



## Report

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## **The 1998 smolt run on the River Frome**

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## Introduction

This is the fourth year of counting salmon smolts on the R. Frome. During this time, novel systems have been tested, both to deflect smolts and to count them. Equipment for both these areas has been evolving over this period to increase accuracy and to reduce manpower. Although the objectives are as listed below, the priority for the 1998 smolt run was to test the efficacy of deflecting smolts into the new smolt channel (first installed in 1997) and to determine a counting protocol using, video recording, automatic smolt counters or a combination of both.

## Objectives

1. To produce an accurate estimate of the number of smolts migrating downstream during the spring run.
2. To maximise the proportion of smolts passing the counting systems
3. To minimise the effort needed to run the counters
4. To fully automate the counting systems

This report deals with objective 1 only.

## Experimental design

The basic design of the smolt counting systems was the same as in 1997 namely a BAFF (Bio-Acoustic Fish Fence) in the main River Frome, upstream of the adult salmon counter, deflecting smolts to counting stations in the East Stoke Millstream.

The New Smolt Channel situated in the side channel of the millstream was operational from 31 March. Fish were deflected to this counting station by a variety of systems and positions during the spring migration system.

The Fluvarium counting stations were first operated on 16 March, earlier than the previous year in an attempt to determine the start of the smolt season and the cleaning regime needed for the weed screens. They were subsequently operated on 19, 23, 24, 30 and 31 March, 3, 6-9, 11-20 April and 21 April to 19 May. Non-operational time was due mainly to flood events and very high water levels.

## Results

The daily count of smolts passing through all counters is shown in Fig 1. Smolt occurrences were sporadic until 30 March when the first sustained run was recorded over a 5 day period. Heavy rain in early April caused the first flood of the season and the counter was not operational for some periods until 6 April when high numbers (~~200~~ <sup>>100</sup>) were recorded on two successive days. It is likely that there was a run on 4-5 April when the high water precluded the operation of the counters. Smolts were recorded on all subsequent days to the end of the study although numbers were generally low (<50), reaching peaks of c. 100 individuals on two days only.

### **Diel pattern of movement**

For the majority of the smolt run, high percentages of movement occurred in darkness (20.00 – 03.59 hr) (Fig 2). The pattern of migration changed from 8 May when most smolts migrated in daylight (04.00 – 19.59 hr). This change was well defined, changing from c. 80% in darkness to 80% in daylight in a few days (Fig 2). This coincided with a rise in temperature above 12°C. It was noticeable that no large shoals of smolts were seen in daylight in 1998, unlike previous years.

### **Length frequency distribution of salmon smolts**

The modal length of salmon parr was 15.5 cm with the majority being in the 14-18 cm range. Very small numbers of smolts > 20 cm were present (Fig 3). It is expected that these were 2+ smolts. They comprised 2.6% of the number seen and contrast with the data from adult catches (over the previous 25 years) which shows that 12.6% were derived from 2+ smolts. Parr surveys in the Frome catchment in October 1998 showed 5% of the fish at a size suggesting that they would smolt at 2+ which is in better agreement with the smolt counter data. This shows that there has been either a reduction in the number of 2+ smolts produced in the Frome or that there is differential mortality at sea which increases the proportion of fish returning which were derived from 2 + smolts.

### **Estimate of the run of smolts in the R. Frome**

The estimate is based on the number of smolts passing through the counting stations and the efficiency estimates of the acoustic bubble screen in the main river.

Smolt movement was split into day and night as acoustic bubble screen efficiencies change between daylight and darkness.

The total number of smolts passing through the counting stations were:

Daylight	450
Darkness	1474

The counters were not fully operational on several occasions due to adverse environmental conditions. Estimates of numbers missed were based on means of data from the previous and following days for the appropriate time periods. Estimates of these additional counts were: daylight 116, darkness 526, giving estimated total numbers in daylight of 566 and darkness of 2000.

The efficiency of the main river acoustic bubble screen was calculated from data collected at the smolt counters in the millstream and video recordings of smolts passing the salmon counter (ie having passed through the acoustic bubble screen). Due to turbid water conditions, video recording was not possible until May, towards the end of the smolt migration. At this time, the acoustic bubble screen was not working correctly, gaps could be seen in the bubble curtain and the sound was intermittent. As a result, the calculated efficiencies for daylight and darkness were low, being 16% and 18% respectively.

Using these estimates of efficiency and assuming that 32% of the smolts would naturally use the millstream (32% of the discharge was measured in the millstream between 16 March and 20 May), the calculated total run of smolts for the R. Frome is 10783.

This is expected to be an overestimate because the acoustic bubble screen was working at a higher efficiency earlier in the study period. For this reason, the total run was recalculated using acoustic efficiency estimates from 1997 for when it was working correctly and reducing the efficiency estimates in accordance with a subjective assessment of the bubble curtain and sound quality based on observations of the screen during the time it was operational.

Table 1 Efficiency estimates, numbers counted in daylight and darkness and total run.

Period	Efficiency (day) %	Efficiency (night) %	Count (day)	Count (night)	Calculated smolt run
19 March - 22 March	37	80	0	4	5
23 March - 1 April	30	70	9	53	91
2 April - 14 April	37	80	180	850	1383
15 April - 17 April	28	60	20	242	408
18 April - 19 April	0	0	18	124	443
20 April - 20 May	16	18	325	745	4540

From data given in Table 1, **the grand total of smolts migrating through East Stoke was estimated at 6870.**

Whilst the calculations of this estimate involved several assumptions and efficiency estimate corrections, it is considered to be the best estimate for 1998.

Figure 1. Daily count of smolts passing through all counters together with total daily discharge (millstream + main river)

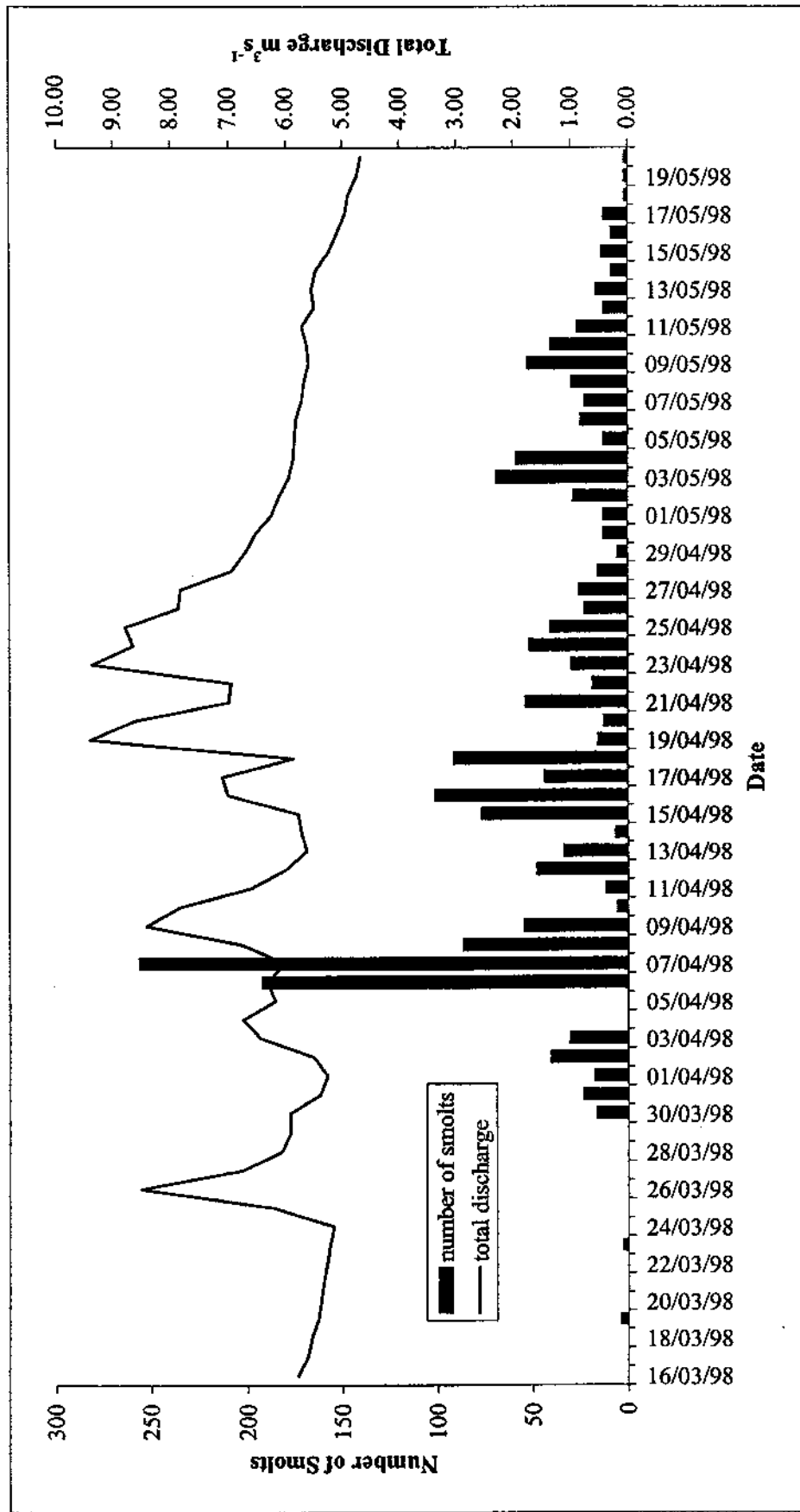


Figure 2. Percentage of smolts moving at night and average daily water temperature

