 100 glass eels per hectare had usually been stocked. However, as a consequence of the reduced availability and the strong increase in price, the re-stocking decreased to about 20–40 glass eel equivalents per hectare during the last 15 years. In the course of the present pilot project, the stocking numbers again increased up to 120 glass eel equivalents per hectare (Brämick *et al*., 2007). It is planned to keep the stocking number stable for the next years.

Even higher stocking densities of about 300 glass eel equivalents per hectare were reported by Leuner, 2007 from the river Main (Rhine RBD).

DE.F Catch per unit of effort

Data on catch per unit of effort are not reported. There is only one long-term series on (silver) eel catches available from a stownet fishery at Gorleben at the river Elbe. During the last years, the cpue data were rather constant and the mean value of the years 2002–2005 were only slightly lower than the mean value of the period) 1966–1980 (see last years report).

DE.G Scientific surveys of the stock

DE.G.1 Recruitment

In the last years, monitoring on immigration and upstream migration of young eels on some locations in Mecklenburg-Pomerania, Schleswig-Holstein and Brandenburg was initiated.

The monitoring stations were established in waters of the RBD's Oder, Warnow/Peene (both Baltic Sea) and Elbe (North Sea).

For a quantitative monitoring of immigrating elvers, eel ladders were installed by the Institute for Inland Fishery Potsdam-Sacrow at four locations, two of them in tributaries to the rivers Elbe and Oder, respectively. The distance of the two locations in the river Elbe from the North Sea coast was 255 km (Löcknitz eel ladder) and 311 km (Havel eel ladder and fykenet), respectively, although the locations in the river Oder were somewhat closer to the Baltic coast (Welse eel ladder 77 km, Finow fykenet 109 km). At all of these spots, upstream migration of elvers is interrupted by dams. Monitoring stations also exist in some smaller rivers (Tanger, Mulde and Jonitzer Mulde).

Based on quantitative catches with a large fykenet, which was installed directly in a fish pass, total numbers of elvers migrating into the river Havel were estimated as 70 000 individuals in 2005 and 43 000 in 2006 (Brämick *et al.*, 2007). Numbers in the river Oder RBD were by far lower (see last years report).

Results are also available from some rivers in Mecklenburg-Pomerania. The data indicate that the numbers of glass eels arriving are very low if compared to former data and that the numbers did not significantly differ during recent years (Lemcke, 2003; Schaarschmidt, 2005; Schaarschmidt *et al.*, 2007; Ubl *et al.*, 2007, Table 4). The mean lengths of the upstream migrating eels were in the range from 11.6 cm (Dove Elbe/Dömitz) to 25.6 cm (Farpener Bach/Alt Farpen; Ubl *et al.*, 2007).

Compared to data from former periods, the recruitment into the Mecklenburg-Pomeranian waters is on a very low level. At the Müritz-Elde-Wasserstraße, the recent catches are about 1.1% compared to the 1950s (Ubl *et al.*, 2007). Similarly, at the Warnow system, the catches are 2% of the catches in the 1950s and only about 0.04% of the 1930s. At the Wallensteingraben, the recent data represent 2% of the catches in the 1950s.

Glass eel and elver monitoring projects have also been initiated in the Kiel Channel (North Sea-Baltic Sea channel, S. Spratte, per. comm.). However, results are not yet available.

Table 4 Comparison of standardized catches of upstream migrating eels 2001–2006 in several rivers in Mecklenburg-Pomerania (number of eels per fishing gear between May and October; Ubl *et al.*, 2007).

CATCHMENT	RIVER	STATION	DISTANCE TO COAST	GEAR/RELATION	2001	2002	2003	2004	2005	2006	2007
Baltic Sea	Warnow	Bützow	53 km	per eel ladder	37	230	73	56	76	40	35
	Hellbach	Mühle	7 km	per eel ladder	not sampled	25	33	not sampled	not sampled	not sampled	Not sampled
	Wallenstein-graben	Wismar (Mühlenteich)	2 km	per eel ladder	not sampled	not sampled	not sampled	173	153	123	296
	Mühlengrube	Wismar (Ziegenmarkt)	0.1 km	per eel ladder	not sampled	not sampled	not sampled	not sampled	not sampled	17	19
	Uecker	Torgelow (Wehr)	52 km (Oder estuary) or 83 km (Peene estuary)	per eel ladder	not sampled	70	33	---	---	53	32
	Peezer Bach	Straßenbrücke	1.8 km	per eel collector	not sampled	not sampled	not sampled	not sampled	not sampled	---	---
	Plastbach (or Farpener Bach)	Alt Farpen (Stausee/Speicher)	4.8	per eel collector	not sampled	not sampled	not sampled	not sampled	not sampled	2.9	---
	Recknitz	Bad Sülze (Fischpass)	28 km	per eel collector	not sampled	not sampled	not sampled	not sampled	not sampled	---	---
North Sea	Müritz-Elde-Wasserstraße	Dömitz (Fischpass)	224 km	per fykenet	not sampled	5934	2365	3145	2861	3124	2440
				per eel collector	not sampled	not sampled	not sampled	not sampled	not sampled	9	---
	Dove Elbe	Dömitz (Wehr)	224 km	per eel ladder	not sampled	not sampled	1981	676	721	1035	890
				per eel collector	not sampled	not sampled	not sampled	not sampled	not sampled	11	---

DE.G.2 Yellow eel

In the last years, there were no yellow eel surveys in German marine coastal waters. At present it is tried to develop such a system in the coastal waters of the Baltic Sea (*Verein Fisch und Umwelt* for the Institute for Fishery of the LFA Mecklenburg-Pomerania). Basic principle will be the use of 30 eel fykenet chains per 1 ha. The system is in a test stage and no results have become available so far.

In the Kiel Channel, yellow eel monitoring will be conducted in four tributaries by electrofishing starting in 2008 (three times per year). Additionally, large fykenets and trawling catches will be used.

In the Elbe-Lübeck channel, yellow eel monitoring will be done by electrofishing and by the use of a special beach-seine. In both waters, re-stocked eels have been marked with *alicarin red*.

DE.G.3 Silver eel

Generally, there are no long-term data on silver eel stocks and escapement available.

Studies on silver eel escapement have been started at the rivers Elbe (and the tributary Havel) and Warnow. First results are available for the river Havel (Elbe RBD). Recapture rates for tagged eels were 0.1–0.2 % for fykenets. As expected, recapture rates were higher for stow nets with 11–15% in the upper Havel and 2.2% in the river Elbe (further downstream).Based on the results, preliminary estimates for the number of downstream migrating silver eels are 4000 individuals from the upper Havel, and about 300 000 individuals at the middle Elbe (Brämick *et al*., 2007).

A silver eel monitoring will also be started in the Kiel Channel by use of stow nets and comparable gears.

DE.H Catch composition by age and length

There is no information available on composition of commercial catches by age and length.

Germany has not sampled the landings/catches of eel. Due to the Data Collection Regulation which so far related only to marine landings/stocks, a country need not to sample a stock when the average of landings of the last three years is less than 100 t for a stock not under TAC regulation as it is for eel. For each division 4b, 3c and 3d, from where landings have been recorded the averages over the last three years were below 100.

However, the DCR now requires that data on eel fishery have to be sampled also in fresh waters. At present, the programme for 2009 is discussed. First data will be sampled in 2009 and results will become available in 2010.

DE.I Other biological sampling

DE.I.1 Length and weight and growth

Recently, some data on age and growth have been published from waters in Mecklenburg-Pomerania (Simon, 2007). The ageing of the fish was done by otoliths.

Table 5 Results of determination of age and growth of eels from waters in Mecklenburg-Pomerania (Simon, 2007).

Catchment	Water body	n	Age groups	Annual individual growth per year according length back calculation (cm)		
				Min	Mean	Max
North Sea	Müritz-Nationalpark	17	4 to 13	2.3	4.8	8.2
Baltic Sea/Inner coastal waters	Bodstedter Bodden	8	5 to 10	2.6	5.9	10.6
	Grabower Bodden	10	5 to 12	2.8	6.0	10.5
	Greifswalder Bodden	21	4+ to 6+	1.4	5.6	8.7
	Salzhaff	18	5 to 8	2.8	5.8	10.4
	Wieker Bodden	10	5 to 9	3.8	6.2	11.0
Baltic Sea/Outer coastal waters	Adlergrund	8	4+ to 9+	1.3	6.0	9.5
	Arkonasee / Arkonabecken	11	3+ to 12+	1.4	6.0	11.6
	Außenstrand Thiessow	9	4+ to 8+	1.4	5.5	8.6
	Außenstrand Usedom	10	6 to 10	2.9	5.2	9.5
	Künstliches Riff	18	4+ to 9+	1.0	5.4	9.5
	Ostmole Warnemünde	8	6+ to 8+	2.7	5.4	8.0

DE.I.2 Parasites

A monitoring for *Anguillicola crassus* has been established at the rivers Elbe and Weser and Ems (Table 6), which are all important rivers for eel. For this monitoring, commercial fisher collect eel swimbladders from commercial catches on a weekly basis. As a consequence, no data on length or weight of the fish are available.

Generally, the prevalence in eels from German waters appears to be between 50 and 90% (Knösche *et al*., 2004; Lehmann *et al*., 2005; Leuner, 2006, 2007; Lehmann *et al*., 2007).

Lehman *et al*., 2007 also reported the presence of *Trypanosoma granulosum* in more than 90% of all investigated eels from the Rhine system.

Table 6 Monitoring of infection of eels from the Rivers Weser, Elbe and Ems with *Anguillicola crassus*.

River	Year	n	Prevalence (%)	Abundance	Infection intensity
Weser	2000	982	88.1	7.6	8.7
	2001	969	85.4	5.7	6.6
	2002	916	87.9	5.3	6.0
	2003	957	81.5	4.1	5.1
	2006	980	90.7	5.5	6.1
Elbe	2000	373	83.4	5.3	6.3
	2001	135	88.9	4.7	5.3
	2002	259	87.7	5.7	6.5
	2003	275	86.2	4.3	4.9
	2006	358	89.1	4.4	4.9
	2007*	118	87.3	4.1	4.7

Ems	2000	384	73.7	4.5	6.1
	2002	240	69.2	3.0	4.3

*** preliminary results, not all samples analysed.**

DE.I.3 Contaminants

Concentrations of pollutants/contaminants in the musculature of eels from the river Elbe have been measured by the Elbe River Water Quality Board (ARGE ELBE) in 1999 and 2000 (e. g. ARGE ELBE 2000). Along the entire German length of the Elbe, contaminant levels were measured in excess of the maximum allowable levels. This was particularly evident for HCB (hexachlorobenzene) content. Occasionally, maximum levels were also exceeded for other contaminants, e.g. DDT. The most recent publication from the ARGE Elbe (ARGE ELBE 2008) provides data on concentrations of contaminants for eels from the river Elbe from a location close to the border to the Czech Republic in 2005 and 2006. Concentrations of mercury have remained rather constant (around 0.25 mg/kg wet weight), whereas the values for cadmium revealed a decreasing tendency (<0.008 mg/kg w. w.). Several PCB's had constant levels or a slightly decreasing tendency. Clearly decreasing values were observed for HCB (from 1.8 mg/kg Fat in 2001 to 0.56 mg/kg Fat in 2006). However, HCB-concentrations are still on a critical level.

The data are provided in detail to C. Belpaire and C. Geeraerts for the inclusion into the quality database. The reports from the Elbe River Water Quality Board are available at www.arge-elbe.de.

Concentrations of PCB's and dioxins were clearly below the maximum allowable levels in eels from the Baltic Sea (Bladt, 2007, cited in Karl, 2007). Mean values were 7.4 ng/kg w. w. for dioxin/dl-PCB.

DE.I.4 Predators

Mortality of eel as a consequence of predation by cormorants was estimated by Brämick and Fladung, 2006 for lakes and rivers in Brandenburg. According to the study, 109 t eel (1.4 kg/ha) were annually preyed upon by cormorants. For the period 1990–1999, a mean annual predation of 0.3 kg/ha had been estimated for the same region (Brämick *et al*., 2007). The increase in the most recent period may reflect the increasing numbers of cormorants.

In Bavaria, predation of cormorants on eel was estimated to 17.5 t (Leuner, 2007).

DE.I.5 Diseases

Compared to the last years report, no new data have become available on diseases of eels in German waters.

DE.J Other sampling

Genetic tests on about 3000 eels from Mecklenburg-Pomerania, Brandenburg and Saxony revealed the presence of about 2% *Anguilla rostrata* (Ubl and Frankowski, 2008). Most likely, these individuals had been stocked in the period 1998–2002. In studies on naturally immigrating glass eels and elvers, no individuals of the American eel had been found. To avoid such unintended introductions of alien species, genetic tests will be used in the future, at least in the course of re-stocking programmes.

DE.K Stock assessment

There is no regular stock assessment. Some studies have started on parameters of certain life stages (e.g. recruitment/immigration, silver eel escapement, mortality rates). Some of these results have been presented in other sections, and some results will become available in the course of the studies.

In the course of the preparation of the management plans, a stock model has been developed to describe the stocks and to estimate the escapement of sliver eels from the catchments. It is planned to publish the model in the scientific literature. In the future, the model has to be evaluated by monitoring of the stock and of escapement. If necessary, it will be improved by including new data.

DE.L Sampling intensity and precision

There is no consistent sampling design applied in Germany.

DE.M Standardisation and harmonization of methodology

DE.M.1 Survey techniques

DE.M.2 Sampling commercial catches

DE.M.3 Sampling

DE.M.4 Age analysis

DE.M.5 Life stages

DE.M.6 Sex determinations

DE.N Overview, conclusions and recommendations

The eel is an important species for the German fisheries sector, especially inland and coastal fishery. However, the importance of this sector itself is rather small.

After a clear decrease during the last decades, as a consequence of enormous efforts spent on re-stocking, the catches of eel by the German fisheries now appear to be on a rather stable (but lower) level.

The data basis is still relatively small but in the last years, several projects and studies have been started, which will improve the availability of data on important population parameters in the future.

In Germany, the relevant authorities and institutions work on the preparation of eel management plans according to the EU Council Regulation on eel management. This will also lead to an improved data basis. Furthermore, data collection on eel fisheries is now necessary also in fresh waters in the frame of the DCR. Therefore, starting with 2009 the amount of available and relevant information on eel and eel fishery in Germany will increase.

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Report on the eel stock and fishery in Poland 2008

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Reporting Period: This report was completed in August 2008, and contains data up to 2008.

PL.B Introduction

PL.B.1 General overview of fisheries

Eel fisheries in Poland occur in lakes, rivers, coastal open waters and two brackish water basins namely Szczecin Lagoon and Vistula Lagoon, however, part of Szczecin Lagoon belongs to Germany and part of Vistula Lagoon belongs to Russia (Figure PL.1). Inland and coastal fisheries are targeted on silver eel and on yellow eel but no data on share of those forms in the catches are available. The total area of inland lakes, reservoirs (over 50 ha) is 2293 km^2. In the main stream of Vistula and Odra Rivers and in supporting rivers many dams were constructed, which successfully stopped the upward migrations of eel, as well as other fish species.

Eel fisheries have a long tradition in Poland. Before WW II it was concentrated mainly in inland waters, because Poland had a very small piece of coast available for sea fishery at that time. After WW II, with gaining a broader access to the Baltic (over 500 km of coastal line), the Polish coastal eel fisheries has developed much more and achieved up to 388 tons per year although inland eel fisheries, which also increased substantially its number of lakes, reached up to 1500 tons per year. In the period of 1974–1994 inland catches constituted up to 75% of total yearly Polish catch of eel. Since then dropped very much, almost to the level of coastal catch and recently both fisheries achieve the level of 200–300 tons.

Until the late 1950s Polish eel fisheries based almost exclusively on natural recruitment, later on, extensive restocking mainly with glass eel was carried out in many lakes and both lagoons. This stocking decreased almost to zero in the late 1990s as a consequence of changes in the fishery management and high prices for glass eel. The lack of stockings resulted in very serious decrease of catch, mainly in inland fisheries.

The eel is a non-licensed species in Poland, both in coastal and inland fisheries. All eel fisheries is in private hands and, at the present, there are no organized fishing companies in the coastal fishing, however, in some river districts so called “cooperatives” operate and they are also fishing for eel. There are private fishery farms having also several lakes with eel but most of lakes have a separate owner. There is no solely eel stock and fisheries management in Poland, however, all eel management issues are within hands of the Ministry of Agriculture and Rural Development. Governmental control is limited only to a set of general rules: size limits, gear restrictions, closed seasons and areas. Special protection rules applies to eel fykenet fishing, in Szczecin Lagoon, Pomeranian Bay and Vistula Lagoon, where all fykenets have to be equipped with protection metal “sieves” in the end of bag to allow release of undersized eel. The three Regional Inspectorates of Fisheries, located in Szczecin, Slupsk and Gdynia,

are responsible for management, monitoring and surveillance of fisheries at territorial level. In the coastal fisheries landings and effort are registered and reported on obligatory basis as monthly reports (boats up to 8 m) and in the EU-standard log-books (boats 8–10 meters, if they are fishing cod, otherwise only as a monthly reports) Boats over 10 m all have EU-logbooks. There is no obligatory reporting from fishery in lakes and rivers. Polish Anglers Association has some data available but it comes from voluntary reporting by PAA members only. The Inland Fisheries Institute in Olsztyn collects selected inland catch data based on its own sources (mainly questionnaires distributed among lake owners).

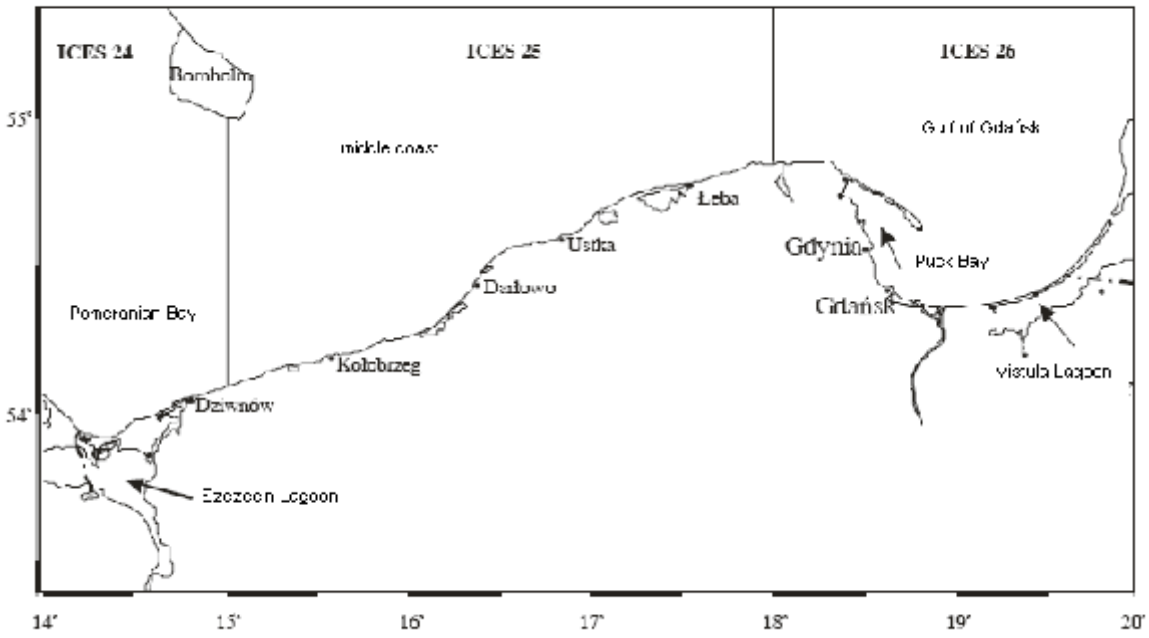

Figure PL.1 The Polish coastal area.

There are five main fishing areas along the Polish Baltic coast (also see Figure PL.1), from all of them landing statistics according to DCR are available since 1994:

1) Szczecin Lagoon; which is influenced first by waters of the Pomeranian Bay, where some fish migrate to feeding grounds then return with the back flow, and second by the waters of Odra River and Swina, Dziwna and Piana Rivers which connect it with the bay (Figure PL.2). Total area of lagoon is 911,8 km^2, of which 457 km^2 is under control of the Polish fishing administration, the rest is under Germany control. The lagoon comprises of several bays, islands, rivers and internal channels. Total exchange of water between the lagoon and bay occurs seven times a year. The lagoon is eutrophic and relatively shallow (mean depth 3,8 m) but along shipping lanes it reaches 11–12 m. In the Polish part of the lagoon approximately 200 fishers with 100 boats operating from 10 harbours reported eel catches in 2007. The main gear used for eel are different types of fykenets and hooks. The Polish highest catch was 447 t in 1967. In 1975–1990 the lagoon was restocked by Poland with an average of 2,5 tons of glass eel per year. The volume of catch is shown in Table PL.F.

Pomeranian Bay; is a broad open area of ca. 6000 km^2, which in part is situated within Polish EEZ (Figure PL.2). Its depth is up to 20 m and means depth is 13

m. The southwest part is under influence of fresh water of rivers: Odra, Piana and Swina. The boat fishing effort in the whole area was "frozen" to the level of 1996. Main gears for eel: hooks ,fykenets. In 2007 there were five boats from three fishing bases reporting eel catches from the area. The volume of catch is shown in Table PL.F.

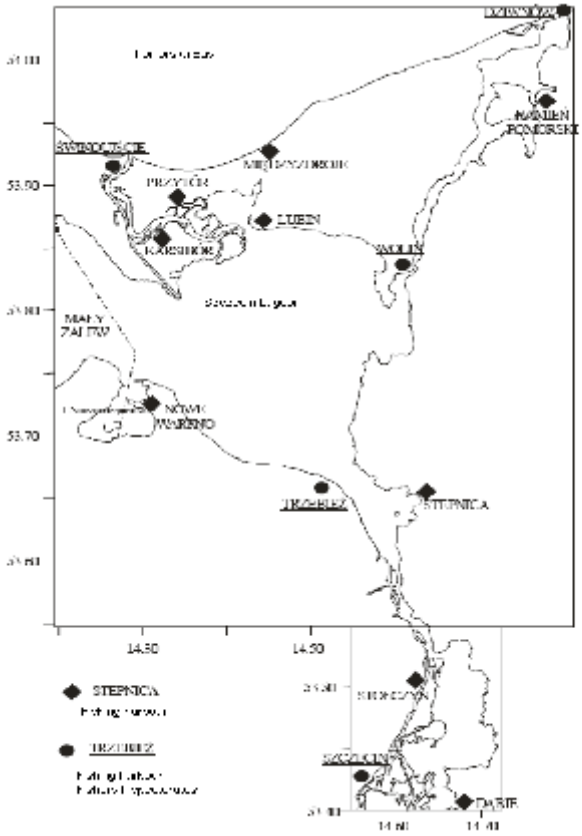

Figure PL.2 Fishing harbours in the Szczecin Lagoon and Pomeranian Bay. (Psuty, 2008).

Open coast (ICES Subarea 25): an open broad belt of coast from 15^{0}E to 18^{0}E, with fisheries operating up to 6 mile from the shore and up to depth of 20 m. There are several rivers discharging to the sea; some of them are connected with near-coastal lakes. The eel fishing there has minor importance and its catches dropped from 5 tons in 1954 (Trella, 2000) to 1 tonne recently (Table PL.F). There were eight fishing bases with nine boats reporting eel catches in 2007.

ICES Subarea 26: the Polish waters of Gulf of Gdańsk and some part of waters north of Hel Peninsula, from 18^{0}E to the Polish-Russian border (without Vistula Lagoon). Salinity ranges from 4–7‰ in the inner part of Puck Bay to 13–14‰ in open coasts. Coastal eel fishing is carried out mainly in shallow waters of Puck Bay and also in coasts on both sides of Vistula River mouth. This area has big tradition in fisheries and has 17 fishing bases with over 100 fishers and 64 boats reporting eel catch in 2006. Yearly eel catch was 118 tons in 1955 (Borowski, 2000) but in the last decade decreased to 9–16 tons (Table PL.F).

Vistula Lagoon-the largest estuarial coastal eutrophic reservoir in the southern Baltic and very important in coastal eel fishing. Total area is 915,5 km^2 out of this 328 km^2 is within Polish borders (Figure PL.3). Total length of the lagoon is 91 km, average width is 9,5 km and mean depth is 2,8 m. The salinity is

0,10‰–1,60‰ during summer and 2,90‰–4,70‰ during autumn. The water has very low transparency (30–90cm). The only one and narrow connection with Baltic Sea is in the Russian part. The highest eel catches of 350–500 tons yearly were recorded in 1926–1940 (Borowski, 2000) but in last decade it decreased from 108 tons in 1996 to 14 tons in 2006 (Table PL.F). There are ca. 90 fishers and 64 boats, reporting eel catches (2007), operating from eight harbours. Fishing gears: fykenets, hooks.

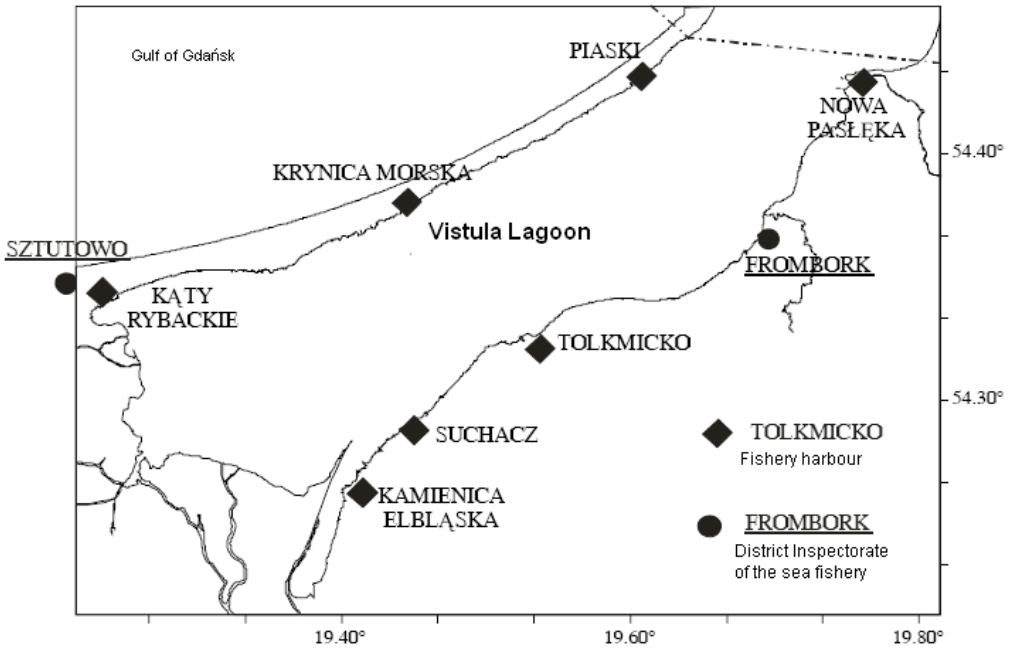

Figure PL.3 Fishing harbours in the Vistula Lagoon. (Psuty, 2008).

PL.B.2 River Basin Districts in Poland

Water Framework Directive separates two RBDs in Poland (Figure PL.4):

a) Odra RBD (ORBD) of total area within Polish borders 118 462 km², which includes:
- Odra drainage -118 861 km², out of this 106 057 km² is within Polish borders, 7217 km² within Czech and 5587 km² within Germany borders;
- Szczecin Lagoon of 12 100 km², out of this 2459,2 km² is within Polish borders and 9471,2 km² is within Germany borders;
- drainages of three Pomeranian rivers (Rega, Parseta,Wieprza) of total area 9029 km² , which are discharging to Baltic Sea;
- drainages of other international rivers, present in the Polish territory, of total area of 249,6 km², out of this 239,8 km² is Elbe drainage, 1,3 km² is Danube drainage and 8,5 km² is Ucker River drainage (flowing to Szczecin Lagoon).

b) Vistula RBD (VRBD) of total area within Polish borders 194 223 km², which includes:

- Vistula drainage of total area 199 813,0 km² , out of this 174 087,2 km² is within Polish borders and 25 725,8 km² is outside Polish borders;
- Drainages of Pomeranian rivers discharging to Baltic Sea, with total area of 5965,8 km² ;
- Vistula Lagoon of 915,5 km² with drainage of Pasleka River-2294 km²;
- drainages of other international rivers present in the Polish territory of total area 11 020 km² , out of this drainage of Pregola-7519,8 km², Niemen (Neumunas)-2511,6 km², Dniestr-233,2 km², Danube-381 km², and Swieza River-374,1 km

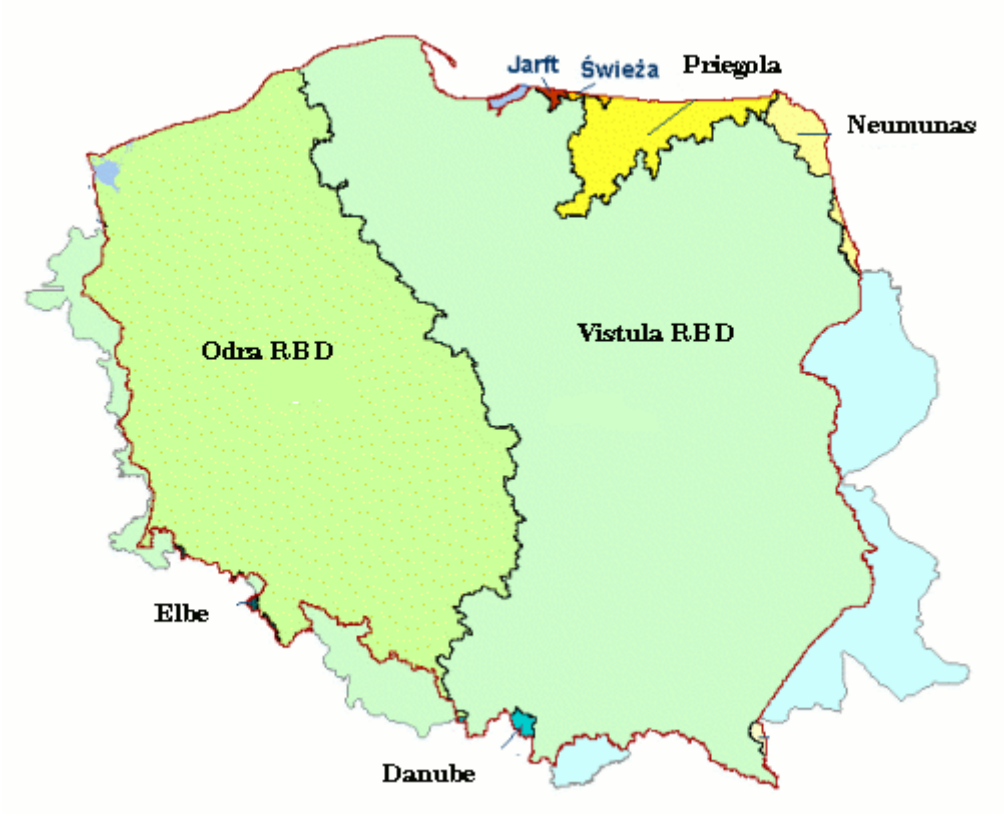

Figure PL.4 River Basin Districts within polish territory.

PL.C and D Fishing capacity and effort

There are no companies organized for coastal fishing eel and every boat owner catch fish on its own. Mean number of fishers and their boats involved in eel fishery from 1948 to 2007 in the lagoons is given in Tables PL.A.–PL.B. Those figures are derived from fisheries database of the District Inspectorates of Sea Fishery. Details on size of individual boats are readily available but nowadays there are no data on numbers of fishers involved.

Total number of boats in register is currently changing as a consequence of implementation of EU programme of reducing fishing capacity. The length of fishing boats ranges from 4 m to 11 m and their age is 6–16 years.

Table PL.A Mean number of fishers, boats and gears used in Vistula Lagoon in the period 1948–2007 (Psuty, 2008).

		No. of boats			No of gears	
Years	No. of fishers	Barkas	Oar boats	Motor boats	Fyke - nets	Hooks
1948–1959	354	34	224	78	8300	200 000
1960–1969	259	11	96	106	13 500	120 000
1970–1979	212	4	72	154	10 000	40 000
1980–1989	249	0	25	206	7200	
1990–1999	253	0	10	214	6000	
2001–2005	-	0	0	117	4500	
2007	-	0	0	64	3072	20 000

Table PL.B Mean number of fishers, boats and gears used in Szczecin lagoon in the period 1948–2007. (Psuty, 2008).

		No of boats			No of gears		
Years	No. Of fishers	Oar boats	Motor boats	Seines	Fyke nets	alhams	Hooks
1948–1959	380	150	170	24	2200	1000	
1960–1969	290	104	133	5	5960	2230	250 000
1970–1979	313	81	151	3	3770	690	190 000
1980–1989	244	61	133	0	3654	540	100 000
1990–1999	230	40	148	0	3520	330	93 000
2001–2005	-	15	135	0	3230	272	80 000
2007	-	-	109	0	2773	184	67 000

Before 1994 data on effort (no of gears and days) were recorded in old database. Since 1994 the number and type of gear used are recorded obligatory in the monthly reports and in the EU-standard logbooks, from where there are retrieved into database of the Ministry. However, the number of days the gears are used is not recorded. Table PL.C presents results of the investigations conducted by SFI of the real fishing effort in the Vistula lagoon.

Table PL.C Values of the fykenets fishing effort in the polish side of the Vistula Lagoon (Psuty, 2008).

Year	No. of boats (licences)	No of fykenets/days
2000	122	328 740
2001	123	290 880
2002	122	233 160
2003	120	160 350
2004	119	149 490
2005	95	125 820
2006	66	81 960
2007	64	73 290

Some provisional information exists on inland fishing effort. This data comes from questionnaires filled by waters owners. Table PL.D presents average proportion of gears used in each river basin district before and after 1985.

Table PL.D Percentage proportion of fishery gears used in inland waters in the relevant period. (Wołos *et al.*, 2008).

	FISHING GEARS					
Period	Fyke nets	Seines	River trapnets	Constant river traps	electro-fishing	longlines
	Vistula River Basin District					
<1985	36	33	19	5	3	4
>1985	44	23	18	3	1	11
	Odra River Basin District					
<1985	16	5	47	1	25	6
>1985	4	2	72	0	15	7
	Pomeranian lakes					
<1985	55	15	12	3	10	5
>1985	93	7	0	0	0	0
	Total area					
<1985	32	27	23	5	8	5
>1985	44	14	27	4	3	8

PL.E Catches and landings

PL.E.1 Restocking

Restocking with glass eel was conducted in Vistula Lagoon (VRBD) during 1970–1988 (mean 1400 kg/year) and in 1988–1994 (mean 167 kg/year) (Borowski, 2000). Restocking in Szczecin Lagoon was conducted in 1975–1991 with mean 1240 kg/year (Borowski *et a*l., 1999). From 2005 restocking re-continued with elvers with aquaculture origin (Netherlands, Germany, Denmark). Table PL.E presents yearly values of re-stocking conducted in the lagoons from 1970 to 2007.

Table PL.E.1 Re-stocking values in both lagoons in the period 1970–2007 (Psuty, 2008).

	Vistula Lagoon		Szczecin Lagoon				Stadium
	kg	ind.	kg	ind.	Mean lenght [cm]	Mean weight [g]	
1970	1630	4 890 000			6.0		
1971	800	2 400 000					
1972	1150	3 450 000			7.0		
1973	800	2 400 000					
1974	2140	6 420 000			10.5		
1975	1600	4 800 000	1000	3 000 000			
1976	1500	4 500 000	1445	4 335 000	6.6		Glass eels
1977	1500	4 500 000	1500	4 500 000	7.5		
1978	1760	5 280 000	1760	5 280 000	7.2	0.3	
1979	2590	7 770 000	2950	7 564 100	7.6	0.39	
1980	1050	3 150 000	3000	7 894 700	7.5	0.38	
1981	2030	6 090 000	675	1 569 700	7.9	0.43	
1982	1630	4 890 000	1690	4 225 000	7.6	0.4	
1983	800	242 000	1700	125 900	20.9	13.5	Elvers
1984	1150	3 450 000	2000	4 444 000	7.9	0.45	
1986	1880	5 640 000	3000	4 838 700	7.2	0.31	
1987	2000	6 000 000	1100	3 437 500	7.3	0.32	
1988	1000	3 000 000	1150	4 259 200	6.3	0.27	
1989	300	900 000					Glass eels
1990			1328	5 533 300	6.8	0.24	
1991	400	1 200 000					
1992	500	1 500 000					
1994	300	900 000					
2005	300	30 000					
2006	839	83 900	840	84 000			Elvers
2007	501	50 100	475	47 500			

Data on inland stocking is still incomplete. Values presented in Figures PL.5–PL.6 come from lakes owners and anglers' societies questionnaires. Due to high glass eel prices, nowadays the most popular material to stock is aquaculture elvers from Western farms (Netherlands, Germany, Denmark). Average stocking values at the beginning of the century fluctuated from 1 to 3 tons of elvers in the total area.

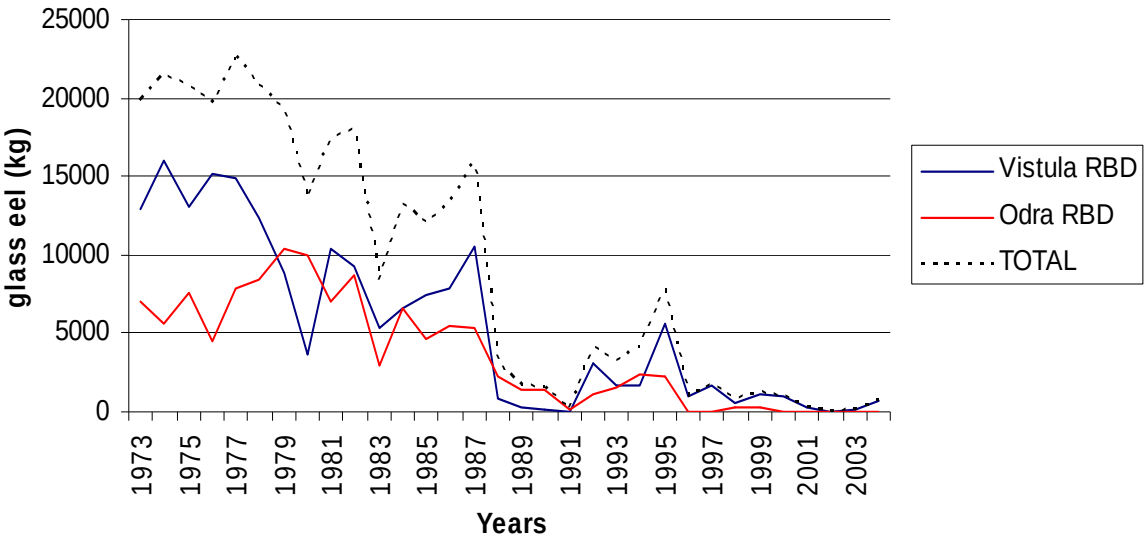

Figure PL.5 Re-stocking of glass eels conducted in inland waters in the period 1973–2004 (data source: Wołos *et al.*, 2008).

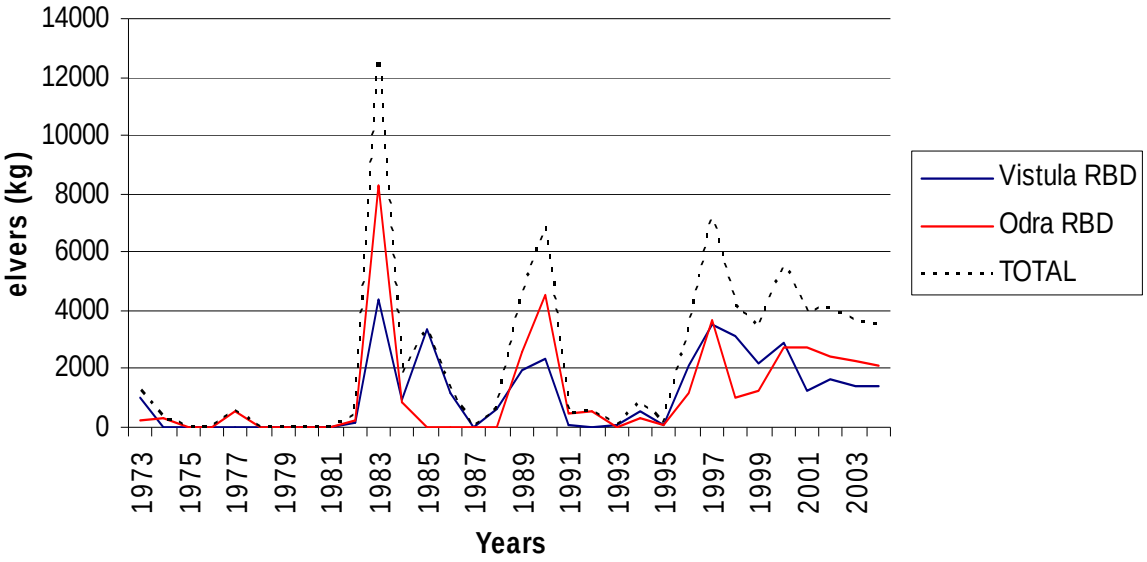

Figure PL.6 Re-stocking of elvers conducted in inland waters in the period 1973–2004 (data source: Wołos *et al.*)

PL.E.2 Catches of yellow and silver eel

Eel fishery in Poland applies mostly to the silver eel and occasionally to the yellow eel. Time series for the coastal eel in 1999–2007 are presented in Table PL.G. In the fishery documents the volume of catch equals to volume of landing. It means that total catch is practically the total landing. The magnitude of unreported catches is probably high, but is difficult to assess. No fishing auction system, except the first one in Ustka, takes place in Poland. The present database in the Ministry has still some errors, also as a consequence of misclassification of species. For inland waters, no obligatory registration of landings exists. The estimates of inland landings are based on other data sources, PAA questionnaires and lake owners' inquiries. Values presented in Figure PL.8.

Table PL.E.2 Polish Baltic coastal eel catch (kg) by area in 1999–2007.

VRBD	1999	2000	2001	2002	2003	2004	2005	2006	2007
East Coast (ICES 26)	16 751	16 290	12 729	14 656	15 213	14 367	14 500	10 900	8769
Vistula Lagoon	100 300	70 155	60 585	34 182	51 472	21 233	21 600	14 200	10 936
TOTAL	117 051	86 445	73 314	48 838	66 685	35 600	36 100	25 100	19 705
ORBD									
Middle Coast (ICES 25)	2855	1712	787	1916	1550	2562	2600	800	1030
Pomeranian Bay	9600	10 800	12 600	12 400	8752	2380	11 100	8900	843
Szczecin Lagoon	92 800	66 200	67 200	58 726	39 162	34 620	26 600	18 300	26 733
TOTAL	105 255	78 712	80 587	73 042	49 464	39 562	40 300	28 000	28 606
GRAND TOTAL	222 306	165 157	153 901	121 880	116 149	75 162	76 400	53 100	48 311

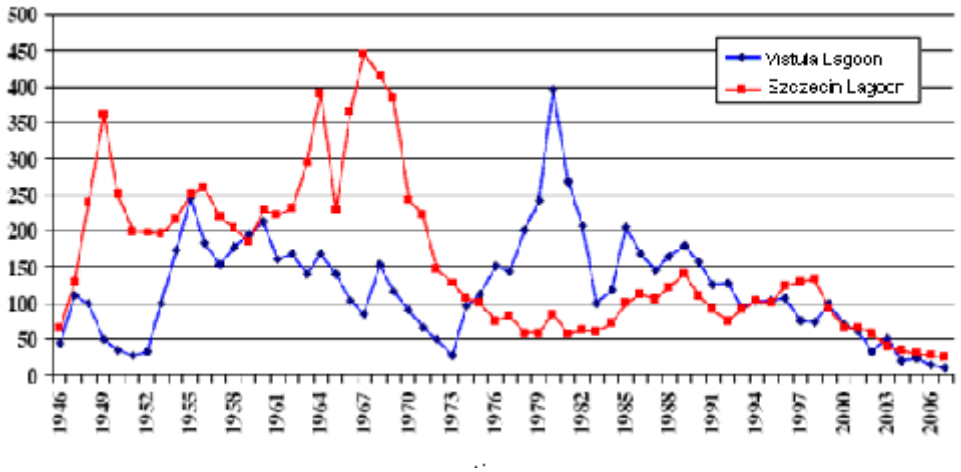

Figure PL.7 Landings of yellow and silver eels in both lagoons in the period 1946–2007 (Psuty, 2008).

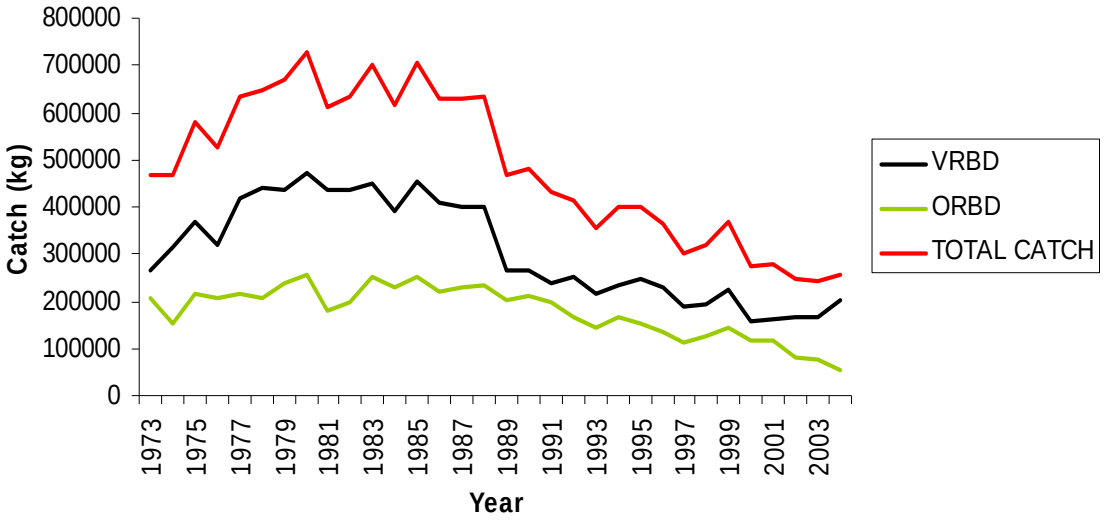

Figure PL.8 Polish eel landings in inland waters in the period 1973–2004 (Wołos *et al.*, 2008).

PL.F Catch per unit of effort

Evaluation of catch per unit of effort was done only for coastal waters. Figure PL.9 present cpue values reported in combined fykenet in the Vistula Lagoon. Negative trend is important and cpue is in the lowest level reported from 1995.

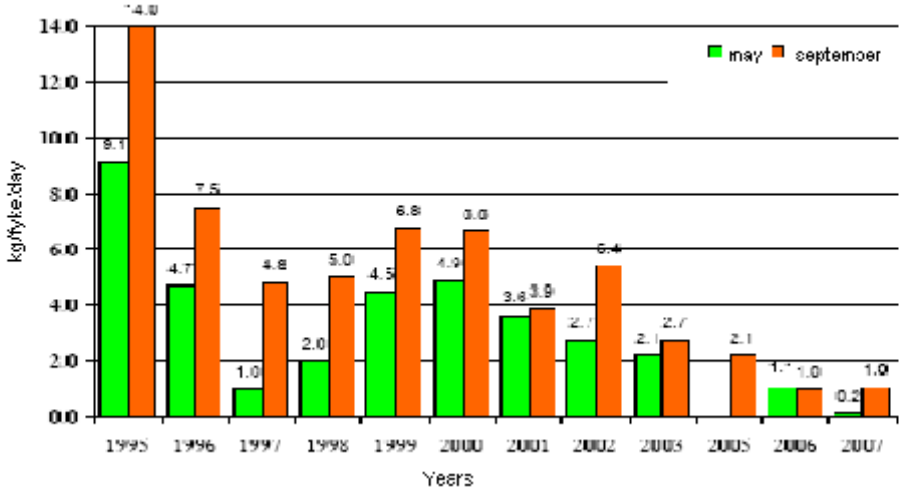

Figure PL.9 Cpue (kg/fykenet/day) values reported in monitoring station in the Vistula lagoon (Psuty, 2008).

PL.G Scientific surveys of the stock

PL.G.1 Results of surveys on ascending young eel into Pomeranian rivers

There are at least seven medium-sized rivers in the Pomeranian region, along the Polish coast, having their outlets open to the Baltic Sea, where glass eel could enter. First surveys on quantity and quality of young eel ascending to those rivers were made by German scientists in 1909–1911 to assess possibility of obtaining young eel for restocking. The results revealed some possibilities; however, it was found not sufficient and not economical comparing to cheap glass eel from the North Sea. After WW II in 1947 similar trials were made by Stankiewicz and later on in 1951, Kaj and Walczak conducted such trials in 16 places in Rega, Prośnica, Wieprza, Słupia and Łupawa rivers. The eel was collected with use of self-catching gears which were set in existing power stations or dams. No bypasses existed in those places. The results revealed that young eel was seen first in rivers on west than on east; moreover, in western rivers the presence of young eel was longer than in eastern rivers. Main flow of eel was noted on Rega River during first decade of May, in Prosnica river-in middle of May and in most eastern river-Słupia in first decade of June. This entire eel was uniform colored and weak pigmented. It was the eel, at first time achieving Polish coast during its voyage from the west. It was found that eel migration to Pomeranian rivers take place all the year-round with a peak in May–June and some eels are up to three years old. No presence of glass eel was found. The length ranged 70–200 mm and weight 0,35–10,7 g with modal length of 70–110 mm.

Data collected in 1998–2005 and 2007–2008 by Polish Angler's Union revealed that ascending young eel in Rega river in 1998–1999 was much smaller (weight 3,7–9,6 g) than in next years (weight 8,1–34,0 g), which can indicate on lack or very small amount of youngest stages.

In Łupawa river similar surveys was made in 1996–1997, 2002 and 2008 in first power station. Results were similar like in other rivers where mean weight of eel was lower in earlier years (8,5–11,6 g) than in last years (15,7–32,2 g).

Results of ascending eel into Pomeranian rivers in years 1951–2008 are presented in Table PL.G.

Table PL.G Results of fishing for ascending eel in Pomeranian rivers in 1951–2008.

River	Year	Month	No of fishing days	Total no of fish caught	Mean no of eel/day	Total weight (g)	Mean weight (g)
Rega	1998	July	4	939	235	6 005	6,4
		August	2	540	270	2 001	3,7
	1999	June	1	198	198	1 700	8,6
		July	3	2593	864	25 008	9,6
		August	2	353	177	2 600	7,4
	2000	June	2	1095	547	10 450	9,5
		July	1	370	370	3 005	8,1
		August	1	310	310	3 600	11,6
		September	1	280	280	3 500	12,5
	2001	June	1	244	244	7 016	28,8
		July	3	2030	677	40 780	20,1
		September	1	420	420	6 000	14,3
	2002	June	1	450	450	9 000	21,4
		July	2	678	339	10 800	15,9
		August	2	1600	800	28 300	17,8
	2003	June	1	480	480	8 000	16,7
		July	1	600	600	10 700	17,8
		August	1	n.d.	n.d.	700	n.d.
	2004	July	1	1135	1135	21 000	18,5
	2005	July	2	210	105	4 000	19,1
	2007	May-June	73	721	9,8	15 000	20,8
	2008	July	2	37	16	1 257	34
Grabowa	1951	May	1	36	36	36,9	1
Wieprza	1951	May	1	30	30	26,1	0,9
		August	1	25	25	26,5	1,1
Słupia	1951	July	1	50	50	75,6	1,5
	2008	July	5	8	1,6	96,2	12
	2008	August	14	28	2	335,8	12
Łupawa	1996	June-July	n.d.	108	n.d.	912,4	8,5
	1997	July–August	n.d.	1956	n.d.	22 651	11,6
	2002	August	n.d.	60	n.d.	634,4	10,6
	2008	July	9	17	1,9	266,1	15,7
	2008	August	1	2	2	64,4	32,2

PL.H Catch composition by age and length

For the Vistula Lagoon samples from commercial fykenets landings have been collected in the years 1969–1976 (Filuk and Olsza, 1978) and 1992–2001. For the Szczecin Lagoon sampling from fykenets was conducted in 1969–1970 and in some years during 1993–2000. After then no measurements were conducted. Samples from longlines catches were collected in the period 1999–2001. During 1996–1998 also length and weight measurements from fykenets in the Puck Bay (part of ICES area 26) were done.

For all eels in the samples length (up to 1 cm) and weight (up to 1–2 g) were determined. In 1969–1970 otoliths from Szczecin Lagoon eels were collected and age readings were carried out in the laboratory. Fish for sampling were acquired directly from fishers in fishing bases located in different parts of the coast.

All length-weight-age sampling was executed by the Sea Fisheries Institute in Gdynia. Having in mind that DCR specifies one sample of 100 eel per 20 tons of landings, the previous level of sampling was sufficient, even in some years much exceeding, for landings obtained. Results of catch composition findings were used in general management advice presented to the Ministry as a part of all-species sampling and fishery expertise.

There is no regular sampling for eel in inland waters; however, scientist of Inland Fishery Institute (IFI) in Olsztyn are collecting length and weight data from some lakes in the Pojezierze Mazurskie and Pomeranian lakes. Data were collected from 60 lakes. In 2007–2008 IFI collected some data for EMP needs:

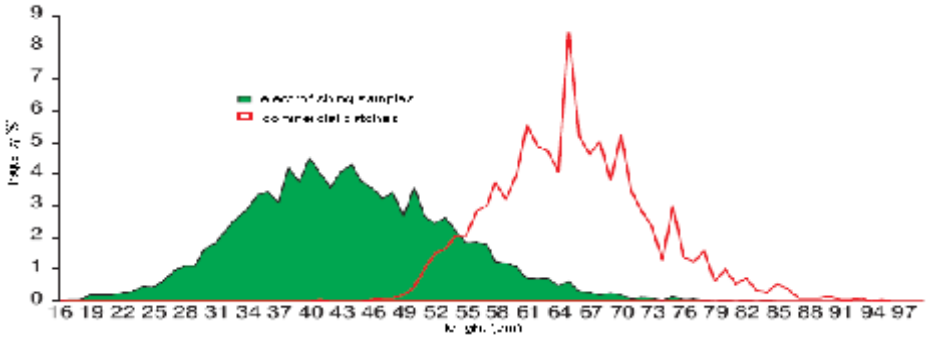

Figure PL.10 Length distribution of eels from inland waters. Data derived from both electrofishing and fishery landings. (Robak, 2008).

Length and age measurements of eel from commercial catches are yearly conducted by SFI on DCR basis. All stages are included:

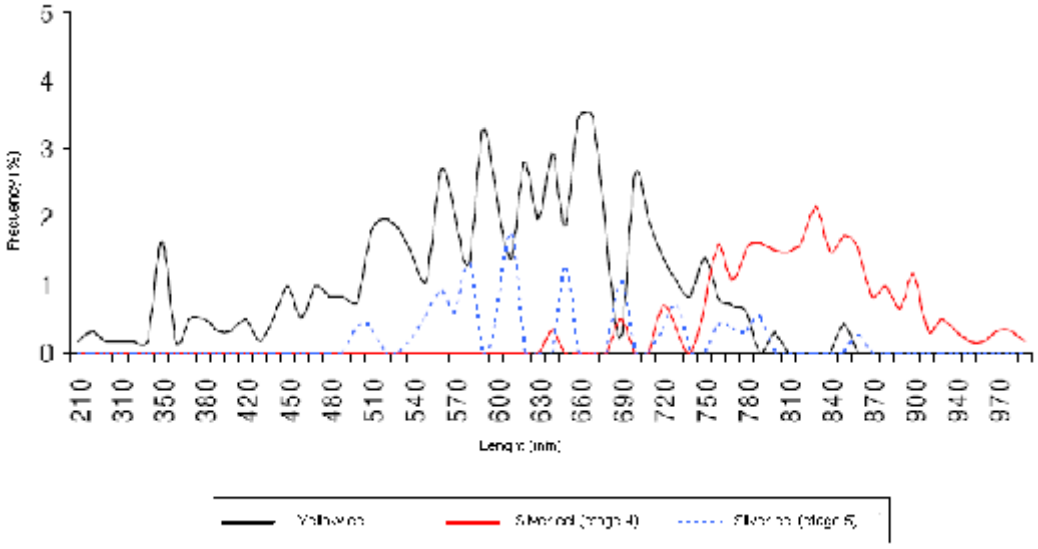

Figure PL.11 Length distribution of yellow and silver eels from the Vistula Lagoon.

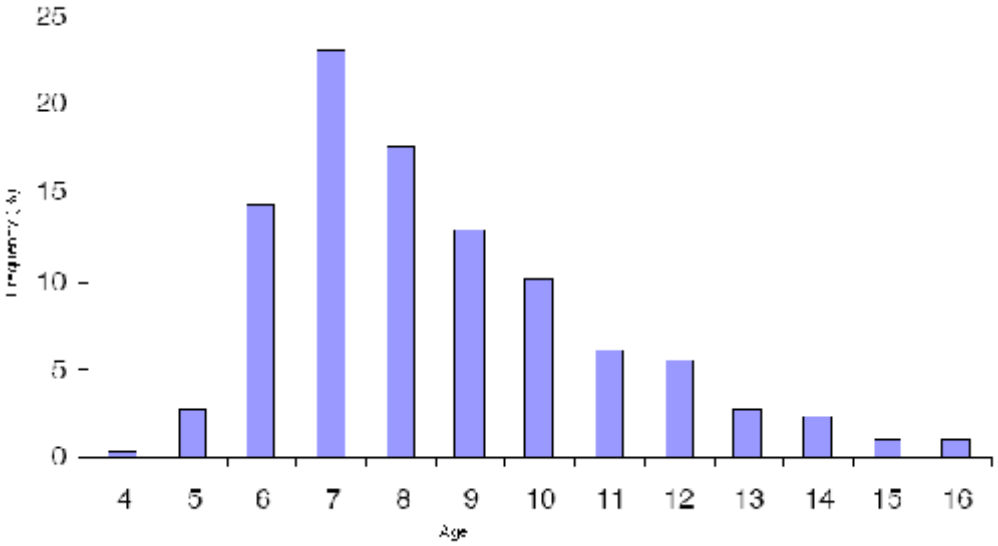

Figure PL.12 Age distribution of yellow and silver eels from the Vistula Lagoon.

PL.I Other biological sampling

PL.I.1 Length and weight and growth (DCR)

Beside length, weight and age measurements requested by DCR regulation, stage determination was done (silvering index).

PL.I.2 Quality of eels

In 2008 research on several factors influencing quality of eel was made in Certified Laboratory of the Sea Fisheries Institute in Gdynia (Usydus Z., Szlinder-Richert J., 2008.)

Samples of eel were collected during autumn 2007 and spring 2008 in Vistula Lagoon and Szczecin Lagoon. Number and size of fish collected are in Table PL.I.

Table PL.I Samples of eel collected in 2007 and 2008 for quality of eel examinations.

Code of sample	Year	Month	Place of catch	Length range [cm]
WTN/1/08	2007	X	Vistula Lagoon	46–59
WTN/2/08	2007	X	Vistula Lagoon	76–86
WTN/3/08	2008	IV	Vistula Lagoon	50–60
WTN/4/08	2008	IV	Vistula Lagoon	67–74
WTN/5/08	2008	IV	Vistula Lagoon	74–89
WTN/6/08	2008	IV	Szczecin Lagoon	54–64
WTN/7/08	2008	IV	Szczecin Lagoon	71–83

In the laboratory chemical examinations were made on:

- fat contents,
- dioxins, furans and dl-PCBs
- heavy metals: Cd, Pb, As, Cr, Ni, Hg.

Results of heavy metals and PCDD/F and dl-PCBs were compared to maximum allowable values obligatory in UE and described in Regulation (EC) 18881/2006 and assessed to classes described by Belpaire and Goemans, 2007. The results were also compared to maximal values given in FAO Fisheries Circular No 825 (1989).

Resulting data of those all examinations were supplied to ICES WGEEL database.

Fat contents

Values of fat contents ranged from 15,1% to 31,4% with mean 15,1% ±5,46. There was observed slight tendency to increase fat contents with increase of eel length.

Heavy metals contents

It was found that presence of all heavy metals, of which contents in the food is limited in UE countries, was much lower in eel tissue comparing to allowed levels given in EU regulations.

The maximum contents of those metals in eel ranged from 2% (Cd) to 22,5% (Hg) of allowed values. In case of Ca, Pb and Cr all samples were classified as Class I, according to as Class II, and according to Ni and Hg as Class I or II.

PCBs contents

It was found that according to majority of indicative congeners, all samples were of class I or class II. According to sum of six indicative PCBs six of seven samples were qualified as class I. Comparing results to very restrictive German regulations it was found that in none of samples allowed limits were not achieved.

Results of eel samples were also compared to samples from herring, sprat, flounder, cod and salmon. Sum of seven indicative PCBs expressed as μg/kg of tissue in case of eel was comparable to those of salmon and higher in case of rest of species.

Chloroorganic pesticides

For HCB four of seven samples were classified as class I and 3 others as class II. In case of ∑DDT 4 samples were classified as class I, two as class II and one as class IV. None of samples exceeded limits of ∑DDT 4 and HCB given in FAO Fisheries Circular No 825 (1989).

Dioxin-like –PCBs

In all samples the dominating congener among non-*orto* PCBs was congener penta-PCB 126, which revealed highest toxicity in that group, and dominating congener among mono-*orto* PCBs was congener 118.

Dioxin/furans (PCDD/Fs)

In most of samples concentration of PCDF was twofold higher than PCDD concentration, except sample no WTN1, where both concentrations were similar. In none of samples was found exceeding of limits PCDD/F nor sum of PCDD/F and dl-PCBs.

In all samples highest share of total toxicity constituted non-*orto* PCBs and that share was of 40–50% depending on sample.

Parasites occurrence

The most recent data on occurrence of parasite *Anguillicola crassus* in eel of Polish waters was collected in 2007–2008, however, some earlier data are also presented.

Data were collected and calculated according to three categories:

- Prevalence-proportion between infested eel and number of eel in sample,
- Mean intensity of infection-mean number of parasites per one infected eel,
- Density-mean number of parasites per one eel in sample.

The range of prevalence varied from 0,0 in Szczecin Lagoon in 1971 to 100,0 in Lake Łebsko (2001, 2004).

Intensity of infection varied from 0,0 in Szczecin Lagoon in 1971 to 14,6 in Lake Łebsko (2007).

The density varied between 0,0 in Szczecin Lagoon (1971) to 9,4 in Lake Jamno (2007).

In 2007–2008 total of 168 samples of eel were collected from 15 places of rivers, lakes and lagoons in both RBD's, namely Vistula and Odra. Those samples were examined on presence of viruses EVEX, AgHV-1, VHS, IHN, SVC and IPN. All examinations were made in Department of Pathology and Immunology of Inland Fisheries Institute in Olsztyn.

In none of samples was found presence of above pathogen viruses.

PL.I.3 Predators

There are studies being carried out on the black cormorant pressure on the coastal and inland waters ichthyofauna. Eel contributed from 1,9% to 2,4% in weight of cormorants food from Gulf of Gdańsk in 1998 and 1999 respectively (Bzoma, 2004). In most cases one or two eels on average weight 300 g and length 56 cm were found in eel food. Total amount of eel eaten from Vistula Lagoon is estimated for 52 tons/year on average, during 1998–2000. Nowadays as a consequence of low density, eel is rarely found in cormorants pellets. In 2007 and 2008 in the largest polish breeding colony in Kąty Rybackie only four eels vs. 23 000 other species were found in pellets. It means that total consumption fluctuate about 1 tonne of eels yearly in the Vistula Lagoon.

PL.K Stock assessment

Landing statistics and effort data are reported to the Ministry of Agriculture through Inspectorates of Fisheries. Data on length-and-age sampling are presented every year to the Ministry and fisheries authorities in the form of research reports of the Sea Fisheries Institute.

The other data collected although doing the research is being used for cognitive aims as well as for planning and prognosis actions connected with running a rational fisheries management.

Recommendations on minimum size, effort reduction, closed periods and areas for eel in the Vistula Lagoon were presented by Borowski, 2000. In the 1997 calculations of the von Bertalanffy growth equation parameters were based on a complete set of tag recoveries, as well as on recoveries from particular tagging experiments and the biomass of the eel population of the Vistula Lagoon was estimated based on the catch curve (Borowski *et al*., 1997).

Nowadays stock assessment is still in calculations as a consequence of new requirements from EMP.

PL.M Standardisation and harmonization of methodology

PL.M.1 Sampling commercial catches

In the coastal waters in 2007 samples were collected mainly from landings in three fishery harbours. Total length was measured with accuracy of 1 cm and weight of 1 g. All samples were taken to SFI laboratory.

PL.M.2 Age analysis

Age analysis is conducted in SFI laboratory. Age is calculated based on number of growth interval rings, which are visible as dark rings, clearly differing from light protein matrix, on the surface of otolith. (Moriarty, 1983; Campana, 1992; Campana and Jones, 1992; Lecomte-Finiger, 1992; Tzeng *et.al*., 1994). Two methods of preparation are used. More common: broken and burnt, and less common: sectioned and stained. Thin sections are cut using a high-speed "Acutom-50" saw with a diamond blade.

PL.M.3 Life stages

Life stage is determined using a method described in "EELREP" final report. The silver index is based on the following external body measurements: total body length (L), bodyweight (W), pectoral fin length (FL), and mean eye diameter (MD) which is calculated according to: MD= (vertical eye diameter + horizontal eye diameter)/2.

PL.M.4 Sex determinations

The sex of eel is defined macroscopic according to established schema of ovary and core building.

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Report on the eel stock and fishery in Denmark 2008

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Reporting Period: This report was completed in August 2008, and contains data up to 2007/08.

DK.B.Eel and eel fisheries

The eel is present all along the 7500 km Danish coastline, except on the open North Sea coast in Jutland. In inland waters eels may be found naturally or stocked in ponds, lakes and streams. The fishery is concentrated in the southern and eastern parts of Denmark here the silver eel is exploited during the spawning migration while passing through the Danish straits heading to the North Sea. These fisheries catch the migrating eel by poundnets out to the 10+ meter depth line. Throughout the country, in shallow Fjords, Bays, Lagoons and Inland waters, a combined yellow and silver eel fishery takes place. Most of the catch ca. 97% is reported from saline areas suggesting that catches in fresh water are smaller and more fragmented recreational fisheries.

Current management of the eel stock aims to secure local yield and by a set of general and local rules regarding minimum legal size, mesh size, etc. The fresh-water legislation ensures free movement of local stock by enforcing eel passes at migration barriers. No licences are given explicit to eel fishing but professional fisher has a licence to fish. Catch data are reported to the directorate of fisheries by the trade and processing companies. Three different groups exploit the eel. These are: 1) Professional fisher with a licence; either fulltime or part time fishers. 2) Recreational fishers with a licence and 3) land owners without a licence. Only catches from the professional fishers are known. In this report, where possible, data are separated in River Basin Districts.

Figure DK.B. River Basin Districts in Denmark defined by the Water Framework Directive.

DK.C. Fishing capacity

The available figure of capacity is the number of boats that have landed eel. At present about 500 boats (Table DK.C) are operating in marine areas. The number of professional fishers in inland waters is very limited less than five boats are registered.

Table DK.C. Number of fishing boats that have landed eel in fresh and salt water. (Source: Directorate of fisheries).

YEAR	NO OF EEL FISHING BOATS	
	Marine	Fresh
2001	604	-
2002	590	-
2003	578	5
2004	562	3
2005	503	3
2006	507	4
2007		

DK.D. Fishing effort

The Pound net fishery is concentrated in the southern and eastern parts of Denmark (BRD 2). The number and position of poundnets are in some areas known but again in others no exact figure is available. The number of poundnets registered in year 2004 was 2124, however this figure is probably not all active gear (Pers. com. Lasse Aufeldt) a more realistic figure is <1000 poundnet. The number of larger fykenet (Pole fykenet) used by recreational fishers is shown in Table DK.E. Eels are also caught by longlines and bottom trawl but no record is available.

In fresh water landowners/stakeholders have an ancient privilege to operate eel traps fixed at the outlet of a lake or mill pond. Currently there are 87 of these eel traps.

DK.E. Catches and landings

DK. E.1 Catch of glass eel

Catch of glass eel in Denmark took place between 1971 and 1990 at Vidaa and Ballum sluices in the Wadden Sea. There has been no glass eel fishery since 1990.

DK.E.2 Restocking

Restocking has taken place for many decades, by landowners in inland waters where recruitment of young eel, was limited or absent, because of distance to the ocean or migration barriers. From mid 1960s to the end of the 1980s a number of licenses were given to sell young eels for restocking. These eels were captured at pass traps and glass eels at the sluices in the Wadden Sea. This is now forbidden as a consequence of the low recruitment. Since 1988 a restocking programme has been financed by the Danish government and the eel fishers. From 1994 the restocking programme has been financed solely by the recreational license fee. The eels stocked today are imported, as glass eels mostly from France. They are grown to a weight of 2–5 grammes in heated culture before they are stocked. The amount stocked has been decreasing during the last years because the price for stocked eel increased dramatically in the same period. Figure DK.E.2.

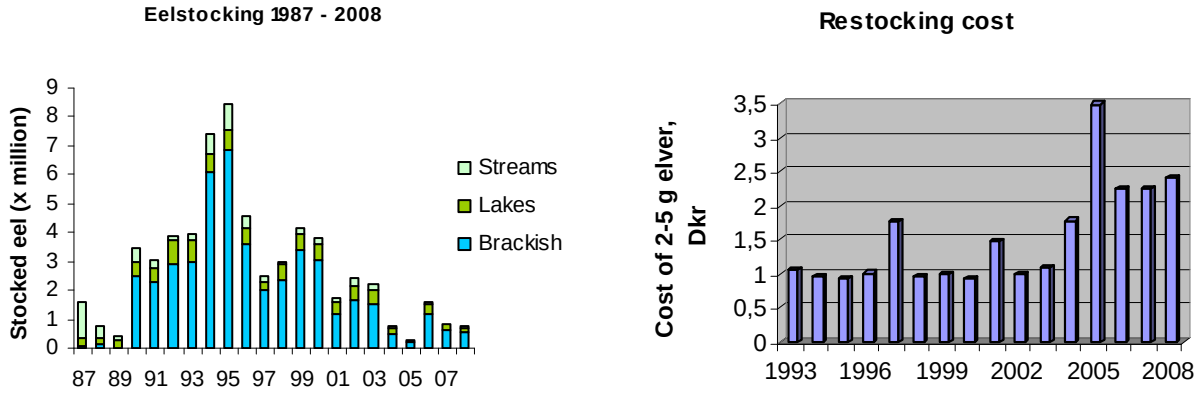


Figure and Table DK.E.2. Restocking of elvers (2–5g) in marine and fresh waters from 1987–2008. Numbers stocked in (millions) and cost per stocked eel.

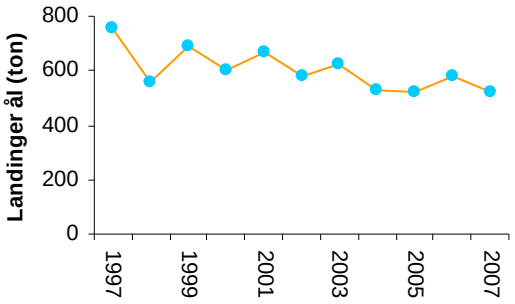
Year	Marine	Lake	River	Total	Year	Marine	Lake	River	Total
1987	0.07	0.26	1.26	1.58	1998	2.35	0.53	0.1	2.98
1988	0.11	0.24	0.4	0.75	1999	3.38	0.56	0.18	4.12
1989	0	0.24	0.17	0.42	2000	3.02	0.55	0.25	3.83
1990	2.46	0.49	0.51	3.47	2001	1.2	0.38	0.12	1.7
1991	2.3	0.44	0.32	3.06	2002	1.66	0.47	0.3	2.43
1992	2.94	0.81	0.11	3.86	2003	1.54	0.49	0.22	2.24
1993	2.97	0.76	0.23	3.96	2004	0.52	0.18	0.06	0.75
1994	6.12	0.61	0.67	7.4	2005	0.24	0.06	0	0.3
1995	6.83	0.72	0.9	8.44	2006	1.15	0.35	0.1	1.6
1996	3.58	0.58	0.44	4.6	2007	0.59	0.21	0.02	0.83

1997	2.02	0.29	0.22	2.53	2008	0.52	0.19	0.04	0.75

DK.E.3. Catch of yellow and silver eel in marine and salt water

Marine and fresh-water catches

The annual catches of yellow and silver eels during the last decade have been fairly constant (Table DK.E). There is a trend that relatively more silver than yellow are being captured, suggesting yellow eels are less exploited now a days.

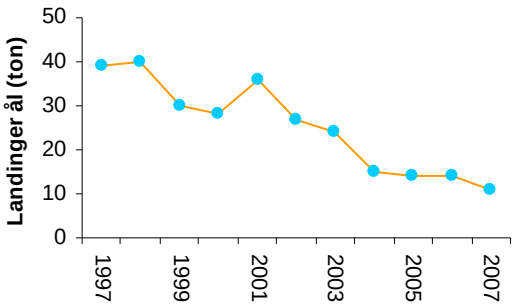


År	Silver	Yellow	Total
1997	375	383	758
1998	306	251	557
1999	380	307	687
2000	382	218	600
2001	446	225	671
2002	365	217	582
2003	437	188	625
2004	343	187	531
2005	372	149	520
2006	427	154	581
2007	411	115	526

Figure and Table DK.E.3. Annual catch in (tonne) separated into yellow and silver eel during the last decade 1997–2006 (Source: Fisheries Directorate).

Freshwater catches

The annual catches in fresh water have been decreasing relatively more than marine catches during the last 10 years. The fresh-water catch is 2–3 % of the marine catch.



Year	Silver	Yellow	Total
1997	-	-	39
1998	-	-	40
1999	-	-	30
2000	4	24	28
2001	2	34	36
2002	5	27	27
2003	2	21	24
2004	4	12	15
2005	3	10	14
2006	7	8	14
2007	5	6	11

Figure and Table DK.E.4. Catch of yellow and silver eel in fresh water (Source: Fisheries Directorate and DFU).

DK.E.4 Aquaculture

Aquaculture production in Denmark started in 1984. The production takes place at indoor, heated aquaculture systems. Annual production is ca. 2000 tonne.

Table DK.E.4. Aquaculture production (1984–2007). (source: C. Graver).

Year	Production units	Production [tonne]	Year	Production units	Production [tonne]
1984	??	18	1996	28	1568
1985	30	40	1997	30	1913
1986	30	200	1998	28	2483
1987	30	240	1999	27	2718
1988	32	195	2000	25	2674
1989	40	430	2001	17	2000
1990	47	586	2002	16	1880
1991	43	866	2003	13	2050
1992	41	748	2004	9	1500
1993	35	782	2005	9	1700
1994	30	1034	2006	9	1900
1995	29	1324	2007	9	1900

DK.E.5. Recreational fishers

The number of licences sold to recreational fishers was 33 615 in 2005 and has been quite stable for the last seven years (www.fd.dk). The recreational fishers are not allowed to sell their catch and the catch is not recorded. The number of gear allowed to fish with, is one large fyke (Pole fyke) and five small summer fykes! A questionnaire among the recreational fishers in 1997 demonstrated that 56% of all recreational fishers catch eels. Based on the information given in the questionnaire it was estimated that in 1997 they caught 200 tonnes, equivalent to 26% of the official catch. Assuming

this relation to total landing hold, each licence landed 7 kg (50–70 eel) in 2004 equivalent to a recreational catch of 138 tonnes.

Table DK.E.5. Estimated number of recreational eel fishers, estimated catch, and number of gear registered in the directorate of fisheries in the year 2004.

River Basin District	Recreational eel fishers, estimated, no	Catch, kg	Pole-fyke (Pæleruse)
1	11 181	82 249	448
2	7260	53 406	264
3	327	2406	0
4	-	-	-
Total	18 768	138 060	712

DK.F. Catch per unit of effort in commercial landings

There are no official cpue-data available. The only records available are from the fishers. These records are available because the fishers count the number of eels caught by each poundnet. There has been no attempt to collect cpue data from the fishers. Below is data from one fisher (N.E. Jensen) who has been fishing on the same spot and same depth for many years in Fakse Bugt (Øresund, RDB no. 2). These data demonstrate that cpue has been increasing during the last two decades. We speculate if this may be interpreted as a result of decreasing number of poundnets on the migration route and thus fewer eels caught (decrease in fishing mortality) on the way out of the Baltic and in the Danish Sound.

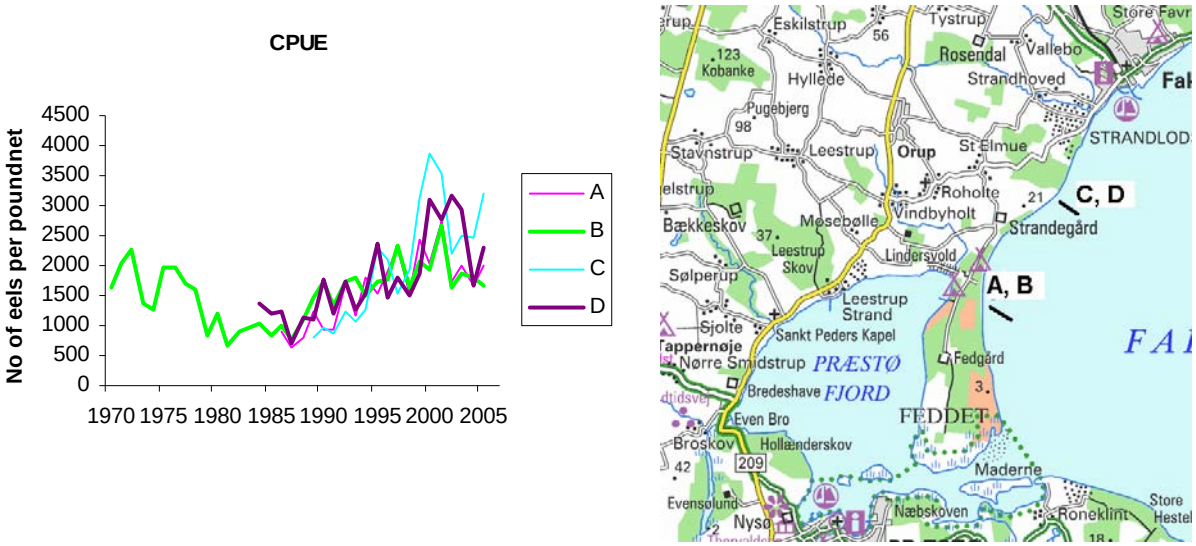


Figure DK.F. Annual catches (in number) of silver eels per poundnet (A.D) in Faxe Bugt, RDB 2 (55⁰, 10′;12⁰ 8′). All the eels are females with an average weight per eel of ca. 800 gramme (Pers. com. N.E. Jensen) Fishing depth of poundnet A and C = 5,3 meter; B and D = 8 meter.

DK.G. Scientific surveys of the stock

DK.G.1 Recruitment surveys of glass eel and ascending yellow eel

The recruitment of young eels to Danish fresh water is currently monitored in pass

traps at Harte hydropower stations in river Kolding Å and at Tange hydropower station in river Guden Å. Both rivers empty into Kattegat on the east coast of Jutland. On the west coast of Jutland no passive trapping facilities are available. Here the recruitment is monitored by annual population surveys (electro fishing four sections 2–4 times a year) in a brook by the Wadden Sea. The method used is sampling by during the year Vester Vedsted brook). Further details in Pedersen, 2002.

Table DK.G: Recruitment monitoring of young eel at pass traps and electrofishing.

Year	Tange	Harte	Vester Vedsted brook Density eel/m2		Year	Tange	Harte	Vester Vedsted brook Density eel/m2	
	Kg	Kg	Mean	Max (season)		Kg	Kg	Mean	Max (season)
1967		500			1988	252	253	-	-
1968		200			1989	354	145	-	-
1969		175			1990	367	101	-	-
1970		235			1991	434	44	-	-
1971		59			1992	53	40	-	-
1973		117			1993	93	26	-	-
1974		212			1994	312	35	-	-
1975		325			1995	83	23	2,6	2,6
1976		91			1996	56	6	4,6	6,8
1977		386			1997	390	9	0,7	1
1978		334			1998	29	18	0,3	0,4
1979		291	2,8	6,5	1999	346	15	0,4	0,5
1980	93	522	7	13	2000	88	18	0,6	0,7
1981	187	279	7,8	13	2001	239	11	0,6	0,8
1982	257	239	-	-	2002	278	17	0,5	0,6
1983	146	164	-	-	2003	260	9	0,6	0,7
1984	84	172	-	-	2004	246	9	0,3	0,4
1985	315	446	-	-	2005	88	7	0,5	0,5
1986	676	260	-	-	2006	123	7	0,3	0,7
1987	145	105	-	-	2007	62	7	0.4	0.5

DK.G.2 Stock surveys, yellow eel

All Danish streams are electrofished every seventh year in BRD (1,2,3,4) to determine trout stocks and the need for restocking trout. During this evaluation all fish species are recorded and the number of eels observed during the survey is included in the final report. The information on eel is semi quantitative or just qualitative. These data seem to be of little value!

DK.G.3 Silver eel

In the small Roskilde Fjord (BRD 2) a catch and recapture survey with tagged silver eel has taken place during autumn 1998, 2001–2004. The silver eels are tagged with Carlin tags and released in the inner parts of the fjord. On reported recapture, a fee per tag is given to the fisher. The F-values are minimum values but reflecting a high level of fishery mortality on silver eels in this area.

Table DK.G.3 Catch-recapture experiment with Carlin tagged silver eel during 1998, 2001–2004.

Date of release	Stage	Tagged no	Recaptured no	F %
30.09.1998	Silver	500	189	37,8
09.08.2001	Half silver	300	25	8,3
07.10.2002	Silver	400	68	17,0
19.09.2003	Silver	500	159	31,8
20.09.2004	Silver	500	135	27,0

DK.H. Catch composition by age and length

Only a few sporadic datasets of old age are available.

DK.I Other biological sampling

DK I.3 Parasites

Anguillicola

The swimbladder worm *Anguillicola crassus* introduced to Europe from the far east at the beginning of the 1980s was discovered in Danish wild eels in 1986. Since 1988 a monitoring programme on the abundance of the *anguillicola,* in the eel population in different fresh and brackish water bodies has been continued annually. Data from 2006 in Table DK.I.1.

Table DK.I.1 Analyses of *anguillicola* 2006.

Location	ppt	Coordinates	Year	Total	Infected	Prevalence	Intensity			Abundance
				N	n	%	Mean	Stdv	Max	
Arresø	0	55,59N;11,57E	2006	107	61	57,0	3,4	3,1	14	2,3
Isefjord	18	55,50N:11,50E	2006	101	30	29,7	3,1	3,1	11	0,9
Ringk. Fj.	5–10	55,55N:08,20E	2006	60	38	63,3	6,3	5,2	24	4,0

DK.I.4. Contaminants

There are few surveys and mostly of older date. Recent data for PFAS and organotin-compounds in the aquatic environment extracted from report by Strand *et al*., 2007 and unpublished data from Århus Amt, 2003 see Appendix. A.

DK.I.5 Predators

Cormorants

The number of Cormorants is estimated throughout the country every year by the Ministry of Environment. Cormorant's predation on flatfish, trout, salmon (smolt) and eels have been studied using various tagging methods e.g. floy tags, coded wire tags and radio tags in Ringkøbing Fjord (BRD 1; 55,55'N:08,20'E). In a study of cormorant predation eel 10 163 eels (10 grammes) were coded wire tagged and released in Ringkøbing Fjord in 2003. In the same year 5734 regurgitate were analysed and 21 coded wire tags were found. From these data it was estimated that 43% of the tagged eels were eaten by the cormorants. However, the cormorant do not eat many eels as the frequency of occurrence of otolliths found in regurgitate in 2005 was only 0,12% (Sonnesen, 2007) suggesting that eels are not important as food in Rinkøbing Fjord.

Recent work from Hirsholmene (57,29'N;10.37'E) a cormorant colony in Kattegat suggested that of 350 regurgitate eel otoholiths occurred with a frequency of 0,3% (Poul Hald, 2007).

DK. N. Summary of the report

The fishing capacity about boats landing eel have been reduced from ca. 600 boats to ca. 500 boats during the last five years. No exact data for the current effort are available but the effort in poundnets in use has without been markedly reduced. The marine fishers claim that cpue have not changed negatively over several years and an example of increase in cpue is provided. During the last 10 years the total catches in the marine areas have been fairly constant ca. 500–600 tonne. In fresh water reported catch has decreased from ca. 40 tonne to ca. 15 tonne during the last 10 years. Restocking costs have increased by 100% over the last four years and therefore enhancement by restocking has been reduced equally. Eel production in aquaculture is ca. 2000 tons of eel per year. Recruitment surveys of glass eel and ascending yellow eel indicate a continuously low recruitment.

DK.O. Literature references

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Sonnesen P. 2007. Skarvens prædation omkring Ringkøbing Fjord-en undersøgelse af sammenhænge mellem fødevalg og fiskebestandenes sammensætning. Pp 76 and attachments.

Strand, J., Bossi, R., Sortkjær, O., Landkildehus, F. and Larsen, M.M. 2007. PFAS og organotinforbindelser i punktkilder og det akvatiske miljø NOVANA screeningsundersøgelse. DMU rapport nr. 608 (http://www2.dmu.dk/Pub/FR608.pdf).

Erichsen *et al.* 2000. Miljøfremmede stoffer i sediment, vandløbsvand, fisk og jord. Miljø og Teknologi/Vand og Landskab 14: 7–16.

Appendix A On contaminants

Appendix1: Unpublished data from Århus county 2003

STATION (ÅRHUS AMT 2003)	LYNGBYG.Å	LYNGBYG.Å	GIBER Å 1A	GIBER Å 2A	
Fisk	Ål	Ål	Ål	Ål	
Dato					
Matrice	muskel	muskel	muskel	muskel	
	03-0581-1*	03-0581-2*	03-0582	03-0583	Enhed
Prøvens vægt (g ww)	2,19	1,74	1,55	1,92	g
Fedt procent (%)	27,68	24,23	26,06	28,24	%
CB-28	0,54	0,54	< 0,38	< 0,38	µg/kg vv
CB-31	< 0,37	< 0,37	< 0,37	< 0,37	µg/kg vv
CB-44	0,42	0,42	0,41	0,45	µg/kg vv
CB-49	0,30	0,34	0,34	0,30	µg/kg vv
CB-52	2,72	2,68	2,86	3,81	µg/kg vv
CB-99	2,58	2,52	2,31	2,70	µg/kg vv
CB-101	3,61	3,57	8,79	12,38	µg/kg vv
CB-105	2,98	3,03	2,93	4,05	µg/kg vv
CB-110	3,81	3,85	4,79	7,28	µg/kg vv
CB-118	6,21	6,31	6,93	9,48	µg/kg vv
CB-128	1,81	1,83	2,89	4,52	µg/kg vv
CB-138	10,77	10,90	20,60	32,50	µg/kg vv
CB-149	5,14	5,17	14,38	22,89	µg/kg vv
CB-151	1,05	1,06	2,24	2,93	µg/kg vv
CB-153	16,55	16,53	30,57	45,42	µg/kg vv
CB-156	1,14	1,14	1,85	3,21	µg/kg vv
CB-170	2,14	2,15	5,45	9,32	µg/kg vv
CB-180	5,13	5,26	12,67	21,06	µg/kg vv
CB-187	5,27	5,33	13,63	23,61	µg/kg vv
CB-194	0,43	0,45	1,03	1,48	µg/kg vv
CB-209	< 0,31	< 0,31	< 0,31	< 0,31	µg/kg vv
Alfa-HCH	1,44	1,52	3,48	3,84	µg/kg vv
beta-HCH	0,41	0,73	0,89	0,70	µg/kg vv
gamma-HCH	1,63	1,60	2,64	2,52	µg/kg vv
HCB	13,38	13,70	33,22	69,30	µg/kg vv
o'p-DDE	0,86	0,87	0,77	0,91	µg/kg vv
o'p-DDT	0,73	0,67	4,38	3,38	µg/kg vv
p'p'-DDD	7,04	6,82	11,64	10,25	µg/kg vv
p'p-DDE	33,40	34,69	49,76	42,84	µg/kg vv
p'p-DDT	9,09	9,11	16,95	21,62	µg/kg vv
TNC	2,83	2,83	2,00	1,96	µg/kg vv
Recovery					
CB-40 (%)	96,0	95,8	97,3	96,2	%

Station (Århus Amt 2003)	Lyngbyg.Å	Lyngbyg.Å	Giber Å 1A	Giber Å 2A	
Brommerede flammehæmmere					
PBDE-17	0,09	0,16	< 0,08	0,08	µg/kg vv
PBDE-28	0,14	0,38	0,19	0,20	µg/kg vv
PBDE-49	0,28	0,29	0,19	0,23	µg/kg vv
PBDE-47	6,48	6,83	3,57	4,04	µg/kg vv
PBDE-66	0,10	0,11	< 0,08	0,11	µg/kg vv
PBDE-100	2,13	1,86	1,53	2,27	µg/kg vv
PBDE-99	0,71	0,59	0,37	0,40	µg/kg vv
PBDE-85	< 0,06	< 0,07	< 0,08	< 0,06	µg/kg vv
PBDE-154	0,26	0,17	0,14	0,23	µg/kg vv
PBDE-153	0,38	0,28	0,22	0,36	µg/kg vv
PBDE-183	< 0,29	< 0,36	< 0,40	< 0,32	µg/kg vv
Recovery PBDE (%)	106	97	107	97	µg/kg vv

Appendix 2

Analyses from Brabrand sø in 1998 mussel tissue on eel pool of 6 individuals. Erichsen *et al.*, 2000.

sum PCB	0.33 mg/kg tørstof
sum DDT/DDE/DDD	0.1 mg/kg tørstof
sum PAH	0.59 mg/kg tørstof

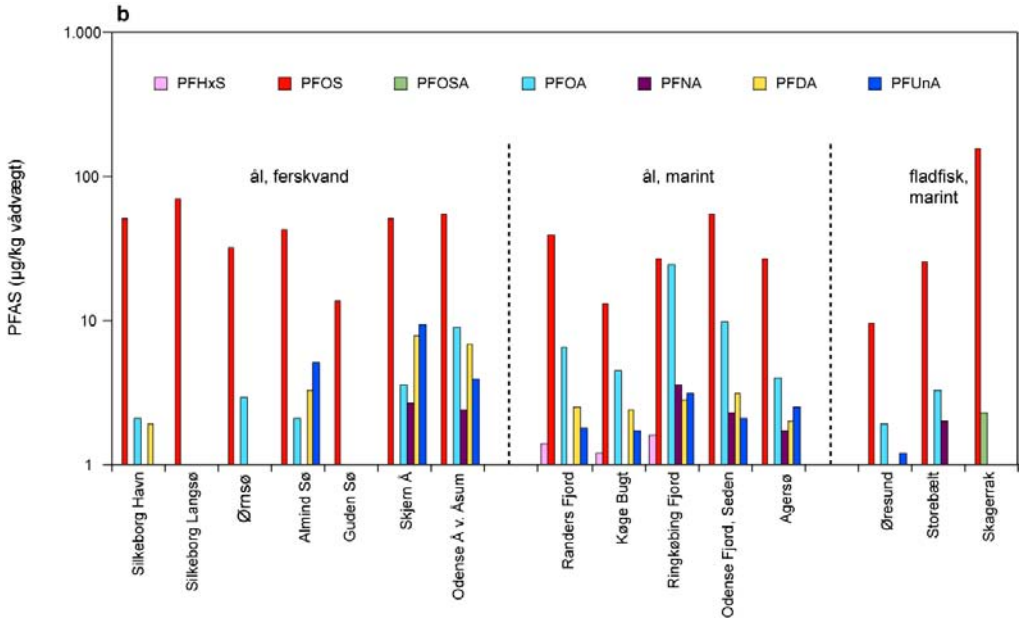

Figure PFAS concentration wet weight in eel (ål) and flatfish (fladfisk) in fresh water (ferskvand) and marine (marint) waters from fish liver.

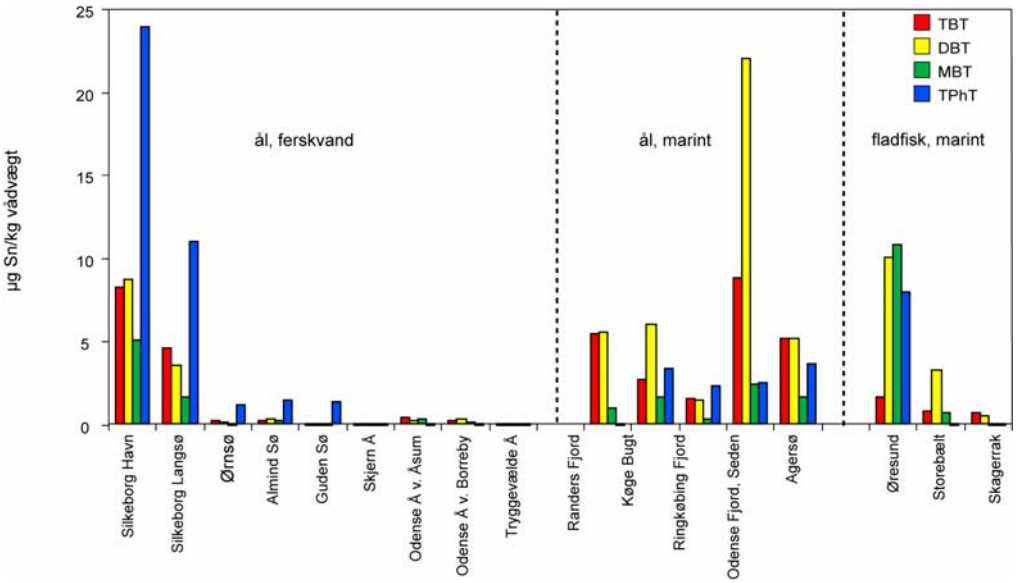

Figure PFAS concentration wet weight (vådvægt) in eel (ål) and flatfish (fladfisk) in fresh water (ferskvand) and marine (marint) waters from fish lever.

Appendix 3

Data for PFAS in fresh water.

LAB-ID	FISK, LEVER (µG/KG VÅDVÆGT)	PFHxS	PFOS	PFOSA	PFOA	PFNA	PFDA	PFUnA
04-0700	Odense Å v. Åsum, ål	<0,8	54,5	<0,5	8,9	2,4	6,9	3,9
04-0679	Skjern Å, ål	<0,8	51,6	<0,5	3,6	2,7	7,9	9,4
04-0680	Silkeborg Havn, ål	<0,8	51,1	<0,5	2,1	<1,4	1,9	<0,7
04-0683	Silkeborg Langsø, ål	<0,8	70,1	<0,5	<1,2	<1,4	<0,8	<0,7
04-0682	Ørnsø, ål	<0,8	31,7	<0,5	2,9	<1,4	<0,8	<0,7
04-0681	Almind Sø, ål	<0,8	42,3	<0,5	2,1	<1,4	3,3	5,1
04-0684	Guden Sø, ål	<0,8	13,7	<0,5	<1,2	<1,4	<0,8	<0,7
04-0314	Randers Fjord, ål	1,4	39,5	<0,5	6,5	<1,4	2,5	1,8
04-0315	Køge Bugt, ål	1,2	13,1	<0,5	4,5	<1,4	2,4	1,7
04-0316	Ringkøbing Fjord, ål	1,6	26,5	<0,5	24,5	3,6	2,8	3,1
04-0467	Odense Fjord, Seden Strand, ål	<0,8	54,3	<0,5	9,8	2,3	3,1	2,1
04-0816	Agersø, ål	<0,8	26,8	<0,5	4,0	1,7	2,0	2,5
04-0632	Øresund, Nivå Bugt, skrubbe	<0,8	9,5	<0,5	1,9	<1,4	<0,8	1,2
04-0633	Storebælt, Agersø, skrubbe	<0,8	25,4	<0,5	3,3	2,0	<0,8	<0,7
04-0634	Skagerrak, Hirtshals, rødspætte	<0,8	156,0	2,3	<1,2	<1,4	<0,8	<0,7
LAB-ID	**SEDIMENT, FERSKVAND (µG/KG TØRSTOF)**	**PFHxS**	**PFOS**	**PFOSA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**
04-0623	Guden Sø (TS: 33.6% , GT:25.0%)	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0624	Ørn Sø (TS: 24,7% , GT: 18,3%)	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0625	Silkeborg Langsø (TS:27,7%, GT:28,7%)	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0626	Almind Sø (TS: 28,2% , GT: 25,5%)	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0678	Silkeborg Havn (TS: 63,8% , GT: 3,0%)	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0698	Odense Å (TS: 14.7% , GT: 24,4%)	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0699	Skjern Å (TS: 61,1% , GT: 3,4%)	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0284	Tryggevælde Å (TS: 20,1% , GT: 15,0%)	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
LAB-ID	**MUSLINGER, MARINT (µG/KG VÅDVÆGT)**	**PFHxS**	**PFOS**	**PFOSA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**
04-0317	Odense Fjord	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
04-0320	Nivå Bugt, Øresund	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
04-0323	Agersø, Storebælt	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
04-0332	Køge Bugt,	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
04-0335	Randers Fjord	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
04-0346	Ringkøbing Fjord	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
04-0407	Anholt, Kattegat	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
04-0658	Bornholm, Østersø	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
04-0671	Lønstrup, Skagerrak	<0,8	<0,2	<0,5	<1,2	<1,4	<0,8	<0,7
LAB-ID	**SEDIMENT, MARINT (µG/KG TØRSTOF)**	**PFHxS**	**PFOS**	**PFOSA**	**PFOA**	**PFNA**	**PFDA**	**PFUnA**
00-1992	Randers Fjord	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
00-2006	Ringkøbing Fjord	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
00-2063	Odense Fjord	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0179	Anholt, Kattegat	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7

04-0183	Bornholm, Østersø	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0190	Agersø, Storebælt	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0203	Nivå Bugt, Øresund	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7
04-0206	Lønstrup, Skagerrak	<0,7	<1,0	<0,9	<0,4	<0,7	<1,0	<1,7

PFHxS: perfluorohexane sulfonate; PFOS: perfluorooctane sulfonate; PFOSA: perfluorooctane sulfonamide;

PFOA: perfluorooctanoic acid; PFNA: perfluorononanoic acid; PFDA: perfluorodecanoic acid; PFUnA: perfluoroundecanoic acid, TS: tørstof; GT:glødetab.

Data for organotin in fish and fresh-water sediment.

LAB-ID	FISK, LEVER (µG SN/KG VÅDVÆGT)	TBT	DBT	MBT	TPHT	DPHT	MPHT	TOCT	DOCT	MOCT
04-0700	Odense Å v. Åsum, ål	0,5	0,3	0,4	<0,5	<0,3	<0,2	<0,5	<0,5	<0,3
04-0701	Odense Å v. Borreby, ål	0,3	0,4	0,2	<1	<0,5	<0,2	<1	<0,5	<0,3
04-0679	Skjern Å, ål	<0,2	<0,2	<0,2	<0,5	<0,3	<0,2	<0,5	<0,5	<0,3
04-0680	Silkeborg Havn, ål	8,3	8,7	5,1	24	3,2	1,9	<0,5	<0,5	<0,3
04-0683	Silkeborg Langsø, ål	4,7	3,6	1,7	11	2,0	0,6	<0,5	<0,5	<0,3
04-0682	Ørnsø, ål	0,3	0,2	<0,2	1,2	<0,3	<0,2	<0,5	<0,5	<0,3
04-0681	Almind Sø, ål	0,3	0,4	0,3	1,5	0,5	0,3	<0,5	<0,5	<0,3
04-0684	Guden Sø, ål	<0,2	<0,2	<0,2	1,4	<0,3	<0,2	<0,5	<0,5	<0,3
04-0284	Tryggevælde Å, ål	<0,2	<0,2	<0,2	<0,5	<0,3	<0,2	<0,5	<0,5	<0,3
04-0314	Randers Fjord, ål	5,5	5,6	1,0	<0,5	<0,3	<0,2	<0,5	<0,5	<0,3
04-0315	Køge Bugt, ål	2,8	6,1	1,7	3,4	<0,3	<0,2	<0,5	<0,5	<0,3
04-0316	Ringkøbing Fjord, ål	1,6	1,5	0,4	2,4	<0,3	<0,2	<0,5	<0,5	<0,3
04-0467	Odense Fjord, Seden Strand, ål	8,8	22,1	2,5	2,6	<0,3	<0,2	<0,5	<0,5	<0,3
04-0816	Agersø, ål	5,2	5,2	1,7	3,7	<0,3	<0,2	<0,5	<0,5	<0,3
04-0632	Øresund, Nivå Bugt, skrubbe	1,7	10,1	10,8	8,0	0,9	1,0	<0,5	<0,5	<0,3
04-0633	Storebælt, Agersø, skrubbe	0,9	3,3	0,8	<1	<0,5	<0,2	<1	<0,5	<0,3
04-0634	Skagerrak, Hirtshals, rødspætte	0,8	0,6	<0,5	<1	<0,5	<0,2	<1	<0,5	<0,3
LAB-ID	**SEDIMENT, FERSKVAND (µG SN/KG TØRSTOF)**	**TBT**	**DBT**	**MBT**	**TPHT**	**DPHT**	**MPHT**	**TOCT**	**DOCT**	**MOCT**
04-0623	Guden Sø (TS: 33,6% , GT:25,0%)	<2	<2	<4	<10	<5	<5	<5	<4	<4
04-0624	Ørnsø (TS: 24,7% , GT: 18,3%)	<1	<1	<1	<5	<4	<4	<5	<4	<4
04-0625	Silkeborg Langsø (TS:27,7%, GT:28,7%)	21	13	<3	<5	<4	<4	<5	<4	<4
04-0626	Almind Sø (TS: 28,2% , GT: 25,5%)	<2	<5	<4	<10	<5	<5	<5	<5	<4
04-0678	Silkeborg Havn (TS: 63,8% , GT: 3,0%)	6,1	3,4	<2	<1	<1	<1	<1	<1	<1
04-0698	Odense Å(TS: 14,7% , GT: 24,4%)	6,6	10	7,3	<1	<1	<1	<1	<1	<1
04-0699	Skjern Å (TS: 61,1% , GT: 3,4%)	<0,5	<0,5	<0,5	<2	<2	<2	<2	<2	<2
04-0284	Tryggevælde Å (TS: 20,1% , GT: 15,0%)	<1	<1	<2	<3	<1	<1	<3	<1	<1

TBT: Tributyltin; DBT: Dibutyltin; MBT: Monobutyltin; TPhT: Triphenyltin; DPhT: Diphenyltin; MPhT: monophenyltin; TocT: Trioctyltin; DocT: Dioctyltin; MocT: Monooctyltin; TS: tørstof; GT: glødetab.