Fundy Model Forest

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Report Title: Effects of Riparian Zone Management on Fish Community Structure: Hayward and Holmes Brook Study: Final Report 1995

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C10C

HOLMES AND HAYWARD BROOK FISH COMMUNITY STUDY

1996

Revised July 16, 1996

Alyre Chiasson
Université de Moncton

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Submitted to the Fundy Model Forest

March 1, 1996

Revised July 5, 1996

by

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Introduction

This report cover the second year in a three year study to investigate the effects of changes in riparian zone widths on both fish habitat and abundance. In 1994, the first year of the study baseline data was collected in preparation for 1995 when actual cutting would take place. Methodology and study sites have been consistent throughout the study and are outlined in the initial proposal of 1994 as well as in the recent publication by Chiasson (1995). In 1995, J.D. Irving commenced harvesting at all study sites. Presently, there are two sites designated as 30 m buffer strips, two as 60 m buffer strips and two control sites where no cutting will take place. The following year is critical and paramount to the completion of the project as it will evaluate the effects of the first year subsequent to harvesting. The previous two year of data collecting have been able to meet and exceed the initial goals set forth in the 1994 proposal. Projections are for a similar year in 1996.

Results from the 1994 field season were presented at the **48th CWRA Annual Conference on Managing the water environment** and was published as part of the proceedings. Terrance Melanson continues to work on both the project and the field data as part of his Master's program at the Université de Moncton. We will take full advantage of local conferences to present more recent results from this study. In 1995, we were also successful in obtaining funding from the **On Site** program which covered a large portion of the salary for Thomas Groundwater our field assistant. Based on satisfactory results on the part of both participants, application for additional funding from **On Site** in 1996 has a reasonable expectancy of success.

Review of goals

The initial project proposal identified a number of areas of research and data collection required to assess changes in both fish abundance and distribution as well as physical changes to fish habitat both prior to and following experimental changes in riparian zones widths. These have consisted of fish trapping, electrofishing, quantification of physical habitat based on a subdivision into pools, runs and riffles as well as analysis of woody debris. These goals have all been meet in 1995. I have also been able to accomplish the additional goal set out in the 1995, which was to include another sampling site at the confluence of sites 5 and 6 (Figure 1). This site, labelled 11, was electrofished in early summer. The intention was to intercept any movement of fish out of the study sites on Hayward Brook. Fall sampling included trapping at all sites. In conclusion, goals set forth last year in the request for renewal of funding have all been meet. The major features of the data collected in 1995 are presented in the following sections.

Fish sampling in 1995

Trapping

Sampling dates for fish in 1995 are presented in Table 1. As in the previous year sampling included a late June early July period, a late July and early August period and a period in October and November. Total number of fish captured by trap in 1994 and 1995 are showed in Table 2 . A total of 18 traps were set in each study site on each date.

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Table 1. Sampling dates for trapping and electrofishing in 1995.

	Site	Date (1995)
Electrofishing	5,6	June 7
	3,11	June 28
	4,9	June 29
	10	June 30
	5,6	July 18
	3,4	July 19
	9	July 20
	10	July 22
Trapping*	5,6	June 15,16
	3,4	July 5 ,6
	9,10	July 11,12
	5,6	July 27, 28
	3,10	August 3,4
	4,9	August 9,10

*(fished on each day for a two day period)

Table 2. Total number of fish captured using G-traps.

Site	1994	1995
3	62	45
4	32	9
5	51	88
6	53	79
9	56	60
10	127	102
Total	381	383

Overall, the total number of fish captured by trap in 1995 (383) was almost identical to 1994 (381). However, the most noticeable difference in the number of fish captured was in site number 4 which ran dry in both years. This difference cannot be explained by sampling dates which are only several days apart in 1994 and 1995. The very dry conditions in the summer of 1994 coupled with a beaver dam downstream of the study site suggested that fish were lost from the upper reaches in 1994 and did not or could not return in 1995. Results that were unique to the 1995 season was the capture of a several eels which were absent from surveys conducted in 1994.

Electrofishing

Electrofishing results during the summer sampling period in 1995 had a number of differences compared with 1994 results (Table 3). Site number 4 has a greater number of fish in early July compared with later in the season when the tributary was virtually dry in the upper reaches. The early July date in 1994 compares more closely with the later date

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Table 3. Electrofishing results from the summer of 1994 and 1995. Number of fish per 100 m².

	1995		1994
Site	Early July	Late July-August	Early July
3	48	48	40
4	34	17	15
5	18	35	27
6	28	39	23
9	45	63	32
10	87	58	not sampled

Fall sampling

Fish were sampled using G-traps in the fall of 1995 and using electrofishing in 1994 (Figure 2). Electrofishing in the fall of 1995 could not be conducted as equipment was not available. Unlike the previous year (see 1994 report) there was no evidence of an influx of spawning fish during the fall (Table 3). Sampling in 1995 was later than 1994 and was conducted by trapping rather than electrofishing, which may explain the difference between years. Only active fish are susceptible to fixed traps, whereas electrofishing captures any fish in the path of the electrical field. Spawning fish hold and defending territories in the fall making them less likely to enter traps. In addition, fish captured in the fall of 1995 appeared to be spent, suggesting that the peak of spawning activity may have been over at the time of sampling.

Habitat analysis

As in the pervious year the length, width and depth of each pool, run and riffle were measured. Last year no correlation was found between fish abundance and the variables used to describe each habitat type (Chiasson 1995). Unless habitat conditions were limiting in 1995, no correlation is anticipated in 1995. Nevertheless, data will serve to classify changes in aquatic habitat prior and subsequent to cutting. This pattern may change in 1996 as post-cutting conditions will be in effect. Measurements for pools, runs and riffles are found in Tables 5 to 7.

Table 4. Fish captured in the fall of 1995 using G-traps and fish captured in the fall of 1994 using electrofishing.

Site	1994[1]	1995[2]
3	70	0.56
4	134	0.75
5	74	1.03
6	26	1.08
9	80	0.78
10	NA	0.94

[1]Number of fish captured per 100 m^2
[2]Catch per unit effort (fish per trap per day)

Substrate composition

Substrate composition in pools was conducted as in previous year by placing a 1 m^2 grid subdivided into 625 cm^2 grids over the first ten pools in each study site. Results were consistent with the previous year in that sand remained the dominant component in most study sites. However, unlike 1994, sand was the dominant component at all sites in 1995.

Woody debris

Information on the distribution and quantity of woody debris was collected as in 1994 by drawing sketches for the first 25 m in study sites 5 (30 m buffer strip) and the control site number 3. The data are complex and efforts are currently underway to devise a statistical method that will permit detection of changes over time as well as correlations with fish distribution.

Physical habitat description and fish abundance and distribution

The physical habitat measurements for pools runs and riffles were plotted against trapping and electrofishing results (Figure 3, 4). Graphical analysis at this time supports the conclusion that as in 1994 there is no correlation between habitat description variables found in Tables 4-6 and fish abundance measured by either electrofishing or trapping. Study sites 3, 9 and 10 contained the largest number of fish trapped in 1994 whereas sites 5 and 10 contained the largest numbers in 1995. Study sites 3 and 9 contained the largest number of fish caught by electrofishing in both 1994 and 1995. However, based upon graphical analysis it is unlikely that any of these differences will be significant.

Substrate type and fish distribution

Based upon initial graphical analysis there appear to be no evident correlation between the substrate composition in pools at any of the study sites compared with number of fish caught in the traps (Figure 5). Sites 5, 6 and 10 have the higher catch rates but do not

Table 5. Physical description of pool habitat in 1995.

Pools

	mean(cm)		
Site	Length	Width	Depth
3	125	66	13
4	186	125	17
5	196	70	23
6	143	76	16
9	258	96	22
10	126	109	21

Table 6. Physical description of runs habitat in 1995.

Runs

	mean (cm)		
Site	Length	Width	Depth
3	227	150	14
4	188	112	14
5	421	226	29
6	221	133	15
9	462	266	24
10	306	129	17

Table 7. Physical description of riffles habitat in 1995.

Runs

	mean (cm)		
Site	Length	Width	Depth
3	431	136	12
4	584	84	7
5	461	215	17
6	353	136	11
9	594	274	12
10	337	114	11

appear to be correlated with substrate type. The electrofishing results also indicate no clear correlation between substrate type and fish abundance (Figure 6). This is in agreement with the 1994 results (Chiasson 1995). In both cases it is believed that fish in both Hayward and Holmes Brooks are not limited by habitat type or availability. Primary productivity is more likely to limit trout production in such small streams. This hypothesis is being examined by looking at water quality data provided by Environment Canada. If primary production is the limiting factor an increase in nutrients should result in an increase in biomass as long as other remaining water quality and habitat variables remain unchanged.

Projections for 1996

No changes in methodology and approach are foreseen for 1996. General agreement between electrofished and trapping data indicate that these methods are reliable indicators of abundance of brook trout in both Hayward and Holmes watersheds. Changes in habitat variables are more likely to be evident during the crucial post-treatment phase in 1996. In combination with water quality data from Environment Canada we are confident that the initial goals set forth in the 1994 proposal can be completed and even surpassed in 1996.

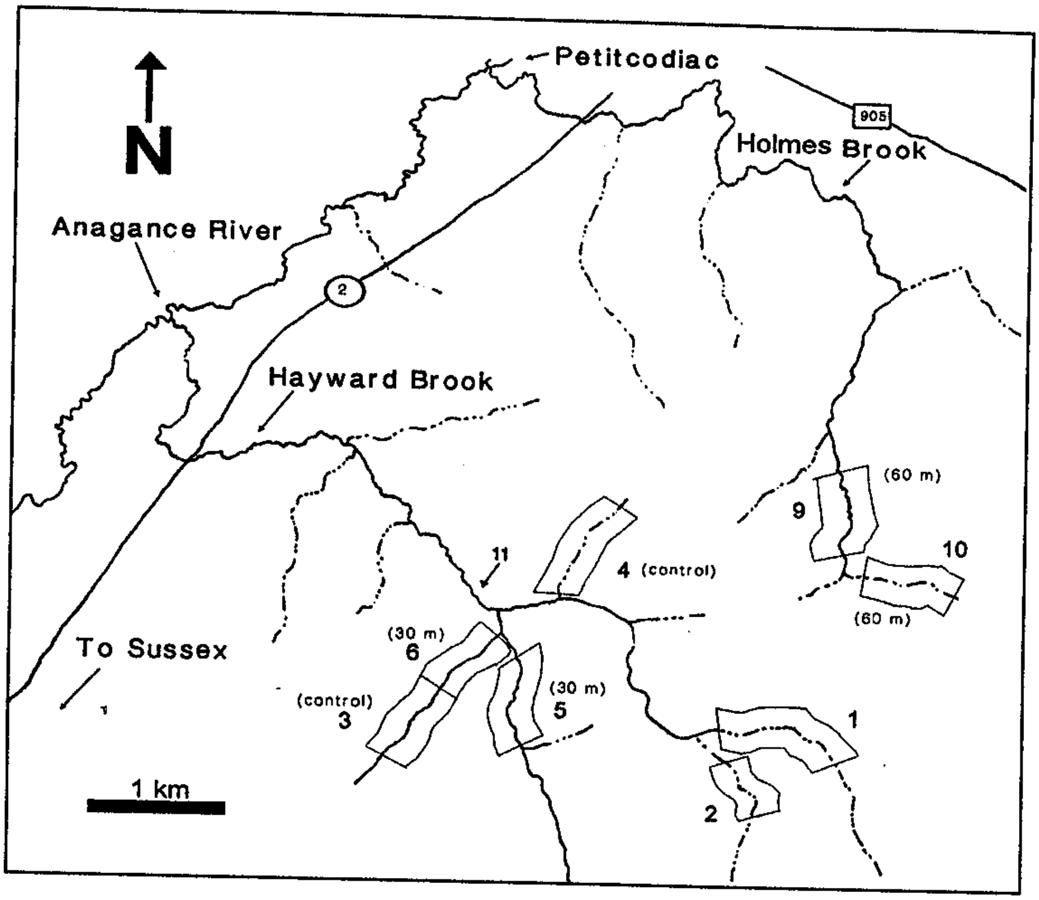

Figure 1. Map of the study sites, Hayward and Holmes Brook watersheds, New Brunswick, Canada.

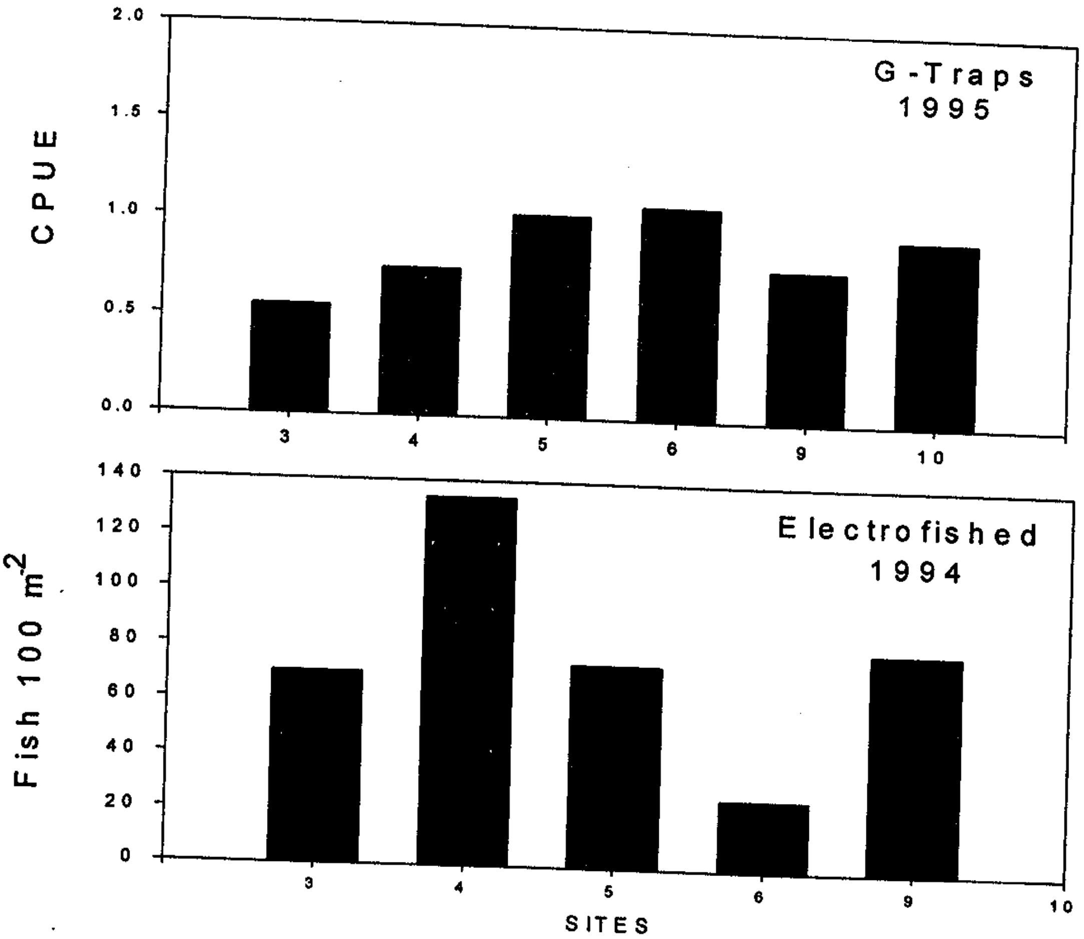

Figure 2. Fish captured in the fall in 1995 using G-traps and in 1994 using electrofishing. Site 10 was not electrofished due to inaccessibility of location to equipment.

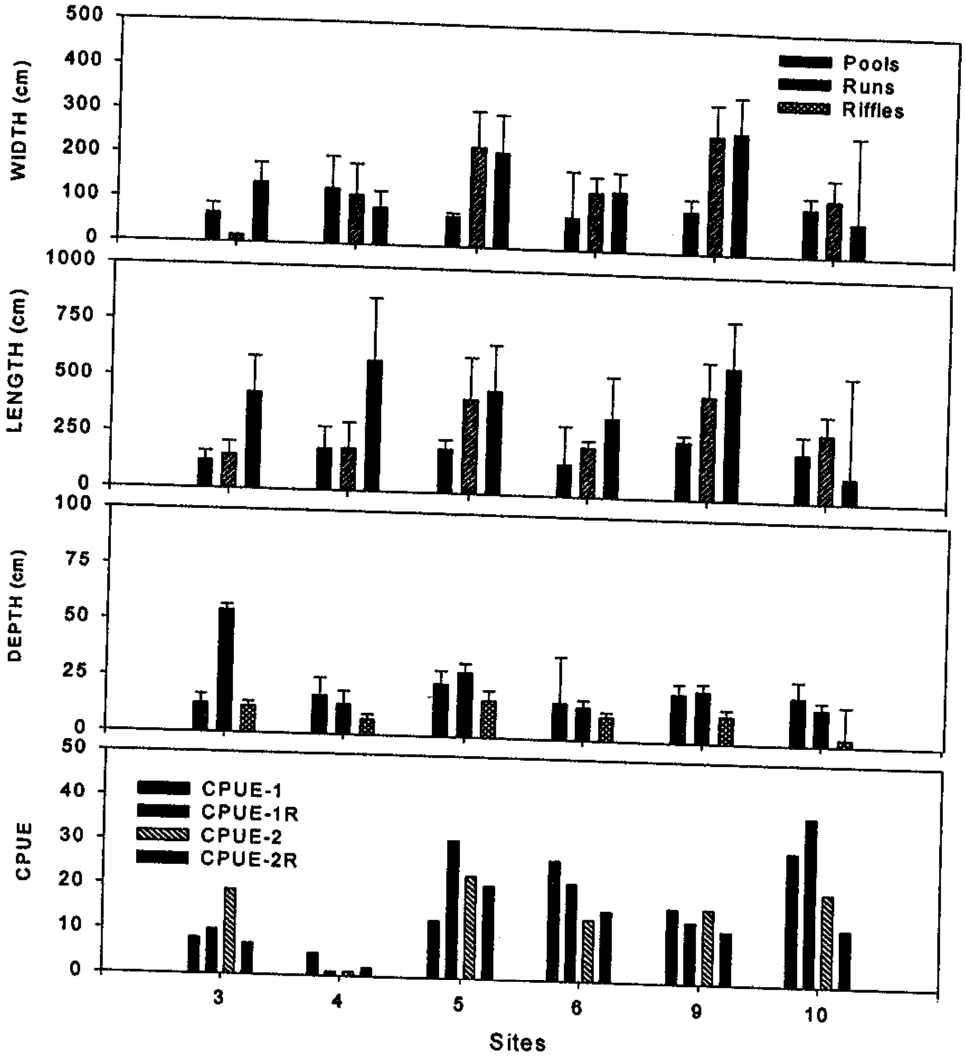

Figure 3. Width, length and depths of pools, runs and riffles plotted with catch per unit effort (CPUE) using G-traps for early summer sampling dates and replicates (1, 1R) and late summer sampling dates (2, 2R). Site descriptions: 3 and 4 (controls), 5 and 6 (30 m buffer strips) and 9 and 10 (60 m buffer strips).

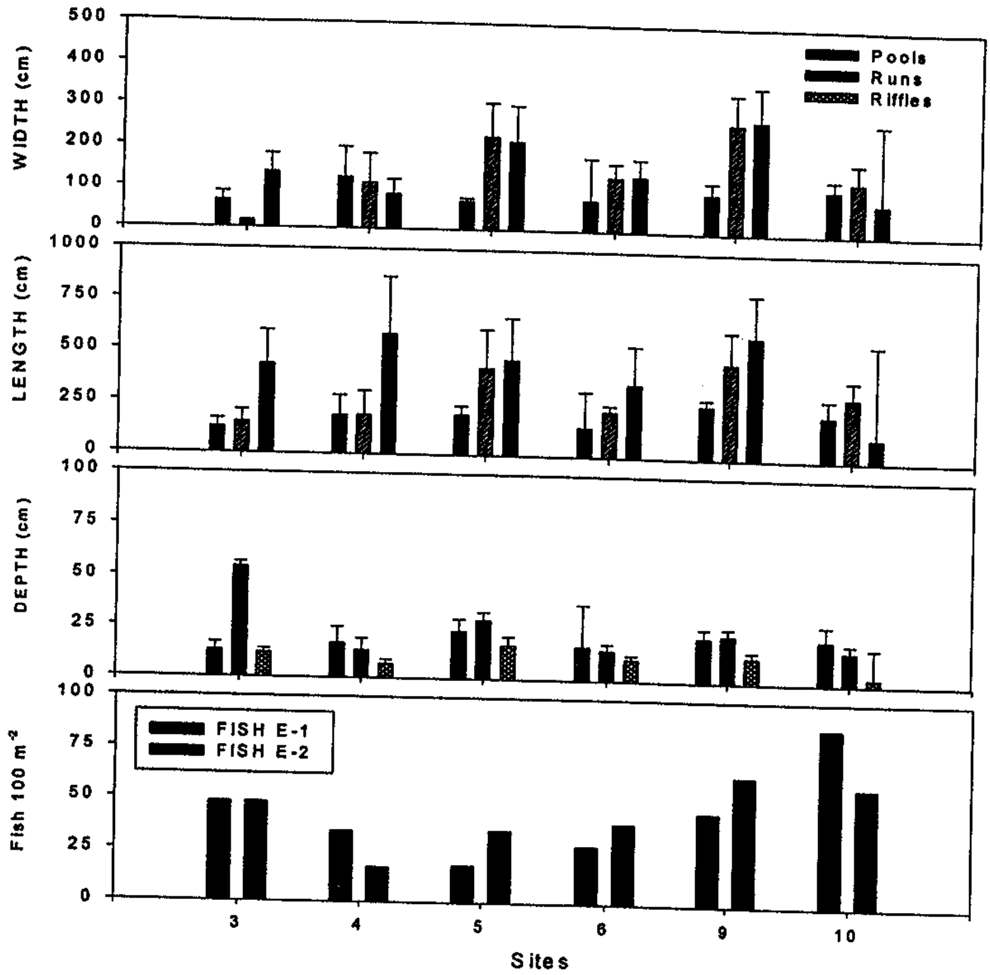

Figure 4. Width, length and depths of pools, runs and riffles plotted against total fish caught per 100 m² using electrofishing for early summer sampling dates (E1) and late summer sampling dates (E2). Site descriptions: 3 and 4 (controls), 5 and 6 (30 m buffer strips) and 9 and 10 (60 m buffer strips).

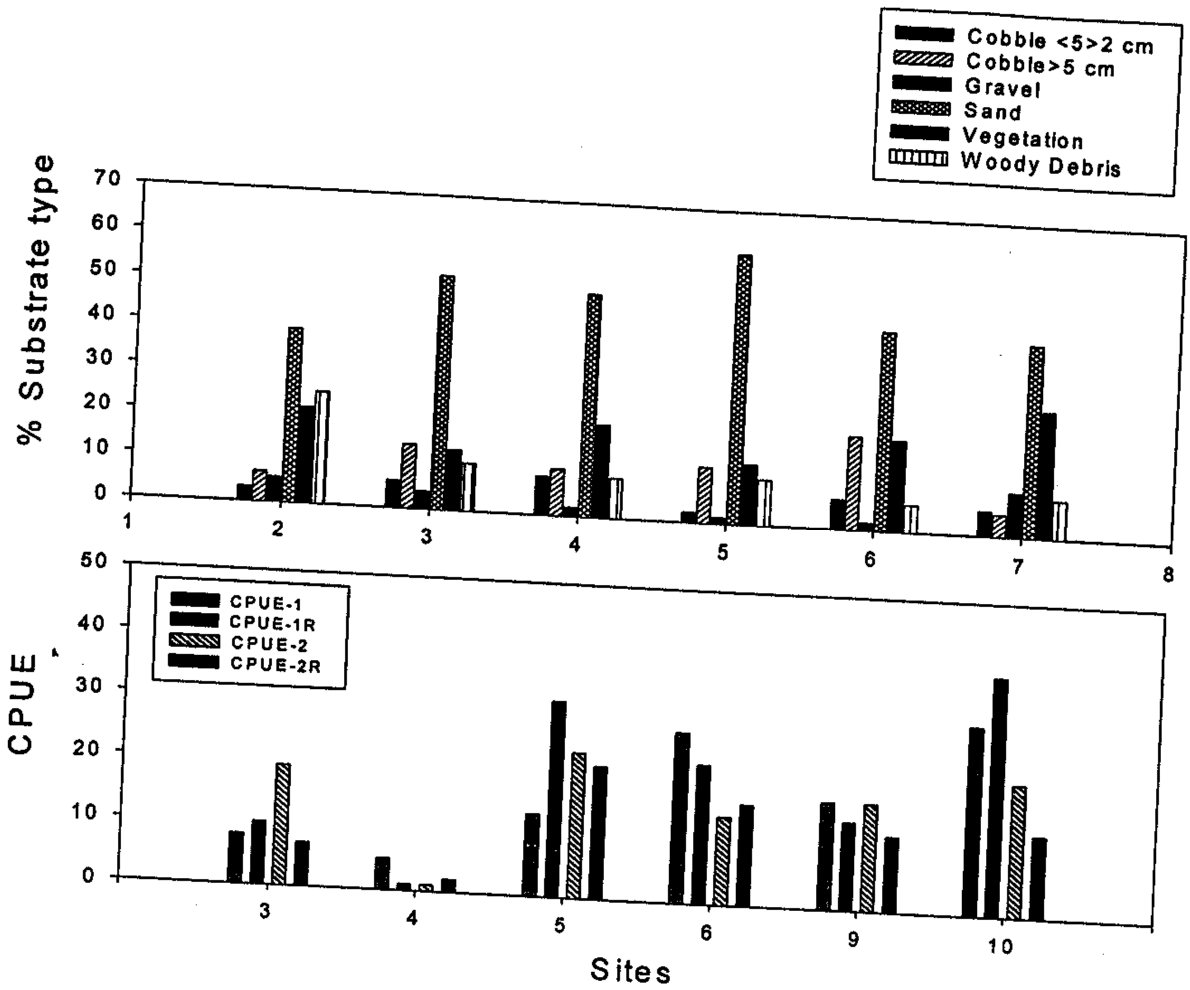

Figure 5. Percent composition of the bottom substrate in the first 10 pools of each study site plotted against CPUE for early (1, 1R) and late summer sampling dates(2,2R). S.C. = small cobble, L.C.=large cobble, G=gravel, S=sand, V=vegetation, W.D.=woody debris, R=replicates. Site descriptions: 3 and 4 (control), 5 and 6 (30 m buffer strip) and 9 and 10 (60 m buffer strip).

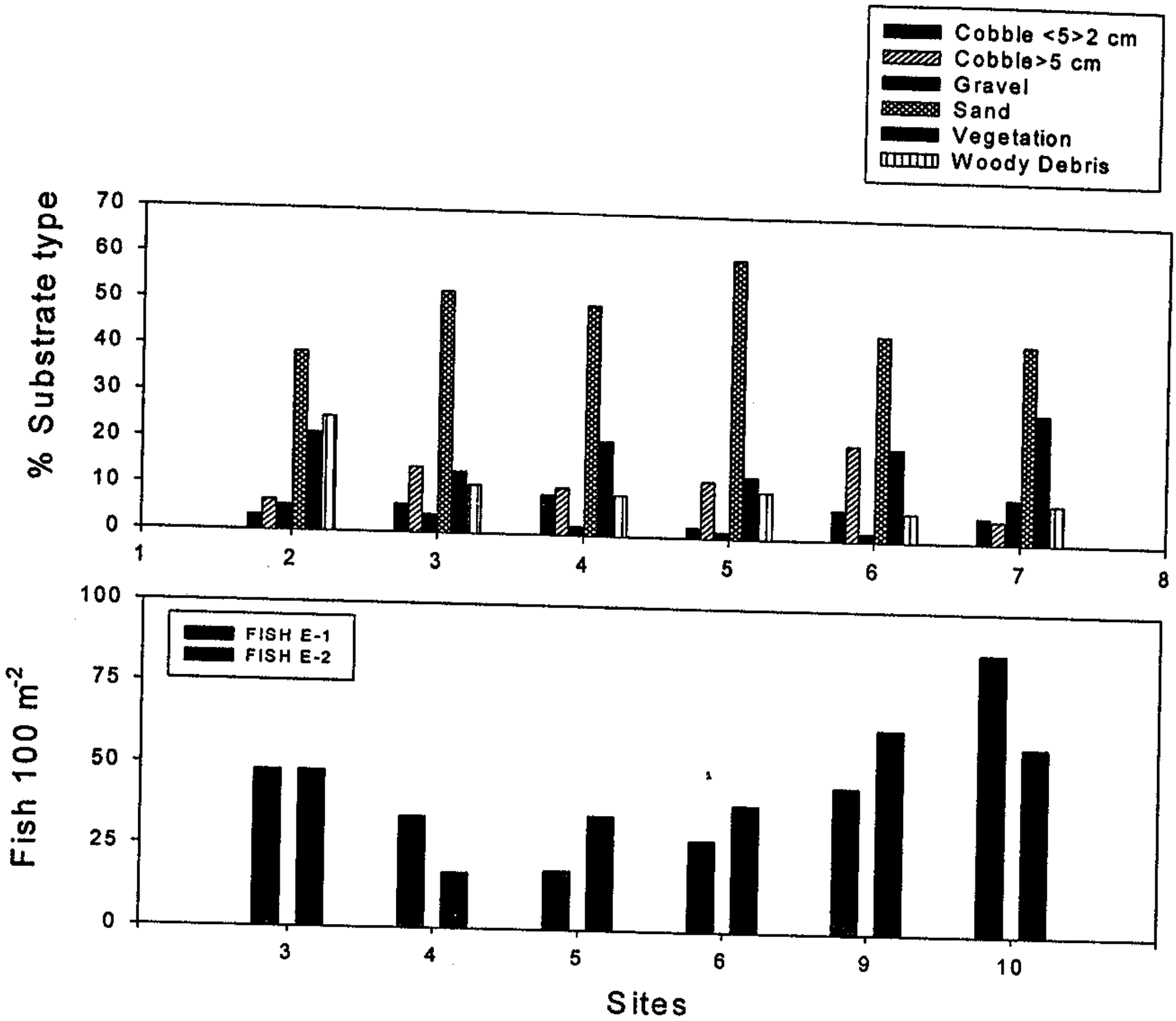

Figure 6. Percent composition of the bottom substrate in the first 10 pools of each study site plotted against fish per 100 m^2 using electrofishing for early (1) and late (2) sampling dates. S.C.=small cobble, L.C.=large cobble, G=gravel, S=sand, V=vegetation, W.D.=woody debris. Site descriptions: 3 and 4 (control), 5 and 6 (30 m buffer strip) and 9 and 10 1(60 m buffer strip).