THE RIVERS TEST AND ITCHEN

SALMON MANAGEMENT PLAN

A Consultation Document
Produced by
The National Rivers Authority

October 1995

NRA

NRA Southern Box 3

CONTENTS **PAGE**

EXECUTIVE SUMMARY

This document provides factual information on the history and current status of the salmon populations of the Rivers Test and Itchen.

The purpose of the document is to provide a basis for discussion and consultation with fishery owners, anglers and other fishery interests. The objective being to produce a definitive salmon strategy for the Hampshire rivers which is consistent with the NRA's National Salmon Strategy by June 1996.

It is proposed that the overall aim is to address the very serious decline in the salmon runs on both rivers and achieve self sustaining populations which provide annual runs of approximately 4,000 salmon on the Test and 1,500 salmon on the Itchen. The current runs on the Test and Itchen (based on 1994 figures) are 775 and 374 respectively. The Test and Itchen Salmon Strategy will provide clear objectives and targets. The way to achieve those targets will be identified with responsibilities and timescales.

CONSULTATIVE ARRANGEMENTS

Consultative Period: 18 October 1995 to 30 April 1996
In writing to:

Area FRCN Manager
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1. INTRODUCTION

1.1 AIMS

1.1.1 The aim of this document is to provide a framework for consultation with fisheries interests on the Rivers Test and Itchen in order to propose clear objectives and recommend a strategy for the future management of salmon on these rivers.

1.1.2 The preparation of a Salmon Strategy will enable a clarity of direction and purpose to be formulated and for the respective roles of all interests to be identified and quantified.

1.1.3 This document will also provide basic information which describes both the past and present status of the salmon runs on the Test and Itchen.

1.1.4 The overall aim following an active and detailed discussion and consultation period is to publish a final Salmon Strategy for the Rivers Test and Itchen which is owned and supported by all the respective fishery interests.

1.1.5 This strategy will establish an Action Plan for the Rivers Test and Itchen and identify the appropriate issues for inclusion to the catchment management planning process.

1.2 CONTEXT

1.2.1 Throughout 1994 the NRA has consulted widely on the need to produce a National Strategy for the Management of Salmon. The final document is due to be published in the Autumn of 1995.

1.2.2 The need for a National Strategy arose for a number of reasons not least that salmon stocks throughout the UK are facing considerable pressures and threats to their well being.

1.2.3 This document looks at the Rivers Test and Itchen in the context of the National Strategy at the same time recognising the uniqueness of chalk river salmon stocks and the respectively higher pressures on them.

1.2.4 The National Strategy recognised 3 primary deficiencies in the present management of English and Welsh salmon stocks, these are:

(A) The lack of clear biological, economic, social and political objectives.

(B) Inadequate information to manage the resource (eg to set accurate targets for the numbers of spawning fish required for each river system).

(C) A lack of coordination and cooperation between many of those involved in their management.

1.2.5 To address these 3 deficiencies the NRA has proposed four major objectives for the future management and exploitation of English and Welsh salmon. These are:-

OBJECTIVE 1

Individual salmon stocks and the environment in which they live should be managed to optimise recruitment to homewater fisheries.

OBJECTIVE 2

The diversity and fitness of salmon stocks should be maintained and where appropriate improved throughout English and Welsh rivers.

OBJECTIVE 3

Once an optimal spawning escapement has been allowed for, the exploitation of surplus stocks should take account of social and economic factors.

OBJECTIVE 4

The necessary costs of managing migratory salmonid fisheries should be met by the beneficiaries (nets, rods, riparian owners and the general public) and where schemes adversely affect these fisheries, any mitigation or restoration costs should be met by the promoter or polluter.

1.3 LEGAL RESPONSIBILITIES

1.3.1 Statutory protection of fish stocks and fisheries is specifically laid down within various Acts of Parliament including the Salmon and Freshwater Fisheries Act 1975, the Salmon Act 1986 and the Diseases of Fish Act 1937 and 1983. General responsibility for fisheries legislation lies with the Minister of Agriculture Fisheries and Food.

1.3.2 Other legislation relating to the control of pollution, to the establishment of water quality objectives and to wildlife and conservation also has implications for the maintenance and development of fisheries. The Secretary of State for the Environment has general responsibility for this.

1.3.3 The NRA is constrained to operate within this legal framework and is given powers and responsibilities under various provisions of the legislation. It has a general duty under Section 114 of the Water Resources Act 1991 to maintain, improve and develop fisheries (now covered under the Environment Act 1995).

1.3.4 The responsibility of the NRA is towards the protection of the fishery, it is not within the power of the NRA to determine the allocation of the resource among the various exploiters and so it has responsibility to both rod and net fisheries alike.

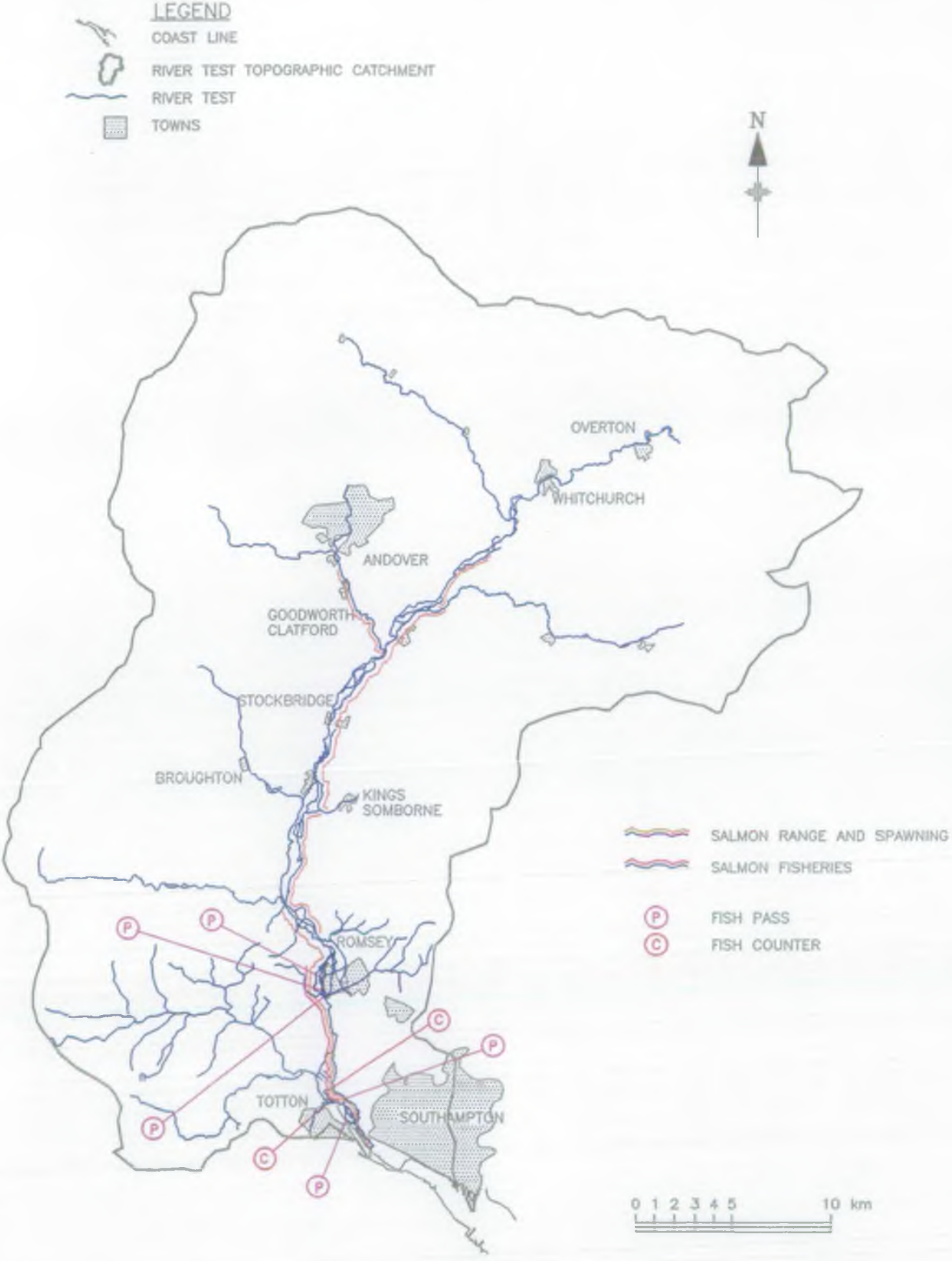


Figure 1 RIVER TEST SALMON FISHERY

1.4 PAST AND CURRENT STATUS OF THE RIVER TEST SALMON FISHERY

1.4.1 Solomon (1989) analysed the history and long term performance of the Test salmon fisheries. The extent of the Test salmon fishery is summarised in Figure 1. This work combined with more recent analysis (Thorpe 1994) indicates that the long term average salmon run on the Test was in the order of about 4,000 fish per annum (Figure 2).

1.4.2 The average exploitation rate by the rods since 1935 is estimated as being about 25% yielding a rod catch average of about 1,000 fish per annum. More recent data (Table 1) shows that since the dramatic decline of the late 80s the rod exploitation rate increased. This rate has been as high as 36% of the returning stock in 1990 and 35% in 1993.

1.4.3 The dramatic decline of the runs of the Test have also been observed on other chalk rivers. The Hampshire Avon most notably mirroring the crash in salmon populations on the Test and the River Frome and River Itchen also being affected (Solomon 1992).

1.4.4 The River Test had an estimated run of approximately 775 salmon in 1994, with predictions from smolt trapping indicating an expected return of 360 salmon in 1995. Although at the time of writing the run is far from complete, it is close to that predicted from the 1994 smolt run estimates (Table 2).

1.4.5 Diligent management of the Test salmon fisheries records over the years provides a reliable history of rod catches. Such long term information combined with more recent fish counter data has enabled the NRA to be quite accurate in its overall assessment of the Test salmon stocks.

1.4.6 Commercial netting ceased on the Test around the outbreak of the First World War when the netting rights were bought out by the rod interests. Unfortunately no data relating to the net fishery has been found by the NRA.

1.4.7 As well as the overall decline in salmon stocks on the Test which shows a long term linear progression over 30 years there has also been a long term trend to an increased proportion of grilse running the river. This trend is widespread for Atlantic Salmon at this time.

1.4.8 Solomon (1989) reported a steady decline in the spring component of the Test catch from a peak of around 40% of catches of multi-sea winter (MSW) fish to around 1% or even less. The 3 SW fish weighing anything between 16lbs to 30lbs appear to have suffered the most. Of those MSW fish that now run the Test most are 2 SW and between 10 and 15lbs.

1.4.9 Solomon (1989) goes on to analyse reasons for the decline in MSW fish a major influence being identified as a shift in oceanic conditions.

TABLE 1

ESTIMATES OF ROD CATCH AND TOTAL RETURNING STOCK OF SALMON ON THE TEST 1989 TO 1994

YEAR	1989	1990	1991	1992	1993	1994
Rod Catch	496 (29%)	288 (36%)	139 (26%)	151 (25%)	434 (35%)	247 (32%)
Returning Stock Estimate	1730 (100%)	790 (100%)	538 (100%)	614 (100%)	1249 (100%)	775 (100%)

TABLE 2

SURVIVAL OF SALMON FROM SMOLT TO ADULT ON THE RIVER TEST 1991 TO 1995

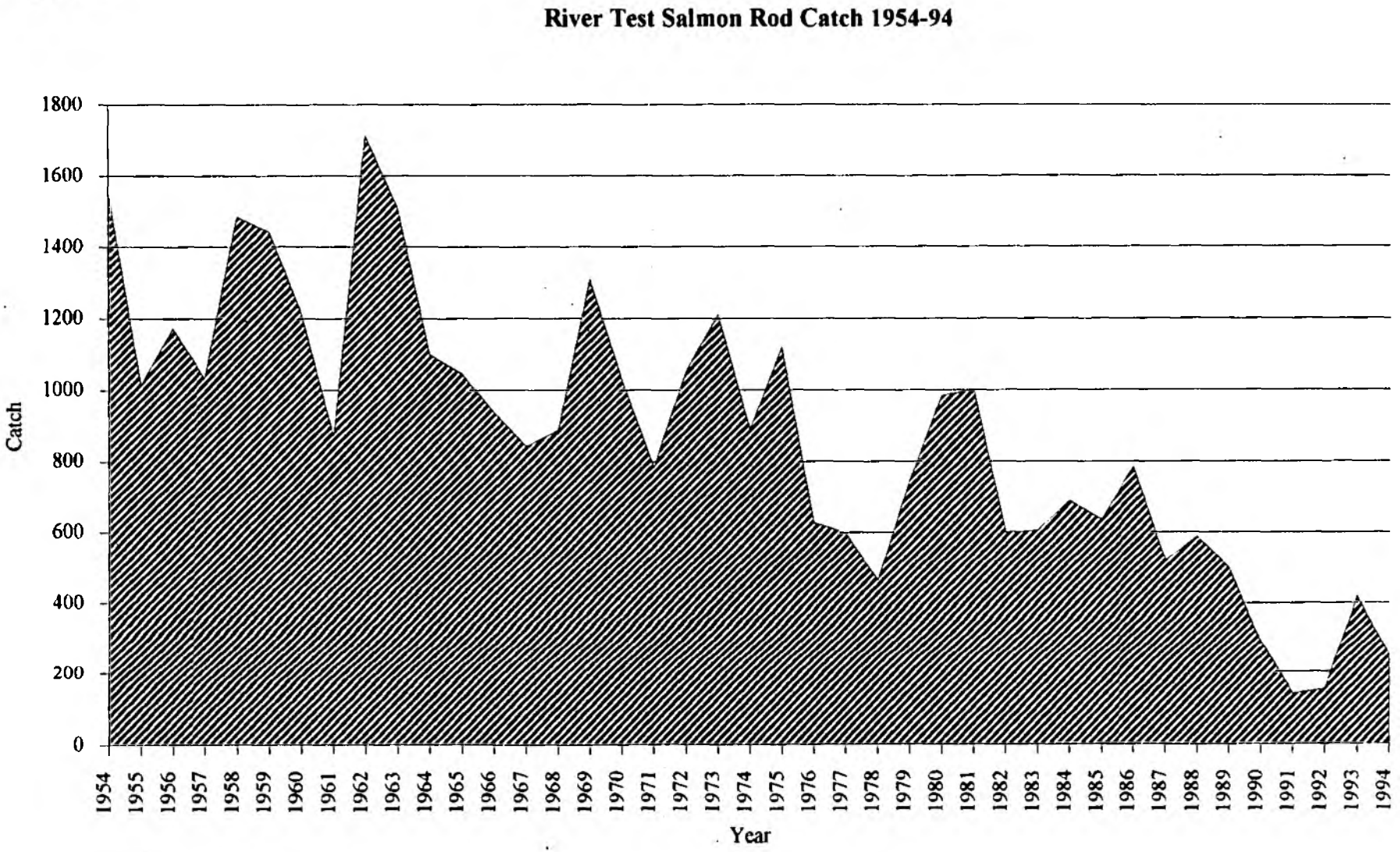
YEAR	SMOLT RUN ESTIMATE (MAFF DATA)	RETURNING SALMON STOCK ESTIMATE (NRA DATA)	SURVIVAL ESTIMATE SMOLT TO ADULT (%)
1991		538	
1992	11976	614	
1993	7131	1249	10.4%
1994	3381	775	10.9%
1995	7040	360*	10.6%*

* ESTIMATED

1.4.10 A total run of between 350 and 750 salmon per annum with an anticipated exploitation rate of 25% indicates that between approximately 100 and 200 fish are available for the rods to take. If runs were to continue at this level the commercial viability of the Test salmon fisheries lies in some doubt.

1.4.11 In 1994 the total number of fish killed on the River Test dropped to 132 representing 17% of the total run.

Figure 2


River Test Salmon Rod Catch 1954-94
Catch
1800
1600
1400
1200
1000
800
600
400
200
0
1954
1955
1956
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1958
1959
1960
1961
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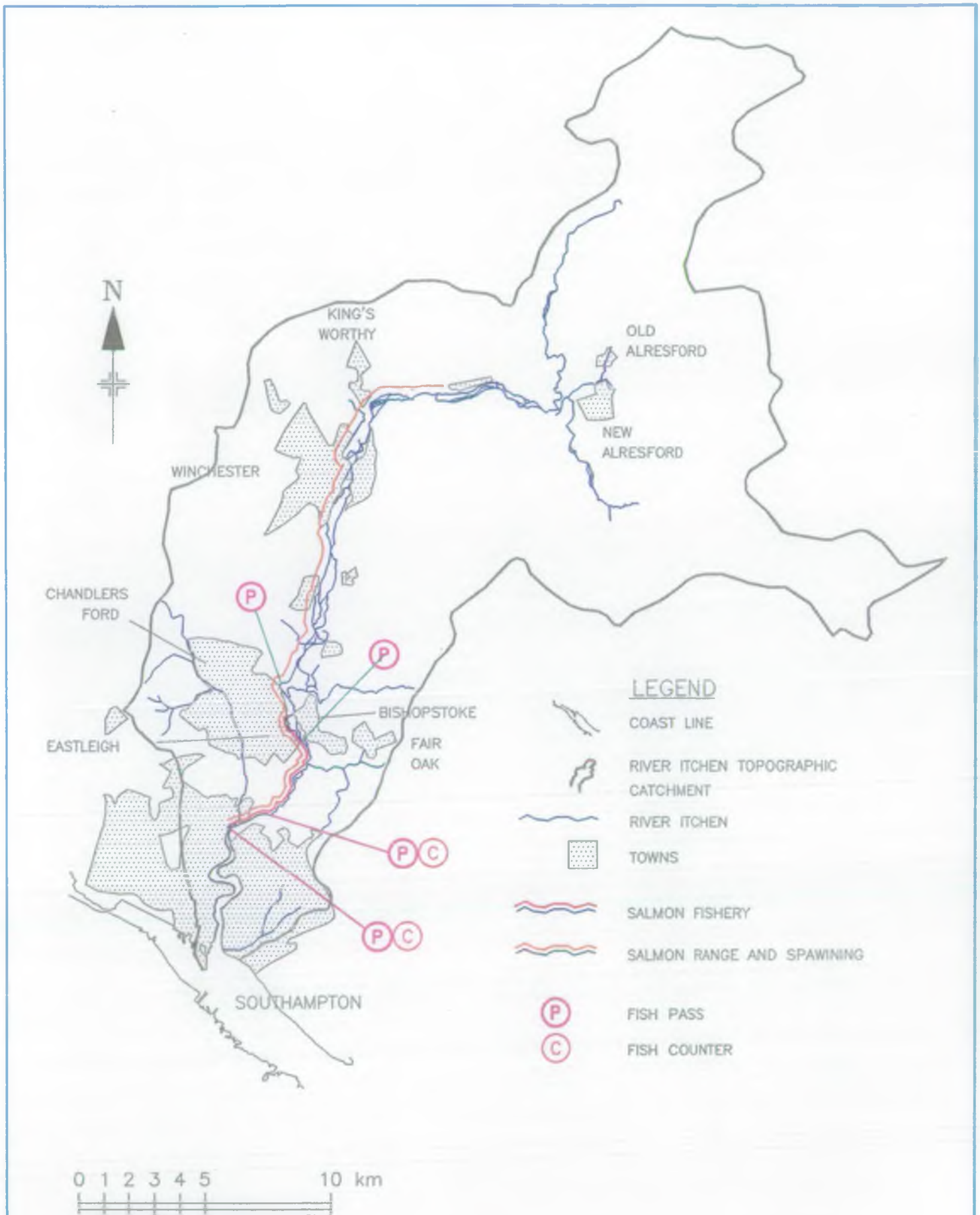


Figure 3 RIVER ITCHEN SALMON FISHERY

1.5 PAST AND CURRENT STATUS OF THE RIVER ITCHEN SALMON FISHERY

1.5.1 Fewer facts are known about the Itchen salmon fishery and the figures available are further distorted by the operation of an ancient right of commercial fishing at Woodmill. The extent of the fishery is summarised in Figure 3.

1.5.2 Rod catch data available to the NRA indicates that between 1954 and 1993 a total of 10,072 salmon were caught by the rods yielding an annual average catch over 40 years of 252 fish per annum. The maximum number caught in any one year was 454 in 1988, the lowest catch was in 1991 with a figure of 69. A plot of net and rod catches for this period is given in Figure 4.

1.5.3 More recent catch data is summarised in Table 3. Since 1992 no fish have been caught and killed by the Woodmill Net, it being run entirely for scientific purposes by the NRA with every single fish being returned to river.

1.5.4 Long term figures for the Woodmill Net indicate that from between 1954 to 1993 a total of 8412 salmon were caught with an annual average for this 40 year period of 210 fish per annum.

1.5.5 It is not known what the long term rod and net exploitation rate has been as a proportion of the total run. If the total exploitation rate is assumed to be somewhere between 25 and 50% then the total salmon run of the Itchen would be in the order of 1000 to 2000 fish.

1.5.6 The Itchen has behaved very differently to the Test in respect of the declines in stocks. No long term trend could be recognised statistically over the last 30 years and the decline appears to be sharp and recent against the natural fluctuations in catches.

1.5.7 The Woodmill Net was very heavily fished in the years 1986, 1987 and 1988 with respectively 461, 505 and 477 fish being killed in each year. It is thought that the sharp decline in stocks in the early 90s could be as a direct result of heavy fishing pressure. It is also notable that in these years the rods killed a large number of fish. Estimates suggest that for a number of years more than 70% of the total run could well have been killed by a combination of the rods and nets.

1.5.8 If this figure is combined with the marine exploitation by the Irish nets it is clear that the losses of potential spawning fish to exploitation are extremely high.

1.5.9 In 1994 a total of 149 salmon (40% of the run) were killed by the Itchen rods with 34 fish released back to the river.

1.5.10 No smolt counter data is available for the River Itchen, therefore it is difficult to predict the run for 1995 and 1996. Fish counter data so far in 1995 indicates that the run on the Itchen is significantly higher (by 250%) than for the same period in 1994. Evaluation of further data may confirm this as an ongoing recovery for the river.

TABLE 3

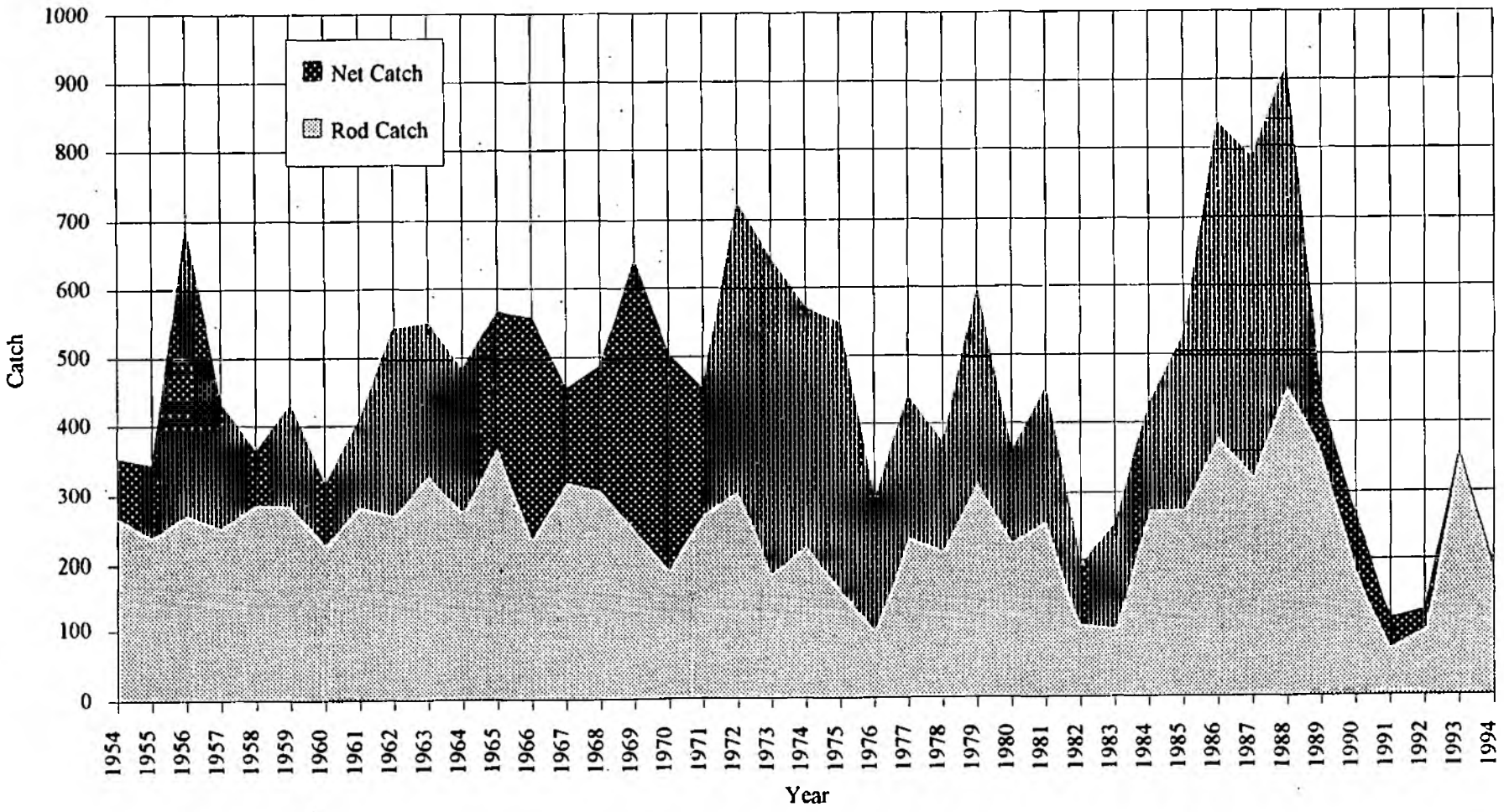
ESTIMATES OF ROD AND NET CATCHES FOR SALMON ON THE RIVER ITCHEN 1989 TO 1994

YEAR	1989	1990	1991	1992	1993	1994
Rod Catch	359	187	69	95	357*	183
Net Catch	71	74	46	0	0	0
Returning Stock Estimate	791 (100%)	367 (100%)	152 (100%)	357 (100%)	852 (100%)	374 (100%)

* CONTAINS UNSUBSTANTIATED HIGH RETURN FROM WOODMILL POOL

Figure 4

River Itchen Salmon Rod/Net Catch 1954-94



2. WHAT DO WE KNOW?

2.1 INTRODUCTION

2.1.1 The purpose of this section of the document is to clearly define what is currently understood about the dynamics of the salmon populations of the Test and Itchen.

2.1.2 A summary of what is known is presented in Table 4. The information is presented following through the life cycle of the salmon from the egg to the sexually mature adult.

2.1.3 Key issues are expanded further in the text of this section.

2.2 EGG/ALEVIN

SPAWNING GRAVELS

2.2.1 Work undertaken by MAFF (Scott, 1993) has demonstrated clearly that egg survival in the spawning gravels on the Itchen is extremely low. Embryo survival experiments demonstrated that the average survival rate was 2.6% with the exception of 1991 when the average survival was 17%. The primary cause of low egg survival was identified as poor gravel quality as a result of fine sediments.

2.2.2 Scott (1993) identified ways in which the gravel quality could be improved with particular emphasis on gravel cleaning techniques. Other ways of maintaining the stock were identified to include stocking, streamside incubators and wider habitat management.

2.2.3 The degradation of spawning gravels is a crucial issue to address. In the short term, gravel cleaning methods have been adopted. Fishery owners and the NRA have undertaken a vigorous programme of gravel cleaning manually on the Itchen over the last 4 years.

2.2.4 Gravel cleaning remains arguably a short term measure which is difficult to sustain as only a relatively small proportion of the gravels potentially available for spawning can practically be cleaned.

2.2.5 The long term solution to this problem lies with understanding where the silt is being derived from and how it is getting into the river. The most sustainable option being to implement measures to address the primary cause of the problem.

2.2.6 Much, however is unknown about the sediment dynamics of the Test and Itchen and methods to prevent fine sediment reaching the river and degrading the gravels. This subject represents a prime subject for substantive Research and Development.

Wild salmon parr grow rapidly in the rich chalkstream waters but insufficient numbers are produced to sustain stocks.

Allbrook and other fish passes reduce vulnerability to poaching and ease access to salmon spawning grounds.

Table 4

STAGE	ISSUE	KNOWN	UNKNOWN
Egg/Alevin	Genetics	Drift from chalk stream trait since 1990 *"I. Russel & D James 1995"*	Unequivocal definition of the chalk stream race and sub races *(**Need for a more comprehensive set of genetic markers for Atlantic Salmon)*
	Egg survival	Typically less than 5% Average Non-chalk 65-95% Max known chalk stream 20%	Siltation is responsible for decline of stocks. (Probably the limiting factor in the population)
		Silt depositation is responsible for poor egg survival, River Itchen experiments *"A Scott 1993 Hampshire Salmon Seminar 1993"*	Means for prevention of silt deposition *(**Means of encouraging Buffer Zones, river narrowing, stewardship scheme).*
		Increased siltation is probably due to the following: (a) Average annual rainfall is decreasing *"Water Resources data"* (b) Increased arable farming in the catchment *"T.Thorpe 1994"* (c) Decreased gravel raking by fisheries *"T.Thorpe 1994"* *"All reviewed by Solomon 1990"*	The condition of most spawning areas is unknown.
		Some spawning locations are known	The full extent of the spawning locations is unknown. *(**A map of known spawning areas in recent years should be compiled)*

STAGE	ISSUE	KNOWN	UNKNOWN
Fry	Survival	Predation by cormorants has been shown to occur.	Actual survival rates Habitat availability *(**Habscore spawning locations and adjacent nursery areas)* Predation impacts Avian, trout, other.
Parr/Smolt	Survival	Minimum value of 5% survival from fry to smolt on River Itchen from run reconstruction *"A Scott 1993 Hampshire Salmon Seminar 1993"* For hatchery fish from 1-8% *"Smolt trapping report 1995 MAFF/NRA"*	Actual survival rates Habitat availability *(**Habscore spawning locations and adjacent nursery areas)* Predation impacts Avian, trout, other.
	Production	Good growth rates *"Juvenile survey reports"* >99% of smolts are S1 *"Smolt trapping report 1995 MAFF/NRA"* R. Test smolt production estimates 1991 to 1995 3381 to 11976, Table 2	Historical data *(**Check old scale samples etc.)*
	Entrapment	A risk of entrapment exists at water intakes Prior to 1960 there were no commercial fish farms, production of Rainbow trout started in the early 1970s	Quantative losses to abstractions *(**Investigate and report on the major abstraction sites)*
	Behaviour	Smolt run timing effect on age at return and season of return *"Run timing of salmon, SAC report"*	

STAGE	ISSUE	KNOWN	UNKNOWN
Smolt/Adult	Production	Wild production constitutes 55% of 1995 run *"Smolt trapping report 1995 MAFF/NRA"*	Annual variability
		Hatchery component of smolt run was 45% *"Smolt trapping report 1995 MAFF/NRA"*	Relationship to egg and parr numbers *(**Develop more sophisticated juvenile surveys)*
		Total smolt production estimates are 1994 = 3381 1993 = 7131 1992 = 11976 *"MAFF Smolt trapping reports 1992-94"*	Best strategy for rearing and stocking *(**Develop external batch marking method and PIT tag February pre smolts)* Ratio of wild to reared smolts prior to 1995 *(**Estimates can probably be derived)*
	Behaviour	Smolt estuarine behaviour has been investigated *"MAFF Smolt tracking reports"*	Early marine survival factors
Adult/Marine	Survival	Adult return rate has ranged from 10.4 to 10.9% of the smolt run estimate *"NRA Hampshire salmon statistics 1994"*	The annual variability in migration from estuary to river.
	Exploitation	Irish drift net 23% Faroes<1% West Greenland<1% *"I Russel 1993 Hampshire Salmon Seminar 1993"*	Accurate return rates of wild and reared parr for incomplete microtagged years. Illegal/undeclared catch. Poaching exploitation rate. Age structure of adult population *(**Compile all known scale reading data and initiate systematic scale reading programme).*

STAGE	ISSUE	KNOWN	UNKNOWN
Adult/ Freshwater	Survival	Adult returns Adult exploitation Rod Adult exploitation Net Available spawners See Table 1 Age at return *Analysis of weight frequency data* Timing of return *From counter data* Sex ratio *From catch records* Adult straying rates *From microtag recapture data* Influence of genetics and environment on grilse/MSW adults *"Run timing of salmon, SAC report"*	Poaching exploitation rate. Survival to spawning Number of redds Number of viable redds Factors affecting above Disease status - vulnerability

References

"I. Russel & D. James 1995 Genetic Appraisal of Salmon Stocks on the River Test - Results for 1994 (MAFF)"
"D.J. Solomon River Test Salmon Fisheries - An Analysis of Their History and Factors Affecting Their Performance"
"T.Thorpe 1994 A Study of the Factors Influencing the Success of the Salmon Populations on the Rivers Test and Itchen, Hampshire: Recommendations for action

Extensive hatchery facilities are required to support the stocks while environmental improvements are implemented.

Freeze coring reveals the high silt content of the spawning gravels.

GENETICS

2.2.7 The genetic issue still remains one of considerable concern. MAFF studies (Russell and James, 1995) have demonstrated that in the recent past the salmon stocks of the Test and Itchen demonstrated a degree of genetic uniqueness when compared to other UK populations. The advantage conferred to the local stocks of this situation is in real terms unknown, however, the bulk of current thinking, theory and empiricism (Salmon Advisory Committee Report, 1991) supports the need whenever possible to protect genetic integrity.

2.2.8 The debate on genetics is however an active one. Purdom (1994) argued that many of the traditional arguments against stocking were flawed. The arguments for and against genetic pollution will doubtless role on. The majority of scientific opinion however, supports the need for great care to be exercised if genetic material from a different source is used to stock a fishery

2.3 FRY/PARR

2.3.1 Scott (1993) identified from a run reconstruction model that a minimum survival rate of 5% is required from fry to smolt to sustain the salmon population.

2.3.2 We have very little information on fry survival other than what can be deduced from the recent stocking work.

2.3.4 A summary of estimated stocked fish survival rates on the River Test is given below in Table 5. Further information on the numbers of fish stocked to both the Test and the Itchen are given in Tables 6 and 7.

Table 5

ESTIMATED SURVIVAL RATES OF STOCKED PARR TO SMOLT

COHORT YEAR	TOTAL NUMBER OF PARR STOCKED	SMOLT RUN ESTIMATE	SURVIVAL RATE TO SMOLT
1991	710,817	11,976	0.5%**
1992	661,928*	7,131	0.3%**
1993	207,628	3,381	1.7%*
1994	38,806	7,040	8% actual
1995			

* Parr stocked were smaller than expected at that age.

** Estimated survival rate from parr to smolt assuming that 50% of the smolt run is made up of fish of wild origin.

Table 6

DETAILS OF HATCHERY FISH STOCKED INTO THE RIVER TEST 1987 TO 1994

YEAR	TOTAL NUMBER STOCKED
1987	10,504*
1988	7,461*
1989	28,447*
1990	22,475*
1991	710,817
1992	661,928
1993	207,628
1994	38,806
TOTAL	1,689,260

* mostly introduced as pre-smolts

Table 7

DETAILS OF HATCHERY FISH STOCKED INTO THE RIVER ITCHEN 1986 TO 1993

YEAR	TOTAL NUMBER STOCKED
1986	2,906*
1988	8,904*
1989	190*
1990	3,000*
1991	31,613
1992	40,808
1993	6,000
TOTAL	93,421

* mostly introduced as pre-smolts.

2.3.5 If it is assumed that for the years 1992, 1993 and 1994 that 50% of the smolts trapped were of wild origin (we unfortunately have no definitive measure), then in 1992 it could be argued 3,566 parr survived to smolt from 710,817 stocked in 1991, a survival rate of 0.5%.

2.3.6 In 1993 and 1994 similar calculations can be done indicating respectively parr survival rates of 0.3% and 1.7%.

2.3.8 Even if it assumed that no fish caught at the smolt trap were of wild origin the data indicates extremely low fry to smolt survival.

2.3.9 The stocking in 1994 of 38,806 large parr, all of which were microtagged, showed a survival rate to smolt of over 8%, compared to surivial rates of 0.3 - 1.7% for smaller parr stocked in 1991 - 1993. The poorest survival was noted for 1992 where the parr were of notably small size and poor condition on stocking.

2.3.10 It is not unknown what is causing the high mortality rates. Research on avian predators in the Test Valley has demonstrated that cormorants could well be a significant problem with over 100 microtags being recovered from one cormorant roost following the 1994 parr stocking. The impact of stocked brown and rainbow trout is unknown but thought by some people to be significant.

2.3.11 Other reasons for poor fry/parr survival also need to be investigated and figures for wild fry/parr survival are needed.

2.4 SMOLTS

2.4.1 It is known that the growth rate of parr to smolt is extremely good and that the majority of parr smoltify as S1's (>99%).

2.4.2 The major concern for smolts is the risk of entrapment at a variety of intakes on the smolt migration route. NRA has developed radio tracking techniques for smolts to establish the scale of this risk.

2.4.3 It is also known that of the smolts leaving the river, approximately 10% have returned as adults year on year, for the 3 consecutive years 1992, 1993 and 1994.

2.5 ADULT/MARINE

2.5.1 The Irish drifts nets are know to take a large number of Test fish. Estimates from microtag return data indicate that this figure could be as high as 23% of the extant stock at sea. Further research however is needed to define the year on year exploitation of the Irish nets.

2.6 ADULT/FRESHWATER

2.6.1 Extremely good data exists for adult returns from angler catches and fish counters these are summarised in Section 1.4 and 1.5.

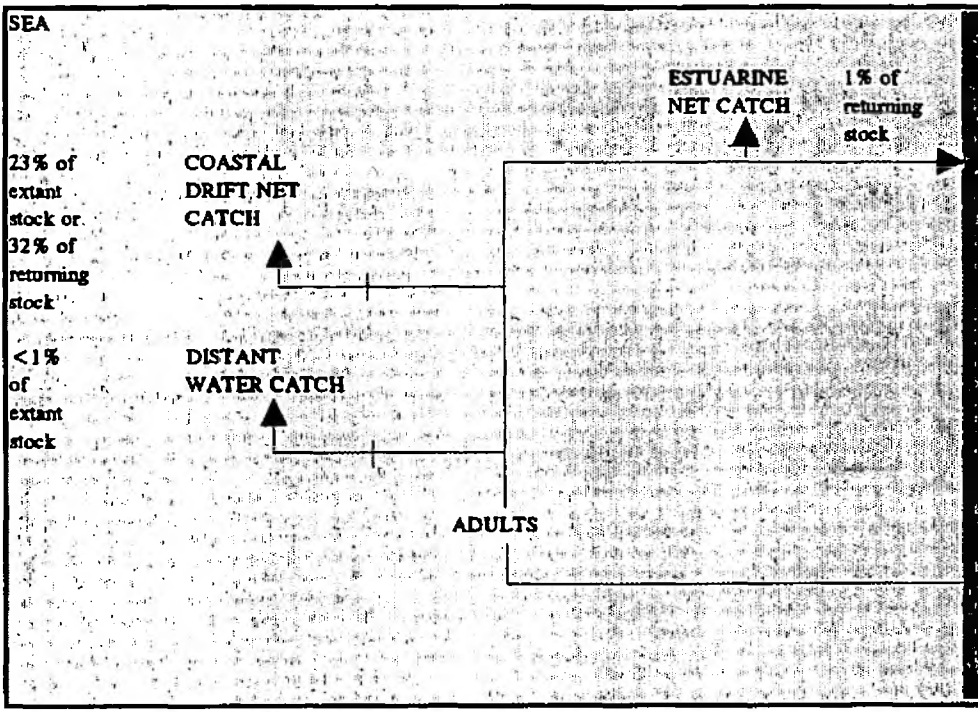
2.7 COHORT RECONSTRUCTION MODEL

2.7.1 Arising from the information known about the Test and Itchen salmon stocks, it has been possible to develop a model of their life cycle and the estimated percentage losses at each stage. This is represented in Figure 5.

2.7.2 Figure 6 utilizes this information and applies it to a theoretical stock of 1000 spawning fish applying the least and greatest loss rates at each stage of the life history. The stock ceases to be self-sustainable at the point where it falls below 1000.

2.7.3 This demonstrates that with losses as they currently exist, the wild stock is not able to self-sustain.

Figure 5 Cohort Reconstruction Hatch to Grilse



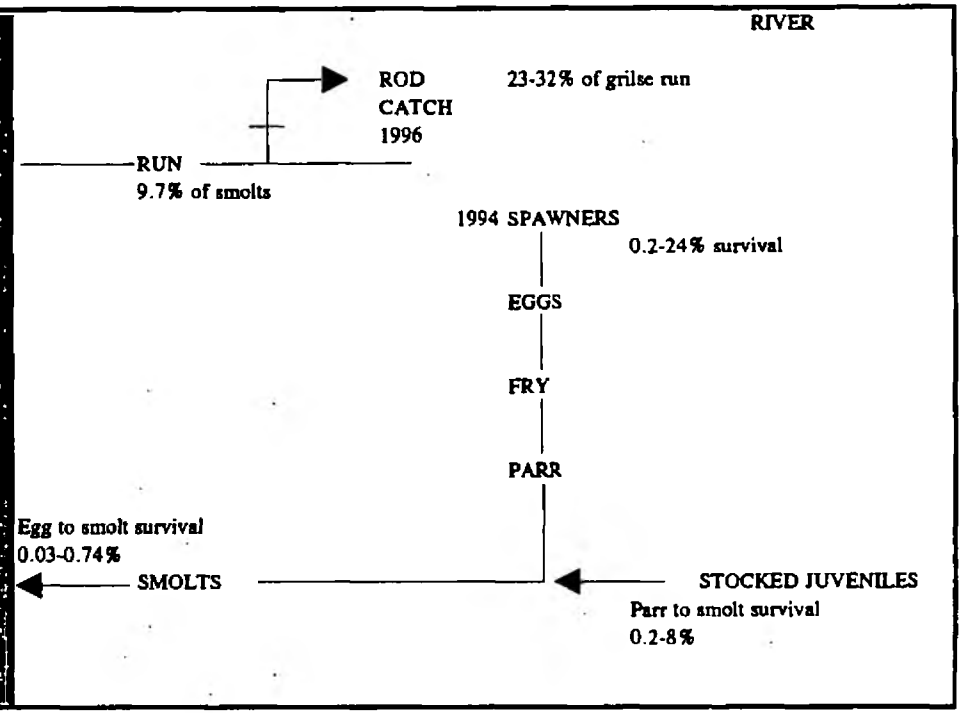
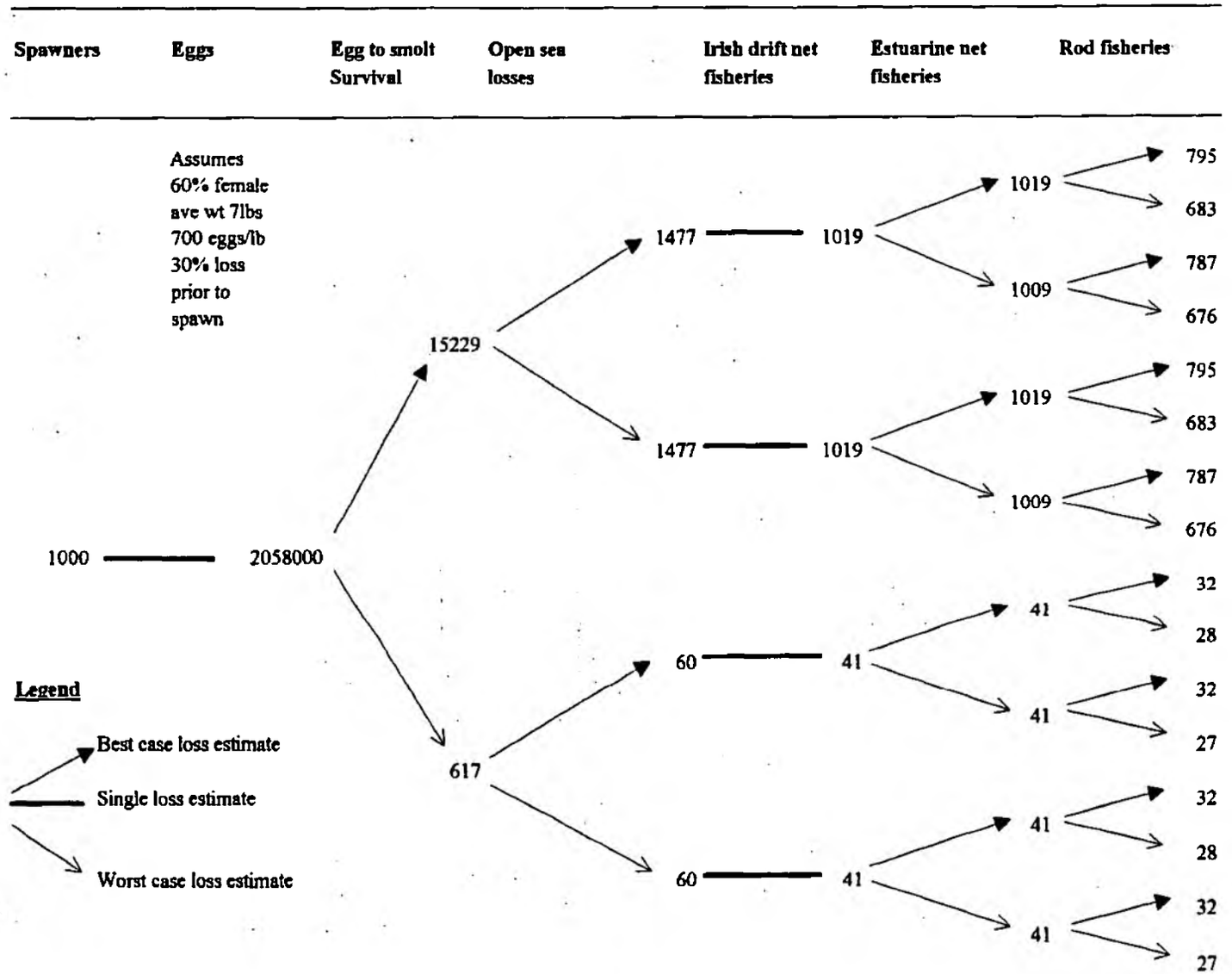

RIVER
ROD
CATCH
1996
23-32% of grilse run
RUN
9.7% of smolts
1994 SPAWNERS
0.2-24% survival
EGGS
FRY
PARR
Egg to smolt survival
0.03-0.74%
SMOLTS
STOCKED JUVENILES
Parr to smolt survival
0.2-8%

Figure 6 **Hypothetical 1000 spawners model with current estimated losses**
Number of individuals left after losses



3. WHAT DON'T WE KNOW?

A summary of areas of work where our knowledge is incomplete is given in Table 4.

3.1 EGG/ALEVIN

SPAWNING GRAVELS

3.1.1 Although a number of studies have been commissioned on sediment deposition and sediment dynamics a great deal of further information is required. Specific knowledge is required on how to reduce base sediment loadings to the river and how through river geomorphology and engineering to prevent sediment deposition in crucial spawning areas.

3.1.2 Egg survival has always been poor throughout much of the Test and the lower reaches of the Itchen. River keepers have suspected that other possible causes could be the build up of effluent or anaerobic gases in the peat substrate underlying the gravel. It is vital that all potential causes of egg mortality are investigated and the role of methane or hydrogen sulphide should be substantiated. Other water quality factors may be important, the long term data needs closer scrutiny for trends.

3.1.3 Gravel impaction could well mean that eggs are deposited relatively shallow in the gravel column. In this case there would be increased vulnerability to scouring and possible invertebrate predation. The significance of these factors is so far unknown.

3.1.4 The adverse conditions affecting salmon egg survival may impact similarly on native Brown Trout. This may provide an additional requirement for investigation but offer a ready means for identifying the cause.

GENETICS

3.1.5 The argument on the desirability of retaining river specific genetic stocks needs to be investigated more fully. The grilse run of 1996 on the Test should give excellent data in respect of the 'fitness' of hatchery origin fish from the 1994 introductions relative to the performance of the wild stocks.

3.2 FRY/PARR

3.2.1 Far more work needs to be done to quantify pressures on wild and stocked fry and parr to definitively establish the major causes of mortality.

3.2.2 The relative impacts of avian or fish predators needs to be quantified.

3.2.3 A thorough evaluation of the suitability of habitat is needed as is an ecological evaluation of the fishery as a whole including assessing the relative dynamics of the coarse fish populations and the trout fisheries.

3.3 **SMOLT**

3.3.1 Further work is needed to determine the extent of smolt entrapment and factors affecting the smolt run.

3.3.2. Further data is required to relate smolt outputs to spawning targets. It is also vital that we know the relative proportions of stocked to wild smolts.

3.4 **SMOLT/ADULT**

3.4.1 The captive breeding programme to date has had limited success. Steady improvements are being made but more research is needed to understand the factors influencing captive stock sexual maturation and spawning success.

3.4.2 More information is needed on the factors affecting early marine survival.

3.5 **ADULT/MARINE**

3.5.1 Our knowledge of the marine exploitation rate particularly off the Irish coast is thought to be incomplete. Deficiencies lie particularly with the extent of the illegal or undeclared catch.

3.5.2 Further research is needed to determine factors affecting the rate at which fish enter the river.

3.6 **ADULT/FRESHWATER**

3.6.1 Further information is required on the numbers of fish actually surviving to spawning. As yet the in river survival rate is unknown and the poaching exploitation rates are unlikely to be quantifiable.

3.6.2 It is thought that many adult fish are succumbing to disease before they are able to spawn. This statement is corroborated by bailiff and keeper observations including a marked reduction in the number of live spawned kelts in the river. The true extent of this problem needs to be addressed.

Gravel cleaning to improve the fry production from redds.

Antipoaching Patrols protect the high value spawning fish during their return migration.

4 A PROGRAMME FOR ACTION

4.1 INTRODUCTION

This document identifies the issues where we have sufficient information to take management action or propose measures to reverse the decline in salmon stocks on the chalk rivers. There are many other areas where we either have no information or it is incomplete, which need to be investigated further.

It is not always possible to have all the answers before taking management action, this is recognised and proposals are made where a healthy degree of pragmatism and local knowledge are combined with what is known scientifically.

This chapter seeks to identify issues where some degree of action can be taken and where there are issues which are beyond the control of the NRA. These are highlighted but would require the influencing, persuasion or lobbying of others to effect action.

4.2 FISHERY MANAGEMENT

4.2.1 Commercial Exploitation

- Seek to minimise commercial exploitation of salmon stocks in the Southampton Water, The Solent and Tidal rivers. This would be effected under the existing Net Limitation Order which is due for renewal in 1996.

- Seek to ensure the operation of the Woodmill net for scientific purposes only..

- To support and actively promote the value of the move from commercial drift netting off the Irish coast to protect the recreational fisheries in Ireland and the United Kingdom.

4.2.2 In River Exploitation

- To actively encourage fishery owners to manage their fisheries in a way that the total number of fish killed by the rods on both the Test and Itchen does not exceed 20% of the respective runs (Figures can be calculated for each fishery based on previous years catches and rods).

- To continue to actively encourage anglers not to kill fish but to either donate them to the captive rearing programme or to practice Catch and Release. This has been widely supported by the anglers during 1995. To provide facilities to enable live fish to be donated to the captive rearing programme.

- To encourage the use of the fly in preference to the spinner, prawn or worm.

- To discuss with fishery owners, fishing interests and anglers the desirability of introducing byelaws to regulate specific aspects of the operation of the fishery notably method restrictions, bag limit restrictions, length of season restrictions.

- Seek to reduce significantly by voluntary code or byelaw the number of multi-sea winter salmon killed by the rods.

4.2.3 Enforcement

- Continue to police the rivers and estuarial waters to keep poaching to an absolute minimum.

- Continue to make the case loudly and strongly to maintain the current funding levels specifically from Government Grant in Aid (GIA) to ensure effective enforcement can continue to be carried out.

- Further develop intelligence networks with enforcement agencies (Police, Customs, MAFF, Sea Fisheries Committees etc) to optimise the best use of resources and targeting of resources.

- To investigate high technology methods such as video cameras, radar, electronic trips etc for protecting specific known vulnerable sites and further enhance cost effectiveness.

- To continue to liaise with and co-ordinate with river keepers to optimise the use of private fisheries staff to reduce poaching.

- To install fish passes at obstructions known to delay fish and make them vulnerable to poaching eg Bishopstoke Mill and Stoke Lock.

4.2.4 Stock Monitoring/Stock Assessment

- Closely monitor commercial and in river exploitation of stocks, liaise closely with fishery owners, The Test and Itchen Association and fishery interests on the management implications of measured exploitation rates.

- Continue a detailed programme of juvenile salmonid stock assessment surveys to assess spawning success, growth rates, condition factor, health etc of young stock.

- Continue to run and improve the Nursling and Little River fish counters on the River Test and the Gaters Mill counter on the River Itchen and provide high quality validated and audited fish count data.

- Undertake programmes of Redd counts if feasible to enable assessment of survival of number of fish surviving to spawn and to assess spawning time.

- To continue to support MAFF in the salmon microtag programme. Coordinate the collection of microtag heads and provide staff and resources to man the smolt traps to adequate levels.

- Continue to support work to establish factors affecting egg survival and fry emergence.

- Assess the performance of the entire fishery on an annual basis in respect of the run reconstruction model and identify stages where the fishery is under-performing.

- Produce regular newsletters detailing counter, survey, and catch results.

- Hold regular meetings with the Test and Itchen Association to discuss stock management issues and the implications of survey and counter results.

- To monitor the migration of adults and smolts to assess the impacts of entrapment in the river systems.

4.2.5 FISH HABITAT DEVELOPMENT

- Continue to develop a programme of habitat improvement which identifies obstructions to fish migration and facilitates maximum freedom of fish to spawn in the most suitable areas. This would usually be implemented by construction of fish passes but could identify sluice operating practices or water level management regimes as alternative methods for allowing fish passage.

- Seek to address the opportunities for river channel management to reverse the tendency of river to deposit silt in key spawning areas.

- Identify long term by means of Research and Development ways in which the amount of sediment being flushed into the rivers can be reduced.

- Encourage the provision of buffer strips by riparian owners.

- Encourage a move to increased habitat diversification on first order streams and spawning areas including bank management and river bed management.

- Investigate and develop the potential of semi-natural rearing channels to increase production.

4.2.6 STOCKING

- Continue to preserve the genetic integrity of the River Itchen stocks.

- Manage stocking of the River Test to preserve as far as possible indigenous traits of local stocks through the captive rearing programme.

- Only use Scottish reserved stock on the River Test which are derived from a R.Test generation brood line.

- Continue to microtag all stocked fish to allow careful monitoring of both reared and wild stock.

- Do not stock on known productive natural spawning sites.

- Put an emphasis on quality stocked fish rather than quantity. The 1995 stocking of 40,000 parr produced a known survival of 8% at the smolt trap.

- Critically examine the success of stocking against natural production for returning adults from the microtag programme.

- Continue to observe best stocking practice as defined in the Salmon Advisory Committee Report (1991).

4.3 SOCIO-ECONOMIC FACTORS

4.3.1 Urban Development

- The linear decline in salmon stocks can be statistically correlated with the urban development and change in agricultural practice on the Test Valley over the last 30 years (Thorpe 1994). The precise reasons for this decline need to be investigated more fully.

- No such correlations can be made with the Itchen, indicating that the two rivers are behaving some what differently.

4.3.2 Agricultural Practice

- Changes in land use have been studied over the last 45 years. The results show how arable farming has increased along with the urban population coupled with a decline in the rural sector and the percentage area of rough grazing land. Statistically the Test correlated most strongly with these changes. Further work needs to be done to establish whether it is feasible to reverse any land use practices or encourage land management in a way which will reduce sediment loading, nutrient run off and pesticide run off into the rivers.

- The opportunities to develop buffer zones to protect these rivers should be vigoursly pursued. The protection derived from ESA and countryside stewardship agreements within the catchment should be evaluated with respect to this problem.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

1 The salmon stocks of the River Test appear to be under more severe pressure than the River Itchen. Figures for 1995 indicate an improvement on the Itchen against a fall on the Test.

2 The Test salmon stocks have shown a steady rate of decline over 30 years with a more recent accelerated collapse during the late 80's and early 90's.

3 Long term reasons for the Test decline have been postulated as: change in land use practice from grazing to arable, increased siltation of spawning gravels, increased urbanisation, excessive marine exploitation, excessive in-river exploitation and as yet unknown water quality effects.

4 Reasons for the decline of the Itchen stocks in part have been identified as being similar to the Test, however heavy commercial fishing by the Woodmill Net in the mid 1980s will have contributed.

5 Both the salmon fisheries of the Test and Itchen are heavily exploited by anglers with catch rates in the order of 25% of the returning adult stock.

6 Figures indicate that on average between 50 and 60% of adult stock (marine and riverine) are taken by nets (Irish coast) and rods each year.

7 Egg survival in the spawning gravels is viewed as a major factor influencing the success of the populations.

8 Heavy stocking of the River Test has yielded generally disappointing results so far but more recently has shown improved yields.

9 The Test salmon fishery continues to remain under extreme pressure in terms of its viability.

10 The Itchen salmon fishery appears to be recovering.

11 A reasonable target run for the Test based on historical catches would be in the order of 4,000 fish per annum, this would yield a rod catch of about 1,000 fish assuming 25% exploitation.

12 Based on current knowledge this would require a smolt run of 40,000 for the River Test. In 1995 natural wild spawning produced 3,907 smolt indicating a 10 fold increase is required.

13 Survival from stocking has ranged from 0.3 to 8% to smolt. Even at the best survival rate of 8% the smolt target would require 460,000 parr to be stocked to the River Test in October of a year. The hatchery facilities preclude this scale of operation.

14 A reasonable target run for the Itchen would be in the order of 1,500 fish per annum, this would yield a rod catch of about 250 fish per annum based on known average catches over 40 years. Without smolt trapping data for the Itchen it is not possible to set smolt production targets.

5.2 RECOMMENDATIONS

It is proposed that the following recommendations should be implemented to achieve a self-sustaining salmon population and viable fishery:

1. That the long term causes of the salmon declines are actively and vigorously investigated through a programme of local surveys, collaborative projects and National NRA Research and Development.

2. That work continues to determine the optimum stocking strategies for the rivers taking specific account of known survival rates of previously stocked parr.

3. That stocking should be actively monitored through a programme of microtagging to enable the performance of the wild stocks to be properly monitored.

4. That the dynamics of the Itchen are carefully compared to the Test to determine differences and hence establish why the two rivers exhibit different trends.

5. That the need for Government Grant in Aid (GIA) funding is strongly made to maintain the NRA's ability to mange all facets of the fishery including conservation, enforcement, habitat work, research and development, scientific surveys, monitoring and stocking.

6. That the principle of a self sustaining stock on both rivers is accepted and target runs for the Test and Itchen will be 4,000 and 1,500 fish per annum respectively.

7. That fisheries owners, anglers, land owners and all other interested parties advise the NRA on the formulation of a definitive salmon strategy for both rivers. That a clear strategy is produced defining targets and objectives and the means and deadlines by which they well be achieved..

8. That a definitive Salmon Strategy for the Hampshire rivers is produced by June 1996 following a 6 month consultation period.

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