Institute of Freshwater Ecology

Meon and Hamble low flow investigation

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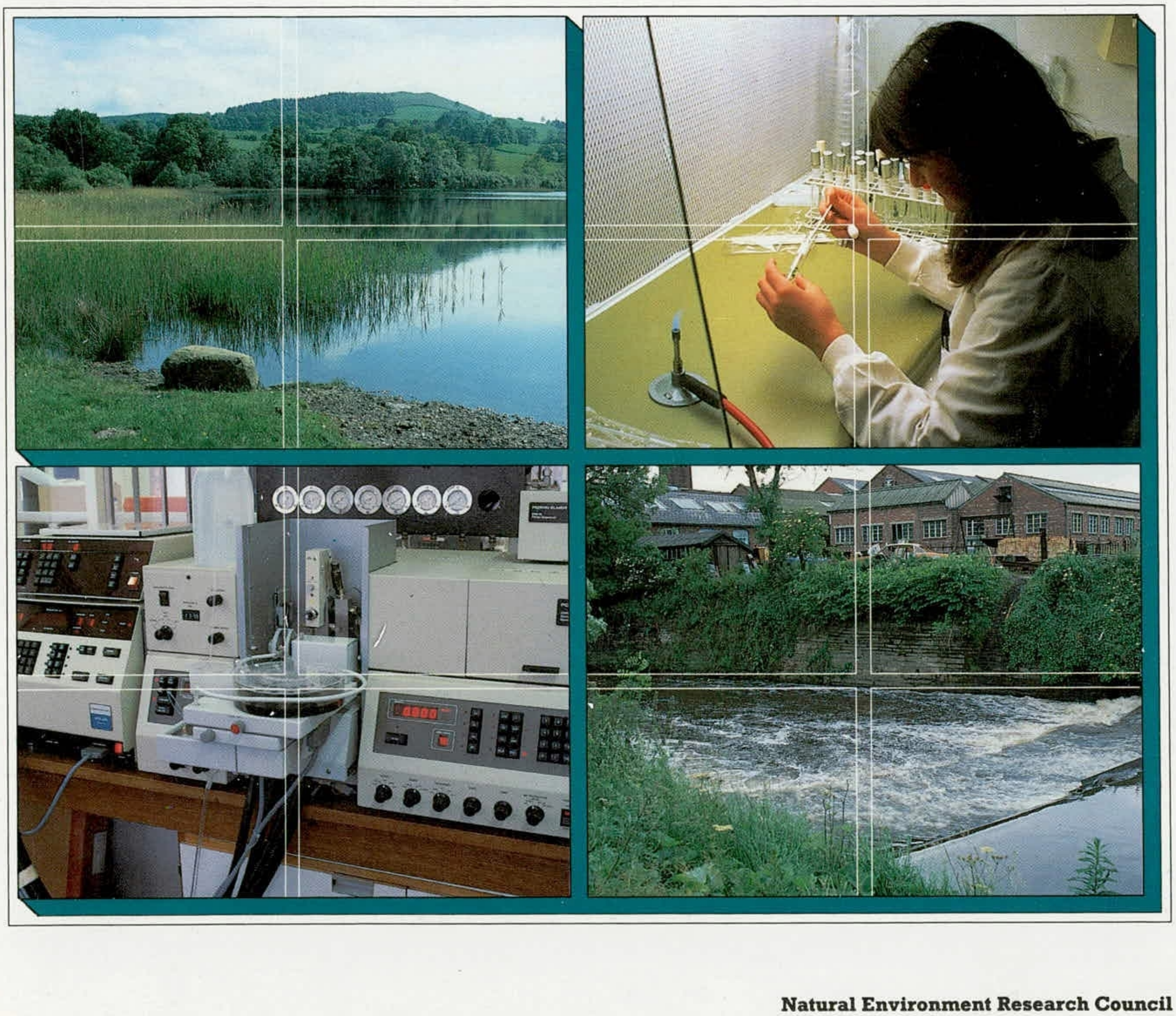

Natural Environment Research Council

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INTRODUCTION

The objectives of the present desk study are as follows (**bold type**):-

The appended comments are from Charles Jones and other sources.

(a) **Determine evidence of adverse conditions possibly attributable to low flows**

(b) **Determine evidence of the resilience of the aquatic system**

(c) **Advise on the biological factors relating to a recommended minimum acceptable flow regime**

(d) **Comment on the biological component indicators within the NRA standard methodology**

(e) **Derive a cost indicator of the fisheries benefits. Some sort of assessment of the value of the sea trout/trout fishing**

The following bodies were consulted:-

IFE Staff

Dr Hugh Dawson - Some salt marsh hydraulics (water levels) on the Hamble. **Report obtained**

Mr Mike Furse - Nothing, but would check on past records. **Nothing**

Dr John Wright - Lots of work was done by the Reading University Lambourn team.

Should consult Alasdair Berrie. **Report obtained**

Mr Harry Casey - **Nothing**

Mr Anton Ibbotson - data examined

NRA Staff

Mr Robin Crawshaw

OUTPUTS

1. Ultimately, a usable NRA methodology

2. Cost indicators of the Meon and Hamble fishery quality

(a) Adverse conditions possibly attributable to low flows

MEON

Apparently on the Meon it seems unlikely that any action will be taken to modify flows in the short term. The conservationists and anglers clearly and with good reason do not want "another 1976" but otherwise there may not be a major problem. Perceived difficulties such as silting of redds and poaching of the margins by livestock may be functions of low flow. The following is a brief account of known and perceived comments with annotations in italics.

Anecdotal information

1. **An angler** - who has fished since 1970 on the stretch from Warnford to Titchfield Haven has commented that sea trout "no longer run above Segensworth in the season". On three miles of water between Titchfield and The Haven less than 10 sea trout between 1 and 2 lb are believed to have been taken in the past ten years. It is said that thirty years ago hundreds were taken every season with some over 10 pounds. Parr are reputedly less abundant than in times past. The bankside is much drier. This situation should be seen in the context of the general decline in sea trout catches nationally and notably in other south coast chalk fed rivers.

These comments suggest that there has been deterioration due to reduced flows/groundwater levels which may act at almost any life stage of the sea trout. Critical stages are likely to be autumn (October-November) flushing flows to clear spawning gravels of silt.

2. **Letter Brian Manhire** - Chairman of Portsmouth Services Fly Fishing Club. Canvassed members regardng water levels since mid seventies. Three members have fished for 30-40 years. General view is of low flows adversely affecting fishing after June and narrowing of the channel.

This emphasises the preceding comment. Low flows through the summer months would normally result in encroachment of bankside vegetation and, in the absence of flushing flows through the autumn and winter, would result in poor salmonid spawning conditions.

3. **Notes from Charles Jones** -

The channel can apparently be regarded as divided into four sections.

(a) East Meon to Warnford Springs is a small stream often dry in summer. Trout farm above West Meon.

(b) Complex perennial chalk river with variable accretion profile and wide range of seasonal flows. Downstream of Droxford and round Soberton West Street the river is often losing - possibly exacerbated by pumping. Should be key spot for fishing interests. Possible poor management of banks and beds. Landscape interests may spoil fishing.

(c) Perennial reach over tertiaries (with chalk water??). Bed more clayey towards Wickham. Sewage treatment plant outfall minor influence. Low flows affected by pumping.

(d) Perennial with SSSI at the Haven. Low peak winter flows may affect ecology but NOT? thought to be due to abstraction???.

Since 1900's (but more so since the 1960's) abstraction has been significant fraction of minimum flows. Flow gauge at Mislingford. (Low flows - minima 0.07-0.15 cumec, maxima 0.4 cumec).

Less cattle are now kept in the valley?

Much of sewage etc. goes direct to the sea resulting in a nett loss of water.

It is probable that most of the successful sea trout spawning activity and recruitment would take place in section (b). Significant improvements seem to have taken place in recent years and provided that there are still sea trout in the system (as seems to be the case) the restoration of adequate flows would permit recovery of the fishery (subject to "national" or marine factors operating) in the space of a decade or even less.

4. Berrie et al. (1980) report -

Six sites were sampled on the Meon (Figure 1).

1.5 km intermittent -3.5 km perennial -3.0 km intermittent Slight braiding beyond Meon Stoke. It is about 35 km long in total. Highest discharges occur in February March and lowest in August September (1957-1978 means). Flows over the year (monthly means) ranged from <0.4-1.8 cumec.

Ranunculus was only frequent at two of the six sites and was absent from three. At Meon site six where the river flows over tertiary clays chalk stream species (eg Ranunculus penicillatus) were absent.

Invertebrates were surveyed on a 25 m stretch. A ten minute (two five minute) bulked sample was used. 231 taxa were recorded with a slight downstream trend of decrease in number followed by an increase below site 3 in number of species. Various comparisons of species zonation etc are given (Tables 2 and 3). A distinctive invertebrate fauna relative to Test and Itchen was noted.

5. NRA - River Meon - 15.12.1992 *The lower reaches are historically sea trout fishing but now it belongs to the county council and is operated as nature reserves and fishing is very little if any. Some big redds were seen during surveys and when Anton Ibbotson did his fishing an 82 cm sea trout was caught. It is primarily a trout river with coarse fish at the bottom end (Tables 4 and 5). In the past it was felt that migratory fish did not go above Titchfield mill but a fish pass is now installed and there are passes at Fintley and Wickham as well. Occasional salmon run the river but Robin Crawshaw is not aware of the presence of salmon parr. Anton Ibbotson surveyed eight sites with the NRA last year (in 1991).*

Wickham to Warnsford is essentially brown trout. Above Wickham it is too small for fish of any kind really. The river is probably underfished and the only sizeable club is the Portsmouth Services Flyfishing Club, who stock with trout to some extent, but wild fish are also believed to be present. The stream comes off chalk in the upper catchment but downstream runs through sands and clays. Below Wickham and near Titchfield it is a coarse (lots of dace) and seatrout fishery. Other species now present include roach, bream, rudd and even chub. ***(see Table 5).***

6. Ibbotson Data - *The gradient diminishes from source to mouth as does average mid-point velocity. Width and width depth ratio are variable. High levels of instream and outstream cover generally occurred at the downstream sites with the exception of the site ten kilometres from the source where outstream cover was 55%. Gravel substrata were only common in the middle and upper reaches.* **(Table 4)**

Coarse fish and catadromous fish were only common in the most downstream reaches and, perhaps surprisingly in view of the time of year (October-November) so were sea trout. Brown trout occurred throughout the system and rainbow trout were clearly introduced to the upper reaches. **(Table 5)**

HAMBLE

The Hamble is quite a different issue. It is essentially a coarse fishery with a dam partway along its length. Above the dam, waters are apparently contaminated with sewage effluent. The weir itself is often incorrectly operated and may cause problems. Clay in the catchment causes rapid run off and the river is inclined to be flashy with very low flow rates in the summer months. The 1990 values could be a reasonable target for flow reinstatement.

1. NRA - "Surveys were carried out on the Hamble by the NRA the year before last" (?1990). Five sites were studied and the raw data is available for inspection. Over the years the river has been subject to a number of pollutions mostly from farm discharges. The Bishops Waltham sewage treatment works did produce rather poor effluent quality. A new works has been commissioned and the quality of the effluent is now much better.

There are some good quality fish mainly from NRA stocking in the past. The fishings carried out were on 1 upper tributary, 2 on main river, 1 on second major tributary, 1 on tideway tributary. There is no significant fishery but the mixed populations include some self sustaining brown trout. There are now roach perch, grayling (breeding from a stock introduced four years ago), eels and bullheads.

Years ago Robin Crawshaw did many invertebrate surveys which are in internal reports.

2. Notes from Charles Jones -

(a) Dry valleys and winterbournes above Bishops Waltham

(b) Pools and springs at the streams heads (The Moors, Bishops Pond etc.)

(c) Small perennial river down to the estuary

(d) The estuary

(a) and (b) are said to be of minimal importance to conservation and fisheries.

(d) is of some interest but not so sensitive to low flows.

(c) Complex with steady baseflow and flashy runoff. Abstraction is a high proportion of minimum runoff since 1943 (baseflow component). Flows are gauged at Frogmill.

Low flows (minima 0.05-0.1 cumec, maxima 0.2cumec)

Big improvements in water quality may be in train. There is, nevertheless, concern about low flows.

(b) The resilience of the aquatic system

Resilience of the system is believed to be a fairly minor matter but after the serious drought of 1976 the rivers may have taken some time to recover. In general terms -

Flows respond to changes in aquifer conditions and although failure to recharge in a given year may persist in its effects on stream discharge for one or two succeeding years the time scale of such influences is usually less than twelve months.

Water chemistry changes are generally variable within the scale of water transit times (a few days).

The biological resilience of the system is often dictated by plant growth patterns in response to annual discharge cycles. Failure in late Summer and Autumn to flush out aquatic macrophytes, and with them the accumulated sediments of the main growing season, can result in switches of plant community characteristics which then persist for several years or, if reinforced within this normal duration (by nutrient enrichment, high sediment loadings or repeated low flow years), become more or less permanent. In extreme cases a mixed association of rheophilous macrophytes may be replaced by carpets of undesirable filamentous algae. Because of interactions between the various photo autotrophic organisms such switches may be difficult to reverse.

As a rule, invertebrate communities are extremely resilient in a qualitative sense. The data required to assess quantitative resilience is rarely collected but overall the sensitivity of invertebrate communities to physical change (other than total change of sediment type) is poor.

Fish vary considerably in their life spans and reproductive periods from one or two years in the case of small species such as minnows and bullheads through a few years in grayling, trout, sea trout and salmon, to a decade or more in some cyprinids and even several decades in eels. Clearly the recovery of fish populations and communities from events and environmental changes is, to a degree species specific. Most of the species in the Meon and Hamble are likely to recover from damage to recruitment within a few years given that suitable conditions are reinstated.

(c) Advice on the biological factors relating to a recommended minimum acceptable flow regime

It may be possible to comment on the use of various methods to arrive at MAF values. *Specifically -*

With regard to the MAF values for the Meon and the Hamble, as far as I can ascertain at this stage and from the limited data at my disposal, values of roughly 0.11 cumec for Mislingford and 0.07 cumec for Frogmill, provided they did not occur with frequencies greater than about once in ten years, and that in the intervening years at least half the minimum flows were in excess of about 0.30 cumec and 0.15 cumec respectively, then the ecology of the rivers might be reasonably well sustained. Of course a great many factors are involved in the survival of particular species of plants, invertebrates and fish. Although higher plants may not, in themselves, be critical features for conservation they are nevertheless key hydrological factors and in complex interaction with flow regime, channel dimensions and water quality (nutrients) they govern the nature of lowland, hard-water streams. The objective should be to sustain vigorous growths of aquatic angiosperms which will localise silting, maintain high velocity channels in summer, compete effectively with filamentous algae and provide cover/shelter for invertebrates and fish.

(d) Comment on the biological component indicators within the NRA standard methodology

<u>*Difficulties perceived*</u>

Five ecological parameters are proposed. (Summary on p.41.)

*Neither **RIVPACS** nor **ASPT** are likely to be sensitive indicators of low flows. Indeed, it may often be difficult to detect shifts in invertebrate communities (which are very resilient) following quite massive changes in flow regime.*

Low flows (particularly intermittent low flows) may not shift fish communities from game to coarse but simply cause impoverishment. Decline in flows could well have a more striking impact on fishing than on the fish themselves.

"Potential" fish stock is very difficult to assess. There are few established meaningful correlations between habitat factors and fish populations. "Large" stocks may consist of large numbers of stunted fish generated by adverse environmental conditions or smaller numbers of bigger fish in good condition. Comparisons of past (≡potential) and present stocks will be hindered by changes in fishing conditions, methodology and equipment.

Plants - Not clear what is meant by "seasonal change in terrestrial plants in channel". How are long term changes in bankside flora to be assessed? Perhaps changes in plants could be assigned greater weight than at present suggested.

Conservation - presumably data on NCC designation is readily available?

(e) **Derive a cost indicator of the fisheries benefits. Some sort of assessment of the value of the sea trout/trout fishing**

The ***best*** *trout fishing ranges from 100 to 200 pounds per yard of double bank fishing but most are less and at worst the value is zero (Mr Evans talking to F&PFA 14.12.92). Good sea trout fishing* ***should*** *be of comparable value but is clearly subject to greater variation due to environmental factors and in general the fish are more difficult to catch. Salmon fishing is valued in terms of cost per fish and ranges from the ridiculous (14k per fish caught) to normal values of 2-3k per fish caught. The fisheries under consideration are clearly at the low end of any assessment as they stand at present but could be substantially increased given improvements in flow regime.*

Table 1 **Species of macrophytes recorded from each site on the River Meon. U = ubiquitous; D = downstream. After Berrie et al. 1980.**

	1	2	3	4	5	6
Fontinalis antipyretica Hedw.			+	+	+	
Ranunculus penicillatus var. *calcareus* (Butcher) C.D.K.Cook			+	+	+	
Barbarea vulgaris R. Br.						+
Nasturtium officinale R. Br.	+		+	+	+	
Filipendula ulmaria (L.) Maxim.					+	
Lythrum salicaria L.						+
Epilobium hirsutum L.	+	+	+	+	+	+
Callitriche stagnalis Scop.	+		+			
Callitriche platycarpa Kütz.	+		+		+	
Callitriche obtusangula Le Gall			+			
Apium nodiflorum (L.) Lag	+	+		+	+	+
Berula erecta (Huds.) Coville			+	+	+	
Oenanthe crocata L.				+		
Symphytum officinale L.						+
Myosotis scorpioides L.	+	+		+	+	+
Solanum dulcamara L.	+	+		+		
Scrophularia auriculata L.			+		+	+
Mimulus guttatus DC.				+		
Veronica beccabunga L.	+	+	+	+	+	+
Veronica catenata Pennell	+	+	+	+	+	+
Mentha aquatica L.	+	+	+	+		+
Lycopus europaeus L.		+	+		+	
Pulicaria dysenterica (L.) Bernh.				+	+	+
Elodea canadensis Michx.		+			+	+
Potamogeton pectinatus L.						+
Juncus inflexus L.	+			+		

	1	2	3	4	5	6
Iris pseudacorus L.			+			
Sparganium erectum L.		+	+	+	+	+
Sparganium emersum Rehman						+
Scirpus lacustris L.						+
Carex riparia Curtis				+		+
Carex acutiformis Ehrh.				+	+	
Glyceria fluitans (L.) R. Br.	+	+		+	+	
Glyceria maxima (Hartman) Holmberg						+
Phalaris arundinacea L.			+		+	+

Table 2 Some taxa with restricted distributions in the Meon. (After Berrie et al. 1980)

(a) Taxa found only at sites 1 and 2		
Polycelis felina	*Paracyclops fimbriatus*	*Psychoda* sp.
Dugesia polychroa	*Acanthrocyclops viridis*	*Psychoda alternata*
Crenobia alpina	*Amphinemura standfussi*	*Dixa nebulosa*
Valvata cristata	*Velia* sp. (nymph)	*Conchapelopia*
Armiger crista	*Agabus* sp.	*Sympotthastia* sp.
Ophidonais serpentina	*Ilybius fuliginosus*	*Odontomesa fulva*
Nais elinguis	*Helophorus* sp. larva	*Rheocricotopus*
Eiseniella tetraedra	*Helodes* sp. larva	*Simulium aureum* gp
Simocephalus vetulus	*Oulimnius troglodytes*	*Sciapus contristans*
Cypria ophthalmica	*Tipula lateralis*	*Limnophora*
Eucypris crassa	*Erioptera* sp.	Lonchopteridae
Eucypris lilljeborgi	*Pericoma fusca*	
(b) Taxa found only at site 6		
Lymnaea auricularia	*Callicorixa praeusta*	*Prionocyphon serricornis*
Gyraulus albus	*Sigara dorsalis*	*Cypris trimaculatus*
Acroloxus lacustris	*Sigara falleni*	*Phyganea bipunctata*
Ancylus fluviatilis	*Sigara fossarum*	*Mystacides azurea*
Limnodrilus claparedeianus	*Sigara venusta*	*Pilaris nemoralis* gp
Potamothrix hammoniensis	*Haliplus fluviatilis*	*Molophilus* sp.
Enchtraeidae	*Haliplus wehnckexi*	*Ablabesmyia*
Hemiclepsis marginata	*Laccophilus hyalinus*	*Procladius*
Eurycercus lamellatus	*Stictotarsus duodecimpustulatus*	Brillia longifurca
Macrocyclops albidus	*Hydroporus*	*Nanocladius*
Crangonyx pseudogracilis	*Gyrinus* sp. larva	Dicrotendipes
Gerris thoracicus	*Helphorus obscurus*	*Dictya* sp.
Gerris lacustris	*Helophorus grandis*	*Bibio pomonae*
Micronecta poweri	*Laccobius* sp. larva	

c) Taxa found at sites 5 and 6		
Nemotelus pantherinus	*Sialis lutaria*	*Limnodrilus udekemianus*
Limnephilus extricatus	*Oulimnius tuberculatus*	*Pisidium personatum*
Limnephilus rhombicus	*Asellus meridianus*	*Bithynia tentaculata*
Polycentropus irroratus	*Aulodrilus pluriseta*	
d) Taxa found at site 1 and/or 2, and 5 and/or 6		
Valvata piscinalis	*Nemoura cambrica*	*Potthastia gaedii* gp
Haplotaxis gordioides	*Haliplus* sp. larva	*Hemerodromia*
Candona neglecta	*Haliplus lineatocollis*	*Syntormon*
Cloeon dipterum	*Tipula montium*	Muscidae

Table 3 Taxa showing ubiquitous distributions in the Meon. (After Berrie et al. 1980)

a) Taxa found at six sites		
Pisidium casertanum	*Lumbriculus variegatus*	*Baetis rhodani*
Pisidium subtruncatum	*Helobdella stagnalis*	*Prodiamesa olivacea*
Pisidium nitidum	*Gammarus pulex*	*Orthocladius*
Psammoryctides barbatus	*Baetis vernus*	*Simulium ornatum*
b) Taxa found at five sites		
Polycelis nigra	*Erpobdella octoculata*	*Hydroptila*
Rhyacodrilus coccineus	*Ephemerella ignita*	*Limnephilus lunatus*
Piscicola geometra	*Elmis aenea*	*Potamophylax/Chaetopteryx*
Glossiphonia complanata	*Limnius volckmari*	*Micropsectra*

Table 4 **Physical data from the River Meon sites in 1991**

River catchment	Meon	Meon	Meon	Meon	Meon	Meon	Meon
Map reference	SU 626 234	SU 612 207	SU 608 184	SU 609 185	SU 580 123	SU 543 056	SU 544 047
Date measured	30.9.91	30.9.91	6.12.91	6.12.91	14.10.91	15.10.91	15.11.91
Gradient (m/km)	2.6	1.9	1.7	1.7	1.8	0.4	0.4
Distance from source (km)	6.5	10	12	11.9	20.5	33	34.5
Length (m)	59	85	85	105	170	100	113
Area (hectare)	0.023	0.053	0.050	0.057	0.097	0.039	0.059
Average depth (m)	0.17	0.20	0.22	0.12	0.23	0.58	0.69
Average midpoint depth (m)	0.23	0.32	0.32	0.19	0.39	0.78	0.97
Average velocity (m/s)		0.17	0.17	0.15	0.14	0.08	
Average midpoint velocity (m/s)		0.32	0.31	0.28	0.25	0.13	
Average width (m)	3.8	6.3	5.8	5.5	5.7	3.9	5.2
Width/depth	22.4	30.6	27.1	46.4	25.1	6.7	7.5
% instream cover	17	6	5	11	2	38	24
% outstream cover	11	55	14	6	33	86	36
% total cover	19	90	16	61	33	89	40
% silt	100	47	51	53	26	100	100
% sand	0	0	9	2	2	0	0
% fg	0	26	7	11	0	0	0
% cg	0	26	28	32	57	0	0

% pebbles	0	2	5	2	10	0	0
disc		0.28	0.27	0.16	0.19	0.21	
gm part	0.0	12.0	15.5	13.9	30.4	0.0	0.0
% perm cover	0	52	9	2	33	78	8

Table 5 Fish from the River Meon sites in 1991

	Upstream						Downstream
River catchment	Meon	Meon	Meon	Meon	Meon	Meon	Meon
Map reference	SU 626 234	SU 612 207	SU 608 184	SU 609 185	SU 580 123	SU 543 056	SU 544 047
Date measured	30.9.91	30.9.91	6.12.91	6.12.91	14.10.91	15.10.91	15.11.91
Trout (n/ha)	266	2589	40	122	1434	179	68
Sea trout (n/ha)	0	0	0	0	0	765	51
Rainbow (n/ha)	44	113	0	0	0	0	0
Salmon(n/ha)	0	0	0	0	0	0	0
Grayling (n/ha)	0	0	0	0	0	26	0
Dace (n/ha)	0	0	0	0	0	9643	854
Roach (n/ha)	0	0	0	0	0	128	17
Rudd (n/ha)	0	0	0	0	0	0	171
Pike (n/ha)	0	0	0	0	0	0	0
Perch (n/ha)	0	0	0	0	0	51	0
Barbel (n/ha)	0	0	0	0	0	0	0
Bream (n/ha)	0	0	0	0	0	26	0
Gudgeon (n/ha)	0	0	0	0	0	0	0
Eel (n/ha)	*	*	*	*	*	*	*

Flounder (n/ha)	0	0	0	0	0	332	376
3 spined Stickleback	*	0	0	0	*	0	0
10 spined Stickleback	0	0	0	0	0	0	0
Bullhead	0	*	*	*	*	0	0
Minnow	0	0	*	*	*	*	*
Stone loach	0	0	0	0	0	0	0
Lamprey	0	*	*	*	*	*	*

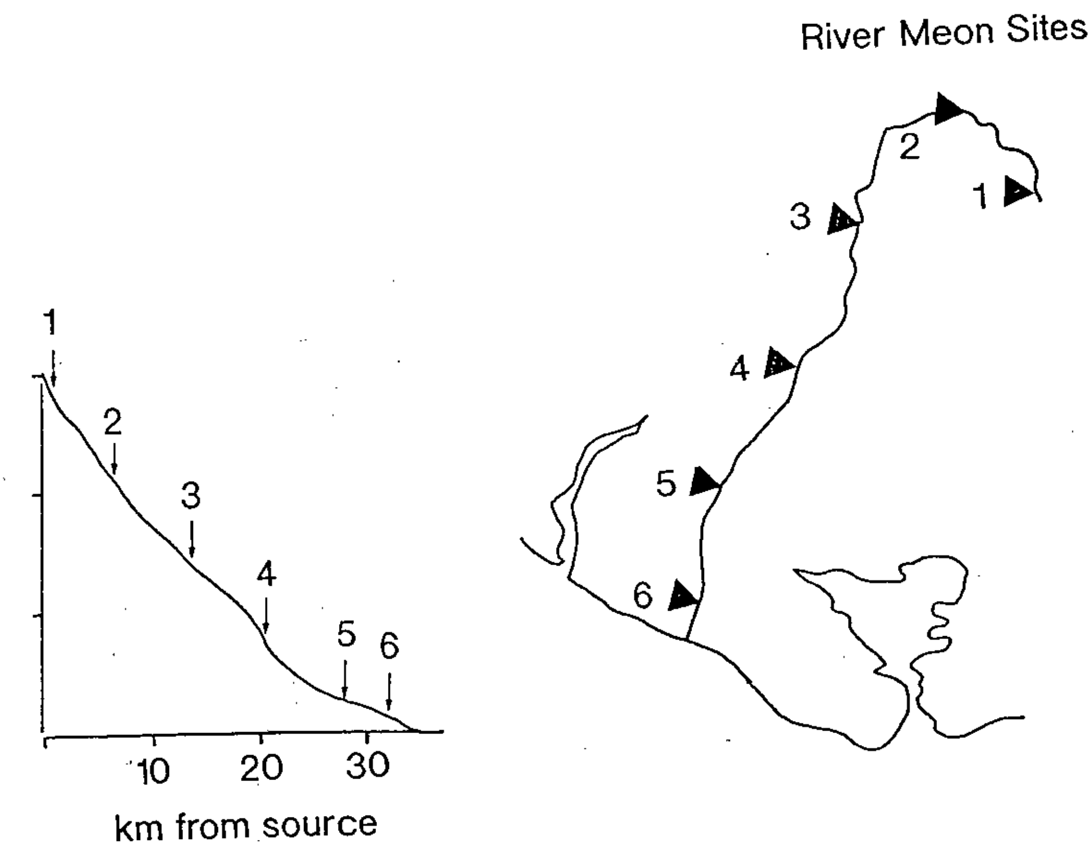

FIGURE 1.

Natural
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