SALMON
Action Plan
CONSULTATION

River Itchen
May 1998

ENVIRONMENT AGENCY

ACKNOWLEDGEMENTS

The Environment Agency wishes to thank all those involved in current efforts to re-establish a self-sustaining salmon fishery on the River Itchen.

Thanks are given to the Test and Itchen Association, CEFAS (the Centre for Environment, Fisheries and Aquaculture Science); the Salmon Fisheries of the River Itchen; Riparian Owners, Sparsholt College and the Anglers.

EXECUTIVE SUMMARY.

- The River Itchen salmon fishery is one of only six remaining in English chalk streams.
- Conservation of the salmon stock is essential to protect the bio-diversity and heritage of the Itchen.
- This Action Plan identifies factors believed to be causing declining stock levels, and puts forward a costed series of actions to reverse that decline to return to a self-sustaining fishery.
- The key limiting factors in freshwater which are preventing a recovery of the Itchen salmon stock are seen to be poor egg survival in gravel impacted by siltation/concretion combined with over exploitation of returning adults. Both of these factors are critically linked to the effects of low flows in the river.
- The total returning stock has only been at a level for long term sustainability of the stock and fisheries in four of the last 10 years.
- The rod fisheries on the river have exploited the stock at an average rate of 30% over the last 6 years, reflecting the increased catch opportunity attributed to slowed migration caused by low flows.
- The voluntary move to returning rod caught fish (over 60% in 1997), combined with extensive habitat improvement works, is essential to the recovery of the stock.
- Stock composition has changed with the spring salmon having all but disappeared from catches in recent years, having composed 50% of the catch in the 1950s.
- The minimum run required for a self-sustaining stock is about 900 fish, allowing a rod catch of around 200 fish.
- The stock has exhibited considerable resilience to a considerable range of impacts suggesting that with increased spawning escapement, habitat improvements and habitat protection there can be a high degree of confidence that a recovery is attainable.
- Stock recovery represents a realistic and economically viable option which would re-establish the Itchen as a premier chalk stream for salmon.
- The measures necessary for stock recovery require a collaborative programme of action involving the riparian owners, the salmon fisheries, the Hampshire Salmon Trust, the Agency and those bodies impacting on stocks indirectly.
- The river management undertaken by the salmon fisheries is essential in maintaining the character and ecology of the lower river.

Summary of proposed actions of highest priority.

Issue	Limiting Factors	Options
Poor egg survival.	Siltation/concretion of gravel. Diffuse pollution - silt, low flows.	Control silt inputs through catchment management. Promote soil conservation, clean and rehabilitate spawning gravel, restoration of river banks. Establish Minimum Acceptable Flow.
Insufficient spawning escapement	Over exploitation: rods, marine, poaching.	Release rod catch. Influence exploitation by restrictions on mixed stock marine fisheries. Anti-poaching operations.
Spring fish (pre-June) virtually extinct.	Over exploitation.	Stop exploitation by voluntary or statutory means.
Poor returns from marine phase.	Exploitation, climate change, straying.	Influence international fisheries policy, anti-poaching operations.

CONTENTS.

PART 1: INTRODUCTION.

In February 1996, the National Salmon Management Strategy was launched by the Environment Agency's predecessor the National Rivers Authority (NRA, 1996).

The strategy concentrates on four main objectives for the management of salmon fisheries in England and Wales:

(i) ***Optimise the number of salmon returning to homewater fisheries.***

(ii) ***Maintain and improve fitness and diversity of salmon stocks.***

(iii) ***Optimise the total economic value of surplus stocks.***

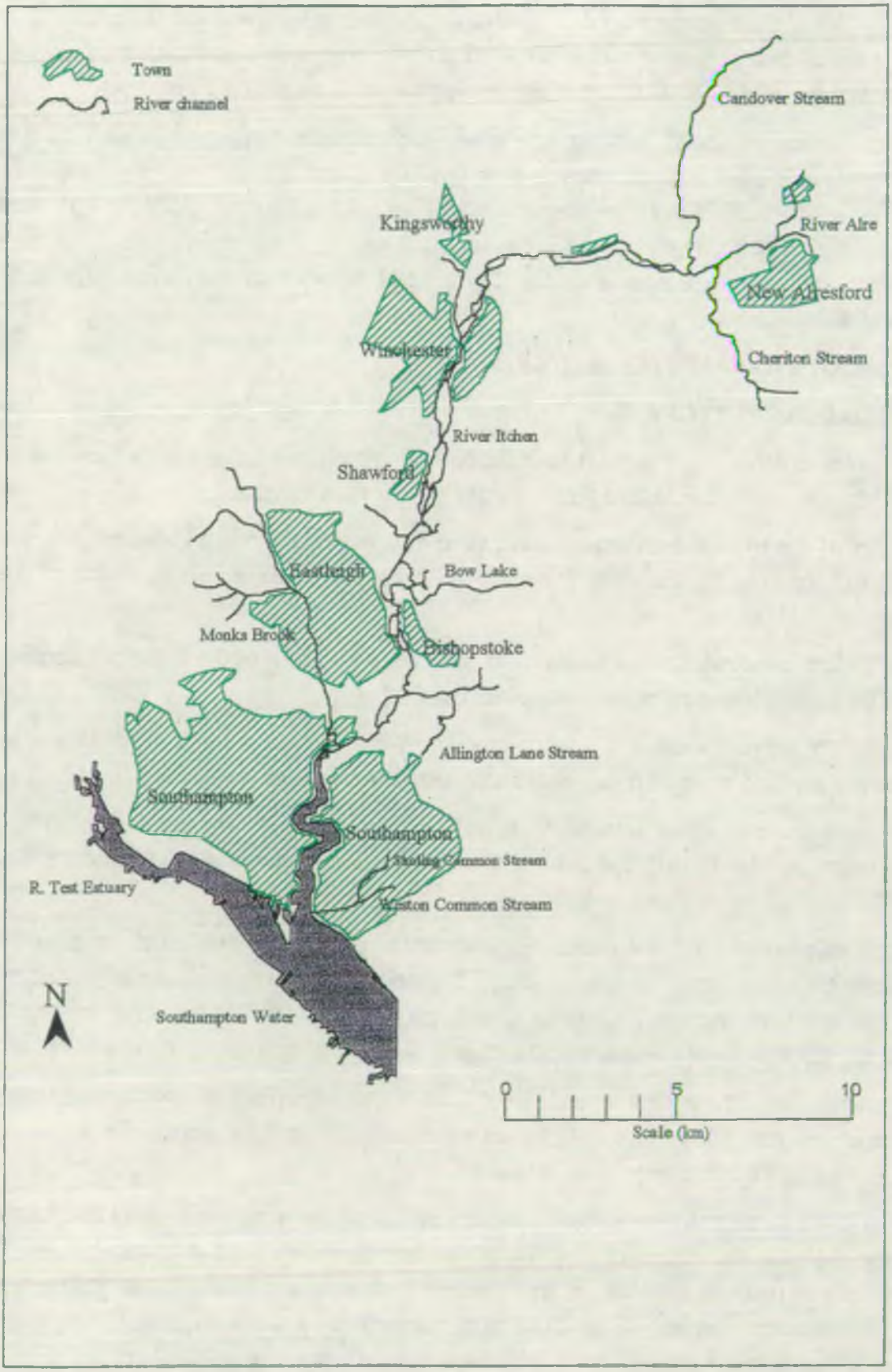
(iv) ***Ensure necessary costs are met by beneficiaries.***

- These are primarily aimed at securing the well being of the stock and in doing so will in the long term improve catches and the associated economic returns to the fisheries.
- These four objectives were to be addressed by way of local Salmon Action Plans (SAPs) which the Agency intends to produce for each of the principal salmon rivers by the year 2001. Each plan will review the status of the stock and fisheries on a particular river, will seek to identity the main issues limiting performance, and will draw up a costed list of options to address these.
- A new concept introduced by SAPs is that of setting 'spawning targets' to assess stock and fishery performance - providing a more objective approach than has previously been possible. The processes of target setting and compliance assessment are developing ones and are likely to be improved upon in the coming years. Nevertheless, the targets described in this document represent a sound starting point for using this important technique in the management of salmon stocks in England and Wales - one which has been successfully applied on Canadian rivers for a number of years and has recently been advocated by the North Atlantic Salmon Conservation Organisation (NASCO) to facilitate salmon management in the international context.
- In delivering each SAP the Agency seeks the support (including in some instances the financial support) of local fishery and other interests. This collaborative approach is vital to secure the best way forward for our salmon rivers at a time when stocks are generally at an historic low, environmental pressures are as great as ever, and funding for salmon fisheries has been reduced.
- This document is presented for consultation to be circulated widely for refinement in the light of outside opinion.
- The finalised SAPs developed through consultation will publicly define the Agency's intentions for salmon management into the next century, with a commitment to review progress on an annual basis.
- The issues raised by local plans will cascade down to Regional and National plans which will focus the Agency's business activities in the wider context. Furthermore, each SAP will feed into Local Environment Agency Plans or LEAPs (the successors of Catchment Management Plans) which serve to integrate environmental protection and improvement within the Agency's remit, including management of air, land and water.

1.1: DESCRIPTION OF THE CATCHMENT.

- The River Itchen rises on the Upper Chalk of the Hampshire Downs as three spring fed tributaries; the Candover Stream, the River Alre and the Cheriton Stream (or Titchbourne) which join just west of New Alresford. From here the river flows west to Winchester and then southwards, through the outskirts of Eastleigh and Southampton to the tidal limit at Woodmill. The Monks Brook, which drains a largely urban catchment, joins the river at Woodmill Pool, the tidal limit (Figure 1.). For much of its length the River Itchen is divided between two or more separate channels running parallel to each other, with many structures to regulate flows and levels. This braided nature arises from past uses of the river to provide water power for milling, to supply water meadows, and from the development of a private navigation.
- Dating from the reign of Charles II, the Itchen Navigation remains in parts and flows parallel to, or coincident with, the river between Winchester and Eastleigh. The navigation fell into disuse in the 1890s.
- The character of the River Itchen owes much to its geology. Exposed chalk in the upper catchment allows most of the rainfall to soak directly into the ground, then supporting the relatively few spring fed tributaries characteristic of chalk streams. In the lower catchment the river flows over tertiary sands, silts and clays which are less permeable than the Chalk, allowing the development of surface streams such as the Monks Brook.
- The chalk aquifer provides the river with a strong ground water fed flow of alkaline spring water. It is these characteristics which have led to the development of the excellent brown trout chalk stream fisheries which have become internationally renowned. There are important watercress beds and fish farming industries in the upper half of the catchment.
- Low rainfall years experienced within the catchment since the 1980s have resulted in the progressive seasonal emptying of the chalk aquifers and thereby similar seasonal reductions in the flow of the river. The freshwater life phases of salmon within the river are critically influenced by the maintenance of adequate seasonal flow regimes. Lower flows in the Itchen have increased the magnitude and numbers of in-river obstructions to fish migration, and have also increased the deposition of silt due to reductions in the natural flow induced silt flushing processes occurring within the river. These factors respectively impact upon the Itchen salmon by hampering migration of the adults (exposing them to greater exploitation) and by reducing egg and fry survival.
- There are existing major abstractions of both groundwater and surface water for public supply throughout the catchment. Linked to each public abstraction there is also a significant corresponding discharge of treated wastewater further down the catchment. Abstraction exceeds the groundwater input to the river Itchen, thereby having the potential to further exacerbate the effects of a low rainfall period upon flows. In consequence it is vital that abstracted water is recycled to maintain river flows.
- The need for water recycling may become even more important given potential future increases to abstraction that could be required to supply a proportion of the Governments target of 56,000 new homes within Hampshire. The siting of these homes will be detailed within the Strategic Housing Development Plan for the county, however it seems unlikely that the Itchen catchment will not be affected by this plan.

Figure 1: The Itchen Catchment.



- In low rainfall years river flow can be augmented by pumping groundwater from the upper catchment, (the Candover and Alre Schemes), to maintain the water quality in the lower reaches, sustaining the environment during drought. However such support is dependant upon sufficient rainfall being subsequently received to recharge the abstracted volume to the supporting aquifer, and as a result is a short term option to maintain the river flows.
- The Itchen is of national and international conservation importance, with proposed classification as a Special Area of Conservation (pSAC), 42km of the river being classified as a riverine Site of Special Scientific Interest (SSSI) and 10 additional SSSIs. The various designations are principally for its chalk stream plant and invertebrate species. Designations and the species covered are listed in Annex 1. General statistics for the Itchen catchment are presented in Annex 2.

PART 2: DESCRIPTION OF THE FISHERIES.

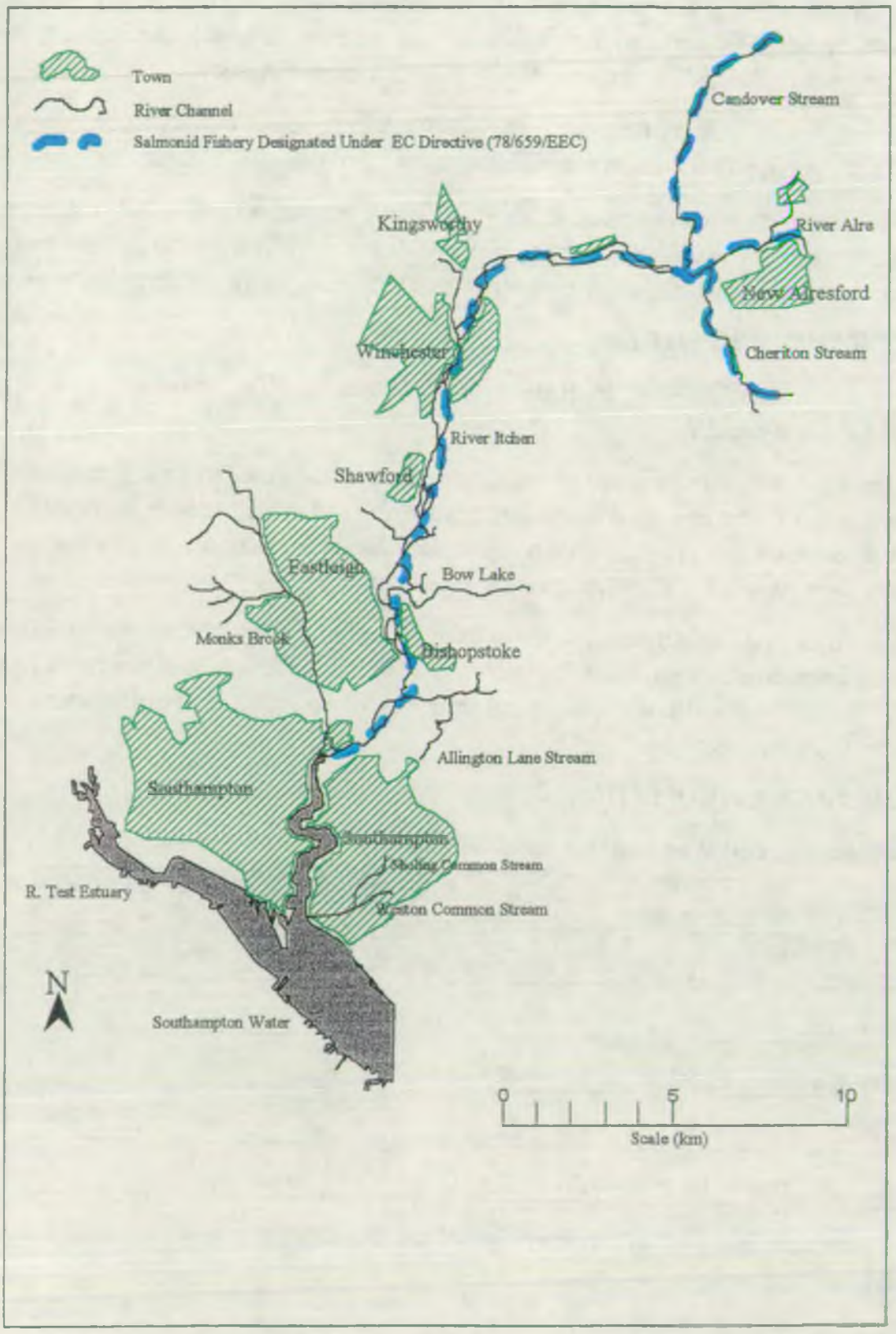
2.1: GENERAL DESCRIPTION.

- The three miles upstream of the tidal limit supports a salmon rod fishery, with Woodmill Pool having an historic right (pre Magna Carta) to net migratory salmonids.
- The majority of the river and tributaries have been designated 'Salmonid Fisheries', (Figure 2), under the EC Freshwater Fisheries Directive (78/659/EEC), which relates to water quality standards.
- The River Itchen is world famous for its trout fisheries, with much of the technique and literary history of fly fishing being closely bound to the river.
- The fisheries are for predominantly wild trout above Winchester (Figure 3). Those lower in the catchment are stocked with trout to supplement natural production.
- The trout rod season extends from April 3rd to October 31st. The method of fishing is restricted between March 14th and June 16th to artificial fly or lure fishing, (Southern Region Byelaw 8).
- The catchment provides suitable habitat for a variety of coarse fish which include: pike, perch, roach, chub, gudgeon, carp, eel and grayling. The eel population is commercially exploited by a number of traps on the river. Grayling, perch, pike, roach and chub numbers are controlled by the river's game fishery managers who perceive them as competitors to trout and salmon.
- The rod season for coarse fish extends from June 16th to March 14th following. Little rod fishing for coarse fish takes place, with the only primarily coarse fishery being the public stretch through Riverside Park in Swaythling, on the lower river.
- The Itchen catchment supports a significant population of sea trout, with many also known to run up the Monks Brook. The remainder of the population lead a somewhat enigmatic freshwater phase of their lifecycle, as few are seen in comparison to the numbers known to be entering freshwater. Catches of sea trout have declined in recent years, though this may be a reflection of decreased fishing effort at Woodmill Pool, the primary night fishery.
- The rod season for sea trout extends from May 1st to October 31st following. The method of fishing is restricted between March 14th and June 16th to artificial fly or lure fishing, (Southern Region Byelaw 8).

Plate 1: Gaters Mill, Lower Itchen Fishery.

Plate 2: A Salmon Passing Through Gaters Mill Fish Counter.

Figure 2: Designated Salmonid Fishery.



2.1.1: THE SALMON NET FISHERY.

- There is an historic right to seine net salmon and sea trout at Woodmill Pool. Though this right to net is held by Southampton City Council, who own the pool, it is not currently exercised, other than for specific limited scientific studies by the Environment Agency.
- It is thought that catch returns from the historic net fishery, prior to current ownership, were inaccurate, with potential for both over and under reporting of catch.
- Under a Net Limitation Order, two licensed seine nets may be used within the Test Estuary and Southampton Water to catch salmon from both the Itchen and Test stocks as they migrate through these waters. The seine net season extends from February 15th to July 31st following.

2.1.2: THE SALMON ROD FISHERY.

- The lower three miles of the river, from Bishopstoke to Woodmill Pool, supports an important salmon rod fishery (Figure 3).
- Prawn, shrimp and worm are the most popular, and effective, baits used to stalk fish in the clear chalk stream waters. The capture efficiency of this stalking technique has been increased by the recent low flow years that have delayed the upstream migration of salmon. In consequence the salmon have been exposed to a greater level of exploitation.
- The rod season extends from January 17th to October 2nd following. The method of fishing is restricted between March 14th and June 16th to artificial fly or lure fishing (Southern Region Byelaw 8). Permission to fish with prawn and shrimp is, however, legally possible with written dispensation from the Agency.

2.2: CATCHES AND EXPLOITATION.

Table 1: Salmon rod and Woodmill net catch summary.

Method	Rods		Nets	
Year	1997	Mean 1992-96	1997	1991
Pre 1st June Catch	3	4	0	0
Post 31st May Catch	92	225	0	64
Annual Catch	95	229	0	64
Catch Per Licence Day	0.22 (1996)	N/A	N/A	N/A

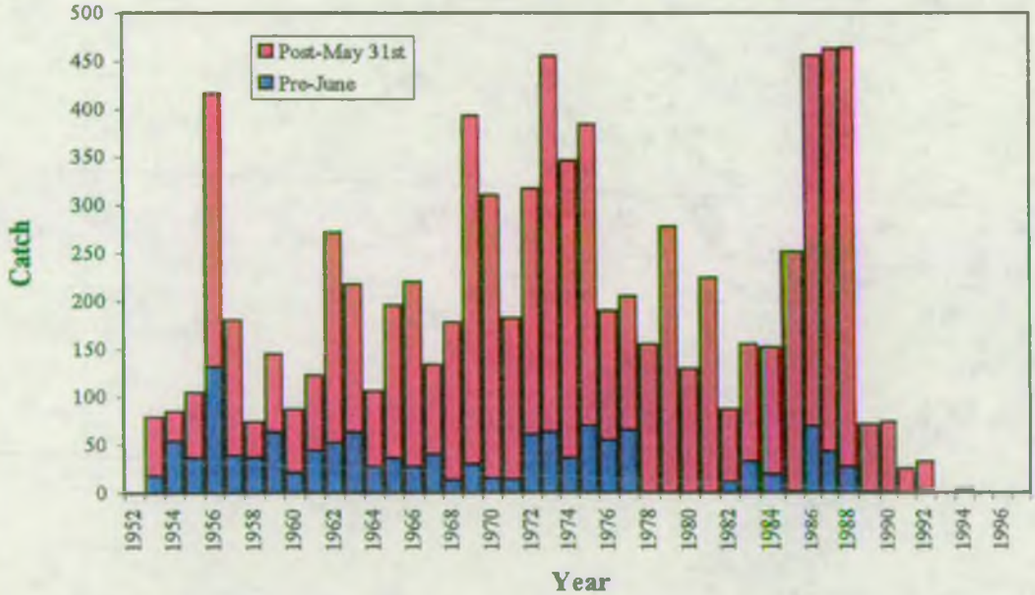
Note 1: 1991 was the last year of full operation of the Woodmill net, with only four fish killed since, in 1994.

Figure 3: Distribution Of Fisheries - River Itchen.

2.2.1: NET FISHERY.

- Declared historic net catches at Woodmill peaked in the late 1980s (Figure 4) at over 450 fish per year.
- Catches of spring (pre-June) Multi-Sea-Winter (MSW) salmon were a significant proportion of the catch historically, but declined from the 1970s on, with no catches pre-June by the end of the 1980s.
- This dramatic reduction in spring running MSW fish would severely impact upon net catches, as the netting season ends on July 31st.
- Significant quantities of sea trout were captured historically by the Woodmill net.
- The Woodmill net fishery is exempt from the current local Net Limitation Order (NLO), thereby putting its operation outside these controls.

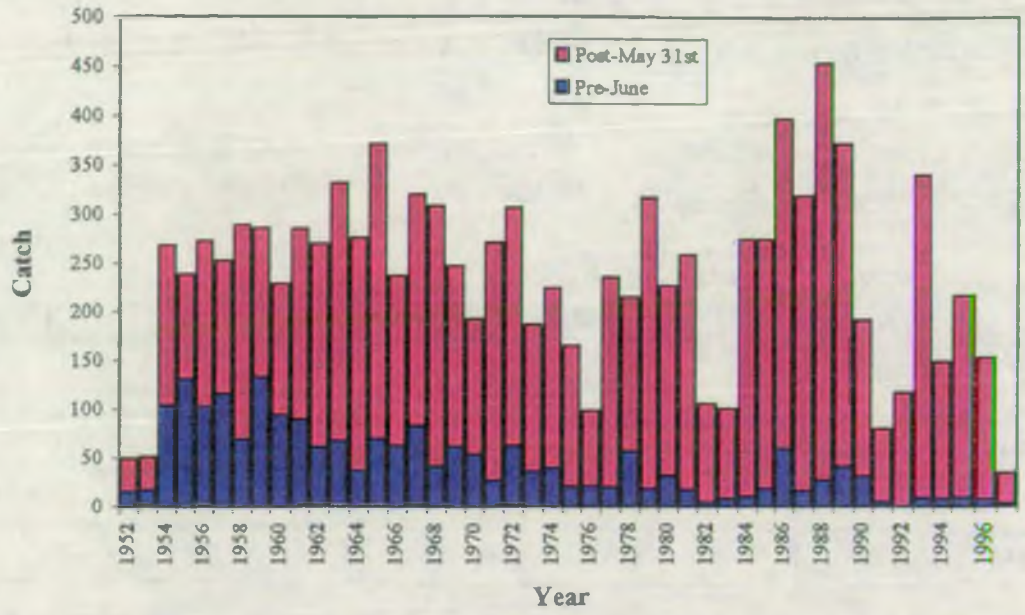
Figure 4: River Itchen Salmon Net Catch, Woodmill Pool 1952 - 97 (Post 1980 catches exclude any fish returned)



2.2.2: ROD FISHERY.

- The salmon rod catch per licence day (of 0.2 fish) on the Itchen is the second highest in England and Wales (1996 National Catch Statistics).
- Catches of spring MSW fish have declined from over 100 fish in the 1950s (50% of the catch), to single figures in recent years (3% of the catch) (Figure 5). Average weight of salmon caught has declined from 13lbs in the 1950s, to 7lb in 1996, indicating the shift from MSW fish to grilse.
- It is suggested that the collapse of the population occurred as a result of habitat degradation combined with the extreme rod and net exploitation rates of the late 1980s. There has been a long term decline in MSW stocks nationally, possibly linked to changes in oceanic conditions.

Figure 5: River Itchen Salmon Rod Catch 1952 - 97
(Post 1980 catches exclude any fish returned)



- The increase in rod catches in the late 1980s shown by Figure 5 is not indicative of an increasing stock, but of an increase in angling effort due to Woodmill Pool being opened as a rod fishery in 1984. Whilst the number of available beats fished and hence the number of rod days fished at the Lower Itchen Fishery has decreased, the efficiency of methods has risen, in part due to low flow induced retention of the salmon within the fisheries. Angling effort at Stamford Meadows has also increased in recent years.

Table 2: Rod Exploitation Rates, River Itchen.

Year	1992	1993	1994	1995	1996	1997	Mean
Returning Stock	399	852	378	880	427	246	530
Total Rod Catch	116	360	183	241	245	95	207
Rod Catch Returned	0	29	35	25	93	61	41
Rod Catch Removed	116	331	148	216*	152	34**	166
Exploitation	29%	39%	39%	25%	36%	14%	30%

* Includes 51 fish donated for broodstock. ** Includes 4 fish donated for broodstock

- A number of salmon were donated as broodstock in 1995 and 1997, to enable the artificial propagation of their gametes. Although some juveniles were produced from these donations, the majority of the 1995 broodstock did not survive to spawn. For the purposes of the plan, these donated salmon are included within the figures for catch removed, as they were not available to contribute to the natural production within the river. The importance of any subsequent artificially derived contribution made is however fully recognised.

- The apparently large fluctuation in run size compared to parent run size is influenced by annual variations in flow and its variable impact upon the suitability of river habitat for production; exploitation during the marine and freshwater adult life cycle phases reducing the eventual spawning escapement; the MSW stock element (though small) retaining resilience to challenges; variation in natural survival; straying from other rivers; stocked fish; other naturally varying factors.
- The Itchen stocks resilience has enabled it to recover, to some degree, which may have been aided by the stocking of parr and smolts in the late 1980s and early 1990s (Table 3).

Table 3: Parr And Smolts Stocked, River Itchen.

Year	1986	1988	1989	1990	1991	1992	1993
Tagged Smolts	2,906	5,904	190	0	3,613	10,808	0
Source Of Smolts	Itchen	Scottish	Itchen	N/A	Itchen	Test	N/A
Untagged Parr	0	3,000	0	3,000	28,000	30,000	6,000
Source Of Parr	N/A	Scottish	N/A	Itchen	Test	Test	Test

- The contribution of the 70,000 parr stocked between 1988 and 1993 cannot be evaluated as none were tagged.
- The smolts stocked between 1986 and 1991 produced an estimated return to the river of 68 adults (Solomon 1994), from 12,500 fish stocked. Returns from the 11,000 stocked in 1992 could be assumed to be similar. Under reporting of microtag recaptures may have led to the under estimation of the true contribution of all batches, though a return of 0.5-1% is normal when compared to other rivers.
- The Itchen stock remains critically depleted, with an average exploitation of 30% since 1992. Limited catch and release of fish has taken place since 1994. Although the initial numbers of fish returned were small in relation to total catch, more recent efforts have been more encouraging with over 60% of the fish caught in 1997 being returned. It is considered essential for the recovery of the stock that the numbers of fish returned is maximised to meet the spawning escapement required for the long-term sustainability of the stock and fisheries, of 660 fish.

2.3: PARTICIPATION AND FISHERY VALUE.

2.3.1: PARTICIPATION.

- Participation is a function of both the number of anglers and the number of days they fish. Both are important in the estimation of value to the fisheries, and other economic parameters.
- The Itchen salmon fishing is divided into beats with a set number of rods per day. Participation can be calculated for the whole fishery, as presented in table 4. The assumption is made that rods paid for are actually fished, and that there are not a significant proportion of unfished days.
- Data included for the minor fisheries of British Rail, Pirelli and Lower Bishopstoke are taken as an average of two rod days per week per fishery. No participation data is available for Itchen Manor, as it is only fished occasionally, when salmon are spotted.

- Data to differentiate between resident and visiting anglers is not available for the Itchen fisheries, and the number of anglers is a minimum figure as it refers to the number of rods fished, of which some may be shared.
- With the Itchen being the closest salmon river to the conurbation of the south-east, the majority of anglers are thought to be from outside the immediate locality

Table 4: Rod Fishery Participation.

Year	1997	Mean 1992-96
Number Of Rods Let/Day	18	18
Days Fished	2646	2801

- Net fishery participation is currently nil, as the nets have not been commercially fished since 1991.

2.3.2: ECONOMIC EVALUATION.

- The conservation and heritage value of the salmon fishery are recognised as being highly significant, with pre Magna Carta rights recorded, although these attributes are difficult to assess in monetary terms. An evaluation of the economic value of the salmon fishery to the country provides a minimum estimate, consisting of the nett economic value and the impact on the local economy (including intangible benefits).
- The landscape of the majority of the lower Itchen owes much to the river keepers who have traditionally managed the waters for salmon fishing. If salmon were to become extinct then this would undoubtedly result in changes in river management practices, or as seems likely the fisheries would fall into dis-repair in the absence of economically viable fisheries to continue the specialised and costly river maintenance.
- Concerns have been expressed by the fisheries that the high capital costs of restoring degenerated salmon fisheries would make it a non-viable option, even in the event of a subsequent stock recovery. Furthermore in the absence of river keepers an increase in illegal exploitation of the stock would undoubtedly occur, further impacting any stock recovery.

2.3.2.1: MINIMUM NETT ECONOMIC VALUE.

- For these purposes the minimum nett economic value of the River Itchen salmon fishery is seen as the sum of:

(i) the value to fishery owners (market value of fishing rights)

(ii) the value to anglers (consumers surplus)

(iii) the value to owners of the right to net (market value of right to net)

(iv) the value to netsmen (profits from sale of catch)

- Market value of fishing rights is a measure of the present value of the capitalised future nett benefits to the owners of those fisheries. This is largely a function of the average annual catch and is estimated at £3 million for the Itchen given in Table 5, based on mean total rod catch

1992-97, of 207 fish, and a regional value per salmon of £14,000 (value of £10,000 from Radford *et al* (1991) x 1.4 for inflation). This calculation assumes that the fishing rights have no alternative value in the absence of salmon fishing, though the fisheries concerned have an additional value as trout fisheries.

- The angler's consumer's surplus given in Table 5 represents the difference between what anglers are willing to pay for their fishing and what they actually pay, and is based on a minimum estimated ratio of 1:1 between market value and consumers surplus (Radford, 1984).

Table 5: Value to fishery owners (market value) and to anglers (consumers surplus).

Mean Rod Catch 1992-97	Regional Value Per Salmon	Market Value To Fishery	Ratio Of Angler's Consumer's Surplus: Market Value	Anglers Consumers Surplus
207	£14,000	£3 million	1:1	£3 million

- The value to owners of the right to net, as the market value of that right, is recognised as being potentially significant, but a reliable estimate of this value is not currently available.
- The value to netsmen is presently nil for the Itchen as no fish are caught.
- From these values the minimum nett economic value of the Itchen salmon fishery is calculated at an estimated £6 million, as given in Table 6.

Table 6: Fishery nett economic value.

Value	£
To fishery owners	3 million
To anglers	3 million
To owners of right to net	N/A
To netsmen	0
Minimum nett economic value	6 million

2.3.2.2: IMPACT ON THE ECONOMY.

- The proximity of the Itchen to the major conurbation of the south-east means that expenditure on accommodation by anglers is seldom necessary. Expenditure is restricted to the cost of the fishing (estimated at £130 per rod day) plus significant travel, food and other costs (estimated at £40 per day).
- Due to the intensively managed nature of the lower river the bulk of the £130 cost to fish is absorbed by essential fishery maintenance activities.
- A combination of these expenses gives an estimate of the expenditure generated, most of it locally, by the presence of the salmon fisheries of £450,000 as presented in Table 7.

Plate 3: A 7lb Grilse, Average Size For Recent Years.

Plate 4: A 30lb Spring Salmon Caught By John Unsworth, Bishopstoke, 1960.

Table 7: Anglers Expenditure.

Days Fished (1996)	Cost To Fish	Other Costs	Total Expenditure
2646	£130	£40	£450K

PART 3: CURRENT STOCK STATUS AND RELEVANT TRENDS.

3.1: MONITORING ACTIVITIES.

3.1.1: MONITORING.

- The Agency operates a fish counter at Gaters Mill (Figure 3) which provides verified data on run size and composition passing this point.
- The presence of keepers on most of the salmon fisheries also leads to accurate information on catches, and hence exploitation, through catch record books. Keepers also reduce the level of illegal exploitation.
- Redd location mapping provides data on areas of the catchment utilised for spawning.
- Monitoring of the stock is carried out in collaboration with CEFAS to assess disease status, spawning success, juvenile survival and habitat requirements.
- Flow and water quality data collected and collated by the Agency Water Resources and Water Quality departments are assessed against environmental and fisheries data.

3.1.2: INVESTIGATIONS.

- The Hampshire Salmon Investigation researches the migratory behaviour of adults in relation to changes in flow in the river. In addition to counter data, radiotracking of adults has been extensively used in this project.
- Radiotracking has enabled additional findings to be made on the spawning locations of adults during periods of elevated turbidity, to ascertain preferred routes of passage, and to identify obstructions to migration.
- Rod catch data is now routinely evaluated against run data throughout the fishing season to determine exploitation rates, and to model the population dynamics of the stock against other environmental data.

3.2: ADULT SALMON RUN.

- The Itchen salmon stock has declined to a level where the total population of 246 (1997) is less than one third of the annual rod and net catch in the late 1980s.
- The depleted size of the Itchen adult run highlights the critical need to continue the 1997 trend towards the catch and release of all salmon by rods. This is considered pivotal to preventing the extinction of the stock, and will provide time to address the other factors impacting upon the population, thereby enabling a recovery to a sustainable level.

3.2.1: RUN SIZE AND COMPOSITION.

- The fish counter at Gaters Mill provides assessments of the adult run size and timing (Table 8). The counter has been shown to be over 90% accurate. The run estimates vary from those presented elsewhere, due to the fact that a proportion of the total run is caught below the counter.

- Run composition exhibits the lack of a significant pre-June (mostly MSW fish) run (2% mean 1992-97), with the stock being predominantly grilse. Grilse mainly arrive in the river from July each year, with the run showing a summer peak followed by smaller autumn peaks centred around freshets (Figure 6).
- The loss of a significant MSW stock component of the population will greatly affect egg deposition due to the lower size and consequently fecundity of grilse when compared to MSW fish. The value of multiple spawners, reported as up to 20% of returning MSW stock in chalk streams (River Frome), is also a considerable loss to potential stability and the stocks ability to overcome years of poor freshwater production.
- The MSW stock component comprises predominantly 2SW fish, with only the occasional older fish present.

Table 8: Run Size And Timing.

Year	1997	Mean 1992-96
Pre June	5	10
Post 31st May	226	479
Total	231	489

Figure 6: Run Timing.

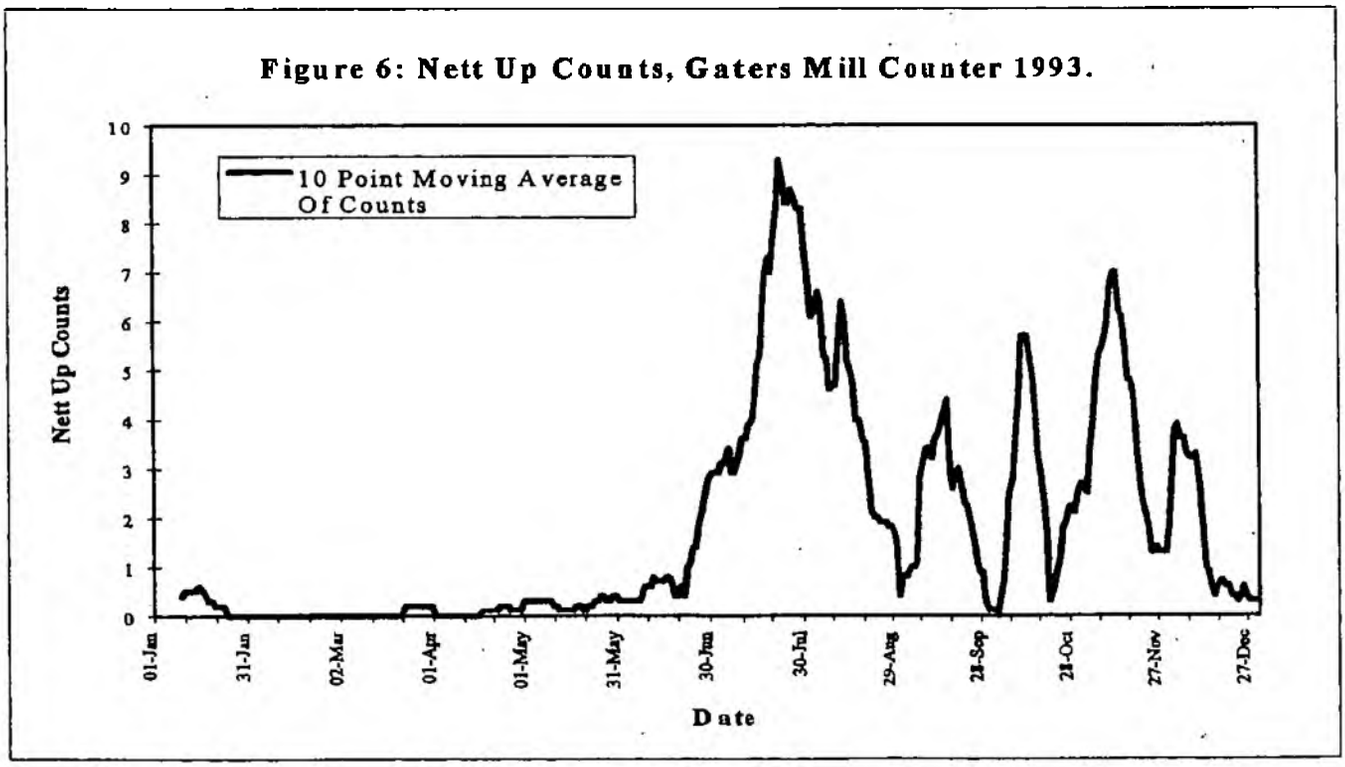


Plate 5: A Barrier To Migration: St Catherines Lock, Itchen Navigation.

Plate 6: Easing Passage For Adults: Bishopstoke Lock Fish Pass.

3.2.2.: SPAWNING ESCAPEMENT AND EGG DEPOSITION.

Table 9: Spawning Escapement and Egg Deposition.

Year	1992	1993	1994	1995	1996	1997	Mean
Returning Stock	399	852	378	880	427	246	530
Rod Catch Removed	116	331	148	216	152	34	166
Net Catch Removed	32	0	4	0	0	0	6
Spawning Escapement	251	521	226	664	275	204	357
Egg Deposition (1000s)*	619	1285	558	1638	678	503	880

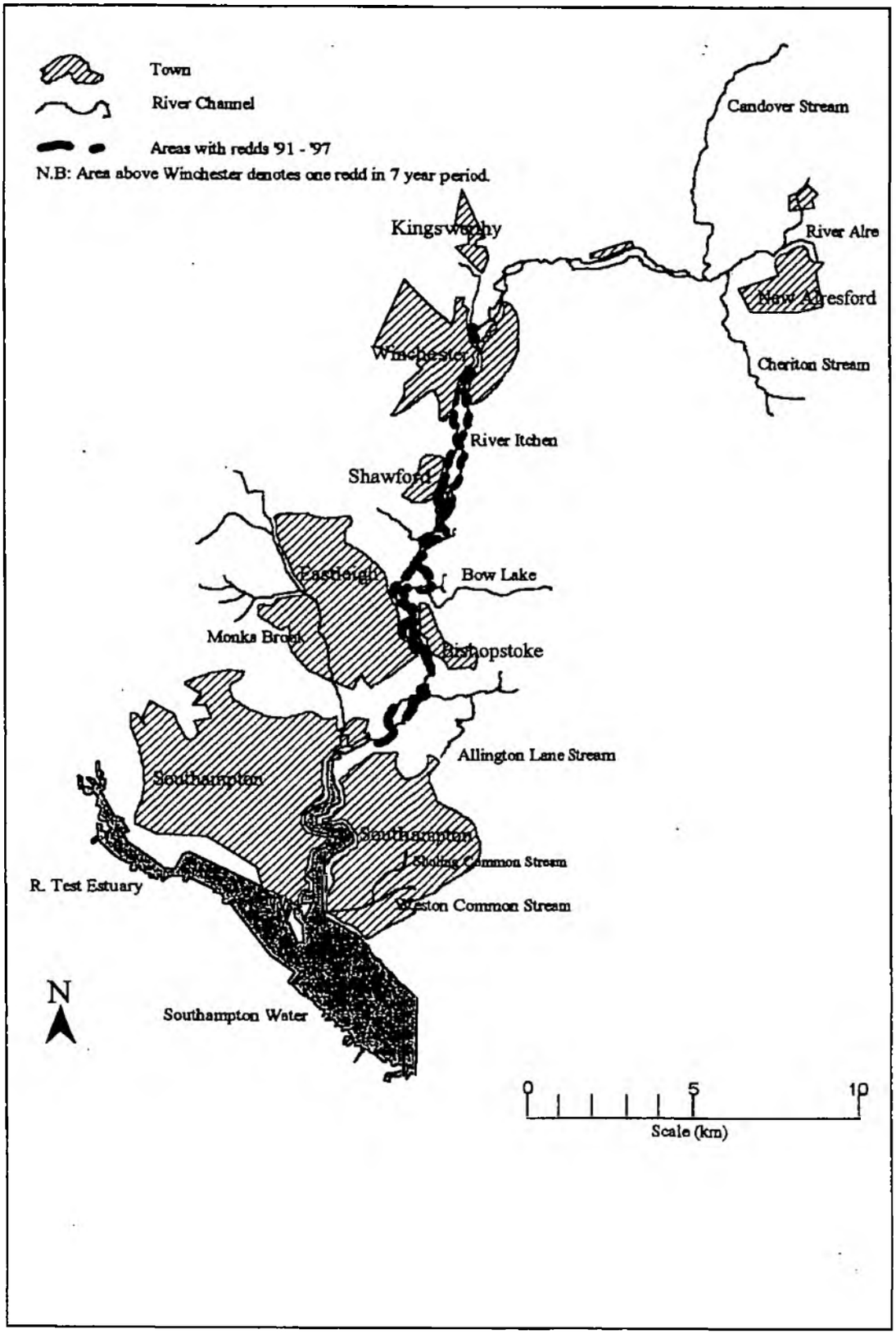
* Uses figures of 91% survival to spawning, 58% female and fecundity of 4674 eggs/female. Figures are means from actual River Itchen & Test data, and length/fecundity relationships.

- The mean spawning escapement to the river from the returning stock was 70% (1992-97, Table 2). This level of escapement is not considered sufficient to support a viable salmon population with current habitat conditions in both the freshwater and saltwater phases of the lifecycle. The escapement does not include the fish donated as broodstock for artificial propagation for the reasons previously outlined.
- From Table 9, spawning escapement averages 357 (range 204 to 664) over the last 6 years, with an average egg deposition of 880,000 eggs (range 128,000 to 1.6 million).
- In its current challenged state, it is considered that both the environmental degradation of habitat and the insufficient spawning escapement must be addressed to promote a recovery of the Itchen salmon stock.
- Catch and release to minimise the number of salmon killed by the rods, habitat improvement and environmental protection works are considered capable of addressing these factors and returning the River Itchen population to a self sustaining condition.
- Catch and release is a potentially favourable method of increasing escapement, since it can allow fishing to continue and the fisheries, therefore, to survive. However in practising catch and release it is vitally important that the stress and damage suffered by the fish are minimised to enable them to survive to spawn successfully.
- A number of fishing methods have been observed to be more damaging to salmonids than others. For example salmon have been found to often be hooked deeper with a baited worm, resulting in critical damage during hook retrieval. Damage during hook retrieval would also be further reduced by use of barbless hooks, hooks of less than 8mm gape and only one (single, double or treble) hook per bait.
- Controls restricting the use of such fishing methods are required to minimise post release mortalities. Nationally the Agency intends to bring in a new byelaw (MAFF permitting) requiring the use of knotless landing nets to minimise damage to fish.

3.3: DISTRIBUTION OF SPAWNING AND UTILISATION OF THE CATCHMENT.

The distribution of spawning in the Itchen is largely restricted to the area downstream of Winchester which represents some 55% of the accessible catchment, the potential habitat area of which is considered as being sufficient to ensure long-term sustainability of the stock and fisheries.

Figure 7: Distribution Of Salmon Spawning.



- The migration of salmon within this area has been eased by fish passes at Woodmill, Gaters Mill, Bishopstoke Lock and Allbrook (Figure 3). However the degree of these easements is related to the flow passing over them. Consequently lower flows reduce the efficiency of the fish passes to pass salmon upstream. These reduced easements combined with the occurrence of other low flow created obstructions to migration, such as excessively shallow riffles, result in the fish gathering in known sections of the lower river to await the increases in flow brought about by the first autumn rains.
- The flow related restrictions upon salmon migration have also enabled their greater exploitation by legal and illegal methods.
- These events leave the salmon with little time to penetrate further upstream than Winchester before spawning. Flow reducing factors, such as abstraction, must therefore be managed to ensure that impacts upon salmon migration are minimised. A long running presumption against licencing further consumptive abstraction has been incorporated into Catchment Management Plans.
- Historically, a few salmon have spawned in the Martyr Worthy fishery upstream of the city (1960s and 70s), and as far up the catchment as Alresford. Only two salmon redds have been sighted upstream of the city since 1990.
- The lack of early running MSW fish, combined with the effects of a series of low flow years, have also reduced the chances of fish penetrating the upper catchment.
- A combination of four physical obstructions (Durngate Hatches, City Mill, Fifty Pound Gardens and Wharf Mill), restrict migration upstream of Winchester. These restrictions are greater emphasised by the effect of low flows.
- Although the river above Winchester contains some of the best potential habitat for salmon spawning and juvenile production, its utilisation would cause inter-species conflicts with the wild brown trout populations inhabiting the area. Such conflict might result in detrimental impacts upon the production of each species and upon the ecology of the river. Therefore it is not considered appropriate at present to ease salmon passage through Winchester, although this consideration may be re-visited once the salmon stock fully utilises the habitat downstream of Winchester.

3.4: JUVENILE ABUNDANCE.

- The most recent survey of juvenile Itchen salmon populations was carried out in July 1995.
- Juvenile salmon were encountered in 32% of the sites surveyed at a mean density of $0.029/m^2$.
- The very low observed densities of juveniles may have been due to their redistribution away from the sampled shallow riffle sites, or poor juvenile production due to poor spawning escapement and egg deposition during the winter of 1994/5. Abnormally high flows throughout the early part of 1995 could have caused washout of eggs and fry from redds.
- The survey results described four main areas for juvenile salmon which coincide with the known major spawning areas.

PART 4: ASSESSMENT OF STOCK AND FISHERY PERFORMANCE.

4.1: SPAWNING TARGETS IN MANAGEMENT.

- The use of targets in salmon management has the overriding aim to provide an objective standard against which to assess the status of the river's salmon stock.
- The standard is selected to ensure the long term sustainability of the stock and the fishery it supports.
- The principle is simple. The numbers of salmon a river can produce (and consequently the catches which result) are a function of the quality and quantity of accessible spawning and rearing area.
- This is why, in general, big rivers have larger catches and have correspondingly bigger total spawning requirements than small rivers. Thus, for any given size of river there should be a preferred or optimum level of stock which the target seeks to define.
- The three processes in the use of targets are setting the target, estimating actual egg deposition and assessing compliance against the target. The procedures used are described elsewhere (Environment Agency 1997), but some general principles are outlined in Annex 3.

4.1.1: TARGET SETTING.

- The river specific spawning target to achieve a sustainable stock for the Itchen has been calculated at **1.6 million eggs**, based on a surveyed accessible habitat area of 694,500m^2 and target deposition of 234 eggs per 100m^2. This is based on the biological parameters given in Table 9. The habitat area upstream of Winchester is included as it is not inaccessible.
- This target depends on **660 fish being allowed to escape exploitation**.
- The **total salmon run has only exceeded this figure in four of the last 10 years**, with escapement reaching 660 fish in 1995.
- It is important to note that whilst the spawning targets refer to the sustainable stock level of abundance, including the maximised sustainable catch, this level is not necessarily equivalent to the stock level required for economically viable salmon fisheries.
- The fisheries have expressed a requirement for a rod catch of salmon equivalent to that of the late 1980s, to ensure their viability. This is recognised by the Agency, however the initial target of the salmon action plan must be to return the stock to a sustainable level. Further stock improvement above this level would be a potential target for future development of the plan.
- It must also be noted that the survival of both potential grilse and MSW salmon at sea has reduced over the last 25 years (NASCO). Historic levels of exploitation are thus no longer sustainable with progressively fewer salmon surviving to return to home waters.

4.1.2: COMPLIANCE ASSESSMENT.

- Using the egg deposition target and estimated deposition figures from Table 9, enables the compliance with the egg target to be calculated (Table 10).
- The target does assume that available habitat is of good quality for spawning and juvenile production. The Itchen catchment is impacted by siltation and concretion, reducing egg and fry survival to very low levels, thereby reducing smolt output.

Plate 7:.Gravel Cleaning In The Past: Horsepower.

Plate 8: Gravel Cleaning Today: High Pressure Water Jets.

- The target is a minimum, and a 'buffer' in the egg deposition, as an amount above the target, is necessary to compensate for years with poor production. In this context, a one-off compliance should not be viewed as a success.
- The target was only reached in 1995, where the run was at its highest level in the 6 year period studied.

Table 10: Compliance With Egg Deposition Target.

Year	1992	1993	1994	1995	1996	1997	Mean
Egg Deposition (1000s)	619	1285	558	1638	678	503	880
Target Deposition (1000s)	1625	1625	1625	1625	1625	1625	1625
Compliance With Target	38%	79%	34%	101%	42%	31%	54%

4.2: FISHERY PERFORMANCE AT TARGET SPAWNING LEVELS.

- Recent studies on the River Bush, Northern Ireland, have shown that a fines (sediment <2mm) content of 25% causes total mortality (O'Connor 1997). Other literature concludes that significant impacts on survival occur at levels above 20% fines. Recent studies on the Itchen (Rowlatt *et al* 1997) have found sediments of <2mm at concentrations of greater than 20% in all uncleaned gravel sites sampled using gravel coring techniques.
- Lower flows critically increase the influx and retention of fine sediments in gravel, as outlined in 1.1.
- The impact of poor habitat quality directly affects the target deposition needed for a self-sustaining stock, requiring a target higher than quoted until sufficient clean spawning gravel is available and utilised by the 350 females required for target compliance level.
- With improved environmental conditions it is necessary that catch-and-release is practised to a level whereby escapement exceeds target levels. This will preferably be achieved through effective voluntary catch-and-release, otherwise by mandatory controls.
- The one year of target compliance in available data (1995) suggests that, with an improvement in the quality of spawning habitat, 200 fish could be exploited from a returning stock of 900 fish, whilst maintaining target compliance.

4.3: FRESHWATER PRODUCTION.

- The size of the smolt run on the Itchen is not currently known. However with the availability of video smolt counting it could be undertaken in the future. Evaluation of total freshwater production is therefore not possible at present, but R&D is intended to enable an assessment to be made in one year.
- Freshwater production is restricted to the main river, its carriers and the Itchen Navigation downstream of Winchester due to flow related obstructions delaying up stream migration and restricting access above Winchester, as outlined in 3.3.
- The main factor limiting freshwater production is seen as poor egg to fry survival due to the flow related siltation and concretion of gravel, as discussed in 4.2 above.

- Food supply for parr does not appear to be limiting, as few potential S2 or greater smolts are found during routine electrofishing works, other than precocious males. The rich food supply and relatively high water temperatures in chalk streams during winter promote fast growth of the parr, producing predominantly S1 smolts.

- Some recent habitat improvement works on the Itchen have been shown to increase egg to fry survival, by over four fold, to 25% (CEFAS data). This potential to directly increase freshwater production is encouraging.

- Piscivorous and avian predation, and competition from other fish species are factors known to affect freshwater production. Though these impacts are not thought to be the primary limiting factors they could be significant and quantification is needed. Various aspects of predation and competition are discussed in Annex 4.

4.4: DIVERSITY AND FITNESS.

- The second of the four key objectives of the National salmon strategy is to ***'maintain and improve fitness and diversity of salmon stocks'***.

- The chalk stream salmon may have evolved genetic characteristics appropriate to the challenges of their particular environment, including factors affecting disease resistance, spawning season, foraging for food, the marine phase and as yet unknown factors.

- In common with other chalk stream salmon, the Itchen stocks have historically shown genetic differences to other UK salmon stocks. A genetic appraisal of the stock, in 1995 (sampling 52 parr), described a change in these differences that suggest the Itchen stock may no longer be genetically indicative of a pristine chalk stream stock (CEFAS data). Whether this change has affected the fitness of the stock is unknown. Further genetic appraisal is planned.

- Any genetic change may have been caused by the historic stocking of non-native stock in the late 1980s and early 1990s, selective exploitation of MSW stock, straying from other rivers, or by natural factors as yet unknown.

- Application of the 'precautionary principle' (Rio declaration) dictates that no further stocking of non-native salmon should take place.

- The North Atlantic Salmon Conservation Organisation (NASCO) have established the protection of MSW salmon as an international priority in salmon management. Through membership of the EU we are obligated to take action to promote their conservation. Their presence in a stock adds to diversity of age composition and consequent risk reduction from poor spawning years.

- The Itchen spring MSW stock is now virtually non-existent. Control of angling pressure on MSW stock through byelaws (Southern Region Byelaw 8), mandatory catch and release, or restrictions on early season fishing effort are suggested to be necessary to protect this most valuable component of the stock.

- A high female proportion, higher fecundity and egg size, inherent in MSW stock, also promotes fitness of the stock through enhanced juvenile production and survival. MSW stock also add valuable genetic variability to the population and give inbuilt stock protection through extra

cohorts of returning stock from a given parent run. The current pre-June run of MSW spring fish in the Itchen needs urgent protection to avoid extinction.

- Enforcement of Southern Region Byelaw 8, combined with catch and release, is seen as the most practicable means of achieving this aim.
- Preliminary counter data for the summer of 1997, whilst showing no improvement in pre-June runs, suggests an unforeseen upturn in the proportion of salmon counts of MSW size, though this may be a factor of poor grilse returns throughout the UK.

PART 5: LIMITING FACTORS.

Factors limiting salmon production can be categorised into those impacting the marine and freshwater phases of the lifecycle. Effective management of limiting factors is necessary to minimise their effect and thus promote the recovery of the salmon population to a self sustaining level.

5.1: MARINE PHASE.

- Limiting factors on the marine phase of salmon production are outwith the direct control of the Agency other than in home waters. Any actions deemed necessary to mitigate the effects of the following factors, and any other factors as they arise, will be brought to the attention of the relevant international bodies involved.
- Natural mortality: Advice to NASCO suggests that natural mortality during the marine phase, although variable, has been increasing over the last 5-10 years. Fewer smolts are therefore surviving to become salmon. Changes in ocean climate may be a factor. The abundance at sea of salmon which would return as multi-sea-winter fish is strongly related to the availability of ocean at temperatures preferred by salmon (6-8 deg. C). The amount of such suitable thermal habitat has been lower in the 1980s and 1990s than during the 1970s (Reddin & Friedland 1996).
- Greenland fishery: There has been a net fishery on the west coast of Greenland since the 1960s. Catches peaked in 1971 at 2689 tonnes. Since 1976, only Greenland vessels fish it and the catch has usually been limited by a quota agreed at NASCO. Since 1993 the quota has been related to estimates of the pre-fishery abundance of North American salmon, which has been declining. About 15% of the catch is thought to be derived from rivers in England and Wales. In 1993 and 1994, the fishery did not operate as netsmen were paid not to fish. As a result about 5000 additional multi-sea-winter salmon are estimated to have returned to England and Wales in each subsequent year (Potter 1996). In 1995 and 1996, catches in the Greenland fishery were 85 and 92 tonnes respectively.
- Faroes fishery: This developed in the 1960s as a long-line fishery. The catch peaked at 1027 tonnes in 1981 but subsequently has been controlled by an annual quota. Unlike Greenland this quota has not been directly related to salmon abundance. The permitted quota is 425 tonnes (1997) although this is not caught. Since 1992, commercial fishing has ceased as compensation payments have been paid to fishermen. Only a research fishery has operated since, taking about 5 tonnes a year. Potter (1996) estimated the number of extra salmon which returned to home waters due to the reduction in the fishery. For all of England and Wales this amounted to about 1200 salmon each year, of which 750 would have been grilse.

- International fishery: An unregulated high seas fishery operates in international waters by countries who are not signatories to the NASCO convention. Annual catches are though to be between 25 and 100 tonnes, comprising predominantly European stocks.
- Irish fishery: The reported catch of salmon in Ireland increased from about 700 tonnes in the 1960s to a peak of over 2000 tonnes in the mid-1970s. This coincided with the expansion of a coastal drift net fishery. About three-quarters of the Irish salmon catch, some 700 tonnes in 1995, is currently taken by the drift nets. Tagging studies indicate that these nets take a significant, though variable proportions of the stock of salmon destined for English and Welsh rivers.
- The Irish Government has recently announced additional controls on the drift net fishery, including delaying the season until 1 June and restricting fishing to daylight and within 6 miles. These measures may reduce exploitation on English and Welsh stocks provided fishing effort is not allowed to increase. However the Irish Government have no intention, as yet, to phase out this mixed stock fishery.
- Provisional estimates suggest that the Irish fishery exploits approximately 18% (average 1991-96) of the Itchen stock surviving to that point (extant stock), as microtag recoveries indicate that a similar proportion of Test origin stock are taken there. It is questionable whether the control measures imposed on the Irish fishery will result in a reduction in exploitation. If not, this fishery will continue to rank as a major limitation upon recruitment of River Itchen adults to home waters.

5.2: FRESHWATER/ESTUARINE PHASE.

5.2.1: FLOW RELATED IMPACTS.

- Siltation of the spawning gravels is believed to be the greatest limiting factor.
- Excessive opportunities for exploitation at time of low flows.
- Climate change and abstraction causing reduction in flows and magnification of all impacts.
- Detremental changes to the channel morphology of spawning areas.
- Other impacts on bed composition and hence spawning gravels (eg. concretion).
- Entrapment, obstructions and delays to smolt and adult migration.
- Degradation of juvenile habitat.
- Changed water chemistry affecting organic silt loading by sewage effluents.
- Water quality changes such as temperature, BOD, ammonia, phosphates, nitrates and turbidity.
- Estuarial environmental conditions such as water temperature and dissolved oxygen content.
- Extremes of flow causing the wash out (exacerbated by developed land causing increased rates of runoff) or dry out of redds.
- Adult density related disease losses when migration slowed by low flows.

5.2.2: EXPLOITATION RELATED IMPACTS.

- Excessive exploitation by rods (and historically by the Woodmill net) reducing spawning escapement.
- Illegal fishing in river and coastal waters.
- Predation by fish, birds and mammals throughout the life cycle.

Plate 9: In-Stream Egg Incubators.

Plate 10: Bank Reinstatement With Hazel Bundles And Chalk Backfill.

- Decreased survival of caught and released salmon due to the use of some angling methods (eg. worm) and poor handling.

5.2.3: OTHER POTENTIAL IMPACTS.

- Physical entrapment of smolts at the intakes of surface water abstractions.
- Diseases and parasites.
- Adverse genetic change.
- Weed cutting and its effect on physical features and habitat availability.
- Damaged channel morphology caused by cattle poaching of banks, excessive numbers of channels, unsympathetic engineering works and land drainage.
- Other impacts on physical features of habitat.
- Global warming.
- Pesticides.
- Endocrine disrupters.
- Our limited understanding of factors and mechanisms determining stock abundance (need for R&D).
- River management (degradation of salmon habitat, trout stocking, electric fishing).

5.3: SUMMARY OF PERCEIVED GREATEST IMPACTS THROUGHOUT LIFE CYCLE.

- Siltation of spawning gravel exacerbated by low flows.
- High historic exploitation of returning stock by rods.
- Changes in the morphology of spawning/juvenile habitat.
- Marine exploitation by Irish drift net fishery.
- Lack of MSW stock and consequent lack of resilience to poor survival years.
- Illegal exploitation in river and estuary.
- Predation/competition in juvenile phases.

PART 6: ISSUES AND ACTIONS.

- Limiting factors considered relevant to the current stock and fishery status are set out in Table 11, together with the proposed options for action to promote the required recovery of the salmon stock. Options taken forward from the consultation phase will be annualised for inclusion in the Salmon Action plan for the Itchen.
- It is identified that recovery to a self sustaining salmon stock requires continuation and expansion of the extensive spawning and juvenile habitat improvements undertaken to date. The required scale of these improvements demand that they are undertaken collaboratively with all river owners and fisheries.
- Habitat improvements undertaken must benefit the general ecology of the catchment. Such holistic programmes may attract support and funding from sources not directly involved with salmon.
- This would enable stock recovery within ten years provided that catch and release practices ensure sufficient spawning escapement.

Table 11 (a): Issues and Proposed Actions. ***Italicised costs denote current expenditure.*** Other costs approximate estimates.

Issue	Limiting Factors	Options	Responsibility	Cost £k	Priority
Very poor egg/fry survival.	Poor in-gravel egg survival due to siltation.	1. Collaborative habitat enhancements & gravel cleaning.	Fishery Owners, Anglers, Agency Fisheries, Hants Salmon Trust.	30 per annum. *5 per annum.*	VH
		2. Land use management to prevent silt ingress.	EN, CLA, NFU, EU, FRCA, MAFF, Land owners.	N/A.	H
		3. Promote awareness of siltation problem among agricultural community.	EN, CLA, NFU, EU, FRCA, MAFF, Land owners, Agency PR.	10 per annum. *2 per annum.*	H
		4. Develop and optimise use of in-stream incubators.	Fishery Owners, Agency Fisheries.	20 per annum. *5 per annum.*	H
		5. Survey to pinpoint silt sources.	Agency Water Resources and Fisheries. Reporting of silt sources by riparian owners.	25 (project).	H
	Insufficient flow to flush out silt.	1. Ensure best practice for flow management.	Agency Flood Defence & Fisheries. Fishery Owners.	5 per annum.	H
		2. River bank restoration where sympathetic to other conservation & flood defence issues.	Agency Water Resources & Fisheries. Fishery Owners.	100 per annum. *5 per annum.*	VH
	Unknown temporal efficacy of gravel cleaning.	1. Assess temporal efficacy of gravel cleaning.	Agency Fisheries, CEFAS.	10 (project). *4.*	H
Adult stock at non-sustainable level. Spring MSW stock extinction imminent	Rod exploitation too high.	1. Promote voluntary measures to control rod catch.	Fishery Owners, Anglers, Agency Fisheries.	5 per annum. *1 per annum.*	VH
		2. Ensure that rod caught fish are returned.	Fishery Owners, Anglers, Agency Fisheries.	5 per annum. *1 per annum.*	VH
		3. Introduce byelaw to ban use of barbed hooks and worm. Restrict to use of one hook (single, double or treble) with gape <8mm.	Fishery Owners, Anglers, Agency Fisheries.	5 per annum.	H

Table 11 (b): Issues and Proposed Actions. ***Italicised costs denote current expenditure.*** Other costs approximate estimates.

Issue	Limiting Factors	Options	Responsibility	Cost £k	Priority
Adult stock at non-sustainable level. Spring MSW stock extinction imminent		4. Restrict fishing to fly and lure in spring.	Fishery Owners, Anglers, Agency Fisheries.	5 per annum.	H
		5. Introduce byelaw to reduce season length or to impose catch limits.	Fishery Owners, Anglers, Agency Fisheries.	5 per annum.	H
		6. Develop exploitable stock models to protect stock from excessive exploitation at times of low flow.	Fishery Owners, Anglers, Agency Fisheries & Water Resources.	15 (project)	M
	Illegal exploitation in river & estuary	1. Intelligence driven anti-poaching activities	Agency Fisheries, Fishery Owners, Anglers, Public, Police.	15 per annum. *5 per annum.*	H
		2. Request Sea Fisheries Committee for byelaw to prohibit estuary netting for sea fish.	Agency Fisheries.	N/A	M
	Excessive marine exploitation.	1. Exert pressure on fisheries to reduce exploitation	NASCO, EU, MAFF, Agency, Fishery owners, Anglers.	5 per annum.	M
	Poor adult returns from marine phase. Post-smolt mortality.	1. Further research into marine phase of lifecycle.	NASCO, ICES, EU, MAFF.	N/A	M
Lack of repeat spawners.	Kelt entrapment & survival.	1. Assess potential.	Agency Fisheries	10 (project) *1 per annum*	M
Poor juvenile survival to smolt	Competition & predation.	1. Assess level of competition and predation.	Agency Fisheries, contractor.	20 (project).	M
	Smolt entrapment.	1. Screening of intakes and outfalls. Required by 1st January 1999 (Schedule 15, Environment Act).	Abstractors & fish farms.	N/A.	H
Lack of knowledge	Physical and chemical aspects of environment.	1. BSC, MSC, PHD student studies.	Colleges, universities and other research bodies.	N/A.	H

- With level funding the Environment Agency will be able to achieve the activities:
  - Limited fish counter works (dependent upon additional Water Resources funding).
  - Limited spawning assessments (dependent upon collaboration with CEFAS).
  - The maintenance of clear fish passes.
  - Limited enforcement operations.
- Notably the majority of the current salmon recovery programme, with the exception of Agency manpower, has been funded through additional Grant In Aid bids secured on an annual basis. However, the programme is based ***on at least a 10 year time scale*** and therefore requires secure commitment for this period, including the essential funding from collaboration with owners and other organisations. The essential collaborative activities will include:
  - Habitat improvement works (gravel cleaning and restoration, bank restoration).
  - In-gravel egg survival studies.
  - Egg incubator works.
  - Siltation impact assessments.
  - Technical spawning assessments.
  - Technical equipment for enforcement operations and salmon monitoring.
  - Easements to fish passage and structure replacements.
- The following Research and Development projects are proposed for funding:
  - Management of sediment loading and nutrient enrichment for chalk streams.
  - Management best practice for sustainable fisheries, including weed management, gravel cleaning (including its automation) and predation impacts upon native salmon populations.
  - Cost effective large scale river enhancements for salmon populations.
  - Efficiency of stock enhancement programmes, including egg incubators and nursery carriers and their application.
- A number of key investigations by the Agency have been identified for further work:
  - Alternative water supply and discharge redistribution schemes to preserve river flow.
  - The effects of sewage effluents on water quality during periods of low flow, with special reference to the more unusual chemicals.
  - An investigation into the effect of silt, flow, water chemistry and macrophytes on the river ecology that supports the salmon in its river phase.
- CEFAS has chosen the River Itchen as a study site for an investigation of the effects of siltation of river gravel on salmonid spawning and the survival of eggs and alevins. These studies have also looked at methods of removing sediment from spawning gravels and the efficacy of river channel modification in maintaining improvements in gravel quality following cleaning. CEFAS is also using several carrier streams on the River Itchen as experimental sites for a study of the effects of riparian vegetation on salmonid production and the need to manage the growth of vegetation in riparian buffer zones. The Agency will continue its collaboration with CEFAS in pursuing these and other areas of research.
- The Environment Agency is committed to continuing its work in collaboration with the Hampshire Salmon Group of the Test and Itchen Association and recognises the essential collaborative benefits derived from this partnership.

PART 7: FUNDING THE PLAN.

- At present, the income to fund Agency work in migratory salmonid fisheries (totalling approx. £9 million) is obtained from rod and net licence duties, Grant In Aid (GIA) and, to a very limited extent, rechargeable services. Of these Grant In Aid has historically funded 82% of the national expenditure on salmon and sea trout fisheries, although the amount of Grant In Aid received has halved over recent years.
- To enable the plan to be enacted requires that other funding sources, including the beneficiaries of the stock recovery and impactors on the environment, are identified and utilised, with a further need to identify how these sources can contribute either in partnership or independently.

7.1: CURRENT EXPENDITURE.

- A breakdown of Agency expenditure on the salmon fisheries in 1997/8 is given in Tables 12 & 13.

Table 12: Hampshire Fisheries 1997 Basic Expenditure on the River Itchen Salmon Fisheries

Process	Cost (£K)	Source
Enforcement	20	Licence Revenue/GIA
Monitoring	10 (+ 6 from Water Resources)	Licence Revenue/GIA
Research	20 (+ 5 from Water Resources)	GIA
Enhancement	15	GIA
Total	**76**	**All Of Above**

- The current basic expenditure on the River Itchen Salmon Fisheries is 25% of the fisheries area budget.
- Additional bid based funding from GIA further supports enhancement and monitoring (Table 13).

Table 13: Hampshire Fisheries 1997 Additional GIA Bid Expenditure on the River Itchen Salmon Fisheries

Process	Cost (£K)	Source
Enhancement	25	GIA (Additional bid)
Monitoring	10	GIA (Additional bid)
Total	**35**	GIA (Additional bid)

- Implementation of the proposed actions from Table 11 would require 94% of the area basic fisheries budget to be spent on the salmon fisheries of the River Itchen. This is not feasible due to the other duties of the Area but highlights the need for additional funding to be sought.
- A strategic investment plan is required to ensure the continued commitment to future expenditure upon the salmon fisheries by the riparian owners of the River Itchen. The lack of such planned investment results in uncertainty and risks, reducing pro-active and collaborative benefits between the Agency and its partners.

7.2: FUTURE FUNDING SOURCES.

- New sources of funding resource are essential to enable the plan to be implemented. Initial sources to be investigated include:
  - Further cross funding by other Agency functions.
  - Partnership, sponsorship funding and joint ventures with fishery owners and industry.
  - The National Lottery Millennium funds.
  - The European Union on the basis of the Habitat Directive.
  - Licensing Revenues from other functions.
  - Cost recovery.
  - Service charges.
- The Hampshire Salmon Trust has been formed to enable external funds to be utilised in suitable partnership operations with the Test & Itchen Association. The four trustees of which include the Secretary of the Test & Itchen Association and the Hampshire Area Manager of the Environment Agency.
- In addition to direct funding other methods are being investigated to maximise any benefits to the fisheries of other works being carried out in the system. Such methods may include:
  - Mitigation works and conditions on any potentially detrimental consent application.
  - Additional benefits from associated works.
  - Changes to working practices to lower potential impacts and maximise benefits to the fisheries (eg. flood defence works).
  - Other sources as they become available.

PART 8: CONSULTATION PLAN.

Table 14: Consultation Plan.

Stage	Timescale
Draft to internal consultation	1st Sept 1997
Internal forum	15th Oct 1997
2nd draft	15th Nov 1997
Presented to forum of involved parties	Dec 1997
Responses from forum	Dec 1997
Quality check by Nat. Salmon Group	Jan 1998
Final consultation draft	Feb 1998
Public launch	May 1998
Responses from launch	Jun 1998

CONSULTEES: Environment Agency Staff, Riparian owners, Salmon fishing interests, CEFAS, Local Government, English Nature, General public.

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GLOSSARY OF TERMS.

Accessible habitat: the total area of the catchment accessible to adult salmon.

Alevins: juvenile salmon during the life stage between hatching and absorption of the yolk sac, whereupon they become free swimming and referred to as fry.

Broodstock: adult salmon removed from the river catchment, to provide eggs/sperm, to produce artificially reared juveniles. These juveniles are stocked into the river to enhance the natural production of juveniles where this is identified as a limiting factor in increasing smolt production.

Buffer strips: areas adjacent to the river channel where natural vegetation is allowed to thrive, thereby reducing the chemical and particulate (silt) elements of surface water runoff from surrounding land entering the river.

CEFAS: the Centre for Environment, Fisheries and Aquaculture Science.

Cohort: a yearclass of the population, from egg deposited to returning spawner.

Concretion: calcification of gravel, leading to an effect not unlike concrete in the top layer of the river bed. Digging of redds by spawning salmon is thus severely impaired.

Exploitation: removal of stock through legal/illegal fishing.

EC/EU: European Community/ European Union. As members of the EC/EU we are obliged to act upon european law, issued in the form of directives.

Egg incubators: instream egg incubator boxes used to incubate salmon eggs to the stage of swim-up fry (independent). They remove the problem of poor natural survival in spawning gravels until mitigation is achieved. Cheap in capital terms, though labour intensive.

Entrapment: the trapping and/or delay of smolts and/or adults by structures or channel features, leading to death or delays in migration.

Escapement: the stock remaining after exploitation.

Extant: when applied to fish stocks (eg. extant stock), refers to the total population of that year class/cohort at any point in time.

Fecundity: the total number of eggs produced by one mature female.

Fertility: the number/proportion of fertile eggs produced by one mature female.

Fitness: specific genetic adaptation to a particular environment. Artificial propogation, influx of non native genotypes, and changing environmental conditions may lower the natural 'inbuilt' suitability of chalkstream salmon for their environment.

Freshet: a temporary elevation in flow following heavy rainfall and consequent runoff from saturated topsoils.

Fry: juvenile lifestage between alevin and parr, where the alevin becomes free-swimming and actively hunts for food.

GIS: Geographic Information System, a computer programme used to estimate river channel lengths/width from high resolution digital maps.

Grilse: adult salmon returning to freshwater to spawn after spending one winter at sea.

Hampshire Salmon Investigation: a project initiated by the NRA and supported by the Environment Agency, involved with the relationships between river discharge and migration of salmon. Studies use data from both fish counters and radiotracking, funded by the area water resources function.

ICES: International Council for the Exploration of the Seas, the role of which in relation to salmon is to assess the international status of stocks and advise NASCO and other organisations on the management of fisheries.

MAFF: the Ministry of Agriculture, Fisheries and Food.

The Directorate of Fisheries Research (DFR) section is involved with salmon research and data collation at national and international levels.

MBAL: Minimum Biologically Acceptible Level. Defines, from a Stock Recruitment curve, that level of spawning which maximises the sustainable catch (total catch, comprising all marine and freshwater fisheries).

Microtag: a coded wire rod of of 1.1mm long and 0.25mm diameter, inserted into the nasal cartilage (snout) of fish. Detectable in live fish, but only readable after removal.

MSW: Multi Sea Winter. Refers to adult salmon returning to freshwater to spawn after spending more than one winter at sea.

NASCO: North Atlantic Salmon Conservation Organisation. A convention of signatories including all North Atlantic countries with salmon interests, which advises and formulates policy on the management/exploitation of salmon stocks. As a member of the EU, the UK is represented by their delegation to NASCO.

Parr: juvenile lifestage, following fry, where the fish exhibit characteristic parr marks/bars as dark vertical stripes upon their flanks.

PIT tag: Passive Integrated Transponding tag. A cylindrical glass tag, 11mm long and 2mm diameter, using one of 35,000 million different codes to allow permanent, unambiguous identification of individual fish. Tags are injected into the body cavity or muscle tissue, and subsequently read without harm to the fish.

Precautionary principle: set out by the Rio Declaration as:

"When 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."

Redd: salmons 'nest' in riverbed. Dug out of gravel/stony beds by spawning adults, with eggs deposited in displaced material.

Run: the number of adult salmon ascending, or smolts descending, a given river in a given year.

Siltation: deposition of waterborne suspended solids in/on the riverbed. Siltation blocks gaps between substrate particles, preventing the through passage of water, necessary for egg survival.

Smolt: lifestage between freshwater parr and seawater 'adult' phase, where parr undergo a process of pre-adaption to a saltwater environment. As a part of this process, smolts acquire a characteristic silver appearance, similar to adult salmon, prior to migration down river and out to sea.

SSSI: Site of Special Scientific Interest. A designation, administered by English Nature, intended to conserve the biological interest of a given site through legal restrictions on development/management practices.

Straying: the habit of some salmon to return to rivers other than that of their parent stock.

Substrate: the composition of the river bed.

The Agency: the Environment Agency, successors to the National Rivers Authority (NRA).

Year Class: the population of salmon, of all life stages, resulting from one years spawning.

ANNEX 1: CONSERVATION DESIGNATIONS APPLYING TO THE ITCHEN

River Itchen SSSI.

- Ordnance Survey Sheet: (1:50,000) 185, 196.
- Length of River SSSI: 42km (approx)
- Date notified (under 1981 and 1991 Acts): 17th July 1996. The designation covers bank top to bank top in each channel. Away from the river only those habitats of particularly high conservation value have been designated.
- The SSSI designation will seek to maintain the quality and diversity of the River Itchens characteristic features and associated habitats. The characteristic flora and fauna and overall diversity are largely dependent on features such as water chemistry, geomorphology, flow dynamics and substrate type. In these respects the River Itchen is largely typical of chalk streams. However, elements of particular interest have been, and still are, vulnerable to change, and it must be recognised that the river we see today is the result of extensive management. Its physical, chemical and biological make-up have been significantly altered through mans intervention, and, in some respects, it does not resemble a "classic" chalk stream. Maintenance and restoration of the full range and interests will require remedial management, and many positive measures are required in order to increase the representation of particular features which are lacking.

Other SSSI designations.

- Some parts of the river and additional areas within the corridor already have SSSI status. These include, Alresford Pond, Itchen Valley (Cheriton to Kings Worthy), Itchen Valley (Winnall Moors), Itchen Valley (Winchester Meadows) and Ratlake Meadows

Special Area of Conservation (SAC).

- Special Areas of Conservation (SACs) are sites which support the best examples of habitats listed in Annex I and species listed in Annex II of the EC Habitats and Species Directive. The purpose of SACs is to form a network of sites (the NATURA 2000 network) whose nature conservation importance is recognised at a European level. The whole of the Itchen SSSI has been proposed as a Special Area of Conservation (pSAC) on the basis of its floating vegetation of *Ranunculus* (water crowfoots) of plane and submountainous rivers. This designation has significant implications for the Agency who, as the regulating body for land drainage, water abstraction, discharge and waste regulation operations, will have to review authorisation consents likely to damage the special interest of the pSAC.

Species and habitats listed in EC Habitats & Species Directive which occur in the Itchen valley.

- In addition to being a pSAC for its water crowfoot habitats the River Itchen also supports a number of Annex I habitats and Annex II species which remain of European importance despite not actually being selected to be represented in the NATURA 2000 network. A third Annex within the Directive is of significance here where Annex V lists species whose exploitation should remain compatible with their maintenance at a favourable conservation status. These habitats and species, and the Annex in which they appear, are therefore listed below.

Molinia meadows on chalk and clay. Annex I

Alkaline Fen Annex I

Atlantic salmon (*Salmo salar)* Annex II and V

grayling (*Thymallus thymallus)* Annex V

bullhead (*Cottus gobio)* Annex II

sea lamprey (*Petromyzon marinus)* (occasional) Annex II

brook lamprey (*Lampetra planeri)* Annex II

white-clawed crayfish (*Austropotamobious pallipes)* Annex II

southern damselfly (*Coenagrian mercuriale*) Annex II

otter (*Lutra lutra)* Annex II

'Salmonid Fishery'.

- The whole of the Itchen is designated a salmonid fishery under the EC Freshwater Fisheries Directive (78/695/EEC). The implications of this relate to the responsibilities of several Agency Functions (e.g. Fisheries, Water Quality and Water Resources) whose duties directly effect the quality and management of salmonid habitat.

County Heritage Area and Sites of Interest for Nature Conservation (SINCs).

- The whole of the Itchen Valley has been designated one of 12 County Heritage Areas in the county. The boundary of this designation also encompasses important landscape features such as St. Catherine's Hill. The aim of this is to help conserve its special and distinctive character. Within this designation there are 5 Sites of Interest for Nature Conservation (SINCs) designated by Hampshire County Council, being Marlhill copse and meadow, Gaters Mill meadow, Fair Oak School Meadow, Highbridge Meadow and Mariners Meadow.

Area of Outstanding Natural Beauty (AONB).

- The East Hampshire AONB runs approximately from the eastern side of Winchester east to the county boundary.

Hampshire Wildlife Trust Nature Reserves.

- Two reserves situated at the head waters of Monks Brook and on the northern edge of Winchester City.

Globally threatened and declining species recognised by the UKs Biodiversity Action Plan.

- Species which are globally threatened, or are rapidly declining in the UK, (by more than 50% in last 25 years), and which require immediate conservation action, are short-listed in "Biodiversity: The UK Steering Group Report", (1995). The River Itchen is important for a number of these species which are listed below. (This list is not exhaustive).

water vole (*Arvicola terrestria)*

pipistrelle bat (*Pilistraellus pipistrellus)*

white-clawed crayfish *(Austropotamobious pallipes)*

southern damselfly (*Coenagrian mercuriale)*

freshwater snail (*Pisidium tenuilineatuym)*

Species specially protected by the 1981 Wildlife &Countryside Act

- The following species occurring in the Itchen valley are given special protection by The 1981 Wildlife and Countryside Act. (i.e. birds listed in Schedule 1, and animals listed in Schedule 5).

kingfisher (*Alcedo atthis)*

osprey (*Pandion haliaetus)*

hobby (*Falco subbuteo)*

green sandpiper (*Tringa ochropus)*

cetti's warbler (*Cettia cetti)*

bittern (*Botaurua stellaris)*

barn owl (*Tyto alba)*

white-clawed crayfish (*Austropotamobious pallipes)*

otter (*Lutra lutra*)

water vole (*Arvicola terrestris)*

ANNEX 2: STATISTICS FOR THE ITCHEN CATCHMENT.

Administration	Hampshire County Council (100% of catchment)
Proportion of river classified as class A water quality	56% (1995 survey)
Proportion of river classified as class B water quality	32% (1995 survey)
Proportion of river classified as class C water quality	8% (1995 survey)
Proportion of river classified as class D water quality	4% (1995 survey)
Actual abstractions (inc. fish farms)	164,328Ml
River flow Q50	4.81 cumecs
River flow Q95	2.94 cumecs
Total river channel length	97.7 km
Surface catchment area	47,300 Ha
Groundwater catchment area	60,000 Ha
Topography	Max. level 234m AOD Min. level 0m AOD
Geology	Tertiaries in south Chalk in north
Population	Approx. 240,000

ANNEX 3: SPAWNING TARGETS IN MANAGEMENT.

- The Environment Agency defines targets in terms of optimum spawning levels, expressed as egg deposition (eggs laid per $100m^2$, or the total number of eggs per river). This is because spawning level is regarded by salmon biologists as the primary factor controlling the number of smolts likely to come out of a river section. On average, more eggs deposited means more smolts being produced, up to some level beyond which output levels off or may even decrease. This occurs because young salmon are strongly territorial and there is a maximum number that a river section can support. This level of production is often referred to as the carrying capacity. If data are available, then for a given river a curve can be plotted showing the change in smolt production (or adult "recruiting" back to fisheries) accompanying increasing spawning stock level. This is known as a "stock-recruitment curve" (S-R). A characteristic and important feature of such curves, even when numbers are accurately and precisely measured, is the wide variation in recruitment which occurs at any one stock level; this is due to the effects of random factors influencing survival.

- The target used for SAPS is derived from ICES findings and defines, from a S-R curve, that level of spawning which maximises the sustainable catch (total catch, comprising all marine and freshwater fisheries), and it is termed the Minimal Biologically Acceptable Level **(MBAL).** If exploitation rate increases above the sustainable catch level then, although catch may temporarily increase, the stock will eventually reduce. Thus, MBAL is a threshold spawning level below which it is inadvisable to go. Indeed, in order to give some leeway on the estimate it is preferable to establish a long term spawning level rather higher than MBAL to insure against the effects of unforeseen exceptional events leading to low survival. Some buffer is incorporated into the statistical compliance procedure adopted in SAPS, but it may be felt that more insurance is desirable. This should be a local management decision and depends on circumstances, for example particular uncertainty over the deposition estimates may lead to higher target to reduce risk of the potentially damaging effect of overfishing.

- Because S-R curves are not available for most rivers the procedures use one taken from the River Bush in Northern Ireland, where long term studies have given a working model of the relationship between spawners and recruits. The shape of S-R curves are controlled by the productivity of the freshwater habitat and the survival rate. So, correcting for these features allows the Bush model to be transported to other rivers. This gives a first approximation of a river-specific target.

- It is most important to recognise targets for what they are - valuable, objective reference points to guide managers in stock assessment. Moreover, although spawning targets have been internationally accepted as a good working practice for some years, there is still a need for improvements in understanding and methodology. Therefore nominal "passing" or "failing" of targets does not guarantee a correct management decision, because the targets and compliance data are naturally subject to error. Professional scientific judgement on this point combined with consideration of the full range of other factors acting on a fishery is essential. Reliance on targets *in isolation* is most unwise!

ANNEX 4: COMPETITION AND PREDATION.

- Competition within salmonid communities for food resource and individual territory niches is well documented, (Shaw, 1839; Lindroth, 1955; Saunders & Gee, 1964; Jones, 1975; Wankowski & Thorpe, 1979; Kennedy & Strange, 1986; Hearn, 1987; Huntingford *et al.*, 1988; Bird *et al.*, 1995). Competition between juvenile salmon has been reported, (Wankowski & Thorpe, 1979), to be a function of food acquisition which was related to water velocity and swimming ability. This competition resulted in larger juvenile salmon out-competing smaller individuals for preferred velocity habitats by means of better swimming ability due to their larger size.

- Where salmon and trout co-exist, it has been suggested that juvenile trout out-compete salmon, with salmon being displaced to niches with either higher or lower water velocities, (riffles or pools), than preferred. However, it has been identified, (Nilsson, 1967; Kennedy & Strange, 1986; Heggenes, 1990;1991) that in the absence of juvenile trout, juvenile salmon occupied habitats with a wide range of depths and slower water velocities. In the Itchen juvenile salmon have also been observed occupying similar habitats to these. This suggests that inter-species competition may not be a significant factor. The densities of both juvenile trout and salmon are also considered as low, in the stocked reaches downstream of Winchester (trout tending to be stocked as 1+), further supporting this suggestion.

- Predation of juvenile salmon is also well documented, (Mills, 1964; Environment Agency, 1995c; Ibbotson, 1996), with both avian and piscivorous predation being observed. Avian predation has received a lot of press in recent years with the focus of attention being placed upon predation by cormorants, which is currently being assessed by a Research and Development Project.

- Piscivorous predation is not currently being assessed to the same extent, although local studies have been undertaken, (Ibbotson, 1996), which have found juvenile salmon in the Test to be taken by a wide variety of the fish species present including pike, eels and trout. These predators tend to occupy glide and pool habitats which have slower water velocities than riffles, (Kennedy & Strange 1986; Bird et al., 1995).

- Notably the absence of displacement pressures from competition with juvenile trout may therefore expose the juvenile salmon to increased pressure from predation by the predators that inhabit their preferred habitats. This suggests that the absence of competition may constrain the population due to the increased pressure of predation. The effects of competition and predation upon the juvenile salmon of the River Itchen requires further investigation.

SOUTHERN REGION ADDRESSES

REGIONAL OFFICE
Environment Agency
Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD
Tel: 01903 832 000
Fax: 01903 821 832

HAMPSHIRE AND ISLE OF WIGHT AREA OFFICE
Environment Agency
Sarum Court
Winchester
Hampshire SO22 5DP
Tel: 01962 713 267
Fax: 01962 841 573

ISLE OF WIGHT
Tel: 01983 822 986
Fax: 01983 822 985

KENT AREA OFFICE
Environment Agency
Orchard House
Endeavour Park
London Road
Addington, West Malling
Kent ME19 5SH
Tel: 01732 875 587
Fax: 01732 875 057

SUSSEX AREA OFFICE
Environment Agency
Ridgeworth House
5 Liverpool Gardens
Worthing
West Sussex
BN11 1YH
Tel: 01903 215 835
Fax: 01903 215 884

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— Regional Boundary

● Area Office

▲ Regional Headquarters

For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

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