creates a barrier to upstream juvenile eel migration, for onward stocking into L. Neagh. Elvers are also trapped at the same location and stocked into the Lough.

The yellow eel fishery (May–September, 5 days a week) supports 80–90 boats each with a crew of two men using draft nets and baited longlines. Eels are collected and marketed centrally by the Co-operative. Around 300 families derive and depend on income from the fishery. Through the Co-operative, yellow eel fishers are paid the market price for their catch. Silver eels are caught in weirs in the Lower River Bann. Profit from the less labour-intensive silver eel fishery sustains the management of the whole co-operative venture, providing working capital for policing, marketing and stocking activity and an out of season bonus payment for yellow eel fishers at Christmas.

Natural recruitment has been supplemented since 1984 by the purchase of glass eel. Approximately 77 million additional glass eel have been stocked by the LNFCS. Reviews on the fishery, its history and operation can be found in Kennedy, 1999 and Rosell *et al.*, 2005.

The cross-border Erne system is comparable in size to L. Neagh and produces a fishery yield in the region of 35–50 t of eels per year. Within N. Ireland, Upper and Lower Lough Erne sustain small-scale and declining yellow and silver eel fisheries. Elvers are trapped at the mouth of the River Erne using ladders placed at the base of the hydroelectric facility that spans the Erne, and trucked into the Erne lake system for stocking. A comprehensive study into the structure, composition and biology of the eel fisheries on the Erne was conducted by Matthews *et al.*, 2001.

Overall policy responsibility for the supervision and protection of eel fisheries in Northern Ireland, and for the establishment and development of those fisheries rests with the Department of Culture, Arts and Leisure (DCAL).

Summary of management measures for eel fisheries in Northern Ireland:

- Ban on glass eel fishing (other than for stocking);
- Trapping and transport of juveniles on the Erne system;
- Restricted access to the fisheries through a system of licence, permits and seasonal closures;
- Minimum landing sizes (30 cm, though fisheries impose voluntary 40 cm);
- Technical measures associated with fishing gears;
- Closure of the Department-owned silver eel fishery on the Erne as a conservation measure;
- Free gaps (10%) in silver eel fishing weirs.

In addition to the above, the LNFCS has in place:

- Trapping and transport of juveniles on the Bann;
- A quota system on yellow eel catch;
- Restocking with purchase of supplemental glass eel;
- Ban on the use of fykenets;
- Suspension of two silver eel fisheries on the Lower River Bann.

UK.B.3 Distribution of eel within Scotland (1996–2006)

Electrofishing surveys by the Fisheries Trusts in Scotland (from 1996–2006) indicate

that the eel is widespread in Scotland (Figure 2). These surveys were primarily targeted at salmonids. Eels appear absent from many of the upper reaches of rivers, likely as a consequence of difficulties of access. Data are currently available only for the Scotland River Basin District (excluding areas of Galloway and the Tweed in the South). In all 6651 electrofishing visits were made to 3645 sites. Eels were present at 39.7% of visits, and recorded as present on more than one visits at 44.3% of sites.

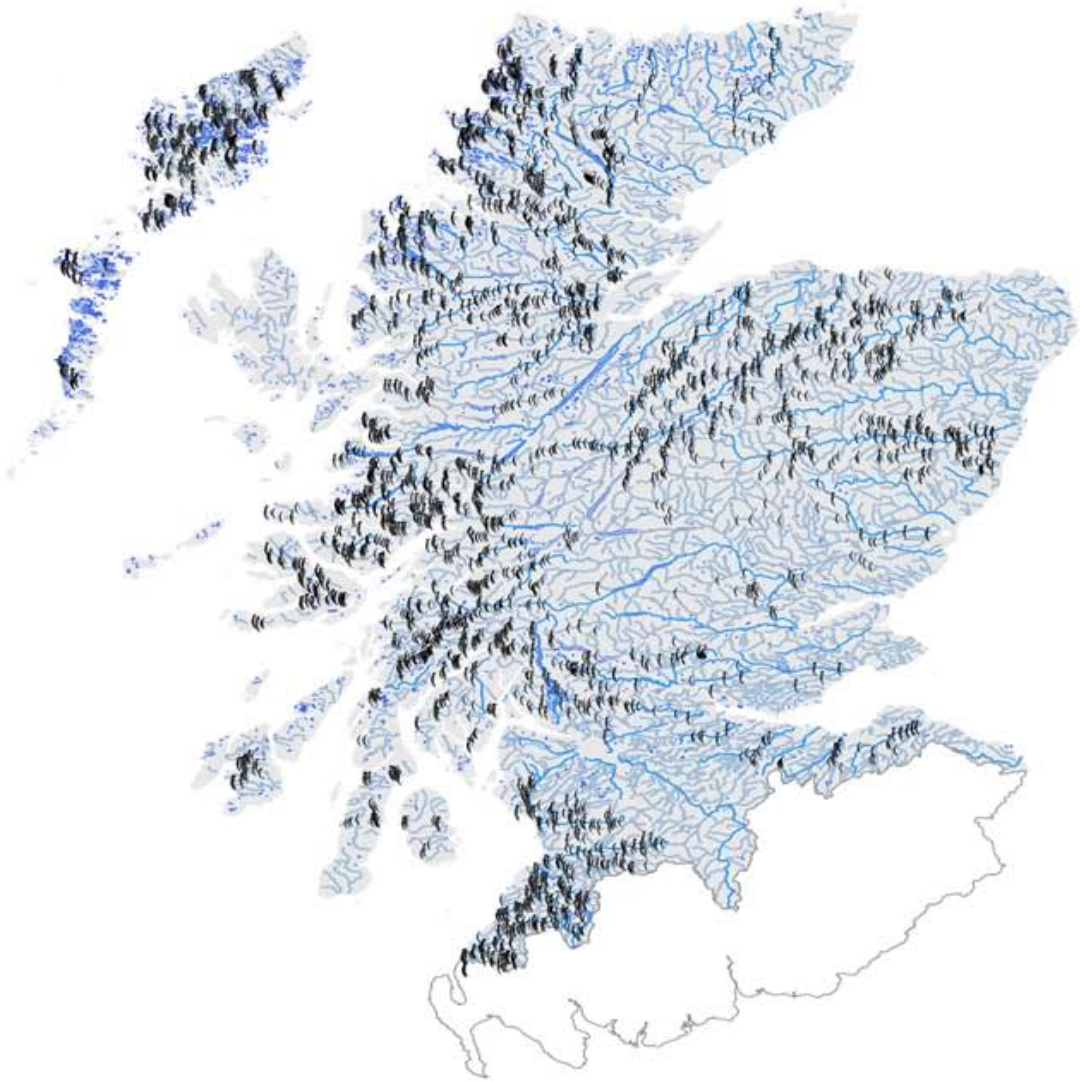

Figure 2. Eel presence (•) or absence (◦) for sites electrofished by the Fisheries Trusts in Scotland RBD (1996 to 2006). Where sites were visited more than once, eels appear as present if they were reported at the site on any occasion.

UK.C Fishing capacity

UK.C.1 England and Wales

All life stages of eel are exploited in England and Wales by approximately 1000 eel fishers using altogether around 2500 licensed instruments. At present, there is no legislative mechanism to limit the number of licences. The main fisheries are for glass eel by dipnets (654 licences in 2008), in estuaries draining into the Bristol Channel, in particular from the Rivers Severn, Wye and Parrett, with smaller fisheries, such as that in

Morecambe Bay, Cumbria (Figure 3). The main fisheries for eel >300 mm are based in southern and eastern lowland England, with fykenets being the preferred instrument used for capturing yellow and silver eel (Figure 3).

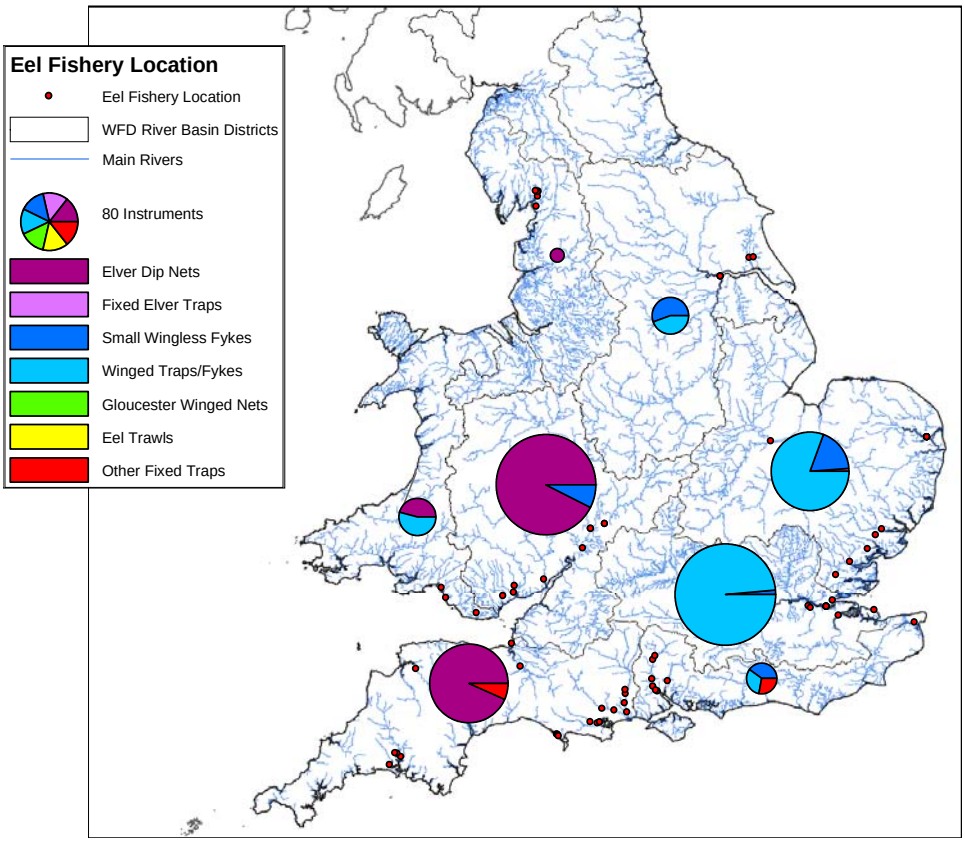

Figure 3. Eel and Elver Fisheries in England and Wales. Proportional size pie charts representing number of each instrument type in each WFD River Basin District.

UK.C.2 Northern Ireland

L. Erne

Fishing capacity is measured in the number of licensed instruments (by type of gear) and is an individual activity with no regulating company. Currently there are 14 commercial fishers operating on this catchment, with 14 eel permits (11 longline and three fykenets) issued. Boat size on the Erne is restricted to 6.1 m long by 2.2 m at the widest point. Licence applications are approved by the fishery owner (DCAL) and are issued on the condition that a catch declaration is returned at the end of each year. All of these catch data are held within DCAL Inland Fisheries Division. The elver run to the River Erne is monitored by capture at a box at the tidal head and transported to upper and lower Lough Erne. Silver eel fisheries let by the State on Lower Lough Erne have been suspended since 2005.

L. Neagh

Lough Neagh/River Bann comprises a 400 km^2 lake-based system, which produces around 95% of the total Northern Ireland eel catch. Eel fishing on L. Neagh is controlled by a Registered Company, the LNFCS who licence the fishery to 180 fishers. Around 1990, there were 200 boats fishing the Lough, but this number has steadily declined to the present day number of 80 to 90 boats as a result of an aging fisher

population, availability of alternative employment and falling market prices for eel. Boat size on L. Neagh is restricted to 8.6 m long and 2.7 m wide. Information on licence applications, number of boats, fishing activity, recruitment to the fishery and the catch of yellow and silver eels from L. Neagh is collected and maintained by the LNFCS with several aspects of these data spanning 40 years. This information is made available to DCAL and the Agri-food and Biosciences Institute (AFBI) for scientific analysis.

UK.C.3 Scotland

Historically there has been no regulation of commercial eel fisheries in Scotland, no licenses were issued and there was therefore no means of collecting catch return data. There is no export of any eel product and therefore no proxy values for recruitment or home or international market trends.

However, early in 2007, provision was made by the Scottish Parliament to allow for the regulation of eel fisheries if Scottish Ministers considered it necessary or expedient for eel conservation (see: http://www.scottish.parliament.uk/business/bills/67aquaFish/b67s2-introd.pdf).

UK.D Fishing effort

UK.D.1 England and Wales

Fishing effort is not directly quantified, but annual licence sale data from the EA and predecessor agencies provide an index from which we can examine changes in apparent effort over time.

Glass eels and elvers

Around 1100 glass eel/elver licences (dipnets) were sold each year from 1980 to 1994, which increased rapidly to peak at nearly 2500 in 1998, declined to about 800 in 2001, and have since remained around this level (Figure 4). The rapid increase in sales of licenses in 1995–2000 was likely as a consequence of substantial increases in the market value of glass eel from about £100/kg to over £250/kg, as a consequence of extra demands from eel farms in the Far East. Fishing activities were depressed during the 2001 Foot and Mouth Disease outbreak because of restrictions imposed on access to fishing sites and licence sales have not recovered.

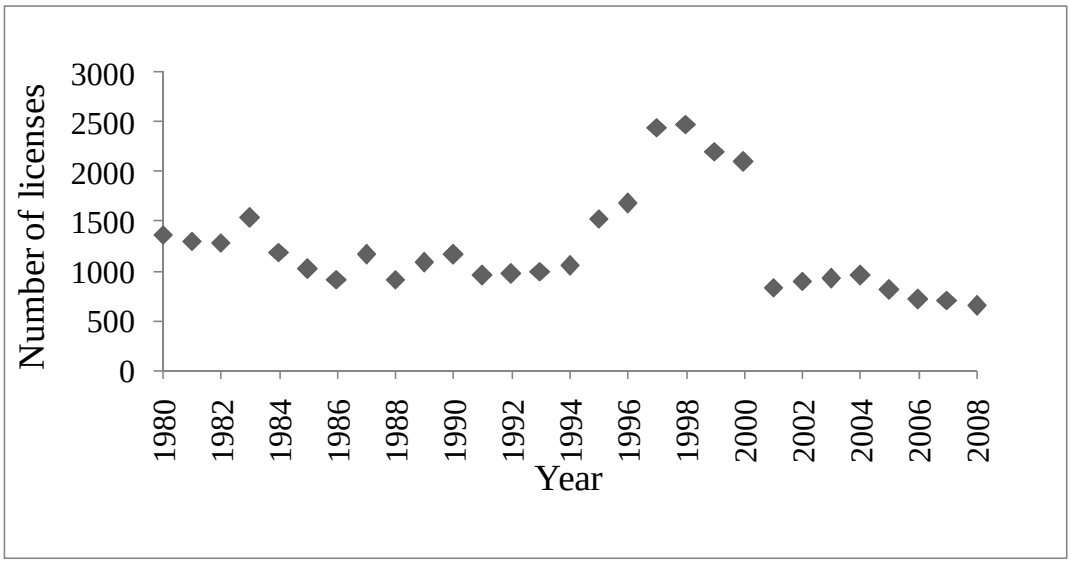

Figure 4. Number of licenses sold per year across England and Wales for dipnet fishing for glass eel, 1980 to 2008 (Agency data).

Yellow and silver eels

Environment Agency sales of yellow and silver eel licences (combined) have varied from around 1100 to 2900 over the period 1983–2007, with highest sales in the mid-1980s, mid-1990s and again in 2005 to 2007 (mean 2622) (Figure 5).

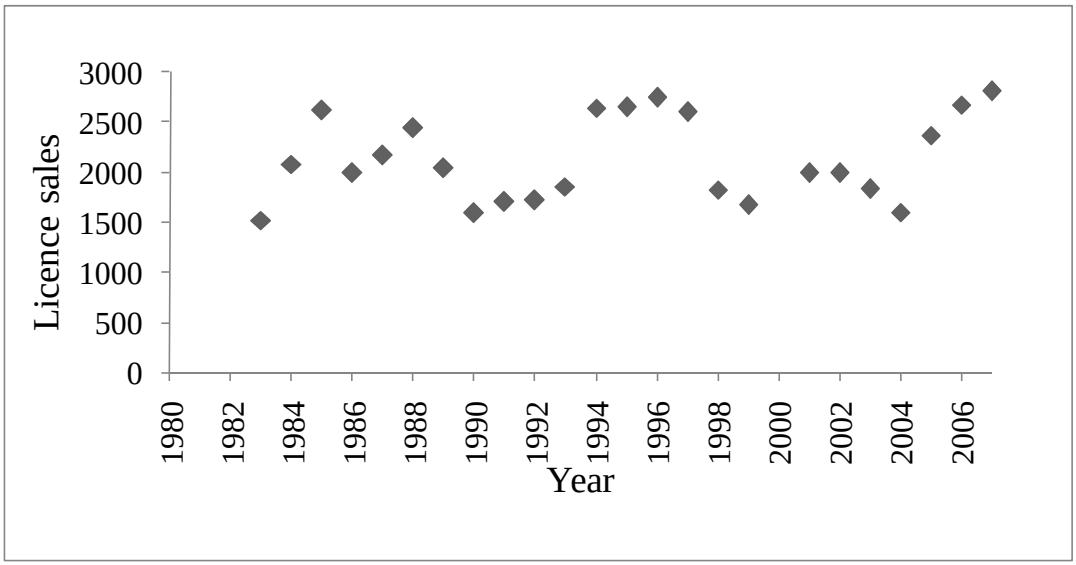

Figure 5. Number of licenses sold per year across England and Wales for yellow and silver eel fishing, 1983 to 2007 (Agency data).

UK.D.2 Northern Ireland

The capture of glass eel and elvers is prohibited in N. Ireland, except under licence from DCAL to help with upstream migration past in-river obstacles on the River Bann.

In N. Ireland, fykenets, longlines and draft nets are authorized fishing instruments for yellow eels. Silver eels are trapped at fixed weirs using large coghill nets (the 2007

UK Report: Appendix 1 provides a description of net and trap methods).

L. Erne

Fifteen longline licences were issued in 2007 and each fisher is allowed to fish a longline not exceeding 1200 hooks of a standard hook size 23 mm long, 7.75 m gape. Four fykenet licences were issued in 2007 and a fisher is not eligible to fish fykenets and longlines simultaneously. Each fykenet licence permits the holder to use 60 fykenets (not exceeding 7.3 m in length, a trap at each end on which no hoop shall exceed 50 cm in diameter and no mesh size of less than 12 mm knot to knot). There is no obligation for a fisher to use a logbook to record his catch, but it is a condition of the licence to report the total catch at the end of each year. Catches are sold to travelling eel dealers who are also required to make annual returns. The small silver eel fishery in the Erne River has been suspended since 2005.

L. Neagh

Glass eel fishing on the River Bann for stocking into L. Neagh is carried out using a drag net with an area of 0.94 m^2. A record of total catch per night is recorded, but not of catch per individual net. Thirty per cent of the L. Neagh yellow eel catch is derived from draft nets, the other 70% from longline fishing using a maximum of 1200 standard sized hooks baited with either earthworms, fish fry or the larvae of the flour beetle (meal worm). The fishery is run on a quota based system (normally 60 kg per boat per day) and a log is kept of each individual boat's daily (Monday–Friday) catch. However, as most fishers catch their quota every day, the catch is not limited by the size of the eel population, and it is not appropriate to calculate cpue. New technologies such as hydraulic draft net haulers have been introduced over the last 10 years, thereby reducing the labour needed in the fishery. Daily catch statistics and division by method are recorded by the LNFCS.

Silver eel catch is taken by three weirs at two locations using coghill nets. The number of coghill nets fished depends on weather and flow conditions in the river at the time of fishing and normally ranges from 2–4 nets per fishing night. The record of nightly catch is only obtained if the catch is processed and sold the following day, otherwise catches are retained in tanks, processed and sold as and when market conditions are more favourable, and therefore a 'single' catch record may be a total for several nights fishing.

UK.D.3 Scotland

Glass eel fisheries and recruitment

In survey in the early 1970s no elver fisheries were recorded in the Scottish Highlands and Islands (Williamson, 1976). During the mid-late 1990s there was a short period of exploitation, in response to the rise in demand and thus prices. Catches were estimated at 1–2 t per annum, mainly from the North West and Outer Hebrides. Present levels of exploitation are unknown.

There have been no studies of glass eel recruitment in Scotland, although there is some interest in establishing traps on some systems as a means of monitoring recruitment.

Yellow eel and silver eel fisheries

Commercial fisheries for yellow eels are largely based in low-lying productive lochs, the eels being sold mainly to local smoke houses. There is no tradition of eel consumption in Scotland. During the 1960s–1970s, eel catches in Scotland were esti-

mated at around 10–40 t per annum. In 1989, 17 eel fisheries were operating, with catches ranging from 0.25 to 10.76 t (total: 23 t) (I. McLaren, FRS, unpublished data). Correspondence with proprietors of eel fisheries in 2003 indicated a catch of less than 2–3 t per annum, chiefly yellow eels, with silver eels contributing less than 100 kg, mostly from traps in mill-races. Although there are few comprehensive records, data for one silver eel fishery demonstrate a 90% decline in catches between the early 1990s and 2002, although a yellow eel fishery was established in the upstream loch during the same period. The last known commercial yellow and silver eel fishery in Scotland ceased operation in late 2006, and today, catches of silver eels are largely destined for research purposes.

It is concluded that eel exploitation in Scotland is at its lowest level in the recent past, with fishing for silver eels and glass eels/elvers in particular being less than a few hundred kg per annum. Fisheries for yellow eels probably amount to little more than 2 t per annum.

UK.E Catches and landings

UK.E.1 England and Wales

Glass eels and elvers

The glass eel/elver catch reported to the Environment Agency for 2008 (0.23 t) is the lowest on record since 1972, and continues the very low trend since 2001 (Figure 6, Table 1). In comparison, reported catches in the 1970s and 1980s ranged between 10 and 70 t (Figure 6, Table 1). However, comparison of these reported catch data with net exports from HM Revenue and Customs (HMRC) data for England and Wales suggests a significant level of underreporting to the Agency, by between 5 and 15 times, which varied between years.

HMRC data are collected for trade in live, chilled, smoked and frozen eel separately, but the records do not distinguish between life stages. For the purposes of the analyses reported here, therefore, trade records are assigned as glass or yellow/silver eel based on their unit value: values greater than £200 per kg are classed as glass eel, those less than £10 per kg are classed as yellow and/or silver eel, and intermediate values are classed as mixed batches. Glass eel are imported into England from France and Spain throughout the winter season (typically November to March) and subsequently re-exported (HMRC data). By subtracting imports from exports and adding the quantities of glass eels sold for stocking Lough Neagh in Northern Ireland, the UK catch of glass eel is estimated from the net export. Neither of these datasets is particularly robust, but they do yield useful information and provide proxy estimates of recruitment and of home and international market trends (Knights *et al.*, 2001; Knights, 2002).

Based on these HMRC data, it is estimated that the glass eel catch in England and Wales averaged 10.4 t in 2003–2006 (Figure 6). The trade data for 2007 include a large proportion of trades with intermediate values and, therefore, it is not possible to include a robust trade figure for 2007 in the dataset. Peter Wood (UK Glass Eel) estimated that about 8–10 t of glass eel were landed across England and Wales (B. Knights, pers. comm.).

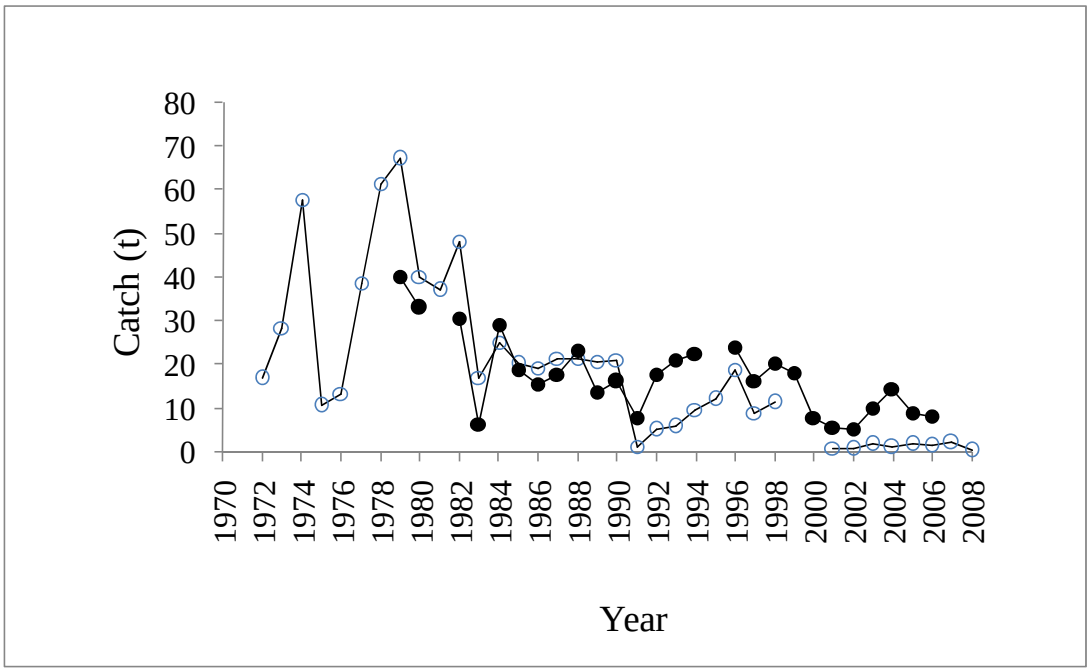

Figure 6. Trends in UK glass eel/elver catches reported to the Environment Agency in t (open circles), and derived from HMRC net export data (closed circles) from 1972–2008.

Both datasets demonstrate a general decreasing trend in both glass eel catches. Considerable between-year variations in these data preclude meaningful analyses based on period means. A more simplistic comparison is between maximum catch levels in the late 1970s and early 1980s and minimum levels in the 2000s. This suggests that the catch reported to the Agency has declined by at least 98% and the HMRC net exports by 75% (but see Section UK.F).

Table 1. Glass eel/elver catch and cpue estimates for England and Wales, based on catch reports to the Environment Agency, and HMRC net export data, 1972–2008. na = data not available. Note, HMRC data not available for 2007 or 2008 as a consequence of data: the 2007 HMRC data presented in the 2007 UK report were provisional, but could not be verified.

	Catch estimates based on		Licence sales	CPUE	
	Defra/EA	HMRC Nett Exports		HMRC/EA	
Year	t	t	No. dip-nets	kg/net	£/net
1972	16.70				
1973	28.20				
1974	57.50				
1975	10.50				
1976	13.10				
1977	38.60				
1978	61.20				
1979	67.00	40.10			
1980	40.10	32.80	1367	23.99	121
1981	36.90	na	1303	na	na
1982	48.00	30.40	1288	23.60	187
1983	16.90	6.20	1537	4.03	49
1984	25.00	29.00	1192	24.33	162
1985	20.00	18.60	1026	18.13	245
1986	19.00	15.50	917	16.90	330
1987	21.30	17.70	1162	15.23	384
1988	21.40	23.10	918	25.16	861
1989	20.60	13.50	1087	12.42	804
1990	20.90	16.00	1169	13.69	986
1991	1.10	7.80	960	8.13	625
1992	5.00	17.70	969	18.27	1335
1993	5.73	20.90	1000	20.90	1959
1994	9.50	22.30	1058	21.08	1304
1995	11.90	na	1530	na	na
1996	18.80	23.90	1682	14.21	1480
1997	8.70	16.20	2450	6.61	821
1998	11.20	20.10	2480	8.10	1113
1999	na	18.00	2207	8.16	1012
2000	na	7.60	2100	3.62	na
2001	0.81	5.40	838	6.44	1021
2002	0.52	5.10	899	5.67	na
2003	1.72	10.00	922	10.85	1213
2004	0.97	14.40	957	15.05	709
2005	1.70	8.80	812	10.84	1836
2006	1.27	8.20	719	11.40	1789
2007	2.05	na	705	na	na
2008	0.229	na	654	na	na

Yellow and silver eels

EA returns for yellow and silver eel fisheries (combined) for 2007 (18.9 t) continue at the low level since 2001 (Table 2, Figure 7). As with the glass eel/elver reported catches, however, these reported data are likely underestimates (by ~ 6 times) of the true catch when compared with net exports from HMRC data for England and Wales. The annual HMRC net export of yellow and silver eels has averaged 125.6 t over the period 2003–2007.

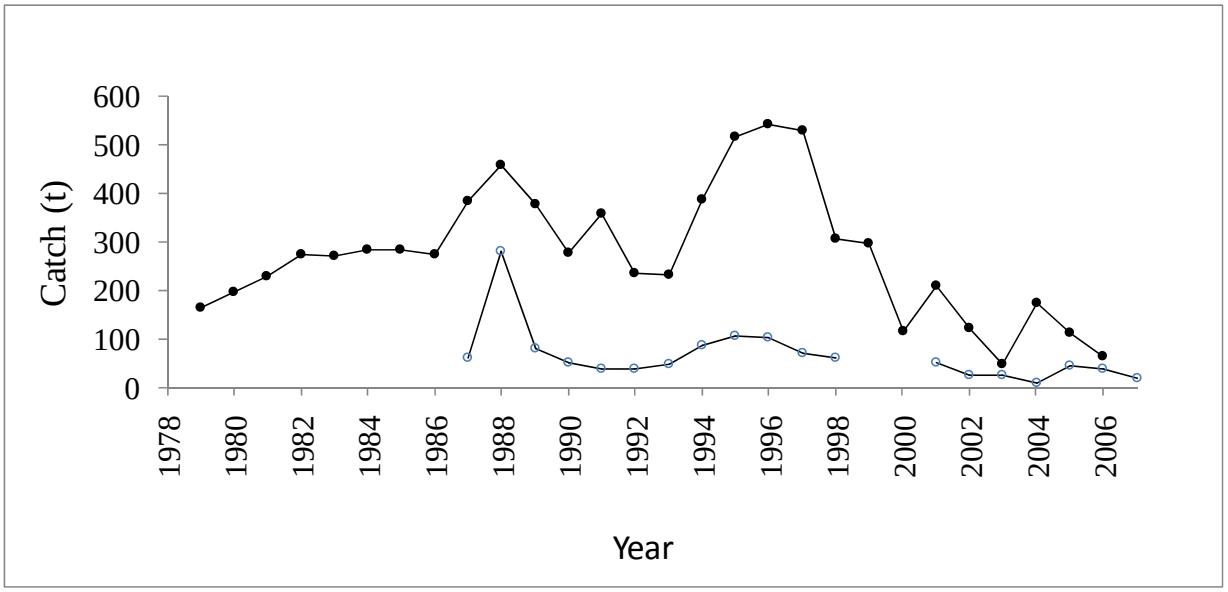

Figure 7. Trends in yellow and silver eel catches (t) reported to the Environment Agency (open circles), and derived from HMRC net export data (closed circles) from 1979 to 2007.

Table 2. Yellow and silver eel catch and effort data for England and Wales, 1979–2007. The 2007 Environment Agency data have been revised, but the provisional HMRC data for 2007 could not be verified and therefore have been removed. No catch data available for 2008 at the time of publication. Note column headings have been revised to clarify data sources.

	Catch estimates based on		Export trade value		Licence sales	CPUE	
	HMRC Nett Exports	EA catch returns	Total value	Unit	No. of licensed gears	HMRC/EA	
Year	(t)	(t)	£000	£/kg		kg/gear	£/gear
1979	162						
1980	196		670	3.42			
1981	229		759	3.31			
1982	273		850	3.11			
1983	270		888	3.29	1523	177	583
1984	283		922	3.26	2085	136	442
1985	283		1012	3.58	2624	108	386
1986	274		1190	4.34	1994	137	597
1987	381	60.41	1869	4.91	2168	176	862
1988	456	280.58	2992	6.56	2443	187	1225
1989	376	80.63	1699	4.52	2041	184	832
1990	277	48.74	1016	3.67	1589	174	639
1991	358	38.26	1724	4.82	1704	210	1012
1992	234	35.63	1383	5.91	1724	136	802
1993	232	46.62	1442	6.22	1859	125	776
1994	384	86.79	1920	5.00	2647	145	725
1995	514	103.76	2484	4.83	2648	194	938
1996	540	100.51	2532	4.69	2752	196	920
1997	526	68.04	1956	3.72	2602	202	752
1998	306	58.31	1126	3.68	1825	168	617
1999	294	na	1012	3.44	1670	176	606
2000	113	na	345	3.05	na	na	na
2001	207	48.62	771	3.72	1991	104	387
2002	122	24.06	445	3.65	1992	61	223
2003	46	25.44	195	4.24	1831	25	106
2004	171	9.58	232	1.36	1600	107	145
2005	110	42.26	160	1.45	2369	46	68
2006	62	35.91	314	5.06	2679	23	117
2007	na	18.90	na	na	2818	na	na

UK.E.2 Northern Ireland

Glass eels and elvers

Glass eel recruitment to Lough Neagh from 1936 to 1946 was provided by the Toome eel fishery (Figure 8).

The LNFCS has provided data since the 1960s. Glass eel and elver supply to Lough Neagh, as recorded by the capture in traps and nets in the Bann Estuary, for transport

to Lough Neagh, is given in Table 3 and Figure 8. In 2006 and 2007, these were 444 kg and 456 kg, respectively, a 50% reduction on 2005 (930 kg) and around 65% of the previous 5 year average (691 kg). As in most years since 1984, glass eels were bought from the Severn Estuary to stock L. Neagh (Figure 8). Recruitment in 2008 has reached a new historical minimum with only 24 kg (approx 75 000 eels) caught. To supplement this 428 kg of elvers (1.3 million individuals) were purchased from the River Severn.

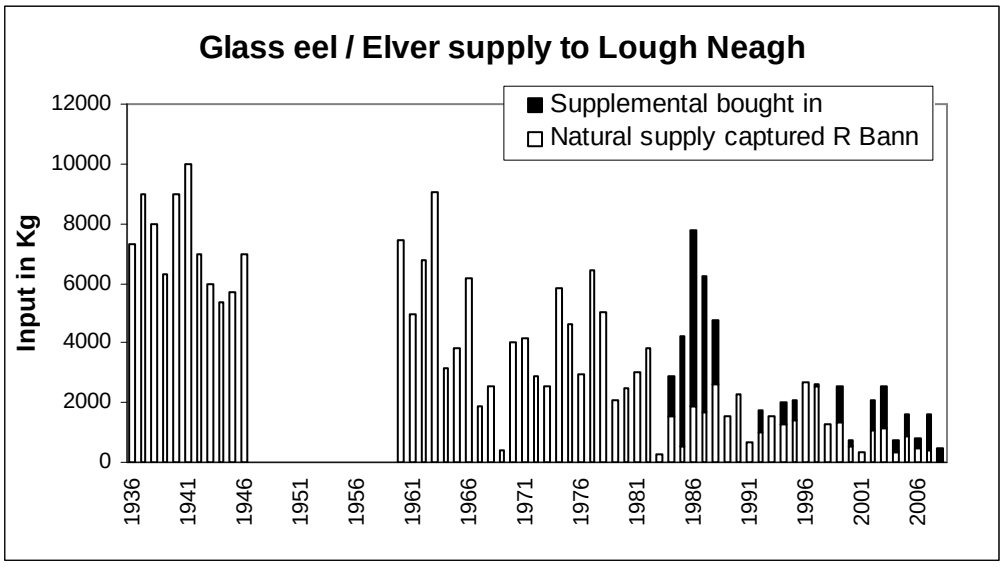

Figure 8. Elver supply to Lough Neagh, 1936 to 2008.

Table 3. Lough Neagh eel fishery data, 1965–2008. The natural elver run from 1960 to 1964 was 4708.55, 4938.69, 6740.46, 9076.7 and 3136.92 kg, respectively.

Year	Natural elver run (kg)	Additional elvers bought from UK (kg)	Emigrating silver eel catch (kg)	Yellow eel catch (kg)	Total yield (kg)
1965	3801	0	329563.6	236759.1	566322.7
1966	6183	0	332800	284772.7	617572.7
1967	1898.77	0	242727.3	327281.8	570009.1
1968	2524.9	0	204618.2	382327.3	586945.5
1969	422.03	0	238327.3	368677.3	607004.5
1970	3991.63	0	237345.5	516504.5	753850
1971	4157.07	0	233309.1	610909.1	844218.2
1972	2905.27	0	124945.5	509090.9	634036.4
1973	2524.2	0	162400	562481.8	724881.8
1974	5859.47	0	178872.7	587904.5	766777.3
1975	4637.27	0	187527.3	576354.5	763881.8
1976	2919.93	0	144872.7	481886.4	626759.1
1977	6442.8	0	236690.9	455350	692040.9
1978	5034.4	0	280727.3	544695.5	825422.7
1979	2088.8	0	341163.6	702609.1	1043773
1980	2485.93	0	245272.7	668945.5	914218.2
1981	3022.6	0	228690.9	681545.5	910236.4
1982	3853.73	0	209890.9	705759.1	915650
1983	242	0	203636.4	662709.1	866345.5
1984	1533.93	1334.67	165890.9	807672.7	973563.6
1985	556.73	3638.51	135054.5	616668.2	751722.7
1986	1848.47	5935.16	129854.5	522359.1	652213.6
1987	1682.8	4584.07	121345.5	503777.3	625122.7
1988	2647.4	2107	150981.8	503236.4	654218.2
1989	1567.53	0	152436.4	643395.5	795831.8
1990	2293.2	0	123600	613231.8	736831.8
1991	676.67	0	121381.8	578868.2	700250
1992	977.67	785.87	148036.4	533240.9	681277.3
1993	1524.6	0	90327.27	535150	625477.3
1994	1249.27	771.87	95200	597418.2	692618.2
1995	1402.8	686	138581.8	659050	797631.8
1996	2667.93	33.19	112290.9	594045.5	706336.4
1997	2532.6	70.47	109418.2	554750	664168.2
1998	1283.33	17.27	104545.5	531968.2	636513.6
1999	1344.93	1200	113054.5	556213.6	669268.2
2000	562.8	150.33	101963.6	486595.5	588559.1
2001	315	0	84000	451309.1	535309.1
2002	1091.53	1007	95963.64	432313.6	528277.3
2003	1155.93	1368.03	114327.3	413763.6	528090.9
2004	334.6	427.09	99636.36	363522.7	463159.1
2005	930	718.67	116727.3	317800	434527.3
2006	456	330	104000	242000	346000
2007	444	1000	76000	351000	427000
2008	24	428	na	na	na

The elver run to the Erne in 2007 was 189 kg and 32.8 kg in 2008, monitored by capture at a box at the tidal head and transported to upper and lower Lough Erne.

Yellow and silver eels

Annual commercial production figures (LNFCS) are divided into outputs of yellow eels (line or draft net catch) and silver eels (caught in traps in the River Bann when migrating downstream from L. Neagh) (Table 3, Figure 9).

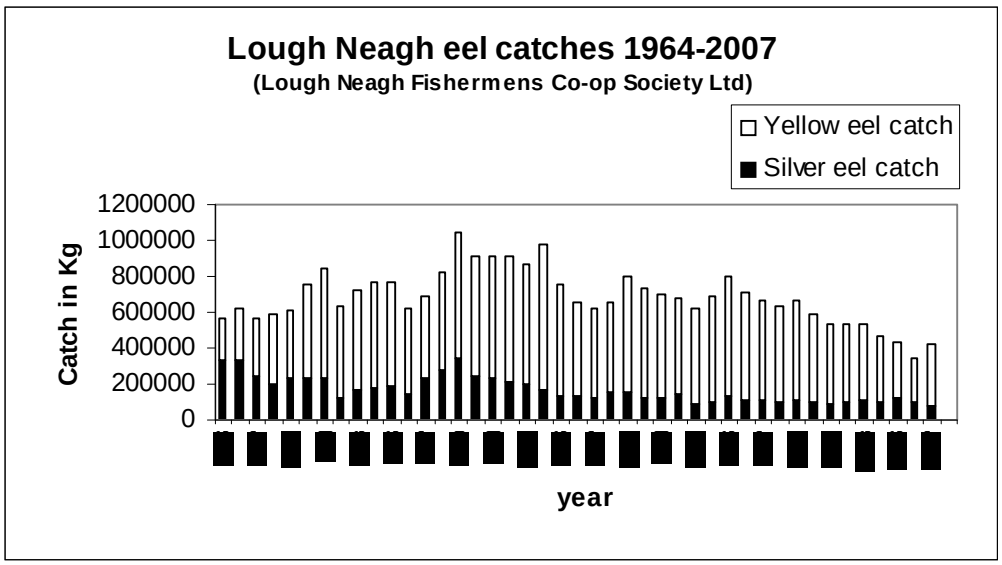

Figure 9. Yellow and silver eel catches-Lough Neagh, 1965 to 2007.

Yellow and silver eel catches in L. Neagh in 2007 amounted to 351 and 76 t, respectively, continuing the general downward trend since the late 1990s (Figure 9) associated with reducing effort in the yellow eel fishery as a function of falling boat numbers. Licences have fallen from 200 active boats in 1990 to around 80–90 boats in 2007, a significant cause of the long-term decline in catches and a response to alternative work/low prices available for yellow eels rather than declining stocks. Catches per boat per day in the longline and draft net fisheries continue to meet or exceed daily quotas imposed by the Co-operative, implying that sufficient stocks for the number fishing in the Lough are being maintained. In 2007, a mild autumn meant that yellow eel fishing continued through until the end of October. This was responsible for the increase in yellow eel catch in 2007 compared to 2006.

Sex ratio in the silver eels in 2004 to 2005 was numerically close to 1:1 male:female, but changed in 2006 to 0.37:0.63 and 2007 to 0.38:0.62 (Table 4). Taking account of differing sizes and weights of males and females, 80% of the recorded silver eel biomass is now female.

Table 4. Biological characteristics of silver eels emigrating from Lough Neagh. Note–mean ages of males and females for 2005 and 2006 have been revised in light of additional data.

	Males				Females			
year	%	mean L (cm)	mean Wt (g)	mean Age	%	mean L (cm)	mean Wt (g)	mean Age
1927	0				100		567	
1943	27				73			
1946	40				60			
1956	61				39			
1957	62				38			
1965	10		180		90		330	
2004	51	40.6	122	11	49	58.6	386	18
2005	52	41.4	126	11.4	48	58.1	393	18.2
2006	37	40.1	117	11.3	63	59.5	368	18.7
2007	38	40.2	121	na	62	62.3	370	na
2008	na				na			

An annual mark-recapture programme was initiated in October 2003, with the objective of estimating escapement of silver eels past the fishery (weir traps), which is subject to a trap-free gap in the river channel, a three-month fishing season (some silver eel movement occurs outside this season), and inefficient fishing when river flows are very high. Recaptures occur both during the year of upstream release and at least one or even two years thereafter. Maximum estimates of escapement, based on the proportion of recaptured Floy™ tagged silver eels, range from 62% to 84% during 2003 to 2006 (Table 5): no tagging was undertaken in 2007 as a consequence of the sporadic nature of the silver eel run as a consequence of a dry autumn.

Table 5. Results of mark-recapture estimation of silver eel escapement from the Lough Neagh fishery. No silver eels were tagged in 2007 as a consequence of the sporadic nature of autumn run.

	Males				Females			
year	%	mean L (cm)	mean Wt (g)	mean Age	%	mean L (cm)	mean Wt (g)	mean Age
1927	0				100		567	
1943	27				73			
1946	40				60			
1956	61				39			
1957	62				38			
1965	10		180		90		330	
2004	51	40.6	122	11	49	58.6	386	18
2005	52	41.4	126	11.4	48	58.1	393	18.2
2006	37	40.1	117	11.3	63	59.5	368	18.7
2007	38	40.2	121	na	62	62.3	370	na
2008	na				na			

UK.E.3 Scotland

No commercial fisheries.

UK.F Catch per unit of effort

UK.F.1 England and Wales

Glass eels and elvers

Trends in glass eel recruitment are likely to be better indicated by catch per unit of fishing effort (cpue) than by reported catch alone. Glass eel/elver fishing effort is not directly quantified in the UK, but annual licence sales data from the Environment Agency and predecessor agencies provide an index from which changes in effort over time can be inferred, because each licensee is likely to fish the same number of suitable tides over the short season each year.

However, the variable, apparent underreporting of glass eel/elver catches to the Agency precludes a meaningful analysis of cpue from Agency data alone. Therefore, trends in cpue are examined based on net export over Agency licence sales (kg/licensed net).

The HMRC data are also limited in value, because the trade statistics do not differentiate between life stages, and trade in glass eel is inferred from unit value calculations. Trends in cpue (kg/net licence sales) derived from reported catch or net exports are similar (Figure 10), at least to 1998 (correlation coefficient: 0.62). Both indices demonstrate declining trends throughout the 1980s and 1990s, similar in magnitude to those of reported catch and HMRC net exports: 98% for reported catch and 85% for net exports. In contrast, both indices demonstrate increases from 2002, by about 3 times to 2006.

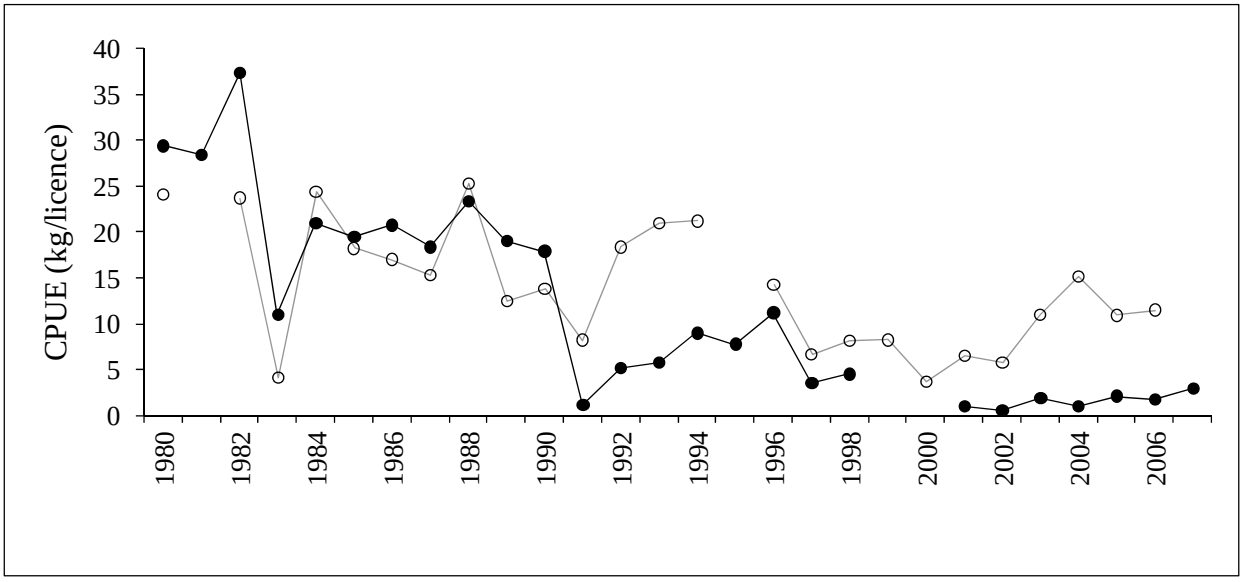

Figure 10. Trends in UK glass eel/elver fishery catch per unit of effort, derived from HMRC net export weight (kg) against Environment Agency net licence sales (open circles), and from catch reported to the EA against net licence sales (closed circles) from 1980 to 2007.

Yellow and silver eels

As with glass eel/elver data, estimating cpue for English and Welsh yellow and silver eel fisheries is problematic, given concerns regarding underreporting, but indices derived from HMRC net exports or reported catches per licence sold both suggest relatively consistent cpues in the late 1980s and mid 1990s, with a decline of about 80% from then onwards (Figure 11).

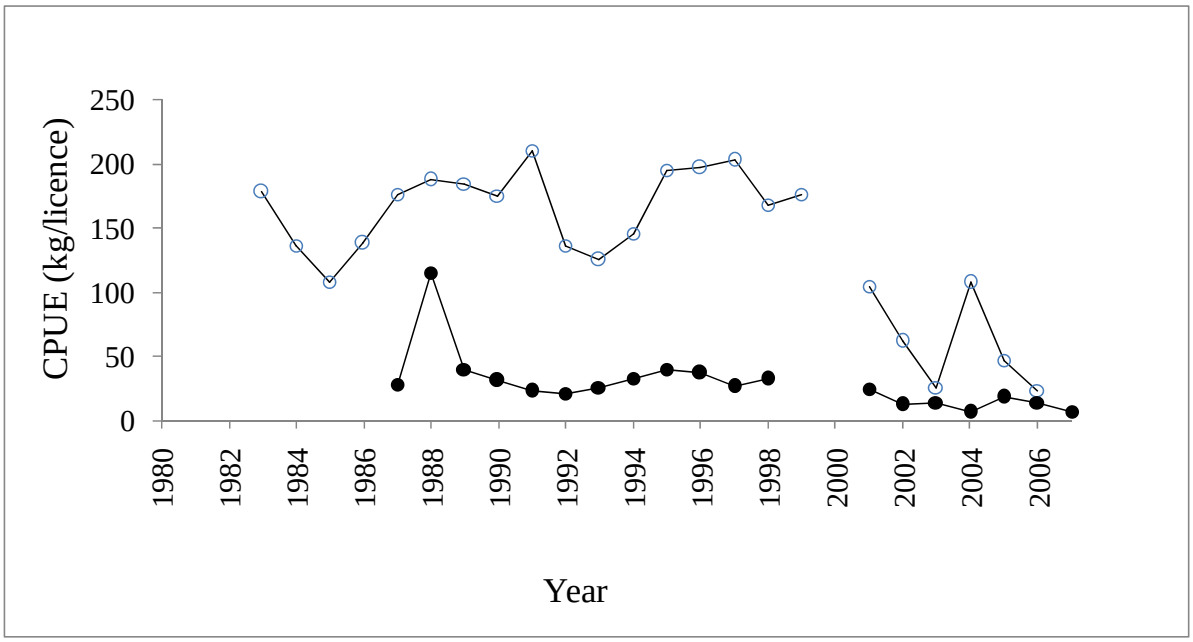

Figure 11. Trends in England and Wales yellow/silver eel fishery catch per unit of effort, derived from HMRC net export weight (kg) against Environment Agency net licence sales (open circles), and from catch reported to the EA against net licence sales (closed circles) from 1983 to 2007. Note that licenses are required for each fixed trap and for each net-end, and therefore the number sold is considerably greater than the number of 'licensed' fishers.

UK.F.2 Northern Ireland

Glass eels and elvers

No standardized cpue data are available for glass eel fishing (for stocking) on the River Bann.

Yellow and silver eels

A quota-based catch management system on L. Neagh means it is not possible to calculate cpue. Daily catch statistics and division by method are recorded by the LNFCS.

UK.F.3 Scotland

No commercial fisheries.

UK.G Scientific surveys of the stock

UK.G.1 England and Wales

Environment Agency eel-specific and multispecies surveys

The EA conducts annual multispecies surveys of fish populations in rivers, lakes and estuaries throughout England and Wales. Prior to 2001, eels were not a target species for these surveys, but some records of presence/absence or more quantitative data are available. From 2001 to 2006, at least the presence/absence of eels was recorded on all surveys (see Figure 1). From 2007 onwards, all Environment Agency surveys will collect length, and possibly weight, measurements for all eel caught.

More intensive, eel-specific electrofishing surveys, and silver eel or elver trapping exercises have been conducted in a number of basins (Figure 12), yielding more accu-

rate estimates of survey site population biomass, density and length frequency distributions over a number of years. In addition, fykenet surveys have been conducted in still waters and estuaries, yielding length and weight data for eels along with catch per unit of effort indices.

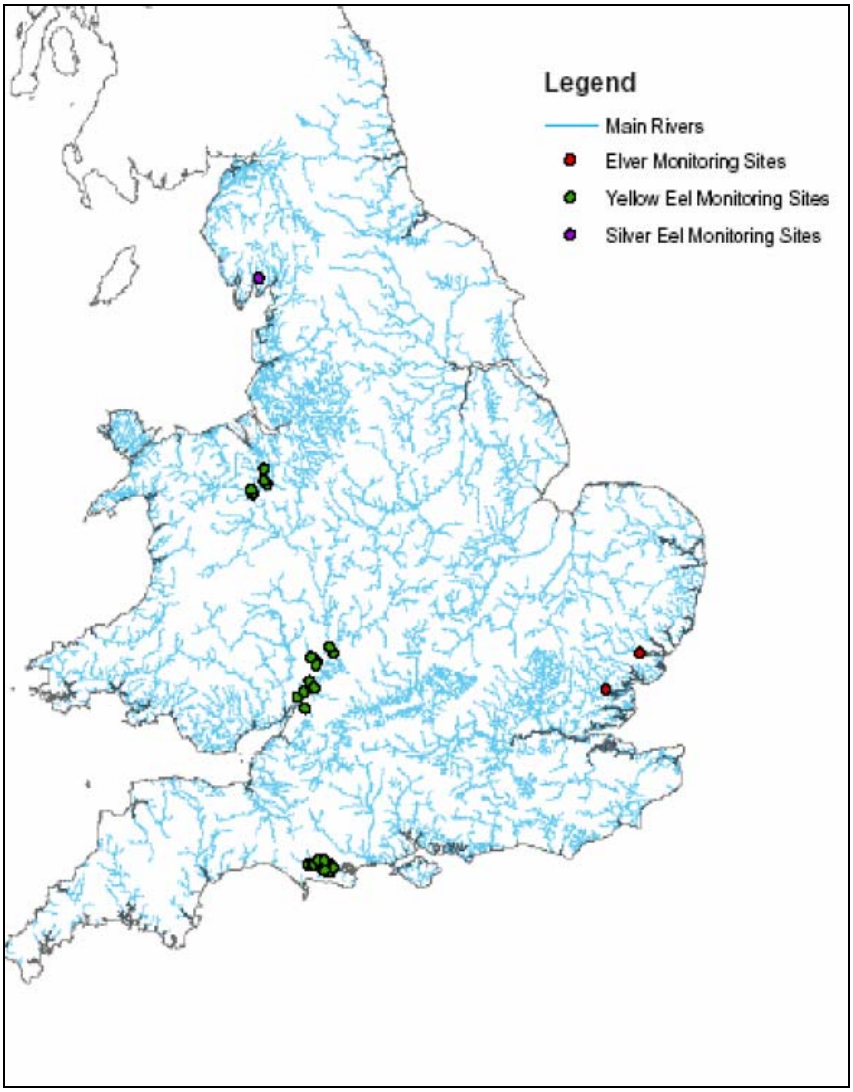

Figure 12. Regional distribution of eel-specific monitoring by the Environment Agency in England and Wales.

UK.G.2 Northern Ireland

The North South Shared Aquatic Resource (NSSHARE) Project covers three river basin districts; North Western International River Basin District, Neagh Bann International River Basin District and North Eastern River Basin District. One of the main outcomes of the project is to develop ecological classification tools for assessing water quality under the Water Framework Directive using three biological quality elements; aquatic flora, benthic invertebrate fauna and fish fauna. The fish fauna biological quality element must include species composition, abundance and age structure. Eels are recorded as part of the species composition element (see Table 6).

The NSSHARE Fish in Lakes team was set up to develop an ecological classification tool using fish fauna, suitable for monitoring and classification of lakes under the requirements of the Water Framework Directive. This involved developing a standard

methodology for sampling fish populations in lakes, with which in all 83 lakes have been surveyed to date. The ecological classification tool is currently under development.

Table 6. Eel population data for Northern Ireland lakes from surveys conducted during the development of ecological classification tools for the WFD, 2005–2006. No eels were caught in loughs Big Dog, Carrick, Carrickavoy, Corry, Drumacrittin, Formal, Lea (Knox Lake), Legane, Nadarra, Natroey, Portmore, Rossole, Roughan and Skale.

			Length (cm)		Weight (g)		Age (y)	
Lake	Catch	CPUE	Mean	Range	Mean	Range	Mean	Range (no.)
Ballydoolagh	1	0.125	62.5	62.5	654.9	654.9	18	18 (1)
Beg	11	1.375	48.9	20.0-70.0	297	35.0-740.0	14	14 (1)
Brantry	1	0.125	80	80.0	1362	1362		
Castlehume	2	0.25	31.5	30.0-33.0	71	64.5-77.5		
Castlewellan	13	1.625	73	62.5-80.0	857.3	616.5-1362.0	23.1	18-25 (11)
Clea Lakes A	16	2	49.4	41.2-56.2	219.7	106.8-347.8	16.6	14-23 (14)
Corranny	1	0.25	56	56.0	867.9	867.9	18	18 (1)
Creeve	4	0.5	54	49.0-57.0	253.7	169.8-303.5	15.3	13-18 (4)
Erne Upper	5	1.25	45.3	42.5-48.2	170.6	125.0-230.2	14	13-15 (5)
Glencreawan Lough	1	0.25	60	60.0	402.1	402.1		
Knockballymore Lough A	1	0.25	68.5	68.5	748	748	14	14 (1)
Lisleitrim	4	1	43.4	37.0-52.5	176.2	93.0-341.6		
Macnean Lower	8	0.889	50.5	36.0-60.2	261.6	82.1-423.1	12.4	8-17 (8)
Macnean Upper	5	0.556	49.4	42.0-55.2	229	126.4-338.5	13.5	12-16 (4)
Meenameen	2	0.5	37	34.0-39.0	90	65.0-115.0		
Nalughoge	2	0.5	58.5	56.0-61.0	423.4	397.2-449.6		
Sand	2	0.5					16	16 (2)
Tullybrick	1	0.25	60	60.0	407.8	407.8		

L. Erne

There are no surveys of the L. Erne eel population at present.

L. Neagh

Eels are sampled regularly as part of an ongoing long-term research programme, which investigates all life stages throughout the year.

Glass eel/elvers are sampled twice a month from their arrival in February/March through to August. A sample of 50 juveniles is removed for morphometric analysis, calculation of number per kg and length frequency analysis.

Yellow eel catches are sampled weekly over 20 weeks (from May to September). A sample of 20 eels is chosen to reflect all size ranges caught, and analysed for age and length. In addition, the entire, ungraded landing of two fishing crew on one day each month is sampled, usually comprising 400–600 eels captured by longline and a similar number by draft net, to allow comparison between methods. Every eel is meas-

ured for length and the total number of fish captured recorded.

Preliminary analysis indicates that a larger proportion of small eels (<40 cm) are captured by draft nets (34%, compared to 21.4% on longlines), and that more of the larger eels (>60 cm) are taken on longlines (Figure 13). The results also indicated there was significant variation in the numbers of small eels captured by long lining dependent upon bait type (earthworm caught more) and hook size (larger hook caught fewer small eels). Undersized eels are returned to the Lough.

Silver eel catches are sampled over a 12 week period (from October to December). At weekly intervals, the previous night's haul averaging at least 400 fish is measured for length, and 10 eels are chosen to reflect all size ranges caught, and analysed for age.

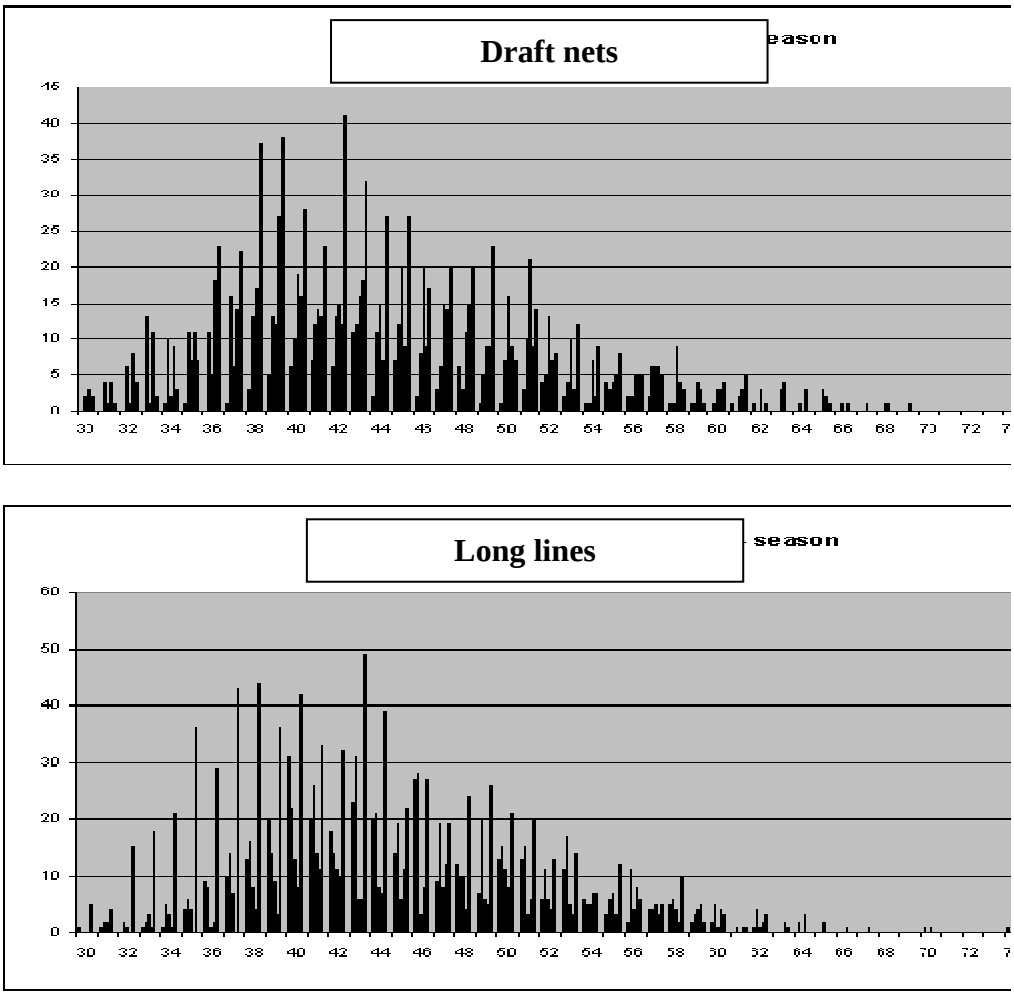

Figure 13. Length frequency distributions for L. Neagh yellow eels caught via longlines and draft nets.

UK.G.3 Scotland

The FRS Freshwater Laboratory has two long-term, but intermittent, datasets on yellow eels, both from small, upland tributaries. FRS has operated a fish trap on the Girnock Burn, a tributary of the River Dee in Northeast Scotland, since the mid-1960s. The Girnock Burn rises at an altitude of 500 m and flows northwards, joining the River Dee some 70 km above the tidal limit. The stream channel has a largely open aspect, and is typically <5 m wide, depths ranging from a few cm to 0.5 m. Annual trap catch and electrofishing data were collected between 1967 and 1982 and again in

2004 and 2005. Since 2004, eels >200 mm have been PIT-tagged in order to determine movements and growth.

Analysis of these data (Chadwick *et al.*, 2007) demonstrates that, in the late 1960s, the Girnock Burn eel population was composed of relatively high densities of small (140–180 mm) males and with few females (320–360 mm). Growth rates are currently estimated to be between 8.7 and 17.4 mm y^{-1}, with growth occurring chiefly in summer. Small eels leave the system in late spring/early summer, larger eels in late summer/early autumn. Due to construction of a major barrier to immigration (plus the effects of recruitment declines since the 1980s), the estimated standing stock and escapement declined from 1968 to 2005 by about 80%. The mean population density declined between 1968 and 2005 from 16 to 3 eels 100 m^{-2}, and biomass from 256 g to 71 g m^{-2}. Thus, current densities are about 19% of the 1968 level, biomass about 28%. Biomass has probably fallen more slowly than density because the average body length has increased 11% over the 37 year time-series, possibly as a consequence of lower in-river densities reducing competition and density-dependent mortality.

The other site monitored by FRS is the Allt Coire nan Con Burn, which is situated in the Strontian region of western Scotland and drains into the River Polloch, an inflow to Loch Shiel. The catchment covers 790 ha and its altitude falls from 756 m to 10 m at the sampling point, where the river is 5–6 m wide and features riffle interspersed with glides which can be deep. Riparian vegetation at the sampling sites is predominantly mature deciduous woodland. In Table 7, data from the annual electrofishing survey demonstrate no clear evidence of declines in yellow eel densities since 1992 (source: P. Collen, unpublished data).

Table 7. Relative population density of eels in electrofishing surveys in a small stream in north Argyll, 1990–2007.

Year	Population density (no.s/100m^2)
1990	41
1991	30
1992	16
1993	14
1994	11
1995	15
1996	18
1997	12
1998	14
1999	8
2000	10
2001	14
2002	15
2003	3
2004	14
2005	24
2006	8
2007	12

Fisheries Trust Data

The establishment of Fisheries Trusts and the Scottish Fisheries Coordination Centre has allowed the coordination of a number of electrofishing surveys, which now represent the principal source of information. The earliest of these data are from 1996,

but spatial coverage is adequate only from 1997 onwards. It should be noted that there is considerable variation among the reports from individual Trusts in the level of detail that are recorded. Some of the data were collected with funding from Scottish Natural Heritage (SNH) and are their property. Otherwise all data are the property of the relevant Fisheries Trusts which have kindly allowed their use here. There are substantial areas of Scotland RBD for which data are not available, including the catchments of the Rivers Clyde, Don, Ythan, Nairn, Ugie, as well as the entire islands of Skye, Orkney and Shetland, (these latter two island groups are omitted from subsequent maps for reasons of space and clarity).

There are a number of problems with the interpretation of these data:

1. The surveys were not specifically targeted at eels; instead the eel data were a bycatch of a sampling programme aimed at assessing salmonid densities.
2. Even directly targeted at the species, electrofishing for eels is an inexact science, and density estimates should be regarded with caution. Observed densities are likely to be size and habitat (in particular substrate) dependent, and no attempt has been made to account for this.
3. The dataset is composed of different types of electrofishing: multi-pass (22.9%), single-pass (69.5%), and timed fishing without delineated areas (7.6%).
4. In most cases the numbers of eels caught were not recorded directly, but allotted to abundance classes (Absent, 1–10, 11–100, 101–1000). For some Trust areas the exact number of eels was routinely reported. In others the exact number was only occasionally reported, with potential for bias (of unknown size or direction).
5. In most cases the size of eels was not reported. For some Trust areas length of eels was routinely reported, in others the lengths of eels were only occasionally reported, with potential for bias (of unknown size or direction).
6. Where eel lengths were recorded individual eels were sometimes described as 'silver', but it is not known how often (if ever) the lengths of eels was recorded and their maturity status overlooked.

In an attempt to standardize these disparate fishing methods, the following assumptions were made:

- Based on the average decline in capture rates of eels in three run fishing (where they were recorded), the likely result of a single-pass fishing was calculated for the remaining three-pass and two-pass fishings;
- Based on a negative binomial distribution of the observed data, the mean value expected for each class of eel number (1–10, 11–100, 101–1000) was calculated. This number, or the exact number if recorded, was used to calculate density by dividing it by the reported area of the site fished.
- For timed fishings (<4% of the total fishings), the area was estimated from the time fished (based on the relationship between time and area fished from a subsample of sites in which both parameters were recorded). A few timed fishings (n = 445 or 0.67% of fishings) had neither time nor area associated with them, and these were assumed to have the same area as the mean of the other timed fishings. In this way all the fishings were con-

verted to the same units (number of eels per $100m^{-2}$ in a single-pass fishing).

There are a number of assumptions inherent in the treatment of the data described above:

- That the sample for which capture rates of eels on all three runs were reported were representative of all fishings (i.e. that the decline in capture rates is constant across fishers and habitats);
- That the sites for which exact numbers were recorded were representative of sites for which the number of eels was estimated only to a class size category;
- That 'timed' fishings for which no time was recorded were of a similar duration to average duration of timed fishings where the time was recorded;
- That effort was constant over the survey period.

All these assumptions are likely to be violated to some extent, compromising the confidence that can be placed in the density estimates and strong confidence can only be placed in the presence/absence data.

The data demonstrate no consistent trend in reported eel abundance class over the period 1996–2005 (Figure 14). In contrast, an analysis of the percentage of sites where eels were absent on the adjacent Solway Tweed RBD suggests this increased from 12% in 1972–1988, to 24% in 1992–1996, to 44% 1997–2001 and to 46% 2002–2005 (B. Knights, unpublished data), but it is possible that this represents a change in methodology in the early 1990s rather than a genuine decline in distribution.

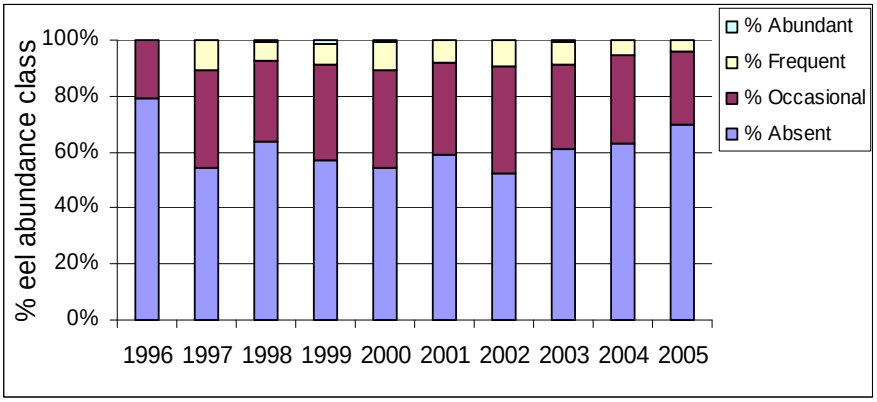

Figure 14. Eel presence/absence and abundance classes in Scotland RBD, 1996–2005. All site visits (n=6651) are included, number of site visits and contribution of different areas to the Scotland RBD total varies; in 1996 only 19 sites were fished, all on one river (the Spey). Abundance classes as follows: Absent 0 eels, Occasional =1–10 eels, Frequent =11–100 eels, Abundant = >100 eels.

There was considerable spatial variation in the distribution of eels, with eels being much less likely to be absent from sites in the northwestern parts of Scotland RBD. In the Western Isles, West Sutherland and Wester Ross, eels were absent at approximately 20% of sites, compared with 55% in Scotland RBD as a whole (Figure 15). This probably reflects the proximity of the northwest of Scotland RBD to the continental shelf (Knights *et al.*, 2001).

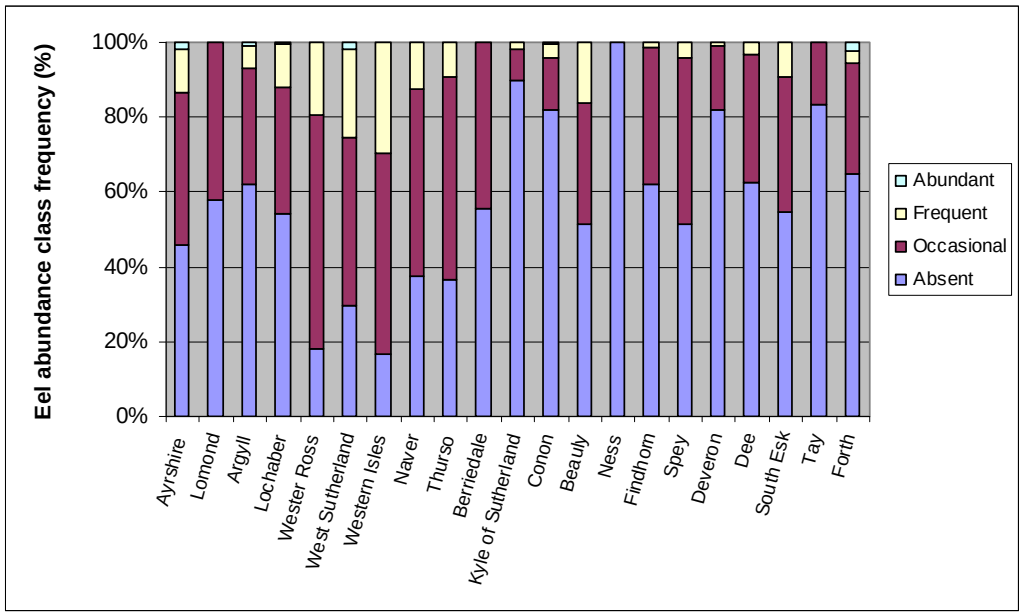

Figure 15. Percentage frequency of eel abundance class at electrofishing sites in various rivers or districts of Scotland RBD. Areas are arranged clockwise around the coast, from Ayrshire in the southwest, to Naver and Thurso on the north coast then down the east coast to the Forth region. Where more than one visit to a site was made, the highest recorded abundance was used. In general, eels were more widely distributed and more common in the northwest and north.

There is weak evidence that eel densities in Scotland may have declined since 2002 (Figure 16). It is possible that this is a spatial rather than a temporal effect, however, because the distribution of sites differed between years, both locally and regionally. A similar pattern of decline in recent years was evident for several individual regions of Scotland RDB for which data were available, but was not universal; in particular West Sutherland in the North West revealed a trend for an increase in population density (Figure 17).

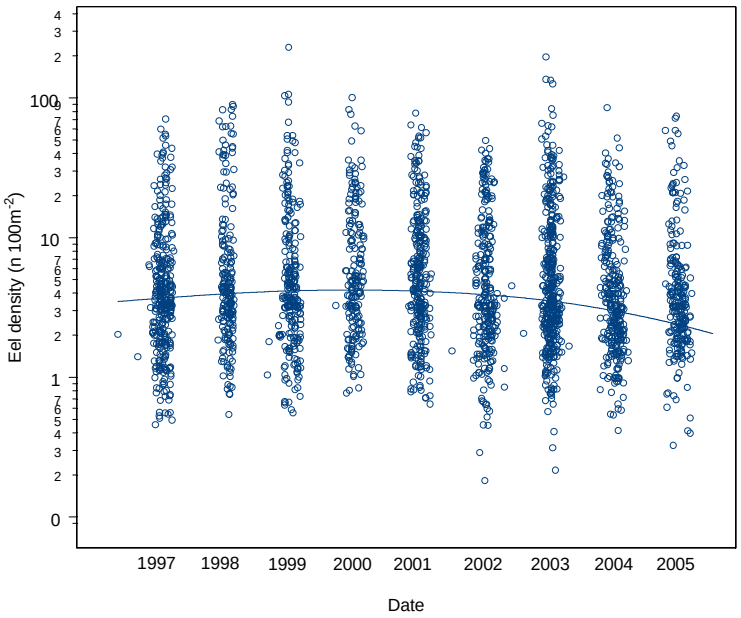

Figure 16. Eel density (log scale) from all electrofishing sites between 1997 and 2005. Smoothing spline fitted with 3 degrees of freedom suggests a slight decline in density post-2002, however, different regions of Scotland RBD are not equally represented in each year.

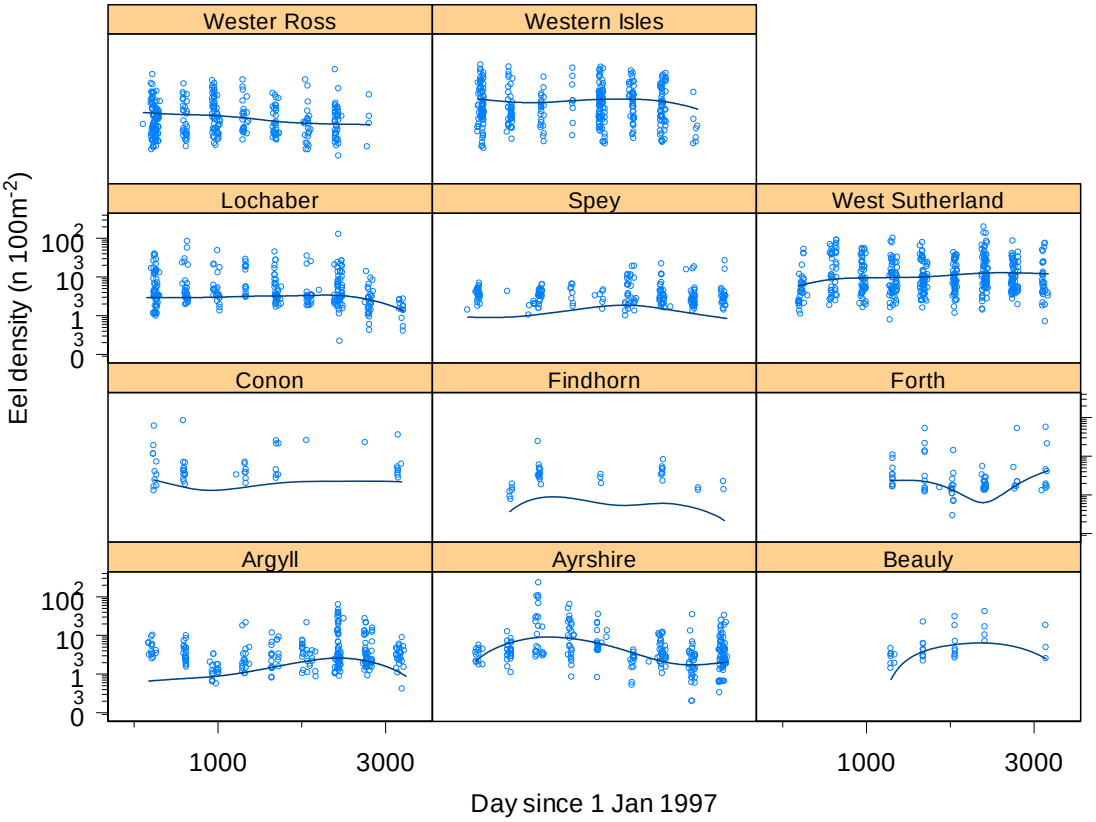

Figure 17. Temporal variation in eel population density at regional level within Scotland RBD, 1997–2005. Sites where eels are absent do not appear in the graphs, but the lines (smoothing splines with 3 degrees of freedom) are fitted with them.

UK.H Catch composition by age and length

UK.H.1 England and Wales

Catch are only reported by stage (glass/elver, yellow, eel), so there are no data on catch composition by age and length.

UK.H.2 Northern Ireland

See above.

UK.H.3 Scotland

No commercial fisheries.

UK.I. Other biological sampling

UK.I.1 Reported by catchment or River Basin?

UK.I.2 Length and weight and growth (DCR)

England and Wales

As of 2007, measurements of length are now collected from all eel captured by the Environment Agency during eel-specific and multispecies surveys. In all 637 lengths were collected in 2007. The 2008 sampling programme is ongoing at the time this report was produced.

The Defra-funded study, "The Development and Implementation of Biological Reference Points for the Management of the European Eel (SFO236)", included the sampling of 13 500 eels from surveys of none basins across England and Wales during 2002 to 2006 (Bark *et al*., 2007; in press). Length and weight were recorded, with a subsample of 1400 eels sexed and aged.

Northern Ireland

In addition to the glass eel sampling at the River Bann, other sampling is undertaken at several other coastal sites in N. Ireland: the Foyle Estuary, the River Lagan (Belfast), River Quoile (Strangford Lough) and Carlingford Lough Estuary.

L. Erne

There are no surveys on going on L. Erne.

L. Neagh

The monitoring programmes listed above also measure many other biological parameters within the fishery stock and samples removed from it.

The glass eel/elvers are monitored for the presence of *Anguillicola crassus*.

The weekly samples of yellow eels are also examined for weight, sex, age, stomach contents, the prevalence and intensity of *A. crassus*, and gastrointestinal endohelminths.

The undersized yellow eels (<40 cm long) captured via longline are returned to the Lough at the point of capture with hooks in place. Every month 100 undersized eels are sampled at the fishery, their hook location recorded and in conjunction with catch composition analysis; attempts are made to quantify possible losses to the fishery through hook mortality.

The weekly silver eel samples are also analysed for weight, sex, age, stomach contents, the prevalence and intensity of *A. crassus*, and gastrointestinal endohelminths. Sex ratio of the silver eel population is also estimated by counting the numbers of individuals contained in the graded 15 kg boxes which the fishery then sell. Eels are graded as small (males) and large (females), based on a length-sex key derived from previous sampling.

Scotland

An un-coordinated effort to determine the presence/absence of *Anguillicola crassus* is currently being undertaken in Scotland.

Some Fisheries Trusts collect data on the length of eels captured during routine electrofishing surveys targeted at salmonids (1136 eels have been measured since 1996).

UK.I.3 Parasites

England and Wales

Anguillicola crassus is now considered ubiquitous throughout the UK (Nigel Hewlett, Environment Agency National Fisheries Laboratory, pers. comm.). Foster and Block, 2006 reported infestation levels in eels (~300 mm total length) sampled across the Sussex area in 2005–2006 ranging from 60% to 88% (regional mean 72%). Similar levels of infestation were reported for eels in Kent rivers in 1996–1998 (Cave, 2000).

Northern Ireland

L. Erne

Anguillicola crassus was first recorded in the swimbladders of eels in Ireland during an extensive fykenet survey of the Erne system in July 1998. Of 328 yellow eels examined in 1998, 24 (7.3%) were infected, with a mean intensity of 4.3 worms per eel. Infected eels were only recorded in southern Lower Lough Erne and northern Upper Lough Erne. Examination of 432 yellow eels in 1999, revealed an increase in both mean intensity (6.7 worms per eel) and prevalence (9.9%) of *A. crassus*. The range of the parasite had also increased, with infected eels recorded from the lower reaches of the Erne, 30 km downstream of the original area of infection. Monthly samples of silver eels taken by commercial nets near the outlet of the Erne during October–December 1998 and 1999 confirmed active migrants contained the parasite. Prevalence and mean intensity among silver eels rose from 4.5% and 2.5 worms per silver eel in 1998 to 15% and 8.6 worms per eel in 1999 (Evans *et al*., 2001).

L. Neagh

A. crassus was found in Lough Neagh yellow and silver eels for the first time in 2003, and its spread has been monitored via the analysis of a total of 1100 yellow and 400 silver eels from 2003 to 2006. Samples were stored in 70% alcohol and in the lab; swimbladders were examined macroscopically for the presence of pre-adult and adult *A. crassus*, but not for larval *A. crassus*. Recorded prevalence and mean intensity in yellow eels rose from 24.4% and 2.2 in 2003 to 69% and 3.6, and to 100% and 7.7 in 2004 and 2005, respectively. However, the same infection parameters recorded for silver eel were significantly different, with almost 60% infected in 2003 rising to almost 90% in 2004. By 2005, 100% of yellow and silver eels were infected with *A. crassus* (Evans and Rosell, 2006). In 2007 the prevalence of *A. crassus* in both yellow and silver eels had fallen to 70% and 76%, respectively.

Scotland

There is to date only a single reported instance of *Anguillicola crassus* in Scottish RBD (Lyndon and Pieters, 2005), for a fish farm near Bridge of Earn, on the Tay system. However, the absence of targeted effort on the identification of *A. crassus* in the Scottish RBD may have led to under-recording. The parasite is currently being sought in eel samples collected in the catchments of central Scotland, and there is an unconfirmed report of an infected eel from the Forth (Willie Yeomans, pers. comm.). However, the likelihood is that *A. crassus* is not sufficiently widespread as yet in Scotland, as a consequence of low levels of stock transfer, to have had possible impacts on eel populations.

UK.I.4 Contaminants

England and Wales

Concentrations of most metals including mercury, arsenic, cadmium, chromium, copper, lead, nickel and zinc, Poly chlorinated biphenyls (PCBs), Dichloro-diphenyl-trichloroethanes (DDTs), Hexa-chlorocyclo-hexanes (HCHs) and Aldrin and Endrin ('Drins) decreased substantially in eels from Sussex rivers between 1994–1995 and 2005–2006 (Foster and Block, 2006). In 2005–2006 more eels were in the low to moderate risk bands (to people) and fewer eels were in the high risk band for PCBs proposed by the Oslo and Paris Commissions. The EU regulation limit of 8 pg/g of dioxin-like PCBs in eels was significantly exceeded for the dioxin-like PCB-118 at 100% of sampled sites in 1994–1995 and 2005–2006. Current levels of dioxin-like contaminants in eels in Sussex rivers are higher than those necessary to impair survival of fertilized eel eggs (Palstra *et al.*, 2006).

Northern Ireland

No routine sampling undertaken but available by request.

Scotland

No assessments of contaminants in eels have been undertaken in Scotland.

UK.I.5 Predators

England and Wales

Limited studies of the diet of piscivorous birds shot during winter suggest that eels are rare in the diet at this time of the year, but other published information for England and Wales indicates a fairly large proportion of eel at other times.

Northern Ireland

None undertaken and studies into the impacts of predators on the eel stocks of N. Ireland are not likely to form part of Management Plan contents.

Scotland

No information.

UK.J Other sampling

England and Wales

The Environment Agency's eel population model development programme, running from 2006 to 2010, includes the collation and analysis of existing and new data de-

scribing eel production processes from river basins in England and Wales.

A Defra-funded research programme (SF0249), running from 2007 to 2012, will (1) determine and compare the population structure and relative production of eels from different habitats within river basins, and (2) investigate relationships between habitat and eel production in order to inform the transport of models from data-rich to data-poor locations within and between river basins. This programme includes substantial field sampling of eel populations from the variety of habitats utilized within river basins in England and Wales.

Northern Ireland

None at present.

Scotland

No information.

UK.K Stock assessment

England and Wales

No formal assessments of eel populations have been conducted to date for England and Wales, although assessment methodologies are being developed to provide the tools required for Eel Management Plans (EMPs). EMPs require the assessment of silver eel escapement biomass against a historical target level, but as silver eel escapement biomass is not, nor has been, measured from any river in England and Wales, a modelling approach is required to estimate potential and actual escapement, and to assess the likely effects of management measures. Two modelling approaches have been developed in the UK: the Reference Condition Model (RCM: EIFAC/ICES, 2004; Aprahamian *et al*., 2007) and the Scenario-based Model for Eel Populations (SMEP: developed for the Department for Environment, Food and Rural Affairs (Defra) by El-Hosaini, Bark, Knights, Williams (Kings College, London) and Kirkwood (Imperial College, London): El-Hosaini *et al*., in prep; Aprahamian *et al*., 2007). The EA is supporting the further development of SMEP and the RCM.

Draft EMPs have been prepared for 12 River Basin Districts (11 in England and Wales and one in N. Ireland). The plans aim to describe the catchment, status of the eel stock, assess compliance with the 40% escapement target and, for those RBDs which are failing the target, set out management options to increase silver eel output. The plans conclude with a plan of actions that are to be achieved and associated delivery schedules.

In addition, various biological indicators of stock status have been considered during recent Environment Agency-, and Defra-funded research programmes (Knights *et al*., 2001; Knights, 2005; Knights, 2007; Bark *et al*., 2007; in press), though these indicators do not address the specific requirements of the EMPs.

Northern Ireland

Apart from the biological sampling efforts listed above, there are currently no eel stock assessment exercises within Northern Ireland. However, attempts have been made to predict future catches the L. Neagh fishery using biological data and catch statistics (Allen *et al*., 2006).

Stock assessment was carried out on the Erne as part of the 3 year Erne Eel Enhancement Programme which ended in 2001 (Matthews *et al*., 2001).

Scotland

No information.

UK.L Sampling intensity and precision

England and Wales

Knights *et al.*, 2001 examined variation in Severn eel population data from the early 1980s and late 1990s, and suggested that at least 25 sites should be surveyed throughout the first 50 km of river length (measured from the tidal influence) in order to determine the number of sites required to detect a temporal change in eel population density or biomass. Their analysis suggested that this intensity of sampling would be required if one wished to detect a ±50% change in density or biomass between two consecutive surveys, with 95% statistical confidence and 80% power.

Northern Ireland

No information.

Scotland

No information.

UK.M Standardisation and harmonization of methodology

UK.M.1 Survey technique

England and Wales

Knights *et al.*, 2001 provided recommendations for design of monitoring programmes to detect spatial and temporal changes in population status, including those on electrofishing method.

The Environment Agency has two standard work instructions in relation to eel, for survey in rivers and specifically for fykenetting.

UK.M.2 Sampling commercial catches

England and Wales

There is no routine sampling of commercial catches, although some sampling has occurred to characterize migrating silver eel populations sampled by commercial eel-rack fisheries (Knights *et al.*, 2001; Bark *et al.*, 2007; in press).

Northern Ireland

Methods described above. No Quality Assurance is undertaken within the sampling of the commercial catches.

Scotland

No commercial catches are reported.

UK.M.3 Sampling

England and Wales

See above.

Northern Ireland

Methods described in previous sections.

Scotland

No information.

UK.M.4 Age analysis

England and Wales

Ages reported in Knights *et al.*, 2001 were quality assured by the Environment Agency's National Fisheries Laboratory at Brampton. A similar QA method was employed by Bark *et al.*, 2007.

Northern Ireland

Age analysis is performed on yellow and silver eels sampled from the Lough Neagh fisheries using the grinding and polishing technique. The results have been quality assured against burning and cracking of sister otoliths performed at the Marine Institute labs in Newport. Results to date indicate mean yellow eel age of 14 years, male silvers 11 years and female silvers 18 years.

Scotland

No information.

UK.M.5 Life stages

England and Wales

No information.

Northern Ireland

All life stages on Lough Neagh are studied. Glass eels and yellow eels are periodically examined from those systems listed previously and as part of NS Share work.

For Northern Ireland in general, no analysis of glass eel developmental stage is undertaken. The difference between yellow eel and silver eel is determined by gross morphology, aided by length and time of year and was originally under the guidance of senior fisheries scientists and in the company of experienced fishers.

Scotland

No information.

UK.M.6 Sex determinations

England and Wales

No information.

Northern Ireland

The correct gender assignment was originally under the guidance of senior fisheries scientists and is based on *in situ* macroscopic examination.

Scotland

No information.

UK.N Overview, conclusions and recommendations

Acknowledging the concerns regarding the quality of catch data from England and Wales, all UK indicators continue to suggest that natural recruitment of glass eels and elvers is much lower than the peaks of the late 1970s and early 1980s. Indicators of natural yellow and silver eel production suggest similar trends.

There have been few attempts to assess the stock status of eel populations throughout the UK to date, but research and monitoring is underway to address this in light of the requirements set out in the Eel Recovery Plan and associated Eel Management Plans.

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