Annual Assessment of Salmon Stocks and Fisheries in England and Wales 2006

Cefas

Environment Agency

Front cover images (clockwise from top left)

1 - Fish trap and counter on the River Lune.
2 - Unhooking a salmon before release.
3 - Seine netting.
4 - Leaping salmon.

Photographs courtesy of Environment Agency, Cefas and British Waterways.

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SALMON STOCKS AND FISHERIES IN ENGLAND AND WALES, 2006

Preliminary assessment prepared for ICES, April 2007

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FOREWORD

This is the tenth annual report on the state of salmon stocks in England and Wales prepared by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the Environment Agency. Each annual report is designed to stand alone, so that the reader does not need to refer to previous reports for background information. This means that much of the descriptive information is similar to that in reports for previous years.

The main purpose of the report is to provide information on the status of salmon stocks and fisheries in England and Wales to the International Council for the Exploration of the Seas (ICES), which is used, in turn, to provide advice to the North Atlantic Salmon Conservation Organisation (NASCO). An account of the way in which ICES uses the national data presented in this report to make an assessment of the status of salmon stocks is presented in Section 4.

The objectives of NASCO are to contribute to 'the conservation, restoration, enhancement and rational management of salmon stocks'. In particular, NASCO is responsible for negotiating the quotas for the salmon fisheries at West Greenland and Faroes. Annex 1 gives further information on NASCO and ICES.

The full list of information requested by NASCO from ICES for its annual meeting in 2007 is given at Annex 3. However, for this report, the pertinent requests relating to events in 2006 are to:

- *provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and production of farmed and ranched salmon;*
- *describe the key events of the 2006 fisheries and the status of the stocks;*
- *evaluate the effects of management measures introduced in recent years;*
- *provide age-specific stock conservation limits for all stocks; and*
- *provide a compilation of tag releases.*

NASCO has previously indicated that it would like the information on the fisheries to relate to *catches, gear, effort, composition and origin of the catch (including escapees and sea-ranched fish), and rates of exploitation*. These headings have, therefore, been used in the appropriate sections of the report.

Around 100 hard copies of this report have been disseminated to managers and fishermen so that this information is available to them at the earliest opportunity. A shorter summary report will be more widely circulated. Both reports are available as 'pdfs' on the Environment Agency and Cefas websites (see inside front cover). We would welcome any further comments or suggestions for improvements to the report. It must be noted that most of the data relating to 2006 are provisional and will not be finalised until complete catch data are obtained and records can be fully validated. In compiling the report, the previous year's data are routinely updated. Where corrections have been made to data from earlier years, this is indicated by a footnote. Final data for 2006 will be presented in the Environment Agency's annual publication of the Salmonid and Freshwater Fisheries Statistics, which will be published later in the year (e.g. Environment Agency, 2006).

A programme of Salmon Action Plans (SAPs) for the principal salmon rivers in England and Wales was finalised in April 2004; there are 64 SAP rivers (see Figure 1). SAPs are the means by which the Environment Agency aims to meet the objectives of its National Salmon Management Strategy (launched in 1996) at a local level. Each SAP is the result of responses to a Consultation Document that reviewed stock and fishery status, identified factors limiting these, and listed a series of costed options to address them. These were circulated to outside interests to seek their opinion and support for the plan. The Final Plan contains an agreed list of actions that the Environment Agency, in partnership with others, is committed to address in the five year lifetime of the plan. Progress against these actions is reviewed annually at both regional and national levels, but is not included in this report. The SAPs are now progressively being reviewed to ensure that they continue to match current circumstances and provide a realistic programme to address the issues facing each river.

The Environment Agency's National Salmon Management Strategy has set policy and guided delivery over the 10 years since its publication in 1996. There have been significant developments in this period, including publication of the Government-sponsored Salmon and Freshwater Fisheries Review in 2000, the Environment Agency's own salmon stock conservation review in 2004, and changes in the status of salmon stocks and in their regulation. The Environment Agency has now embarked on a review and expects to publish a new, revised Strategy by 2008.

An updated assessment of the effects of the Irish coastal fishery was produced in 2005. This reported that exploitation of salmon from north east England in the Irish fishery appeared to be negligible. Whilst exploitation on stocks from north west England and north Wales was low, levels increased further south in Wales and for rivers in south west and southern England. In 2006, the Irish Government announced that it has adopted the key recommendations of a report by its Independent Working Group on Salmon, the key implication of which is that coastal drift netting for salmon is expected to cease through a buy-out in 2007. It is anticipated that this change should mean that up to 5,000 more grilse may return to English and Welsh home-waters in 2007, representing a 4% increase overall. Rivers in the south and west of England and Wales are expected to benefit the most.

A new report outlining the key management objectives for salmon in England and Wales, and actions to address these, has been prepared: 'NASCO Implementation Plan for Salmon Management in the UK (England and Wales), 2006/07 to 2010/11'. This has been submitted to NASCO and will be reviewed at its annual meeting in 2007. Reports on progress with this plan will be submitted annually to NASCO (separate from this Annual Assessment) with an initial report being made in June 2007.

MAIN FEATURES OF REPORT FOR 2006

- The declared salmon catch by nets and fixed engines in 2006 was 50.5 t (13,578 fish), a decrease of 10.4 t on 2005 (60.9 t; 16,811 fish), and just under half the average catch of the last five years. A major factor in the reduction over recent years has been the buy-out of net licences in England and Wales, particularly in the north east coast drift net fishery in 2003.

- The provisional declared rod catch in 2006 (18,965 fish) was 89% of that in 2005 (21,418 fish). This may, in part at least, reflect low flows for most of the fishing season and relatively poor fishing conditions rather than reduced runs. Some 10,550 rod-caught salmon (56% of the catch) were released, the third highest number recorded.

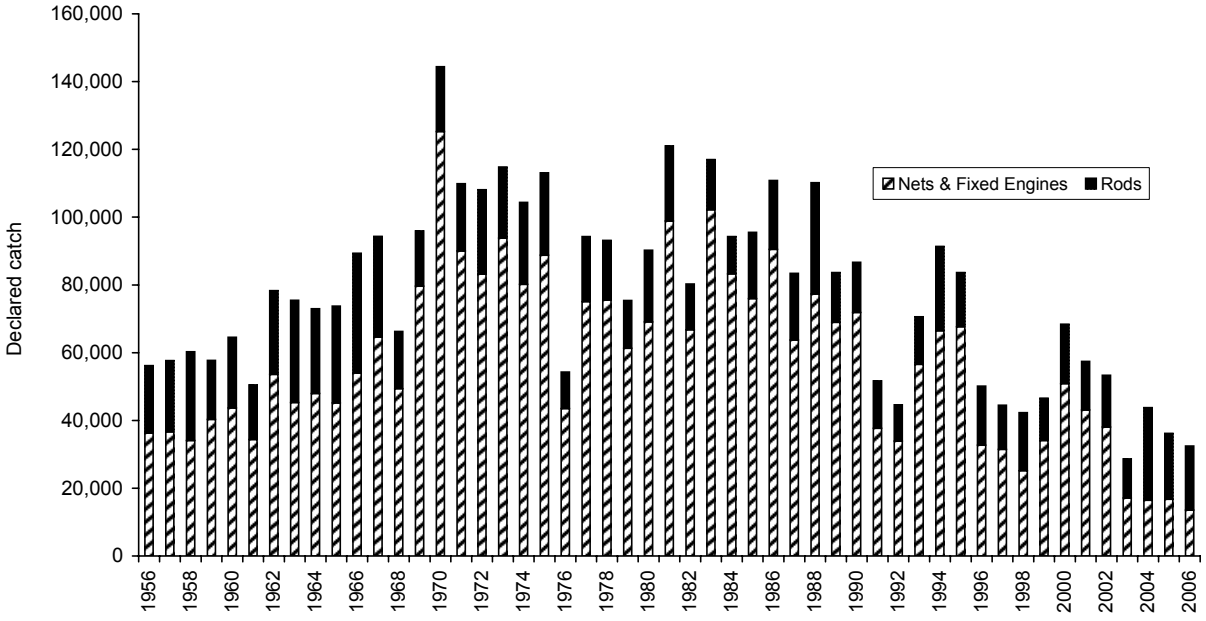
- Since the introduction of the national measures to protect spring salmon in 1999, anglers have been releasing a greater proportion of all fish caught, and of large salmon in particular.

- Rod catches of multi-sea-winter fish in 2006 were close to the 5-year (2001–2005) average, whilst grilse catches were 5% above the 5-year average.

- Adult counts and returning stock estimates over available time series show a recent increasing trend on some rivers (Tees, Tamar, Fowey, Lune and Kent), no substantive change in others (Dee, Test and Caldew), but a declining trend in others (Thames, Itchen and Frome).

- No salmon of possible fish farm origin were identified in catches taken by net and rod fisheries in England and Wales in 2006.

- Spawning escapement was estimated to be above the conservation limit in 59% of rivers in England and Wales in 2006. However, compliance assessments taking trends into account indicate only 11 rivers currently have a high probability (p >95%) of achieving their conservation limit in 2006, and that the majority of salmon stocks in England and Wales continue to be in a depleted state.



Declared catch of salmon by nets & fixed engines and rods (including released fish) in England and Wales, 1956–2006. The north east coast drift net partial buy-out occurred in 2003.

SUMMARY

This report presents a preliminary assessment of the state of salmon stocks and fisheries in England and Wales in 2006 to assist ICES in providing scientific advice to NASCO and to provide early feedback to fishery managers and anglers. The chief indicators of the state of salmon stocks are the catches taken by rod and net fisheries. The declared salmon catch for 2006 (including those fish released alive by anglers) is provisionally estimated at 121.0 t, representing about 32,500 fish, and comprising 50.5 t (~13,600 fish) by nets and fixed engines and 70.4 t (~19,000 fish) by rods. Of the rod caught fish, 10,550 were released alive (41.2 t), representing 56% of all the rod-caught fish by number. These figures do not take account of catches of salmon which go unreported (including those taken illegally), and it is estimated that there may have been a total of 25 t of additional fish caught in 2006.

Net catch

The declared net catch in England and Wales in 2006 was well below that in 2005 (down 19%); catches were below those in 2005 in all Regions, except the Anglian Region. Overall, catches in 2006 were about half the average of the previous five years. This largely reflects the partial buy-out of drift nets in the north east coast fishery in 2003, although there have also been recent substantial reductions in netting effort in the South West Region. In the north east net fishery, 16 licensees have fished in the years 2003 to 2006 compared with 69 in 2002. There has now been an 89% decline in the number of drift net licences in this fishery since a phase-out in the fishery commenced in 1993. However, catches taken by the drift net and T- and J-net fisheries in the North East Region still account for over 50% of the total catch taken by nets in England and Wales (56% in 2006). Nationally, the number of licensed nets and fixed engines fell by a further 7% in 2006.

The number of days/tides fished by netsmen in 2006 increased compared with 2005 in the North West Region, but fell in other Regions. Catch per unit of fishing effort (CPUE) for net fisheries in 2006 was below the 5-year mean (2001-2005) in all Regions, except the Midlands (River Severn), where there was a small increase. CPUE values for the North East and South West Regions and the north east coast drift nets were the lowest in the 10-year time series.

Rod catch

The number of salmon rod licences (annual and short term) issued in 2006 (27,102) was well below that in 2005 (down 20%) and the second lowest in the time series, the lowest being in 2001 when foot and mouth disease severely restricted access to many rivers for much of the season. The data presented in this report include many returns received as a result of the second reminder issued to licensees in February 2007. The number of days fished by anglers fell by 21% compared with the previous year, and was below the mean of the previous five years in all Regions apart from the North West, where it was marginally greater. The declared rod catch in 2006 (including released fish) fell by 11% compared with 2005; catches were below those in 2005 in all Regions except the South West. Catches were below the 5-year average in Wales and the Southern and South West Regions, but above average elsewhere. Overall, the provisional 2006 catch (18,965) was above the 5-year average and the third highest in the recent time series.

Over the last nine years, the declared annual rod catch has fluctuated between about 11,500 and 27,300 fish without any evident trend. Over this time, grilse catches have tended to alternate between relatively good and bad years. However, while rod catches of grilse in 2006 were lower than those in 2005 in all Regions, they remained above the recent 5-year mean and were the third highest in the time series. In general, rod catches of multi-sea-winter (MSW) salmon in 2006 were below the

recent 5-year average, going against the increasing trend over the period in all Regions except the South West and Wales, where they have remained relatively steady.

Stock status update

The reduction in rod fishing effort and generally poor angling conditions through most of the 2006 season make it difficult to draw general conclusions about current stock status from catches alone. The actual relationship between catch and stock abundance depends upon exploitation rates (i.e. the proportion of the salmon population taken in the catch - both retained fish and those released). This can be estimated where there is a fishery-independent measure of the salmon run, such as that obtained from fish counters. Data from counters and traps in England and Wales show that runs into freshwater in 2006 were above the recent 5-year mean in 5 of the 11 catchments for which data are available. Exploitation rates in 2006 were below the recent 5-year average on some of these rivers (e.g. Frome), but above average on others (e.g. Fowey, Kent and Lune).

While some stock indicators suggest improvements in recent years, the conservation limit (CL) compliance assessment (which takes trends in egg deposition into account) indicates that only 11 of the rivers across England and Wales had a high probability of achieving their CL in 2006, one more than in 2005. Ten rivers are also forecast to meet compliance in 2011. Over 40% of rivers (28) were assessed as having a high probability of failing to meet their CL in 2006, and 20 are also forecast to fail compliance in 2011. The remaining 25 rivers fall between a clear fail or pass in 2006; this rises to 34 rivers in 2011. The majority of salmon stocks in England and Wales thus remain in a depleted state.

Management measures

Viewed against historical data, current stock estimates and catches provide ongoing cause for concern and the conservation of salmon (especially early-run MSW fish) remains a priority. The number of licences issued for nets and fixed engines has continued to decline as a result of measures taken to reduce levels of exploitation and the declining commercial viability of some fisheries. Overall, the number of net licences has decreased by 64.2% between 1985 and 2006 as a result of reductions in netting effort in all parts of England and Wales.

Concerns about the decline in the numbers of MSW salmon and particularly those returning early in the year ('spring salmon') resulted in national measures being introduced in 1999, banning netsmen from killing and, in most cases, fishing for salmon before 1 June in England and Wales. These measures have reduced the proportion of the net catch taken before June from a 5-year average of 6.7% in the mid-1990's to 0.1%, on average, from 1999: all such fish are released.

A number of measures aimed at better management of this valuable resource have been implemented or strengthened in England and Wales in recent years. Several net fisheries are being (or have been) phased out because they exploit migratory salmonids returning to more than one river (i.e. mixed stock fisheries). The most important recent development was the buy-out of a substantial proportion of the north east coast drift net fishery, which has reduced the number of licensees from 69 in 2002 to 16 in the last four years. Additional reductions and buy-outs have been implemented in other Regions. Arrangements have also been made to reduce netting effort in some fisheries by either compensating netsmen not to fish for a particular period, or through voluntary agreement to return salmon alive.

As with the net fisheries, national measures to safeguard spring salmon were introduced for rod fisheries in 1999 and continued through 2006. These banned the killing of salmon caught by anglers prior to 16 June and restricted the methods that they could use at this time to artificial flies or lures. The

proportion of the rod catch taken before June fell from a mean of 11% over the period 1994–1998 to around 6% in 1999–2006, and these fish are now required to be released. Non-statutory restrictions on methods and fishing areas imposed by fishery owners and angling associations include weekly and seasonal bag limits, and there is a continued emphasis on encouraging anglers to return rod-caught fish. As a consequence, the proportion of salmon released by anglers has increased steadily from 10% in 1993 to around 50% in the last five years. In 2005, a national campaign was undertaken aimed at increasing voluntary release rates and providing guidance on best practice, and efforts to promote catch and release have continued in 2006. A salmon stock conservation review also identified rivers where voluntary release rates should be increased to protect and enhance stocks. The overall level of catch and release in 2005 and 2006 was 56%, with larger increases in a number of the rivers identified by the review. Tracking studies suggest that, if handled appropriately, the majority (~85%) of released salmon can go on to spawn successfully.

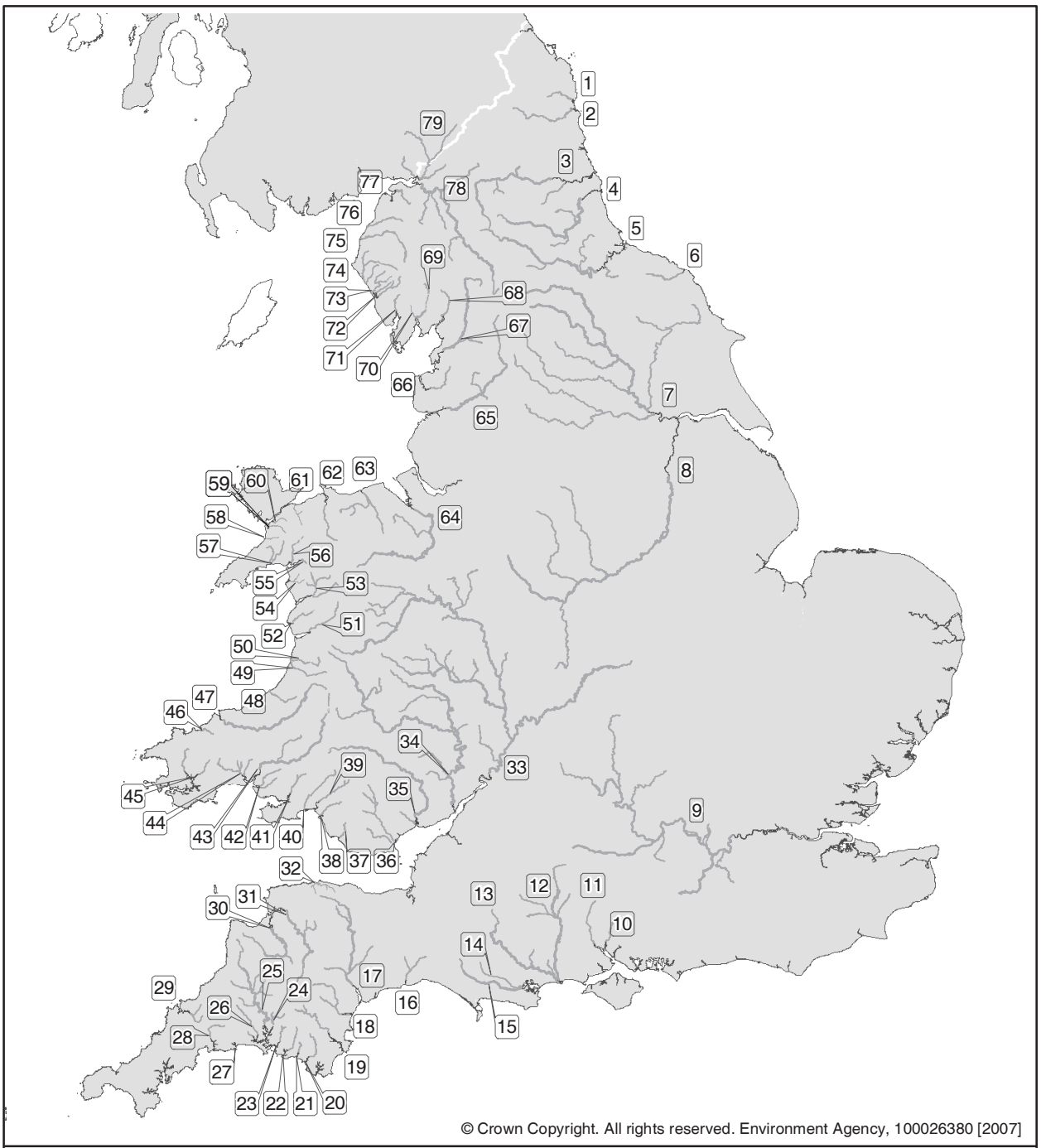
Other, non-regulatory, factors may also have contributed to changes in catches and exploitation rates in 2006. River flow is a key factor affecting angler success; the monthly flows for 13 monitored rivers in England and Wales showed that flows on most rivers were above the long-term average between March and May, being particularly high in May, but nearly all rivers were well below the long-term average between June and September. July 2006 was the hottest on record in England & Wales, when water temperatures of 25 to 26°C were recorded in a few locations. This is above the upper lethal limit for salmon. Flows generally increased again in October and were above the long-term average in November and December. Thus conditions for salmon angling in summer 2006 were generally regarded as poor, with better angling conditions largely confined to the start and end of the season.

National overview

The ICES North Atlantic Salmon Working Group makes an annual assessment of the status of national stocks in the Northeast Atlantic (NEAC) area as a basis for advising managers. The pre-fishery abundance (PFA) of salmon for each country (defined as the number of salmon alive in the sea on January 1 in the first sea winter) is estimated. A description of the assessment process and the latest national assessment for stocks in England and Wales is included in this report (Section 4).

The NEAC PFA model endeavours to provide an interpretation of what the available catch and effort data may tell us about changes in the status of the total national stock of salmon over the past three decades. The model output suggests that, for salmon from rivers in England and Wales, the overall PFA has declined by over 60% from the 1970s to the present time. The majority of this decline has been in the non-maturing (i.e. potential MSW) component of the PFA, which is thought to have declined by over 70%, whilst the maturing (i.e. potential grilse) component has declined by about 40%. It should be noted that these trends mask conflicting changes in individual river stocks. Many rivers have experienced more serious declines but these are obscured by the very substantial improvements in others. The results also suggest that there was a marked decline in PFA around 1990, which is consistent with the general perception of a decrease in the marine survival for many stocks around the North Atlantic at this time.

The estimated number of salmon returning to England and Wales and the total spawning escapement show similar trends to the PFA, although the declines are less marked due to the reductions in net exploitation both in distant water and homewater fisheries, and in rod fisheries. Thus, numbers of returning fish are estimated to have declined by around 45% between the 1970s and the present time, and the spawning escapement by about 25%. However, as with the PFA, the decline in MSW components has been much greater than that of the 1SW (grilse) components. There was a slight improvement in numbers of returning fish and spawners in 2000 and 2001, but the general trend has been downward since the late 1980s.



1 Aln
2 Coquet*
3 Tyne*
4 Wear*
5 Tees*
6 Esk (Yorkshire)*
7 Ouse
8 Trent
9 Thames*
10 Itchen*$
11 Test*
12 Avon (Hants)*$
13 Stour (Dorset)*
14 Piddle*
15 Frome*
16 Axe*
17 Exe*
18 Teign*$
19 Dart*$
20 Avon (Devon)*
21 Erme*$
22 Yealm*$
23 Plym*
24 Tavy*$
25 Tamar*
26 Lynher*
27 Looe
28 Fowey*
29 Camel*$
30 Torridge*
31 Taw*$
32 Lyn*
33 Severn*
34 Wye*$
35 Usk*$
36 Taff*
37 Ogmore*
38 Afan*
39 Neath
40 Tawe*
41 Loughor*
42 Gwendraeth Fawr
43 Tywi*
44 Taf*
45 E & W Cleddau*
46 Nevern*
47 Teifi*$
48 Aeron
49 Ystwyth
50 Rheidol*
51 Dyfi*
52 Dysynni*
53 Mawddach*$ & Wnion*
54 Artro
55 Dwyryd*
56 Glaslyn*
57 Dwyfach & Dwyfawr*
58 Llyfni
59 Gwyrfai$
60 Seiont*
61 Ogwen*
62 Conwy*
63 Clwyd*
64 Dee*$
65 Ribble*
66 Wyre*
67 Lune*
68 Kent*
69 Leven*
70 Crake*
71 Duddon*
72 Esk (Cumbria)*
73 Irt*
74 Ehen & Calder*$
75 Derwent*$
76 Ellen
77 Wampool
78 Eden*$
79 Esk (Border)*

** River with Salmon Action Plan; $ River designated as a Special Area of Conservation*

Figure 1. Main salmon rivers in England and Wales

REPORT ON SALMON FISHERIES IN 2006

1. Gear and fishing effort

1.1 Gear

Salmon are caught in a variety of nets and traps around the coasts of England and Wales. These comprise: gill nets, including drift, trammel and coracle nets; sweep nets, such as seine (draft, draw and wade) nets; fixed engines, which include T-nets, J-nets, stop (compass) nets, putcher ranks, traps and cribs (coops); and hand-held nets, which include haaf (heave) and lave (dip) nets. Brief descriptions of all these nets and fixed engines are given in Annex 4. The principal salmon rivers for which data are presented in this report are shown in Figure 1, and the types of gear used in each net fishery operating in 2006 are listed in Table 1.

There were no substantial changes in the types of gear used to capture salmon in England and Wales in 2006.

1.2 Effort

The restrictions on fishing introduced in England and Wales in 1999 to protect early-running 'spring' MSW salmon remained in force in 2006. Details of the restrictions imposed on net and rod fisheries are provided in Sections 1.2.1 and 1.2.2, respectively.

Levels of exploitation of migratory salmonids by both rods and nets in England and Wales are regulated by byelaws controlling the fishing gear that may be used, and where and when fishing may take place. Separate licences are required to use rods and nets. There is no restriction on the number of rod licences that may be issued, but the numbers of licences in most net fisheries are subject to Net Limitation Orders (NLOs) that limit the number and types of nets that can legally operate, as noted in Table 1. A NLO is time limited and must be reviewed within 10 years from the time it was introduced.

The regulatory measures provide an overall limit on the 'allowable' fishing effort. The single most important recent change was the north east coast partial buy-out in 2003, in which 52 of the 69 licensees using drift nets along the coast of Northumberland and Yorkshire in 2002 were compensated for relinquishing their right to fish from 2003 onwards, in perpetuity. In 2004, 23 seine net licensees were bought out on the Rivers Tamar, Lynher and Tavy in south west England. In addition to these restrictions, there will be annual variations in the amount that both netsmen and anglers actually fish (the 'utilised' effort), due to weather conditions, perceptions about the numbers of fish returning, and other factors. Netting effort has probably also been affected by the price of salmon, which has decreased in real terms over the past two decades due to the rapid expansion in the production of farmed salmon, and the increased costs of net licences, fuel and fishing gear. However, in recent years the limited availability of wild salmon appears to have enhanced their market value once more, with fish commanding a premium price. Changes in costs and the imposition of compulsory catch-and-release may also have affected the take-up of rod licences and angling effort.

For rod fisheries, river flow is a key factor affecting angler effort. Figure 2 shows the monthly river flows for 13 rivers in England and Wales for 2006, expressed as a percentage of the long-term average for the same month. Overall, flows on most rivers were above the long-term average between March and May, being particularly high in May, when parts of England and Wales had double the normal monthly rainfall. However, nearly all rivers were well below the long-term average between June and September. July 2006 was the hottest on record in England & Wales, when water temperatures

Table 1. Allowable and utilised effort for the principal salmon net fisheries in England and Wales in 2006

Region	River/ Fishery	Method	No. lics	NLO	Days available *	Allowable effort net days **	Utilised effort net days	Utilised effort net tides	% days utilised #	Av. day/lic.
NE	N Coastal (N)	Drift & T	5	X	114	570 }				
	N Coastal (N)	Drift	5	X	66	330 }	1,132		30	37
	N Coastal (N) [1]	T	21	25	114	2,850 }				
	N Coastal (S)	Drift	4	X	66	264	212		80	53
	N Coastal (S) [1]	T	1	1	114	114	23		20	23
	Y Coastal	Drift	2	X	66	132	83		63	42
	Y Coastal [1]	T or J	28	50	114	5,700	707		12	25
	NE Region		**66**			**9,960**	**2,157**		**22**	
SW	Avon & Stour	Seine	4	4	52	208		153	53	27
	Poole Harbour	Seine	1	1	52	52		42	58	30
	Exe	Seine	11	11	64	704		187	19	12
	Teign [1]	Seine	3	3	119	357		75	15	18
	Dart [1]	Seine	3	3	133	399		129	23	31
	Camel [2]	Drift	7	7	26	182		2	1	0
	Fowey [1,3]	Seine	2	2	66	132		33	18	12
	Taw/Torridge	Seine	3	X	52	156		93	43	22
	SW Region		**34**			**2,190**		**714**	**19**	
Midlands	Severn	Putchers	5		76	380	368		97	
	Severn	Seine	3	4	78	312		38	9	9
	Severn	Lave	21		78	1,638		530	23	18
	Midlands region		**29**			**2,330**	**368**	**568**	**33**	
Wales	Wye	Lave	7		78	546		206	27	21
	Tywi [1]	Seine	8	9	131	1,179		375	23	33
	Tywi [1]	Coracles	5	12	131	1,572		223	10	32
	Taf	Coracles	1	1	131	131		30	16	21
	Taf	Wade	1	1	131	131		14	8	10
	E/W Cleddau	Compass	6	6	78	468		109	17	13
	Nevern [1]	Seine	0	1	131	131		0	0	0
	Teifi [1]	Seine	1	4	131	524		87	12	62
	Teifi [1]	Coracles	7	12	131	1,572		184	8	19
	Dyfi [1]	Seine	2	3	131	393		67	12	24
	Dysynni	Seine	1	1	131	131		3	2	5
	Mawddach	Seine	2	3	78	234		86	26	31
	Conwy	Seine	2	3	78	234		56	17	20
	Conwy	Basket	1		92	92		0	0	0
	Dee	Trammel	3	X	53	159		144	65	34
	Dee	Seine	9	X	53	477		291	44	23
	Welsh Region		**56**			**7,974**		**1,875**	**17**	
NW	Ribble	Drift	6	6	78	468		177	27	21
	Lune	Haaf	12	12	78	936		891	68	53
	Lune	Drift	7	7	78	546		287	38	29
	Lune	Seine	1	0	78	78		45	41	32
	Kent	Lave	8	8	78	624		98	11	9
	Leven	Lave	3	0	53	159		120	54	29
	Eden & Esk	Haaf	96	155	87	13,485		4,512	24	34
	Eden & Esk	Coops	3		87	261		0	0	0
	NW Region		**136**			**16,557**		**6,130**	**26**	

Notes: *National spring salmon byelaws apply - all net fisheries closed until June 1.*
(Note several sea trout fisheries exempted from byelaws, but all salmon caught before June 1 to be returned).
NLO refers to number of nets allowed under the terms of the net limitation order for that fishery.
In calculating the days available, any day, or part day, on which fishing has been allowed is included.
For fisheries in which utilised effort is recorded in terms of tides fished (Wales, Midlands, SW and NW Regions) the proportion of the available effort used has been estimated by assuming that an average of 1.4 tides have been fished per day.

Key: * *Days available have been adjusted to take account of partial buy-off arrangements.*
** *Allowable effort is calculated by multiplying the days available by the number of nets permitted under the NLO, except where the number of licences exceeds the NLO, in which case the higher figure is used.*
\# *Expressed as days utilised (i.e. tide data x 1.4).*
X Denotes reducing NLO - fishery being phased out as existing licensees leave the fishery.
[1] *Sea trout fisheries - exempted from national spring salmon byelaws (all salmon caught before 1 June to be released).*
[2] *Buy-off 1 July to 31 August.*
[3] *Buy-off 2 March to 15 June.*

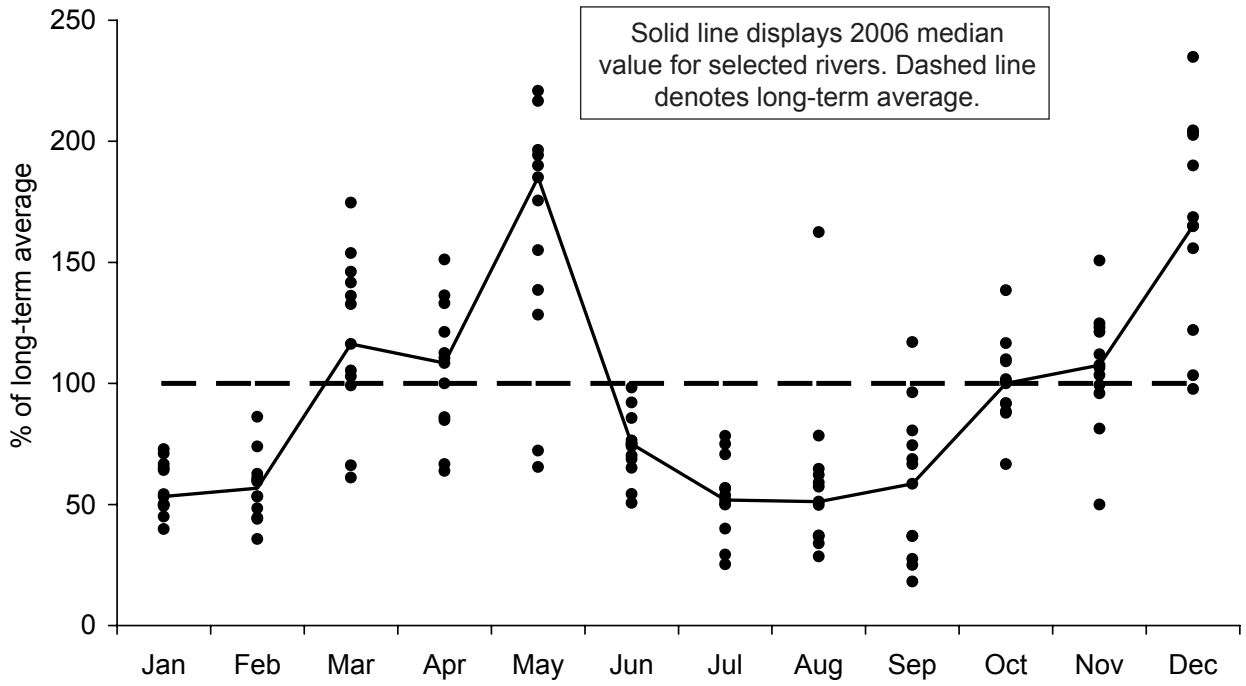


Figure 2. Monthly mean river flows (cubic metres per second) in 2006 for 13 rivers (South Tyne, Tees, Itchen, Avon, Exe, Taw, Severn, Wye, Cynon, Teifi, Dee, Lune and Eden) in England and Wales, expressed as a percentage of the long-term average for the same month. (Data supplied by Centre for Ecology and Hydrology). The long-term average is calculated for the available time series, which varies from river to river, but is in the range of 25–40 years.

of 25 to 26°C were recorded in a few locations. This is above the upper lethal limit for salmon (e.g. Danie *et al*., 1984). Fishing was suspended on the Hampshire Avon from mid July to mid August in response to the high temperatures. Flows generally increased again in October and were above the long-term average in November and December. Thus conditions for salmon angling in summer 2006 were generally regarded as poor, with better angling conditions largely confined to the start and end of the season.

On some rivers, releases were arranged to facilitate fish movement and improve water quality. For example, there were releases from Kielder Reservoir (River Tyne), where 191 dead fish were removed from the estuary between mid July and early September. In addition, there were releases from Roadford Reservoir (River Tamar), Llyn Brianne Reservoir (River Tywi) and Llys-y-Fran Reservoir (Eastern Cleddau River) in response to concerns about low flows and reduced oxygen levels. There were no reports of fish mortalities other than those on the Tyne, although throughout the summer and autumn there were reports from many parts of England and Wales of returning adult salmon with swollen and/or bleeding vents (further details in Section 2.4). Rain in October provided more favourable conditions for fish migration and led to an increase in rod catches.

Conditions for salmon angling in summer 2006 were generally poor and likely to have resulted in both decreased effort (rod-days fished in 2006 were the second lowest in the time series, Table 4) and exploitation. Therefore, the use of rod catch as a measure of salmon abundance may not provide an accurate indication of stock size and, by itself, is likely to under-estimate salmon numbers.

1.2.1 Allowable effort in net fisheries

The various fishing gears used to catch salmon in England and Wales have been grouped into broad categories based on their method of capture (see definitions in the footnote to Table 2 and descriptions in Annex 4). Since 1985, there has been a steady decline in the numbers of licences issued for gill nets, sweep nets and hand-held nets and, since 1990, for fixed engines, as a result of measures taken to reduce levels of exploitation (especially in mixed stock fisheries, see Section 2.1.3) and the declining commercial viability of some fisheries. The total number of licences issued decreased by 7.0% in 2006 (Table 2 and Figure 3), the largest reductions being for seine nets fished in the South West (Rivers Dart and Teign) and gill (coracle) nets on the River Teifi in Wales. Overall, the number of net licences issued has decreased by 64.2% between 1985 and 2006.

The national measures to safeguard spring salmon, introduced in 1999, continued to apply in 2006. Under these measures, netsmen are banned from killing, and in most cases fishing for, salmon before 1 June. There are derogations that allow fishing in some areas where netting is predominantly for sea trout, on the basis that any salmon caught are returned alive (see Table 1).

A number of net fisheries in England and Wales are being (or have been) phased out because they exploit migratory salmonids returning to more than one river (i.e. mixed stock fisheries). Licence numbers are being reduced as fishermen retire from the fishery. The phase out of the north east coast drift net fishery was accelerated by a compensation scheme (details in Section 2.1.3). Progress with those phase-outs that were incomplete in 2006 is summarised in the text table below:

Fishery	Netting method	Start of phase out	Number of nets: before start	in 2006	Reduction
North East Coast	drift nets	1993	142	16	89%
Anglian Coast	coastal nets	1996	59	36	39%
River Taw/Torridge	seine nets	2002	14	3	79%

In 2006, all seine nets operating in the joint estuary of the rivers Lynher, Tavy and Tamar in south west England continued to be subject to a 10 year buy-out. Further 10-year reductions in effort were negotiated for two other rivers in south west England, the Dart and Teign, where the number of seine net licences was reduced to 3 on each river from 13 and 6, respectively. These reductions were facilitated by compensation payments to the netsmen. Netting effort was also reduced on the River Dee (North Wales), where a phase out was introduced for both the trammel and seine net fisheries in late 2004. In 2006, compensation payments were agreed with four fishermen, resulting in the number of licences being reduced to 3 trammel and 9 seine nets. Further reductions have been agreed for 2007.

Table 2. Numbers of rod licences (1994–2006), and net and fixed engine licences (1983–2006) issued in England and Wales

Year	Rod licences		Gear Type					Total net licences
	Short-term	Annual	Gill	Sweep	Hand-held	Fixed Engines	Combined drift/T net #	
1983			232	209	333	74	75	848
1984			226	223	354	74	75	877
1985			223	230	375	69	75	897
1986			220	221	368	64	75	873
1987			213	206	352	68	75	839
1988			210	212	284	70	75	776
1989			201	199	282	75	75	757
1990			200	204	292	69	75	765
1991			199	187	264	66	75	716
1992			203	158	267	65	75	693
1993			187	151	259	55	36	652
1994	10,637	26,641	177	158	257	53	30	645
1995	9,992	24,949	163	156	249	47	29	615
1996	12,508	22,773	151	132	232	42	29	557
1997	11,640	21,146	139	131	231	35	27	536
1998	11,364	21,161	130	129	196	35	26	490
1999	10,709	18,423	120	109	178	30	26	437
2000	10,916	19,223	110	103	158	32	25	403
2001	9,434	14,916	113	99	143	33	24	388
2002	10,039	19,368	113	94	147	32	24	386
2003	8,683	21,253	58	96	160	57	5	371
2004	10,628	22,138	57	75	157	65	5	354
2005	10,170	23,870	59	73	148	65	5	345
2006*	**8,637**	**18,465**	**52**	**57**	**147**	**65**	**5**	**321**

Notes: Rod short-term licences are for 1 or 8 days; annual licences are valid from the date of issue to 31 March following.
Gill nets include: drift, trammel, sling and coracle nets.
Sweep nets include: seine (draft and draw) and wade nets.
Hand-held nets include: haaf/heave and lave/dip nets.
Fixed engines include: T-nets, J-nets, stop (compass) nets, putcher ranks, traps, weirs and cribs (coops).
East Anglian coastal nets are not included, as they are targeted primarily at sea trout and catch few salmon.
Key: # Combined drift/T net licences (issued in Northumbria (Northern area)) have been included in the gill net totals.
** Provisional*

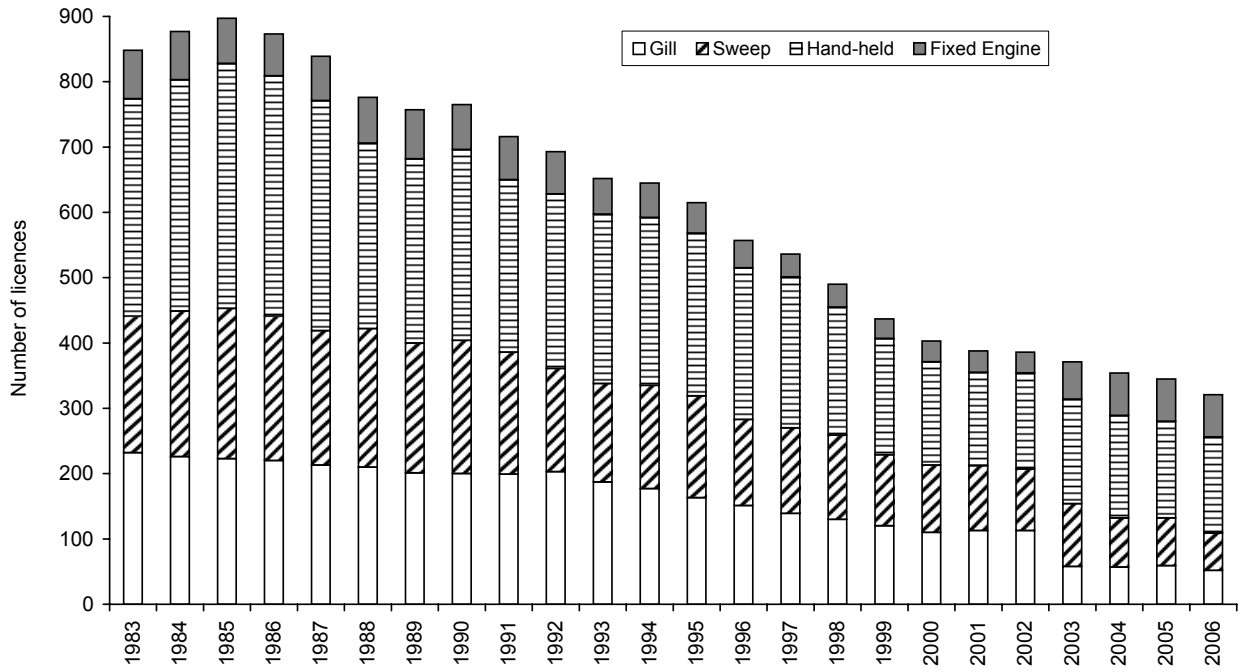


Figure 3. Numbers of salmon net and fixed engine licences issued in England and Wales, 1983–2006. Note that the 2006 data are provisional

Arrangements were made to reduce netting effort in the following fisheries in 2006, principally by agreement to release fish alive or by compensating netsmen not to fish for the periods shown below:

River/ Fishery	Method	Period without netting (starting year) (*full season in parentheses*)	Brokers/ Funding agency
Tavy	seine nets	complete season (commenced 2004) (*1 June–31 August*)	South West Water plc, English Nature, Maristowe Estate, Lynher River Association, and Tamar & Tributaries Fisheries Association (10-year buy out)
Tamar	seine nets	complete season (commenced 2004) (*1 June–31 August*)	
Lynher	seine nets	complete season (commenced 2004) (*1 June–31 August*)	
Fowey	seine nets	2 March–15 June (*2 March–31 August*) (Varying measures have applied on the above rivers since 1997)	South West Water plc
Camel	drift nets	1 August–31 August (commenced 2002) (*1 June–31 August*)	Environment Agency
Dart	seine nets (10)	complete season (commenced 2006) (*15 March–14 August*)	Local fisheries interests
Teign	seine nets (3)	complete season (commenced 2006) (*15 March–31 August*)	Local fisheries interests
Lyn	fish trap	complete season (in perpetuity) (commenced 2003) (*1 June–31 August*)	Environment Agency
Avon and Stour (Christchurch Harbour)	seine nets	All salmon caught to be released (scheme operating since 1997) (*1 June–31 July*)	Environment Agency[1]
Dee	seine nets (3)	complete season (commenced 2006) (*1 June–31 August*)	Dee Fishery Association
Dee	trammel nets (1)	complete season (commenced 2006) (*1 June–31 August*)	Dee Fishery Association

Notes: National byelaw - salmon season start delayed until 1 June from 2000.
Fowey buy-off - fishing from 2 March to 31 May for sea trout only.
Dart & Teign buy-off - fishing from 15 March to 31 May for sea trout only.
[1] Voluntary agreement - no compensation payments.

There have thus been substantial reductions in net fisheries in England and Wales over the past 10 to 15 years as a result of various controls and restrictions; details are summarised in Tables 3a and 3b.

1.2.2 Allowable effort in rod fisheries

The national measures to safeguard spring salmon, introduced in 1999, continued to apply in 2006. These ban the killing of salmon caught by anglers prior to 16 June and restrict the methods that they can use at this time to artificial flies or lures. The measures were introduced in response to a widespread decline in stocks of early-running multi-sea-winter (MSW) salmon. It was determined that exploitation of this stock needed to be significantly reduced. Mandatory catch and release was imposed for rod fisheries as an alternative to the closure of fisheries in the early part of the fishing season, aiming to allow continued fishing with minimal loss of stock. In 1998, the reported proportion of salmon released by anglers was 31% (Table 9 below). This rose to 44% in 1999 (including the spring salmon that have to be released by byelaw) and is now 56%.

No other statutory effort restrictions were imposed on rod fisheries in 2006, although byelaws enacted in 2005 enabled some rivers and beats in north Wales to remain open until later in the year. Catch and release (C&R) remained mandatory after 17 October on these rivers. A new season extension was also introduced on the River Seiont in 2006 (extended to 15 November); 10 salmon were caught during this period. The fishing season was once again extended on the River Exe in Devon from 30 September to 14 October. Fishing at this time (an additional catch of 83 salmon) was restricted to fly only, with mandatory C&R. In 1997, the length of the fishing season for salmon and sea trout on the rivers Tywi, Taf and the Eastern & Western Cleddau was shortened to protect vulnerable fish stocks. The end of the season was extended by 10 days in 2005, from 7 to 17 October, during which time anglers were required to return all their catch to the river; 60 fish were caught in this period in 2006, the same as in 2005.

A C&R byelaw introduced in June 2003 for the Rivers Leven and Crake upstream of the Leven viaduct near Ulverston, continued in 2006. New byelaws came into force on the River Wye on 1 September 2003 (expire 31 December 2008), which delayed the start of the salmon season until 3 March (from 26 January), allowed spinning from the opening day until 31 August, and banned bait fishing at all times.

Non-statutory restrictions on methods and fishing areas are known to be imposed by some fishery owners and angling associations, but there is no national record of these. For example, anglers on a number of the southern chalkstream rivers are encouraged to return all rod-caught fish. One of the main rod fisheries on the River Test also imposed a ban on fishing with shrimp and prawn in 2006. Anglers on the Rivers Frome and Piddle were again urged to increase their levels of C&R, failing which a byelaw would be considered necessary. Fishery owners on these rivers were also asked to stop worming on their waters and to make C&R compulsory in their Fishery Association rules. In 2006, almost all the fish caught on these rivers were released (>96%). In Cornwall, the use of circle hooks is being promoted on the Rivers Camel and Fowey, where worm fishing has been responsible for the capture of a high proportion of the salmon rod catch. Fisheries Associations on the two rivers have introduced rules requiring the use of circle hooks from 30 September to the end of the season (15 December).

Table 3(a). Number of licences issued each year under phase outs (reducing NLOs to zero) and closures for net fisheries in England and Wales, 1992–2006

Fishery	Phase Outs																	Closures **		
	NE Coast drift	Anglian coastal	SW Wales coast wade & seine	R. Ogwen seine	R. Seiont seine	R. Clwyd sling	R. Llyfni seine	R. Dwyfawr seine	R. Usk drift	SW Cumbria drift	R. Lune seine	Taw/Torridge seine	R. Tamar seine	R. Lynher seine	R. Tavy seine	R. Dee trammel	R. Dee seine	R. Duddon seine	S. Caern seine	N. Anglesey seine
Commenced	1993	1996	1997	1997	1997	1997	1997	1997	1997	1998	2000	2002	2004	2004	2004	2005	2005			
NLO at start	142	65	1	2	4	2	1	2	8	4	1	14	15	5	1	4	16			
Year																				
1992	142	129	17	2	2	2	0	2	8	4	1	0	14	5	4	4	13	2	0	0
1993	124	93	11	1	1	3	0	2	8	4	1	0	14	5	4	4	21	1	0	0
1994	114	72	16	2	2	2	0	2	8	4	1	0	14	5	5	4	18	0	0	0
1995	99	65	9	2	1	2	0	2	8	4	1	0	14	5	5	4	14	0	0	0
1996	89	59	0	2	1	2	1	2	8	4	1	12	14	5	4	4	14	0	0	0
1997	81	56	1	2	1	2	0	2	8	4	1	14	14	5	5	4	15	0	0	0
1998	75	54	**0**	2	**0**	**0** *	**0**	1	8	4	1	14	15	5	5	4	14	0	0	0
1999	72	54		2				1	8	1	1	14	14	5	4	4	12	0	0	0
2000	71	46		1				**0**	**0** *	1	1	14	14	5	4	4	10	0	0	0
2001	70	46		**0**						1	1	14	14	5	4	4	8	0	0	0
2002	69	46								1	1	3 *	14	5	4	4	12	0	0	0
2003	16 *	45								1	1	3	14	5	4	4	12	#	0	0
2004	16	40	#	#	#	#	#	#	#	**0**	1	3	**0** *	**0** *	**0** *	4	11		#	#
2005	16	39								#	1	3				4	13			
2006	16	36									1	3				3 *	9 *			

Note: Bold text denotes target reached.
*Key: * Phase out accelerated by full or partial buy-out.*
 # Denotes fishery closed by byelaw.
*** Fisheries have not operated for a number of years, now formally closed through byelaw.*

Table 3(b). Other measures affecting net fisheries introduced in England and Wales, 1993–2006

Year	Full or part season buy-offs in place	Other measures
1993	1 fishery: Taw & Torridge seine nets	Itchen seine net fished for scientific purposes only - all fish released
1994	1 fishery: Taw & Torridge seine nets	Itchen seine net fished for scientific purposes only - all fish released
1995	1 fishery: Taw & Torridge seine nets	Reduced netting season (delayed start) in Wye, Usk & Dee fisheries
1996		New net licence fees resulted in reduced 'take up' of licences Some fisheries in SW Wales closed due to Sea Empess oil spill
1997	4 fisheries: Tavy, Tamar, Lynher and Fowey (all seine nets)	Reduced netting season (earlier close) in Tywi & Taf fisheries Avon & Stour (seine nets) - fish released alive.
1998	6 fisheries: Tavy, Tamar, Lynher, Exe & Fowey (seine nets) & Cumbrian coast (drift net)	Reduced netting season (delayed start) on Taw & Torridge seine net fishery. Avon & Stour (seine nets) - fish released alive.
1999	6 fisheries: Tavy, Tamar, Lynher, Exe & Fowey (seine nets) & Cumbrian coast (drift net)	National measures introduced - all net fisheries banned from taking, and in most cases fishing for, salmon before 1 June. Reduced netting season (delayed start) on Taw & Torridge seine net fishery. Avon & Stour (seine nets) - fish released alive.
2000	8 fisheries: Tavy, Tamar, Lynher & Fowey (seine nets), Cumbrian coast & Usk (drift nets), Usk & Wye (fixed engines)	New net licence fees resulted in reduced 'take up' of licences Avon & Stour (seine nets) - fish released alive.
2001	8 fisheries: Tavy, Tamar, Lynher & Fowey (seine nets), Cumbrian coast & Usk (drift nets), Usk & Wye (fixed engines).	Avon & Stour (seine nets) - fish released alive.
2002	9 fisheries: Tavy, Tamar, Lynher & Fowey (seine nets), Camel, Cumbrian coast & Usk (drift nets), Usk & Wye (fixed engines)	Avon & Stour (seine nets) - fish released alive.
2003	10 fisheries: Tavy, Tamar, Lynher & Fowey (seine nets), Camel, Cumbrian coast & Usk (drift nets), Usk, Wye & Lyn (fixed engines)	Avon & Stour (seine nets) - fish released alive. Leven lave nets - delayed start of season to 1 July.
2004	11 fisheries: Tavy, Tamar, Lynher & Fowey (seine nets), Camel, Cumbrian coast & Usk (drift nets), Usk, Wye, Lyn & Severn (1) (fixed engines)	Avon & Stour (seine nets) - fish released alive. Leven lave nets - delayed start of season to 1 July.
2005	7 fisheries: Tavy, Tamar, Lynher & Fowey (seine nets), Camel & Ribble (drift nets), Lyn (fixed engine)	Avon & Stour (seine nets) - fish released alive. Leven lave nets - delayed start of season to 1 July.
2006	10 fisheries: Tavy, Tamar, Lynher, Fowey, Dart, Teign, Dee (seine nets), Camel (drift nets), Dee (trammel nets) & Lyn (fixed engine)	Avon & Stour (seine nets) - fish released alive. Leven lave nets - delayed start of season to 1 July

1.2.3 Utilised effort in net fisheries

Table 1 presents data on utilised effort for salmon net fisheries in England and Wales in 2006. The national net catch return system introduced in 2001 in all Regions, except the North East, required netsmen to report catch and effort data monthly according to the number of tides fished (catch and effort data were already being collected in the North East Region). This represented a change in effort reporting procedures for the South West Region (previously, days fished). Reporting rates for net fisheries have been at, or close to, 100% in all Regions for many years. Consequently, the effort data for the nets and fixed engines presented in this report are not expected to change significantly due to late returns. In comparison with 2005, there was a decrease in the numbers of days/tides fished in 2006 in the North East (down 3%), South West (down 39%), Midlands (down 23%) and Welsh (down 33%) Regions, and an increase in the number of days/tides fished in the North West Region (up 4%).

As in previous years, the proportion of the allowable effort that was utilised in 2006 varied considerably between fisheries and was highest on average for the Midlands Region (33%) and lowest for Wales (17%). It is virtually impossible for most fisheries to utilise 100% of the allowable effort due to factors such as weather conditions, tide heights and availability of fishing stations. In the north east coast fishery, for example, it has been suggested that no more than about 75% of the allowable effort could be used in the summer months under typical weather conditions (Anon., 1997).

1.2.4 Utilised effort in rod fisheries

The numbers of licences purchased each year for salmon and migratory trout angling (annual and short-term) between 1994 and 2006 are shown in Table 2. No comparable data are available for earlier years because of changes in licensing arrangements. The total number of rod licences issued decreased from ~37k in 1994 to ~24k in 2000 (down 35%), but then increased progressively to 2005 (34k). However, there was a marked downturn in licence sales in 2006, with numbers falling to ~27k, the second lowest in the time series (licence sales were particularly low in 2001 due to the restrictions on access to many rivers). These changes have largely been driven by fluctuations in the number of annual licences issued; the sale of short-term (one day and eight day) licences has remained relatively stable over the period. The earlier reduction in the number of annual licences is thought to have been influenced by the decline in salmon stocks and by the introduction of restrictions on angling, especially those to protect early-run MSW fish. The more recent increase in annual licences is believed to reflect Environment Agency efforts to promote angling and to reduce levels of licence evasion through targeted enforcement efforts. The downturn in 2006 probably reflects the particularly hot and dry summer months and the resulting unfavourable conditions for angling.

Rod licensing has been enforced throughout the Border Esk catchment, including those parts of the catchment lying in Scotland, since April 2005, improving the accuracy of Environment Agency catch returns from this river.

The Environment Agency maintains a national rod licence database for England and Wales. In order to maximise the quantity and quality of catch returns received, reminders are issued to as many anglers as possible in November, soon after most rod fisheries have closed. In 2001, various improvements to these procedures were made, reflecting NASCO's resolution to reduce the level of unreported catch: a more complete list of anglers was available in November; a second reminder was issued, some 10 weeks after the first, to anglers who had failed to send in a return (in previous years only a single reminder was issued). These procedures continued to apply in 2006, and a second reminder was issued at the beginning of February 2007. In addition, rod licences have been issued electronically by the Post Offices since 2005, which has resulted in a more up-to-date and accurate database for issuing reminders. Therefore, a higher proportion of anglers will have received a reminder.

The percentage of salmon rod licence holders making a catch return, by licence type, 1998–2006 are presented in the text table below:

Year	Licence Type	
	Annual (Full & concessionary)	Short-term (1 & 8 day)
1998	78	51
1999	76	53
2000	71	53
2001	83	61
2002	94	60
2003	86	44
2004	83	48
2005	88	55
2006*	**87**	**52**
Mean 1998–2000	75	52
Mean 2001–2006	87	53

* Provisional data

Reporting rates for both licence categories increased in 2001 and 2002 when the new reporting arrangements were first introduced, but then fell in 2003 and 2004, although they remained above pre-2001 levels for annual licences at least. An improvement in reporting rates in 2005 is thought to have reflected the introduction of an improved database for issuing reminders. Provisional data for both licence categories suggest reporting rates for 2006 are broadly similar to those in 2005. Though only 52% of short-term licence holders made a return, it is known that many anglers who purchase more than one short-term licence during a season combine catch details on a single licence return, and this contributes to the lower return rate for this licence category. Also, in general, short-term licence holders fish less and catch fewer fish than those anglers who hold an annual licence. A detailed analysis of catch return data for 2002 for the Rivers Dee (North Wales) and Tyne indicated that 89% and 86%, respectively, of short-term licence holders making a return declared a nil catch, and that 98% and 96%, respectively, of the total declared salmon catch for these rivers was made by anglers holding an annual licence. The lower return rate for short-term licence holders is, therefore, expected to have a negligible impact on the declared catch. A brief description of the Environment Agency's catch reporting and reminder system is provided at Annex 2.

Rod Effort

Table 4 shows the total declared number of rod days fished by anglers in each of the Regions in each year from 1994 to 2006. Most of the salmon and sea trout angling in 2006 took place in Wales (36%) and in the North West (28%) and North East (21%) Regions, as in previous years. There was relatively little angling for these species in Thames and Southern Regions. The number of days fished in 2006 was well below that in 2005 in all Regions, and down 21% overall with the total number of days fished the second lowest in the time series. Rod effort was well below the average of the previous five years in all but the North West Region, where it was marginally above, and down 15% overall. A decrease of 32% in rod fishing effort between 1994–1998 and 1999–2006 is thought, in part at least, to reflect the introduction, in 1999, of compulsory C&R before 16 June.

The distribution of fishing effort before and after 16 June for 2006 is shown in Table 5, as extracted from a random sample of 2,000 rod catch returns. Based on this sample, 24% of the overall angling effort took place prior to June 16, with the proportion varying regionally from 16% (North West) to

Table 4. Total number of rod days fished from catch returns for each Region, 1994–2006

Total days	NE	Thames	Southern	SW	Mids	Welsh	NW	Total
1994	37,937	343	2,446	41,087	13,596	118,862	78,176	292,447
1995	38,724	414	2,696	35,853	14,893	85,107	65,601	243,288
1996	34,726	154	1,928	32,504	13,056	84,922	64,454	231,744
1997	40,345	181	2,332	38,809	14,886	102,930	70,222	269,705
1998	38,229	145	2,095	31,285	11,493	85,906	64,248	233,401
1999	31,676	311	2,018	25,642	7,024	70,660	50,667	187,998
2000	32,319	143	1,771	22,401	5,373	66,270	49,255	177,532
2001	27,485	111	2,117	18,573	4,084	59,163	23,320	134,853
2002	34,423	91	2,462	25,526	4,720	72,328	43,278	182,828
2003	31,030	126	2,663	23,322	5,302	72,719	37,567	172,729
2004	37,677	110	2,344	24,730	4,633	72,846	48,174	190,514
2005	37,355	86	2,096	22,427	5,221	69,786	49,698	186,669
2006*	**30,294**	**1**	**1,586**	**17,589**	**4,089**	**53,346**	**40,736**	**147,641**
Mean (2001-05)	33,594	105	2,336	22,916	4,792	69,368	40,407	173,519
% change:								
2006 on 2005	-19	-99	-24	-22	-22	-24	-18	-21
2006 on 5-yr mean	-10	-99	-32	-23	-15	-23	+1	-15

** Provisional*

Table 5. Number and proportion of rod days fished in 2006 before (<) and from (≥) 16 June (based on a sample of 2,000 rod catch returns)

Region	No. days fished			As % of Regional total		As % of days fished in period	
	< June 16	≥ June 16	Total	< June 16	≥ June 16	< June 16	≥ June 16
North East	955	2,798	3,753	25	75	24	22
Thames	0	0	0	0	0	0	0
Southern	72	192	264	27	73	2	2
South West	611	1,642	2,253	27	73	15	13
Midlands	214	581	795	27	73	5	5
Wales	1,648	4,981	6,629	25	75	42	39
North West	468	2,496	2,964	16	84	12	20
Total	**3,968**	**12,690**	**16,658**	**24**	**76**		

27% (Southern, South West and Midlands) (excluding the Thames). This represents a small increase on 2005, when 22% of the overall angling effort was prior to June 16. Expressed as a percentage of all the days fished early in the season in 2006 in England and Wales, the highest fishing effort before June 16 was in Wales. This also applied in the years 2003 to 2005 and may reflect early season fishing targeted at sea trout rather than salmon.

1.3 Catch limits

There are no regulations directly limiting national catches of salmon in net or rod fisheries in England and Wales, but a number of restrictions have been introduced under local byelaws for rod fisheries. Details of the rod bag limits currently in force are listed below. Non-statutory restrictions have also been introduced in some areas by fishery owners and angling associations, but there is no national record of these.

Region	River	Salmon Bag Limit - rods			Other constraints
		per day	per week	per season	
Thames	Thames	2			
South West	Taw	2	3	10	) No fish > 70 cm to be retained
	Torridge	2	2	7	) after 1 August
Wales	Tywi	2	5		
	Taf	2	5		
	E&W Cleddau	2	5		
	Teifi	2	5		
	Aeron	2	5		
	Ystwyth	2	5		
	Rheidol	2	5		
North West	Lune			4	

2. Catches and CPUE

2.1 Catches

The provisional catch statistics for 2006 are based upon returns received up until 3 March 2007. Except for a few rivers where the data from fishery owners' returns are considered to be more complete (Test and Itchen), the rod catch data are largely based on anglers' returns and include fish reported as a result of the second reminder. A further small increase is expected as a result of late returns. The catch returns for the nets and fixed engines are not expected to change substantially.

2.1.1 Catches in 2006

Table 6 presents the provisional total salmon catch for England and Wales for 2006, compared with confirmed catches for recent years. A breakdown of the provisional 2006 rod and net catches for each Region is provided in Table 7.

The total declared catch for nets and fixed engines in 2006 was well below that in 2005 (down 19%), and around half of the average for the previous 5 years (Tables 6 and 8, Figure 4). Catches were well below those in 2005 in all Regions, except the Anglian Region where they were the same. Despite the partial buy-out in the north east drift net fishery in 2003, the England and Wales catch was still dominated by the north east coast fishery, which has accounted for between 53% and 85% of the national annual net catch during the period 1992–2006 (56% in 2006). Because of the variability in catches from year to year, care must be taken in comparing annual figures. A more reliable picture of recent catch trends may be obtained by comparing data aggregated over a period of years. Between the periods 2000–2002 and 2003–2006, there has been a decline in the average net catches in most regions; the greatest reductions have occurred in the North East (74%) and the South West (47%) as a direct consequence of the partial buy-out of the north east coastal drift net fishery in 2003, and the substantial reductions in fishing effort in the South West, respectively. However, there has been a small increase in the average catch between these two periods in the North West Region (up 7%).

Table 6. Declared catch of salmon for England and Wales for 1998–2006

Year	Nets & Fixed Engines		Rods (inc. released fish)		Total caught		Total retained	
	No.	Wt (t)	No.	Wt (t)	No.	Wt (t)	No.	Wt (t)
1998	25,179	84.7	17,109	59.1	42,288	143.9	36,917	122.9
1999	34,167	124.4	12,492	49.8	46,659	174.2	41,094	150.0
2000	50,998	182.7	17,596	67.5	68,594	250.2	60,953	218.8
2001	43,243	153.3	14,383	56.8	57,626	210.1	51,307	184.2
2002	38,279	133.2	15,282	60.4	53,561	193.6	45,669	161.0
2003	17,219	69.2	11,519	48.5	28,738	117.7	22,206	89.0
2004	16,581	59.1	27,332	104.5	43,913	163.6	30,559	111.4
2005	16,811	60.9	21,418	85.8	38,229	146.7	26,162	96.5
2006*	**13,578**	**50.5**	**18,965**	**70.4**	**32,543**	**121.0**	**21,921**	**79.4**
Mean (2001-2005)	26,427	95.1	17,987	71.2	44,413	166.3	35,181	128.4

** Provisional*

Table 7. Provisional regional salmon catches (including released fish) for England and Wales - 2006 season

Region	Net catch		Rod catch		Total catch	
	No.	Weight (kg)	No.	Weight (kg)	No.	Weight (kg)
North East	7,566	29,505	5,631	22,812	13,197	52,317
Anglian	15	36	0	0	15	36
Thames	0	0	0	0	0	0
Southern	0	0	332	1,109	332	1,109
South West	477	1,586	1,746	6,086	2,223	7,672
Midlands	864	3,643	341	1,616	1,205	5,259
Welsh	679	2,853	4,113	15,262	4,792	18,115
North West	3,977	12,911	6,678	23,256	10,655	36,167
Unknown	0	0	124	278	124	278
Total	**13,578**	**50,534**	**18,965**	**70,419**	**32,543**	**120,953**

Table 8. Summary of declared regional salmon net and fixed engine catches (including released fish), 1992–2006

Year	Region						
	NE	Anglian[$]	SW	Mids	Wales	NW	Total
1992	20,144	11	5,521	2,117	2,927	3,123	33,843#
1993	41,800	4	5,017	950	3,324	5,460	56,555
1994	46,554	3	6,437	2,321	4,995	6,143	66,453
1995	53,210	5	3,251	2,588	3,039	5,566	67,659
1996	18,581	3	5,093	1,608	2,931	4,464	32,680
1997	21,922	0	2,466	1,282	2,628	3,161	31,459
1998	18,265	3	1,759	1,074	2,300	1,778	25,179
1999	26,833	6	1,605	989	2,347	2,387	34,167
2000	43,354	0	2,171	973	1,004	3,496	50,998
2001	36,115	0	1,794	1,027	997	3,310	43,243
2002	30,980	112	1,404	1,190	1,275	3,318	38,279
2003	10,435	24	1,444	1,540	975	2,801	17,219
2004	11,017	53	1,295	769	970	2,477	16,581
2005	8,987	15	572	938	1,121	5,178	16,811
2006 (provisional)	**7,566**	**15**	**477**	**864**	**679**	**3,977**	**13,578**
Mean (2001 - 2005)	19,507		1,302	1,093	1,068	3,417	26,427
% change:							
2006 on 2005	-16		-17	-8	-39	-23	-19
2006 on 5-yr mean	-61		-63	-21	-36	+16	-49

Key: # Totals exclude small numbers of fish caught in the Southern Region. River Itchen seine net fished for scientific purposes only; all salmon caught tagged and released.
** Includes a small number of fish caught & released (Anglian, Wales & SW Regions only).*
[$] It is unusual for salmonids positively identified as salmon to be caught in this sea trout fishery in any numbers; these reported fish may have been misidentified. Hence, no period means are reported.

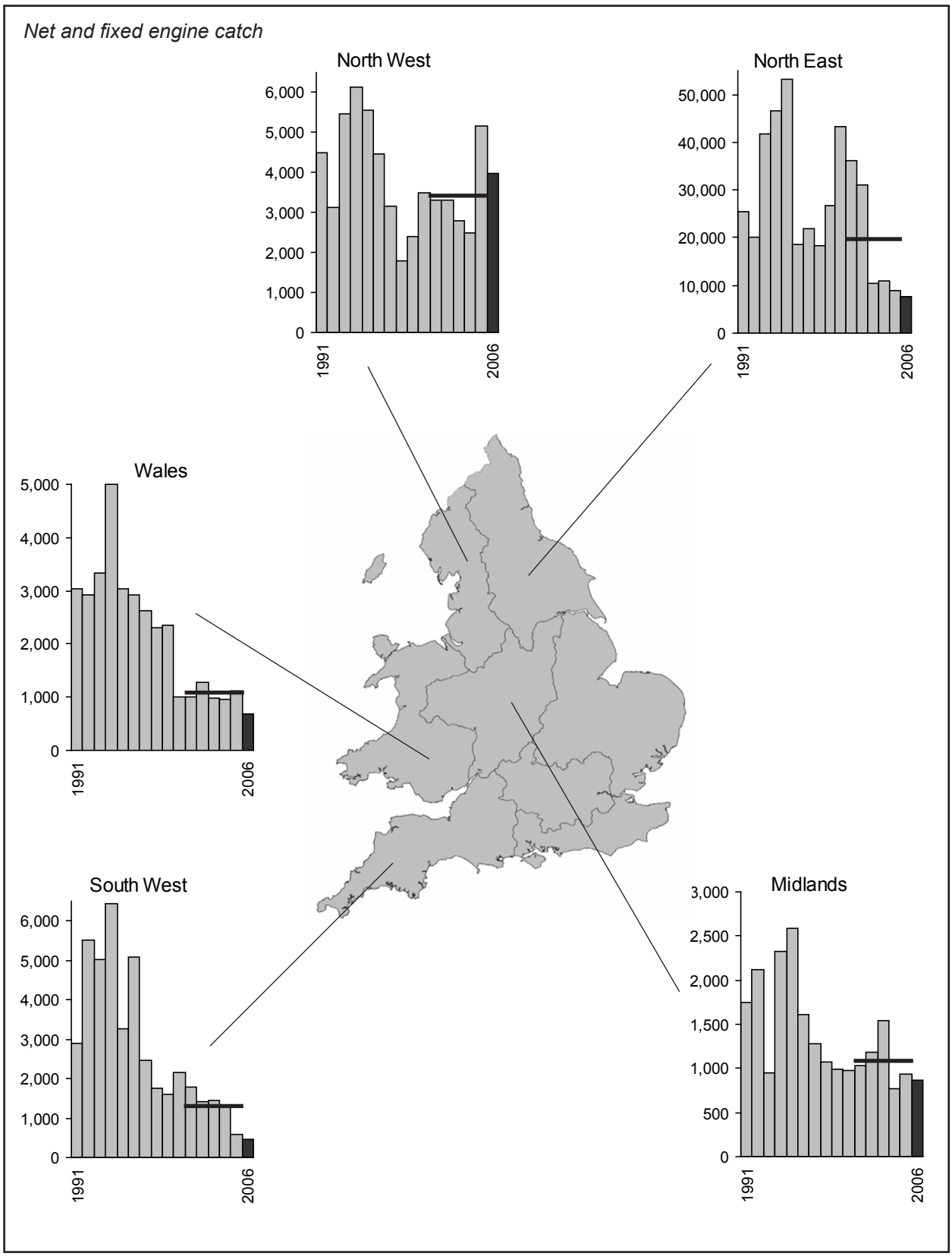


Figure 4. Regional declared salmon net and fixed engine catches. The histograms display data for the sixteen years 1991 to 2006, together with the five-year mean for the period 2001–2005 (displayed as a horizontal line). Note that the histograms are not drawn to the same scale. Data for 2006 are provisional.

The rod catches (both retained and released fish) for recent years are shown in Table 9 and Figure 5.

The total declared catch varied between about 12,500 and 17,600 fish over the period 1998 to 2002 without any evident trend. The low catch of just over 11,500 fish in 2003 was associated with a considerable reduction in angling effort in that year due to a warm dry summer, with the dry conditions extending into the middle of October. In 2004, the total rod catch, at 27,332 salmon, was the highest since 1994 in the North East, North West and Wales, and stood out against the declining trends in several Regions (except the North East and Midlands). Total catches in 2005 and 2006 have been below the 2004 figure but have remained above the recent average; catches in 2004 to 2006 are the three highest in the recent time series (Table 9). The provisional rod catch in 2006 was lower than that in 2005 in all Regions apart from the South West, but remained above the 5-year mean in the North East, North West and Midlands Regions and by 5% overall.

Table 9. Summary of declared regional salmon rod catches, 1999–2006 - including details of fish caught and released and fish caught and retained

Year	Region							
	NE	Thames	Southern	SW	Midlands	Wales	NW	Total*
Declared catch (fish caught and retained)								
1999	1,322	0	116	983	120	2,166	2,338	7,045
2000	1,712	0	69	1,335	224	2,785	3,998	10,126
2001	1,878	0	8	761	145	3,004	2,430	8,240
2002	1,710	0	3	817	122	1,966	2,998	7,624
2003	1,242	0	0	520	180	1,460	1,688	5,094
2004	3,176	0	0	1,227	145	4,161	5,350	14,121
2005	2,507	0	0	595	159	2,098	4,070	9,435
2006 (provisional)	**2,410**	**0**	**0**	**474**	**141**	**2,018**	**3,306**	**8,415**
Declared catch (fish released)								
1999	1,348	1	137	898	65	1,203	1,795	5,447
2000	1,888	0	247	1,152	103	1,264	2,816	7,470
2001	1,855	0	397	635	128	1,347	1,779	6,143
2002	2,257	0	528	920	73	1,346	2,534	7,658
2003	2,265	0	225	746	153	1,172	1,859	6,425
2004	3,612	0	609	1,572	174	2,487	4,672	13,211
2005	3,426	0	438	1,130	271	2,310	4,376	11,983
2006 (provisional)	**3,221**	**0**	**332**	**1,272**	**200**	**2,095**	**3,372**	**10,550**
% of fish released								
1999	50		54	48	35	36	43	44
2000	52		78	46	31	31	41	42
2001	50		98	45	47	31	42	43
2002	57		99	53	37	41	46	50
2003	65		100	59	46	45	52	56
2004	53		100	56	55	37	47	48
2005	58		100	66	63	52	52	56
2006 (provisional)	**57**		**100**	**73**	**59**	**51**	**50**	**56**
Declared catch (including fish caught and released)								
1999	2,670	1	253	1,881	185	3,369	4,133	12,492
2000	3,600	0	316	2,487	327	4,049	6,814	17,596
2001	3,733	0	405	1,396	273	4,351	4,209	14,383
2002	3,967	0	531	1,737	195	3,312	5,532	15,282
2003	3,507	0	225	1,266	333	2,632	3,547	11,519
2004	6,788	0	609	2,799	319	6,648	10,022	27,332
2005	5,933	0	438	1,725	430	4,408	8,446	21,418
2006 (provisional)	**5,631**	**0**	**332**	**1,746**	**341**	**4,113**	**6,678**	**18,965**
Mean - including fish caught & released (2001-2005)	4,786	0	442	1,785	310	4,270	6,351	17,987
% change:								
2006 on 2005	-5		-24	1	-21	-7	-21	-11
2006 on 5-yr mean	+18		-25	-2	+10	-4	+5	+5

** Totals include some fish of unkown Region of capture.*
Most 2006 figures are based on anglers' catch returns up to 3 March 2007 (including the second reminder); data for the Rivers Test and Itchen are based upon owners' returns.

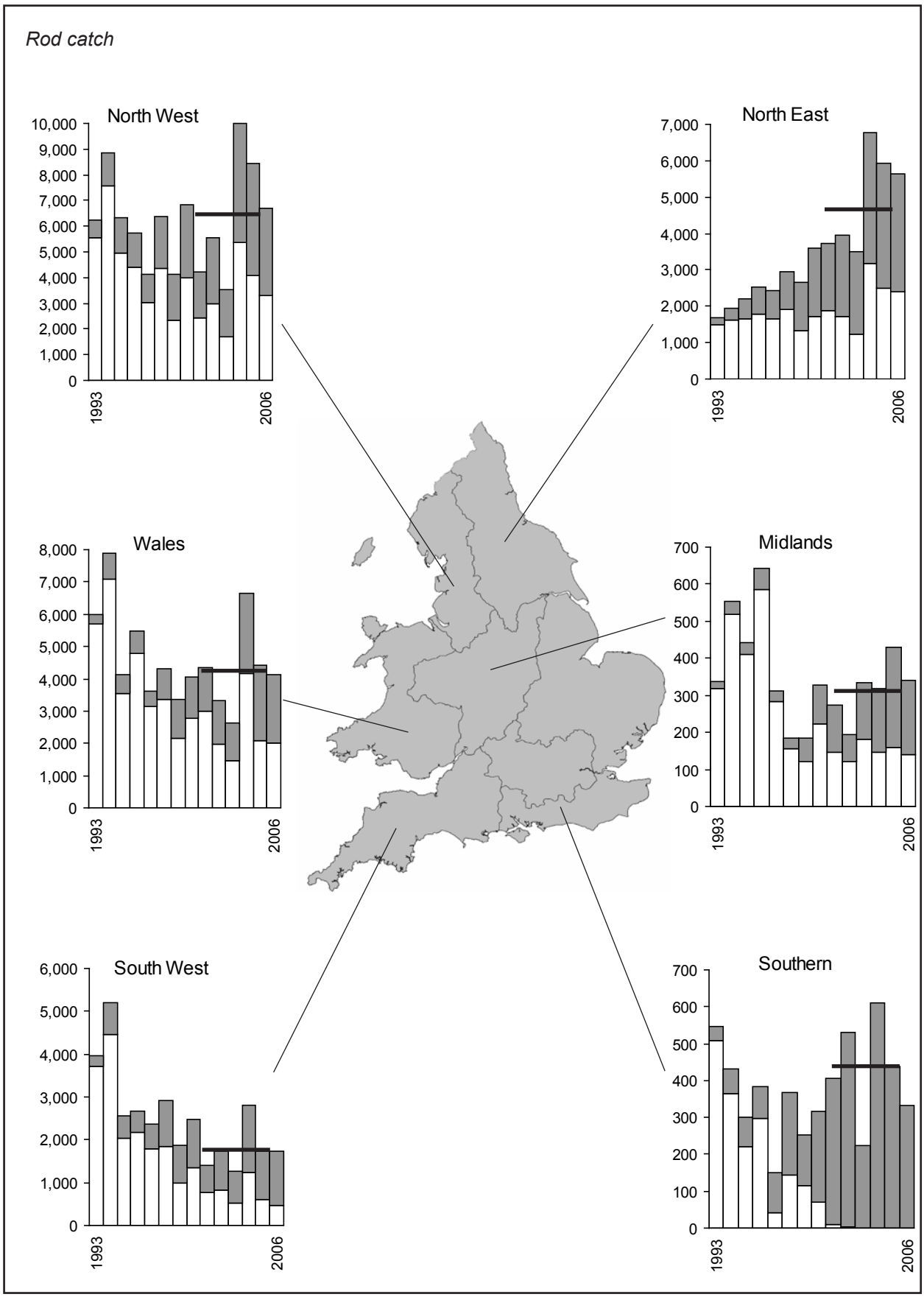


Figure 5. Regional declared salmon rod catch. The histograms display total declared catch, with the shaded area denoting fish caught and released, for the fourteen years 1993–2006, together with the five-year mean for the period 2001–2005 (displayed as a horizontal line). Note that the histograms are not drawn to the same scale. Data for 2006 are provisional.

2.1.2 Catches in coastal, estuarine and riverine fisheries

ICES requests that catch data are grouped for coastal, estuarine and riverine fisheries and these data (fish caught and retained only) for the years 1993 to 2006 are presented in Table 10. The catch for the coastal fisheries mainly reflects the catch in the north east drift net fishery, but also includes fixed nets in this area, drift nets on the Cumbrian coast (North West Region) until 2003, and a number of nets and fixed engines fished around the Welsh and East Anglian coasts and in the Bristol Channel. The data set starts in 1993, as this marks the start of the phase-out of the north east drift net fishery; though other mixed stock fisheries have also been phased out since this date. A full list of the fisheries included in the coastal category appears in the footnote to Table 10. In 2006, only two coastal fisheries remained in operation, and one of these, Anglian, takes very few salmon (Table 8). The riverine fisheries comprise catches in freshwater and represent the rod catch plus the very small catches in two ancient fixed engines, the River Conwy basket trap (last fished in 2002) and River Eden coops (not fished in 2006 due to flood damage). The estuarine category includes all the other net and fixed engine fisheries (Table 1).

On average, over the period 1993–1998, coastal catches comprised 59% of the total (declared fish caught and retained), estuarine catches 18% and riverine catches 23%. Over the period 1999 to 2002, the coastal proportion of the catch was at its highest level over the 13-year time-series (67-72%). In 2003–2006, the coastal catch comprised 38% of the total, compared to 25% and 37% for estuarine and riverine catches, respectively. The principal influences on these changes have been the national byelaws protecting early-running MSW salmon introduced in 1999, phase-out of net fisheries generally, and the partial buy-out of north east drift nets from 2003.

Table 10. Declared catch of salmon (fish caught and retained only) in coastal, estuarine and riverine fisheries, 1993–2006

Year	Coastal		Estuarine		Riverine		Total
	Wt (t)	%	Wt (t)	%	Wt (t)	%	Wt (t)
1993	158.8	64	43.4	18	45.9	18	248.1
1994	183.5	57	58.4	18	81.9	25	323.8
1995	200.3	68	45.4	15	48.9	17	294.6
1996	83.3	45	42.3	23	57.5	31	183.2
1997	80.5	57	26.7	19	34.6	24	141.8
1998	65.2	53	19.4	16	38.2	31	122.9
1999	101.0	67	23.1	15	26.0	17	150.0
2000	156.6	72	25.4	12	36.9	17	218.9
2001	128.6	70	24.2	13	31.3	17	184.1
2002	107.9	67	24.4	15	28.7	18	161.0
2003	42.0	47	26.6	30	20.3	23	88.9
2004	39.2	35	19.4	17	52.8	47	111.4
2005	32.2	33	28.3	29	36.0	37	96.5
2006*	**29.5**	**37**	**20.7**	**26**	**29.2**	**37**	**79.4**
Mean (1993-98)	128.6	59	39.3	18	51.2	23	219.1
Mean (1999-02)	123.5	69	24.3	14	30.7	17	178.5
Mean (2003-06)	35.7	38	23.8	25	34.6	37	94.1

** Provisional*

Notes: ***Coastal*** *catches in 2006 from North East coast nets and Anglian coastal nets, but previously included River Parrett putcher rank (last fished 1999), River Usk drift nets (1997) & putcher rank (1999), SW Wales coastal wade (1995) & seine nets (1997), River Ogwen seine nets (2000), River Seiont/Gwyrfai seine nets (1997), River Dwyfawr seine nets (1999), N. Caernarvonshire seine nets (1996), River Clwyd sling (drift) nets (1997) and the SW Cumbria drift nets (2003).*
Riverine *catches in 2006 from rod catches only - River Eden coops and River Conwy basket trap (last fished 2002) not operated in 2006.*
Estuarine *fisheries include all other nets and fixed engines not mentioned above.*

Table 11. Number, weight and proportion of declared salmon rod catch released by anglers, and number and weight of net catch released, 1993–2006

	Salmon released by rods			Salmon released by nets	
	Number	Weight (t)	As % of declared catch	Number	Weight (t)
1993	1,448	5.26	10		
1994	3,227	12.19	13		
1995	3,189	12.11	20		
1996	3,428	13.99	20		
1997	3,132	13.77	24		
1998	5,365	20.98	31		
1999	5,447	23.87	44	118	0.4
2000	7,470	30.70	42	171	0.7
2001	6,143	25.50	43	176	0.4
2002	7,658	31.80	50	234	0.9
2003	6,425	28.20	56	107	0.5
2004	13,211	51.70	48	143	0.5
2005	11,983	49.80	56	84	0.4
2006*	**10,550**	**41.20**	**56**	**72**	**0.3**

** Provisional*

Notes: Many of the salmon released by nets have been as a result of an agreement between the Environment Agency and netsmen fishing the estuary of the River Avon (see Section 1.2.1).
Data on catch and release not collected prior to 1993.
There was no requirement for net caught salmon to be released prior to 1999.

Table 12. Number and proportion (%) of rod-caught salmon released, by weight category (kg) and season, 1998–2006

Season	April to June			July to August			September to October			April to October		
Wt. category (kg)	<3.6	3.6-6.4	>6.4	<3.6	3.6-6.4	>6.4	<3.6	3.6-6.4	>6.4	<3.6	3.6-6.4	>6.4
Number												
1998	136	113	20	643	197	40	2,076	900	253	2,855	1,210	313
1999	209	570	194	295	163	61	1,430	994	466	1,934	1,727	721
2000	221	532	148	499	229	72	2,325	1,431	502	3,045	2,192	722
2001	119	602	138	422	302	52	1,673	1,141	420	2,214	2,045	610
2002	241	659	213	488	207	57	2,084	1,473	488	2,813	2,339	758
2003	214	629	193	239	235	64	1,382	1,392	595	1,835	2,256	852
2004	283	576	143	1074	501	116	5,154	2,962	707	6,511	4,039	966
2005	464	1105	265	715	439	67	4,240	2,661	598	5,419	4,205	930
2006*	**499**	**1198**	**233**	**581**	**291**	**50**	**4,286**	**2,007**	**490**	**5,366**	**3,496**	**773**
Percentage (%)												
1998	26	15	18	17	23	18	36	44	45	28	33	35
1999	59	66	74	23	26	30	39	45	53	36	47	54
2000	57	69	72	20	28	30	40	46	56	35	47	53
2001	58	62	68	24	29	26	39	45	58	35	45	57
2002	64	65	71	24	27	33	47	54	63	41	52	61
2003	76	77	80	27	28	34	48	58	69	46	56	66
2004	55	69	59	32	32	41	46	48	58	43	47	56
2005	85	76	81	36	37	40	53	54	61	51	56	63
2006*	**88**	**81**	**88**	**41**	**38**	**47**	**49**	**56**	**65**	**50**	**60**	**68**

** Provisional*

1998 Pre national byelaw.
1999 National byelaw requiring compulsory catch and release before 16 June introduced on 15 April.
2000 First full year of national catch and release byelaw.

2.1.3 Effects of significant management measures on catches

Catch and release (C&R): Within England and Wales, there has been increasing use of C&R by salmon anglers in recent years, and this has been reinforced by the introduction in 1999 of a national byelaw requiring the compulsory release of all salmon caught by rods before 16 June. This was in response to the well-publicised and ongoing concerns about the decline in the numbers of spring salmon. The number of fish caught before June fell from a 5-year average (1994–1998) of 1,898 (10.9% of the total catch) prior to the introduction of the national byelaw, to a mean of 1,074 fish (6.3% of the catch) since 1999 (Table 13). This reflects both the decline in the abundance of spring salmon and the reduction in fishing effort due to the national byelaw. However, the number of salmon caught before 1 June in 2006 was the second highest since 1996.

The Environment Agency's 2004 Salmon Stock Conservation Review (SSCR) identified rivers where release rates should be increased to protect and enhance stocks. In 2005, a national campaign was undertaken aimed at increasing voluntary release rates and providing guidance on best practice for anglers, and a number of Environment Agency Areas wrote to and/or made presentations to anglers and fishing associations with a view to encouraging C&R. A new C&R guide was circulated to all holders of a full Environment Agency salmon licence in September, highlighting rivers with poor stocks and a low C&R rate. As a result, a number of clubs introduced bag limits and method restrictions (details in Section 1.2.2). In 2006, there were further efforts to promote C&R by both the Environment Agency and local fisheries groups. For example, the Carmarthen Fishermen's Association introduced a badge reward and prize draw scheme for anglers releasing fish, and this resulted in release rates of 51% and 60% on the Rivers Tywi and Taf respectively (up from 45% and 50% in 2005).

Table 13. Number and proportion of declared salmon net and rod catch taken before (<) 1 June, and the numbers taken from (≥) 1 June, 1989–2006

Year	Net catch				Rod catch (including released fish)			
	Numbers			%	Numbers			%
	< 1 June	≥ 1 June	Total	< 1 June	< 1 June	≥ 1 June	Total	< 1June
1989	4,742	64,198	68,940	6.9	3,199	11,529	14,728	21.7
1990	7,339	64,488	71,827	10.2	2,397	12,290	14,687	16.3
1991	3,637	34,038	37,675	9.7	2,240	11,496	13,736	16.3
1992	2,497	31,352	33,849	7.4	1,012	9,725	10,737	9.4
1993	1,630	54,936	56,566	2.9	865	13,194	14,059	6.2
1994	4,824	61,633	66,457	7.3	2,609	22,282	24,891	10.5
1995	4,888	62,771	67,659	7.2	2,141	13,865	16,006	13.4
1996	2,913	29,767	32,680	8.9	2,691	14,753	17,444	15.4
1997	1,528	29,931	31,459	4.9	1,335	11,278	12,613	10.6
1998	832	24,335	25,167	3.3	712	15,275	15,987	4.5
1999	116	34,043	34,159	0.3	920	11,211	12,131	7.6
2000	19	50,979	50,998	0.04	760	16,496	17,256	4.4
2001	47	43,196	43,243	0.11	708	13,675	14,383	4.9
2002	32	38,247	38,279	0.08	815	14,250	15,065	5.4
2003	42	17,177	17,219	0.24	1,037	10,373	11,410	9.1
2004	35	16,546	16,581	0.21	1,168	25,777	26,945	4.3
2005	29	16,782	16,811	0.17	1,652	19,239	20,891	7.9
2006*	**17**	**13,561**	**13,578**	**0.13**	**1,533**	**17,067**	**18,600**	**8.2**
Mean (1994-98)	2,997	41,687	44,684	6.7	1,898	15,491	17,388	10.9
Mean (1999-06)	42	28,816	28,859	0.1	1,074	16,011	17,085	6.3

** Provisional, excludes fish for which no capture date recorded.*

Notes: National measures to protect 'spring' salmon introduced on April 15 1999 - required compulsory catch and release of all rod caught salmon prior to June 16, and closed most net fisheries prior to June 1.
Rod catch data only include fish for which date of capture is recorded, so data differ from total catch (Table 9).

Details of fish caught and released are published for each major salmon river in England and Wales in the annual catch statistics and these data are summarised in Tables 9 and 11 and in Figure 5. Preliminary figures indicate that overall C&R rates in 2006 were the same as those in 2005 (56%). At the individual river level, 28 rivers had increases in 2006 and 28 decreases, with no change in 8 others; the majority of rivers in the South West Region had increased C&R rates in 2006. It is estimated that a total of 10,550 salmon were released by anglers in 2006, contributing 34 million additional eggs to the breeding population (assuming 80% survival to spawning, 50% females and an average of 8,000 eggs per fish). The proportion of rod-caught salmon released by anglers has increased over the period from 10% in 1993 to around 50% in the last five years. The higher values (56% in 2003, 2005 and 2006) may, in part, reflect relatively good catches in the spring and at the very end of the fishing season, when a higher proportion of MSW and coloured fish would have been caught and released. The lower release rate (48%) in 2004 may have reflected the relatively high catches in most areas during summer and early autumn in that year.

Levels of C&R have been enhanced on some rivers in recent years through negotiated agreements. On the Rivers Test and Itchen in the Southern Region, the salmon fisheries have reached voluntary agreements for all the fish to be released. Agreement has also been reached with fishermen on the Hampshire Avon for all salmon caught by nets and rods to be returned to the water alive. This agreement was reviewed in 2006, and will continue for another five years (from January 2007).

An analysis of the numbers of salmon released by weight category (<3.6 kg (8 lbs), 3.6–6.4 kg (14 lbs), and >6.4 kg) and season, for the years 1998 to 2006, is shown in Table 12. This indicates that, since the introduction of the national measures to protect spring salmon, anglers have been voluntarily releasing an increased proportion of all fish caught after June, and large salmon in particular. For example, in the months of September and October, 58 to 69% of large salmon were voluntarily released by anglers over the last five years, compared to 45% in 1998.

Impact of stocking on recovery of the River Tyne: Milner *et al.* (2004) examined the relative contributions of hatchery stocking and natural recovery to the substantial and ongoing development of the salmon fisheries of the River Tyne in north east England. Natural recovery, following water quality improvement in the estuary and lower reaches, was shown to be the dominant process. Stocking from the hatchery was likely to have contributed more in the early stages (up to 20% of cumulative escapement) and to have accelerated and stabilised stock recovery. Latterly, the hatchery contribution has proportionately been much lower, but has been assessed as successful in meeting the hatchery's purpose to mitigate for spawning areas lost to the Kielder reservoir development.

Later net fishery opening under National Byelaws: The national measures introduced in April 1999 closed all net fisheries for salmon before 1 June. This has resulted in a large reduction in the number of fish caught by net fisheries before June, from a 5-year average (1994–1998) of 2,997 fish (6.7% of the total catch) to a mean of 42 (0.1% of the catch) since 1999 (Table 13). The latter were taken in a small number of fisheries in Wales, the South West and Anglian Regions (primarily targeted at sea trout) that are allowed to operate prior to 1 June, provided any salmon caught before that date are released. In 2006, a total of 72 salmon, weighing 0.3 t, are reported to have been caught and released by netsmen. The majority of these fish (55) were actually released after 1 June on the Hampshire Avon. Summary data are included in Table 11.

The contribution of MSW salmon to catches in recent years is covered in Section 2.5.

Review of national byelaws: The national measures to protect spring salmon were subject to a mid-period review in 2003 (Environment Agency, 2003a) that concluded that the provisions should remain in place until at least 2008, that no further measures for spring salmon were currently necessary, and that the need for river-specific enhanced measures would be examined through Salmon Action Plans (see Foreword).

Mixed stock fisheries: Since 1993, there has been a policy to phase out coastal mixed stock salmon fisheries in England and Wales as existing licensees retire. A scheme to accelerate the phase-out of the north east coast fishery on a voluntary basis was based on funding of nearly £3.4 million, of which £1.25 million came from the Government and involved compensation payments to 52 licensees to permanently relinquish their licences. As a consequence, 16 drift net licences have been issued in each year from 2003 to 2006, compared with 69 in 2002 (down 77%) and 142 in 1992 (down 89%). The remaining drift nets in 2006 took a catch of 4,040 salmon. This is 85% lower than the catch of 27,685 in 2002. Some of the netsmen who relinquished their drift net licences were able to remain in the fishery by switching to inshore T- or J- nets, which are known to exploit a higher proportion of local salmon and sea trout. The salmon catch by T/J nets in recent years has therefore been higher than that in 2002 (3,295 fish from 41 nets). Catches in subsequent years have been 5,096 in 2004 (55 nets), 3,380 in 2005 (54 nets) and 3,526 in 2006 (55 nets). The overall net catch on the north east coast has fallen from 30,980 in 2002 to 7,566 in 2006 (down 76%).

The reduction in netting effort in the North East Region appears to have had a substantial beneficial effect on salmon runs and catches in local rivers. In 2006, the fish counter on the Tyne recorded a run of 41,308 fish (combined count for salmon and sea trout). On average, the Tyne count in the four years since the buy-out (2003–2006) has been 41,739 fish, representing an increase of 97% on the mean count in the five years prior to the buy-out (21,152 fish). After good catches in 2004 and 2005, salmon rod catches in 2006 were once again above the five-year, pre buy-out average in all of the rivers in the North East Region. The salmon rod catch for the Tyne in 2006 was provisionally 3,696, the Coquet 755 and the Wear 823. On average, declared rod catches of salmon in north east rivers (including fish released) have been 61% higher in the four years since the buy-out compared with the average of the five years before the buy-out. Salmon rod catches on the River Tweed (the next major river to the north) between 2003 and 2005 have also been at their highest level since 1955 (Trout and Salmon, October 2006).

It should be noted that the improvement in salmon catches and escapement in north east rivers may reflect both reduced levels of exploitation in the net fishery, due to the drift net buy-out, and possibly favourable flows and good angling conditions in some years. Catches in the rivers Tyne and Wear had also demonstrated a consistently improving trend prior to 2003. It will also reflect increased production from 2006 onwards, when the first grilse resulting from any increase in juvenile production should return. Grilse did comprise a higher proportion of the rod catch in north east rivers in 2006 than in 2005, with values for the Coquet, Tyne and Wear of 85%, 67% and 81% respectively, compared with 71%, 63% and 78% in 2005. However, 45% of rivers elsewhere in the country also had higher proportions of grilse in the rod catch in 2006 than in 2005.

A number of other small coastal mixed stock fisheries have also been subject to reductions in recent years, eight of which are no longer operating and have now been closed in perpetuity through byelaw changes (Table 3a). Reductions continue in other fisheries. For example, in the Anglian coastal fishery, which exploits mainly sea trout, 36 (27 drift and 9 ‘other’ gear) licences were issued in 2006, three less than 2005.

In addition to the north east coast partial buy-out, the drift nets and fixed engines on the River Usk were bought off in 2000, prior to which the average catch of this fishery was about 1,000 fish each

year (~40% of the total net catch in Wales). The Usk drift net fishery was permanently closed by byelaw in February 2005. The more recent buy-out of the Taw/Torridge fishery has resulted in a drop in the catch from a 5-year mean (1997–2001) of 665 fish to just 65 in 2006. The buy-out of the Tamar/Lynher/Tavy seine nets in 2004 equates to a reduction in the average annual catch of 250 salmon over the previous five years. Further, the initial reduction in netting effort on the River Dee in 2006 resulted in a 41% reduction in the catch compared with the mean of the previous five years (467 and 796 fish respectively).

Although there have been large annual fluctuations in the declared catches, the overall effect of these measures has been to reduce the catches in coastal fisheries from an average of about 41,000 fish for the period 1988–1992 to a little under 32,000 for the period 1998–2002, to about 9,500 fish in 2003–2006.

2.1.4 Long-term catch trends

Figure 6 shows the annual declared net catch for England and Wales since 1956, and distinguishes the catch in the north east coast fishery, which increased rapidly in the late 1960s with the introduction of synthetic nets and has comprised well over 50% of the total net catch in most of the subsequent years. The partial buy out in 2003 has led to a 69% reduction in the reported average north east coast catch in 2003–2006.

The catches in the other net fisheries have been declining since the mid 1970s and have fallen to levels of around 7,000 fish between 1998 and 2003. The decline in catches in the 1990s reflects reductions in both fishing effort (see Table 2) and stock size. The catch in 2006 of 6,012 salmon is the lowest in the time series.

The declared rod catch of salmon (including released fish) has declined by around 60% from its peak in the mid-1960s to the lower level observed in most years since 1989. The catch has fluctuated around a level of 15,000 fish between 1989 and 2003. The catch in 2004 was the highest since 1988, and the reported catches of salmon in 2005 and 2006 have remained above recent levels and close to the long-term mean (Figure 7). This may suggest that the long-term declining trend has recently been reversed, but the pattern on individual rivers has varied from much more severe declines to substantial recoveries. Rod catches in 2006 were higher than the 5-year mean (2001–2005) only in the North East, North West and Midlands Regions. Although angling effort appears to have declined considerably since 1994 (Table 4), we do not know how this relates to the level of fishing activity in earlier years. It should also be borne in mind that the figure presents declared catches: reporting rates are known to have improved substantially later in the time series.

2.2 Catch per unit effort (CPUE)

Catch levels are influenced by stock abundance, the catchability of the fish, and by the variation in the time anglers and netsmen spend fishing. Catch per unit of fishing effort (CPUE) is, therefore, used as well as the declared catch in order to help evaluate the relative status of stocks. CPUE can also provide an index of angler satisfaction (people would rather catch one salmon for every 10 days they fished than one every 20 days), and indicates changes in the profitability of net fishing, the income from the catch being set against the costs of time spent netting. For net fisheries in England and Wales, Regional CPUE data have been collated using the number of tides fished (or in the North East Region the number of days fished) as a measure of the amount of fishing undertaken by each licence holder. Rod CPUE data (catch per licence day fished) are now reported for all major salmon rivers in England and Wales in the annual catch statistics reports.

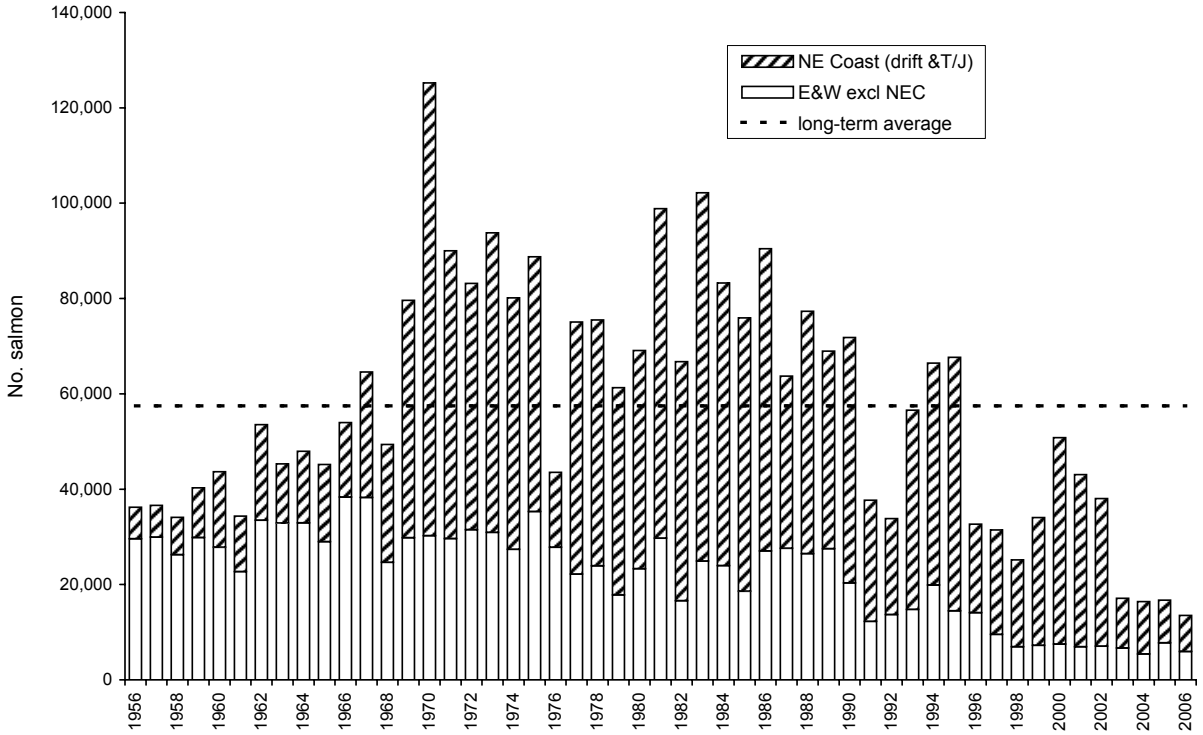


Figure 6. Total declared salmon net and fixed engine catch for England and Wales 1956–2006; the shaded area indicates the catch in the north east coast fishery. Data for 2006 are provisional

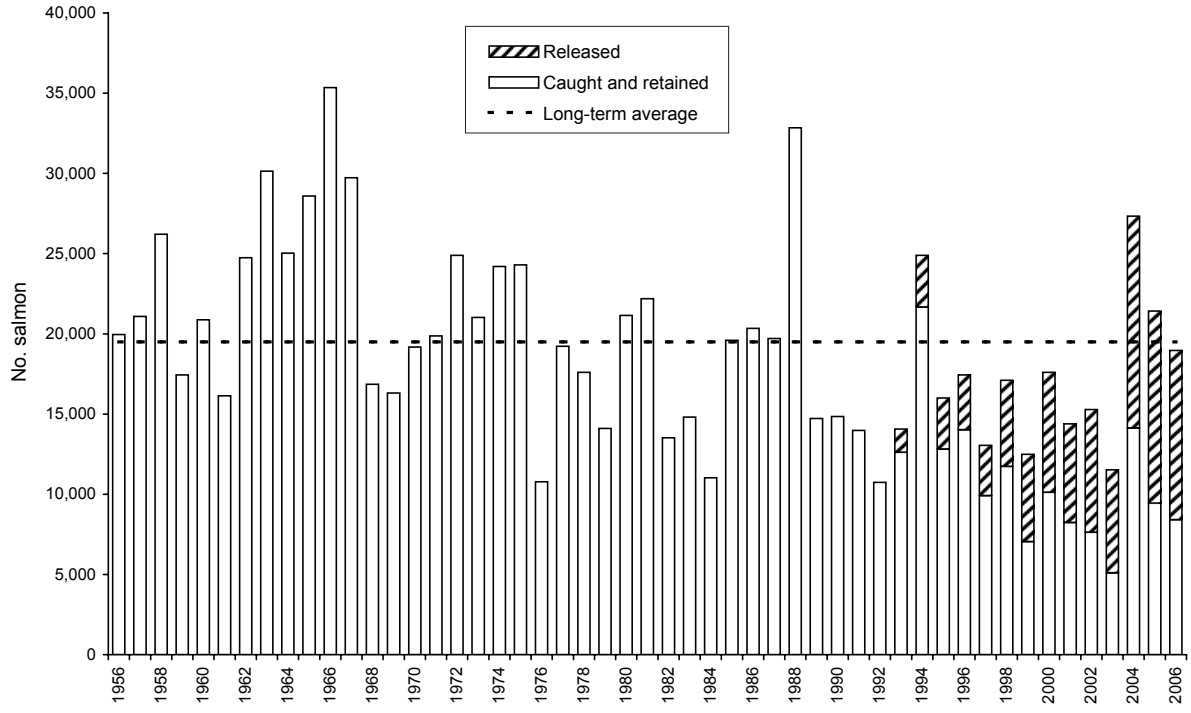


Figure 7. Total declared salmon rod catch for England and Wales 1956–2006; the shaded area indicates fish caught and released. (N.B. Data for 2006 are provisional; fish caught and subsequently released were not reported prior to 1993)

Table 14. Regional CPUE data for 27 net fisheries, 1997 to 2006. Fisheries were selected on the basis that they were fished consistently during the period. Data are expressed as catch per licence-tide, except for the North East, for which data are recorded as catch per licence-day

Year	Region NE Drift nets (June-August)	NE	SW	Midlands	Wales	NW	England & Wales (not NE drift nets)
1997	6.48	4.40	0.56	0.48	0.31	0.63	1.08
1998	5.92	3.81	0.99	0.42	0.51	0.46	1.11
1999	8.06	4.88	0.63	0.72	0.44	0.52	1.19
2000	13.06	8.11	1.05	0.66	0.33	1.05	1.87
2001	10.34	6.83	0.61	0.79	0.45	0.71	1.54
2002	8.55	5.59	0.82	1.39	0.57	0.90	1.51
2003	7.13	4.82	1.06	1.13	0.41	0.62	1.32
2004	8.17	5.88	0.95	0.46	0.45	0.69	1.46
2005	7.23	4.13	0.49	0.97	0.41	1.28	1.22
2006*	**5.60**	**3.20**	**0.44**	**0.97**	**0.35**	**0.82**	**0.94**
Mean (2001-2005)	8.28	5.45	0.79	0.95	0.46	0.84	1.41
No. fisheries	1	4	6	1	9	6	26

** Provisional*

2.2.1 CPUE in net fisheries

In reports prior to 2004, regionally aggregated CPUE data for the period 1988 to date were presented, but these data did not take account of the differing fishing methods employed in the various regions, nor of any changes in the relative proportions of different gears used as measures have been introduced to reduce fishing effort.

To partially address the above concerns, and to provide a more consistent time series, annual mean CPUEs for 27 fisheries that have fished in a consistent manner over the period 1997 to 2006 are given in Table 14. Though this results in the CPUE for salmon varying between Regions, it provides more robust comparisons through time within a Region. Overall, the CPUE values for 2006 were down on the 5-year mean (2001-2005), with the exception of the fixed engine fisheries in the River Severn (Midlands Region) where it was slightly higher. CPUE values for the North East and South West Regions and the north east coast drift nets were the lowest in the time series. At the individual fishery level (n=26), the CPUE remained virtually the same as in 2005 (95% - 105% of the previous year's value) in five fisheries, increased in seven fisheries and declined in the remainder. There were no evident regional differences in these CPUE changes.

CPUE values tended to be higher in most regions in the period after 1999 and this was thought to reflect, in part at least, the effect of the national measures to safeguard spring salmon, which concentrated effort in the more productive time of year. Since this would tend to mask the effects of any reduced availability (stock abundance) of salmon on the CPUE in recent years, it would be inadvisable to draw conclusions about long-term stock status based on catch and effort data alone. Thus, despite this possible masking, the current low CPUE values in some regions suggest availability to a number of fisheries may have been well below average in 2006.

Table 15. Rod CPUE - number of salmon (including released fish) caught per 100 days fished for regional rod fisheries, 1997–2006. (Catches shown in Table 9)

Year	Region							England & Wales
	NE	Thames	Southern	SW	Midlands	Wales	NW	
1997	5.0	0.6	3.1	5.2	1.7	2.6	5.3	4.0
1998	6.5	0.0	5.9	7.5	1.3	3.9	8.6	6.0
1999	7.4	0.3	3.1	6.3	2.1	3.5	7.4	5.5
2000	9.2	0.0	5.2	8.8	4.9	4.4	11.7	7.9
2001	11.3	0.0	11.0	6.6	5.4	5.5	15.4	8.7
2002	9.4	0.0	18.3	6.0	3.5	3.6	10.0	6.8
2003	9.7	0.0	8.8	4.7	5.2	2.9	8.3	5.7
2004	14.7	0.0	18.8	9.6	5.5	6.6	17.4	11.4
2005	12.4	0.0	12.7	6.2	6.6	4.5	13.9	9.0
2006*	**13.8**	**0.0**	**15.5**	**8.3**	**6.3**	**5.7**	**13.2**	**9.9**
Mean (2001 - 2005)	11.5	0.0	13.9	6.6	5.2	4.6	13.0	8.3
% change:								
2006 on 2005	+11		+22	+34	-5	+27	-5	+10
2006 on 5-yr mean	+20		+11	+25	+20	+23	+2	+19

Note: Based only on catch returns for which effort data have been reported.
** Provisional*

2.2.2 CPUE in rod fisheries

Regional summaries of rod CPUE data for anglers making returns (expressed as number of salmon caught per 100 days fished) are presented in Table 15 for the period 1997 to 2006. These figures include returns from a wide variety of anglers (e.g. locals who fish regularly, holiday anglers, and those who fish primarily for sea trout) and river types. This will result in the CPUE for salmon varying between regions, but still provides scope for comparisons through time within a region. It should also be noted that reductions in effort due to the national measures to protect spring salmon may have affected CPUE from 1999 onwards (Table 4). Rod CPUE values in 2006 were generally above those in 2005 (not in Midlands or North West Regions) and were above the recent 5-year average in all regions. Overall, rod CPUE was the second highest recorded in the period. The relatively high CPUE values in 2006 suggest that, despite low flows throughout most of the summer and reported poor conditions for fishing, this was compensated for by high flows in May and October which allowed fish to run and provided good fishing conditions in these parts of the season. Note, however, that CPUE values reflect only the availability of salmon during the fishing season and may bear less relation to spawning escapement of late-running fish in November and December. As with nets, the relationship between CPUE for rod fisheries and salmon abundance can be influenced by confounding factors.

2.3 Unreported and illegal catches

If the full effects of fisheries upon stocks are to be assessed, managers must take account of unreported catches by net and rod licence holders and also the scale of illegal catches. In earlier years, estimates of the levels of under-reporting and illegal fishing (expressed as percentages of the declared regional catches) have been provided annually by regional fisheries staff. However, in an effort to improve these estimates, the methodology was re-examined in 1998 and a revised approach agreed. This has been used to estimate the extent of unreported and illegal catches since that time; the procedures were reviewed again in 2003, but no changes were made.

2.3.1 Under-reporting by licence holders

The rate of under-reporting for net fisheries is generally considered to be low in most fisheries of England and Wales and a figure of 8% has been used to adjust for the level of under-reporting of the net catch in recent years, based on the best available information. Opinions on the level of under-reporting in net fisheries in England and Wales collected from Environment Agency Regional fisheries personnel in February 1998 were in the range 0% to 15%. In the North East, under-reporting in the coastal fishery has previously been estimated at about 7% (Anon., 1991). In the North West, comparison of the catches seen by the bailiff with those declared for that day, suggested that catches in the estuary net fishery on the River Lune were under-reported by around 8%. However, a surveillance operation throughout July and August 2004 linked observed daily catches of salmonids caught by identified Solway haaf netsmen (North West Region) to the returns they subsequently submitted to the Environment Agency. Of the 35 netsmen observed, 22 submitted inaccurate returns and an initial assessment suggested that the fishery had been declaring only 50% of its catch. Reporting in this fishery is believed to have improved significantly in 2005 and 2006.

It has been suggested that over-reporting of catches may occur in some fisheries in response to rumours about potential future buy-outs (and the perception that compensation will be based on declared catches). This may have applied to the north east coast fishery and in 2000–2002 there was assumed to be no under-reporting in this fishery. Apart from this, the 8% correction has been used consistently in recent years; this continued to apply in 2006.

For the purpose of setting conservation limits under their Salmon Action Plan guidelines, the Environment Agency have estimated that declared salmon rod catches from 1994 onwards should be increased by 10% to allow for under-reporting of the legal rod catch across England and Wales. This has been based on a study of annual catch returns made following reminders (Environment Agency, 1998). Though the reporting rate is likely to vary between rivers and is thought to be less than satisfactory on some, the 10% correction for under-reporting continued to apply through to the 2006 season. Exceptions to this apply for the River Wye in Wales and the Rivers Test and Itchen in the Southern Region, for which the fishery owners' returns are regarded as being accurate, and for which no scaling factor has been applied for under-reporting.

2.3.2 Illegal catches by unlicensed fishermen

By their nature, illegal catches are very difficult to quantify. However, assessments can be made on the basis of enforcement activities. Consultation with Environment Agency Regional fisheries personnel was used as the basis for an assessment in February 1998, which provided estimates of illegal catches in coastal waters and within rivers and estuaries. These ranged from 5% to 18% of the declared catch for different Regions.

These estimates were reviewed in 2003 through a brief questionnaire sent to Environment Agency Regional fisheries personnel, as in 1998, asking them whether they agreed with the current estimate or to provide a revised estimate together with any justification for their decision. The results indicated a similar overall level of illegal catches, though Regional estimates ranged from 5% (Southern Region, with no licensed commercial catch) to 24% (North West Region, with 15% of the national catch). These catches of salmon tended to arise as by-catch taken by nets legitimately targeting bass and other marine species, although in-river poaching was reported to be an ongoing problem in many areas, driven partly by the premium prices paid for wild salmon. There are no commercial salmon fisheries in the Thames or Thames Estuary, but a questionnaire survey of netsmen fishing for

marine species in 2003 indicated a possible by-catch of over 100 salmon that year. This suggests that illegal exploitation of salmon may be significant in this area and has led to much tighter policing in the estuary in recent years.

It is recognised that the use of a national average might not be entirely appropriate given the variation apparent in the Regional estimates and the proportion of the England and Wales catch declared by each Region. However, pending further refinement of this analysis, a value of 12% was applied in 2006 (as in all years since 1998) to estimate the total illegal catch for England and Wales.

2.3.3 Under-reported and illegal catch estimate for 2006

On the basis of the above estimates, the non-reported and illegal catch for England and Wales in 2006 is estimated at about 25 t, which represents 24% of the total weight (including the under-reported and illegal catch) of salmon caught and killed.

2.4 Other sources of non-catch fishing mortality

Non-catch fishing mortality includes all sources of mortality generated directly or indirectly by fishing which are not included in the recorded catch. It includes the illegal and unreported catches discussed above, in addition to losses of fish that are removed from fishing gear by predators, dead fish that fall out of a net and fish that escape or are released but subsequently die.

The extent of the likely losses will vary between fisheries because of the type of gear used and its method of operation. In addition, the impact of predators, particularly seals, varies between areas. However, in most net fisheries in England and Wales, the netsmen remain with their gear and remove any fish caught quite quickly; thus relatively few fish will drop out and losses to predators can usually be limited. Sweep and hand-held nets cause very little damage to the fish and so losses of fish that escape are likely to be minimal. However, small losses may occur from enmeshing nets, and predation losses may be significant in the north east coast fishery, which is close to a large grey seal colony.

No data are available of the mortality of salmon incurred during normal angling activities (e.g. due to lost or foul-hooked fish that subsequently die) that are not recorded in the retained catch. Whilst the use of C&R (see Section 2.1.3) is likely to result in some fish dying through exhaustion or damage, studies have demonstrated that if fish are appropriately handled, mortality following capture is low and a large proportion of fish survive to spawn (Webb, 1998a,b; Whoriskey *et al*., 2000). Recent radio-tracking studies carried out by the Environment Agency on the River Eden, Cumbria, found that upwards of 85% of released spring salmon can reasonably be expected to survive to spawning (Environment Agency, 2003a). A study in the Cornwall Area, where a high proportion of the total salmon rod catch on some rivers is taken by worm fishing, indicated that fish caught with circle hooks were more likely to be hooked in the mouth, and this has been shown to reduce post-release mortality rates by approximately 50% (Cooke and Suski, 2004).

In 2004, a new byelaw was introduced in Wales banning the use of a tailer with rod and line fishing. Whilst the use of tailers was already infrequent, this ban will have had a beneficial effect, increasing the likelihood of survival of released fish.

Throughout the summer and autumn of 2006 there were reports from many parts of England & Wales of adult salmon with swollen and/or bleeding vents. Most of the reports came from Environment Agency staff working on fish traps, however a number of anglers also reported such fish. The occurrence of

fish with bleeding vents was noted from a wide geographical area, extending from the River Tamar in the South West to the River Eden in the North West. At the Environment Agency's River Dee adult trap approximately 10% of the catch (119 fish) was affected. Investigation of a small number of salmon failed to indicate a common causative agent. It was not clear to what extent the high water temperatures and low flow conditions experienced across England and Wales in the summer months may have been a contributory factor, or whether the condition affected mortality or breeding success (a small number of fish taken as broodstock were reportedly stripped successfully). The situation will continue to be monitored closely in future.

As noted in Section 1.2, there were no evident mass mortalities of fish in rivers, apart from those noted in the Tyne estuary. However, given the climate change scenarios for England and Wales (UKCIP, 2002) in the coming decades, there is concern that the hotter, dryer summers predicted will result in an increased threat to already depleted salmon stocks.

2.5 Composition of catches

2.5.1 Age composition of net catches

Prior to 2001, it was not possible to estimate the proportions of grilse (1SW) and MSW salmon in the catch of all Regional net fisheries, because netsmen were generally not required to report the sizes of individual fish caught and few scale samples were collected. However, data collection procedures for all fisheries were standardised in 2001, except in the North East that has its own long-standing methodology, and this permits age composition of catches to be reported.

Catches in some net fisheries are reported as small (<3.6 kg = 8 lb) or large (>3.6 kg) salmon, based upon weight splits, and this can be used as a rough indication of sea-age, although this will result in some fish being mis-classified. Such data are available for 2006 for a number of Regions as shown in the text table below. Overall, large MSW salmon comprised 46% of the reported net catches, varying regionally from 28 to 66% (excluding the small catch in Anglian Region):

	Small salmon		Large Salmon		Total
	(<3.6 kg)	%	(>3.6 kg)	%	
NE	3,396	45	4,170	55	7,566
Anglian	15	100	0	0	15
SW	315	66	162	34	477
Mids	292	34	572	66	864
Wales	460	68	219	32	679
NW	2,881	72	1,096	28	3,977
Total	**7,359**	**54**	**6,219**	**46**	**13,578**

Where the reporting systems have been consistent, these data can provide an indication of changes in the age-composition of the catches over time. In the North East Region, for example, the proportion of large (MSW) salmon appears to have declined for a period after the mid 1960s (Figure 8) and

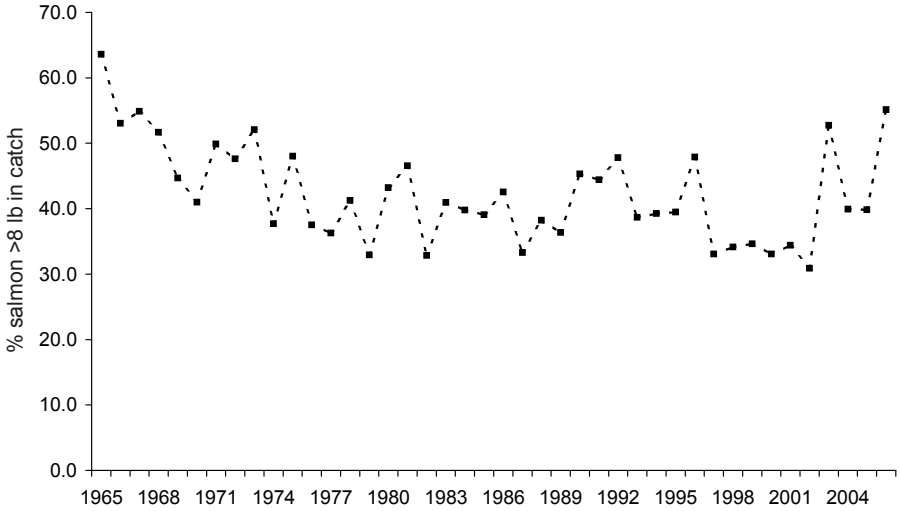


Figure 8. Estimated percentage (%) of salmon >8lb in the catch (as declared by netsmen) in the north east coast fishery, 1965–2006

then remained reasonably consistent from the mid-1970s to the mid 1990s. The proportion of large salmon was then consistently low (between 31 and 35% of the catch) from 1997 to 2002, but has increased again more recently to levels not seen since the early 1970s (52% in 2003 and 55% in 2006). The latter may reflect poor grilse runs in these years. However, the major reduction in the drift net catch from 2003 (and thus higher proportion taken by fixed T-nets) may also explain this change. Nationally, the proportions of MSW salmon recorded since 1999 are expected to have been reduced by the introduction of the measures restricting netting effort in the early part of the season when MSW salmon comprise the majority of the catch.

2.5.2 Age composition of rod catches

Monthly age-weight keys are available for salmon caught in the River Dee trap over the period 1992–2006, and these have been used to estimate the age composition of catches for the principal salmon rivers (Table 16). These estimates were derived from the declared catches where a weight and date of capture have been provided.

In 2006, rod catches in seven of the principal salmon rivers listed in Table 16 (Hampshire Avon, Dart, Taw, Torridge, Lyn, Severn and Wye) contained 50% or more MSW salmon (including fish subsequently released), compared to five rivers in 2005 (Hampshire Avon, Taw, Torridge, Severn and Wye). As in 2005, fifteen of the listed rivers had at least 25% MSW salmon in the rod catch in 2006, more than that in the period 1999 to 2002 (10–13 rivers each year) and the 6 rivers in 2004, but less than the 24 rivers in 2003. The estimated numbers of grilse and MSW salmon, and the proportion of MSW fish, in regional rod catches over the period 1995 to 2006 are shown in Table 17 and Figure 9.

In 2006, MSW salmon were estimated to comprise 23% of the catch nationally; since 2000 the proportion of MSW fish has varied between 19 and 33%, with the lowest figure being recorded in 2004. The recent variation in the proportion of MSW fish in river catches mainly reflects fluctuations in the grilse run rather than in MSW fish. There were fewer MSW salmon caught than in 2005 in all Regions bar the South West, where MSW catches were the highest since 1999. The overall MSW rod catch was very close to the mean of the previous five years. In general, there has been an increasing trend in the MSW catches over the past 8–9 years in all Regions except the South West and Wales, where they have remained relatively steady.

Table 16. Numbers and percentage of grilse and MSW salmon in provisional declared 2006 rod catches, including fish released

Region	River	No. grilse	%	No. MSW	%
NE	Coquet	641	85	110	15
	Tyne	2,409	67	1,205	33
	Wear	641	81	153	19
Southern	Itchen	64	76	20	24
	Test	67	78	19	22
SW	Hants Avon	21	20	86	80
	Frome	32	57	24	43
	Exe	129	70	56	30
	Teign	45	71	18	29
	Dart	18	37	31	63
	Tavy	72	95	4	5
	Tamar	125	65	66	35
	Lynher	50	89	6	11
	Fowey	212	91	21	9
	Camel	324	96	15	4
	Taw	67	44	84	56
	Torridge	1	2	42	98
	Lyn	25	39	39	61
Midlands	Severn	125	37	209	63
Wales	Wye	92	25	283	75
	Usk	409	57	311	43
	Ogmore	37	97	1	3
	Tywi	523	84	97	16
	Tawe	168	93	13	7
	Taf	63	66	32	34
	E & W Cleddau	21	72	8	28
	Teifi	443	86	72	14
	Dyfi	152	90	16	10
	Mawddach	100	86	16	14
	Ogwen	50	100	0	0
	Conwy	138	92	12	8
	Dee	463	81	111	19
NW	Ribble	870	86	137	14
	Lune	1,022	90	108	10
	Kent	429	92	37	8
	Leven	40	80	10	20
	Irt	144	98	3	2
	Ehen	265	97	9	3
	Derwent	745	88	106	12
	Eden	1,208	78	349	22
	Border Esk	733	90	83	10
Total		**13,183**	**77**	**4,022**	**23**

Note: Data only included for fish for which weight data were provided on catch return; these data do not represent the total catch for the season.

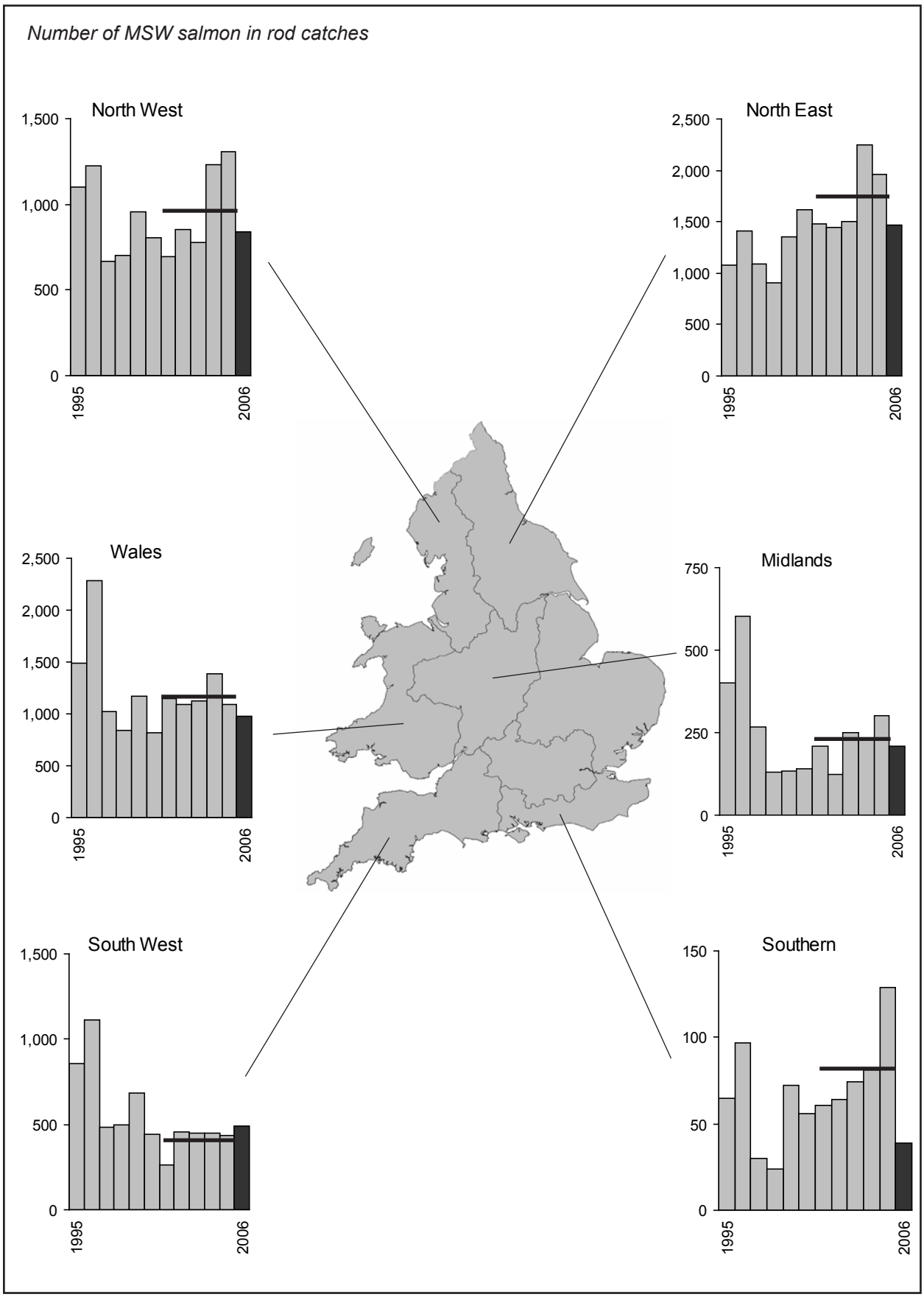


Figure 9. Estimated number of MSW salmon in regional rod catches. The histograms display data for the twelve years 1995 to 2006, together with the five-year mean for the period 2001-2005 (displayed as a horizontal line). Note that the histograms are not drawn to the same scale. Data for 2006 are provisional.

Table 17. The estimated number of grilse and MSW salmon (corrected for under-reporting) and the percentage composition of MSW salmon in regional rod catches in England and Wales, 1998–2006 (including fish caught and released)

Year	Region												All Regions	
	NE		Southern		SW		Midlands		Wales		NW			
	Grilse	MSW	Grilse	MSW	Grilse	MSW	Grilse	MSW	Grilse	MSW	Grilse	MSW	Grilse	MSW
1998	2,226	909	378	24	2,543	501	66	131	3,548	843	5,975	699	14,736	3,107
1999	1,586	1,351	206	72	1,386	683	70	132	2,278	1,175	3,589	955	9,115	4,368
2000	2,188	1,618	292	56	2,270	441	200	139	3,196	816	6,507	807	14,653	3,877
2001	2,628	1,478	344	61	1,275	261	90	210	3,638	1,149	3,936	694	11,911	3,853
2002	2,924	1,440	520	64	1,452	459	92	123	2,550	1,093	5,233	852	12,771	4,031
2003	2,353	1,505	151	74	947	446	117	249	1,766	1,129	3,121	780	8,455	4,183
2004	5,222	2,245	528	81	2,633	446	123	228	5,927	1,386	9,790	1,234	24,223	5,620
2005	5,481	2,088	306	132	1,404	494	151	322	3,588	1,261	7,804	1,487	18,734	5,784
2006*	**4,460**	**1,734**	**256**	**76**	**1,364**	**557**	**139**	**236**	**3,393**	**1,131**	**6,391**	**955**	**16,003**	**4,689**
Mean (2001-2005)	3,722	1,751	370	82	1,542	421	115	226	3,494	1,204	5,977	1,009	15,219	4,694
% change:														
2006 on 2005	-19	-17	-16	-42	-3	+13	-8	-27	-5	-10	-18	-36	-15	-19
2006 on 5-year mean	+20	-1	-31	-8	-12	+32	+21	+4	-3	-6	+7	-5	+5	0

Percentage MSW

Year	Region						All Regions
	NE	Southern	SW	Midlands	Wales	NW	
1998	29	6	16	66	19	10	17
1999	46	26	33	65	34	21	32
2000	43	16	16	41	20	11	21
2001	36	15	17	70	24	15	24
2002	33	11	24	57	30	14	24
2003	39	33	32	68	39	20	33
2004	30	13	14	65	19	11	19
2005	28	30	26	68	26	16	24
2006*	**28**	**23**	**29**	**63**	**25**	**13**	**23**
Mean (2001-2005)	32	18	21	66	26	14	24

** Provisional*

Rod catches of grilse in 2006 were lower than those in 2005 in all Regions, although remained above the recent 5-year mean in three Regions. Overall, grilse numbers were the third highest in the recent time series and 5% above the five-year mean (Table 17). Grilse catches have tended to alternate between relatively good and bad years, with the 2003 grilse catch being particularly poor and that in 2004 the highest over the past eight years.

2.6 Origin of catches

2.6.1 Reared fish

There is no salmon ranching in England and Wales. Although fish farm escapees are not formally recorded in catches in England and Wales, a sampling programme was initiated by Cefas and the Environment Agency in 2003 to identify any salmon suspected of being of farmed origin in the England and Wales catch and to determine the extent to which such fish may be contributing to spawning stocks. Anglers have been encouraged to report any fish they caught that were suspected of being of fish farm origin.

There were no reports in 2006 of salmon suspected to be of farmed origin.

In a number of catchments, juvenile salmon are stocked from hatcheries for mitigation, restoration or enhancement purposes. Full details of the numbers of fish stocked in these programmes, and the stage (eggs, fry, parr and smolts) of release, are included on a catchment by catchment basis in the Salmonid and Freshwater Fisheries Statistics published annually by the Environment Agency. If they return as adults, these fish cannot usually be distinguished from fish derived from natural spawning, although marking and tagging programmes are undertaken in some areas to assess the efficacy of these programmes (Annex 5). The relatively small scale of stocking and low survival of stocked fish in most instances (Harris, 1994) suggest that these initiatives have a small overall impact on natural salmon populations in England and Wales (but see Section 2.1.3 on River Tyne stocking).

2.6.2 Salmon from other countries

Based upon studies conducted in the 1970s, approximately 95% of the salmon caught in the English north east coast fishery were estimated to be returning to rivers in Scotland at this time. However, as North East stocks recovered and exploitation levels were reduced, it was estimated that this proportion fell progressively to around 75% in more recent years. With the buy-out of many of the drift nets in 2003, most of the catch was taken by T- and J-nets which operate close inshore and are known from tagging studies to take a higher proportion of local fish. The proportion of Scottish fish will thus have been lower still in the 2003–2006 catches. The fishery operating in the Solway Firth is also thought to exploit some salmon returning to rivers in Scotland, but the proportion of such fish in the Solway net catch has not been estimated. There are very few other records of tagged salmon released in, or originating from, rivers in other countries being taken in English and Welsh fisheries. No such tag recoveries were reported in 2006.

2.7 Exploitation rates

2.7.1 Homewater exploitation

The relationships between salmon run and catch are mediated by fishing effort and catchability (the proportion of the stock taken per unit of fishing effort), which in turn are shown to vary between and within rivers. A prime cause of this variation is likely to be river flow, which acts by influencing the behaviour and availability of the fish to both nets and rods, and also angler activity.

Relatively few rivers have independent measures of run size to compare against catch. However, such data obtained from counters and traps are available for some rivers in England and Wales (Table 21 and Figure 12), and have been used with the total catch (retained and released combined) to estimate exploitation rates (Table 18 and Figure 10). These show varying trends, but the 'true' exploitation rates (i.e. fish retained) show a strong decline in most rivers in recent years, an effect largely attributable to C&R, which, over the past 10 years, has increased from 10% to over 50% (see Table 3 and Section 1 for details of other management measures). Pending the results of a study to assess recapture rates of salmon caught and released on the Rivers Test and Itchen, it has been decided only to publish recent exploitation rates for retained fish in these rivers. No salmon were known to have been killed by anglers in these two rivers in 2006.

Overall levels of exploitation in 2006 (including released fish) varied considerably between rod fisheries in relation to the average of the previous five years, ranging from a 34% decrease on the River Frome to an increase of 41% on the River Kent. Exploitation rates are also available for three net fisheries, on the Dee, Kent and Lune. There was a marked fall on the Dee (down 34% on the 5-year mean) as a consequence of the reduced netting effort (Section 1.2.1); exploitation rates on the other rivers were above the five-year average.

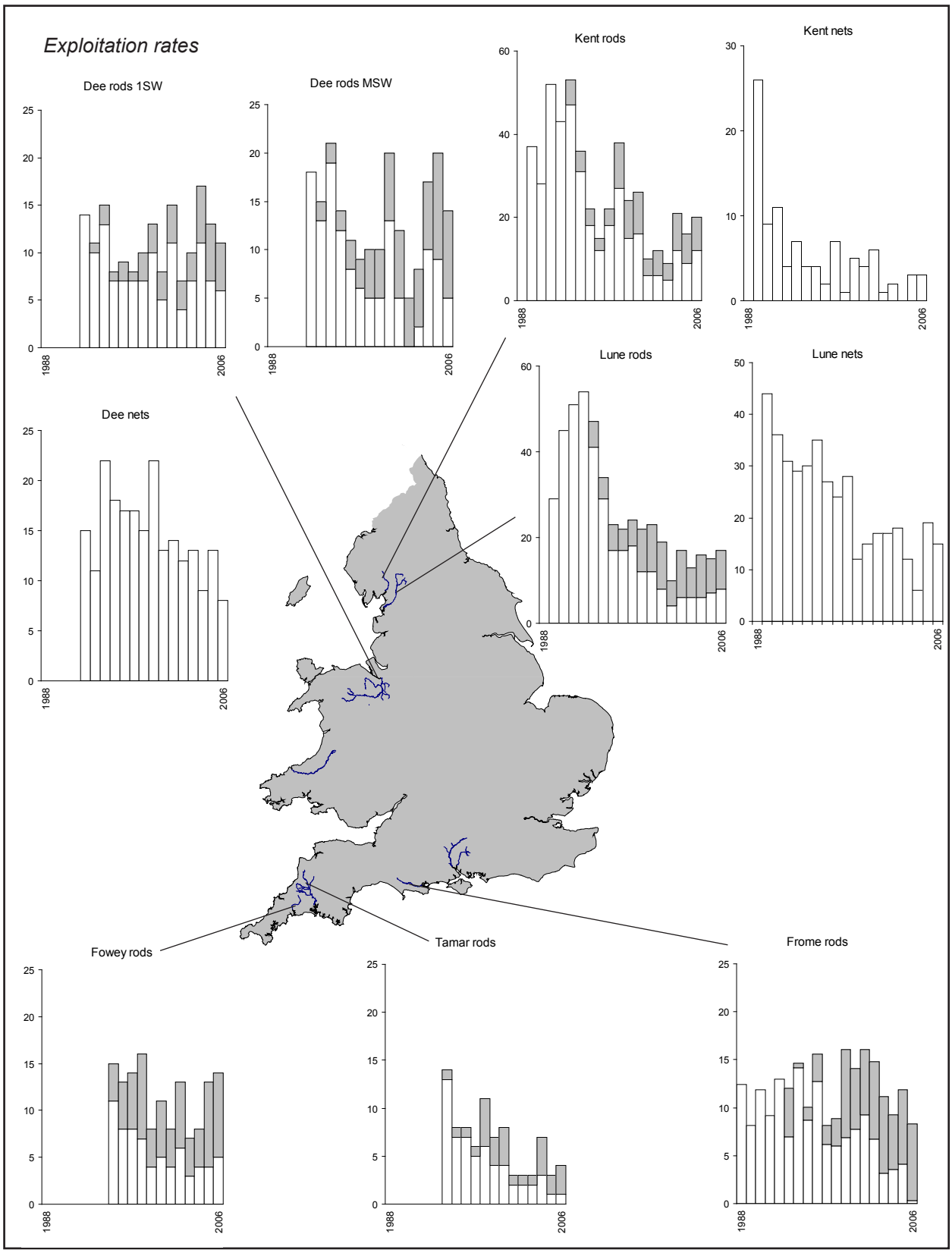


Figure 10. Estimated exploitation rates (%), including fish released (shown as shaded part of bar), for selected rod and net salmon fisheries in England and Wales. The histograms display all available data for the years 1988 to 2006. Data for 2006 are provisional. Note that estimates for the Dee rods have been split by age class (1SW and MSW); all other estimates are combined for all ages.

Table 18. Estimated exploitation rates (%) for selected rod and net fisheries in England and Wales, 1988–2006; data for rod fisheries distinguish exploitation rates for all fish (including fish released) and for retained fish only (Ret.) (Rates are corrected for under-reporting)

	Rod Fisheries																		Net Fisheries		
Region	Southern				SW						Wales				NW				Wales	NW	
River	Test		Itchen		Frome		Tamar		Fowey		Dee		Dee		Kent		Lune		Dee	Kent	Lune
Wild/Hatchery	W/H		W		W		W		W		W (1SW)		W (MSW)		W		W		W	W	W
Year	All (c)	Ret.	All (c)	Ret.	All (a)	Ret.	All	Ret.	All (d)	Ret.	All (b)	Ret.	All (b)	Ret.	All	Ret.	All	Ret.	Ret.	Ret.	Ret.
1988	40	40	34	34	12	12															
1989	29	29	45	45	8	8									37	37	29	29		26	44
1990	37	37	53	53	12	12									28	28	45	45		9	36
1991	26	26	68	68	9	9									52	52	51	51		11	31
1992	53	53	85	85	13	13					14	14	18	18	43	43	54	54	15	4	29
1993	37	34	30	30	12	7					11	10	15	13	53	47	47	41	11	7	30
1994	40	31	59	54	15	14	14	13			15	13	21	19	36	31	34	29	22	4	35
1995	32	26		10	10	9	8	7	15	11	8	7	13	12	22	18	23	17	18	4	27
1996	24	18		53	16	13	8	7	13	8	9	7	10	8	15	12	22	17	17	1	24
1997	15	14		24	8	6	6	5	14	8	8	7	9	6	22	18	24	18	17	7	28
1998		21		20	9	6	11	6	16	7	10	7	10	5	37	27	21	12	15	1	12
1999		11		14	16	7	7	4	8	3	13	10	10	5	24	15	23	12	22	5	15
2000		0		8	14	8	8	4	11	5	8	5	20	13	26	16	19	8	13	3	17
2001		1		1	16	9	3	2	8	4	15	11	12	5	10	6	10	4	14	6	17
2002		0		0	15	7	3	2	13	6	7	4	5	0	12	6	16	6	12	1	18
2003		5		0	11	3	3	2	7	2	10	7	8	2	9	5	13	6	13	2	12
2004		0		0	9	4	7	3	8	4	17	11	17	10	21	12	16	6	9	0	6
2005		0		0	12	4	3	1	14	5	15	8	21	7	20	11	17	7	13	3	19
2006*		**0**		**0**	**8**	**0.3**	**4**	**1**	**14**	**5**	**11**	**6**	**14**	**5**	**20**	**12**	**17**	**8**	**8**	**3**	**15**
Mean (2001 - 2005)		1		0	13	5	4	2	10	4	13	8	12	5	14	8	15	6	12	2	14
% change																					
2006 on 2005					-30	-93	+33	0	0	0	-27	-25	-32	-29	0	+9	0	+14	-38	0	-21
2006 on 5-yr mean					-34	-95	+12	-44	+39	+20	-14	-25	+13	+7	+41	+47	+17	+39	-34	+31	+5

Key: *(a) Data based on CEH counter at Wareham, and supplied courtesy of CEH.*

(b) Data derived from mark-recapture experiment.

(c) Almost all Test and Itchen rod caught salmon have been returned in recent years. The potential for the same fish to be caught more than once means, therefore, that exploitation rates cannot be estimated from catch returns. Research is underway to provide updated exploitation rates for these rivers.

(d) Counter data include large sea trout, therefore exploitation rates for salmon may be underestimated.

** Provisional*

Note: Estimates for Dee, Kent and Lune net fisheries are corrected for estimated rates of under-reporting. The entire catch from these net fisheries is assumed to be killed.

An analysis of data from seven rivers (Test, Itchen, Frome, Tamar, Fowey, Dee and Lune; Milner *et al*., 2001) has shown that, while exploitation rates tend to differ between rivers, there is also considerable variation between years within individual rivers. From a tagging and recapture programme on the River Dee, it has been shown that early season entrants to the river were subject to much higher exploitation than those entering later, though exploitation rates of spring salmon in the Dee declined from 26% in 1992–1994 to 8% in 1999.

Since regulation changes occur frequently in salmon fisheries, with the explicit aim of changing exploitation rates, this needs to be taken into account when interpreting historical catches in terms of indicating stock abundance.

2.7.2 Exploitation in fisheries outside England and Wales

Salmon stocks in England and Wales are exploited in a number of fisheries other than those operating under the jurisdiction of the Environment Agency within national waters. These include the distant-water fisheries at Faroes and West Greenland, and other fisheries such as those operating off Ireland and in homewaters in other parts of the UK. Tagging studies have provided information on the levels of exploitation for English and Welsh stocks in many of these fisheries and this is summarised briefly below.

West Greenland

This fishery exploits only salmon that would have returned to Europe and North America as MSW fish. The exploitation rates on the MSW component of English and Welsh stocks in the late 1980s/ early 1990s were estimated to be in the region of 10 to 20% when catches at West Greenland were in the range of 300 to 900 t (Russell and Potter, 1996). However, following significant quota reductions and other initiatives since the late 1980s, exploitation of MSW fish is believed to have fallen to very low levels. In 1993–94, a privately funded buy-out was negotiated and the fishery (apart from subsistence fishing) was suspended. Between 1995 and 1997 the catch ranged between 58 t and 92 t, while from 1998 to 2000 a subsistence-only fishery (<20 t) operated. In 2001 and 2002, an *ad hoc* management programme was set up to adjust the allowable catch based on CPUE data obtained during the fishery. In 2001, this resulted in a catch of 43 t, whereas in 2002, another privately funded buy-out commenced and a subsistence catch of just 9 t was recorded. Since that time, the fishery has been restricted to a subsistence-only catch of about 10 t as a result of an annually renewable buy-out agreement. However, while the same measure applied in 2006, it was also agreed that it would apply in 2007 and 2008 if ICES provides a framework of indicators for use in identifying any significant change in the previously provided multi-annual advice, which is accepted by the Parties to the agreement. At this subsistence only catch level, exploitation on English and Welsh stocks is expected to be very low (<1%). The regulatory measures agreed by NASCO in respect of the West Greenland salmon fishery are summarised at Annex 1.

Faroes

The Faroes fishery exploits both grilse and MSW salmon of largely northern European origin. Prior to the recent buy-out arrangements, few tags of English and Welsh origin were recovered in this fishery and estimated exploitation rates on English and Welsh stocks were very low (~1%) (Russell and Potter, 1996). Between 1991 and 1998, the Faroes salmon quota was bought out with NASF funds, and only a small research fishery was operated, taking up to 23 t per year. No buy-out was arranged for 1999 or 2000. Although no fishing took place in 1999, a single vessel carried out commercial fishing in 2000 and a catch of 8 t was reported. The fishery has not operated in the period 2001 to 2006. The regulatory measures agreed by NASCO in respect of the Faroes salmon fishery are summarised at Annex 1.

Ireland

Cefas and the Environment Agency have continued to conduct smolt tagging studies to assess the patterns and levels of exploitation on English and Welsh salmon stocks in the Irish coastal fishery. A working group of scientists from the Irish Marine Institute, Cefas and the Environment Agency has co-ordinated the analysis of the results and provided annual estimates of exploitation rates, including confidence limits and incorporating improved estimates of non-catch fishing mortality for the Irish fisheries.

The results have demonstrated that salmon from all parts of England and Wales are exploited in the Irish coastal fishery. However, the levels of exploitation have varied between stocks from different regions and from year to year, and have also declined following the introduction of management measures in the Irish fishery in 1997 and as a result of more restrictions on catch (TACs) since 2002. Based on aggregated data for all available years, the extant exploitation rates for the modelled stocks (1SW fish only) are presented in the text table below, for the periods before and after 1997. While it was not possible to use the modelling approach to estimate exploitation rates for other stocks, the overall pattern of tag recapture rates has been consistent with this regional pattern of exploitation.

River	Pre 1997 management measures			After 1997 management measures		
	Years	Expl. Rate (%)	95% CL (%)	Years	Expl. Rate (%)	95% CL (%)
Tyne - NE England	1986–96	1.3	± 0.4	1997	0.5	± 0.7
Wear - NE England	1986–96	0.9	± 0.2	1997	0	
Dee - N Wales	1992–96	16.8	± 5.7	1997–2004	2.1	± 0.95
Taff - S Wales	1991–96	13.4	± 4.6	1997–2005	8.2	± 3.5
Test - S England	1991–96	28.4	± 5.9	1997–2000	12.0	± 4.2
Tamar - SW England	No data			2003–2005	1.6	± 1.3

Note: Data for the River Taff have been updated; figures in this table thus differ from those provided previously.

It is evident that exploitation rates in the Irish fishery for stocks from all parts of England and Wales were higher before 1997 than since. In recent years, it appears that exploitation of salmon from north east England in the Irish fishery has been negligible (<1%), exploitation on stocks from north west England and north Wales has been low (~2%), but that levels have increased further south in Wales and for rivers in southern England (8-12%), although recent estimates for the River Tamar in south west England (2003 to 2005 only) indicate a current exploitation rate in Ireland of only about 2% for this stock.

In 2006, the Irish Government announced that it has adopted the key recommendations of a report by its Independent Working Group on Salmon, the key implication of which is that coastal drift netting for salmon is expected to cease through a buy out in 2007. It is anticipated that this change should mean that up to 5,000 more grilse may return to English and Welsh homewaters, representing about a 4% increase overall in estimated total returns to homewaters. Rivers in the south and west of England and Wales are expected to benefit the most.

Other homewater fisheries

Few tags of English and Welsh origin have been returned from homewater fisheries in Northern Ireland or Scotland. The exploitation rates of English and Welsh salmon in these fisheries have not been estimated, but are thought to be low.

Marine by-catch

In recent years, the ICES Salmon Working Group has investigated concerns about the potential by-catch of salmon post-smolts and adults in pelagic trawl fisheries. Areas of overlap between the distribution of post-smolts and certain pelagic fisheries have been identified, but assessment of the level of by-catch has been constrained by insufficient knowledge about the temporal and spatial distribution of post-smolts and catches in pelagic fisheries. The Working Group has recognised that data derived from research and commercial vessels using commercial pelagic trawls will provide the most reliable indicators of by-catch, and previous assessments based on these data have indicated a fairly low level of impact. A previous estimate indicated that the upper level of potential post-smolt by-catch (from a range of ~40 to 150k fish) equated to less than 5% of the estimated pre-fishery abundance (PFA) of salmon for the north-east Atlantic stock complex. The Working Group were unable to update these estimates in 2006. However, some new information was received from Russia, Iceland and Faroes.

In June-July 2005, two adult salmon were caught during a total of 101 hauls by a pelagic trawl fished from a Russian research vessel in the Norwegian Sea. In addition, screening of catches was also carried out on Russian commercial pelagic trawlers operating in the same area (between 64°00 and 74°00 N, and from 03°30 W to 14°30 E); a total of 182 hauls were screened. No post-smolts or adult salmon were recovered in June-July when the vessel was fishing for mackerel (total catch of pelagic fish was 849 t) in the international waters of the Norwegian Sea and a strip of water adjacent to the 200 mile limits of the Faroe Islands and Norway. Similarly, no post-smolts or adult salmon were recovered in the first half of August when the vessel was fishing for blue whiting in the international waters of the Norwegian Sea (total catch of pelagic fish was 328t). However, in the latter part of August, 9 post-smolts were found in catches when fishing for Atlanto-scandian herring in the northern part of the Norwegian Sea. These low catches of salmon suggest that Russian vessels in the pelagic fisheries in the Norwegian Sea using traditional pelagic trawl design and rigging are unlikely to catch significant numbers of salmon post smolts or adult salmon. It was suggested that most salmon catches probably take place during trawl retrieval.

In December 2004, a questionnaire survey of virtually all Icelandic fishing vessels included two questions regarding salmon by-catch and revealed much higher values than anticipated. In a following telephone survey, 21.2% of respondents reported a salmon by-catch, with the mean number of salmon per respondent being 6.3 fish. In total, 5,110 salmon (3,165 to 7,055, 95% CL) were estimated to have been caught as by-catch by Icelandic fishermen in 2005, compared to a total catch of 1.7 million tonnes of all species caught by the Icelandic fleet. The majority of the salmon were caught in pelagic trawls and purse seines fishing to the east and south of Iceland in the period June to August. Adult salmon comprised the bulk of the by-catch by number (grilse 61% and MSW salmon 20%), with post smolts comprising 19%.

No salmon by-catches were reported in the Faroese herring fisheries in 2005.

The Working Group concluded that salmon by-catches have a low impact on PFA and returns to homewaters.

2.8 Microtag, fin clip and external tag releases

Details of all marking and tagging of salmon undertaken in England and Wales in 2006 are included at Annex 5.

In 2006, 55 k hatchery-reared salmon parr and smolts and 17 k wild salmon smolts were microtagged and released in England and Wales to assess levels of exploitation and marine survival and to investigate the efficacy of fisheries improvement programmes; all these fish were also adipose fin-clipped. A further 149 k hatchery parr and smolts and 17 k wild parr were marked with adipose fin clips only. The majority of the wild parr were also marked with PIT tags. Just over 2,900 adult salmon were tagged for the assessment of returning stocks or in conjunction with the use of radio and acoustic tags in behaviour studies.

REPORT ON STATUS OF STOCKS IN 2006

3. Status of stocks

3.1 Measures of abundance/escapement

3.1.1 Adult fish

Electronic fish counters are operated on a number of catchments in England and Wales to provide estimates of the upstream run of adult salmon and sea trout. Where it is possible to separate the species, the counts have been adjusted to provide estimates of the numbers of returning salmon, and values for several counters in some years have also been adjusted retrospectively to accommodate new efficiency estimates. Time-series of counts, or other estimates of in-river stocks, are presented in Table 19 and Figure 11.

Data for 2006 show that runs into freshwater were above the recent 5-year mean in 5 of the 11 catchments for which data are available. Over the available time series, data show a recent increasing trend on some rivers (Tees, Tamar, Fowey, Lune and Kent), no substantive change in others (Dee, Test and Caldew), and a declining trend in others (Thames, Itchen and Frome). No salmon were recorded in the adult trap on the Thames in 2006.

There have been growing concerns about increasing levels of salmon mortality at sea. However, few data are available to evaluate long-term trends in marine survival for salmon stocks in England and Wales. Marine survival estimates for the River Corrib (Ireland), River Bush (Northern Ireland) and River North Esk (Scotland) are shown in Table 20. These data confirm patterns seen elsewhere in the North Atlantic, which indicate that marine survival can be quite variable between stocks and between years, but has generally decreased since 1987. Shorter time series for the Rivers Dee (Wales) and Tamar are also included in Table 20. These indicate similar low levels of marine survival in recent years.

3.1.2 Spawning escapement in 2006

ICES and NASCO require countries with natural stocks of Atlantic salmon to set criteria against which to give advice on stock status and to manage and conserve individual river stocks. In England and Wales, conservation limits (CLs) have been developed that indicate the minimum spawning stock levels below which stocks should not be allowed to fall. Full details of the process for setting CLs and assessing compliance with these biological reference points are given in Annex 2. The CL for each river is set at a stock size (defined in terms of eggs deposited – Table 21) below which further reductions in spawner numbers are likely to result in significant reductions in the number of juvenile fish produced in the next generation. In reviewing management options and regulations, the Environment Agency also uses an over-arching management objective that a river's stock should be meeting or exceeding its CL in at least four years out of five. A Management Target (MT) is set for each river, representing a spawning stock level for managers to aim at in order to meet this objective: these are provided in Table 21. It should be noted, however, that the MT is not used as part of the annual compliance assessment that follows.

Table 19. Validated counts and run estimates of salmon smolts and adults in rivers in England and Wales

	Stage:	Smolts	Adults										
	Region:	Southern	Thames	Southern		SW			Wales		NW		NE
	River:	Test #	Thames #	Test	Itchen	Frome	Tamar	Fowey	Dee	Lune	Kent	Caldew	Tees
	Method:	Run estimate	T	RSE[1]	RSE[1]	RSE[1]	RSE[1]	C$	RSE[2]	RSE[1]	RSE[1]	T**	T
1986			81										
1987			41										
1988			288	1,507	1,336	3,614							
1989			91	1,730	791	3,156				4,931	1,137		
1990			63	790	367	1,917				5,311	2,216		
1991			36	538	152	861				5,277	1,736		
1992		11,967	247	488	305	871			4,643	3,916	1,816		
1993		7,131	259	920	646	1,291			9,757	7,586	1,526		
1994		3,381	143	618	311	1,141	6,359		5,285	5,970	2,072	1,461	
1995		6,853	162	517	798	1,102	5,637	890	5,703	4,437	2,762	1,456	87
1996		4,712	122	515	386	1,499	3,988	1,187	4,931	4,605	3,246	1,202	98
1997		7,229	25	317	232	1,207	2,989	1,075	5,496	3,121	1,473	831	125
1998		14,672	6	748	412	1,273	4,176	882	6,661	7,457	2,166	1,042	224
1999		4,085	35	777	207	815	3,588	1,262	3,664	4,846	1,023	969	141
2000		3,516	53	537	204	641	3,539	1,692	3,751	8,262	2,354	1,288	152
2001		2,625	9	408	214	652	4,184	1,611	4,766	6,195	2,882		163
2002		2,190	22	1,046	239	855	6,053	1,804	7,216	7,603	3,149	1,231	239
2003		7,585	18	367	169	562	4,835	1,777	4,915	6,895	2,741	759	126
2004		5,024	7	1,129	410	712	4,938	2,279	7,123	12,781	2,982	1,579	571
2005		7,580	0	819	456	538	4,921	1,903	5,435	9,824	3,082	1,031	171
2006*		**6,118**	**0**	**1,058**	**419**	**750**	**5,459**	**1,296**	**5,607**	**7,443**	**2,625**	**1,239**	**209**
Mean (2001-05)		5,001	11	754	298	664	4,986	1,875	5,891	8,660	2,967	1,150	254

Key to methods: *T = adult trap.*
C = adult salmon count.
RSE[1] = returning stock estimate (validated count + catch below counter).
RSE[2] = returning stock estimate (mark/recapture estimate).

Key: *# Denotes stock supported by large-scale stocking from hatchery programme.*
** Provisional.*
*** Data adjusted for multiple entry (re-entry rate of 6.6% in 2002). Data relate to spawning year, i.e. 12 month period from March to February.*
**** Index of run only - based on adult trap in barrage.*
$ Includes large sea trout.

Note: *Some data corrected from those reported previously.*
Data for the Frome courtesy of CEH.

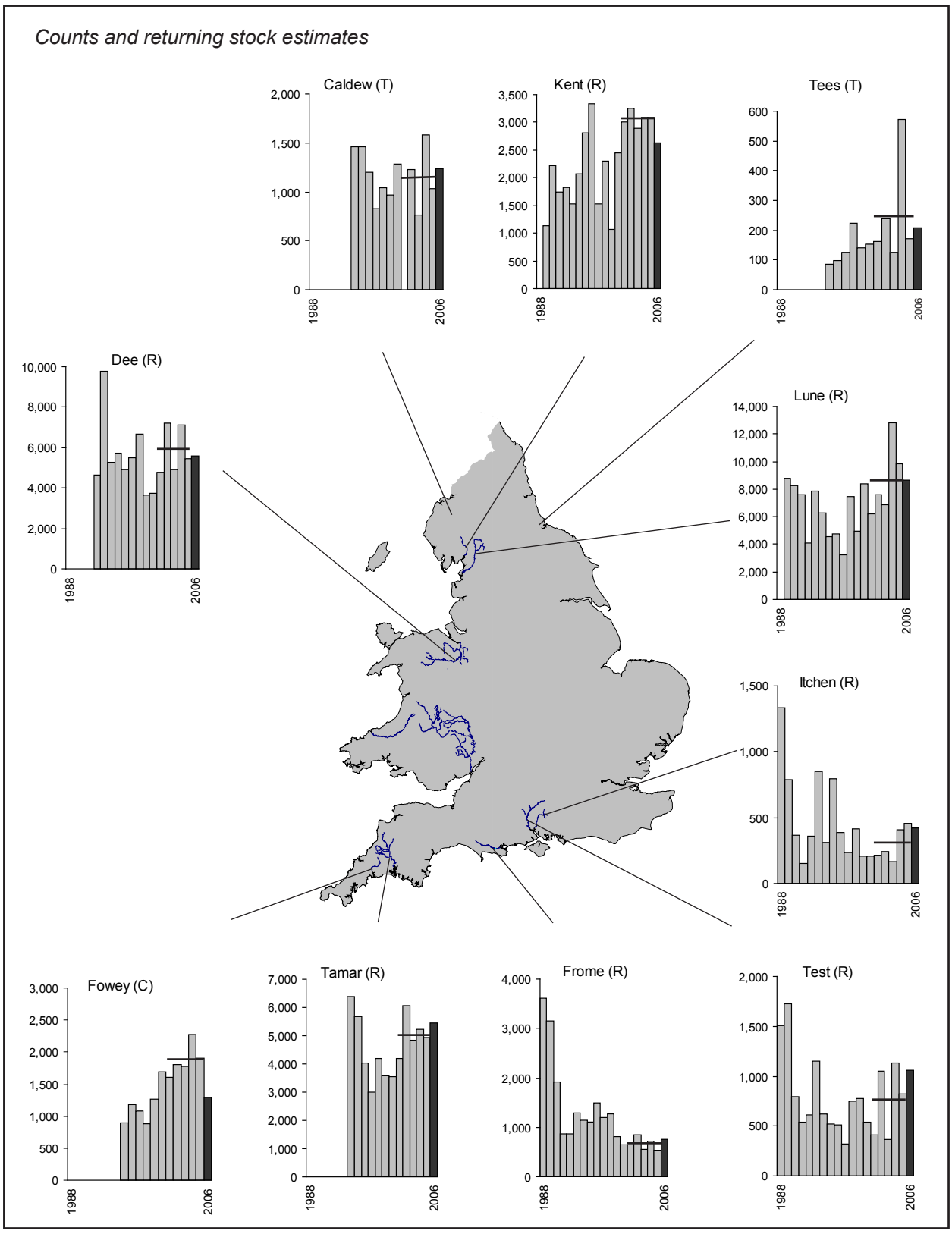


Figure 11. Counts (C), returning stock estimates (R) and trap data (T) for selected salmon stocks in England and Wales. The histograms display all available data for the years 1988 to 2006, together with the five-year mean for the period 2001–2005 (displayed as a horizontal line). Note that the histograms are not drawn to the same scale. Data for 2006 are provisional.

Table 20. Estimated survival of wild smolts (%) to return to homewaters (prior to coastal fisheries) for index rivers in the UK and Ireland (from ICES, 2006) and Environment Agency data

Smolt migration year	Ireland River Corrib		UK (N. Ireland) River Bush*	UK (Scotland) River North Esk**		UK (England and Wales) River Dee***		River Tamar	
	1SW	2SW	1SW	1SW	MSW	1SW	MSW	1SW	MSW
1984	26.2	2		7.8	3.5				
1985	18.9	1.8		19.9	5.8				
1986	-	-	31.3	-	-				
1987	16.6	0.7	35.1	11.9	3.1				
1988	14.6	0.7	36.2	-	-				
1989	6.7	0.7	25.0	7.0	4.2				
1990	5.0	0.6	34.7	6.4	2.9				
1991	7.3	1.3	27.8	9.6	4.2				
1992	7.3	-	29.0	-	-				
1993	10.8	0.1	-	-	-	4.5	1.8		
1994	9.8	1.4	27.1	13.7	2.3	1.0	0.9		
1995	8.4	0.1	-	9.8	3.7	2.2	0.4		
1996	6.3	1.2	31.0	9.3	3.4	3.5	1.6		
1997	12.7	0.8	19.8	9.6	4.4	4.8	2.3		
1998	5.5	1.1	13.4	-	-	1.7	2.7		
1999	6.4	0.9	16.5	-	-	4.3	9.7		
2000	9.4	0.0	10.1	5.9	2.3	1.6	0.8		
2001	7.2	1.1	12.4	9.0	3.2	3.7	0.0		
2002	6.0	0.5	11.3	3.2	2.5	2.2	0.6	3.3	2.2
2003	8.3	0.5	6.8	9.6		2.3	0.3	5.7	1.7
2004	5.2		6.8			3.7	0.8	6.3	1.5
2005						**4.3**		**6.6**	
Mean (5 year)	7.1	0.7	11.8	6.9	3.1	2.7	2.3		
Mean (10 year)	8.3	0.7	16.5	8.8	3.1	3.0	1.9		

*Key: * Based on microtagging, corrected for tagging mortality.*
*** Based on tagging, not corrected for tagging mortality.*
**** Based on microtagging with a 90% tag retention rate, not corrected for tagging mortality.*

Annual compliance with the CL is estimated using egg deposition figures derived from returning stock estimates (Table 19), where such data are available. For rivers without traps or counters, the usual procedure for estimating egg deposition derives run size from rod catch using estimates of exploitation, which do not take into account annual changes in fishing effort. In years when effort was low - such as the 'low-flow' year of 2003 and the Foot-and-Mouth Disease year of 2001 - this approach has probably resulted in rod exploitation being over-estimated on a number of rivers and hence escapement and egg deposition being under-estimated. An improved procedure is being developed by the Environment Agency to take account of annual changes in fishing effort, as well as partitioning effort between salmon and sea trout (no distinction is currently made between these species when reporting fishing effort). Many rivers, and particularly some of the smaller catchments on the west coast of Wales, support relatively small salmon stocks and are principally regarded as sea trout rivers. Current procedures may also fail to take adequate account of this.

The egg deposition estimates for the Hampshire Avon and Dorset Stour are currently derived from the net catch of the Christchurch Harbour Netsmen, but with the clear reduction in effort in this fishery since 2002 it no longer provides a reliable basis for estimating egg deposition in these rivers. Work is currently being undertaken to establish a more reliable method. This work is principally focussing on the validation of the Knapp Mill fish counter on the lower Avon.

Egg deposition estimates for each of the 64 main salmon rivers in England and Wales are given in Table 21, and values for 2006, expressed as the proportion of the conservation limit attained, are illustrated in Figure 12. Summary data for 2006, in comparison with previous years, are presented in Table 23 and discussed in Section 3.1.4. The current compliance assessment for rivers in England and Wales in 2006 is also provided in Table 21 (full details in Annex 2), together with the predicted compliance for each river in five years time (2011). In 2006, 28 of the 64 rivers across England and Wales (44%) were assessed as having a high probability of failing to meet their CL, and only 11 rivers (17%) were assessed as having a high probability of achieving their CL, one more than in 2005. The remaining

25 rivers fall between a clear fail or pass in 2006. It should be noted that for some rivers that have consistently exceeded their CL over recent years (e.g. Lyn, Exe, Ogwen) the compliance assessment in 2006 is still 'uncertain' (Table 21). This reflects the level of variability in the egg deposition estimates and the way in which the compliance procedure works; further explanation is provided in Annex 2. Forecasting compliance in 2011 inevitably carries greater uncertainty: 34 rivers (53%) are currently assessed as falling between a clear fail or pass at this time, while 20 rivers are forecast to fail compliance in 2011 and ten rivers are forecast to meet their CL.

3.1.3. Juvenile fish

The Environment Agency monitors both stocks and fishery performance in most of its salmon rivers. The current juvenile monitoring programme samples the same 380 quantitative sites each year to identify temporal trends in abundance, and 3,030 sites are sampled semi-quantitatively once every five years to identify spatial variation in the juvenile population. The habitat at all sites is assessed using the model HABSCORE (Milner *et al*., 1998), which provides reference conditions against which the abundance of the juvenile salmon population at any site can be compared.

Between 2001 and 2006, reliable data were obtained from 4,259 sites over all rivers shown in Figure 1. The data were assessed using a classification scheme that produces one juvenile salmon density score for each site, using average values for the early 1990s as a baseline (Mainstone *et al*., 1994). Table 22 shows the distribution of density scores for each river relative to the baseline average. In only 14 of the 61 rivers (23%) was 50% or more of the catchment (by stream length) classified as average or above (Class A to C) in terms of juvenile salmon densities. By contrast, in 30 rivers (49%), 50% or more of the catchment (by stream length) was classified as well below average or fishless (Class E or F).

An alternative assessment of juvenile salmon densities is provided in Figure 13. This presents the mean percentage habitat utilisation index (PHUI) for 0+ juvenile salmon in rivers where ten or more juvenile survey sites have been assessed each year over the period 2001 to 2006. The PHUI values provide an index, where values of 1 (or greater) signify full useage of available habitat in the sampled sites. The data indicate relatively good habitat useage in the majority of the sampled sites, although with substantial under-utilisation in some catchments, including the south coast chalkstreams. Although covering a relatively restricted number of catchments, the data are in broad agreement with egg deposition estimates (Figure 12).

Salmon being unhooked by angler

Table 21. Conservation Limits (CL) and the proportion of the CL attained for the period 1997-2006 for the principal salmon rivers of England and Wales. Current compliance and predicted compliance in 2011 are shown in the right hand columns (see Annex 2 for details). Data for 2006 are provisional

Region/ River	Accessible wetted area (ha)	CL eggs/100m^2	CL eggs (x10^6)	Management Target eggs (x10^6)	2006 egg deposition (x10^6)	Proportion of Revised Conservation Limit attained (%)*										Current compliance #	Predicted compliance in 2011 #
						1997	1998	1999	2000	2001	2002	2003	2004	2005	2006		
NE																	
Coquet	144	218	3.14	5.87	8.77	231	190	169	262	285	304	286	484	462	280	Pass	Pass
Tyne	542	208	11.25	25.46	61.63	218	241	307	355	421	436	379	707	533	548	Pass	Pass
Wear	232	250	5.80	9.33	11.85	51	84	71	121	108	144	146	266	238	204	Pass	Pass
Tees	620	240	14.90	15.94	3.06	6	27	25	23	16	15	20	37	17	21	Fail	Fail
Esk-Yorks	86	236	2.02	2.57	2.13	43	22	14	28	36	52	34	85	93	105	Uncertain	Uncertain
Southern																	
Test	138	246	3.40	4.08	2.58	23	56	56	39	29	75	26	81	82	76	Fail	Uncertain
Itchen	69	234	1.63	1.86	1.02	31	62	26	28	32	30	31	62	62	63	Fail	Uncertain
SW																	
Avon-Hants	369	175	6.48	7.76	1.70	17	28	40	64	58	95	30	51	26	26	Fail	Fail
Stour	142	149	2.12	2.20	0.11	11	7	8	14	12	19	6	10	5	5	Fail	Fail
Piddle	18	177	0.31	0.40	0.22	106	113	103	165	54	77	53	67	51	71	Fail	Fail
Frome	88	171	1.50	1.99	2.11	195	200	131	95	97	137	95	124	98	141	Uncertain	Uncertain
Axe	83	175	1.45	1.65	0.49	21	20	28	19	25	70	34	22	10	34	Fail	Fail
Exe	282	253	7.14	11.62	8.05	188	196	255	298	150	137	111	317	154	113	Uncertain	Uncertain
Teign	98	251	2.47	3.35	2.51	93	88	76	134	87	58	50	199	99	102	Uncertain	Uncertain
Dart	137	218	2.98	3.49	1.63	67	51	53	67	49	39	34	106	47	55	Fail	Fail
Avon-Devon	35	202	0.70	0.92	1.17	52	62	59	72	78	126	122	103	117	167	Pass	Pass
Erme	20	180	0.37	0.57	0.47	97	59	120	65	36	237	38	124	13	129	Fail	Uncertain
Yealm	11	212	0.24	0.34	0.13	53	163	17	91	-	67	10	28	54	55	Fail	Fail
Plym	29	188	0.55	0.67	0.43	77	69	33	57	41	57	21	18	17	77	Fail	Fail
Tavy	68	201	1.37	1.90	1.21	96	182	79	82	68	20	19	80	101	88	Fail	Fail
Tamar	293	395	11.56	13.78	12.51	64	78	84	68	84	127	118	96	121	108	Uncertain	Uncertain
Lynher	29	233	0.68	0.92	0.76	76	155	63	130	60	58	52	151	144	111	Uncertain	Uncertain
Fowey	42	207	0.86	1.47	2.43	127	152	221	222	225	311	255	414	318	282	Pass	Pass
Camel	56	176	0.98	1.49	2.88	177	184	131	185	180	214	258	320	277	294	Pass	Pass
Taw	274	211	5.78	9.89	7.68	108	213	200	353	98	123	101	238	92	133	Uncertain	Uncertain
Torridge	198	207	4.10	5.12	2.67	35	95	47	84	17	38	26	102	66	65	Fail	Uncertain
Lyn	27	359	0.97	1.61	1.78	144	172	208	360	293	247	208	320	118	183	Uncertain	Uncertain
Midlands																	
Severn	898	143	12.85	16.78	17.31	138	72	72	93	116	70	137	128	178	135	Uncertain	Uncertain

Region/ River	Accessible wetted area (ha)	CL eggs/100m^2	CL eggs (x10^6)	Management Target eggs (x10^6)	2006 egg deposition (x10^6)	Proportion of Revised Conservation Limit attained (%)*										Current compliance #	Predicted compliance in 2011#
						1997	1998	1999	2000	2001	2002	2003	2004	2005	2006		
Wales																	
Wye $	1,610	221	35.66	39.68	17.20	71	61	60	46	65	28	49	71	63	48	Fail	Fail
Usk	407	248	10.11	13.64	18.49	122	148	153	209	216	174	89	197	124	183	Uncertain	Uncertain
Taff & Ely	146	219	3.19	3.44	0.25	18	19	36	15	7	18	26	11	9	8	Fail	Fail
Ogmore	61	180	1.10	1.36	0.34	70	76	61	77	62	46	26	117	34	30	Fail	Fail
Tawe	88	211	1.85	2.28	1.80	39	43	32	21	64	78	31	83	87	97	Fail	Uncertain
Tywi	500	226	11.30	14.65	14.31	56	78	71	89	44	67	85	162	108	127	Uncertain	Uncertain
Taf	90	189	1.70	2.50	1.99	83	54	85	107	133	48	32	226	136	117	Uncertain	Uncertain
E&W Cleddau	87	179	1.55	1.66	0.45	41	44	30	50	39	26	28	41	32	29	Fail	Fail
Teifi	326	265	8.65	12.40	12.01	139	132	145	143	164	128	89	286	128	139	Uncertain	Uncertain
Rheidol	31	222	0.68	0.80	0.36	76	60	56	51	48	30	27	98	70	52	Fail	Fail
Nevern	19	259	0.48	0.62	0.67	28	36	50	69	71	40	85	103	63	140	Uncertain	Uncertain
Dyfi	179	235	4.21	5.13	4.35	60	83	58	72	85	27	28	97	75	103	Fail	Uncertain
Dysinni	31	216	0.68	0.75	0.04	28	40	8	23	6	26	4	18	6	6	Fail	Fail
Mawddach	57	242	1.37	1.63	1.01	99	107	117	67	80	79	69	133	83	74	Fail	Fail
Dwyryd	9	201	0.19	0.44	0.66	279	281	140	79	234	497	251	630	286	353	Pass	Uncertain
Glaslyn	25	191	0.48	0.63	0.27	136	72	39	24	42	52	15	108	36	57	Fail	Fail
Dwyfawr	33	258	0.86	1.03	0.39	61	35	35	47	34	28	20	106	35	46	Fail	Fail
Seiont	21	226	0.48	1.17	1.63	158	198	111	214	242	69	85	645	375	342	Uncertain	Uncertain
Ogwen	24	362	0.87	1.61	1.33	259	336	165	279	392	195	137	367	396	153	Uncertain	Uncertain
Conwy	50	127	0.63	1.22	1.99	226	267	173	345	430	214	304	552	344	315	Pass	Pass
Clwyd	84	237	1.99	2.52	0.80	27	128	77	63	81	60	46	90	24	40	Fail	Fail
Dee	617	248	15.30	17.58	15.41	91	107	81	61	85	114	88	121	83	101	Uncertain	Uncertain
NW																	
Ribble	351	242	8.49	10.65	9.43	26	63	63	81	38	71	71	97	123	111	Uncertain	Uncertain
Wyre	67	70	0.47	0.60	0.08	16	96	15	14	35	41	9	96	13	18	Fail	Fail
Lune	423	280	11.84	17.47	17.88	56	120	95	165	130	154	142	264	198	151	Pass	Pass
Kent	68	223	1.52	3.26	6.13	139	366	117	271	414	472	429	467	486	403	Pass	Pass
Leven	46	182	0.83	0.97	0.51	45	56	31	92	-	68	81	73	81	61	Fail	Uncertain
Crake	16	194	0.32	0.43	0.23	14	109	32	64	-	58	6	108	117	72	Fail	Uncertain
Duddon (& Lickle)	26	121	0.31	0.68	1.18	56	200	77	69	-	115	52	345	351	380	Uncertain	Uncertain
Esk	20	181	0.37	0.61	0.87	55	161	173	261	116	89	59	192	251	234	Uncertain	Uncertain
Irt	35	198	0.69	1.03	1.38	90	157	47	120	35	90	54	170	179	200	Uncertain	Uncertain
Ehen	41	230	0.94	1.76	2.11	88	253	52	343	-	306	101	275	243	225	Uncertain	Uncertain
Calder	13	261	0.33	0.50	0.41	149	220	26	176	-	183	57	140	85	124	Uncertain	Uncertain
Derwent	213	185	3.93	7.42	8.31	139	146	144	299	235	209	125	440	357	211	Pass	Pass
Eden	688	200	13.75	20.27	20.18	110	95	92	101	108	107	87	252	212	147	Uncertain	Uncertain
Esk-Border	306	255	7.79	9.67	8.94	89	85	63	102	75	120	69	135	147	115	Uncertain	Uncertain
E & W Total			**262.53**	**355.08**	**332.68**												

*Footnotes: * Estimates include eggs contributed by rod-released fish.*

 # Basis for current and predicted compliance explained in Annex 2.

Dash denotes data not available.

$ Spawner/egg deposition estimates on the Wye (1997 onward) have been recalculated using angling catches and assumed rod exploitation rates (the latter derived from the Dee). Previous figures - based on acoustic counter data - have been withdrawn because of recently discovered factors affecting the validity of these data.

Prior to 1 April 2005, Border Esk egg deposition estimates were based only on English rod catch and likely to be undersestimates.

2006 egg deposition estimates are provisional; 2005 estimates may have been revised due to changes in catch data finalised since the publication of last year's report.

In some cases estimates have been amended due to errors in calculation (Piddle and Frome 1999-2005; Ribble 2005 and Lune 2004 and 2005) or data entry into Table 19 (Test and Itchen 1996-2005 and Taff 2005).

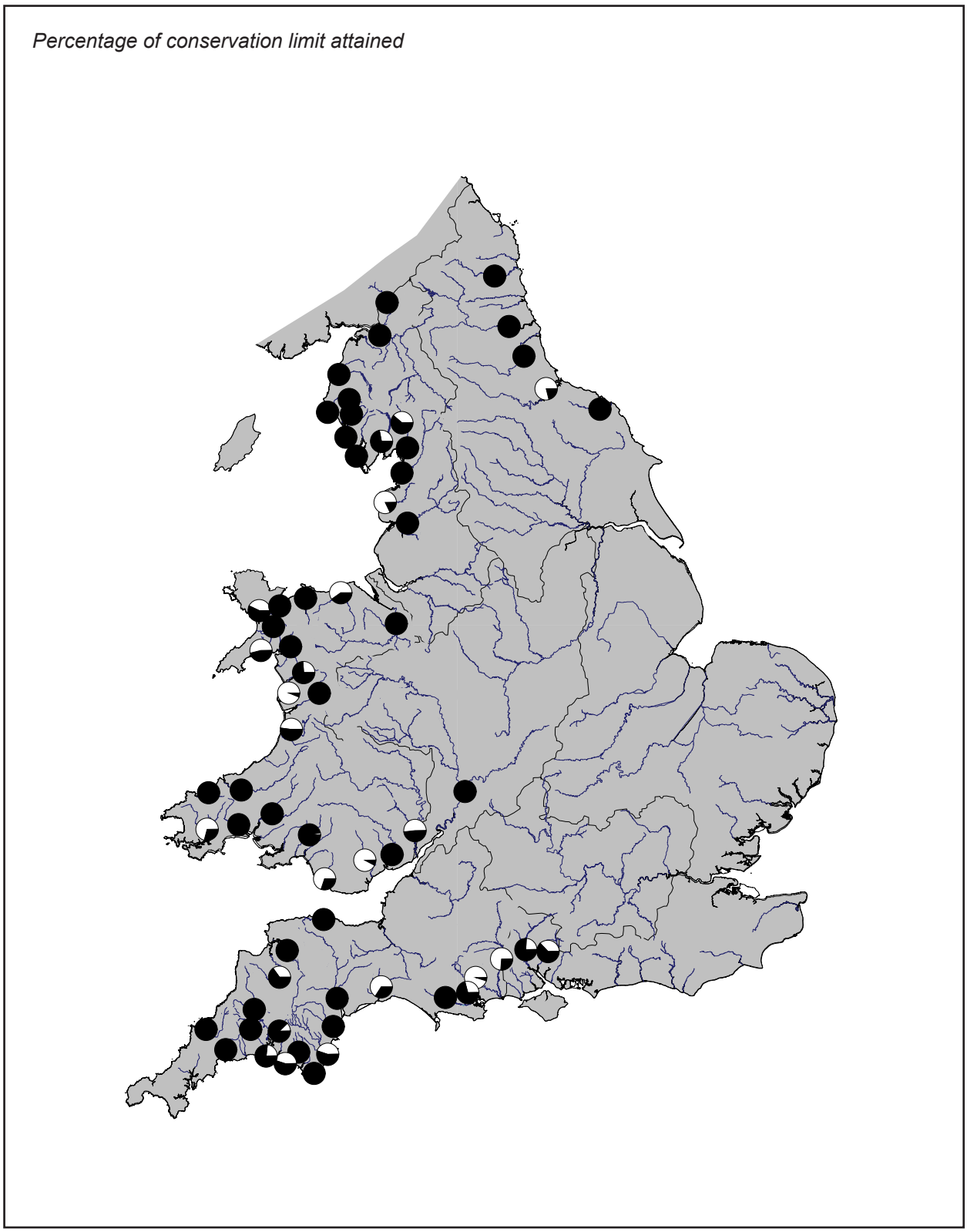


Figure 12. Pie charts for individual rivers for which conservation limits have been set (Table 21) showing the % of the conservation limit attained in 2006. A black circle indicates that the limit was met or exceeded.

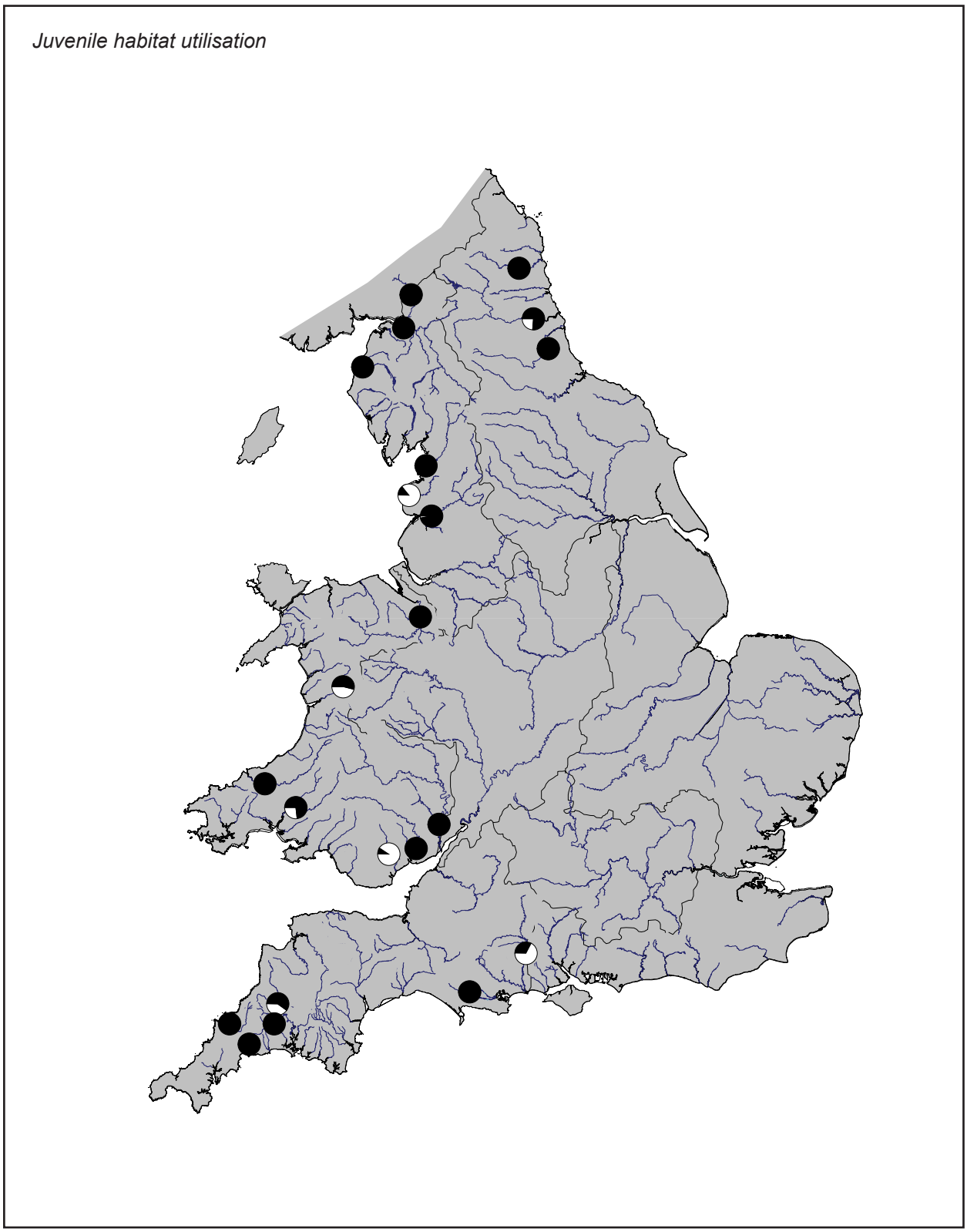


Figure 13. Pie charts showing mean percentage habitat utilisation for the period 2001–2006 for 0+ salmon in river catchments where 10 or more survey sites have been sampled.

Table 22. Juvenile salmon abundance indices (% of classes) for the principal salmon rivers of England and Wales, from surveys conducted by the Environment Agency during 2001 to 2006

Region	River	Salmon Abundance Classes		
		A-C	D	E-F
North East	Coquet	57	0	43
North East	Tyne	40	12	48
North East	Wear	13	2	85
North East	Tees	5	10	85
North East	Esk	31	31	38
Southern	Test	2	6	92
Southern	Itchen	46	0	54
South West	Avon (Hants)	7	16	77
South West	Frome & Piddle	15	20	65
South West	Aze	3	3	94
South West	Exe	47	12	41
South West	Teign	27	18	55
South West	Dart	41	11	48
South West	Avon (Hants)	40	0	60
South West	Erme	0	100	0
South West	Yealm	22	11	67
South West	Plym	48	10	42
South West	Tavy	50	14	36
South West	Tamar	52	10	38
South West	Lynher	55	20	25
South West	Fowey	40	15	55
South West	Camel	43	10	47
South West	Taw	30	23	47
South West	Torridge	21	33	46
South West	Lyn	50	0	50
Wales	Wye	36	8	56
Wales	Usk	46	9	45
Wales	Taff	2	0	98
Wales	Ely	20	30	50
Wales	Tawe	27	0	73
Wales	Tywi	28	12	60
Wales	Taf	20	17	63
Wales	Western Cleddau	21	29	50
Wales	Eastern Cleddau	18	24	58
Wales	Teifi	51	9	40
Wales	Rheidol	9	4	87
Wales	Nevern	47	18	35
Wales	Dyfi	16	3	81
Wales	Dysynni	31	38	31
Wales	Mawddach	11	0	89
Wales	Glaslyn	29	0	71
Wales	Dwyfawr	47	24	29
Wales	Seiont	67	0	33
Wales	Ogwen	60	10	30
Wales	Conwy	32	11	57
Wales	Clwyd	29	14	57
Wales	Dee	37	13	50
North West	Ribble	21	10	69
North West	Wyre	23	23	54
North West	Lune	47	14	39
North West	Kent	82	0	18
North West	Leven	30	24	46
North West	Crake	63	13	24
North West	Duddon	38	15	47
North West	Cumbrian Esk	38	25	37
North West	Irt	55	27	18
North West	Ehen	47	17	36
North West	Calder	57	14	29
North West	Derwent	60	3	37
North West	Eden	28	8	64
North West	Border Esk	53	8	39

Note: Some rivers combined in Table 21 are reported separately here, (i.e. E&W Cleddau, Ely & Taff), whereas the Piddle and Frome are combined here but reported separately in Table 21.

It is necessary to be cautious when drawing conclusions from these data. Fish populations vary considerably with time and location, and only when several more years' surveys have been completed will it be possible to detect any meaningful trends. Work is continuing to revise and update the procedures for collecting and interpreting juvenile data. For example, the Environment Agency recently completed an R&D project to develop a "River Fish Habitat Inventory" (RFHI). This methodology combines statistical modelling techniques with a Geographical Information System (GIS) for producing a quantitative inventory of the juvenile salmonid habitat and populations present within a catchment. Further details are provided in Annex 2.

Table 23. Summary of the number and percentage of rivers above their Conservation Limits (CL), between 50% and 100% of the CL, and less than 50% of the CL, 1993-2006

Year	>CL		50-100% CL		<50% CL	
	No.	%	No.	%	No.	%
1993	33	54	13	21	15	25
1994	41	65	14	22	8	13
1995	26	41	21	33	16	25
1996	30	48	16	25	17	27
1997	21	33	25	39	18	28
1998	30	47	23	36	11	17
1999	20	31	23	36	21	33
2000	26	41	25	39	13	20
2001[$]	20	34	18	31	20	34
2002	26	41	21	33	17	27
2003	18	28	18	28	28	44
2004	41	64	15	23	8	13
2005	31	48	18	28	15	23
2006*	**38**	**59**	**14**	**22**	**12**	**19**
Average % 1993-2005		44.3		30.5		25.2

Key: [$] No CL possible for 6 rivers due to impact of foot and mouth disease.
** Provisional values.*

3.1.4 2006 stock status assessment

For comparison with previous years' assessments, Table 23 gives the number of rivers with egg deposition estimates above their respective CL in 2006, between 50% and 100% of their CL, and below 50% CL. This shows that 38 rivers were above their CL in 2006 (59%) compared with 31 in 2005 (48%), whilst 12 rivers (19%) were below 50% of their CL in 2006, compared with 15 (23%) in 2005. The proportion of rivers with egg deposition estimates above their CL in 2006 is well above the time series mean (44%) and the third highest in the time series.

River-to-river variation in the proportion of the CL attained (Figure 12) indicates an overall pattern in England and Wales in 2006 which is broadly similar to that in recent years. Spawning escapement remained below the CL in most of the south coast chalkstreams and in some of the rivers in southwest England and Wales, with a higher proportion of rivers in northern England exceeding their CL. The juvenile habitat utilisation data (Figure 13) are broadly in line with these findings.

Although salmon have been returning strongly to some historically polluted rivers (e.g. Tyne, Wear, Ogmore), there is concern about chronic environmental degradation in others, mainly in rural areas, caused by changing land use practices, especially agriculture and forestry. Issues of particular concern are siltation resulting from soil erosion, pesticides from sheep dip chemicals, acidification

and changes in river flows. The relative importance of these effects vary around the country, but clusters of high pesticide levels have been found in Welsh upland streams, and acidification still occurs in the uplands of Wales and the North West. Salmon runs in the chalkstreams of Southern Region have declined since the 1980s, but the reasons for this are not clear. The extent and nature of soil erosion impacts are being investigated and national water abstraction licence legislation is under review. Attempts to restore salmon to the Thames continue to be frustrated by water quality problems in the estuary exacerbated by persistent low flow conditions. Earlier investigations (Alabaster and Gough, 1986) indicated that a freshwater discharge in excess of 650 megalitres per day (MLD) was needed at the tidal limit to enable salmon to pass through the Thames tideway. However, summer flows have been below this level in 2005 and 2006, there were significant fish mortalities in 2004, and no salmon at all were reported in the upstream trap in 2005 and 2006.

Changes in the British climate are predicted to become more pronounced (Hulme *et al*., 2002) and the most likely changes are for higher temperatures, wetter winters, drier summers and more extreme events of flooding and drought. Changes in climate are global and the increased natural mortality of salmon at sea in recent years may also be linked to climate change.

3.2 Changes in biological characteristics

NASCO have recently asked ICES to examine associations between changes in biological characteristics of all life stages of Atlantic salmon and variations in marine survival. The purpose is to determine whether declines in marine survival coincide with changes in the biological characteristics of juveniles in fresh water or are related to characteristics of adult fish (size at age, age at maturity, condition, sex ratio, growth rates, etc.). Changes in the sea age composition and run timing of salmon have been reported for numerous populations throughout their geographic range, including populations in England and Wales (e.g. Anon., 1994; Aprahamian *et al.*, in press). Figure 14 illustrates changes in the sea age composition of salmon entering the River Dee over the period 1937 to 2005 and highlights the progressive reduction in the proportion of older fish and associated shift in run timing from spring-summer to summer-autumn (older fish tending to migrate earlier) that is common to many stocks.

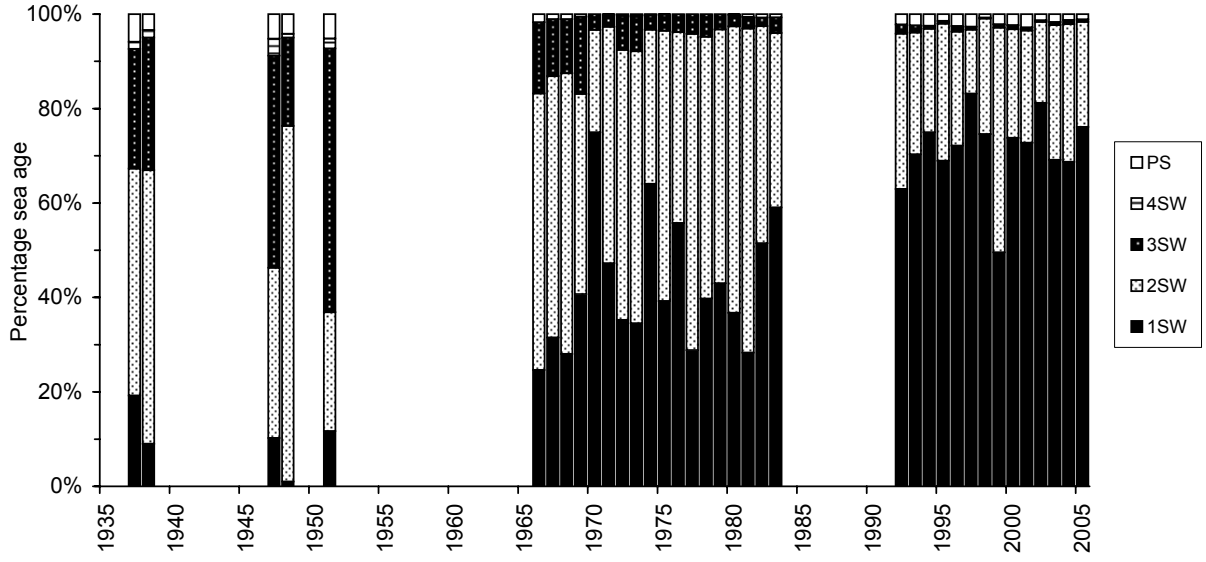


Figure 14. Sea age composition of salmon returning to the River Dee between 1937 and 2005. (PS = previous spawner; SW = sea winter). From Aprahamian et al., in press

In addition to these well publicised changes in age composition and run timing of adult fish, there is increasing evidence that progressive changes are also occurring in other biological characteristics. For example, there is evidence of change in the size and growth of parr and in the age of smolting. Figure 15 illustrates the increase in the mean length of 0+ and 1+ salmon parr at the end of their first and second winter, respectively, for the River Dee between 1937 and 2002. While Figure 16 illustrates changes in the mean smolt age of adult salmon returning to the Rivers Wye, Severn and Dee over available time series, highlighting the progressive reduction in the mean smolt age of salmon that survive to become adults.

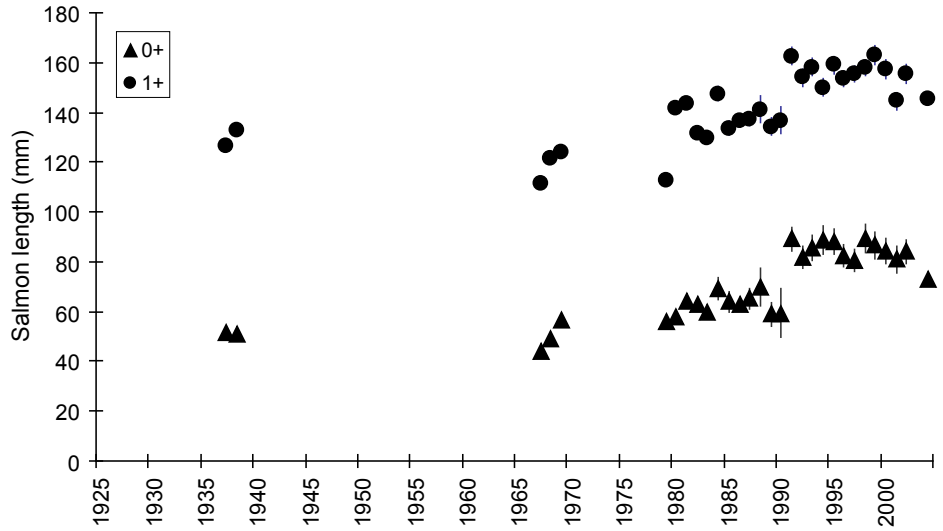


Figure 15. Mean length of 0+ and 1+ salmon parr from the River Dee at the end of their first and second winter, respectively, between 1937 and 2002, 95% confidence limits presented for data post 1983. From Aprahamian et al., in press

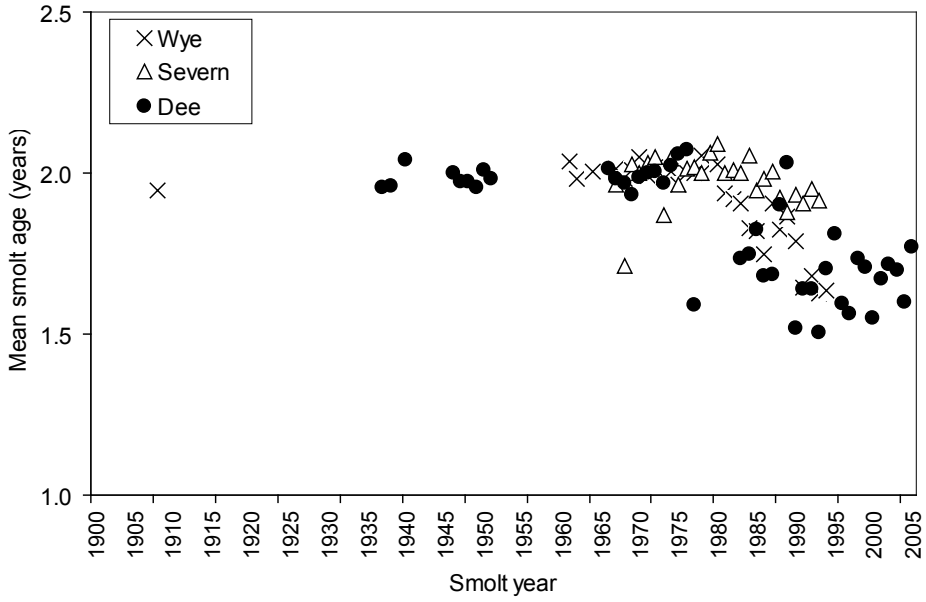


Figure 16. Mean smolt age of adult salmon returning to the Rivers Wye, Severn and Dee, over available time series. From Davidson et al., 2006

Table 24 provides a preliminary inventory of data sets in England and Wales that provide information on various biological characteristics of particular stocks over extended time series, many in excess of 15 years.

Table 24. Preliminary inventory of information on data relating to biological characteristics of salmon stocks in England and Wales

Life-stage/ Parameter	River/ Stock	Time series (adult return year)	Data source	Publications/Agency
Juveniles				
Size at age (freshwater growth)	Wye	1909, 1981-1996	Adult scales	Davidson & Hazelwood, 2005
	Dee	1937,1938, 1968, 1970, 1984 on	Adult scales	Jones (1939), Lees (1972), Davidson & Hazelwood (2005), Davidson *et al*.(2006), Aprahamian *et al*. (in press), Environment Agency (unpublished)
	Lune	1987-1999	Adult scales	Davidson & Hazelwood, 2005
	Frome	1970s on	Adult scales	CEH unpublished
Smolt age composition (as returning adults)	Severn Tamar	1968-1994	Adult scales	Davidson & Hazelwood, 2005
	Wye	1909, 1962-1996	Adult scales	Davidson & Hazelwood, 2005
	Dee	1937-1951, 1967-1978, 1984 on	Adult scales	Jones (1939 and 1949), Lees (1972), Woolland (1972), Davidson & Hazelwood (2005), Davidson *et al*. (2006), Cragg-Hine *et al*., (2006), Aprahamian *et al*. (in press), Environment Agency (unpublished)
	Lune	1987-1999	Adult scales	Davidson & Hazelwood, 2005
	Frome	1970s on	Adult scales	CEH unpublished
Smolt run timing	Wear	1985-95	Trapping	Cefas unpublished data
	Test	1992 on	Trapping	EA/Cefas unpublished data
Adults				
Post smolt growth	Thames	1982-1999	Adult scales	Davidson & Hazelwood, 2005
	Wye	1908, 1909, 1981-1996	Adult scales	Davidson & Hazelwood, 2005
	Dee	1937,1938, 1968, 1970, 1984 on	Adult scales	Jones (1939), Lees (1972), Davidson & Hazelwood (2005), Aprahamian *et al*. (in press), Environment Agency (unpublished)
	Lune	1987-1999	Adult scales	Davidson & Hazelwood, 2005
Sea age composition/ size at return	Frome	Early 1970s on	Counter/catch	Welton *et al*., 1999; CEH unpublished
	Dee	1934 on	Net catch/ trap	Davidson & Cove (2006), Aprahamian et al.(in press), Environment Agency (unpublished)
	Tamar	1985-1987, 2000 on	Trap	Environment Agency (2006), Environment Agency (unpublished)
	Exe	1910 -91	Net catch	Anon., 1999
	Eden	1936-91	Rod catch	Anon., 1999
	Test	1920-91	Rod catch	Anon., 1999
	Usk	1910 -91	Rod catch	Anon., 1999
	Severn	1970-88	Rod and net catches	Churchward and Hickley,1991
	Derwent	1923-89	Rod catch	Ball & Aprahamian, 1993
	Wye (and others)	1952-90	Rod and net catches	Gough *et al*., 1992
	23 rivers (~37k fish)	1970 on	Various	Summary in Davidson & Hazelwood, 2005
Run timing	Frome	Early 1970s on	Counter	Welton *et al*., 1999
	11 rivers	Mid 1980s on	Counters/ traps	Table 19 - this report; EA/CEH data

3.3 Salmon conservation and stock status reviews

A number of reviews have been implemented in England and Wales in recent years in order to assess salmon stock status and to inform management. The following provides a brief summary of these:

Salmon Action Plan (SAP) Review
The programme of developing SAPs for all 64 principal salmon rivers in England and Wales was completed in 2004. Each Plan contains an agreed list of actions with a 5 year planning horizon. Some of the earlier SAPs have now been reviewed (the Wye, Tamar, Test and Itchen, and Leven and Crake), in consultation with fisheries interests and other stakeholders. Several other reviews are in preparation and these will incorporate requirements of the European Water Framework, Habitats and Strategic Environment Assessment Directives. Further details on these European Directives and their implications for salmon management are provided in Annex 1.

Stock Conservation Review
Following NASCO guidance, the Environment Agency carried out a review of salmon stock conservation in 2004, assessing the status and trends in salmon stocks in England and Wales and progress with SAPs. The review demonstrated that, whilst many conservation measures had been implemented, the majority of stocks remained below the river CL and a significant number were in decline. It highlighted that the key pressures on salmon fisheries require concerted and integrated action at a broad scale to address such issues as deficiencies in land management, degradation of in-river salmon habitat and effects of diffuse pollution and siltation. An Action Plan has been drawn up to take forward the Review's recommendations and this is included at Annex 2. Many facets of this plan are also addressed as part of the England and Wales NASCO Implementation Plan that will be discussed and reported upon at the NASCO annual meeting in June 2007.

The review also concluded that, whilst additional controls on exploitation were not by themselves a solution, in some instances further controls would be appropriate to protect stocks in decline and under significant pressures. To assist in applying fisheries regulations in a logical and consistent manner, and consistent with NASCO guidance, a "decision structure for determining fishing controls on salmon fisheries in England and Wales" has been produced. This tool focuses on an assessment of the probability of achieving the management target for a given river's salmon stock (taking into account habitat and exploitation) and indicates the level of change in exploitation rate required in order to improve failing rivers. The model was first used in 2005 to review SAPs for a number of rivers identified in the stock conservation review as needing further measures. Its use has now become part of an annual process and it is followed when existing regulations – both NLOs and byelaws – are reviewed. Most recently it was applied to the Christchurch (Avon and Stour) and Poole Harbour (Piddle and Frome) NLO reviews. A schematic representation of the decision structure is provided at Annex 2.

4. The ICES assessment of the status of salmon stocks in England and Wales

4.1 Description of the assessment methodology

Each year, the ICES North Atlantic Salmon Working Group makes an assessment of the status of the salmon stocks in the Northeast Atlantic (NEAC) area as a basis for advising managers. A key part of this assessment is the estimation of the pre-fishery abundance (PFA) of all NEAC stocks. The PFA of salmon from countries in the NASCO-NEAC area is defined as the number of fish alive in the sea on January 1 in their first sea winter. This is split between maturing (potential 1SW) and non-maturing (potential MSW) fish. ICES uses estimates of PFA for the period 1971 to the present to investigate the effect of fisheries and other natural and anthropogenic factors on stocks. ICES has also used these estimates to develop a forecast of PFA for coming seasons in order to advise on management actions.

The model that ICES uses to estimate PFA for NEAC countries first estimates the returns of salmon to freshwater, and then back-calculates the numbers of fish that must have been alive in the sea to generate these returns. The numbers of returning fish are estimated using the catch data for each country, which are raised to take account of non-reported catches and exploitation rates for 1SW and MSW fish. These values are then further raised to take account of catches in the distant water fisheries and natural mortality between January 1 in the first sea winter and their return to homewaters. Ranges of values are used for some of the input data in order to obtain a measure of the uncertainty in the PFA estimates. In order to run the NEAC PFA model, each country requires time-series (beginning in 1971) of catch in numbers, non-reporting rates and exploitation rates for 1SW and MSW salmon.

For England & Wales, nominal catches have been derived from the catch returns submitted by netsmen and anglers and split into 1SW and MSW categories using two different methods. Over the period 1992-2006, monthly age-weight keys derived from salmon caught in the River Dee trap have been used to estimate the age of all rod-caught fish where a weight and date of capture have been provided. This has then been scaled up to the total catch (rods and nets combined) on a pro-rata basis. In earlier years (1971-1991), the age composition of the total catch has been estimated using the mean weight of the fish caught and the mean weight of 1SW and MSW salmon recovered in tagging programmes. Estimates of unreported and illegal catches have been made on the basis of consultation with regional fisheries personnel and according to the approach described in Section 2.3.

As the contribution of farmed and ranched salmon to the national England and Wales catch is negligible (see Section 2.6), the occurrence of such fish is ignored in the assessments of the status of national stocks. However, a large proportion of the fish taken in the north east coast fishery are destined for Scottish rivers, and these are deducted from the returning stock estimate for England and Wales and added to the data for Scotland in the ICES assessment. This proportion is estimated to have declined from 95% of the north east net catch in the early part of the time-series to 75% more recently and to around 65% since 2003. This reflects both the steady improvement in the status of the stocks in north east England and the phase out of the fishery in 2003 (Section 2.1.3). The latter resulted in a major overall reduction in the fishery, with the majority of the remaining netsmen now fishing close inshore using T- or J-nets. Previous tagging studies have shown that these inshore nets exploit a much higher proportion of local fish (Anon., 1991).

Exploitation rates for a number of monitored fisheries in England and Wales are given in Section 2.7.1. National exploitation rates have then been estimated by deriving a time-series of 'standard fishing units' employed in the salmon fisheries for the period 1971 to the present. These are calculated from the numbers of licences issued (Section 1.2.1) weighted by their relative catching power, which is estimated from historic CPUE data. The annual exploitation rates are then estimated by referencing the number of 'standard fishing units' employed relative to age-specific exploitation estimates derived for the 1998 season. Finally, ICES has agreed to apply a natural mortality rate of 3% per month in back-calculating the PFA of salmon in the sea, on the basis of studies undertaken on a range of stocks (ICES, 2002, 2003, 2004, 2005 and 2006).

Whilst this model is acknowledged as containing a number of uncertainties, it provides our best interpretation of available information on salmon stocks at a national level. Efforts are being made to improve the input data and we hope that progress in that direction is apparent in this and previous annual reports.

4.2 Results of the pre-fishery abundance assessment

The output from the ICES-NEAC model for England and Wales is summarised in Figure 17(a) to (e). The model endeavours to provide our best interpretation of what the available catch and effort data may tell us about changes in the status of the total national stock of salmon over the past three and a half decades. It is important to note that the overall trends may not reflect the patterns of change in any individual river. Indeed, while many river stocks in England and Wales have declined substantially in the past 30 years, there are others, like the Tyne and Wear, that have shown great improvements: the model sums all of these trends. Furthermore, the model is likely to provide a more reliable picture of the medium-term trends than of the year-to-year fluctuations.

Rotary screw fish trap - River Tamar

The model output suggests that the overall PFA of salmon from England and Wales has declined by just over 60% from the 1970s to the present time (Figure 17c, in which no estimate is available for MSW fish in 2006). The decrease has been greater in the non-maturing (i.e. potential MSW) component of the PFA, which is thought to have declined by over 70%, whilst the maturing (i.e. potential grilse) component has declined by about 40%. The results also suggest that there was a marked decline in PFA around 1990, which is consistent with the general perception of a decrease in the marine survival for many stocks around the North Atlantic at about this time.

The estimated number of salmon returning to England and Wales (prior to exploitation in homewater fisheries) and the total spawning escapement show similar trends to the PFA (Figure 17a), although the declines are less marked due to the reductions in net exploitation both in distant water and homewater fisheries, and in rod fisheries. Thus, numbers of returning fish are estimated to have declined by around 45% between the 1970s and the present time, and the spawning escapement by about 25%. However, as with the PFA, the decline in MSW components has been greater than that of 1SW components, by over twice as much in the case of the spawning escapement. Figure 17a indicates that there was a slight improvement in the return and spawner numbers in 2000 and 2001, but the general trend has been downward since the late 1980s.

The results also provide an estimate of the total catches in England and Wales, including the non-reported and illegal catches (Figure 17b), and the consequent overall trends in exploitation (Figure 17d). Overall exploitation probably remained at around 40-45% for most of the 1970s and 1980s but has been reduced to around 25% for MSW fish and 15% for 1SW fish in the last decade due to the measures taken to control both legal and illegal fisheries.

Figure 17e shows the relationship between the numbers of spawners (the lagged egg deposition, expressed as millions of eggs) for the national stock and the subsequent production in the next generation (the recruits = PFA). As expected, production (recruits) appears to have been reduced in years of poor spawner abundance (low egg deposition), but there is also evidence of lower recruitment at all levels of egg deposition since 1990 (dots) compared with earlier years (triangles). This possibly reflects an increase in marine mortality at about this time.

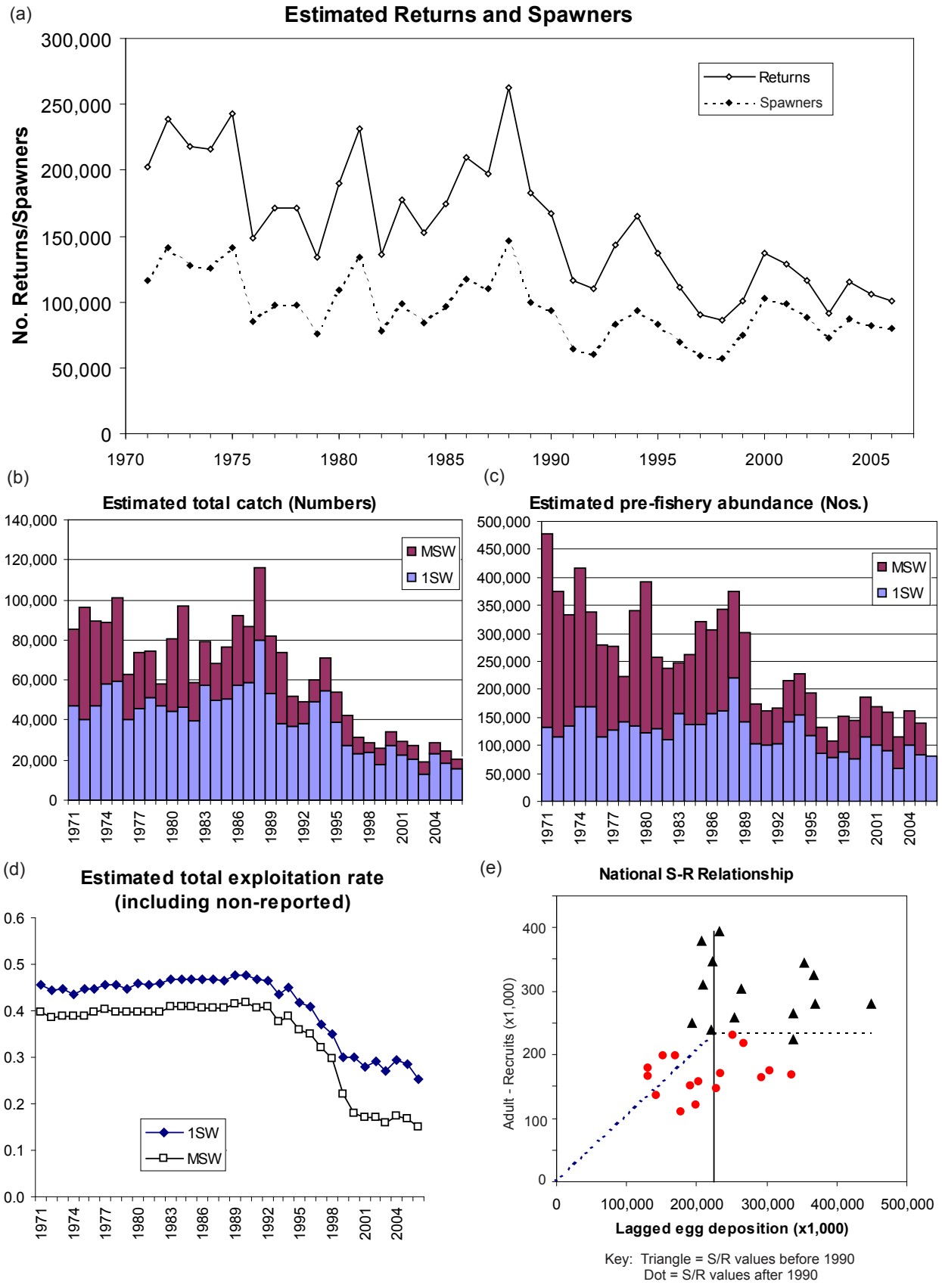


Figure 17(a-e). Summary output from the ICES-NEAC PFA model for UK (England & Wales)

4.3 The ICES assessment in relation to management measures taken to conserve salmon stocks in England and Wales

The preliminary assessment for ICES has indicated that the estimated number of salmon returning to England and Wales has declined by around 45% between the 1970s and the present time, and the decline in MSW fish has been substantially greater than that of 1SW fish.

As noted above, total exploitation was probably at around 40 to 45% for most of the 1970s and 1980s, but has been reduced by approaching 60% for MSW fish and 40 % for 1SW fish in the last decade. This has been due to the measures taken to control both legal and illegal fisheries in England and Wales. These have included the introduction of reducing NLOs (phase outs) for 17 fisheries, the first of which started in 1993, and which by 2006 had achieved the aim of zero effort in all but 6 cases. In 9 fisheries, the phase out has been accelerated by buy-outs using both private and government funds. Since 1993, the number of net licences has declined by 51% and, in many of the remaining fisheries, the open season for taking salmon has been severely curtailed (especially since 1999 when nets were prohibited from taking salmon prior to June 1st). As a consequence, net catches comprised 42% of total catches of salmon in England and Wales (including released fish) in 2006, compared to 82% in 1989. The increase in catch and release in rod fisheries from 10% in 1993 to around 50% since 2002 has also contributed substantially to the reduction in exploitation levels.

In 2004, the Environment Agency carried out a Salmon Stock Conservation Review (SSCR) that aimed to estimate the extent to which each of the principal salmon rivers in England and Wales will achieve compliance with their CL by 2008 and in the longer term. It concluded, at that time, that only 19 rivers in England and 6 in Wales (out of 62) were expected to exceed their CLs in 2008 with high probability, whilst a further 8 may do so but with a greater degree of uncertainty. The current assessment of compliance suggests that only 11 rivers in England and Wales (out of 64) have a high probability of exceeding their CL in 2011, with a further 25 rivers having neither a clear pass nor failure. A key concern is that the trend in estimated egg deposition on many rivers, particularly in Wales and the South and West of England is currently downwards.

The SSCR also concluded, that although exploitation within catchments was not generally considered a primary factor limiting salmon spawning in most rivers, further reductions in exploitation on 19 English and 11 Welsh rivers may be necessary to help sustain and improve stocks. Measures applying in 2006 are outlined in Section 1.2. To assist in applying fisheries regulations in a logical and consistent manner, the use of a decision structure has now become part of an annual process (Annex 2).

The Irish drift net fishery has been a significant exploiter of some salmon stocks on the west and south coasts, and the anticipated closure of this fishery in 2007 is expected to confer benefits for these stocks (Section 2.7.2). Water quality problems (attributed to industrial discharges, agricultural pollution, metal mining, sewerage and acidification) also affect many rivers, as does reduced flow rate. Channel structure and siltation due to intensive agriculture, forestry and the downstream impacts of water supply reservoirs were perceived as a key problem in all rivers, whilst obstructions had substantial effects on some rivers. In contrast, rivers in the North East and some in the North West are showing an upward trend in salmon runs, the former clearly benefiting from improved water quality and, more recently, from the buy-out of the majority of the north east coast drift nets (see Section 2.1.3).

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GLOSSARY OF TERMS AND ABBREVIATIONS USED IN THIS REPORT

This glossary has been extracted from various sources, but chiefly the EU SALMODEL report (Crozier *et al.*, 2003) and the Environment Agency's SAP reports (p.6).

Adult Salmon after the middle of the first sea-winter, after which the main categorisation is by sea-age, measured in sea-winters (e.g. two sea winter, or 2SW).

Abstraction Taking water, either permanently or temporarily, from a water source (river, stream, spring, pond, lake or groundwater).

Anadromous fish Fish, born in freshwater, that migrates to sea, to grow and mature, and then returns to freshwater as an adult to spawn (e.g. salmon, sea trout).

By-catch The capture of non-targeted fish.

Catchment The area of land draining to a defined point.

Conservation Limit (CL) Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that the undesirable levels are avoided.

Dissolved oxygen The amount of oxygen dissolved in water, one of the features that is used to classify water quality.

Distant-water fisheries Fisheries in areas outside the jurisdiction of the country of origin. With respect to the NASCO convention, this specifically refers to the fisheries under the jurisdiction of the Faroe Islands and Greenland.

EU Directive A European Union (formerly EC - European Community) legal instruction, binding on Member States, but which must be implemented through national legislation within a prescribed time-scale.

Escapement Salmon or sea trout that survive to spawn after exploitation.

Exploitation Removal of fish from a stock by fishing.

Fishery The area where it is, or may be, lawful to fish and where the resource is exploitable.

Fry Young salmonids that have hatched out in the current year, normally in May for salmon and trout, at the stage from independence on yolk sac as the primary source of nutrition up to dispersal from spawning areas.

Grilse Adult salmon that have spent only one winter feeding at sea before returning to freshwater to spawn; normally only applied to salmon in homewaters.

Homewater fisheries Fisheries within the jurisdiction of the countries of origin (within 12 miles).

MAFF The former Ministry of Agriculture, Fisheries and Food; incorporated in June 2001 into the Department for Environment, Food and Rural Affairs (Defra).

Management target (MT) A desirable stock level or level of fishing activity which may be used as a reference point to achieve management objectives.

Microtag A coded wire tag 1.1 mm long and 0.25 mm diameter, inserted into the nasal cartilage (snout) of fish and detectable in live fish, but only readable after removal from the carcase.

Multi-Sea-Winter (MSW) salmon An adult salmon that has spent two or more winters at sea.

NLO – Net Limitation Order Mechanism within the Salmon and Freshwater Fisheries Act whereby the competent authority may apply to limit the number of nets fishing a public fishery.

One-Sea-Winter (1SW) salmon An adult salmon that has spent one winter at sea.

Parr Juvenile salmonid in the stage following fry until its migration as a smolt or, for non-migratory forms, until it becomes an adult. Salmon parr are typically <16 cm long and have parr-marks (dark vertical bars) on the sides of the body.

Post-smolt Young salmon, at the stage from leaving the river until the middle of its first winter in the sea.

Precautionary approach A concept enshrined in Principle 15 of the Rio Declaration of the UN Conference on Environment and Development, which states: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Pre-fishery abundance (PFA) The numbers of salmon estimated to be alive in the ocean from a particular stock at a specified time (1st Jan for Faroes fishery; 1st Aug for West Greenland fishery).

Production The assimilation of nutrients to produce growth in a population over a given period.

Radio tag An electronic transmitter which emits radio frequencies and is attached to a fish to enable its position to be determined in freshwater.

Recruits The abundance of fish measured at a particular point in the life cycle, e.g. at the juvenile stages, the smolt stage, at the stage of recruitment to the fishery, or as returning spawners.

Reference point An estimated value derived from an agreed scientific procedure and/or model which corresponds to a state of the resource and/or of the fishery and can be used to assess stock status or inform management decisions.

Run The number of adult salmon ascending, or smolts descending, a river in a given year. The main smolt run takes place in spring, whereas adult salmon runs may occur in spring, summer, autumn or winter.

Special Areas of Conservation (SACs) To comply with the EU Habitats Directive (92/43/EEC) on Conservation of Natural Habitat and of Wild Fauna and Flora, which stipulates that member states maintain or restore habitats and species to favourable conservation status, a number of rivers in England and Wales that support important populations of vulnerable qualifying species have been designated SACs. Where salmon is a "qualifying species", additional protection measures specifically for salmon are required.

Salmon Action Plan (SAP) An agreed list of actions that the Environment Agency, in partnership with outside interests who support the plan, is committed to address in order to meet the objectives of its National Salmon Management Strategy (launched in 1996) at a local level.

Salmonid A fish belonging to the family *Salmonidae*, which includes the Atlantic salmon (*Salmo salar*), trout (*Salmo trutta*), charr (*Salvelinus alpinus*) and rainbow trout (*Oncorhynchus mykiss*).

Sea age The number of winters that a salmon has remained at sea.

Sea trout Anadromous form of the trout (*Salmo trutta*) from the post-smolt stage; the brown trout remains in freshwater throughout its life

Smolt At a particular stage of their development, salmon parr undergo physiological changes, they become silver in appearance and migrate to sea, and are known as smolts. Salmon smolts are typically 12–16 cms long.

Smolt age The number of winters that a salmon remained in freshwater prior to emigration as a smolt (this does not include the winter in which the egg was laid).

Spring salmon Multi-sea-winter salmon which return to freshwater early in the year, usually before the end of May.

Stock A management unit comprising one or more salmon populations, which may be used to describe those salmon either originating from or occurring in a particular area. Thus, salmon from separate rivers are referred to as "river stocks".

Stocking The intentional release of fish into an ecosystem.

Sustainable use The use of a biological resource in a way and at a rate that does not lead to the long-term decline of its potential to meet the needs and aspirations of present and future generations. Sustainable is not meant to imply that abundance is constant.

ANNEX 1. International Organisations and European Directives affecting salmon management

North Atlantic Salmon Conservation Organisation

The North Atlantic Salmon Conservation Organisation (NASCO) was established in 1984 following calls for international co-operation on the management of salmon stocks. It is an international body with the objective of contributing through consultation and co-operation to the conservation and rational management of salmon stocks taking account of the best available scientific evidence. NASCO therefore seeks scientific advice on the status of salmon stocks and fisheries and their management from the International Council for the Exploration of the Sea (ICES) (see below). The Contracting Parties to the NASCO Convention are: Canada; Denmark (in respect of the Faroe Islands and Greenland); European Union; Iceland; Norway; the Russian Federation; and the USA. Much of the business of the organisation is conducted by three regional Commissions: the North American Commission; the North East Atlantic Commission; and the West Greenland Commission. One of the main functions of these Commissions is to propose regulatory measures for fisheries of one Party to the NASCO Convention, which exploit salmon originating in the rivers of other Parties. The main fisheries of relevance for the management of European stocks are those operated on the west coast of Greenland and within Faroese waters. In 1998, NASCO adopted the Agreement on the Adoption of a Precautionary Approach; this requires that more caution be exercised when information is uncertain, unreliable or inadequate, and that the absence of adequate scientific information is not to be used as a reason for postponing or failing to take conservation and management measures.

International Council for the Exploration of the Sea

The International Council for the Exploration of the Sea (ICES) provides biological information and advice on a wide range of fish stocks in order to help fisheries managers maintain viable fisheries within sustainable ecosystems. Information is compiled and assessments are conducted by Working Groups, which are comprised of national experts on the specific fish stocks. The Working Group reports are passed to the Advisory Committee on Fisheries Management (ACFM) for peer review and to prepare the advice to managers. The advice may take many forms, but in general it involves: assessments of stock dynamics; evaluation of the status of the stocks; projections of various stock parameters into the future; and management options. For Atlantic salmon, ICES provides advice relating to the list of questions posed by NASCO (Annex 3). The assessment of salmon stocks and their fisheries presents particular problems to the ICES scientists both because of the highly migratory nature of the fish and because they comprise a large number of distinct river stocks which must, to some extent at least, be managed separately.

Habitats Directive

The EU Habitats Directive 92/43/EEC, on Conservation of Natural Habitat and of Wild Fauna and Flora, stipulates that member states maintain or restore habitats and species to favourable conservation status. To comply with this Directive, a number of rivers in England and Wales have been designated Special Areas of Conservation (SACs) because they support important populations of vulnerable qualifying species.

The following rivers in England and Wales are SACs and have salmon as a "qualifying species", which confers additional protection measures specifically for salmon in these rivers and associated on-line lakes:

Southern Region:	Itchen.
South West Region:	Hampshire Avon, Camel, Dartmoor Headwaters (Dart, Teign, Erme, Taw, Tavy, Walkham and Yealm).
Wales:	Wye, Usk, Teifi, Dee (and Bala Lake), Gwyrfai (and Llyn Cwellyn) and Eden (West Gwynedd - part of the Mawddach catchment).
North West Region:	Derwent (and Bassenthwaite Lake), Eden and Ehen.

Only two of these rivers (Camel and Derwent) are currently considered to be complying with the management objective of passing their conservation limit 4 years out of 5.

Water Framework Directive

Salmon management in England and Wales is becoming increasingly linked with the Water Framework Directive (Directive 2000/60/EC) (WFD), and its 6 year planning cycle. The WFD aims to protect and enhance our water environment, updates all existing relevant European legislation, and promotes a new approach to water management through river-based planning. The Directive requires the drawing up of River Basin Management Plans (RBMP) and Programmes of Measures (PoM) with the aim of achieving Good Ecological Status or, for artificial or more modified waters, Good Ecological Potential.

England and Wales has been divided into nine River Basin Districts (RBDs), which are being 'characterised' by assessing the pressures and impacts on the water environment, such as overuse or pollution. Once that is complete, a RBMP for each District will be prepared setting out how these impacts will be reduced through its PoM. Monitoring programmes will then chart progress towards achievement of Good Ecological Status. RBMPs and PoMs need to be agreed, finalised and published by December 2009 for the first round of the WFD planning cycle. The second round plans are to be published in 2015. In the meantime, the supporting environmental monitoring programmes were established by December 2006, and an interim overview of the significant water management issues (SWMI) in each RBD is to be published for general consultation by December 2007.

Whilst details are still being resolved, the status of salmon stocks will be one important element to take into account. The Environment Agency is taking steps to align its Salmon Action Plan processes with those needed to implement this Directive.

Strategic Environment Assessment Directive

Directive 2001/42/EC (the SEA Directive) requires responsible authorities (public bodies) to undertake Strategic Environmental Assessment (SEA) of the effects of certain categories of plans and programmes. SEA is a tool for integrating wider environmental considerations into the preparation and adoptions of plans thus helping to promote sustainable development.

Summary of Regulatory Measures agreed by NASCO for the West Greenland Salmon Fishery

Year	Allowable catch (tonnes)	Comments/other measures
1984	870	
1985	-	Greenlandic authorities unilaterally established quota of 852t.
1986	850	Catch limit adjusted for season commencing after 1 August.
1987	850	Catch limit adjusted for season commencing after 1 August.
1988-1990	2,520	Annual catch in any year not to exceed annual average (840t) by more than 10%. Catch limit adjusted for season commencing after 1 August.
1991	-	Greenlandic authorities unilaterally established quota of 840t.
1992	-	No TAC imposed by Greenlandic authorities but if the catch in first 14 days of the season had been higher compared to the previous year a TAC would have been imposed.
1993	213 *	An agreement detailing a mechanism for establishing annual quota in each of the years 1993 to 1997 was adopted by the Commission.
1994	159 *	
1995	77	
1996	-	Greenlandic authorities unilaterally established a quota of 174t.
1997	57	An addendum to the 1993 Agreement was agreed by the Commission.
1998	Internal consumption fishery only	Amount for internal consumption in Greenland has been estimated in the past to be 20t.
1999	Internal consumption fishery only	Amount for internal consumption in Greenland has been estimated in the past to be 20t.
2000	Internal consumption fishery only	Amount for internal consumption in Greenland has been estimated in the past to be 20t. A Resolution Regarding the Fishing of Salmon at West Greenland was agreed by the Commission.
2001	28 - 200	Under an *ad hoc* management programme the allowable catch will be determined on the basis of CPUE data obtained during the fishery.
2002 $	20 - 55	Under an *ad hoc* management programme the allowable catch will be determined on the basis of CPUE data obtained during the fishery.
2003-2005	Internal subsistence consumption fishery only	Amount for internal consumption in Greenland has been estimated in the past to be 20t.
2006-2008	Internal subsistence consumption fishery only	Amount for internal consumption in Greenland has been estimated in the past to be 20t. The measure applies to 2006 and will also apply in 2007 and 2008 if ICES provides a framework of indicators for use in identifying any significant change in the previously provided multi-annual advice, which is accepted by the Parties.

Key: ***** *Quotas were bought out*
$ Start of five year, annually renewable buy-out (only subsistence fishery remained)

Summary of Regulatory Measures agreed by NASCO for the Faroese Salmon Fishery

Year	Allowable catch (tonnes)	Comments/other measures
1984-1985	625	
1986	-	
1987-1989	1790	Catch in any year not to exceed annual average (597t) by more than 5%.
1990-1991	1100	Catch in any year not to exceed annual average (550t) by more than 15%.
1992-1995	550	
1996	470	No more than 390 tonnes of the quota to be allocated if fishing licences issued.
1997	425	No more than 360 tonnes of the quota to be allocated if fishing licences issued.
1998	380	No more than 330 tonnes of the quota to be allocated if fishing licences issued.
1999	330	No more than 290 tonnes of the quota to be allocated if fishing licences issued.
2000	300	No more than 260 tonnes of the quota to be allocated if fishing licences issued.
2001-2003	No quota set	It is the intention of the Faroese authorities to manage the fishery in a precautionary manner with a view to sustainability, and to make management decisions with due consideration to the advice from ICES concerning status of stocks contributing to the fishery.
2004-2006	No quota set	It is the intention of the Faroese authorities to manage the fishery on the basis of the advice from ICES concerning status of stocks contributing to the fishery in a precautionary manner with a view to sustainability and taking into account relevant factors such as socio-economic needs and other fisheries on mixed stocks.
2007-2009	No quota set	It is the intention of the Faroese authorities to manage any salmon fishery on the basis of the advice from ICES regarding the stocks contributing to the Faroese salmon fishery in a precautionary manner and with a view to sustainability, taking into account relevant factors such as socio-economic needs. The decision applies to 2007 and will also apply in 2008 and 2009 if ICES provides a framework of indicators for use in identifying any significant change in the previously provided multi-annual advice, which is accepted by the Parties.

Note: The quotas for the Faroe Islands detailed above for the period 1984-2000 were agreed as part of effort limitation programmes (limiting the number of licences, season length and maximum number of boat fishing days) together with measures to minimise the capture of fish less than 60cm in length. The measure for 1984/85 did not set limits on the number of licences or the number of boat fishing days.

Acknowledgement: Information supplied courtesy of NASCO.

ANNEX 2. Salmon management procedures/developments in England and Wales

The Environment Agency's catch return system

The Environment Agency and its predecessor the National Rivers Authority have operated a national catch return system since 1995. The first national catch reminder was issued to anglers (regardless of whether a return had already been made) in January 1995, in respect of the 1994 season. For 1995, the reminder was brought forward to November, closer to the end of the fishing season in most regions. The reporting and reminder system has been subject to a number of difficulties, not least the problem of collating licence counterfoils from over 17,000 outlets and inputting details onto a database in time for the November reminder. In 2001, improvements to the database enabled more effective targeting of reminders. These improvements also made possible the issue of a second reminder (sent to all anglers who had not sent in a return by 11 January), in line with NASCO recommendations, in order to reduce the level of unreported catch. This was undertaken nationwide for the first time early in 2002, in respect of catches for the 2001 season, and has continued in 2003–2005. In 2005 a further improvement resulted from the electronic issuing of licences by the Post Office. This provided a more up-to-date and accurate database for issuing reminders.

Conservation Limits and Management Targets

Setting conservation limits
The use of conservation limits in England and Wales has developed in line with the requirement of ICES and NASCO to set criteria against which to give advice on stock status and the need to manage and conserve individual river stocks. Conservation limits (CLs) indicate the minimum desirable spawning stock levels below which stocks should not be allowed to fall. The CL is set at a stock size below which further reductions in spawner numbers are likely to result in significant reductions in the number of juvenile fish produced in the next generation.

Two relationships are required to derive the CLs:

(i) a **stock-recruitment curve** – defining, for the freshwater phase of the life cycle, the relationship between the number of eggs produced by spawning adults (stock) and the number of smolts resulting from those eggs (recruits).

(ii) a **replacement line** – converting the smolts emigrating from freshwater to surviving adults (or their egg equivalents) as they enter marine homewaters. This relationship requires an estimate of the survival rate at sea.

The model used by the Environment Agency to derive a stock-recruitment curve for each river assumes that juvenile production is at a 'pristine' level for that river type (i.e. is not affected by adverse water quality, degraded physical habitat, etc).

Similarly, in deriving the replacement line, marine survival rates for most river stocks were assumed to be equivalent to the rates estimated on UK monitored rivers (such as the North Esk) in the 1960s and 1970s. Default survival values recommended for this purpose were 25% for 1SW salmon and 15% for MSW fish (Environment Agency, 1998). However, that period is thought to be one of high sea survival, and new default values of 11% for 1SW salmon and 5% for MSW fish which are more representative of sea survival over the last 20 years were introduced by the Environment Agency in April 2003 (Environment Agency, 2003b).

These rates have now been applied in calculating CLs for all rivers with Salmon Action Plans (SAPs). Since 2003, the CLs for all principal salmon rivers for which egg deposition estimates are included in this report have incorporated the new lower marine survival estimates. The net effect of these changes has been to reduce the CLs: the scale varies from river to river, but resulted in a 26% reduction, on average, in England and Wales from values used prior to 2003.

Introducing marine survival rates which are intended to be closer to those currently experienced by UK salmon stocks will reduce the effect of high mortality at sea as a cause of failing CLs. This will help managers focus on other issues over which they have more control (e.g. poor environmental quality in-river, over-exploitation by net and rod fisheries, etc.) when compliance failure occurs. The reduction in CLs means, however, that lower levels of spawning escapement are accepted before the stock is considered to be threatened. The Environment Agency also uses the 'management objective' for each river (e.g. in reviewing management actions and regulations) that the stock should be meeting or exceeding its CL in at least four years out of five. This management objective is built into statistical procedures for assessing compliance with CLs (below).

Compliance assessment

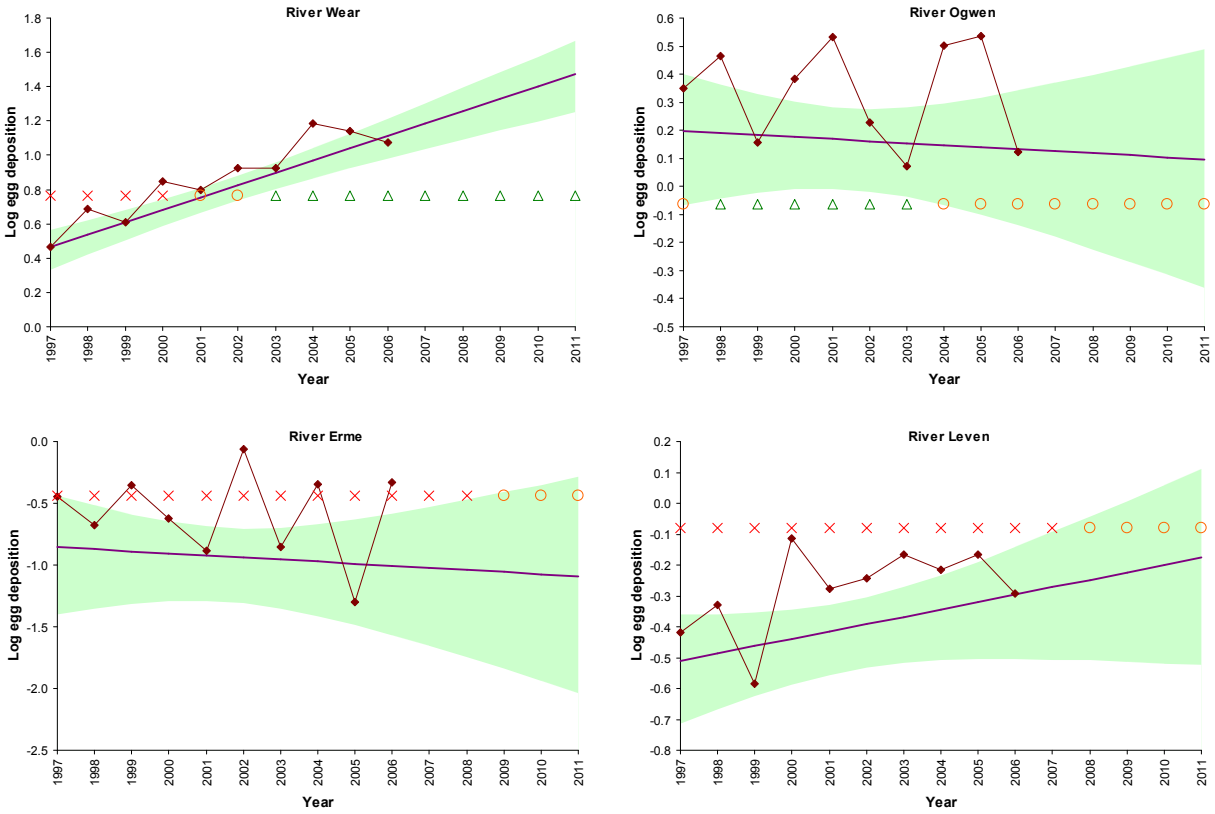
The performance of salmon stocks in England and Wales is assessed using a compliance scheme designed to give an early warning that a river has fallen below its CL. An approach introduced in 2004 provides a way of summarising the performance of a river's salmon stock over the last 10 years (including the current year), in relation to its CL. Bayesian regression analyses are applied to egg deposition estimates from the last 10 years, on the assumption that there might be an underlying linear trend over the period. The method fits a 20 percentile regression line to the data and calculates the probability that this regression line is above the CL, and thus that the conservation limit will be exceeded four years out of five (the management objective). If there is a low probability (less than 5%) that the 20 percentile regression line is above the CL, the river fails to comply. If the probability is high (more than 95%), the river complies in that year, whereas between these probability values we cannot be certain of the stock status. The results are in broad agreement with the previous compliance scheme. The current scheme also allows the 20 percentile regression line to be extrapolated beyond the current year in order to predict the likely future performance of the stock relative to its CL, and so assess the likely effect of recent management intervention and the need for additional measures.

The compliance graphs for the Rivers Wear, Ogwen, Leven and Erme are shown below as examples. These include individual egg deposition estimates (black dots on the graphs), the 20 percentile regression lines and (shaded) 90% confidence intervals, and the CL lines (represented by up to three symbols: X, O and Δ).

When the upper bound (95 percentile) of the regression line confidence interval is below the CL line the river is judged to be failing its CL (i.e. there is a ≥95% probability of failure). For example, this is the case on the Wear from 1997 to 2000 and is indicated by the X symbol on the CL line. When the lower bound (5 percentile) of the regression line confidence interval is above the CL line the river is judged to be passing its CL (i.e. there is a ≤5% probability of failure). This is the case on the Wear from 2003 to 2011 and is indicated by the Δ symbol on the CL line. Between these two extremes, the shaded confidence interval of the regression line overlaps the CL line and so the status of the river is judged as 'uncertain' (i.e. the probability of failure is >5% but <95%). This is the case on the Wear from 2001 to 2002 and is indicated by the O symbol on the CL line.

Egg deposition estimates for a river may be consistently above the CL but status may still be uncertain. This is the case on the Ogwen in 1997 and from 2004 to 2011 (O symbol on the CL line). In part, this reflects the marked year-to-year variation in egg deposition estimates on this river, which produces a broad confidence interval around the regression line, but also arises because of the increasing uncertainty associated with all regressions once extrapolated beyond the data set.

As well as providing an assessment of the status of a river in relation to its CL, the direction of the trend in the 10-year time-series of egg deposition estimates and its statistical significance may also serve as an important indicator of the need to take management action and of the degree of intervention required. For example, CL compliance projections for the Rivers Leven and Erme both indicate 'uncertain' status in the years 2009 to 2011 (in both cases the upper 95 percentile of the regression line confidence interval is close to the CL), but the negative trend on the Erme, in contrast to the positive trend on the Leven, would give additional cause for concern.



The Management Target (MT) for each river is a spawning stock level for managers to aim at, to ensure that the objective of exceeding the CL is met four years out of five in the long run (i.e. 80% of the time). The value of the MT has been estimated using the standard deviation (SD) of egg deposition estimates for the last 10 years, where: MT = CL + 0.842*SD. The constant 0.842 is taken from probability tables for the standard normal distribution, such that the CL forms the 20 percentile of a distribution, the average (or 50 percentile) of which equates to the MT.

CLs and MTs form only one part of the assessment of the status of a stock, and management decisions are never based simply on a compliance result alone. Because stocks are naturally variable, the fact that a stock is currently exceeding its CL does not mean that there will be no need for any management action. Similarly, the fact that a stock may fall below its CL for a small proportion of the time may not mean there is a problem. Thus, a range of other factors are taken into account,

particularly the structure of the stock and any evidence concerning the status of particular stock components, such as tributary populations or age groups, based for example on patterns of run timing and the production of juveniles in the river sub-catchments. These data are provided by a programme of river catchment monitoring (Section 3.1.3).

The Environment Agency is continuing to review and revise its procedures. Work is underway to better reflect real exploitation rates, where these are available, in stock assessments, and to review the balance between use of default (generic) and river-specific data. The approach to compliance assessment described above is now incorporated into a new decision structure (see flow chart below) applied on an annual basis and aimed at guiding decisions on the level of fishing controls required.

River Fish Habitat Inventory

The Environment Agency has also recently completed an R&D project to develop a "River Fish Habitat Inventory" (RFHI). This project developed a methodology that combines statistical modelling techniques with a Geographical Information System (GIS) for producing a quantitative inventory of the juvenile salmonid habitat and populations present within a catchment.

The models for quantifying habitat were calibrated on reference sites throughout England and Wales that were not considered to be impacted by factors such as access for migratory adults, water quality or sedimentation problems. The models operate at two levels: one is based on a very simple assessment of map-based variables from GIS, such as altitude and catchment area; and the other includes field-based variables from habitat surveys, such as substrate and flow types. The primary application for these models will be to improve the basis for setting salmon Conservation Limits. The methods are not yet published.

The models for quantifying juvenile populations are based on annual electrofishing data, and interpolate/extrapolate these data throughout a catchment using the habitat models described above (Wyatt, 2003). The method can be applied to sites that have been sampled by either single or multiple pass removal, by using the capture probabilities from the multiple-pass sites to help interpret the catches at the single-pass sites (Wyatt, 2002). The primary application for these models will be the quantitative assessment of freshwater impacts on juvenile salmonids at a catchment scale.

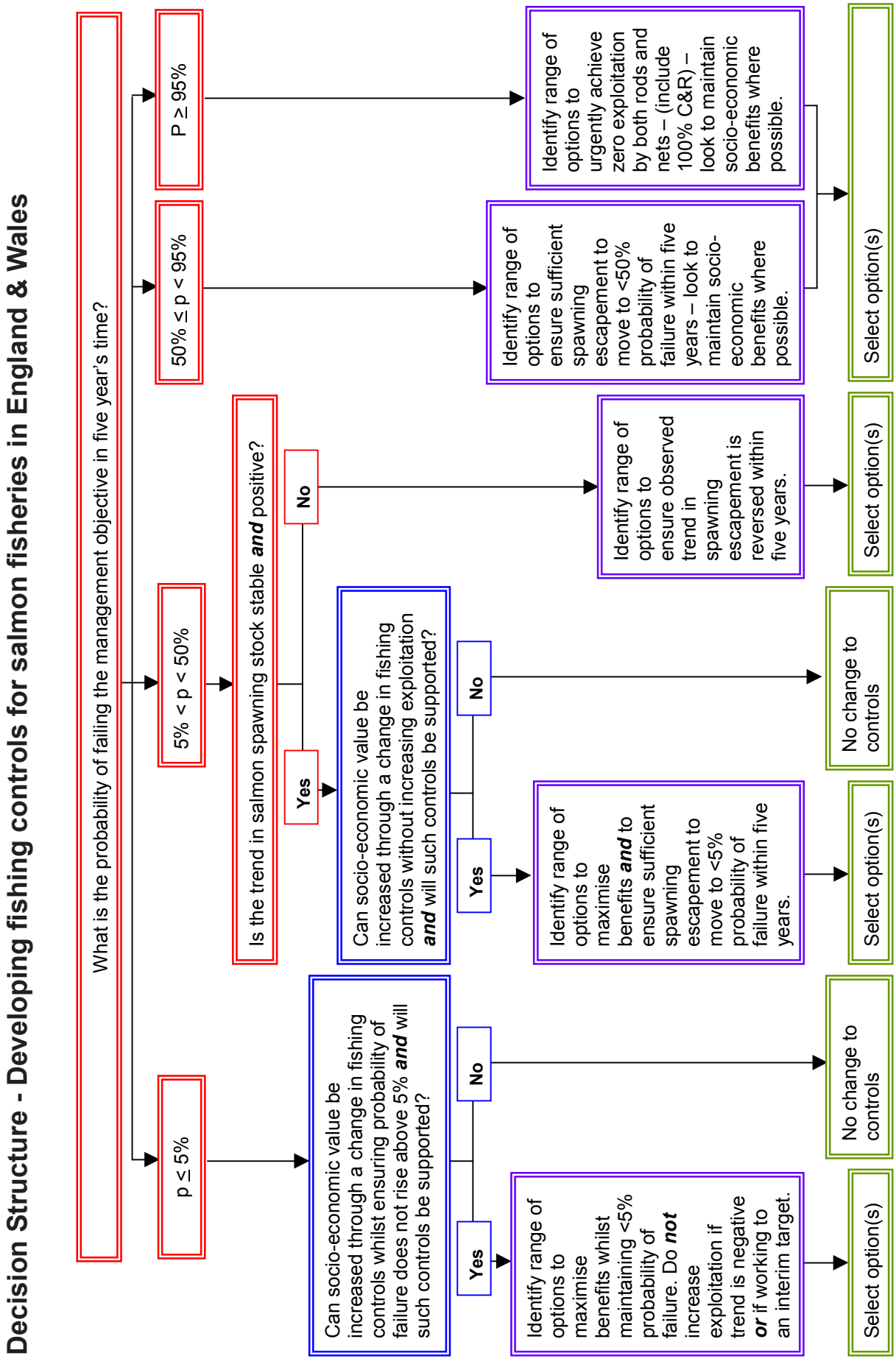
Stock Conservation Review and Decision Structure

The following table details the actions resulting from the Environment Agency's 2004 Salmon Stock Conservation Review and the progress in addressing these up to December 2006. The schematic flow chart on page 91 illustrates the new decision structure for assessing the need for fishing controls; explanatory notes follow on page 92.

ENVIRONMENT AGENCY - SALMON STOCK CONSERVATION IN ENGLAND AND WALES
Action Plan resulting from 2004 Review - with progress to December 2006

Organisations & individuals	Key actions required	Suggested Timescale	Progress to December 2006
NASCO (EU delegation)	~ Help to maintain lowest possible exploitation of salmon in Greenland, Faroes and international waters. ~ Co-ordinate research into cause of reduced marine survival.	On-going	- The current exploitation rate of the Greenland fishery on English and Welsh salmon is insignificant - less than one percent. There was no salmon fishing in the Faroes during the previous five winters to 2005/06 and none expected to 2009 - except possibly some small-scale research fishing. - A steering group with representatives of 5 NASCO Parties and 5 NGOs is responsible for promotion and fund-raising for a major phase of marine work. Governments have been asked to allocate time within research vessel schedules in 2008 and 2009 to support the programme.
UK Governments (Defra and WAG)	**Irish drift net fishery**: Seek reduction in exploitation of English and Welsh salmon to a negligible level (less than 1%). The Agency will continue to provide supporting information. (UK Government and the European Commission lead in international affairs.) **Riverine habitat**: continue and expand the range of initiatives to bring about significant changes in land use, in particular agriculture, and factors causing diffuse pollution (including siltation and pesticides) - including agri-environment schemes, information campaigns and tighter regulation. **Legislation & funding**: improve legislation and funding arrangements to support reductions in exploitation in some estuaries and improvements in riverine environment.	Urgent Urgent Urgent	- **Irish drift net fishery**: The Irish Government has adopted the key recommendations of the 2006 report by its Independent Working Group on Salmon. This includes the closure of the Irish drift net fishery with effect from the 2007 season. - **Riverine habitat**: Defra have introduced funding for Catchment officers (see below) and associated grant schemes as part of their Catchment Sensitive Farming Programme. In Wales WAG are running two pilot Catchment Sensitive Farming projects, as well as funding Catchment Officers. WAG continue to contribute substantial funding to the Sustainable Fisheries Programme which contribute to habitat restoration projects in Wales. - **Legislation & funding**: Orders are in preparation to cover a number of these issues using various legislative means such as the Legislative Regulatory Reform Order.
Environment Agency	**Exploitation in home waters**: ~ Prepare a schedule of measures, voluntary and/or mandatory to reduce exploitation, where needed, on a river by river basis, within legislative and funding constraints and review on an annual basis. ~ Promote a byelaw for England banning the use of a tailer. (Prohibition of the use of tailers is under consideration by Government for inclusion in proposed new national legislation.) **Improve assessments of stock status**: Continue to enhance methods of setting conservation limits and assessing compliance.	Annually (in April) At next opportunity Ongoing	**Exploitation in home waters**: - Annual assessments are carried out on each river as to whether further regulatory measures are required using the compliance assessments and decision structure referred to elsewhere in this report under "Status of Stock". - It is likely that a tailer ban will be included in the Government's plans for new fisheries orders referred to above. **Improve assessments of stock status**: - Work continues on developing the Salmon Lifecycle Model and other improvements - for example in exploitation estimates.

Organisations & individuals	Key actions required	Suggested Timescale	Progress to December 2006
Environment Agency (cont)	**Riverine habitat**:		**Riverine habitat**:
	~ Inform English and Welsh Governments that salmon targets are unlikely to be met primarily through restrictions on exploitation.	Immediate	- This was done in 2005.
	~ Continue and expand, within resources and with available partners, the range of initiatives to bring about significant changes in land use, in particular agriculture, and diffuse pollution (such as siltation and pesticides) - including agri-environment schemes, information campaigns and tighter regulation.	Ongoing	- Work continues on this at all levels from catchment scale upwards. Catchment Officers have been appointed in key catchments to encourage landowners to take advantage of Government incentive schemes to introduce more catchment sensitive farming. Under the Water Framework Directive, work is in progress to identify Programmes of Measures to tackle the widely identified issue of diffuse pollution and the key risk of failing good ecological status.
	~ Develop and implement a project to describe the extent and nature of salmon habitat to help target habitat improvement. Link with local Rivers Trusts and Associations.	Ongoing	- Work has been progressed in several catchments to describe salmon habitat and target priorities in many cases in partnership or led by Rivers Trusts (e.g. the Eden) The Agency contributed to a workshop hosted by the Atlantic Salmon Trust in 2006 (Habitat Description Measurement & Assessment in Rivers Workshop) – to identify best practice methodologies for describing salmonid habitat.
	~ Deliver significant efficiencies and seek other sources of funding, with partners.	Ongoing	- This is ongoing, strengthened by the Memorandum of Understanding between the Environment Agency and Association of Rivers Trusts signed in September 2006: £1.4m of funding has been secured from the EU and Welsh Assembly Government for riverine habitat improvement and fish pass schemes. This work will take place throughout the Competitiveness Region of Wales (formerly Objective 2).
	~ Advisory Committee papers on (i) River Habitat Objectives; and (ii) Agri-enviroment & diffuse pollution.	April 2005	- This was done in 2005.
	~ Collate priorities for salmon habitat improvement from Salmon Action Plans into 3-year strategic regional plans.	March 2005	- This has been achieved for many but not all SAP rivers.
	~ Focus available resources on priorities. Integrate with other biodiversity work. Link with local Rivers Trusts and Associations.	Ongoing	- This is ongoing as described elsewhere in this section.
	~ Continue to prepare for compliance for salmon with Habitats Directive and Water Framework Directive.	2006 2015	- A "Salmon Management in the Water Framework Directive" planning model has been developed and the Environment Agency's National Salmon Strategy is being revised to take these drivers into account.
	Interim conservation limits: Set interim CL on rivers where there is no likelihood of the CL being exceeded in the foreseeable future.	By 2007	**Interim conservation limits**: - None have so far been set.
Fishery Owners/ Angling Associations/ Rivers Trusts	**Exploitation in home waters**: promote voluntary measures to increase levels of catch and release on under-performing rivers and where relevant, contributions to netting buy-outs.	Underway	- **Exploitation in home waters**: Examples of such schemes can be found on the Rivers Wye, Usk, Tywi ,Tamar, Exe, Dart, Teign, Test, Itchen, Hants Avon and Frome.
	Riverine habitat: undertake or contribute to salmon habitat improvement projects focussing resources on priorities. Link with local Agency staff.	Ongoing	- **Riverine habitat**: This approach has spread to more rivers in recent years and is proving very successful. Examples include the Wye & Usk, Pembrokeshire, Ribble, West Country, and Tyne Rivers Trusts – there are many more.
Anglers	**Exploitation in home waters**: ~ increase levels of catch and release on under-performing rivers	Urgent	**Exploitation in home waters**: - Catch and Release nationally remains at around 56% although is as high as 100% on some rivers. More needs to be done – particularly on those rivers that have been identified as "At Risk".
	~ comply with mandatory measures if voluntary measures are either inappropriate or insufficient.	Urgent	
	~ maintain levels of catch and release elsewhere.	Ongoing	
Netsmen	**Exploitation in home waters**: comply with mandatory measures if voluntary measures are either inappropriate or insufficient.	Ongoing	**Exploitation in home waters**: - This is ongoing


Decision Structure - Developing fishing controls for salmon fisheries in England & Wales
What is the probability of failing the management objective in five year's time?
p ≤ 5%
5% < p < 50%
50% ≤ p < 95%
P ≥ 95%
Can socio-economic value be increased through a change in fishing controls whilst ensuring probability of failure does not rise above 5% and will such controls be supported?
Yes
No
Identify range of options to maximise benefits whilst maintaining <5% probability of failure. Do not increase exploitation if trend is negative or if working to an interim target.
Select option(s)
No change to controls
Is the trend in salmon spawning stock stable and positive?
Yes
No
Can socio-economic value be increased through a change in fishing controls without increasing exploitation and will such controls be supported?
Yes
No
Identify range of options to maximise benefits and to ensure sufficient spawning escapement to move to <5% probability of failure within five years.
Select option(s)
No change to controls
Identify range of options to ensure observed trend in spawning escapement is reversed within five years.
Select option(s)
Identify range of options to ensure sufficient spawning escapement to move to <50% probability of failure within five years – look to maintain socio-economic benefits where possible.
Identify range of options to urgently achieve zero exploitation by both rods and nets – (include 100% C&R) – look to maintain socio-economic benefits where possible.
Select option(s)

Notes to accompany Decision Structure

Initial stage - stock assessment
The stock assessment elements of the initial stage of the decision structure are undertaken centrally. Staff in the areas will only be involved in terms of providing information to support the development of derogated or interim targets where their use has been agreed.

Assessing compliance with the management objective
- The management objective is for spawning escapement (in terms of egg deposition) to exceed the Conservation Limit (or the interim or derogated target where appropriate) for four years out of five.
- Compliance assessments are based on a Bayesian analysis which is used to estimate the probability that spawning escapement (in terms of egg deposition) will exceed the Conservation Limit (or the interim or derogated target where appropriate) for 80% of the time by a specified target date.

Second stage – initial screening for potential options
Within the second stage of the Decision Structure both socio-economic concerns and stakeholder support are considered for those rivers that have a <50% probability of failing the management objective. By affording these two factors a higher level of importance the 'do-nothing' option remains a valid outcome for these rivers.
This stage can be seen as a screening stage for these rivers, for example effectively ruling out those management options that would not be supported by stakeholders.
For all other rivers (i.e. those where there is >50% probability of failing the management objective) the decision structure does not provide the option of ruling out potential management controls in this way. In these cases all options must be carried through to the next (evaluation) stage.

Third stage - option evaluation
The third main stage sets out and evaluates those options that could be employed to realise the required changes in exploitation. Considerations that will constrain or direct the thinking at this stage are effectively identified according to which vertical branch of the structure has been followed.

Final stage – selection and implementation
The final stage of the Decision Structure represents the final selection and implementation stage.

ANNEX 3. NASCO's request for scientific advice from ICES in 2007

1. With respect to Atlantic salmon in the North Atlantic Area:

   1.1 provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and worldwide production of farmed and ranched Atlantic salmon in 2006;

   1.2 report on significant new or emerging threats to, or opportunities for, salmon conservation and management;

   1.3 provide a framework of indicators which would be used to identify any significant change in the previously provided multi-annual management advice for each Commission area;

   1.4 examine associations between changes in biological characteristics of all life stages of Atlantic salmon and variations in marine survival[1];

   1.5 provide a compilation of tag releases by country in 2006;

   1.6 identify relevant data deficiencies, monitoring needs and research requirements[2].

2. With respect to Atlantic salmon in the North-East Atlantic Commission area:

   2.1 describe the key events of the 2006 fisheries and the status of the stocks[3];

   2.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;

   2.3 further develop the age-specific stock conservation limits where possible based upon individual river stocks;

   2.4 provide annual catch options or alternative management advice for 2008-2010, if possible based on forecasts of PFA for northern and southern stocks, with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding;[4]

   2.5 provide estimates of by-catch and non-catch fishing mortality of salmon in pelagic fisheries with an assessment of impacts on returns to homewaters.

3. With respect to Atlantic salmon in the North American Commission area:

   3.1 Describe the key events of the 2006 fisheries (including the fishery at St Pierre and Miquelon) and the status of the stocks;[3]

   3.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;

3.3 update age-specific stock conservation limits based on new information as available;

3.4 provide annual catch options or alternative management advice for 2007-2010 with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding[4];

3.5 provide a comprehensive description of coastal fisheries including timing and location of harvest, biological characteristics (size, age, origin) of the catch, and potential impacts on non-local salmon stocks.

4. With respect to Atlantic salmon in the West Greenland Commission area:

4.1 describe the events of the 2006 fisheries and the status of the stocks;[3,5]

4.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;

4.3 provide annual catch options or alternative management advice for 2007-2009 with an assessment of risk relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding.[4]

Notes:

1. *With regard to question 1.4, there is interest in determining if declines in marine survival coincide with changes in the biological characteristics of juveniles in fresh water or are modifying characteristics of adult fish (size at age, age at maturity, condition, sex ratio, growth rates, etc.).*

2. *NASCO's International Atlantic Salmon Research Board's inventory of on-going research relating to salmon mortality in the sea will be provided to ICES to assist it in this task.*

3. *In the responses to questions 2.1, 3.1 and 4.1 ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Any new information on non-catch fishing mortality, of the salmon gear used, and on the by-catch of other species in salmon gear, and on the by-catch of salmon in any existing and new fisheries for other species is also requested.*

4. *In response to questions 2.4, 3.4 and 4.3 provide a detailed explanation and critical examination of any changes to the models used to provide catch advice.*

5. *In response to question 4.1, ICES is requested to provide a brief summary of the status of North American and North-East Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to questions 2.1 and 3.1*

ANNEX 4. Description of fishing methods (nets and fixed engines) used for taking salmon and migratory trout in England and Wales

A wide variety of nets and fixed engines are used to take salmon and sea trout. The term fixed engine is an ancient one used as a general descriptor of stationary fishing gears. The following are generalised descriptions of the gear used in England and Wales (for further details see Russell *et al.*, 1995); in practice there is considerable regional variation in the precise mode of operation of specific gears and in the dimensions and mesh sizes of the nets. These characteristics have generally evolved to suit local conditions and are regulated by local byelaws.

Basket trap This is a type of fixed engine which has only been used on the River Conwy in North Wales. It consists of a metal basket set between two boulders, which is designed to catch salmon and sea trout which fall back when attempting to ascend a small waterfall.

Coastal net A loose term used to describe the nets used in the fishery off the East Anglian coast. In practice, various methods of fishing have been employed, including seine nets and drift nets.

Compass net These nets are operated from a boat held stationary against the current. A net is hung between two long poles lashed together in a V-shape and held over the side of the boat so that the net streams out underneath the boat. When a fish strikes the net, the poles are pivoted upwards with the aid of counter-balancing weights.

Coracle net These nets are only used in parts of Wales. Short lengths of trammel net are suspended between two coracles (small boats), which then drift downstream with the net strung across the current.

Crib (or Coop) These ancient fixed engines consist of stone buttresses set across a river, the gaps between the buttresses being filled by box-like traps made of either wood or metal with in-scale entrances. The River Eden cribs were built by monks in 1133 A.D., although the Derwent cribs are of more recent construction.

Drift net A drift net consists of a sheet of netting which hangs from a floated head rope to a weighted foot rope and is designed to drift with the current or tide. Regional names include: hang, whammel, sling and tuck nets.

Haaf or heave net These one-man-operated nets are operated exclusively in the North West Region. The gear consists of a rectangular net hung from a horizontal wooden beam up to 5.5m wide. A central pole permits the netsmen to stand in the tideway holding the net facing the current with the netting streaming behind him. The net is lifted when a fish strikes the net. It is usual for several netsmen to work together line-abreast.

Lave (or dip) net Lave nets, one regional variety of similar hand-held, one-man-operated nets, consist of a large Y-shaped wooden frame supporting a net, similar in design to an angler's landing net, but measuring up to 2 m across. The netsman actively stalks fish in estuary pools or shallows at low tide.

Putchers (and Putts) Putchers are wickerwork or metal conical baskets which, when erected on stages, form putcher ranks (containing up to 800 putchers). This type of fixed engine is peculiar to the Bristol Channel and is dependent upon the high turbidity and large tidal range which occurs in this area. Each putcher has a mouth from 1 to 1.5 m wide, tapering to a narrow point which will prevent fish of moderate size from passing through. A netting leader is often used to guide fish into the putchers. Putts are of similar design to putchers, only larger.

Seine net A seine net (also known as a draft or draw net) consists of a wall of netting with a weighted foot rope and floated head rope. One end is held on the shore while the rest is paid out from a boat to enclose an area of water between two points on the shore. The net is then retrieved and any fish enclosed drawn up onto the shore. Seine nets normally operate within estuaries, although some are also fished off coastal beaches.

Sling net The sling net is a type of drift net used exclusively on the river Clwyd in North Wales. It differs from other drift nets only in so far as the nets are permitted to carry weights (not exceeding 4 kg) at either end, designed to retard the drift.

T-net T-nets are fixed engines operated close to the shore, usually in specific berths. They comprise a 'leader', usually about 200 m in length, stretching out from the beach to a 'headpiece', which contains two traps with funnel entrances. Some fish may become enmeshed or entangled in the leader of the net, but the majority are taken, free-swimming, in the traps.

'T or J'-net 'T or J'-nets consist of plain sheets of netting on a floated head rope which hang vertically in the water by means of a weighted foot rope and are set from the shore in the shape of a 'T', 'J' or 'P'. These nets are usually operated as fixed engines, held stationary by means of weights, anchors or stakes, but can also be drifted with weights used to retard the rate of movement. Fish can only be caught in a 'T or 'J' net by becoming enmeshed or entangled in the walls of the net.

Trammel net Trammel nets are similar to drift nets but are modified by the addition of sheets of larger mesh netting on one or both sides of the net. Such nets are referred to as being 'armoured'. A fish striking a trammel net pushes the small mesh net through one of the large meshes in the adjoining net and is caught in the resultant pocket. Sometimes known locally as tuck nets.

Wade net A wade net consists of a short (~30 m) single sheet of netting which is attached to a pole at each end, and is pulled along the foreshore parallel to the beach by two men, one wading and the other on the beach. Nets are 'beached' at regular intervals, or when a fish strikes, in much the same way as a seine net.

ANNEX 5. ICES Compilation of microtag, fin clip and external tag releases

Marking season: 2006

Country: UK (England and Wales)

Totals:

Origin	Primary Tag or Mark			
	Microtag	External Mark	Adipose Clip	Total
Hatchery juvenile	54,826	0	148,535	203,361
Wild juvenile	16,778	0	16,749	33,527
Adult	0	2,907	0	2,907
Total fish marked	**71,604**	**2,907**	**165,284**	**239,795**

Marking Agency	Age	Life Stage	H/W	Stock Origin	Primary Tag or Mark	Number marked	Code or Serial	Secondary Tag or Mark	Release date	Release Location
EA North East	Various	Adult	W	Tyne	Floy tag	296	Various	None	Jan-Dec	Tyne
EA North East	1+	Parr	H	Tyne	Adipose	5,000		None	20-Mar	Kielder Burn
EA North East	1+	Smolt	W	Tyne (Kielder Burn)	Adipose	3,524		None	March	Tyne
EA Thames	Various	Adult	W	Thames	Floy tag	2	00655/00656 (Yellow)	None	Sept	Thames
EA Thames	S1	Smolt	H	Delphi	Microtag	4,594	01/42/39	Adipose	02-Mar	Thames (Kennet)
EA Thames	S1	Smolt	H	Delphi	Microtag	2,101	01/42/39	Adipose	06-Mar	Thames (Kennet)
EA Thames	S1	Smolt	H	Delphi	Microtag	1,612	01/42/78	Adipose	06-Mar	Thames (Kennet)
EA Thames	S1	Smolt	H	Shannon	Microtag	10,100	01/42/71	Adipose	06-Mar	Thames (Kennet)
EA Thames	S1	Smolt	H	Shannon	Microtag	10,065	01/42/70	Adipose	06-Mar	Thames (Kennet)
EA Thames	S1	Smolt	H	Delphi	Microtag	2,516	01/42/78	Adipose	07-Mar	Thames (Kennet)
EA Thames	S1	Smolt	H	Delphi	Adipose	2,697		None	21-Apr	Thames
EA Thames	S1	Smolt	H	Delphi	Adipose	1,404		None	18-May	Thames
EA Thames	S2	Smolt	H	Shannon	Adipose	7,849		None	22-Mar	Thames (Kennet)
EA Wales	Various	Adult	W	Taff	Floy tag	11	Various (Green)	None	May-Dec	Taff
EA Wales	Various	Adult	W	Taff	Floy tag	95	Various (orange)	Radio tag	May-Dec	Taff
EA Wales	S2	Smolt	H	Taff	Microtag	9,800	01/42/83	Adipose	25-26 April	Taff
EA Wales	S1	Smolt	H	Taff	Microtag	4,900	01/42/80	Adipose	05-Apr	Cardiff Bay cage
EA Wales	1+	Parr	H	Taff	Adipose	48,300		None	Mar-Apr	Taff
EA Wales	Various	Adult	W	Dee	Floy tag	1,328	Various	None	Feb-Oct	Dee
EA Wales	S1	Smolt	H	Dee	Adipose	7,900		None	01-Feb	Dee (Tryweryn trap)
EA Wales	S1	Smolt	H	Dee	Adipose	15,838		None	6-Mar - 22-Mar	Dee (Tryweryn trap)
EA Wales	S1	Smolt	H	Dee	Adipose	4,000		None	04-Apr	Dee (Tryweryn trap)
EA Wales	1+	Parr	H	Dee	Adipose	5,500		None	05-Apr	Dee (Tryweryn trap)
EA Wales	1+	Parr	H	Mawddach	Adipose	2,200		None	07-Apr	Mawddach (Wnion)
EA Wales	1+	Parr	H	Mawddach	Adipose	4,000		None	24-Mar	Mawddach
EA Wales	2+	Parr	H	Conwy (Lledr)	Adipose	12,553		None	14-Mar	Conwy (Lledr/Pentre)
EA Midlands	1+	Parr	H	Tyne	Adipose	17,000		None	26-Sep	Trent (Dove)
EA Midlands	1+	Parr	H	Severn	Microtag	2,346	01/42/41	Adipose	21-Apr	Severn (Tanat)
EA Midlands	1+	Parr	H	Severn	Microtag	1,722	01/42/42	Adipose	26-Sep	Severn (Teme)
EA North West	2+	Parr	H	Ribble	Microtag	343	01/42/50	Adipose + Panjet	10-Feb	Ribble (Hodder/Langdon)
EA North West	1+	Parr	H	Ribble	Microtag	2,170	01/42/79	Adipose	26-Feb	Ribble (Hodder Pond)
EA North West	1+	Parr	H	Ribble	Microtag	2,557	01/42/79	Adipose	07-Mar	Ribble (Hodder/Dunsop Pond)
EA North West	1+	Parr	H	Ribble	Adipose	5,294		None	08-Mar	Ribble (Hodder/Langdon)
EA North West	1+	Parr	H	Lune	Adipose	9,000		None	January	Lune
EA North West	Various	Adult	W	Caldew (Eden)	Floy tag	1,135	Various	None	Sep-Dec	Caldew (Eden)
Cefas/EA Wales	Various	Smolt	W	Dee (Ceiriog)	Microtag	2,559	01/42/75	Adipose	Apr-May	Dee (Ceiriog)**
EA Wales	Various	Smolt	W	Dee	Microtag	2,115	01/42/37	Adipose	Apr-May	Dee (Lower)
EA Wales	Various	Smolt	W	Dee	Microtag	2,197	01/42/66	Adipose	Apr-May	Dee (Lower)
Cefas	Various	Smolt	W	Tamar	Microtag	8,043	01/42/77	Adipose	Apr-May	Tamar
Cefas	Various	Parr	W	Dee (Ceiriog)	Adipose	2,000		PIT	Sept	Dee (Ceiriog)
Cefas	Various	Parr	W	Itchen	Adipose	225		PIT	Sept	Itchen
Cefas	Various	Adult	W	Tyne	Floy tag	40	EO101 - EO148	Acoustic tag	Mar-Oct	Tyne
Cefas	Various	Smolt	W	Tyne	None	28		Acoustic tag	May	Tyne
Cefas/CEH	Various	Parr	W	Frome	Adipose	11,000		PIT	Sept	Frome
Cefas/CEH	Various	Parr	W	Frome	Microtag	1,864	01/42/76	Adipose	Apr-May	Frome

*Key: ** A small number of these microtagged smolts previously PIT tagged as juveniles.*