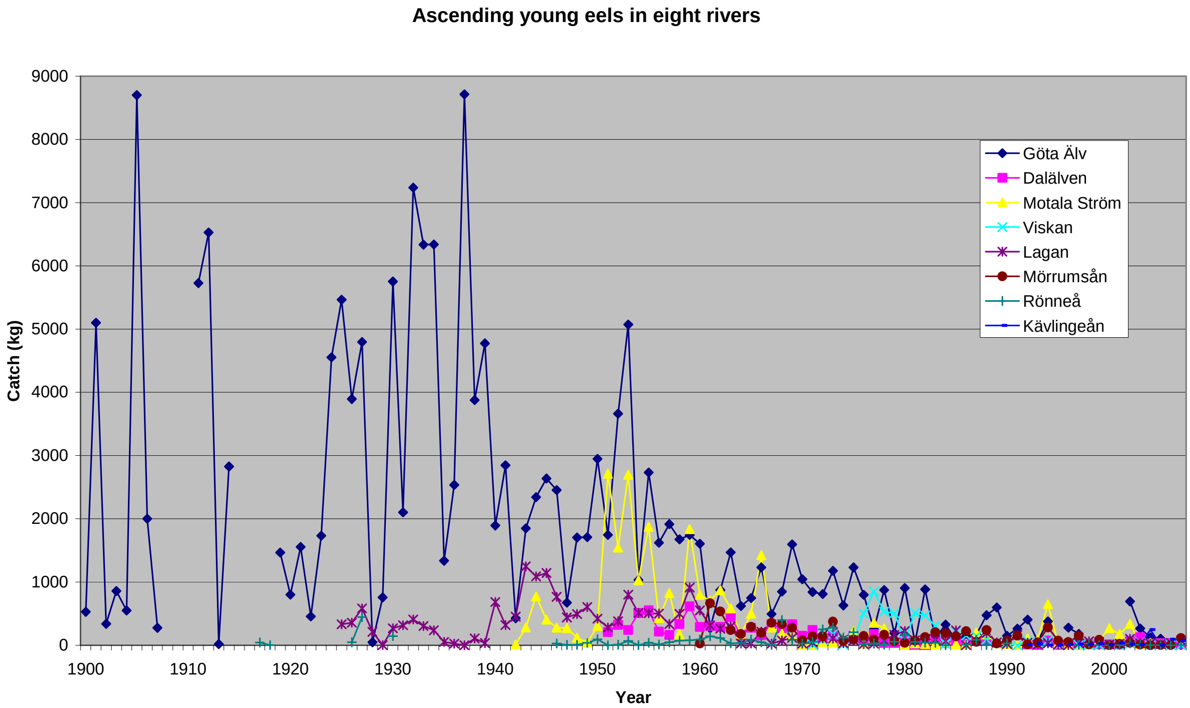
Table SE.i Amounts (kg) of ascending young eels caught in eight rivers along the Swedish coasts.

RIVER	DALÄLVEN	MOTALA STRÖM	MÖRRUMSÅN	KÄVLINGEÅN	RÖNNE Å	LAGAN	VISKAN	GÖTA ÄLV
YEAR/RBD	RBD 2	RBD 4	RBD 4	RBD 4	RBD 5	RBD 5	RBD 5	RBD 5
1900								530,0
1901								5100,0
1902								340,0
1903								858,0
1904								552,0
1905								8700,0
1906								2000,0
1907								275,0
1908								na
1909								na
1910								na
1911								5728,0
1912								6529,0
1913								20,0
1914								2828,0
1915								na
1916								na
1917					45,0			na
1918					4,5			na
1919					na			1465,0
1920					na			800,0
1921					na			1555,0
1922					na			455,0
1923					na			1732,0
1924					na			4551,0
1925					na	331,3		5463,0
1926					49,0	357,8		3893,0
1927					445,0	581,1		4796,0
1928					0,0	211,9		47,0
1929					0,0	4,5		756,0
1930					147,0	268,0		5753,0
1931					na	316,0		2103,0
1932					na	408,0		7238,0
1933					na	303,5		6333,0
1934					na	236,0		6338,0
1935					na	53,5		1336,0
1936					na	24,5		2537,0
1937					na	0,5		8711,0
1938					na	106,5		3879,0
1939					na	36,0		4775,0

RIVER	DALÄLVEN	MOTALA STRÖM	MÖRRUMSÅN	KÄVLINGEÅN	RÖNNE Å	LAGAN	VISKAN	GÖTA ÄLV
1940					na	684,0		1894,0
1941					na	321,0		2846,0
1942		14,0			na	454,0		427,0
1943		283,0			na	1248,0		1848,0
1944		773,0			na	1090,0		2342,0
1945		406,0			na	1143,0		2636,0
1946		280,0			29,7	766,5		2452,0
1947		272,5			5,8	440,8		675,0
1948		120,0			6,0	494,7		1702,0
1949		43,0			39,4	603,6		1711,0
1950		304,5			93,5	419,9		2947,0
1951	210,0	2713,0			1,0	281,8		1744,0
1952	324,0	1543,5			9,1	379,1		3662,0
1953	241,5	2698,0			70,0	802,4		5071,0
1954	508,5	1030,0			2,7	511,3		1031,0
1955	550,0	1871,0			42,6	506,9		2732,0
1956	215,0	429,0			14,1	501,6		1622,0
1957	161,5	826,0			46,8	336,1		1915,0
1958	336,7	172,0			73,2	497,2		1675,0
1959	612,6	1837,0			80,0	910,5		1745,0
1960	289,0	799,0	29,0		93,0	552,4		1605,0
1961	303,0	706,0	665,5		143,7	314,8		269,0
1962	289,0	870,0	534,8		113,0	261,9		873,0
1963	445,4	581,0	241,2		32,5	298,1		1469,0
1964	158,0	181,6	177,8		34,7	27,5		622,0
1965	276,4	500,0	292,3		87,1	28,0		746,0
1966	157,5	1423,0	196,3		48,5	216,5		1232,0
1967	331,8	283,0	353,6		6,6	24,4		493,0
1968	265,5	184,0	334,8		398,0	74,4		849,0
1969	333,7	135,0	276,8		85,7	117,1		1595,0
1970	149,8	2,0	80,4		29,8	24,7		1046,0
1971	242,0	1,0	141,1		53,3	45,3	12,0	842,0
1972	87,6	51,0	139,9		249,0	106,2	88,0	810,0
1973	159,7	46,0	375,0		282,3	107,1	177,0	1179,0
1974	49,5	58,5	65,4		120,7	33,6	13,0	631,0
1975	148,7	224,0	93,3		206,7	78,4	99,0	1230,0
1976	44,0	24,0	147,2		17,1	20,2	501,0	798,0
1977	176,4	353,0	89,6		32,1	26,4	850,0	256,0
1978	35,1	266,0	168,4		10,8	75,8	532,6	873,0
1979	34,3	112,0	61,4		56,1	165,9	505,2	190,0
1980	71,2	7,0	36,5		165,7	226,0	72,5	906,0
1981	6,8	31,0	72,8		49,2	78,0	513,1	40,0
1982	0,5	22,0	129,0		40,0	90,8	472,0	882,0
1983	112,1	12,0	204,6		37,6	87,8	308,4	113,0

RIVER	DALÄLVEN	MOTALA STRÖM	MÖRRUMSÅN	KÄVLINGEÅN	RÖNNE Å	LAGAN	VISKAN	GÖTA ÄLV
1984	33,9	48,0	189,9		0,5	68,0	20,7	325,0
1985	69,7	15,2	138,1		0,0	234,1	211,5	77,0
1986	28,4	26,0	220,3		8,6	2,5	150,9	143,0
1987	73,5	201,0	54,5		84,8	69,8	140,9	168,0
1988	69,0	169,5	241,0		4,9	191,7	91,9	475,0
1989	na	35,2	30,0		0,0	44,0	32,7	598,0
1990	na	21,0	72,5		32,0	21,6	42,1	149,0
1991	na	2,0	151,0	na	na	161,3	0,4	264,0
1992	9,6	108,0	14,0	12,5	na	42,2	70,3	404,0
1993	6,6	89,0	45,7	25,8	na	8,7	43,4	64,0
1994	71,9	650,0	283,0	4,0	na	30,7	76,1	377,0
1995	7,6	32,0	72,4	2,9	na	11,6	5,5	0,0
1996	17,5	14,0	51,9	13,5	na	2,8	10,0	277,0
1997	7,5	8,1	148,0	19,4	10,4	31,7	7,6	180,0
1998	14,7	5,5	12,9	15,3	24,0	62,6	5,0	0,0
1999	15,5	85,0	84,2	22,2	4,2	49,5	1,8	0,0
2000	12,4	270,1	1,0	5,0	na	13,0	14,1	0,0
2001	8,2	177,5	19,3	34,5	1,8	26,8	1,8	0,0
2002	58,6	338,8	37,4	19,3	27,0	102,0	26,2	693,0
2003	126,1	19,0	11,0	9,7	9,1	31,7	45,1	266,0
2004	26,4	42,0	1,5	248,3	2,0	29,0	5,0	125,0
2005	30,9	24,8	2,5	3,4	0,1	20,5	25,8	105,0
2006	35,1	25,9	2,5	94,4	0,1	38,1	2,7	0,04
2007	19	>30	112,6	76	4,45	77	2,1	0
2008	>30,5	na	na	na	na	>25	>3,4	>0

The ascent in River Viskan is totally dominated by elvers that arrived as glass eels the same year. Also in River Lagan there is a considerable proportion of "glass eels" but in the remaining rivers there is a mix of year classes, with eels up to more than 300 mm in TL. No data available = na. 0 for River Göta Älv in recent years (except in 2007) is as a consequence of the fact the eel pass was closed in those years. Data for 2008 are only indicated as the season is not over yet.



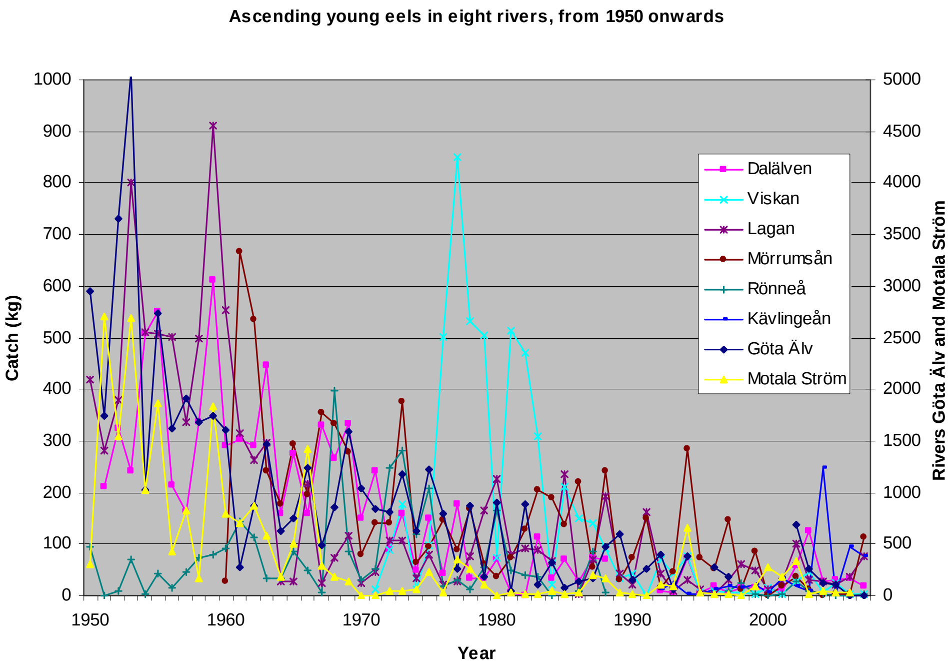


Figure SE.10 a and b Long-term trends in the catches of young eels at various places along the Swedish coast. The lower panel is a magnified version of the upper one from 1950 onwards.

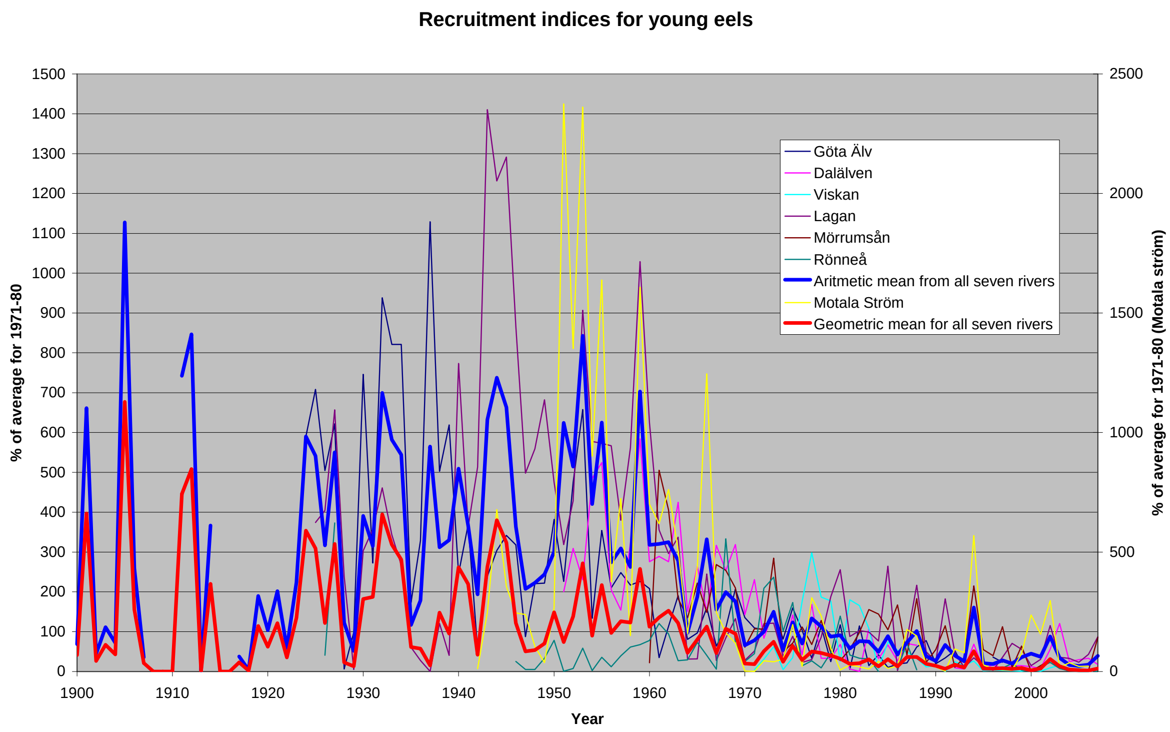


Figure SE.11 Recruitment indices from seven Swedish rivers. Data are presented as percentages of the averages for 1971 to 1980 in the same rivers, respectively.

SE.G.1.2 Recruitment surveys/marine data

The abundance of glass eels in the open sea (Kattegat and Skagerrak) is surveyed by trawling with either an Isaacs-Kidd Midwater trawl (IKMT) or with a modified Methot-Isaacs-Kidd Midwater trawl (MIKT). The former trawl is used in a fixed position in the intake canal for cooling water to the condensers at the Ringhals Nuclear Power Station (e.g. Westerberg, 1998a; 1998b). The latter method is used from RV Argos during the ICES-International Young Fish Survey (since 1993 called the International Bottom trawl Survey (IBTS Quarter 1) (Hagström and Wickström, 1990).

When the glass eels have settled they and larger eels can be monitored on soft and shallow bottoms using a "Drop Trap" technique (Westerberg *et al.*, 1993). This was successfully done during a number of years but is now a resting series. This approach made it possible to roughly estimate the total recruitment of young eels to the Swedish coast.

From all three methods recruitment series could be compiled:

Recruitment of glass eel to the Swedish west coast is monitored at the intake of cooling water to the nuclear power plant at Ringhals in the Kattegat (**Figure SE.12** and **Table SE.j**). The time of arrival of the glass eels to the sampling site varies between years, probably as a consequence of hydrographical conditions, but the peak in abundance normally occurred in late March to early April. Abundance has decreased by 90% if recent years are compared to the peak in the early 1980s. Applying a transition function to the data suggests a break in the trend in the early 1980s (Figure SE.13).

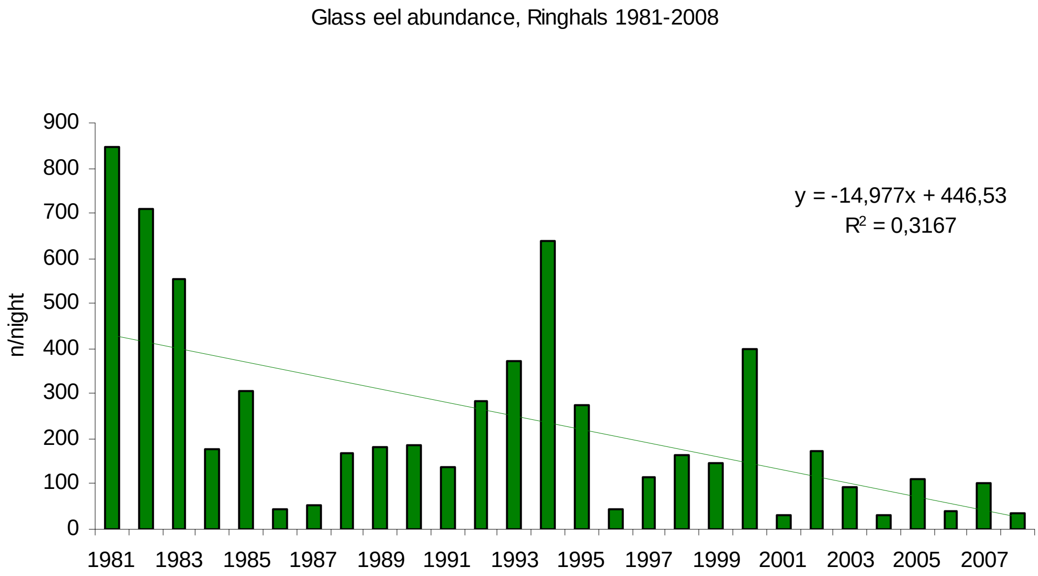


Figure SE.12 Time trend in glass eel recruitment at the Ringhals nuclear power plant on the Kattegat coast in Swedish RBD 5 (Västerhavet).

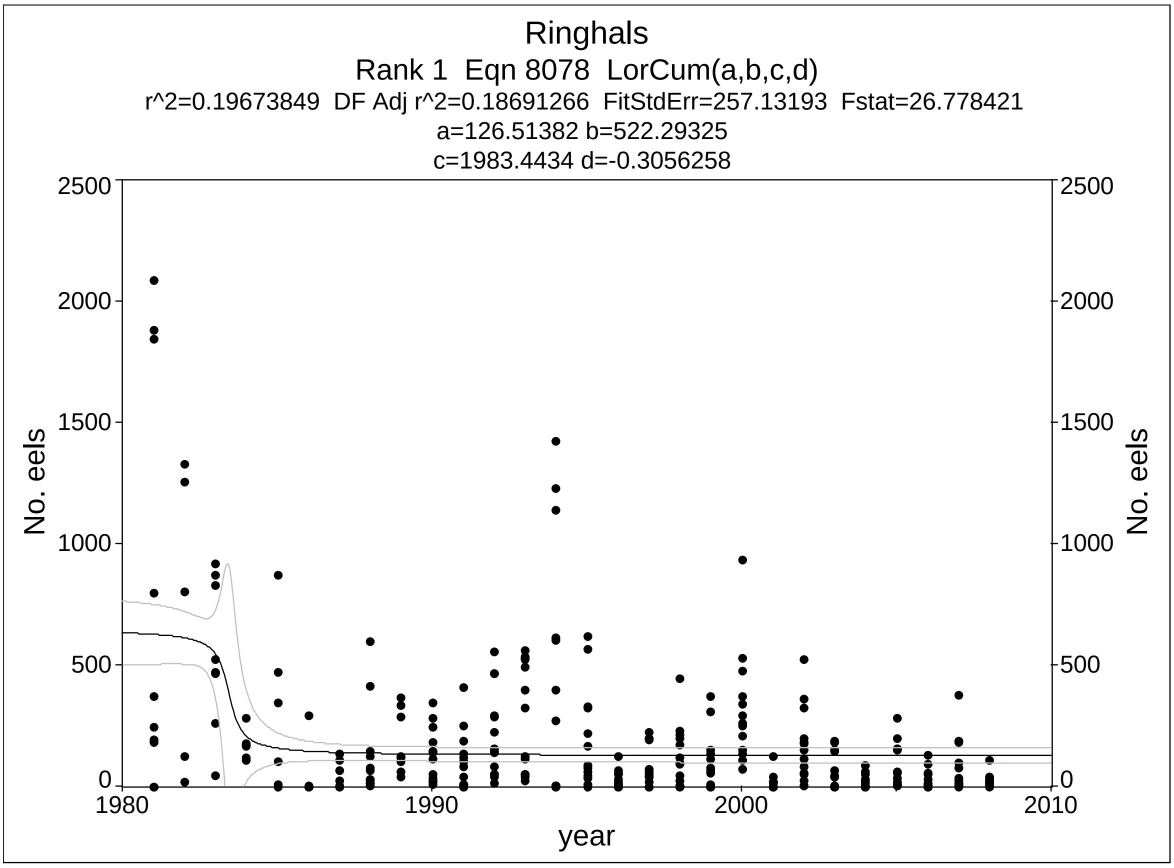


Figure SE.13 A transition function fitted to the glass eel data from Ringhals.

Table SE.j Annual indices of glass eel recruitment at the intake canal for cooling water to reactors 1 and 2 at the Ringhals nuclear power plant. Mean of weekly means of numbers of glass eels collected with a modified Isaacs-Kidd midwater trawl during March and April (weeks 9–18). Data were corrected for variations in water flow.

week	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
3	3													1														
4	0							17			1			4					0									
5	4							8		15	14	18	30	5	4	0	0	1	0	74	2	27	6		20		10	
6								28		27	13	56	45	7	11	0	1	1	0	142	0	86	5	1	12	2	42	8
7								6		22	9	85	331	7	41	0	22	9	8	267	3	154	2	2	62	3	4	27
8	1							34		57	3	44	57	8	48	11	3	50	12	115	5	327	5	0	22	2	12	17
9	187		51			3		36	342	185	3	160	55	3	172	0	68	125	62	344	5	117	5	1	15	6	11	10
10	199	24				2		80	372	150	15	471	118	7	224	4	200	100	121	377	3	200	10	3	10	2	29	31
11	250	130	528	176		4		19	129	150	88	290	130	610	333	13	198	8	72	533	22	366	44	3	39	1	81	114
12	374	806	835	289	14	6	2	16	107	145	42	469	535	400	569	25	60	177	158	214	24	530	53	18	162	13	382	38
13	1886	1258	265	122	109	1	0	72	291	251	110	562	495	1430	331	60	42	220	2	479	16	59	185	35	153	17	186	30
14	2093	1335	469	181	0	3	31	149	121	351	138	151	403	1236	625	33	77	448	314	942	22	185	192	65	162	55	101	43
15	1849		878	112	878		141	603	67	284	414	298	540	1145	91	128	201	237	377	154	45	184	151	55	202	97	191	26
16			925		476		69	416	42	120	254	142	527	619	64	73	49	96	79	299	25	53	74	90	286	132	20	13
17	804		477	171	350		6	127		37	193	231	564	278	80	56	44	202	141	257	128	8	158	32	66	62	18	2
18	0					297	114				124	55					230	31				9	46	8	10	36	7	
mean 9-18	849	711	553	175	305	45	52	169	184	186	138	283	374	636	277	44	117	164	147	400	32	171	92	31	110	42	102	34

The numbers of glass eels caught during the Swedish parts of the International Bottom trawl Survey (IBTS Quarter 1) are given in Figure SE.14.

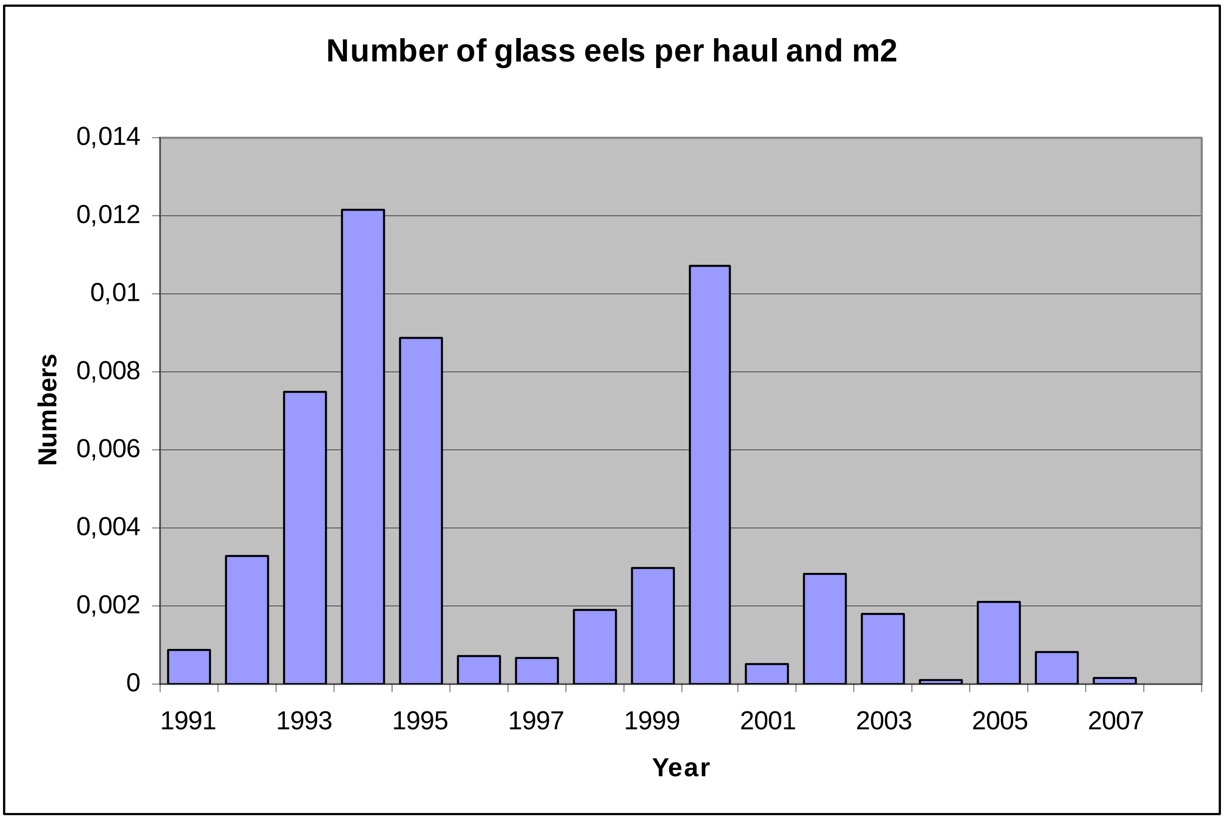


Figure SE.14 Catch of glass eels by a modified Methot-Isaacs-Kidd Midwater trawl (MIKT) in the Skagerrak-Kattegat 1991–2008. Numbers have been corrected for the flow through the net. <u>There were no glass eels caught in 2008.</u>

SE.G.1.3

Another way of estimating the occurrence of young eels ascending in smaller streams is by electro-fishing (Degerman, 1985; Fiskeriverket & Laxforskningsinstitutet, 1999; CEN 2002). Normally this is done with salmonids in focus with eels as secondary product or spin-off.

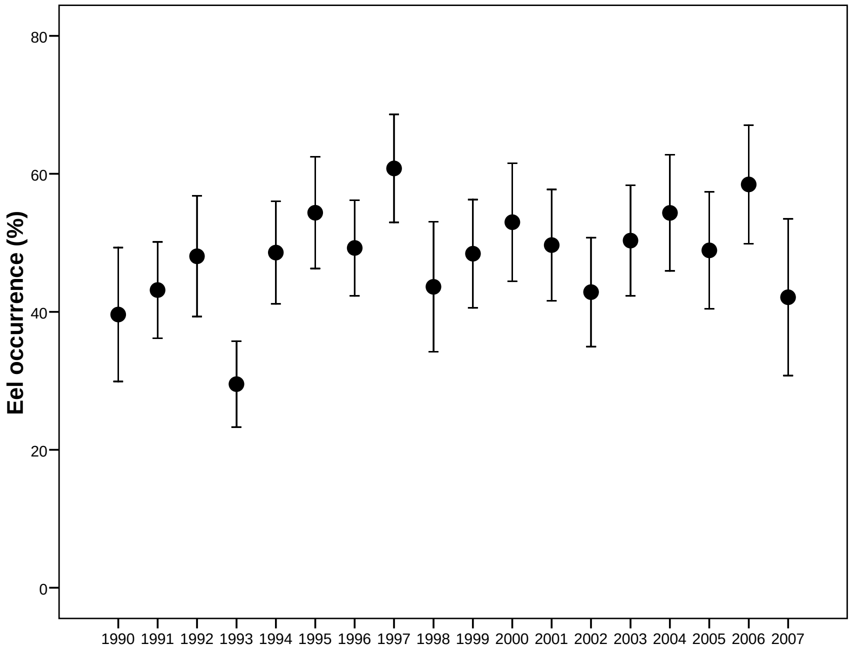


Figure SE.15 Proportion of electro-fished stations (%) with eel occurrence (+/-95% CI) along the West Coast (only the county of Halland). The stations that were fished in 1990–2007 are situated from 0 to 100 m asl. Note that local abundance is not given here, only presence/absence. Data from SERS (Swedish Electrofishing Register). ***The trend is not significant (Pearson correlation, n=18, r=0,36, p=0,144).***

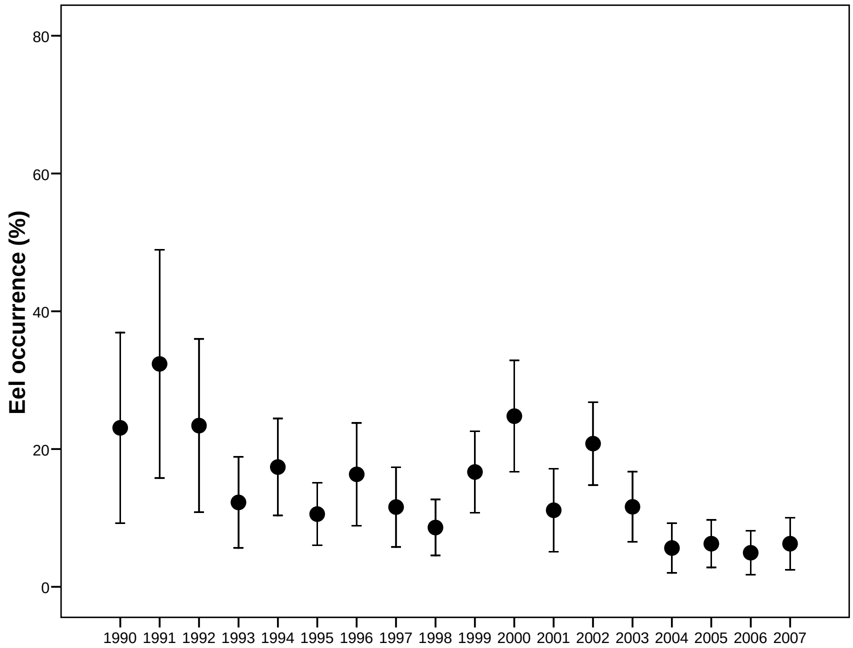


Figure SE.16 Proportion of electro-fished stations (%) with eel occurrence (+/-95% CI) along the East Coast. Stations that were fished in 1990–2007 in this figure are situated from 0 to 100 m asl in six counties along the Baltic Sea Coast. Note that local abundance is not given here, only presence/absence. Data from SERS (Swedish Electrofishing Register). ***The negative trend is significant (Pearson correlation, n=18, r=-0,68, p=0,002)***

SE.G.2 Yellow eel surveys

SE.G.2.1 Yellow eel surveys in coastal waters

The coastal fish communities on the Swedish west coast are monitored by standardized fishing with fykenets in shallow water (2–5 m). Yellow eel was among the dominating fish species in August most years. Barsebäck in the SW part of the area belongs to RBD SE Baltic, other areas to RBD Västerhavet. The trend for the longest time-series from Vendelsö in N Kattegatt is significantly positive. A negative tendency for the Barsebäck area was broken by increasing catches in 2006 and 2007. In the other areas the period of sampling was too short to be examined for biologically significant trends. The magnitude of cpue though, was similar to that of the longer series. The interannual variations in cpue were influenced by water temperature at the time of sampling, but no time-trends in temperature were observed for the period with available data (1988–2007).

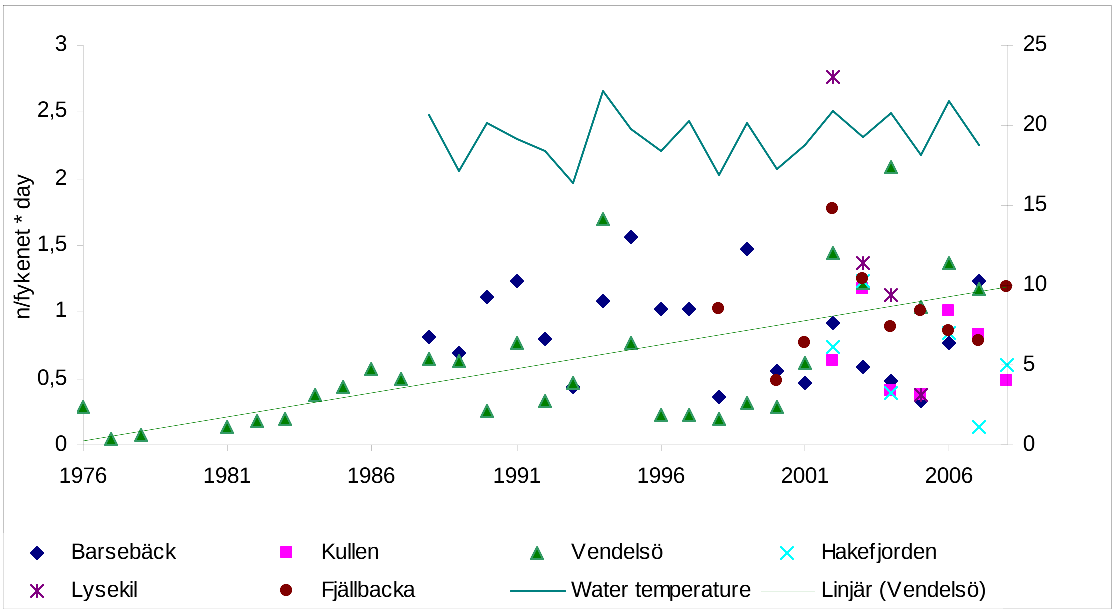


Figure SE.17 Time trend in the yellow eel catches in coastal fish monitoring with fykenets in August on the Swedish west coast. RBD SE Baltic (Barsebäck) and RBD Västerhavet (others). Annual mean water temperature at the fishing gears is presented for the Vendelsö area in central Kattegat.

SE.G.2.2 Yellow eel surveys in fresh water

There are no routine stock surveys for yellow eels in fresh water. The nearest equivalents are the surveys dedicated to stocked populations of eels. These are mostly performed in smaller lakes but also at one site in the large Lake Mälaren where glass eels were stocked in both 1980 and 1997. The aim is to follow the development of the introduced stock and individual growth of young eels stocked in nature. The eels that were stocked in 1997 were marked with Alizarin Complexone. Such marked eels are now dominating the local eel population. Their proportion of the catch has increased from 4% in 2000 to 69% in 2007. In 2007 the stocked eels were 494 mm (+/-75 SD) which corresponds to a growth rate of 39,8 mm/year (+/-7,5 SD) after stocking. Another 96 eels from the sampling in 2008 are still waiting to be processed.

SE.G.3 Silver eel surveys

There are no regular silver eel surveys in Sweden. However, in 2003 the Institute of Freshwater Research collected large samples from the commercial fisheries in eight lakes and at two sites where most silver eels try to leave the Baltic Sea, i.e. in the Sound (Öresund). In 2005 and 2006 silver eels from additional sites along the Baltic Coast were collected for a tagging study. All these eels (except tagged but not recaptured individuals) have now been analysed with respect to e.g. their fat content and to their chemical background (by otolith microchemistry). This extensive study might together with a now realized tag-recapture study be the baseline for recurrent sampling of silver eels. A complementary tag-recapture study is planned for 2008, where silver eels from both Lake Mälaren and the Stockholm Archipelago will be tagged. Useful data from individual eels will by that be collected.

The Coastal Institute is sampling the commercial catch with the purpose to collect length and age data. This is done within the DCR (Data Collection Regulation Programme). See also Section SE.H below.

SE.H Catch composition by age and length

SE.H.1 Catch composition by age and length in coastal areas

In 2002–2007 over 8800 yellow eel were sampled for individual length, total and somatic weight, sex and prevalence of *Anguillicola crassus*. All but 80 were female and the males were mainly recorded on the Skagerrak coast in SD 20. Age readings exist for 2700 individuals, but the major part of the otolits were stored and not analysed after the year of catch 2005 (Table SE.k(b)). The sampling programme started as an initiative of the Swedish Board of Fisheries and is now part of the Swedish contribution to the DCR. Sampling of silver eel in poundnet catches started in 2005. So far length and weight recordings and otoliths were collected from 2500 silver eels and 1200 age readings were performed.

Table SE.k Swedish sampling of yellow eel in commercial catches with fykenets.

a. total number sampled for size and age

	Year of catch						
ICES SD	**2002**	**2003**	**2004**	**2005**	**2006**	**2007***	**Total**
20	202	201	200	729	670	723	2725
21	205	198	200	202	100	104	1009
23	202	201	200	200	197	200	1200
25	409	405	414		1	23	1252
27	392	426	469	465	478	392	2622
Total	**1410**	**1431**	**1483**	**1596**	**1446**	**1442**	**8808**

*in database 20080814

b. total number of age records

	Year of catch						
ICES SD	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**Total**
20	97	96	98	433			724
21	98	99	98	201	100		596
23	96	96	198	199			589
25		97	99		1		197
27			390	188			578
Total	**291**	**388**	**883**	**1021**	**101**	**0**	**2684**

Sampling for length in commercial fykenet catches demonstrate a similar size composition of yellow eel in the Kattegat, the Öresund area and on the southern Baltic coast (SD 21, 23 and 25). Sizes in the interval 40–50 cm were most abundant. In Subdivision 20 on the Skagerrak coast, the negative slope of the size spectrum starts just above 40 cm. Sampling in Subdivision 27 in the central Baltic Proper demonstrates a population with considerably higher mean length and with single individuals reaching almost 90 cm in length (Figure SE.18).

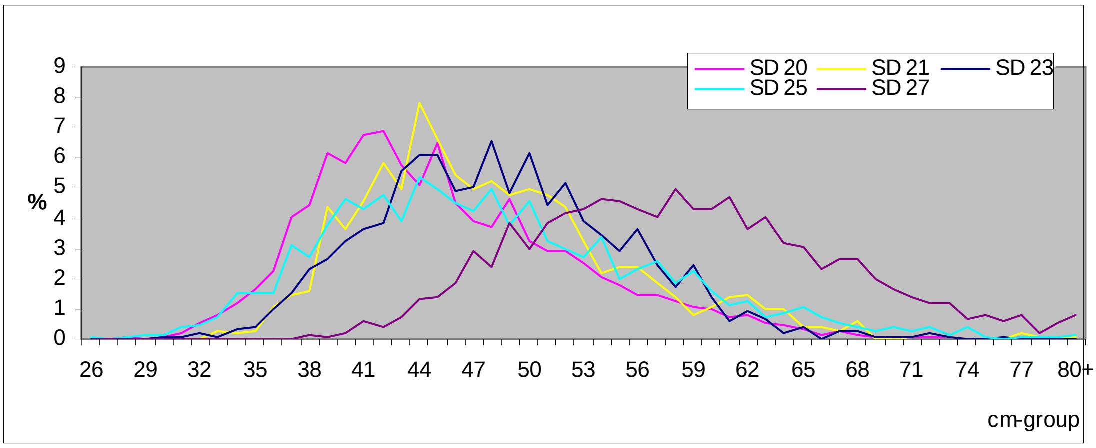


Figure SE.18 Length composition of yellow eel from commercial fykenet catches in samples collected in 2002–2007 in RBD SE Västerhavet (ICES SD 20–21) and RBD SE Baltic (ICES SD 23,25 and 27). Samples from subdivisions 25 and 27 are based on an unsorted mixture of landings and discard.

There is a gradient in mean length of silver eel from 77 cm SD 27 in central Baltic to 65 cm in SD 23, Öresund. Since May 2007 the minimum legal landing size is 65 cm in the Baltic. The length distributions in SD 24–25 in the southern Baltic indicate a potential for a considerable reduction of the fishing mortality in the poundnet fishery in this area with the new size limit.

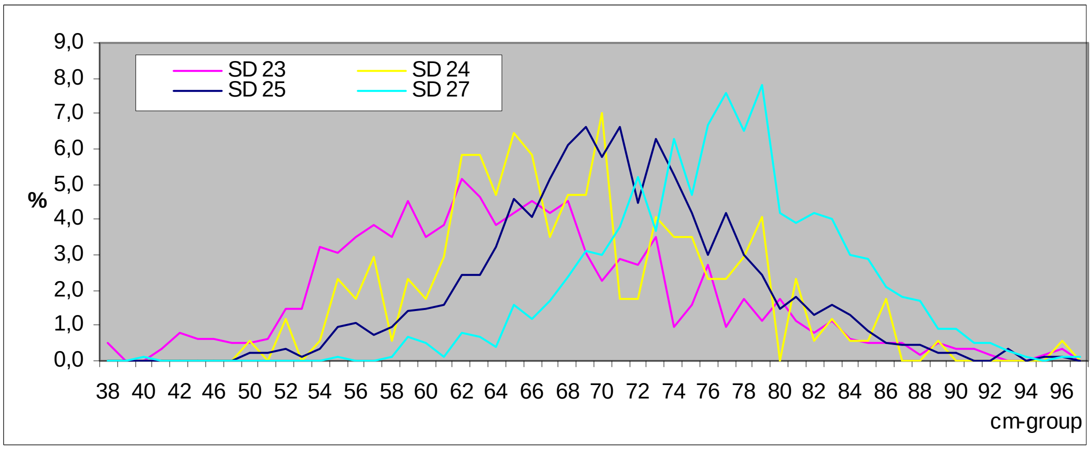


Figure SE.19 Length composition of silver eel from commercial poundnet catches for samples collected in 2005–2007 in RBD SE Baltic (ICES SD 23, 24, 25 and 27).

In the three western subdivisions, Öresund, Kattegat and Skagerrak, the average age of the yellow eel in commercial landings varied between 8 and 10 years. The samples from SD 25 represent the first proper habitat for yellow eel recruits on their path of migration from the west coast into the Baltic Sea. The relatively low mean age in unsorted fykenet landings in SD 25 indicate that migrants on transit might make up a considerable proportion of the catches. Although the yellow eels from SD 27 in the Central Baltic were considerably larger, they were only 1–2 years older compared to the western sampling sites. Silver eel ages varied from 14 years on average in SD 27 to 10–12 years in SD 23–25.

Table SE.1 Mean age of yellow eel in the Swedish coastal fykenet fishery.

ICES SD	Year of catch					
	2002	2003	2004	2005	2006	Total
20	9,0	8,9	9,6	8,7		8,9
21	8,7	8,2	8,7	7,9	9,2	8,4
23	8,6	9,6	9,4	8,9		9,1
25		7,2	6,8			7,0
27			9,8	10,9		10,1

In SD 20, 21 and 23 (West Coast) eels were recruited to the fishery at the age of 4 to 5 years and the oldest individuals recorded had reached the age of 18. On the southern Baltic coast the age span in unsorted landings was 3–12 years. The age distribution in SD 27 was similar to those from the west coast, although shifted one year to the right in Figure SE.20.

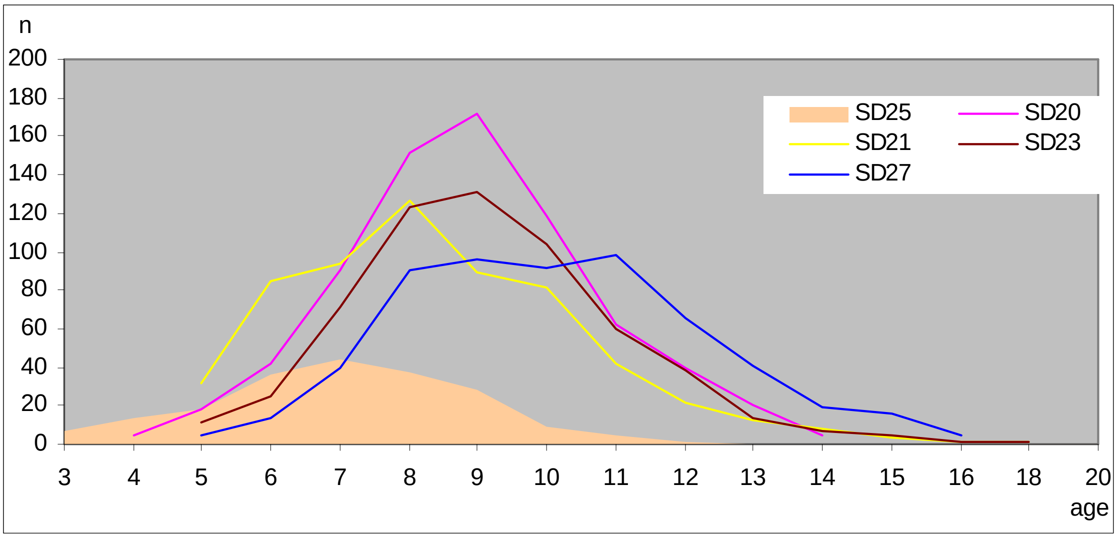


Figure SE.20 Age distribution of yellow eel from commercial fykenet catches for samples collected in 2005–2006 in RBD SE Västerhavet (ICES SD 20–21) and RBD SE Baltic (ICES SD 25 and 27).

The growth pattern is close to linear for both length and weight in all areas (Figure SE.21). Bias is probably introduced for younger ages as a consequence of gear selectivity and in higher ages as a consequence of silvering. Yellow eel from SD 27 in central Baltic were considerably longer and heavier than in other areas, a 10-year-old female being 57 cm and 314 g in the former area compared to 49,5 cm and 192 g on the Skagerrak coast (SD 20). Comparing the most abundant ages, somatic condition is higher in the Baltic samples and increases with increasing age. The possibly transiting eels in SD 25 thus were in better condition than eels from the west coast, but had otherwise grown at approximately the same speed. Condition increasing with increasing age is seen in all areas but SD 20.

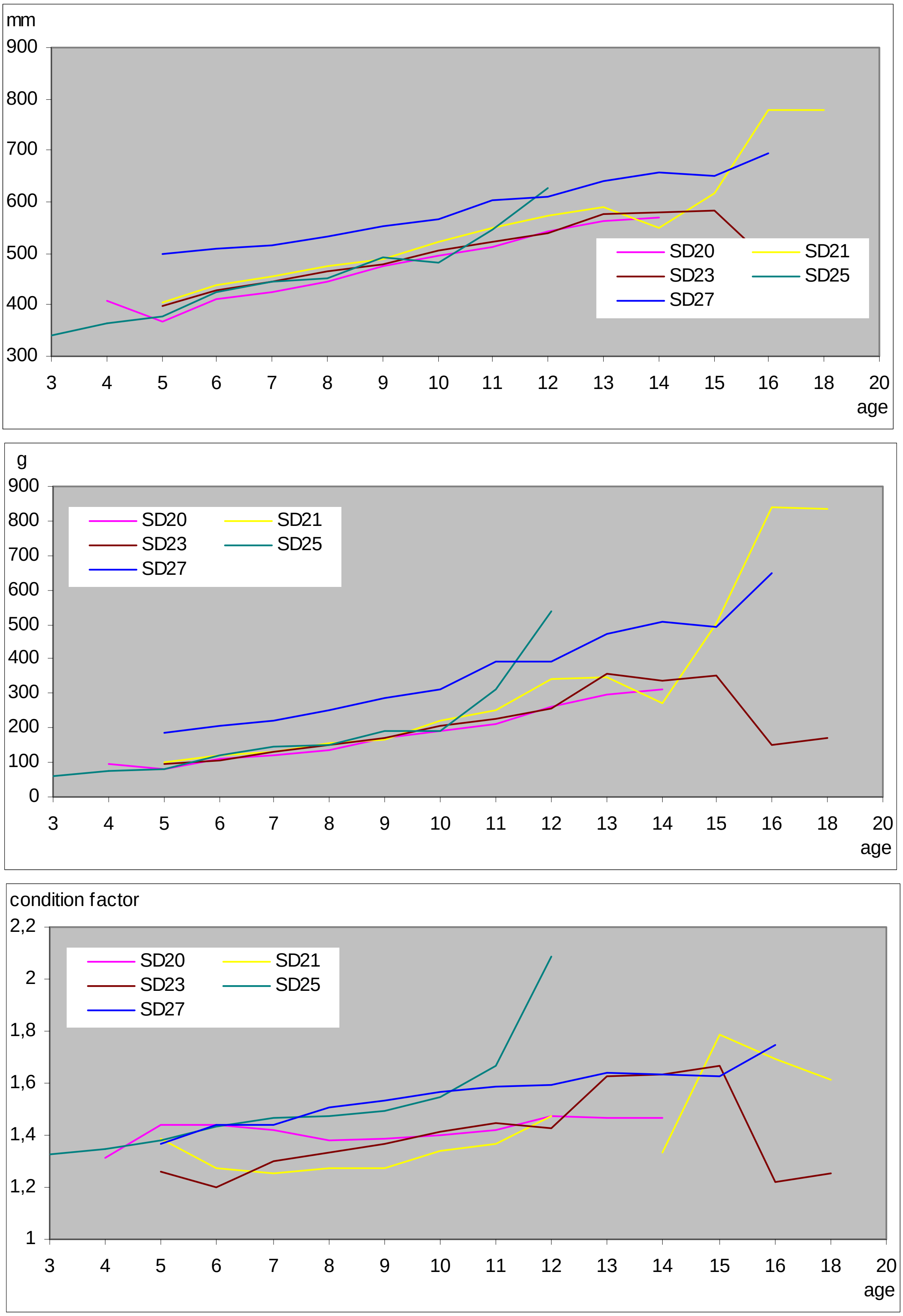


Figure SE.21. Length, weight and condition factor at age of yellow eel from commercial fykenet catches in samples collected in 2005–2006 in RBD SE Västerhavet (ICES SD 20–21) and RBD SE Baltic (ICES SD 25 and 27).

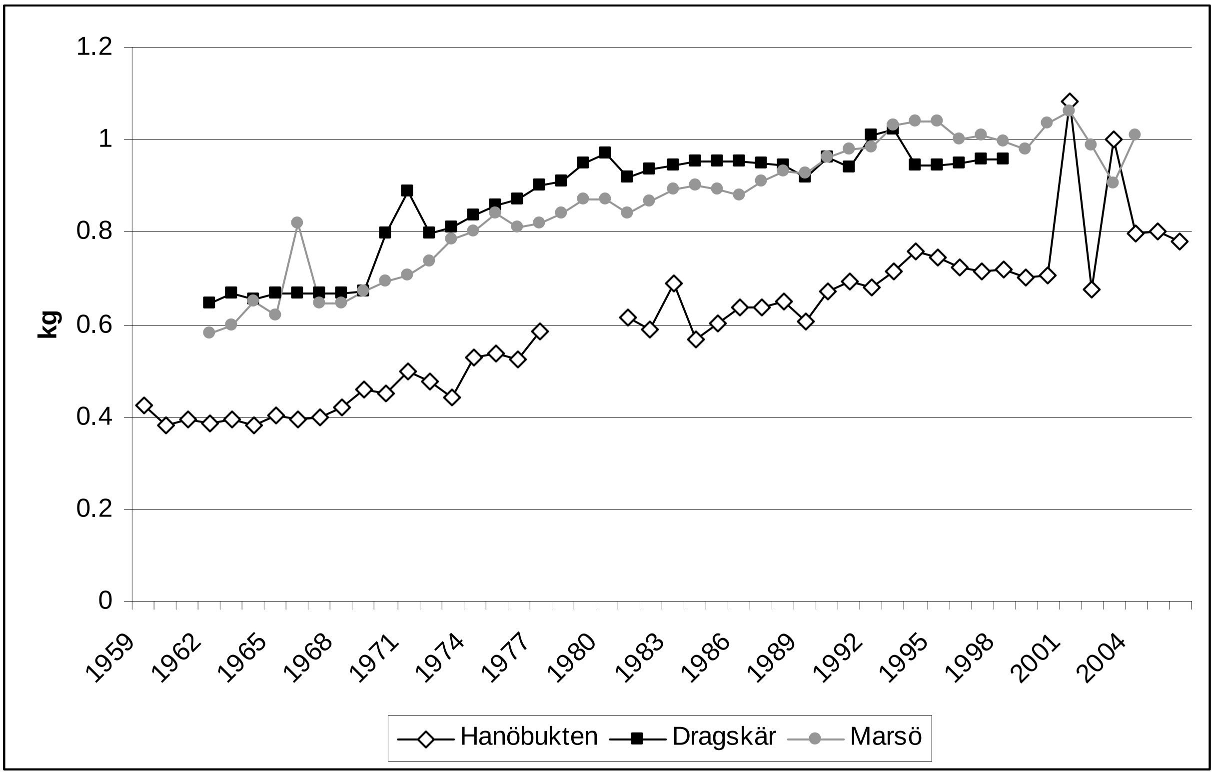


Figure SE.22 Changes over time in mean total weight of silver eels from SD 25 (Hanöbukten) and SD 27 (Dragskär+Marsö).

Mean weight of silver eels in commercial poundnet catches have increased over time (Figure SE.22) from 0.6 kg in the 1960´s to 1 kg in recent years. The trend is the same in both SD 25 and SD 27 although the mean weight of silver eels is generally lower in SD 25. There are some uncertainties in the data before 1970 such that some yellow eel could be included in the statistics.

SE.H.2 Freshwater

In addition to the programme mentioned under Section SE.G.3 no data on catch composition is collected in fresh waters.

SE.I Other biological sampling

SE.I.3 Parasites

The swimbladder parasite (*Anguillicola*) does occur in eels from most sites. All eels dissected at the Swedish Board of Fisheries are analysed macroscopically for the prevalence (at both Institutes involved) and intensity (at the Institute of Freshwater Research only) of *Anguillicola* in their swimbladders. The prevalence in coastal waters in 2002–2005 was close to 10% in the marine habitats of RBD 5 and about 60% in the central parts of RBD 4. The straight between Sweden and Denmark (Öresund, SD 23) took an intermediate position.

SE.H.2 Freshwater

In addition to the programme mentioned under Section SE.G.3 no data on catch composition is yet collected in fresh waters. However, the intention is to monitor both catch and the yellow eel stock within the coming DCR-programme.

Prevalence of *Anguillicola crassus* is a mandatory variable in all coastal sampling of eel in Sweden, including the DCR sampling. The rate of infestation in the pooled data from 2002–2006 was less than 15% in the most marine areas, 47% in Öresund and close to 60 in the Baltic sites.

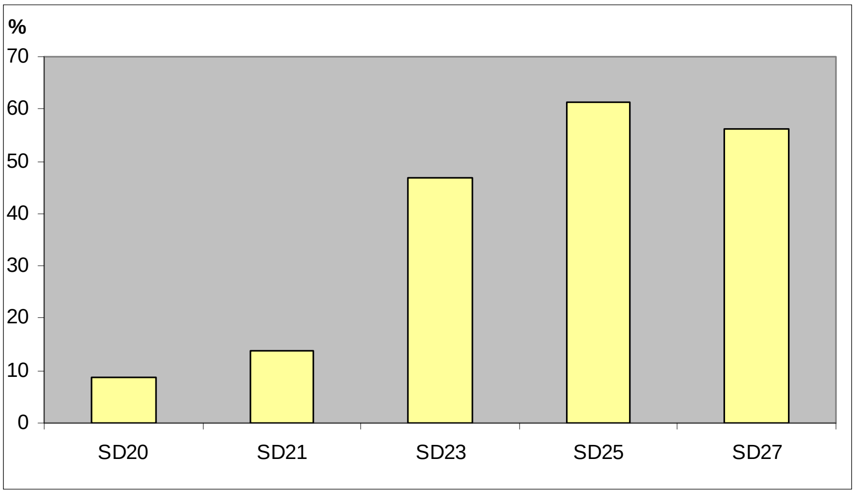


Figure SE.23 Prevalence of the swimbladder parasite (*Anguillicola crassus*) in yellow eel from commercial fykenet catches for samples collected in 2005–2006 in RBD SE Västerhavet (ICES SD 20–21) and RBD SE Baltic (ICES SD 25 and 27).

Table SE.m Prevalence of *Anguillicola crassus* in yellow eel from Swedish coastal waters in 2002–2005. ICES Subdivisions 20–21 represent RBD 5, other Subdivisions represent RBD 4.

	ICES Subdivision				
	20	**21**	**23**	**25**	**27**
Not infested	723	611	442	475	493
Infested	80	93	361	753	794
Grand Total	803	704	803	1228	1287
Prevalence	**0.10**	**0.13**	**0.45**	**0.61**	**0.62**

Between 2000 and 2008 the Institute of Freshwater Research analysed 3608 eels from 41 different fresh-water sites. Infested eels were found in all sites and the prevalence varied from 37% to 91%.

SE.I.4 Contaminants

The National Food Administration in Sweden has analysed both yellow and silver eels sampled in 2000 and 2001 from nine different sites in Sweden with respect to 17 dioxins and furans and 10 dioxin-like PCB congeners (www.slv.se). Pooled samples revealed that eels had less than 1 pg TEQ/g fresh weight of sum TCDD/F in muscle (TEQ = Toxic Equivalents, TCDD = C12H4O2Cl4). To this came about 3.8 pg PCB-TEQ/g fresh weight. Silver eels had higher levels than yellow ones. Compared to the other fish species analysed, eels have a higher ratio of PCB to dioxins. Due to the high costs for this type of analyses only few eels will be sampled regularly in future.

Recently yellow eels from the Sound (between Sweden and Denmark) outside a heavily loaded industrial area in Helsingborg were analysed for dioxins and dioxin-like PCBs. Pooled samples from 2005 contained 5.7 WHO-PCDD/F-TEQ pg/g and 11 WHO-PCB-TEQ pg/g, both based on fresh weights. In 2006 another five pooled samples from the same area were analysed. The dioxins varied between 0.9 and 4.7 with an average of 2,2 WHO-PCDD/F-TEQ pg/g. The PCBs varied between 3.9 and 12.7 with an average of 6,6 WHO-PCDD/F-PCB-TEQ. At some sites the level of dioxins in eel muscle exceeded by that the 4 p/g level of dioxins or the 12 pg/g level of summed up dioxins and dioxin-like PCBs, set as maximum allowed levels in eel by the Commission of the European Communities. In 2007 further samples were analysed from this area. Both yellow and silver eels were analysed in seven pooled samples. The dioxin levels varied between 0,6 and 2,7 pg/g and the summed up dioxins and dioxin-like PCBs between 2.3 and 8.3 pg/g, i.e. all below the maximum allowed levels. However, the sample sites were not exactly the same as in 2005 and 2006 (Source: SLV (The National Food Administration)).

Recent analyses of mercury (Hg) in eels from a number of lakes did demonstrate very low levels.

SE.I.5 Predators

Cormorants

Cormorants are believed to predate substantially on eels. As about 2900 young eels stocked in Lake Ymsen 1998–2000 were equipped with PIT-tags in spring 2004 we took the opportunity to scan the ground below the only cormorant colony in that lake for tags. In total 30 PIT-tags were found corresponding to a minimum loss by cormorant predation of 1%.

An extensive study of the stomach content of cormorants at three sites along the Kattegat-Skagerrak coast revealed that eels were taken by about 5% of the cormorants. That was equivalent to about 1% of their diet. Despite the low percentage, it corresponds to a total annual predation of 310 000 yellow eels, i.e. one fourth of the commercial catch on this coast (Lunneryd and Alexandersson, 2005).

Pellets from cormorants were analysed from a colony outside River Dalälven. No remains from eel were discovered. However, it is known that this approach is not that suitable for eel as their otoliths are easily eroded (Bostrom *et al.*, in press).

Seals

Along the Swedish West Coast there is substantial damage on eel fykenets done by harbour seal (*Phoca vitulina*) Königson *et al.*, 2006. The cost of the damage estimates to several per cent (up to 18%) of the catch (Königson *et al.*, 2003). There are circumstances that indicate that the raiding seals are a minor part of the population. It is demonstrated that those seals have strong preference for eel compared with cod or flatfish in the fykenets (Königson *et al.*, 2006). Old diet studies indicate that a "normal" seal seldom eat eel (Härkönen and Heide-Jørgensen, 1991) but obvious is that the specialised seals that damage the fykenets cause an additional mortality on the eel population of several per cent of the catches.

There is only one minor diet study of grey seals (*Halichoerus grypus*) in the Baltic proper. The material consists of fish remains from 54 stomachs and intestines which reflect maximum one day's food. Remains were found from two eels (Lundström *et al.*, in press). It is from those figures impossible to calculate an accurate figure of how important eels are fore the grey seals.

SE.J Other sampling

SE.J.2 Obstacles to eel migration

During 2005 and 2006 an inventory of obstacles for eels migrating both up- and downstream was performed. Not only are the obstacles as such studied but also the occurrence of fish passes, by-passes, deflecting screens, etc. and their suitability for eels were noted. The purpose is to achieve a database to be used as background when installing new or improving existing eel passes and deflecting devices. Parts of the Swedish eel management plan are based on data in this database. Water Courts decisions might also be reconsidered with this database as argument.

SE.K Stock assessment

So far the collected data has not by routine been used for stock assessment.

Published mortality estimates from Subdivision 20 and 21 (Svedäng, 1999) (approximating RBD 5, Västerhavets vattendistrikt ("the North Sea")) have been used in a simple length based mortality rate model to assess the effect of present yellow eel exploitation on spawner escapement in relation to present and estimated past unexploited levels of spawner escapement (Åström and Wickström, 2004). The relation between the present and past population levels has been estimated using the longer dataseries on ascending elvers and young eels, indicating that the present population probably is less than 10% of the one in the mid-1900s.

An attempt has also been made to use the length sampling from the yellow eel fishery in fives areas in ICES Subdivision 25 and 27 (part of RBD 4, Södra Östersjöns vattendistrikt ("the Southern Baltic Sea" or SBAL)) in a catch-at-length analysis to estimate natural and yellow eel fishery induced instantaneous mortality rates, in terms of mortality rate per unit length increment. The result from analyses of a large number of mark recapture studies on silver eels has been used as a rough estimate of the silver eel fishery mortality rate. Data on average length of female silver eels in the subdivisions were also needed for the analyses. Males have been disregarded because of their very low prevalence in Swedish waters. The simple length based mortality rate model has then been used to assess the effect of present yellow and silver eel exploitation on spawner escapement in subdivision 25 and 27 in relation to present and estimated past unexploited levels of spawner escapement (Åström, 2004).

The above analyses indicate that the yellow eel exploitation allows at most 15% of the present possible escapement to the silver eel stage. This applies both to Subsections 20 and 21 (~ RBD 5) as well as to areas where yellow eels are fished in Subsections 25 and 27 (part of RBD 4), and indicates a severe overexploitation. In the latter area (the coast of the Baltic Sea) the yellow eel exploitation is however only occurring scattered and locally (in 2006 approximately 187 600 kg was caught), so the over all effect of the yellow eel fishery in subsection 25 and 27 is not as severe as on the Swedish west coast. The silver eel fishery in Subsections 25 and 27 then reduces the spawner escapement by about 36%, so that only about 11% of the currently possible spawner escapement remains of eels from areas where yellow and silver eel fishery occur. In perspective of past possible spawner escapement this would only amount to about 1% of the spawner escapement possible in the mid-1900s.

Using additional data on the amounts of yellow and silver eels caught in the different subdivisions have allowed for analyses of the possible effects of fishing restrictions and re-stocking of elvers on spawner escapement using the same conceptual model (Åström, 2005).

SE.N Overview

To some extent Sweden has a good data situation, particularly regarding coastal yellow eels. At the same time much remains to be filled in order to be able to establish a sustainable management in accordance with the EU regulation regarding eel management. The Department of Research and Development of the Swedish Board of Fisheries has recently changed its system for planning and prioritizing allowing for coherent planning, collection of data and analyses. The planning for the sampling of the fishery, monitoring of population status and evaluation of management efforts remain to be done during autumn of 2008.

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Appendix

Table SE.n Commercial landings of eel in Sweden (Kattegat-Skagerrak corresponds to RBD 5 and the data come from the contract notes). (cf Figure SE.4).

Year	South C. (Baltic Sea)	East C. (Baltic Sea)	Kattegat-Skagerrak	Freshwater	Total Sweden
1925	624	936	155		1715
1926	520	1011	176		1707
1927	642	1216	152		2010
1928	373	509	157		1039
1929	582	644	167		1393
1930	716	596	216		1528
1931	782	497	252		1531
1932	769	701	253		1723
1933	645	704	196		1545
1934	798	830	215		1843
1935	829	880	240		1949
1936	608	818	226		1652
1937	548	931	244		1723
1938	666	969	235		1870
1939	535	988	248		1771
1940	553	974	98		1625
1941	633	926	69		1628
1942	426	592	110		1128
1943	820	648	77		1545
1944	879	1042	79		2000
1945	778	790	96		1664
1946	658	738	116		1512
1947	980	761	169		1910
1948	979	689	194		1862
1949	999	671	229		1899
1950	1109	911	168		2188
1951	962	755	212		1929
1952	791	627	180		1598
1953	1146	879	353		2378
1954	1186	780	140		2106
1955	1599	780	272		2651
1956	714	707	112		1533
1957	1158	856	211		2225
1958	938	642	171		1751
1959	1658	977	154		2789
1960	778	703	165		1646
1961	896	870	300		2066
1962	980	713	215		1908
1963	997	802	272		2071

Year	South C. (Baltic Sea)	East C. (Baltic Sea)	Kattegat-Skagerrak	Freshwater	Total Sweden
1964	1303	749	236		2288
1965	749	768	285		1802
1966	748	893	328		1969
1967	646	703	268		1617
1968	713	794	301		1808
1969	622	733	320		1675
1970	476	515	318		1309
1971	545	587	259		1391
1972	425	582	197		1204
1973	419	553	240		1212
1974	322	470	242		1034
1975	494	629	276		1399
1976	283	363	289		935
1977	346	340	303		989
1978	376	385	315		1076
1979	267	404	285		956
1980	371	438	303		1112
1981	243	153	491		887
1982	342	250	569		1161
1983	267	171	735		1173
1984	559	136	378		1073
1985	647	213	280		1140
1986	479	138	234	92	943
1987	439	119	250	89	897
1988	532	190	304	136	1162
1989	447	132	264	109	952
1990	452	119	242	129	942
1991	486	181	285	132	1084
1992	534	162	352	132	1180
1993	550	93	438	129	1210
1994	654	98	630	171	1553
1995	444	79	555	127	1205
1996	564	67	406	97	1134
1997	546	181	513	142	1382
1998	318	50	165	112	645
1999	339	69	186	140	734
2000	286	39	123	113	561
2001	107	123	195	118	543
2002	126	183	222	102	633
2003	115	145	209	96	565
2004	84	134	227	106	551
2005	119	187	211	111	628
2006	125	195	227	123	670
2007	126	178	153	111	568

Table SE.o Total commercial landings (tonnes) in coastal fishery by RBD. (cf Figure SE.2).

YEAR	BBAY	BSEA	NBAL	SBAL	WEST	BBAY+BSEA
1999	0	3.0446	44.2675	265.5355	247.427	3.0446
2000	0.028	2.7171	31.5765	221.2225	161.4925	2.7451
2001	0	3.1427	28.1985	263.8105	227.71	3.1427
2002	0.015	3.05	29.337	239.6801	216.791	3.065
2003	0.003	4.2107	25.0735	244.5234	193.616	4.2137
2004	0.0015	4.2873	22.3375	224.2218	219.357	4.2888
2005	0	3.5522	38.0145	303.818	215.2515	3.5522
2006	0.109	3.5769	30.8573	329.8463	240.3054	3.6859
2007	0.0645	1.207	43.4387	371.4447	172.287	1.2715

Table SE.p Total effort (number of gears* number of fishing nights) in pound nest in a Subarea in SD 27. (cf Figure SE.3).

YEAR	GEARS*NIGHTS
1962	3334
1963	4710
1964	5186
1965	4004
1966	4834
1967	5915
1968	5749
1969	6001
1970	5659
1971	5232
1972	4697
1973	4958
1974	4689
1975	4756
1976	3596
1977	3563
1978	3438
1979	2566
1980	3404
1981	3260
1982	2771
1983	3269
1984	3435
1985	2762
1986	3158
1987	3559
1988	2772
1989	2587
1990	2290
1991	2517
1992	2538
1993	2397
1994	2362
1995	2157
1996	2206
1997	1894
1998	1964
1999	1493
2000	1558
2001	1532
2002	1062
2003	973
2004	1535
2005	1311
2006	1464

Table SE.q Mean length-at-age with standard deviation in Swedish samples of yellow eel from commercial fykenet catches in 2002–2005.

Mean length in mm

	SD 20				SD 21				SD 23			SD 25		SD 27	
	Stenungsund				Kullen				Öresund			Valjeviken		Simpevarp	Kvädöfjärden
	2002	2003	2004	2005	2002	2003	2004	2005	2003	2004	2005	2003	2004	2004	2004
3												336	341		
4		403		407								357	385		
5	396	342		376	403	374	423	428		399	409	369	381	499	
6	378	375	375	396	429	427	449	447	464	444	412	413	435	526	413
7	419	396	441	436	446	447	463	465	432	418	471	414	466	535	485
8	416	418	471	466	451	462	484	499	460	448	491	444	461	549	525
9	459	428	478	513	454	500	501	508	485	457	504	496	484	564	545
10	436	496	484	572	492	525	511	576	508	497	524	477	492	591	553
11	493	502	497	565	541	549	546	590	534	512	527	529		654	559
12	484		543	668	523	524	655	654	521	566	524	628		639	599
13	523	561	573	711		576	561	635	579	562	614			675	609
14	475		547		496	604	565	614	582	568	589			682	645
15					726	512			585	606	568			693	624
16				617										678	
17															
18						778									
20															778

Standard Devation

	SD 20				SD 21				SD 23			SD 25		SD 27	
	Stenungsund				Kullen				Öresund			Valjeviken		Simpevarp	Kvädöfjärden
Age	2002	2003	2004	2005	2002	2003	2004	2005	2003	2004	2005	2003	2004	2004	2004
3												72	37		
4		-		19								37	42		
5	-	20		30	91	18	14	17		61	80	28	33	62	
6	45	45	49	30	61	64	18	35	49	68	22	55	37	45	41
7	38	53	44	53	65	51	51	34	44	40	61	34	55	64	56
8	49	66	44	60	59	56	44	60	33	50	41	33	54	72	50
9	70	54	46	56	39	78	43	69	48	50	53	48	37	62	59
10	56	67	49	51	74	70	71	68	64	56	50	49	43	62	67
11	62	48	32	55	59	70	49	57	41	63	64	111		87	61
12	26		34	67	72	63	102	49	38	77	92	-		100	60
13	95	80	41	-		70	-	-	15	98	64			58	58
14	-		2		56	-	101	-	15	6	16			68	82
15					-	-			-	-	-			112	38
16				-										-	
17															
18						-									
20															-

Table SE.r Mean weight (kg) of silver eels in SD 25 (Hanöbukten) and SD 27 (Dragskär+Marsö). (cf Figure SE.22).

	HANÖBUKTEN	DRAGSKÄR	MARSÖ
1959	0.4257096		
1960	0.3812911		
1961	0.3944881		
1962	0.3841353	0.646057	0.581714
1963	0.3933078	0.66662	0.596092
1964	0.381971	0.656284	0.6516
1965	0.4028978	0.668809	0.617855
1966	0.3956977	0.66507	0.818465
1967	0.3982816	0.666319	0.64349
1968	0.4206718	0.665281	0.643382
1969	0.45799	0.669758	0.67301
1970	0.4487651	0.797074	0.693331
1971	0.4985409	0.888208	0.704245
1972	0.4767305	0.795598	0.737115
1973	0.4437471	0.809352	0.785968
1974	0.5302373	0.836614	0.803108
1975	0.5363621	0.857662	0.842197
1976	0.5226509	0.86879	0.80943
1977	0.5831722	0.9	0.818641
1978		0.910007	0.840489
1979		0.949199	0.869809
1980		0.968704	0.868633
1981	0.6134633	0.9166	0.84257
1982	0.5912612	0.934878	0.866136
1983	0.6886279	0.943427	0.890408
1984	0.5686305	0.952998	0.899468
1985	0.601751	0.95387	0.894093
1986	0.6386582	0.951868	0.8808
1987	0.6384719	0.947937	0.909734
1988	0.6478994	0.946292	0.929888
1989	0.6082842	0.919714	0.928396
1990	0.6707184	0.960589	0.963711
1991	0.694523	0.941953	0.980984
1992	0.678391	1.010102	0.985237
1993	0.7145674	1.023795	1.029801
1994	0.7589975	0.944953	1.038153
1995	0.7438935	0.942792	1.039462
1996	0.7227103	0.949406	1.002065
1997	0.7161557	0.956877	1.011255
1998	0.7193059	0.958333	0.995137
1999	0.7029799		0.980412
2000	0.7044675		1.034976

	HANÖBUKTEN	DRAGSKÄR	MARSÖ
2001	1.0817297		1.059891
2002	0.6769622		0.98806
2003	0.9994292		0.904513
2004	0.7962425		1.007576
2005	0.801855		
2006	0.7786137		