Agenda item 7.2
For information

Council

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Draft NASCO Implementation Plan for Salmon Management in UK (England and Wales)

DRAFT - NASCO Implementation Plan for Salmon Management in UK(England and Wales)

1. Introduction

1.1 Objectives of the national management strategy

The current **Strategy for the Management of Salmon in England and Wales**[1] has the following four main objectives:

(i) Optimise the number of salmon returning to homewater fisheries.
(ii) Maintain and improve the fitness and diversity of salmon stocks.
(iii) Optimise the total economic value of surplus stocks.
(iv) Ensure necessary costs are met by beneficiaries.

These objectives are primarily aimed at securing the well-being of salmon stocks but, in doing so, also strive to improve catches and associated economic returns to the fisheries. They are addressed through local **Salmon Action Plans (SAPs)** which have been produced for the main salmon rivers/fisheries in England and Wales. Each plan is developed in consultation with local interest groups, and reviews the status of the stock and the fisheries on a particular river, seeks to identify the main factors limiting performance, and draws up and costs a list of options to address these.

1.2 Current management regime

The Environment Agency and the Department for Environment, Food and Rural Affairs (Defra), or the Welsh Assembly Government (WAG) in Wales, each has roles in the monitoring and assessment of salmonid and freshwater fish stocks and the management of their fisheries. Defra and WAG have overall responsibility for salmonid and freshwater fisheries within their areas of jurisdiction. They are jointly responsible for setting the statutory framework under which salmonid stocks and fisheries are managed, and the Secretary of State and the National Assembly for Wales have statutory responsibilities to consider the acceptability of all new fishery regulations and fishing licence duties proposed by the Environment Agency in England and Wales respectively. Defra also takes the lead on issues relating to salmon management which involve obligations to the European Union, for example in relation to the European Habitats Directive, and in bodies such as the North Atlantic Salmon Conservation Organisation (NASCO) and the International Council for the Exploration of the Sea (ICES). The Agency has a duty to maintain, improve and develop the fisheries under its jurisdiction, and also to regulate these fisheries and prevent their illegal exploitation.

1.3 Nature and extent of salmon resource

There are 78 rivers in England and Wales that support rod fisheries for salmon (Figure 1), although the catch in some of these rivers is very small. Salmon Action Plans have been developed for the 62 rivers that have been designated 'principal salmon rivers', as well as one major estuary (the Severn). Eighteen rivers have also been designated Candidate Special Areas of Conservation (CSACs), under the EU Habitats Directive 92/43/EEC, with salmon as a named qualifying species. This places an additional requirement on managers to maintain the habitats in these rivers in a favourable condition for salmon.

Salmon rivers in England and Wales vary significantly in their nature, ranging from spatey upland catchments to stable groundwater-fed chalk rivers. There is also a significant variation in stock size, with conservation limits (CLs) (see Section 2 and Annex 1) for

[1] National Rivers Authority (1996)

individual river stocks ranging from 0.19 to 35.7 million eggs. The current total production of salmon is estimated to be about 100,000 returning fish (or a pre-fishery abundance (PFA) of about 150,000 fish), although historically it has been more than double this level. The total CL for all SAP rivers, expressed in terms of adult fish rather than eggs, is currently estimated at just over 81,000, comprising 52,000 one-sea-winter (1SW) and 29,000 multi-sea-winter (MSW) salmon. While the overall estimate of returning salmon currently exceeds the national CL, there is wide river-to-river variation and only a minority of rivers (10 in 2005) are assessed as having a high probability of achieving their CL in four years out of five.

Salmon and sea trout stocks in England and Wales support recreational and commercial fisheries in rivers, estuaries and coastal waters that have a capital value of about £130 million (2001 figures)[2].

1.4 Overview of fisheries and management approach

Salmon fisheries in England and Wales) are regulated by effort controls, which specify the nature of the gear that may be operated, along with where, when and how it may be used. Anyone fishing for salmon with net, fixed engine[3] or rod must have a licence, and numbers of net/fixed engine licences issued are limited by Net Limitation Orders (NLOs) that apply to individual fisheries (e.g. within each estuary). A small number of net/fixed engine fisheries are privately owned and are not subject to NLOs; these fisheries may be regulated by byelaws, but the nature of the gear used cannot generally be altered. There is no limit on the number of rod licences that can be issued.

There are a large number of different specialised salmon fishing methods employed in England and Wales, but these can be grouped into five generic categories: gill nets, sweep nets, hand-held nets, fixed engines and rods. Rod fishing for salmon is permitted on all rivers supporting salmon stocks, and there are currently net or fixed engine fisheries operating on 28 rivers/estuaries. There is a policy to phase out all fisheries that predominantly exploit mixed river stocks of salmon, unless the fishery operates in a common estuary where effort can be regulated to protect the weakest stock.

Netting effort has been significantly reduced over the past 20 years, with the total number of net/fixed engine licences decreasing from nearly 900 in the mid 1980s to 345 in 2005. The number of licences that was issued in each fishery in 2005 and the number of days on which the fishery may operate are shown in Table 1.

Although byelaws may be introduced to make immediate reductions in fishing effort (e.g length of seasons), reductions in licence numbers imposed under NLOs will not necessarily have immediate effect on the number of licences issued, because existing licensees who are dependent upon fishing for their livelihood retain the right to receive a licence as long as they continue operating.

In addition to local byelaws and NLOs, national measures may be introduced. 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. These banned netsmen from killing and, in most cases, fishing for salmon before 1st June and imposed compulsory catch and release in rod fisheries until 16th June.

In addition to statutory measures, there is a range of voluntary measures in place. These include agreements between angling and netting interests, which result in netsmen being compensated to release fish, and extensive voluntary catch and release of rod-caught fish. In total 55% of rod-caught fish were released in 2005.

[2] Radford, Riddington, Tingley (2001) Economic evaluation of inland fisheries. Environment Agency R&D project W2-039/PR/1

[3] The term fixed engine is used as a generic descriptor of stationary fishing gears in the UK.

2. Status of stocks

2.1 Abundance (e.g. egg deposition, juvenile densities, and/or returning adults)

Stock CLs and management targets (MTs) are used to assess the status of river stocks on an annual basis, in line with the requirements of ICES and NASCO. The methods used are described in Annex 1. The 'management objective' for each river is that the stock should be meeting or exceeding its CL in at least four years out of five. A full review of salmon stock conservation was also undertaken in 2004 to assess the status and trends in salmon stocks in England and Wales and review progress with the implementation of SAPs. The Review demonstrated that, whilst many new conservation measures had been implemented, the majority of stocks remained below the river CL and a significant number were in decline.

The total pre-fishery abundance of salmon (the number of salmon estimated to be alive on 1st Jan of their first sea winter) from English and Welsh rivers is estimated to have declined from over 350,000 in the 1970s to around 150,000 in the past 10 years (Figure 2), despite substantial reductions in exploitation both in homewater and distant water fisheries. However, the reduction in exploitation means that there has been a less severe decline in the spawning escapement, from about 110,000 to about 75,000.

The status of 64 river stocks has been assessed against CLs in 2005 (see Annex 1 for method). Of these:

- 10 rivers (16%) had a high probability of meeting the management objective;
- 34 rivers (53%) had a high probability of failing to meet the management objective; and
- 20 rivers fell between a clear fail or pass.

The probability of these stocks meeting their CLs in 2010 has also been assessed as follows:

- 10 are forecast to have a high probability of meeting the management objective;
- 24 are forecast to fail to meet the management objective; and
- the assessment for the remaining 30 falls between a clear fail or pass.

Monitoring of juvenile salmon is also undertaken (see section 5 below). Rivers are classified according to the abundance of fish relative to baseline average values derived from measurements in the early 1990s. In surveys conducted between 2001 and 2005, only 18% of rivers had more than 50% of their stream length at or above the baseline values (class A to C); and in 39% of rivers, 50% of the stream length was well below average or fish-less (class E or F) in terms of juvenile densities. Such information is used alongside the assessments of stocks against CLs and management objectives to make judgements on the management measures appropriate for each river.

2.2 Diversity (e.g. age composition, run-timing, etc.)

The spawning escapement to all rivers in England and Wales is estimated to have comprised about 45% MSW salmon in the 1970s, but to have declined to about 35% in the past 10 years. This is largely due to the decline in early running MSW salmon, particularly the larger 3-sea-winter fish. It is for this reason that exploitation of this stock component has been substantially reduced by the introduction of national conservation measures in 1999 (see Section 1.4)

The age composition of emigration smolts varies in different parts of the England and Wales. In some rivers there has been a significant reduction in their mean age and this may have consequences for marine survival rates and age at return.

2.3 Threatened or endangered stocks

Although a large number of stocks in England and Wales are in a depleted state, none is currently classed as threatened or endangered.

Work is underway to implement the European Union's Water Framework Directive which will progressively set the agenda for all aspects of the protection and improvement of the water environment. Under the Directive, characterisation of water bodies with respect to relevant pressures uses the terms 'at risk', 'probably at risk', 'probably not at risk', 'not at risk' or 'not assessed'. To support use of common language, the Environment Agency is adopting these terms to describe the status of salmon stocks. Those 34 river stocks that were assessed to have a high probability of failing the management objective (see Section 2.1) would be judged to be 'at risk'.

3. Threats to stocks, and current management measures

3.1 Effects of salmon fisheries

Homewater fisheries: The overall level of exploitation, including unreported and illegal landings, in rod and net fisheries in England and Wales is estimated to have declined from over 40% about 15 years ago to less than 25% currently (Figure 2) and there is a national policy to phase out predominantly mixed stock fisheries. The main mixed stock fishery has been in north east England, and a proportion of the catch in this fishery is of salmon returning to rivers in Scotland. In the 1970s this proportion was assessed to be as high as 95%. Since then, great improvements have been made to the water quality in a number of estuaries in the North-east, and the stocks in these rivers have increased markedly; the River Tyne now records the highest rod catches in England and Wales. The exploitation in the net fishery has also been greatly reduced, particularly as a result of the phase out of the drift nets. The proportion of fish returning to Scottish rivers in the much reduced catch is currently estimated at around 65%.

Whilst additional controls on exploitation in English and Welsh fisheries are not by themselves considered to be a solution to the declining status of many stocks, in some instances further controls may be appropriate to protect stocks that are under significant pressures. To assist in applying fisheries regulations in a logical and consistent manner, and in accordance with NASCO guidance, a "decision structure" has been produced to aid in determining fishing controls on salmon fisheries in England and Wales (Annex 2). This tool focuses on an assessment of the probability of achieving the MT 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.

Distant water fisheries: Exploitation of English and Welsh stocks at West Greenland is estimated to have been less than 1% in the last few years, and there has been no Faroese fishery in the period 2001 to 2005.

Irish fisheries: Exploitation of English and Welsh stocks in the Irish coastal fisheries has declined since the introduction of new management measures in Ireland in 1997, and since 2002 the Irish fishery has also been regulated by quotas, which have been reduced each year. Exploitation of salmon from north east England in the Irish fishery is estimated to be negligible (<1%), the exploitation on stocks from north west England and north Wales is currently low, but levels increase for rivers further south in Wales (3 to 11%) and in southern England, where it may exceed 10% (e.g. 12% for the River Test). Recent estimates for the River Tamar in south west England (2003 and 2004 only) indicate a current exploitation rate in Ireland of about 2% for this stock. Some tags of English and Welsh origin have also been returned from homewater fisheries in Northern Ireland or Scotland, but the exploitation rates are estimated to be low.

By-catch: Possible exploitation of salmon post-smolts in the pelagic, mainly mackerel, fisheries in the Norwegian Sea has been raised as a concern, but reliable estimates are not available. Recent investigations suggest that pelagic trawl designs used by commercial fisheries are unlikely to catch significant numbers of salmon post-smolts or adult salmon, and salmon by-catches are believed to have little impact on PFA or returns to homewaters.

Enforcement: Regulations to protect and conserve stocks also need to be enforced. In addressing contravention of fisheries laws, the Environment Agency's enforcement officers have the powers and responsibilities of police officers including powers of arrest, search and seizure. Overt and covert operations are carried out both to ensure licensed fishermen comply with relevant regulations and that action is taken against unlicensed (potentially unregulated) fishing. Such efforts are undertaken in rivers, estuaries and in coastal fisheries to 6 nautical miles to sea. The Environment Agency has reviewed its enforcement practices to promote greater use of 'intelligence' and targeting. Environment Agency officers work in collaboration with local police forces and with the bailiffs operating (largely on a voluntary basis) for fishing clubs and associations.

3.2 Factors affecting estuarine and freshwater salmon habitat

The 2004 Salmon Conservation Review 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. Of the 42 rivers failing their CL in 2003, the review identified the main contributory factors (within catchments) as channel structure and siltation (83%), water quality (52%), in-river obstruction (36%), exploitation (29%) and water quantity (29%).

Factors affecting individual river stocks are identified and prioritised in the SAPs developed for the 'principal salmon rivers'. The Environment Agency acts to protect and improve salmon (and other fish) habitats in a number of ways, including:

- By ensuring appropriate measures are included in consents to discharge to watercourses, in licences issued for water abstraction and impoundment, in consents for developers to undertake physical works in rivers and in responses to planning consultations;
- By influencing the investment plans of water companies responsible for water supply and sewage treatment to seek targeted improvements to water quality where this is a limiting factor. Many of the stock recoveries experienced in the last 30 years have come about following infrastructure improvements resulting from these programmes;
- Through enforcing laws requiring fish passes where developments result in obstacles to fish migration;
- By investing each year in specific projects to improve physical habitat and to address obstacles to migration. Most of these works are undertaken in partnership with other local interests so increasing the resources available to support salmon;
- Through developing material to raise awareness and provide guidance on good practices relating to river management; and
- By operating salmon hatcheries that use local brood-stock to provide for stocking of salmon parr or smolts either to mitigate for reservoir or other developments that permanently take parts of rivers out of production or to help restore stocks where previously limiting factors have been removed.

3.3 Impacts of aquaculture, introductions and transfers and transgenics (including diseases and parasites)

There are no marine salmon aquaculture facilities in England or Wales, and very few farm escapees have been observed in survey programmes, except when large escapes have been reported in Northern Ireland or Scotland.

All stocking activities require consent from the Environment Agency and are regulated in

accordance with the national stocking policy, which follows the principles developed by NASCO, including those under the Williamsburg Resolution. In essence, priority is given to programmes that mitigate for developments having long-term effects on salmon stocks and that aim to help restore stocks where environmental limitations have been addressed. Using a risk-based approach, monitoring is required to assess the efficacy and impact of stocking initiatives. For example, in 2004, the Environment Agency reviewed information on the recovery of the River Tyne salmon stock and assessed the relative contribution of natural recovery and restocking[4]. The Environment Agency operates its own salmon hatcheries to provide for programmes following these same principles and using brood-stock sourced from the nearest available adult stock (usually from the same river).

Defra is currently funding research on the impacts of in-river aquaculture facilities on juvenile and adult salmon.

3.4 Other influences affecting salmon abundance or diversity (including marine environment)

Salmon stocks in England and Wales are in a generally depleted state, and it is believed that, in common with stocks in other countries, they have experienced reduced marine survival in recent years. The reasons for the decline are not known. In 2003 the Environment Agency adjusted values for marine survival rates used in deriving CLs and assessing the status of stocks, from 25% for 1SW fish and 15% for MSW fish down to 11% and 5% respectively (Annex 1). A number of research programmes are underway in England and Wales to contribute to the overall NASCO research effort on the problem of low marine survival. Studies include investigations on:

- the marine survival and exploitation on two monitored salmon stocks;
- the effects of freshwater contaminants on sea-water adaptation in smolts;
- the effects of contaminants on returning adult salmon;
- the habitat requirements of returning salmon in estuaries;
- modelling of bioenergetics in salmon post-smolts.

4. Future Management Priorities

This section provides an overview of the management actions planned for the 5-year period June 2006 to May 2011.

4.1 River Specific Salmon Action Plans

A programme to develop Salmon Action Plans (SAPs) for the principal salmon rivers in England and Wales was completed in April 2004. Each SAP 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. The specific actions planned for each river are not listed here, but progress against these actions is reviewed annually at both regional and national levels and will be reported (in summary) to NASCO.

The Environment Agency also expects to review and revise its National Salmon Strategy by 2008. The EU Water Framework Directive (WFD) requires the production of River Basin Management Plans (covering all aspects of water management) by 2009 and its planning regime will operate to a 6-year cycle.

[4] Environment Agency 2004, The role of stocking in recovery of the River Tyne salmon fisheries, Fisheries Technical Report 2004/1

ACTION 1: Review and update Salmon Action Plans for specific rivers according to the following schedule; this will include identification and prioritisation of management actions. (The developments relating to the WFD will impact on the Salmon Action Plan programme and the following schedule will remain subject to revision.)

Provisional schedule for reviewing and updating Salmon Action Plans:

2006/07	2007/08	2008/09	2009/10	2010/11
Tamar	Lyhner	Camel	Yealm	Fowey
Tavy	Ribble	Dyfi	Plym	Piddle
Avon (Hants)	Seiont	Dysinni	Stour	Leven
Frome	Ogwen	Dwyryd &	Wyre	Usk
Lune	Conwy	Glaslyn	Duddon	Taff/Ely
Dwyfawr	Clwyd	Coquet	Esk & Irt	Wye
Dee	Wear	Esk (Yorks)	Severn estuary	Esk (Border)
Mawddach	Eden	Ogmore	Severn River	Test
Tyne	Tees	Tawe	Derwent	Itchen
Thames	Kent		Rheidol	Exe
Teifi	Ehen		Nevern	Teign
	Tywi		Taw	Dart
	Taf		Torridge	Lyn
	E&W Cleddau		Axe	
			Avon (Devon) & Erme	

4.2 Management of fisheries

The need for new controls on fisheries may be identified within SAPs for individual rivers. In additions, the decision structure for developing fishing controls for salmon fisheries in England & Wales (Annex 2) will be used to undertake annual assessments of the need for changes to fishery regulations, and for the regular reviews of NLOs and Byelaws.

The NLOs regulating salmon net fisheries in England and Wales must be renewed at least every 10 years, and may be reviewed more frequently when stocks are depleted or particular problems are identified. Byelaws, that may apply to either net or rod fisheries, vary in whether or not review periods are set and in the periods for any reviews. In the next five years, the regulations on the rivers/fisheries listed below will be fully reviewed and updated.

In addition, the policies to phase out mixed stock fisheries in England and Wales and seek reductions in the exploitation of English and Welsh stocks in other countries will continue, and management measures may be examined on other fisheries.

ACTION 2: Continue phase-out of mixed stock salmon fisheries.

ACTION 3: Undertake annual reviews of the status of stocks in each principal salmon river and determine the need for immediate changes to regulatory measures.

ACTION 4: Assess NLOs for net fisheries according to the following schedule, including undertaking stakeholder consultation and determine subsequent controls needed.

Schedule for reviewing Net Limitation Orders:

2006/07	2007/08	2008/09	2009/10	2010/11
Southern Region Christchurch Hbr Poole Hbr	Fowey Camel Ribble Solway Firth Teifi E & W Cleddau Welsh rivers - (10 fisheries on 9 estuaries) North east coast (mid term review)	Lune		

ACTION 5: Assess and determine subsequent controls needed prior to the expiry of the following byelaws for salmon fisheries in 2008:

- National - annual close season for salmon & trout fishing other than with rod & line
- National – early season catch and release in specified fisheries; and by rod & line
- National – early season method restriction for salmon with rod and line

ACTION 6: Seek reduction in exploitation of any English or Welsh salmon stock in home-water fisheries outside England and Wales to not more than 1%.

4.3 Protect and restore salmon habitat

Activities to protect and restore salmon habitat will be identified and prioritised within the SAPs for individual rivers. Requirements under the WFD will provide further protection to salmon habitats and provide means to address the impacts of land-use practices, in particular agriculture, and factors causing diffuse pollution (including siltation and pesticides).

ACTION 7: Continue and expand the range of initiatives to bring about significant changes in land use to protect and enhance river habitats - including agri-environment schemes, information campaigns and tighter regulation.

ACTION 8: Deliver strategic programmes targeted to address degraded salmon habitat and involving collaboration between stakeholder groups to optimise what is achieved.

ACTION 9: Build requirements into the programmes of measures demanded by the EU WFD to address issues limiting salmon stocks.

4.4 Manage aquaculture, introductions and transfers

All stocking activities will continue to be regulated by the Environment Agency in accordance with the national stocking policy.

Current research on the effects of in-river aquaculture will be completed in 2007.

ACTION 10: Report on results of research on impacts of in-river aquaculture facilities on juvenile and adult salmon.

4.5 Actions to be taken in relation to other influences

Research and other investigations will continue on factors affecting salmon in the marine environment.

ACTION 11: Report on results of research into factors affecting marine survival of salmon.

5. Evaluation

The Environmental Agency monitoring programme for salmon stocks and fisheries in England and Wales is under review, but currently includes the following activities. Catch statistics are collected annually for all rod and net salmon fisheries in England and Wales and are used in the annual stock assessments. In addition, the Environment Agency operates electronic fish counters on a number of catchments to provide estimates of the upstream run of adult salmonids.

The Environment Agency monitors both the stocks and fishery performance in the principal salmon rivers. Extensive juvenile monitoring is undertaken, and in 2002 the sampling programme was reviewed to ensure a consistent approach in identifying spatial differences and temporal trends in the juvenile salmon population. The 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 juvenile populations. The programme has been designed (number of sites, samples and periodicity) to detect an annual change if it is more than 20% below or more than 25% above, and differences between sub-catchments of 45%, with 5% significance and a 20% probability that the difference is real.

The habitat at all electric fishing sites is assessed using the model HABSCORE [5], which enables the detectable difference of the spatial surveys to be increased by a further 1.1–22.1%, depending on life stage sampled. HABSCORE also provides reference conditions against which the size of the population at any site can be compared.

Wild smolt tagging programmes are being run on the Rivers Tamar (South-west) and Dee (Wales) to assess levels of exploitation in fisheries outside homewaters, principally the Irish coastal fisheries, and to monitor trends in marine survival for salmon from rivers in England and Wales.

ACTION 12: Prepare and publish an annual assessment of the status of salmon stocks in England and Wales and report on the results of on-going monitoring programmes.

[5] (Milner *et al*., 1998)

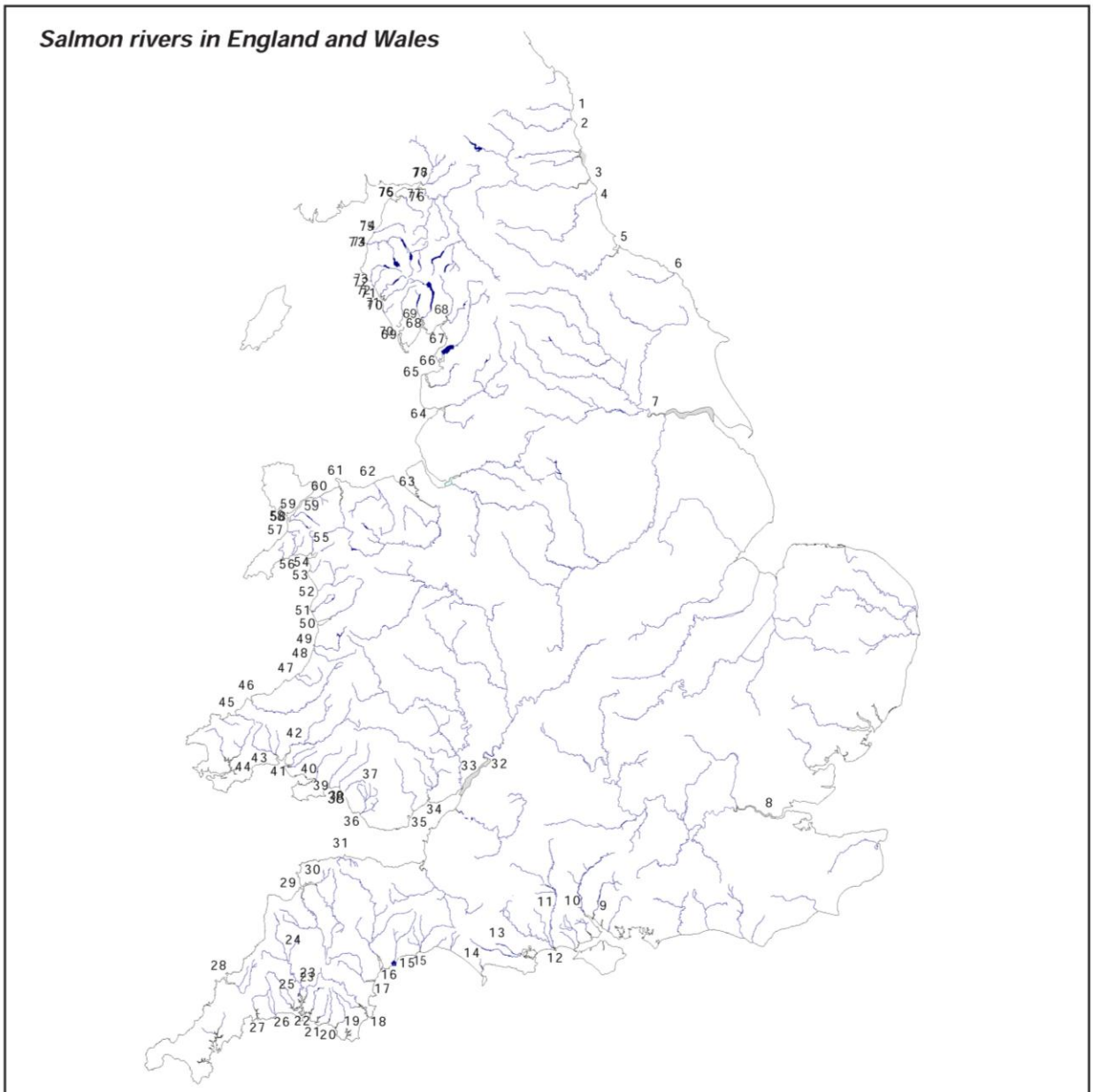
Table 1. Allowable effort for the principal salmon net fisheries in England and Wales in 2005

Reg	River/ Fishery	Method	No. of licences	NLO	Days available *	Allowable effort net days **
NE	N Coastal (N)	Drift & T	5	X	113	565
	N Coastal (N)	Drift	5	X	65	325
	N Coastal (N) [1]	T	21	25	113	2,825
	N Coastal (S)	Drift	4	X	65	260
	N Coastal (S) [1]	T	1	1	113	113
	Y Coastal	Drift	2	X	65	130
	Y Coastal [1]	T or J	27	50	113	5,650
	NE Region		**65**			**9,868**
SW	Avon & Stour	Seine	3	4	52	208
	Poole Harbour	Seine	1	1	52	52
	Exe	Seine	9	18	64	1,152
	Teign [1]	Seine	6	6	142	852
	Dart [1]	Seine	12	13	128	1,664
	Camel	Drift	7	7	26	182
	Fowey [1]	Seine	2	2	65	130
	Taw/Torridge	Seine	3	X	52	156
	SW Region		**43**			**4,396**
Midlands	Severn	Putchers	6		75	450
	Severn	Seine	3	4	75	300
	Severn	Lave	21		75	1,575
	Midlands region		**30**			**2,325**
Wales	Wye	Lave	7		79	553
	Tywi [1]	Seine	9	9	128	1,152
	Tywi [1]	Coracles	6	12	128	1,536
	Taf	Coracles	1	1	128	128
	Taf	Wade	1	1	128	128
	E/W Cleddau	Compass	7	6	75	525
	Nevern [1]	Seine	0	1	129	129
	Teifi [1]	Seine	3	4	129	516
	Teifi [1]	Coracles	12	12	129	1,548
	Dyfi [1]	Seine	3	3	130	390
	Dysynni	Seine	1	1	130	130
	Mawddach	Seine	1	3	75	225
	Conwy	Seine	2	3	75	225
	Dee	Trammel	4	X	51	204
	Dee	Seine	13	X	51	663
	Welsh Region		**70**			**8,052**
NW	Ribble	Drift	6	6	78	468
	Lune	Haaf	12	12	78	936
	Lune	Drift	7	7	78	546
	Lune	Seine	1	0	78	78
	Kent	Lave	8	8	78	624
	Leven	Lave	4	0	51	204
	Eden & Esk	Haaf	96	155	78	12,090
	Eden & Esk	Coops	3		84	252
	NW Region		**137**			**15,198**

Notes: *National spring salmon byelaws apply - all net fisheries closed until June 1, but see footnote 1 below.*
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.

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.*
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).*



Key

No.	River	No.	River	No.	River	No.	River
1	Aln	21	Yealm*$	41	Gwendraeth Fawr	61	Conwy*
2	Coquet*	22	Plym*	42	Tywi*	62	Clwyd*
3	Tyne*	23	Tavy*$	43	Taf*	63	Dee*$
4	Wear*	24	Tamar*	44	E & W Cleddau*	64	Ribble*
5	Tees*	25	Lynher*	45	Nevern*	65	Wyre*
6	Esk (Yorkshire)*	26	Looe	46	Teifi*$	66	Lune*
7	Ouse	27	Fowey*	47	Aeron	67	Kent*
8	Thames*	28	Camel*$	48	Ystwyth	68	Leven*
9	Itchen*$	29	Torridge*	49	Rheidol*	69	Crake*
10	Test*	30	Taw*$	50	Dyfi*	70	Duddon*
11	Avon (Hants)*$	31	Lyn*	51	Dysynni*	71	Esk (Cumbria)*
12	Stour (Dorset)*	32	Severn*	52	Mawddach*$ and Wnion*	72	Irt*
13	Piddle*	33	Wye*$	53	Artro	73	Ehen & Calder*$
14	Frome*	34	Usk*$	54	Dwyryd*	74	Derwent*$
15	Axe*	35	Taff*	55	Glaslyn*	75	Ellen
16	Exe*	36	Ogmore*	56	Dwyfach & Dwyfawr*	76	Wampool
17	Teign*$	37	Afan*	57	Llyfni	77	Eden*$
18	Dart*$	38	Neath	58	Gwyrfai$	78	Esk (Border)*
19	Avon (Devon)*	39	Tawe*	59	Seiont*		
20	Erme*$	40	Loughor*	60	Ogwen*		

Figure 1. Map of England and Wales showing the main salmon rivers and denoting those (*) with Salmon Action Plans and those ($) designated as Special Areas of Conservation in which salmon must be maintained or restored to favourable conservation status.

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

UK(England and Wales)

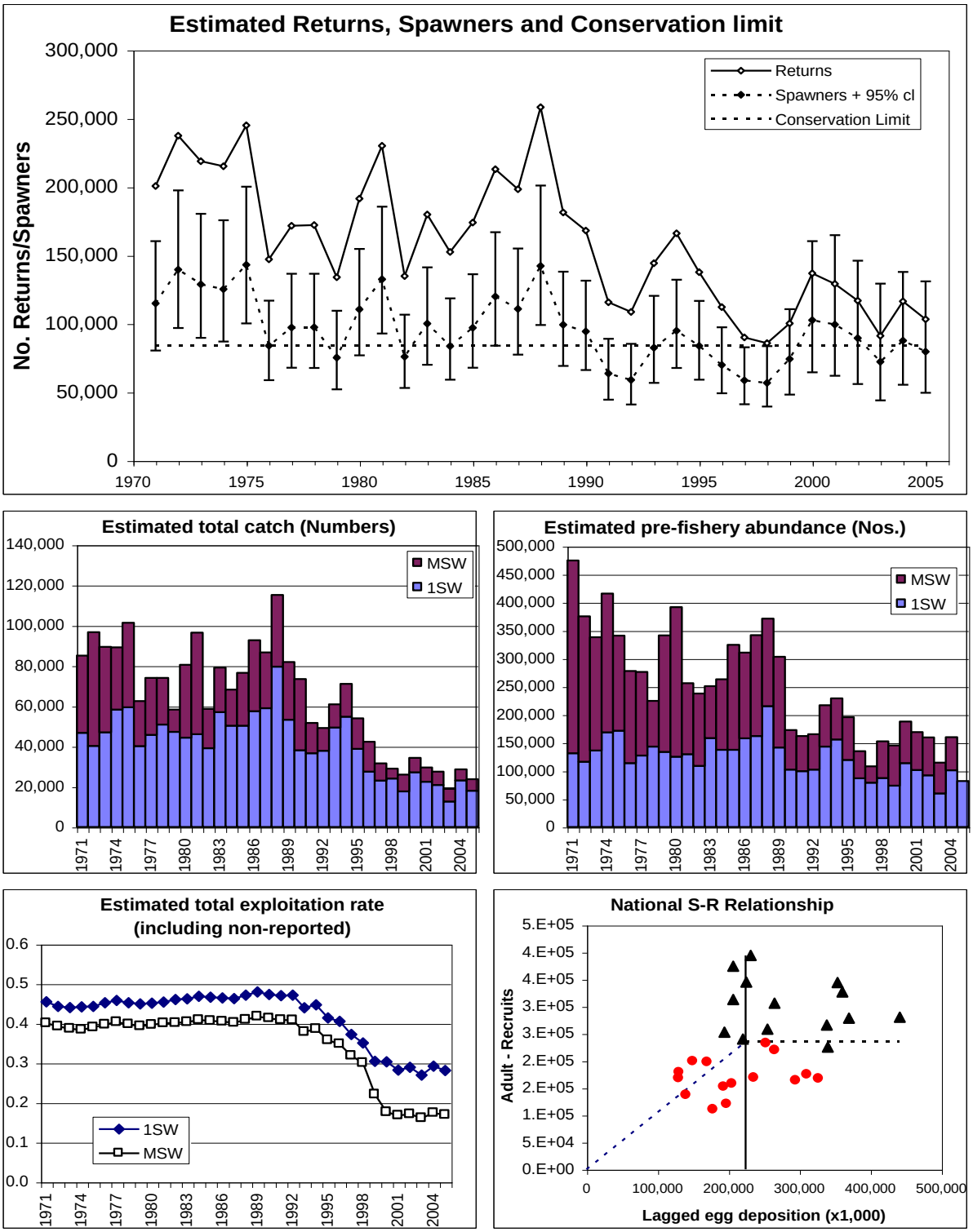


Figure 2. Summary assessment of the status of the national salmon stock in England and Wales (1970-2005) based on the ICES NEAC PFA & NCL models[6]. (The lower right panel is the output of the ICES model which estimates a national conservation limit (NCL) based on national estimates of egg deposition and adult recruitment over about 30 years; black triangles denote years before 1990, and red diamonds the years subsequently.)

[6] ICES, NASWG Report 2005.

Annex 1: Establishment and use of biological reference points for management of salmon stocks in UK(England and Wales)

The use of conservation limits (CLs) in England and Wales has developed in line with the requirements of ICES and NASCO to set criteria against which to advise on stock status and assess the need for management action. CLs indicate the minimum desirable spawning stock levels below which stocks should not be allowed to fall. The CL is the spawner stock size below which further reductions in 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[7]. 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 in April 2003 [8].

These rates have now been applied in calculating CLs for all rivers with Salmon Action Plans (SAPs). 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 stocks fail to meet the management objectives. 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 now 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.

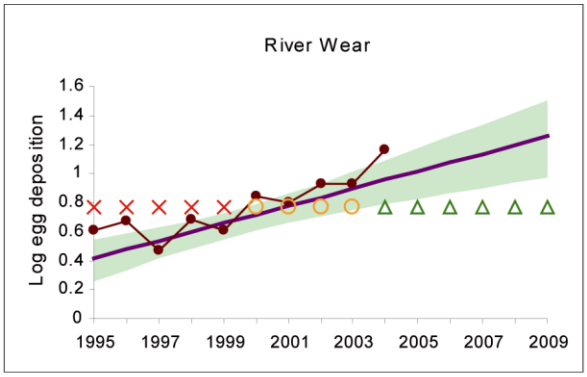
Performance assessment

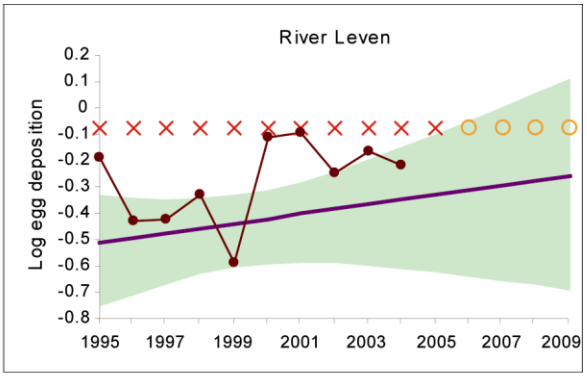
The performance of salmon stocks in England and Wales is assessed using a scheme designed to give an early warning that a river has fallen below its CL. The scheme provides a way of summarising the performance of a river's salmon stock over the last 10 years (including the current year), in relation 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 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 CL 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, whereas if the probability is high (more than 95%), the river complies in that year. Between these probability values we cannot be certain of the stock status. This 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.

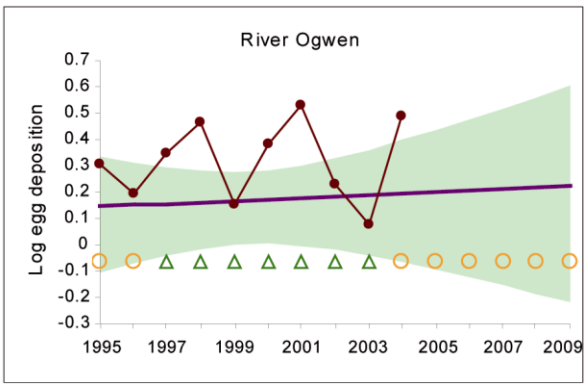
The graphs for the Rivers Wear, Ogwen, Leven and Irt are shown below as examples (with data up to 2004 only). These include individual egg deposition estimates (black dots on the graphs), the 20 percentile regression lines (heavy black line) and 90% confidence intervals (shaded), and the CL lines (represented 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

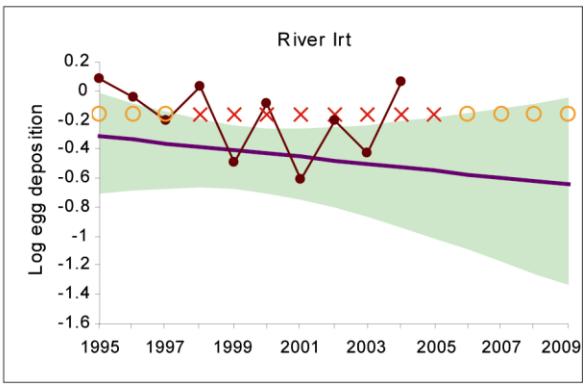
[7] Environment Agency, 1998
[8] Environment Agency, 2003b

is a ≥95% probability of failure). This is the case on the Wear from 1995 to 1999 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 2004 to 2009 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 2000 to 2003 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 1995 and 1996 and from 2004 to 2009 (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, projections for the Rivers Leven and Irt both indicate 'uncertain' status in the years 2006 to 2009 (in both cases the upper 95 percentile of the regression line confidence interval is close to the CL), but the negative trend on the Irt, in contrast to the positive trend on the Leven, would give additional cause for concern.

CLs and MTs form only one part of the assessment of the status of a stock, and management decisions are never based simply on the use of reference points. 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.

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 assessment approach described above is now incorporated into the 'decision structure' for guiding decisions on fishery regulations.

ANNEX 2. Developing fishing controls for salmon fisheries in UK(England & Wales)

Notes to accompany decision structure

INITIAL STAGE - STOCK ASSESSMENT

Assessing compliance with the management objective

- The management objective is for spawning escapement (in terms of egg deposition) to exceed the spawning target (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 (blue boxes - 'C' & 'D') both socio-economic concerns and stakeholder support are considered for those rivers that have a <50% probability of failing the management target. 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 $\geq$50% probability of failing the management target) 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 (purple boxes – 'E' to 'I') 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 (green boxes – 'J' to 'O') represents the final selection and implementation stage.

ANNEX 3a Developing fishing controls for salmon fisheries in UK(England & Wales)