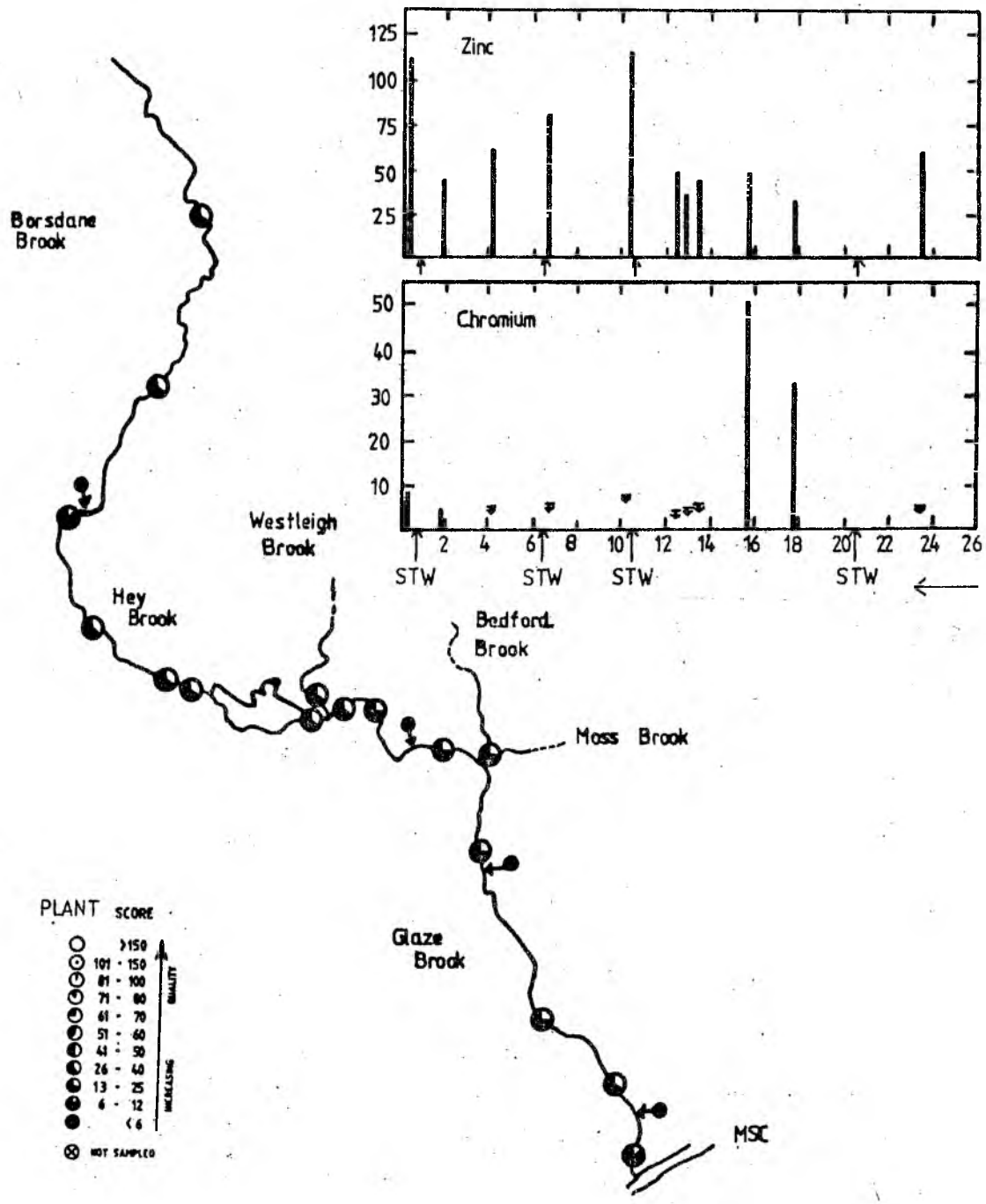
NWWA – RIVERS DIVN.
SCIENTISTS DEPT.
BIOLOGY SOUTH

Intensive biological survey of the Glaze Brook Catchment: Supplementary Report on the water quality as indicated by Macrophytes.

AUGUST 1981



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Introduction

This report describes the results of the macrophyte survey including data on their distribution and the prevailing water quality (nutrient status and toxic metal contamination). It supplements the initial report, TS-BS-81-3, which described the macroinvertebrate survey.

Aims

All the aims outlined in TS-BS-81-3 were applicable to this survey with the following additions:-

(1) To describe the distribution of macrophytes within the river, paying attention to areas where weed growth may directly affect water quality or amenity usage.

(11) To describe the distribution of toxic metals.

Method

(1) At 16 (No) sites 500m lengths of river were surveyed (Table 1), noting the relative abundance and percentage cover of the macrophytes* present (Table 2). Plant score and Community Description Class (C.D.C.) were computed.

* A MACROPHYTE is any plant observed by the naked eye.

(2) At each of the sites two species of macrophyte - Cladophora glomerata and Potamogeton pectinatus were collected for the elucidation of the distribution of toxic metals in the Glaze Brook catchment. These two species can be found at most sites on the Glaze. The plant material was prepared for analysis using the method described by Harding (197).

Results

The results are appended in the following form:-

(1) Plant scores and plant community description class (C.D.C.) with comments on the water quality.
(11) Plant score pie-chart map - Fig.1
(111) Macrophyte species list - Table 2
(1V) The spatial distribution of toxic metals in Cladophora glomerata and Potamogeton pectinatus as pie-charts Fig. 2 - 5
(V) The toxic metal concentrations in Cladophora and Potamogeton - Table 3.
(V1) The toxic metal concentrations in Caldophora and Potamogeton versus kilometre distance - Fig. 6 and 7

Main points of interest

(1) from Macrophyte distribution.

* Nutrient enrichment indicated upstream of Dicconson Lane (?)
* Slight deterioration in W.Q. below Hindley STW since 1980.
* Improvement in W.Q. between Leigh and Irlam since 1980.

(11) from Macrophyte/metals

The immediate question that comes from this data - "How do these concentrations relate to the aqueous concentration?" - must remain unanswered for the moment. Similar data is currently being collected on all catchments in the area and it is planned to collect macrophyte/metals data from key points so that a "rule-of-thumb" relationship between macrophyte/metal versus water/metal concentrations can be elucidated.

The spatial distribution of metals in the catchment, however, did reveal some interesting points (for detail see Fig. 6 and 7).

* Source of chromium at Aye Bridge (?)
* Each sewage work's effect on metal concentrations was apparent, particularly in the case of zinc.

Sample point:	Previous samples			Present sample	Comments
	-	-	1980		

N.B. Our experience of using macrophyte communities as indicators of river water quality is limited but we do intend to develop this method to the same level of competence as our current usage of invertebrates. For this reason, the confidence of our statements on W.Q. may be questionable until we have had a few more years experience.

GLAZE BROOK

1.	Dicconson Lane	(627075)	-	-	-	36cb	Thick Cladophora with more of the pollution tolerant moss, Amblystegiu than the sensitive species Rhynchestegium. Poor W.Q. indicated - constant nutrient enrichment?
2.	Hindley	(620046)	-	-	38cc	15ca	Very thick Cladophora - slight down stream improvement in W.Q. indicate BUT marked deterioration since 1980 - due to problems upstream of Dicconsin Lane.
3.	Platt Bridge	(603023)	-	-	28bc	11bb	Poor W.Q. - downstream deterioration in W.Q. - indicated by absence of Cladophora. Similarly deterioration in W.Q. since 1980 when Cladophora was present.
4.	Aye Bridge	(607004)	-	-	42bb	26bc	Fair W.Q. - downstream improvement in W.Q. indicated by reappearance of Cladophora. Slight deterioration in W.Q. since 1980.
5.	u/s Pennington Flash, u/s A578	(625995)	-	-	25bb	31cb	Fair W.Q. - further downstream improvement in W.Q. indicated with Cladophora dominant. No change in W.Q. since 1980.
6.	u/s Pennington Flash, d/s A578	(627994)	-	-	13dd	29dc	Fair W.Q. Similar dramatic change in flora as recorded in 1980 with massive beds of Potamogeton pectinatus appearing for first time d/s road. SP 5 and SP6 are close together in order to monitor the progrssion of P. pectinatus up the river, its presence may lead to land drainage or fishery/amenity problems in the future. Improvement in W.Q. indicated since 1980.

Sample point:	Previous samples			Present sample	Comments
	-	-	1980		
7. d/s Pennington Flash (646988)	-	-	58db	34bc	Fair W.Q. Slight improvement in W.Q. compared with SP6. Deterioration in W.Q. since 1980 indicated by the absence of P.perfoliatus, Myriophyllum, and Elodea
8. d/s Westleigh Brook (650990)	-	-	45dd	29dc	Fair W.Q. Deterioration in W.Q. since 1980.
9. u/s Leigh S.T.W. (647985)	-	-	-	24dc	Fair W.Q. No change in W.Q. between SP8 and SP9
10. d/s Leigh S.T.W. (667984)	-	-	18dd	13dc	Poor W.Q. - deterioration in W.Q. due to Leigh S.T.W.Effluent. No change in W.Q. since 1980.
11. u/s Glazebury S.T.W. (677956)	-	-	16dd	20dc	Slight downstream improvement in W.Q. indicated. Little change in W.Q. since 1980.
12. Little Woolden Hall (684940)	-	-	6dd	16cd	Little change in W.Q. compared with site 11. The reappearance of the pollution tolerant moss, Amblystegium could indicate a slight improvement (even though Glazebury S.T.W.effluent enters down stream of SP11!)
13. Great Woolden Hall (685937)	-	-	14dd	26cd	Fair W.Q. - downstream improvement in W.Q. and similar improvement since 1980.
14. Cadishead p.t.c.M.S.C. (702912)	-	-	7dd	12dc	Poor W.Q. - reduction in Cladophora and overall species diversity - due to Irlam S.T.W.??
TRIBUTARIES					
15. WESTLEIGH BROOK p.t.c.Pennington Brook (648990)	-	-	21bb	27bb	Fair W.Q. - no change in flora with rooted plants dominant.
16. Moss Brook p.t.c.Glaze Brook (674982)	-	-	-	19bb	Poor W.Q. with P.pectinatus and Sparganium emersum dominant

TABLE 1. MACROPHYTE SURVEY SITES ON GLAZE BROOK CATCHMENT.

	Watercourse	Location	N.G.R. Top	N.G.R. Bottom	Site Length (m)
	Borsdane Brook	u/s Dicconson Lane	625 076	627 075	500
	Borsdane Brook	Hindley	623 049	620 045	500
*	Borsdane Brook	Platt Bridge	606 025	603 018	500
	Hey Brook	Aye Bridge	606 009	608 003	500
	Hey Brook	u/s A578	621 995	626 994	500
	Hey Brook	d/s A578	626 994	628 993	100
	Pennington Brook	PTC Westleigh Brook	646 988	648 989	250
	Pennington Brook	d/s Westleigh Brook	648 990	653 992	500
	Pennington Brook	d/s A572,Moorlands Av.	646 992	647 985	500
	Pennington Brook	d/s Leigh E.T.W.	667 984	673 982	500
	Glaze Brook	u/s Glazebury S.T.W.	675 960	677 956	500
	Glaze Brook	Little Woolden Hall	683 943	685 939	500
	Glaze Brook	Glazebrook	695 930	698 925	500
	Glaze Brook	PTC M.S.C. d/s A57	703 917	702 912	500
	Westleigh Brook	PTC Pennington Brook	645 992	648 990	500
	Moss Brook	PTC Glaze Brook	680 983	674 982	500

* Propose leaving off next survey, but incorporating Amberswood Stream upstream of A58 (612035).

TABLE 2

GLAZE BROOK

1981

	Dicconsin Lane 627075	Hindley 620 046	Platt Bridge 603 023	Aye Bridge 607 004	U/S Pennington Flash 625 995	U/S Pennington Flash 627 994	D/S Pennington Flash 646 988	Glaze d/s Westleigh Brook 650 990	U/S Leigh STW (Moorlands Ave.) 647985	D/S Leigh E.T.W. 667 984	Moss House Farm U/S Glazebury S.T.W. 677 956	Little Woolden Hall 684 940	Great Woolden Hall 685 937	Cadishead, u/s M.S.C.	Moss Brook ptc Glaze 674 982	Westleigh Brook u/s Glaze 648 990
Vaucheria sessilis	1.2					11										
Stigeoclonium tenue			11			11										
Cladophora glomerata	57	58		46	58	35	56	46	25	56	36	59	47	35	34	35
Rhynchostegium rip.	11	11														
Agrostis stolonifera	11	14		12	12	12	12	12	12	12	12	11	11		12	12
Phalaris arundinacea	14	12		12	12	12	13		11	11	11			11	12	11
Equisetum fluviatile																
Epilobium hirsutum	11	11	11	11	11	11	11	11	11	11		11	11			11
Impatiens glandulifera									11							
Alisma plantago-aquatica		11			11			11					11		13	12
Iris pseudacorus	14															
Potamogeton natans			55	47	12		12									
Sparganium erectum	12		45	57	25	24	24	24	13		12	11	11		35	56
Sparganium emersum	12		44	36	47	13		13	11		11		11		55	56
Typha latifolia							13	12								
Polygonum sp.						11	11				11				13	11
Amblystegium riparium	24				11	11						11	11	11		
Callitriche sp(p)	24			36	11								11			
Solanum dulcamara	12	12		11	12	13	11	11	11				11			11
Juncus acutiflorus		12														
Lemna minor						12		11	11		11	11	13	11		11
Juncus effusus							11									
Potamogeton pectinatus						59	56	57	59	57	59	59	57	57	55	35
Myriophyllum spicatum																
Elodea canadensis																
Glyceria maxima		14					24	11	13	11						
Potamogeton crispus																
Potamogeton perfoliatus																
Glyceria fluitans																
Petasites hybridus		11														
Ranunculus		12							11							
Rumex		11		11			11				11		11		11	
Veronica becca.		11														
Phormidium			11													
PLANT SCORE	36	38	11	26	31	29	34	29	24	13	20	16	26	12	19	27
PLANT C.D.C.	CB	CC	BB	BC	CB	DC	BC	DC	DC	DC	DC	CD	CD	DC	BB	BB

Watercourse	Site	Potamogeton pectinatus						Cladophora glomerata					
		Zn	Cn	Pb	Ni	Cr	Cd	Zn	Cu	Pb	Ni	Cr	Cd
Borsdane Brook	Hindley	-	-	-	-	-	-	57.89	ND	ND	12.63	ND	ND
Hey Brook	Aye Bridge	-	-	-	-	-	-	30.01	ND	ND	ND	32.21	ND
Hey Brook	U/S Flash	193.20	11.51	ND	ND	7.61	ND	49.77	ND	ND	ND	48.03	ND
Pennington Brook	D/S Flash	42.95	10.09	10.95	9.02	ND	ND	44.19	6.94	31.56	18.62	ND	ND
Pennington Brook	D/S Westleigh Brook	106.44	9.01	ND	ND	ND	ND	33.94	6.22	ND	ND	ND	ND
Pennington Brook	D/S A572	100.18	15.48	ND	ND	ND	ND	40.63	6.42	10.91	ND	ND	ND
Pennington Brook	D/S Leigh S.T.W.	215.05	12.24	ND	ND	ND	ND	118.19	ND	39.40	ND	ND	ND
Glaze Brook	U/S Glazebury S.T.W.	167.34	9.13	12.68	ND	ND	ND	78.21	11.06	26.99	ND	ND	ND
Glaze Brook	Little Woolden Hall	184.46	23.15	ND	ND	ND	ND	63.98	5.90	16.98	15.75	ND	ND
Glaze Brook	At Glazebrook	263.84	21.19	ND	ND	ND	ND	40.93	9.00	ND	ND	3.60	ND
Glaze Brook	PTC M.S.C.	263.94	35.59	ND	ND	ND	ND	110.90	14.22	55.45	ND	7.95	ND
Westleigh Brook	PTC Pennington Brook	108.46	10.58	ND	ND	ND	ND	71.80	13.05	ND	ND	ND	ND
Moss Brook	PTC Pennington Brook	271.49	13.29	ND	ND	ND	ND	45.40	ND	116.34	ND	ND	ND

TABLE 3 Concentrations of six metals in the plants, Potamogeton pectinatus and Cladophora glomerata from 13 sites on the Glaze Brook catchment (expressed as ppm dry weight; ND = less than detection limit)

FIG1 THE GLAZE BROOK CATCHMENT
plant score pie-charts

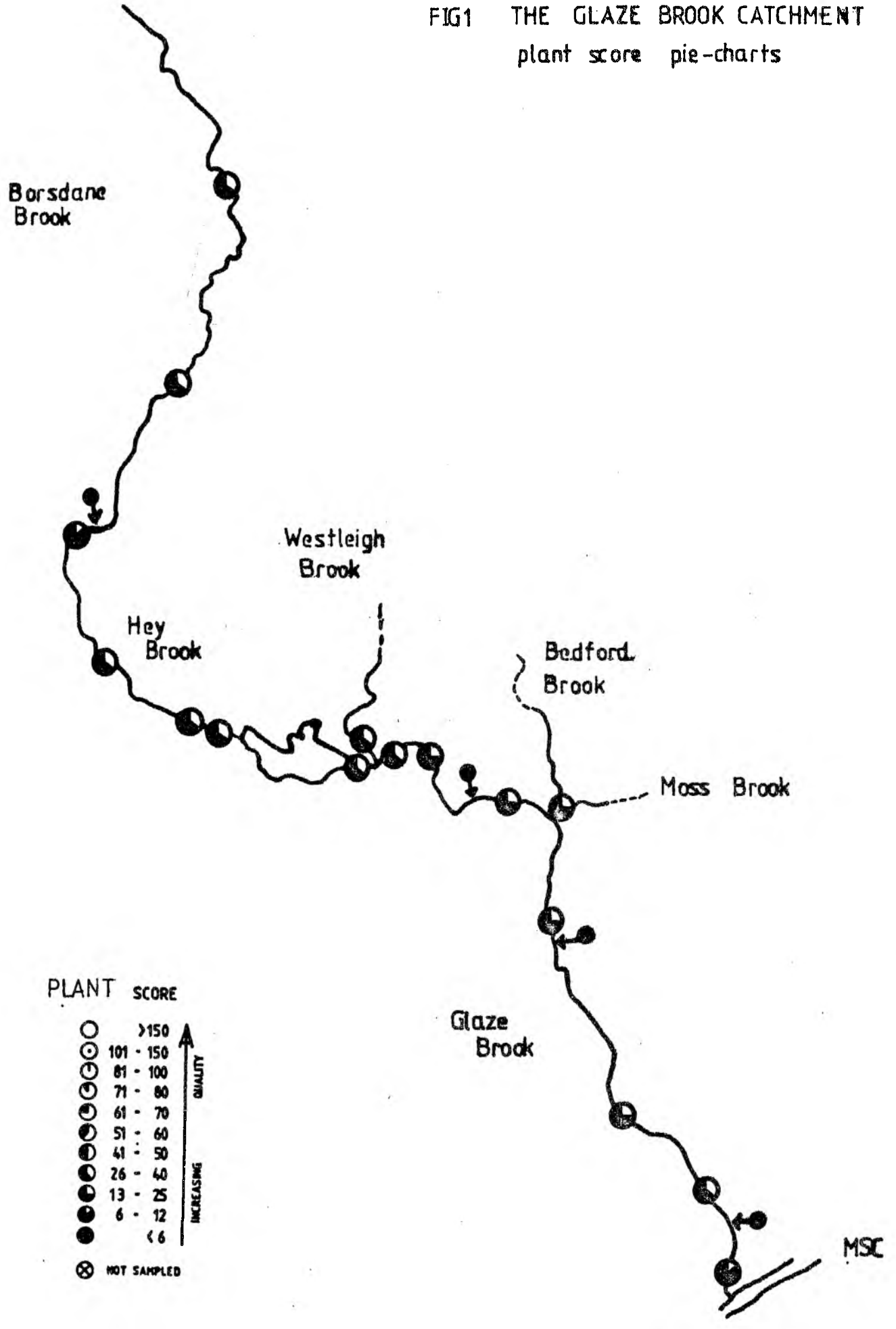
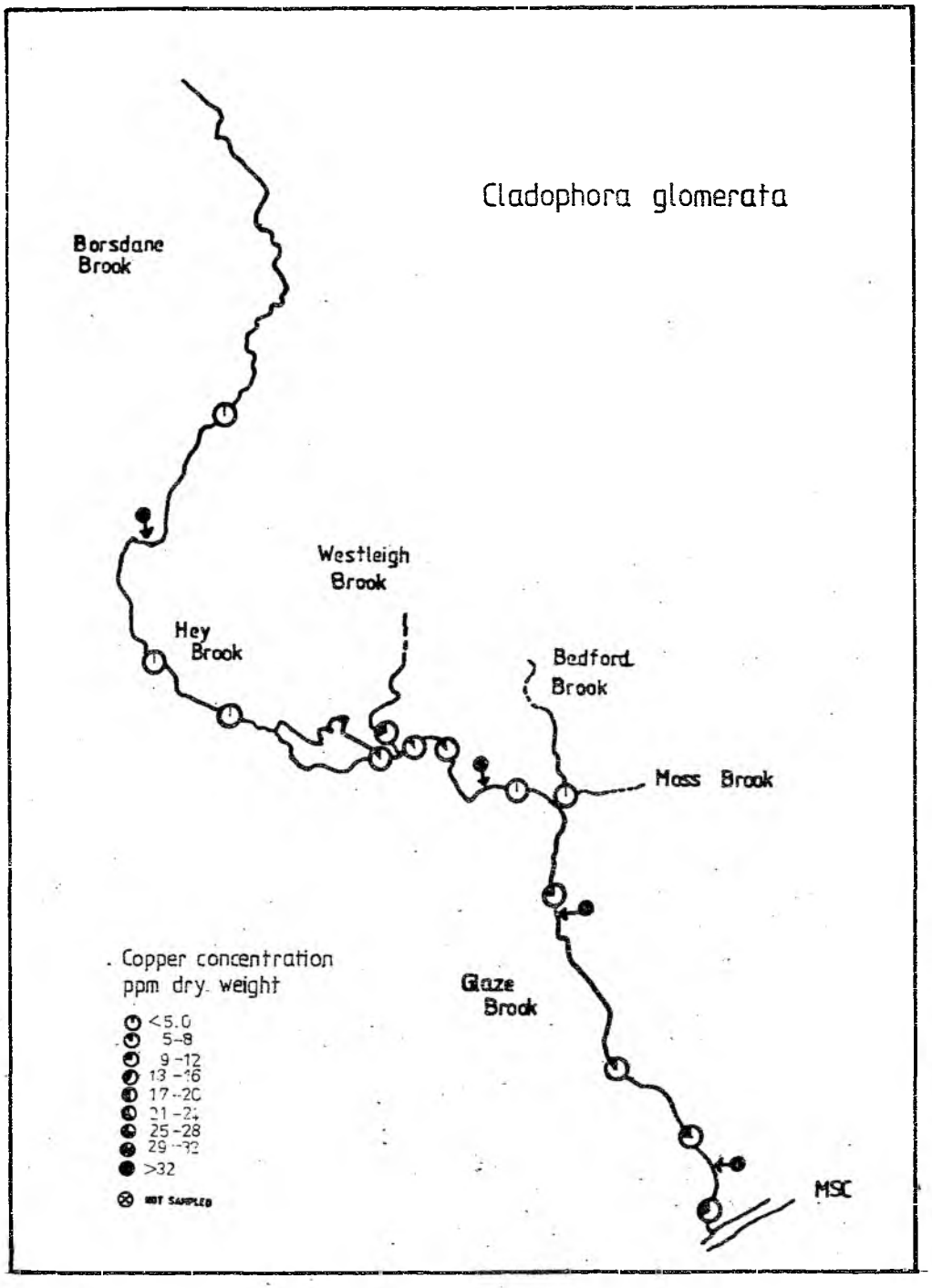


Fig. 2


Cladophora glomerata
Borsdane Brook
Westleigh Brook
Hey Brook
Bedford Brook
Moss Brook
Glaze Brook
MSC
Copper concentration ppm dry weight
<5.0
5-8
9-12
13-16
17-20
21-24
25-28
29-32
>32
NOT SAMPLED

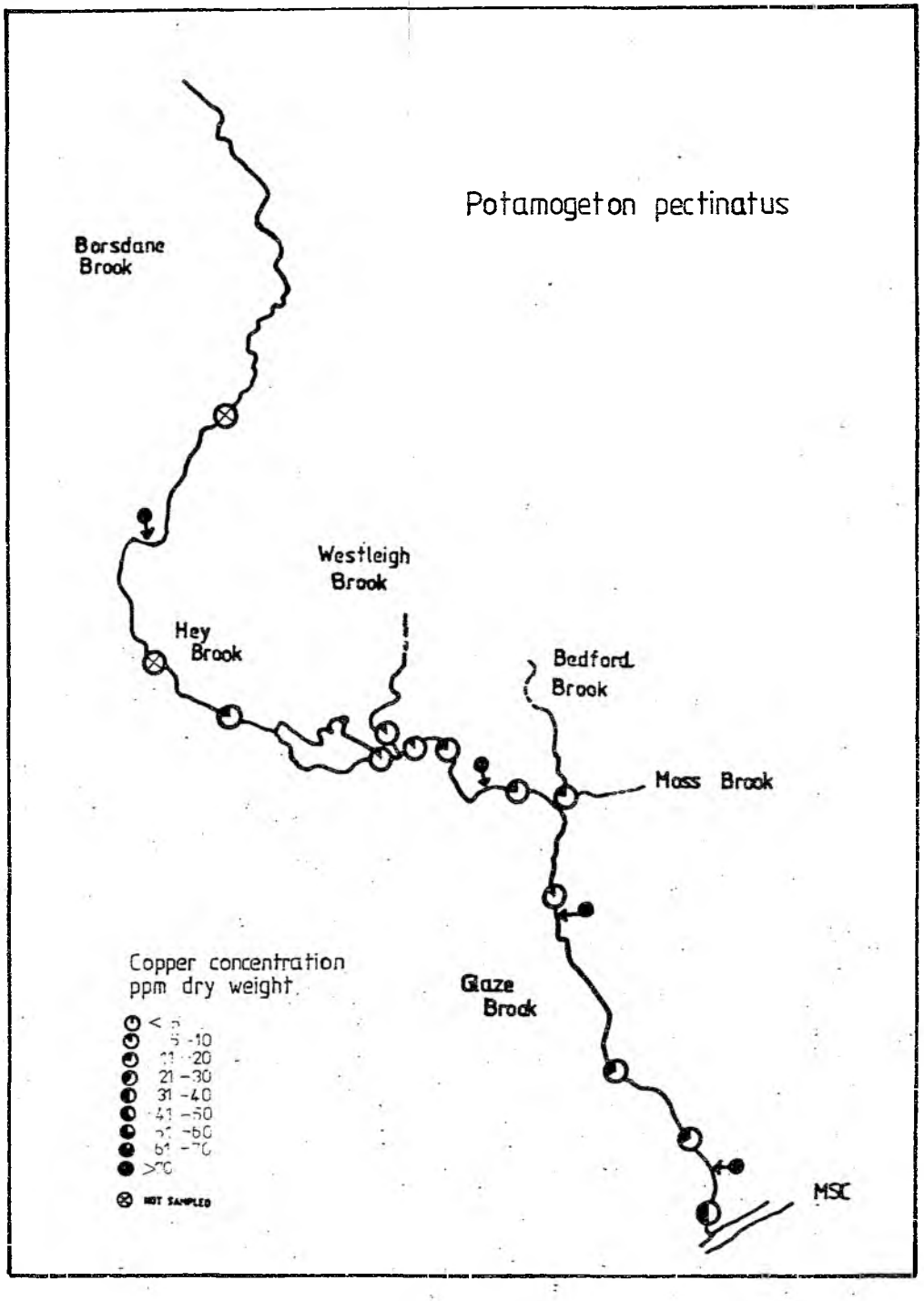
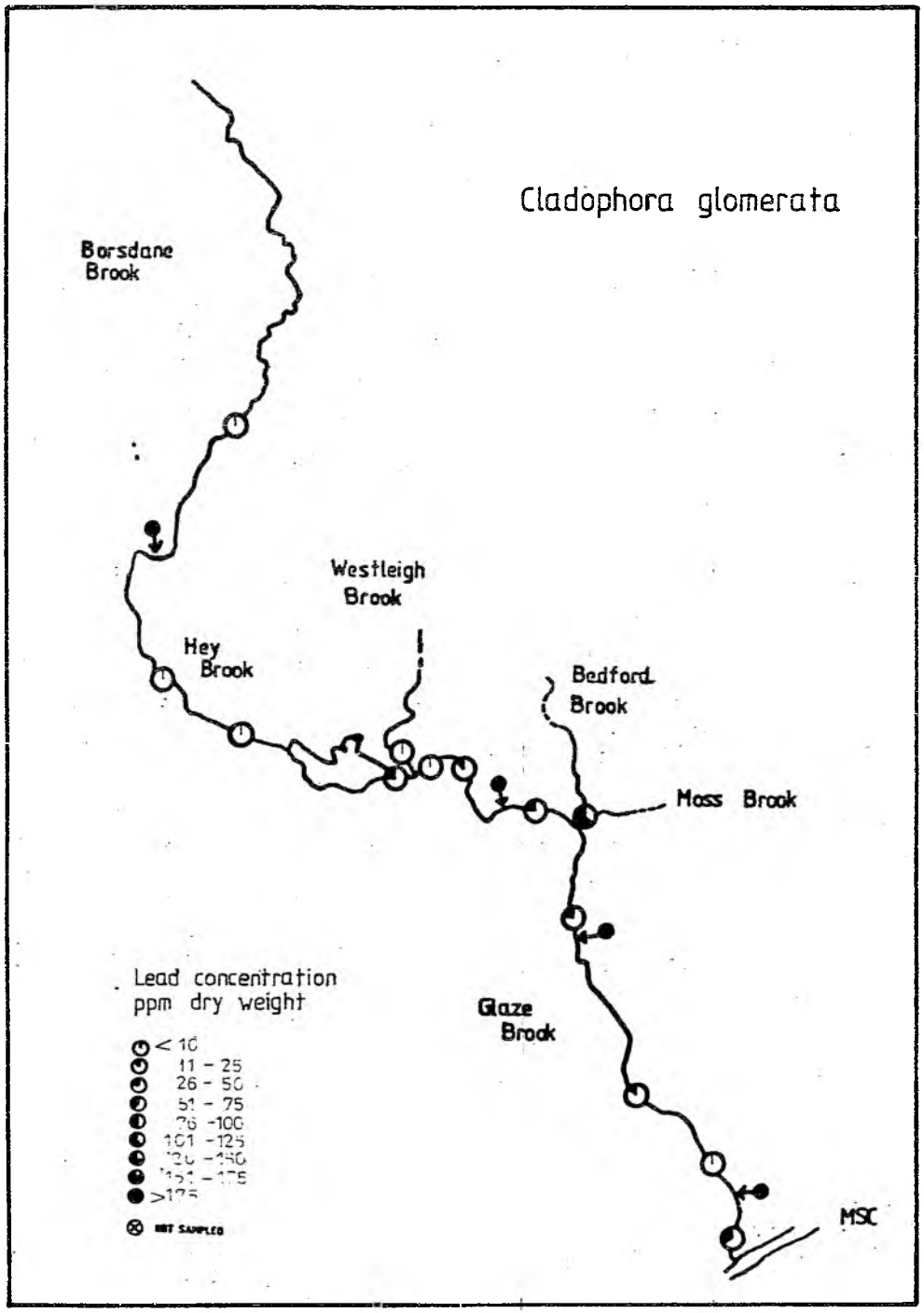
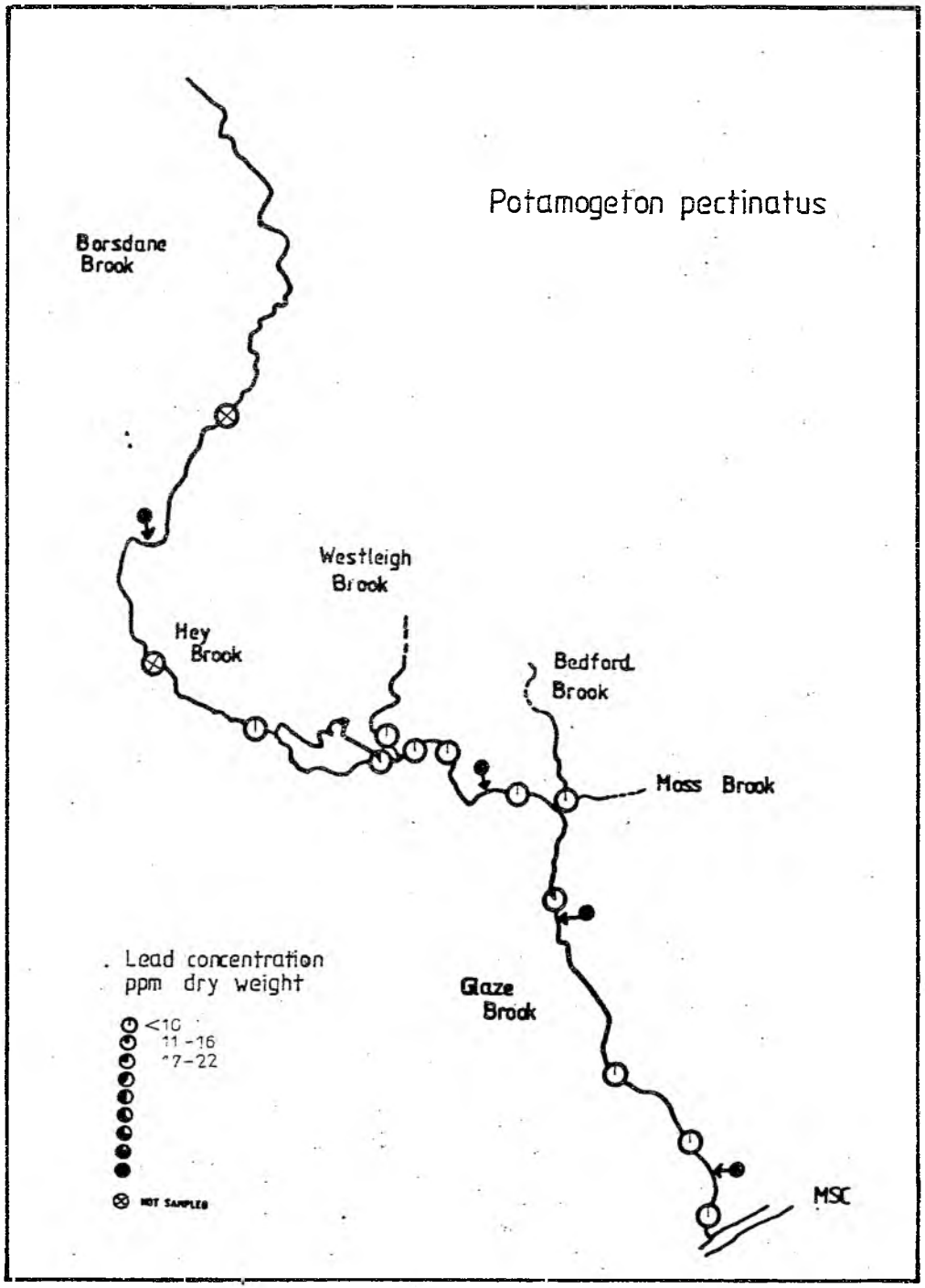
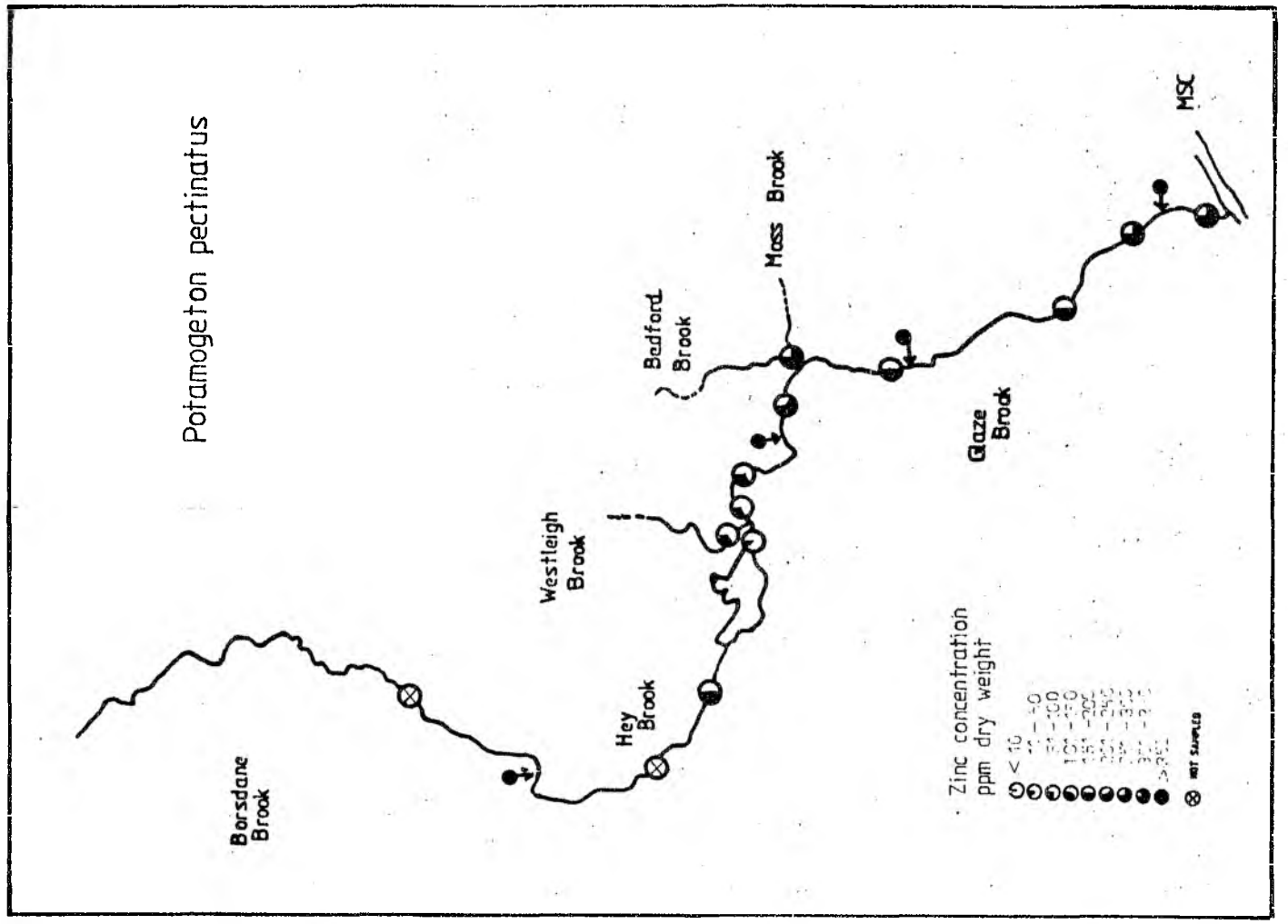

Potamogeton pectinatus
Borsdane Brook
Westleigh Brook
Hey Brook
Bedford Brook
Moss Brook
Glaze Brook
MSC
Copper concentration ppm dry weight
NOT SAMPLED

Fig. 3


Cladophora glomerata
Borsdane Brook
Westleigh Brook
Hey Brook
Bedford Brook
Moss Brook
Glaze Brook
MSC
Lead concentration ppm dry weight
< 10
11 - 25
26 - 50
51 - 75
101 -125
>175
NOT SAMPLED


Potamogeton pectinatus
Borsdane Brook
Westleigh Brook
Hey Brook
Bedford Brook
Moss Brook
Glaze Brook
MSC
Lead concentration ppm dry weight
<10
11-16
17-22
NOT SAMPLED


Potamogeton pectinatus
Borsdane Brook
Hey Brook
Westleigh Brook
Bedford Brook
Moss Brook
Glaze Brook
MSC
Zinc concentration ppm dry weight
< 10
11 - 25
26 - 50
51 - 75
76 -100
101 -125
126 -150
151 -175
> 175
NOT SAMPLED

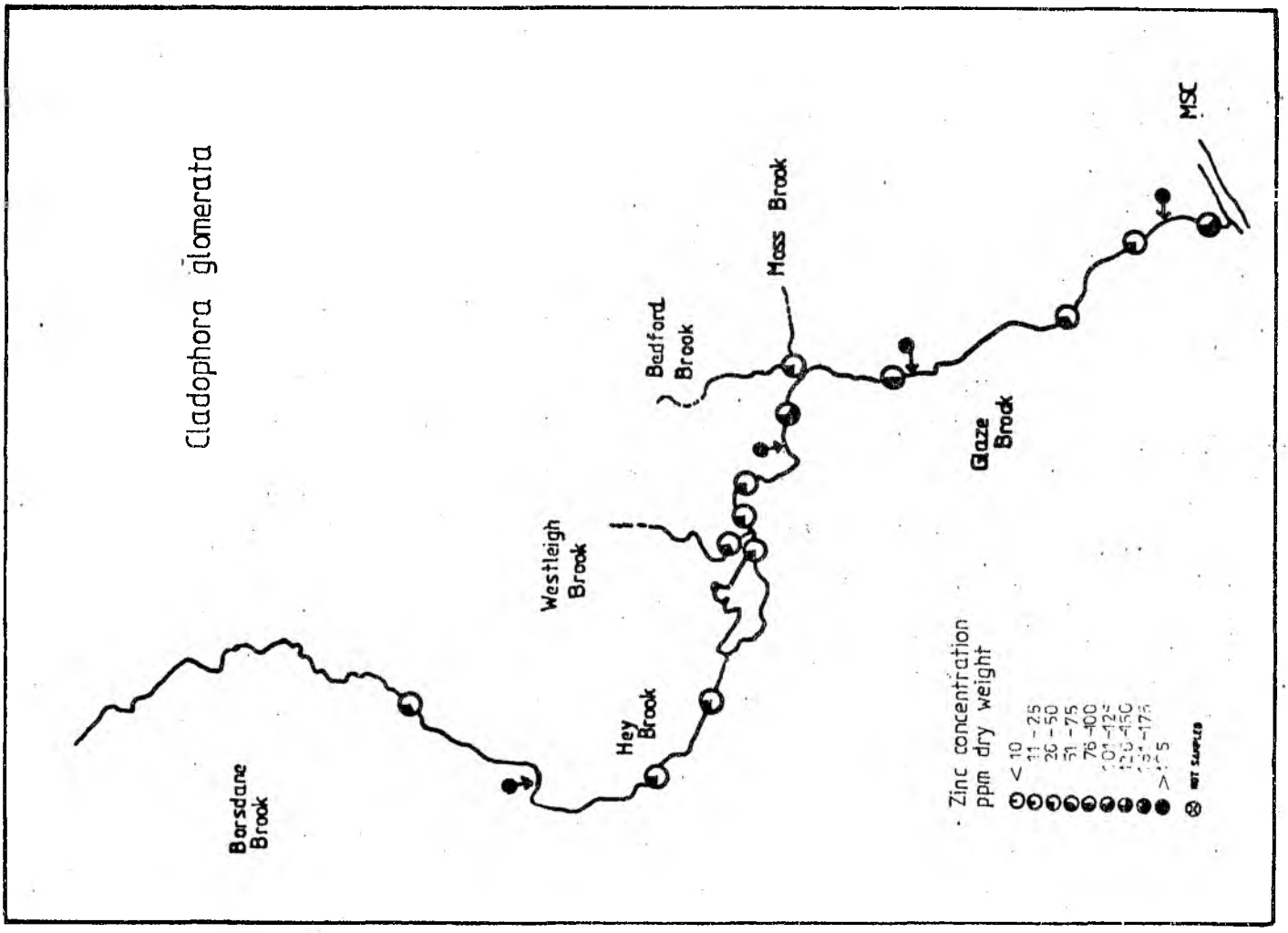
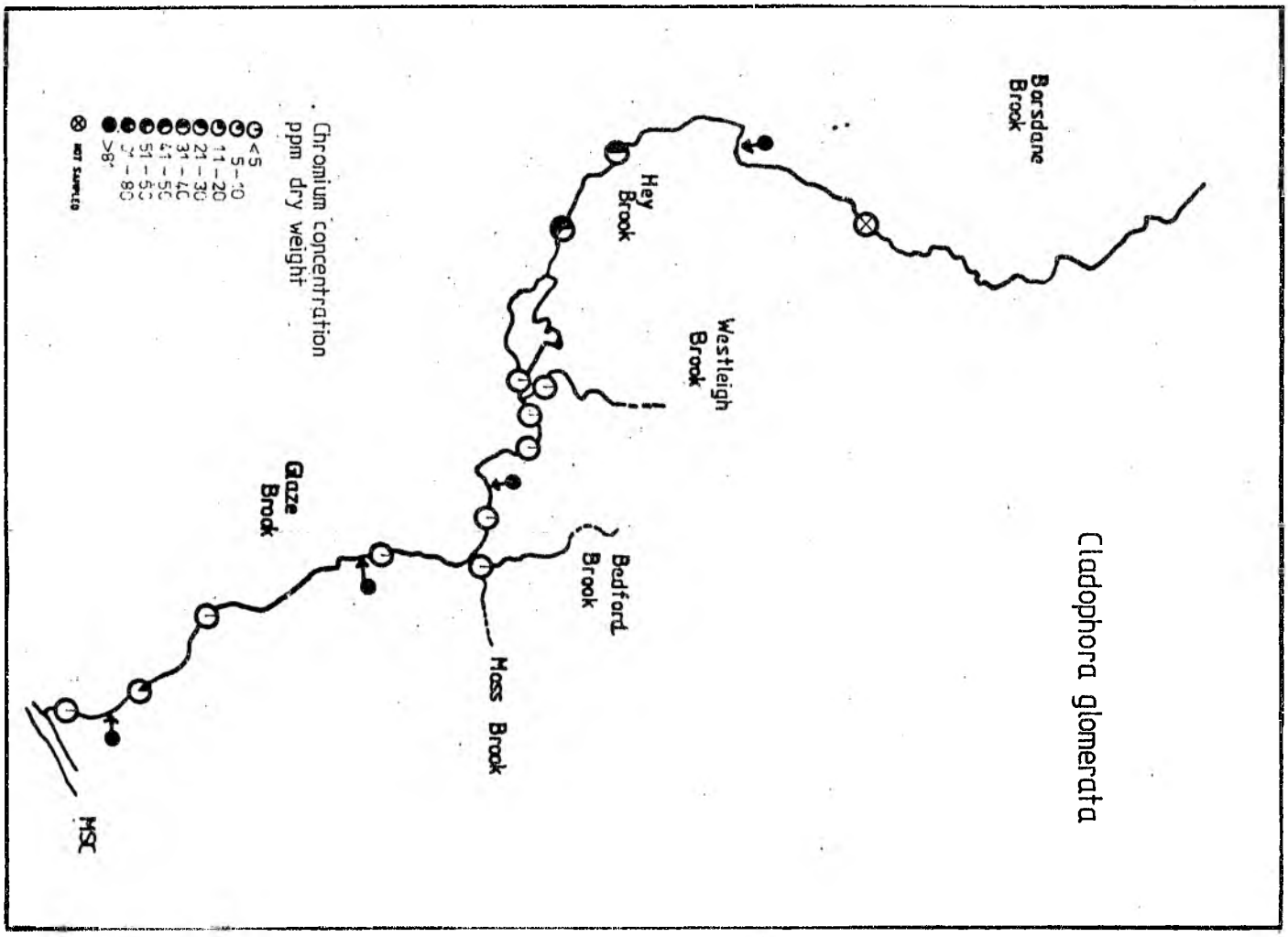

Cladophora glomerata
Borsdane Brook
Hey Brook
Westleigh Brook
Bedford Brook
Moss Brook
Glaze Brook
MSC
Zinc concentration ppm dry weight
< 10
11 - 25
26 - 50
51 - 75
76 -100
NOT SAMPLED

Fig. 4


Cladophora glomerata
Barsdane Brook
Hey Brook
Westleigh Brook
Gaze Brook
Bedford Brook
Mass Brook
MSC
Chromium concentration ppm dry weight
<5
5-10
11-20
21-30
31-40
41-50
51-60
61-80
>80
NOT SAMPLED

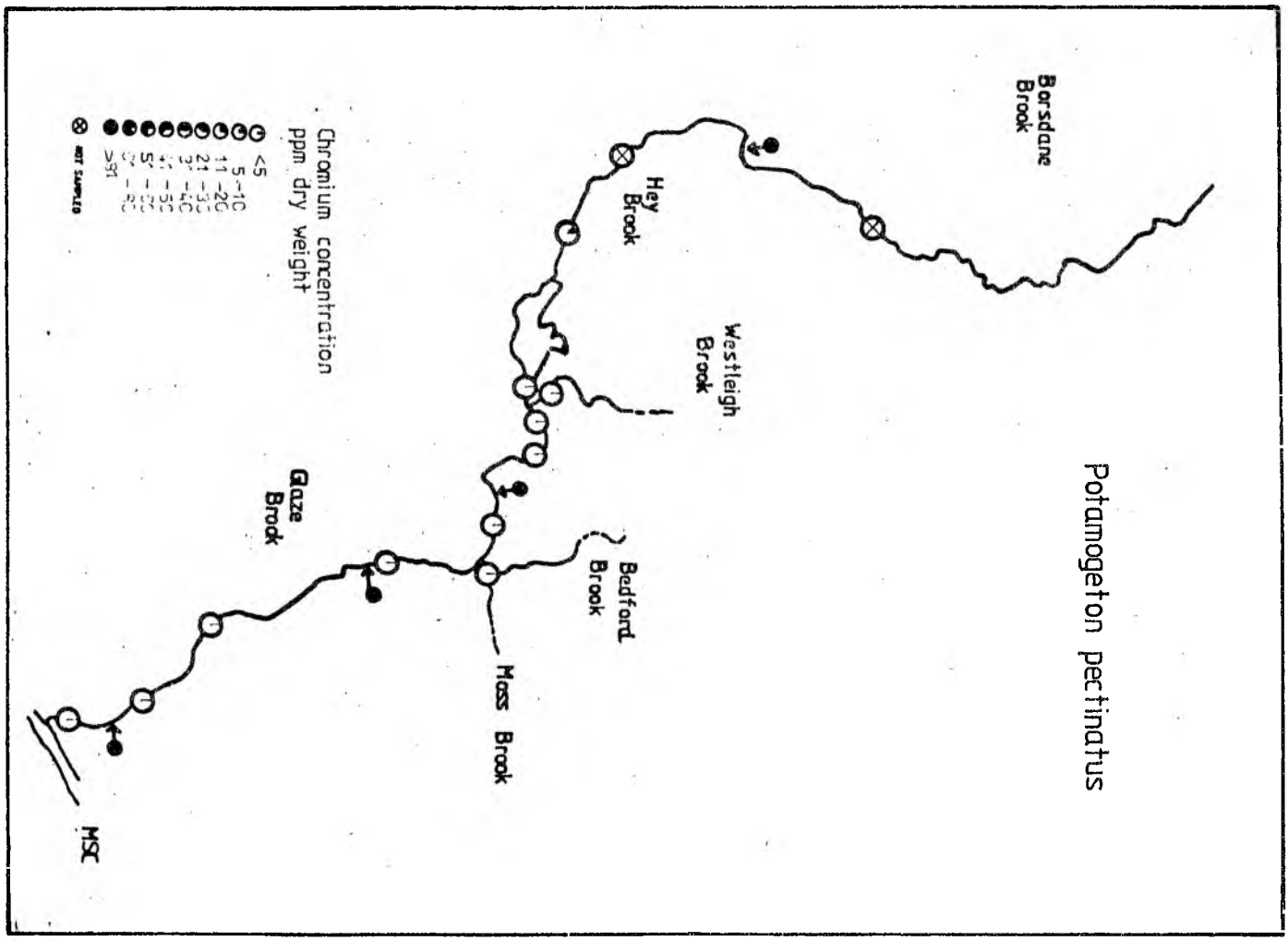

Potamogeton pectinatus
Barsdane Brook
Hey Brook
Westleigh Brook
Gaze Brook
Bedford Brook
Mass Brook
MSC
Chromium concentration ppm dry weight
<5
5-10
11-20
NOT SAMPLED

Fig. 5

Notes on the toxic metal concentrations in Cladophora glomerata and Potamogeton pectinatus on the Glaze Brook catchment. (See Fig 6 and 7)

These two species have different growth habits - Cladophora is an alga, it does not have roots, any toxic metals present may have entered from the surrounding water through the cell wall - Potamogeton is a rooted plant, its leaves are almost impermeable to water and any toxic metals present are likely to have been taken up from the sediments by the roots.

Very simplistically - the toxic metal concentrations in Cladophora reflect the recent concentrations in the water, and the toxic metal concentrations in Potamogeton reflect the concentrations in the sediment and, therefore, the long term concentrations in the water.

Metal concentrations in Potamogeton pectinatus (ppm dry weight)

(See Fig. 6, 2 -5)

Copper

Some copper detected upstream of Pennington Flash, with slight decrease in concentration downstream of the Flash. Marginal increase in copper concentration downstream A572 road bridge (?) Copper increased downstream Leigh, Glazebury and Irlam S.T.W.

Lead

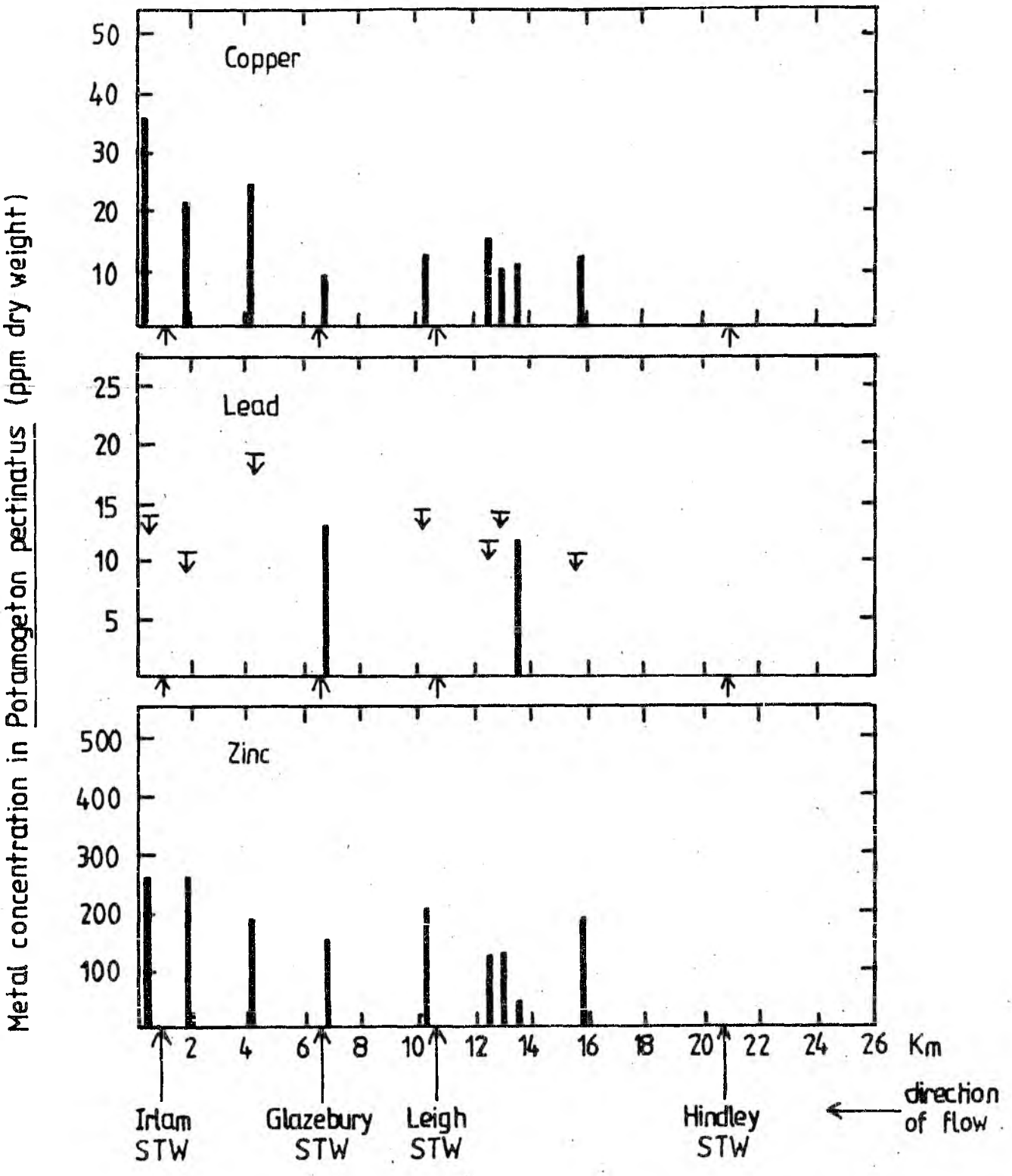
Zinc

Marked reduction in zinc concentrations from upstream to downstream of Pennington Flash - due to precipitation (?) Slight increase in zinc downstream of Leigh S.T.W.

Chromium

Only chromium detected in Potamogeton upstream of Pennington Flash (cf Cladophora).

Fig. 6



$\overline{\Psi}$ = less than stated detection limit

Metal concentration in cladophora glomerata (ppm dry wt.)

(See Fig. 2-5, 7)

Copper

Copper indicated downstream of Pennington Flash and Westleigh Brook. Source of copper in Glazebury and Irlam S.T.W. Copper increase upstream of Irlam S.T.W. is odd(?).

Lead

Lead not indicated below Hindley S.T.W., but indicated below Leigh, Glazebury and Irlam S.T.W. Lead indicated in Moss Brook.

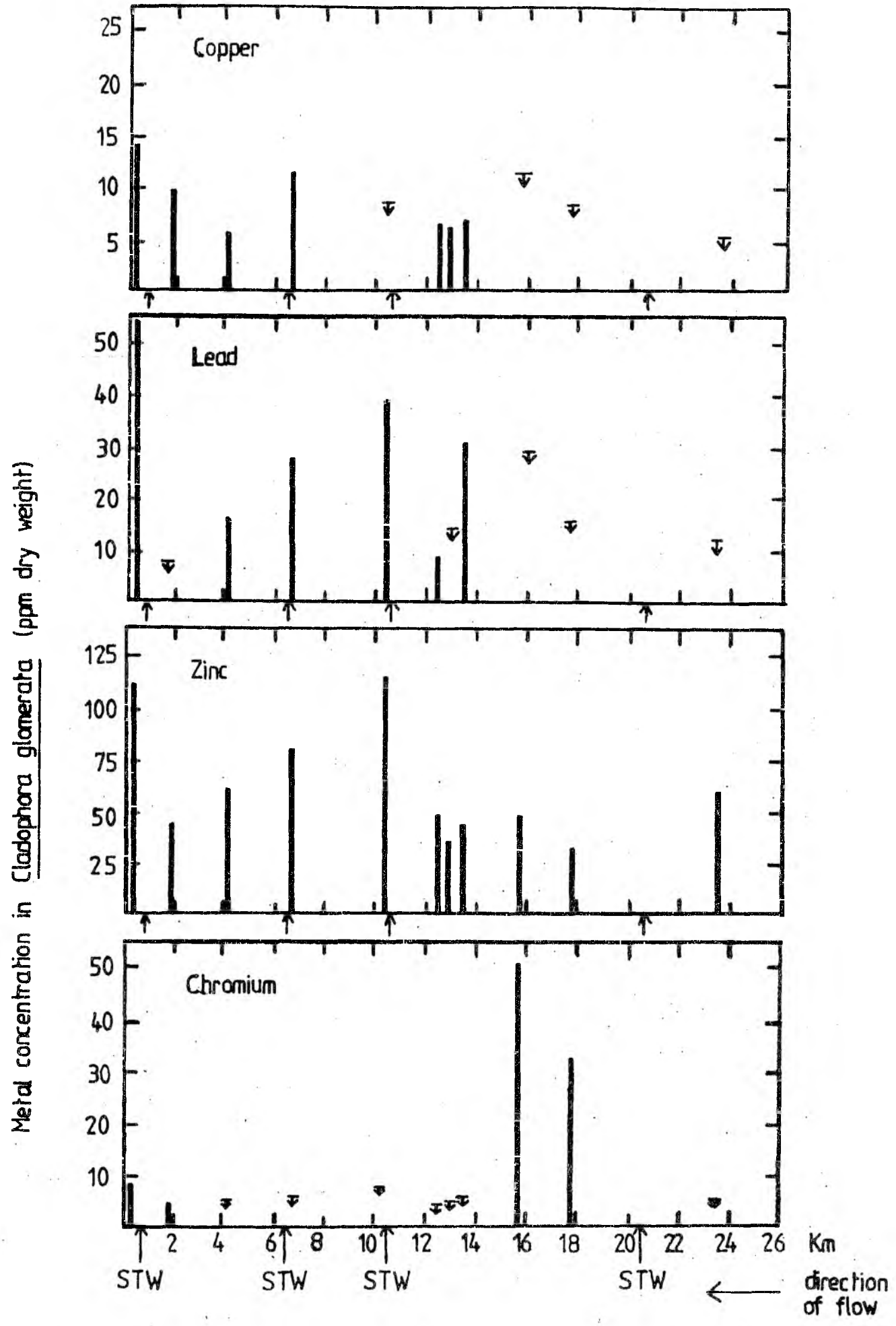
Zinc

Zinc indicated at all sites on the River Glaze catchment. Clear increases in zinc concentrations below Leigh, Glazebury and Irlam S.T.W. Rather high zinc concentrations at Hindley town centre(?).

Chromium

Only significant chromium concentrations recorded at Aye Bridge and upstream of Pennington Flash(?) Chromium detected but low concentration at Glazebury.

Fig. 7


Copper
Lead
Zinc
Chromium
Metal concentration in Cladophora glomerata (ppm dry weight)
STW
STW
STW
STW
Km
direction of flow