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ENVIRONMENT AGENCY

River Ouse

Fisheries Drought Report 1996

Fisheries Science Report 22/97

Drought Monitoring

905

Executive Summary

Yorkshire Water Services currently abstracts water from the R.Ouse at Moor Monkton under a Time Limited Licence. The licence allows abstraction of 144 tcmd with a residual flow at Skelton gauging station of 650tcmd and a further abstraction up to 294 tcmd with a residual flow of 970tcmd. The Environment Agency requires information on fish populations with regards to drought conditions and any possible effects that abstraction may have when considering licence renewal. In order to evaluate any effects of drought and abstraction a three year study was instigated to examine fish populations. Fish population surveys were conducted at six sites in which the triennial rolling programme formed the basis of site selection. Multi-method sampling techniques were carried out at several sites in order to evaluate capture efficiency.

Roach were prolific above the weir at Linton-on-Ouse, with gudgeon, perch and small bream also well represented. Roach dominated catches on the R.Ouse below Linton, with perch and bleak also relatively abundant. Chub were only present in large numbers at Acaster Malbis whilst pike were caught in similar numbers to the previous survey with the exception of more fish recorded below the weir at Naburn.

Coarse fish stocks were supported by a strong 1995 year-class with the exception of a 1994 year-class of dace in the R.Ouse indicating that dace did not benefit from the drought conditions of 1995. Older fish, particularly roach, were from a range of year-classes suggesting good recruitment for several years, but year-classes from 1989-1991 were the most evident of these.

Low flows were not thought to be directly correlated to successful recruitment of coarse fish, rather the associated high temperatures during drought conditions showing a strong positive effect with most species exhibiting growth rates above their long-term average.

At this stage in the study there are no clear indications that the drought has caused any deleterious effects to coarse fish populations or marked changes in species composition, with evidence of good recruitment by several species, indicating that the higher temperatures have generally been beneficial to recruitment. However, the indication that dace did not benefit as well as other coarse fish under these conditions may suggest some species are affected more than others. **The successful strong recruitment of most coarse fish suggests that, in future, fisheries will be supported by the 1995 year-class.**

The behaviour of coarse fish under different flow conditions requires investigation in conjunction with the examination of abstraction points to evaluate fish losses. Several recommendations are highlighted to further evaluate drought impacts.

An examination of sampling techniques and their species, age and size selectivity showed that a multi-method approach produced the least selective sampling but it was considered that more effort with seine netting where fish aggregations were identified from sonar surveys would increase sampling efficiency further.

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1.0 Purpose

The basis for undertaking the study was to examine factors and potential impacts affecting fish and fishing in relation to low flow drought conditions and what other impacts may arise as a result of further reduced flows resulting from abstraction. The study formed the basis of a three year project to concentrate on effects relating to potable water abstractions at Moor Monkton by YWS.

To fully evaluate the possible effects on fisheries the study set out to encompass fish population surveys from fry to adult stock, analysis of angler catch data, reports from anglers and river reports from Environment Agency Fisheries staff.

2.0 Methods/Analysis

2.1 Fish Population Surveys

The triennial rolling programme and the annual fry survey formed the basis of site selection in order to compare long-term monitoring data sets to detect any changes.

The sites sampled are shown in Figure 2.1.

A multi-method sampling protocol was adopted in order to limit species, size and age selectivity. The various techniques used included seine and gill netting and multi anode,"Wessex Array", boom boat electric fishing. At sites where different methods were used, the "traditional" single anode electric fishing was also conducted in order to ascertain the level of efficiency of previous surveys conducted solely by this method. Where multiple methods were used a sampling protocol of seine net, setting of gill net, single anode electric fishing followed by boom boat electric fishing was carried out. Gill nets were retrieved after all other methods had been conducted. Fish samples obtained by each method were retained separately prior to processing. Fry were sampled using a 20m x 1.8m micromesh seine net set in the margins.

Details of sampling methods and site details are given in Tables 2.1.1-2.1.2 in the Appendices.

The fork length of fish captured was recorded and scales were taken from a sub-sample for age determination. Minor species such as minnow, eels and coarse fish fry captured/observed by electric fishing were assigned a subjective score of abundance and fry captured by the micromesh seine were fixed in 10% neutral buffered formalin and returned to the laboratory where they were identified, counted and their fork length recorded.,

Samples of eels were retained in order to analyse white muscle contamination of red maggot dye thought to have food chain health implications and to determine the level of infection of pathogenic parasites which may limit populations.

The fish population survey was conducted between 18-26 July 1996, covering 6 sites with the fry sampled at Acaster Malbis and Beningbrough during the annual fry survey on the 18 and 19 September 1996 respectively. These dates are relatively consistent with the timing of earlier surveys thus allowing a direct comparison with previous results.

2.2 Angling catch returns

A catch return system based upon the results from coarse fishing matches has been running since 1971 and is utilised to demonstrate changes in species composition and catch indices. Angling clubs participating in the Environment Agency catch return system send in details of each fishing match either by a postage paid reply postcard to Coverdale House or via their angling club where they are collected by Environment Agency staff. The cards are processed annually to reveal trends in catch indices and species composition. In 1997 the Fisheries Classification system was introduced to the match return system which allows a venue to be assigned a letter from A to D based upon weight of fish caught per hour. Class A is awarded when catches exceed 149g (5.26oz) per angling hour and class D when catches fall below 71g (2.51oz) per hour. Returns were analysed from two sections on the R.Ouse and will include a small section of the R.Ure which is part of the historical data set. The sections are: Dunsforth to Linton-On-Ouse and Linton-on-Ouse to Naburn Weir.

2.3 Information from Anglers

All reports received from anglers during 1996 are collated to detail a useful source of information. Reports received have either been verbal or written details have been sent in.

2.4 Environment Agency Fisheries staff reports

Fisheries staff monthly reports are collated for 1996 to provide a further source of information about the river state and its fisheries throughout the year.

3.0 Results

3.1 Fish population surveys

The results are summarised in Tables 3.1.1 - 3.1.7 and Figures 3.1.1 - 3.1.11 and include length:frequencies from the R.Ure for comparison.

3.1.1 Sites and species

Roach dominated catches throughout the R.Ouse and **perch** were the second most abundant species at **Beningbrough** and **Nether Poppleton** but in the lower river at **Acaster Malbis** and below **Naburn weir bleak** were the second most numerous species. At **Linton-on-Ouse**, above the weir, **roach** were prolific, with **gudgeon** and **perch** the next most numerous species and **bream** also well represented. As compared with previous surveys, **dace** were more apparent below the two weirs, Linton and Naburn, with relatively large numbers from **Naburn. Chub** were caught in fewer numbers than in the previous surveys, apart from a relatively large number from **Acaster Malbis. Pike** were recorded in similar numbers to the previous surveys with the exception of more fish recorded at **Naburn** in 1996. **Silver bream**, which were recorded in relatively high numbers below **Naburn weir** in 1993 were not as evident in 1996.

Comparisons of percentage species compositions caught by single anode at five R.Ouse sites from 1990 to 1996 are shown in Figure 3.1.11. These highlight the relatively large increase in the numbers of roach at sites above York and an increase in chub and bleak at Acaster Malbis. Pike and dace were relatively more numerous in catches below Naburn weir.

Eels were recorded from all R.Ouse sites except Acaster Malbis. The increased depth at Acaster, relative to the other sites, may limit their susceptibility to capture by electric fishing. One eel, from a sample of five fish, from Naburn Weir showed visible traces of pink dye in the white muscle. **All sites showed the prevalence of the swimbladder nematode *Aguillicola crassus***, with infection levels ranging from 80% (N=5) at Naburn Weir to 36.4% (N=22) at Nether Poppleton. **The gill parasite *Ergasilus gibbus*** was recorded at Nether Poppleton (9.1% infection, N=22) and upstream on Linton Weir (16.7% infection, N=12).

These parasites are known to be pathogenic to eels and could limit stocks in future if significant mortalities occur.

3.1.2 Age and growth

Most coarse fish species were supported by a strong **1995 year-class** and notably **bream** of this year-class were evident above **Linton Weir**. **Ruffe** were not captured in sufficient numbers to indicate that recruitment had been particularly successful. **Pike** were mostly represented by fish from **1994 and 1992** and as with perch the older fish were from **1989-1992 year-classes**.

Compared with previous years, **the growth rates of most fish were greater than those observed in 1993**. For example, the 1+, 1995 cohorts of roach exhibited faster growth rates than 1+ fish in 1990 which is highlighted in the Coarse Fish Fry Surveys (FSR 17/91 and 49/96). The reports demonstrate that their relatively faster rates of growth were instigated by very good growth in their first year, with fry in 1995 attaining greater mean lengths than those in 1990. However, 4+ and 5+ roach were generally slower growing, suggesting perhaps that previous strong cohorts from 1989 and 1990 may have exhibited intra-specific competition. Perch also showed differences in growth rates when comparing results from 1990 and the 1996 surveys, with older fish (>3+) having similar rates, whilst younger fish in 1996 were generally slower than comparative year-classes in 1990.

3.2 Fry survey

The catches, species composition and growth are summarised in Tables 3.2.1- 3.2.4.
In 1996, dace and perch were absent from samples at Beningbrough with a total of 7 species recorded compared with 1995. At Acaster Malbis the number of recorded species was much reduced in 1996, compared with the previous two years ,showing a similar trend in lower species diversity observed following the drought of 1989-1991, which may reflect the presence of competition from previous strong year-classes.

The samples from Acaster show the presence of fry dispersal, with records of rheophilic species such as dace and barbel which are most likely to have originated from spawning above York.

Changes in species composition are highlighted, with indications that dace and gudgeon recruitment may have been reduced at Beningbrough since the drought of 1989 and the numbers of perch have increased. The relatively low numbers of fish captured at Acaster Malbis compared to Beningbrough make direct long-term trend comparisons difficult.

The growth rates of fry were elevated during the hot summers, notably 1984, 1989 and 1995 when, as expected, river flows were low (Figs. 3.2.1 and 3.2.2)

3.3 Angling catch returns

Catch returns are summarised in Fisheries Science Report 11/97 and Figure 3.3

A change in the rating system in 1994, which allowed for the recording of more species from the catch return records accounts for the apparent large declines in the ratings of the most abundant species such as roach and perch.

Dunsforth to Linton

Match returns for 1996 were higher than 1993 but still low compared to other years. A similar percentage of anglers weighing in was recorded compared to previous years. Catch indices have continued to fall since 1994, however they do remain higher than figures recorded in the 1970's and 80's. Perch and roach continue to dominate, with increases in ratings for dace and chub. Eel ratings have fallen while pike and bream were not recorded. Fisheries classification increased in 1992 from D to C, although the class has returned to D in 1996 with the decline in catch indices.

Newton to Acaster

Catch returns for Newton to Acaster have remained high in recent years, however in 1996 they dropped to half the 1995 figure and quarter that of 1991. Percentage of anglers weighing in and other indices all remain high. A good range of species were still recorded, with roach and perch remaining the dominant species and increases in the ratings of ruffe, bream and roach. Ratings for pike and dace have fallen.

The classification for this section on the River Ouse improved from a C to a B during the 1990's, indicating this stretch as a good quality fishery. Warm summers increased recruitment of fish so improving fishing quality in the early to mid 1990's.

3.4 Angler reports

The increase in piscivorous birds has been of concern to many anglers. Throughout the lower R.Ure and R.Ouse anglers have reported an increase in the number of goosander in recent years with large wintering flocks of 70-100 birds reported in areas between Boroughbridge and York during the winter of 1996-97. One angler has reported goosander on the river all year round in the Boroughbridge area, when before he considered them winter visitors. **Anglers fishing the lower R.Ure between Dunsforth and the R.Ouse above York have considered the increase in the number of cormorants to be responsible for the decline in the quality of fishing to such an extent that a major winter league fishing competition was cancelled because the number of competitors catching fish had declined markedly. The decline in catch indices is supported in the analysis of match returns (3.3 above).** Anglers have also suggested that some unusual winter aggregations of fish are a direct result of piscivorous birds, causing the fish to move to areas they are not normally associated . Dense shoals of fish have been observed in Milby Cut on the R.Ure and Linton Lock cut and Nether Poppleton on the R.Ouse. Some anglers have suggested that the fish have moved to these areas because disturbance from human activity has kept the fish-eating birds away.

The abundant macrophyte growth along the margins of the lower R.Ure and Ouse during the summer has been of concern to anglers primarily as a result of reduced access to fishing pegs but one angler has expressed concern over the amount of filamentous algae "smothering other weeds" and what effect it may be having on the river. A macrophyte survey report produced for YWS (Scott-Wilson 1996) has confirmed that filamentous algae has been very abundant at many sites. At Dunsforth, submerged macrophytes had a 70%-100% covering by filamentous algae.

Reports were received from anglers expressing concern over the colour of the river. The river was reported as having a green/grey tinge to it, whilst other reports related to the river being much clearer than normal.

Concern has been expressed by York and District AA over the lack of large bream recorded in angling catches during the start of the 1996 fishing season, when in previous years they have been numerous. Further complaints followed regarding the general poor quality of fishing above York during the summer, which is supported by the analysis of catch returns (3.3 above).

3.5 Environment Agency Fisheries Inspectors reports

Inspectors were notified of the poor catches of bream on York and District AA water at the start of the season and the poor catches in summer above York. In December, large catches of bream were taken around Killingbeck, an area not normally associated with good winter catches.

Abundant macrophyte growth was observed with large mats of filamentous algae noted along the margins of the Overton-Poppleton stretch.

4.0 Key issues/impacts

4.1 Coarse fish

Coarse fish production, measured as mean fry growth by September, shows a strong positive correlation with water temperature and some correlation to low summer flows (Tables 3.2.1 - 3.2.4). The hot dry summers of 1984, 1989 and 1995 produced conditions for very good fry growth and subsequent survival expressed as strong year classes. Almost all coarse fish species have shown good recruitment during the drought of 1995 with the exception of ruffe, which have had limited recruitment success since 1988. Dace recruitment, expressed as the number of juveniles observed in the annual fry survey, has fallen in the period 1989-1996 when compared to the relatively high numbers recorded during 1981 and 1987-1988. Roach have been more variable in their recruitment success during 1981-1996 but in recent years, particularly 1989-1996, they have been slightly more successful which is similar to a trend observed in the R.Ure (FSR 21/97).

4.2 Angling and angler issues

Anglers have reported that the key issues affecting their sport relate to:

Piscivorous birds
Low flows
Abundant weed growth
Perceived marked changes in fish behaviour

4.3 Salmon

Salmon using the R.Ouse as a corridor to their spawning grounds on the R.Ure require to negate the poor water quality conditions of the tidal river. Detailed discussion and factors affecting their success are described in FSR 21/97.

Entrainment of juvenile salmon is of concern at major abstraction points, namely York Water Works at Acomb Landing and Drax Power Station. Examination of these will need to be conducted in order to evaluate any losses.

5.0 Limitations of survey techniques and results obtained

A multi-method sampling technique was adopted at each site, where suitable, in order to improve on capture efficiency and are reported in FSR 21/97 and include:
Method selectivity
Species selectivity
Size selectivity
Age selectivity

6.0 Recommendations for future work

1. Continue to monitor water quality in the tidal R.Ouse to determine the impact to salmon migration under low flow conditions. The installation of a fish counter at Naburn weir will assist in quantifying the numbers of adult salmon.

2. Future fish population survey programmes of the lower R.Ure and R.Ouse should adopt a multi-method approach as described above. In conjunction with this approach further sites should be examined with a view to increased effort from seine netting in relation to known aggregations of fish as identified from sonar surveys.

3. Continue to monitor entrainment at Drax Power Station and extend the evaluation to include York Water Works intake at Acomb Landing.

4. Undertake angling catch census during the 1997 coarse fishing season on York and District AA water at Beningbrough in order to monitor catches and species distribution.

5. Carry out monthly inspections and retain photographic records at Newton-on-Ouse, Overton, Clifton Bridge and Acaster Malbis to assess seasonal trends in river conditions.

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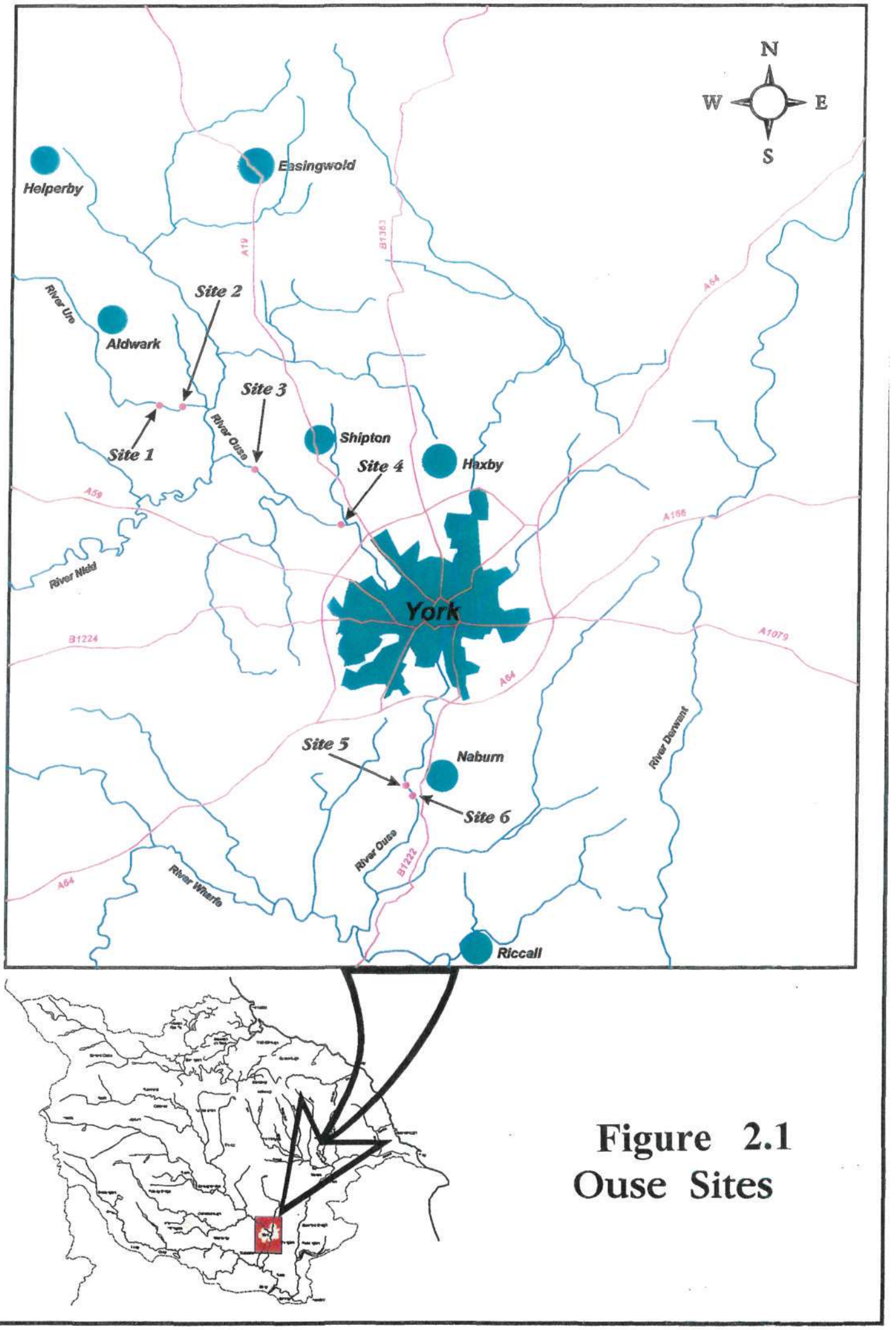


Figure 2.1
Ouse Sites

Figure 3.3 Percentage ratings of major species per year

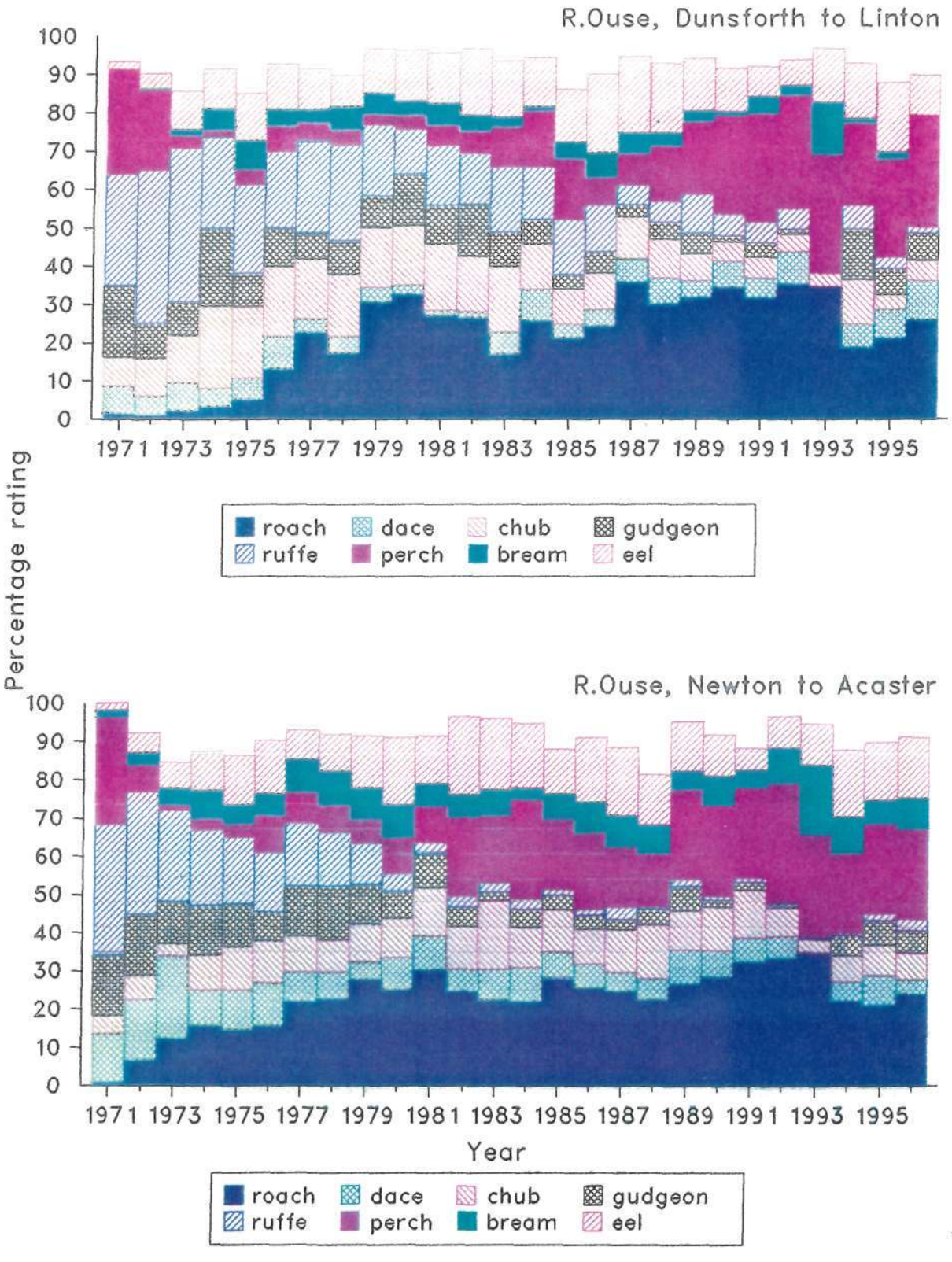


TABLE 3.1.1 CATCHES, RIVER OUSE

SITE	Linton (u/s weir)				Linton (d/s weir)	Beningbrough				Nether Poppleton			Acaster Malbis			Naburn weir			
METHODS	SAB	GN	SN	BB	SAB	SAB	GN	SN	BB	SAB	GN	BB	SAB	BB	GN	SAB	GN	BB	SN
Dace	2		1		17	1						1	1			14	1	34	6
Chub	6		3	3	2	3				1			36			1		1	2
Roach	89	2	22	65	25 (4*)	28	1	14	59	37	3	10	50	10	22	46	6	29	150
Bream	10		9	1														1	9
S. Bream																1		2	
Bleak			2	14	16	3		33		1		11	30	10	3	5		37	18
Gudgeon	8		58		6	4		15		1			14						
Ruffe										1									
Perch	20		23	16	6	12	7	42	1	18		5	13		1	8	15	5	
Pike	6	1	1	4	3	2	1	1		3	1	7	5			14		4	1
Eels	2*			2*	1*	1*			2*	1*		1*				1*		1*	
Fry					5*														

Subjective abundance 1*----------5*
<5 > 2000/100m^2

Table 3.2.1 Catches of coarse fish fry at Beningbrough

Numbers in parentheses are percentage representations in each sample

* Skelton: flows for June, July and August as a percentage of long-term mean(1972-1992) for these months

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	TOTAL
Barbel	16 (1.5)	1 (0.3)	10 (1.3)		1 (0.2)	1 (0.1)		3 (0.1)	1 (0.1)					2 (0.2)			34 (0.2)
Chub	107 (10.2)	64 (18.9)	116 (14.7)		184 (27.7)	74 (5.3)	73 (10.5)	641 (22.8)	99 (9.8)	11 (2.7)	115 (22.4)	170 (17.7)	77 (39.7)	308 (28.9)	83 (13.7)	727 (55.7)	2849 (20.1)
Dace	218 (20.7)	125 (36.9)		50 (10.3)		17 (1.2)	202 (29.1)	205 (7.3)	31 (3.1)	30 (7.5)		107 (11.1)	12 (6.2)	23 (2.2)	7 (1.2)		1027 (7.3)
Roach	362 (34.4)	29 (8.6)	208 (26.4)	148 (30.5)	180 (27.1)	834 (59.8)	149 (21.4)	881 (31.3)	428 (42.3)	294 (73.1)	353 (68.8)	445 (46.4)	28 (14.4)	587 (55.1)	234 (38.7)	405 (31.1)	5565 (39.3)
Bream			89 (23.7)	6 (1.2)		3 (0.2)			1 (0.1)	1 (0.3)		4 (0.4)		11 (1.0)	2 (0.3)	4 (0.3)	121 (0.9)
Perch				10 (2.1)		6 (0.4)	3 (0.4)	13 (0.5)	4 (0.4)	1 (0.3)	41 (8.0)	18 (1.9)		16 (1.5)	29 (4.8)		141 (1.0)
Bleak	11 (1.0)		4 (0.5)	92 (18.9)	2 (0.3)	13 (0.9)	122 (17.6)	23 (0.8)	123 (12.2)	64 (15.9)		167 (17.4)	47 (24.2)	72 (6.8)	102 (16.9)	131 (10.0)	973 (6.9)
Ruffe	12 (1.1)			2 (0.4)	2 (0.3)	211 (15.1)	12 (1.7)	12 (0.4)									251 (1.8)
Gudgeon	268 (25.5)	89 (26.3)	357 (45.2)	40 (8.2)	221 (33.3)	228 (16.3)	27 (3.9)	893 (31.7)	291 (28.8)		1 (0.2)	46 (4.8)	28 (14.4)	28 (2.6)	147 (24.3)	33 (2.5)	2697 (19.0)
Minnow	53 (5.0)	30 (8.8)	5 (0.6)	7 (1.4)	73 (11.0)	3 (0.2)	106 (15.3)	138 (4.9)	32 (3.2)	1 (0.3)	2 (0.4)	3 (0.3)		14 (1.3)	1 (0.2)	2 (0.2)	470 (3.3)
3-spined stickleback	4 (0.4)	1 (0.3)				4 (0.3)	1 (0.1)	8 (0.3)	1 (0.1)		1 (0.2)		2 (1.0)	5 (0.5)		3 (0.2)	30 (0.2)
TOTAL	1053	339	789	486	664	1394	695	2817	1011	402	513	960	194	1066	605	1305	14158
% summer flow*	90	139	91	42	186	109	132	159	44	42	58	64	119	54	35	51	

Table 3.2.2 Growth of coarse fish fry at Beningbrough

Numbers are mean lengths (mm) and numbers in parentheses show sample size for mean calculation

*mean of annual means (not weighted)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	overall*
Barbel	31.9 (16)	42 (1)	39.1 (10)		23 (1)	25 (1)		32 (3)	42 (1)					34 (2)			33.6
Chub	24.9 (107)	26.2 (64)	31.8 (116)	31.6 (131)	24.3 (184)	28.2 (74)	22.6 (73)	29.1 (165)	38.7 (99)	33.1 (11)	26.6 (115)	33.6 (170)	21.4 (77)	29.7 (170)	34.9 (83)	29.0 (190)	29.1
Dace	44.3 (218)	40.5 (125)		48.0 (50)		39.4 (17)	34.9 (202)	41.4 (171)	48.7 (31)	49.7 (30)	46.9 (89)	47.2 (107)	40.6 (12)	45.2 (23)	49.3 (7)		44.3
Roach	29.5 (362)	33.0 (29)	31.8 (208)	37.2 (148)	26.1 (180)	26.4 (165)	28.1 (149)	32.3 (158)	37.0 (159)	37.7 (188)	33.1 (353)	31.2 (155)	22.9 (28)	34.6 (145)	42.1 (158)	21.1 (166)	31.5
Bream			23.7 (89)	29.2 (6)		22.7 (3)				33 (1)		32.3 (4)		27.1 (11)	39 (2)	32.8 (4)	30.0
Perch				65.7 (10)		51.0 (6)	65.0 (3)	55.3 (13)	73.5 (4)	73 (1)	66.4 (41)	53.4 (18)		61.9 (16)	67.8 (29)		63.3
Bleak	22.9 (11)		28.8 (4)	32.8 (92)	26 (2)	25.2 (13)	21.8 (122)	32.3 (23)	41.6 (123)	41.8 (64)		33.2 (167)	20.6 (47)	29.0 (72)	39.9 (102)		30.5
Ruffe	44.4 (12)			58.5 (2)	51.5 (2)	50.0 (211)	41.7 (12)	53.3 (12)									49.9
Gudgeon	38.0 (268)	34.5 (89)	38.4 (159)	40.4 (40)	32.8 (221)	32.4 (228)	32.6 (27)	36.0 (159)	47.8 (160)		50 (1)	38.9 (46)		37.6 (28)	47.8 (147)	33.8 (33)	38.6
Minnow	22.8 (53)	29.8 (30)	28.2 (5)	27.3 (7)	23.7 (73)	17.3 (3)	27.1 (106)	25.0 (138)	34.2 (32)	29 (1)	32.5 (2)	27.3 (3)	16.7 (28)	26.7 (14)	27 (1)	29.5 (2)	26.5
3-spined stickleback	34.8 (4)	40 (1)				33.5 (4)	31 (1)	35.9 (8)	24 (1)		41 (1)		31.5 (2)	31.4 (5)		38.6 (3)	34.2
% summer flow	90	139	91	42	186	109	132	159	44	42	58	64	119	54	35	51	

Table 3.2.3 Catches of coarse fish fry at Acaster Malbis

Numbers in parentheses are percentage representations in each sample

* Skelton: flows for June, July and August as a percentage of long-term mean(1972-1992) for these months

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	**TOTAL**
Barbel							1 (0.7)	1 (1.4)							1 (0.3)		3 (0.1)
Chub		22 (7.1)	61 (42.4)	15 (12.4)	20 (12.4)	40 (10.2)	57 (36.8)	4 (5.7)				269 (97.1)	2 (10.5)	167 (38.2)	77 (26.8)		734 (29.3)
Dace		33 (10.6)			1 (0.6)	3 (0.8)	5 (3.2)			20 (80.0)			4 (21.1)	49 (11.2)	31 (10.8)		146 (5.8)
Roach	28 (87.5)	54 (17.3)	71 (49.3)	69 (57.0)	11 (6.8)	347 (88.3)	15 (9.7)	63 (31.3)	3 (14.3)			6 (2.2)	8 (42.1)	42 (9.6)	17 (5.9)	4 (7.7)	738 (29.4)
Bream			5 (3.5)											11 (2.5)			16 (0.6)
Perch				1 (0.8)	1 (0.6)				18 (85.7)	2 (8.0)				1 (0.2)	6 (2.1)		29 (1.2)
Bleak					20 (12.4)	1 (0.3)		2 (2.9)						25 (5.7)			48 (1.9)
Ruffe					2 (1.2)	1 (0.3)											3 (0.1)
Gudgeon	4 (12.5)	198 (63.5)	5 (3.5)	35 (28.9)	105 (65.2)	1 (0.3)	62 (40.0)			3 (12.0)		1 (0.3)	5 (26.3)	142 (32.5)	153 (53.3)	48 (92.3)	762 (30.4)
Minnow		2 (0.6)			1 (0.6)		14 (9.0)					1 (0.3)					18 (0.7)
3-spined stickleback		3 (1.0)	2 (1.4)	1 (0.8)			1 (0.7)								2 (0.7).		9 (0.4)
TOTAL	32	312	144	121	161	393	155	70	21	25		277	19	437	287	52	2506
% summer flow*	90	139	91	42	186	109	132	159	44	42	58	64	119	54	35	51	

Table 3.2.4 Growth of coarse fish fry at Acaster Malbis

Numbers are mean lengths (mm) and numbers in parentheses show sample size for mean calculation

*mean of annual means (not weighted)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	**overall***
Barbel							22 (1)	26 (1)							55 (1)		34.3
Chub		28.4 (22)	28.0 (61)	24.5 (15)	22.7 (20)	21.7 (40)	20.6 (57)	24.5 (4)				29.4 (156)	23 (2)	20.6 (167)	27.8 (77)		24.7
Dace		39.7 (33)			39 (1)	39.7 (3)	31.0 (5)			57.1 (20)		47.2 (100)	48.5 (2)	50.2 (49)	55.1 (31)		45.3
Roach	33.1 (28)	32.2 (54)	27.5 (71)	37.9 (69)	26.0 (11)	26.2 (347)	24.2 (15)	29.6 (63)	33.0 (3)			31.5 (6)	29.5 (8)	35.7 (42)	37.5 (17)	30.5 (4)	31.0
Bream			23.0 (5)											25.4 (11)			24.2
Perch				77 (1)	57 (1)				67.2 (18)	90 (2)				59 (1)	69.4 (6)		69.9
Bleak					22.3 (20)	28 (1)		21.5 (2)						31.1 (25)			25.7
Ruffe						41 (1)											41
Gudgeon	36.0 (4)	38.9 (198)	43.8 (5)	39.2 (35)	35.6 (105)	36 (1)	30.7 (62)			31.7 (3)		38.9 (46)	34.0 (5)	43.1 (142)	49.5 (153)	38.3 (48)	38.1
Minnow		36 (2)			16 (1)		20.1 (14)					17 (1)					22.3
3-spined stickleback		36 (3)	32 (2)	42 (1)			25 (1)								32 (2)		33.4
% summer flow	90	139	91	42	186	109	132	159	44	42	58	64	119	54	35	51	

Table 2.1.1 Sampling methods

SITE LOCATION	METHOD	COMMENTS
Linton-on-Ouse,U/S weir	single anode, boating boom boat seine net 1x gill net set for 1.5hr	fished both margins, good site for seine netting
Linton-on-Ouse, D/S weir	single anode, boating	nature of site dictates single anode sampling
Beningbrough	single anode, boating boom boat seine net 1x gill net set for 1.5hr	benthic debris reducing seine net capture efficiency, margins electrofished
Nether Poppleton	single anode, boating boom boat 1x gill net set for 1.5hr	margins electrofished
Acaster Malbis	single anode, boating boom boat 1x gill net set for 2hr	margins electrofished
Naburn,D/S weir	single anode, boating boom boat 1x gill net set for 1.5hr	benthic debris reducing seine net efficiency

Equipment details:

Electric fishing: single/double anode with an Electracatch WFC7 box set on pulsed d.c. 100Hz with a 1.7kVA generator.

Boom boat:Electracatch WFC12/30 box set on pulsed d.c. 150Hz with a 7.5kVA generator.

Seine net: 80x5m, 12.5mm mesh.

Gill net: 60m multi-mesh braided gill net, 12 panels from 8mm to 55mm half mesh.

Table 2.1.2 Sites

SITE NUMBER	LOCATION	GRID REFERENCE	DATE	METHODS, SITE MIDPOINT, LENGTH FISHED(m)
1	**Linton On Ouse (above weir)**	SE 494600	23/7/96	SAB, 250m u/s of lock entrance, 300m, both margins BB, 250m u/s of lock entrance, 300m, both margins SN, 80m x 5m LHB, 100m u/s from lock entrance, single sweep GN, set at top of site for 1.5 hours
2	**Linton On Ouse (below weir)**	SE 501602	25/7/96	SAB, 150m d/s from weir, 300m, both margins
3	**Beningbrough**	SE 528578	24/7/96	SAB, 250m d/s from Moor Monkton intake, 250m, both margins BB, 250m d/s from Moor Monkton intake, 250m, both margins SN, 80m x 5m, 100m u/s of drain on LHB, single sweep GN, 60m d/s of willows on RHB for 1.5 hours
4	**Nether Poppleton**	SE 566554	18/7/96	SAB, 125m u/s from gauging station, 250m, both margins BB, 125m u/s from gauging station, 250m, both margins GN, 100m d/s from railway bridge set for 1.5 hours
5	**Acaster Malbis**	SE 593447	26/7/96	SAB, 300m u/s of weir, 300m, both margins BB, 300m u/s of weir, 300m, both margins GN, 175m u/s from weir set for 2 hours
6	**Naburn weir**	SE 594445	22/7/96	SAB, 75m d/s of weir, 150m, both margins BB, 75m d/s of weir, 150m, both margins SN, 80m x 5m, opposite sand bar 100m d/s of weir GN, opposite lock exit (75m d/s from weir), mid channel, set for 1 hour

BB = Boom Boating **SAB** = Single Anode Boating **SN** = Seine Netting **GN** = Gill Netting

Table 3.1.1 Age and Growth

SPECIES	SITE	NO. OF FISH	AGE (YEARS)	YEAR-CLASS	MEAN LENGTH (cm)	LENGTH RANGE (cm)
Dace	**Linton (u/s weir)**	3	1+	1995	6.7	5.2 - 7.9
	Linton (d/s weir)	4	1+	1995	8.4	7.8 - 9.0
		12	2+	1994	10.4	9.3 - 12.1
		1	4+	1992	15.3	-
	Beningbrough	1	1+	1995	6.3	-
	Nether Poppleton	1	1+	1995	7.8	-
	Acaster Malbis	1	1+	1995	8.2	-
	Naburn weir	8	1+	1995	8.0	6.6 - 8.9
		11	2+	1994	12.0	8.7 - 13.0
		2	3+	1993	12.6	12.1 - 13.0
		3	4+	1992	16.7	16.2 - 17.4
		3	5+	1991	18.0	17.9 - 18.2
		1	6+	1990	18.9	-
Chub	**Linton (u/s weir)**	12	1+	1995	6.5	5.3 - 8.4
	Linton (d/s weir)	1	2+	1994	10.0	-
		1	5+	1991	22.3	-
	Beningbrough	3	1+	1995	6.5	6.2 - 7.0
	Nether Poppleton	1	2+	1994	8.6	-
	Acaster Malbis	11	1+	1995	7.1	5.7 - 8.6
		8	2+	1994	10.3	8.8 - 11.1
		4	4+	1992	18.0	16.2 - 18.8
		1	5+	1991	20.9	-
	Naburn weir	4	1+	1995	7.6	7.1 - 8.5

Table 3.1.2 Age and Growth

SPECIES	SITE	No. OF FISH	AGE (YEARS)	YEAR-CLASS	MEAN LENGTH (cm)	LENGTH RANGE (cm)
Roach	**Linton (u/s weir)**	52	1+	1995	6.2	5.3-7.3
		41	2+	1994	9.4	8.1-11.9
		10	3+	1993	13.0	11.1-14.9
		12	4+	1992	14.3	12.6-16.9
		11	5+	1991	17.1	14.7-19.0
		1	6+	1990	22.6	-
	Linton (d/s weir)	4	2+	1994	9.6	8.5-10.2
		1	3+	1993	12.6	-
		9	4+	1992	12.6	10.8-16.5
		5	5+	1991	14.6	13.6-15.9
		4	6+	1990	17.4	15.1-18.9
	Beningbrough	8	1+	1995	6.7	6.1-7.2
		13	2+	1994	9.4	8.7-9.8
		5	3+	1993	11.9	10.9-13.2
		9	4+	1992	13.8	12.5-16.0
		19	5+	1991	15.4	13.8-18.0
		11	6+	1990	17.7	15.3-20.8
		8	7+	1989	19.2	17.1-21.5
		1	8+	1988	17.6	-
	Nether Poppleton	10	1+	1995	6.1	5.1-7.1
		15	2+	1994	8.6	7.6-10.7
		7	3+	1993	11.1	9.6-14.1
		8	4+	1992	13.3	11.7-15.9
		4	5+	1991	14.9	12.4-16.7
		1	6+	1990	16.0	-
		3	7+	1989	18.7	15.7-20.6

Table 3.1.3 Age and Growth

SPECIES	SITE	No. OF FISH	AGE (YEARS)	YEAR-CLASS	MEAN LENGTH (cm)	LENGTH RANGE (cm)
Roach	**Acaster Malbis**	28	1+	1995	6.4	5.3-8.2
		22	2+	1994	9.6	8.4-11.0
		8	3+	1993	11.1	9.7-12.2
		8	4+	1992	12.9	11.4-14.0
		7	5+	1991	14.4	11.6-17.2
		1	6+	1990	16.0	-
		2	7+	1989	17.0	15.8-18.2
	Naburn weir	122	1+	1995	7.2	5.9-8.5
		8	2+	1994	10.1	9.0-12.1
		2	3+	1993	11.5	10.4-12.6
		15	4+	1992	14.1	12.3-18.8
		7	5+	1991	15.7	14.1-17.3
		9	6+	1990	17.7	16.0-22.3
		6	7+	1989	20.8	
		1	8+	1988	21.5	-
		1	11+	1985	26.5	-
		1	13+	1983	27.4	-
Bream	**Langthorpe**	1	0+	1996	4.7	-
	Aldwark Bridge	88	1+	1995	6.5	5.4-8.8
	Linton (u/s weir)	17	1+	1995	8.0	6.4-9.0
	Naburn weir	7	1+	1995	7.4	7.0-7.7
		1	2+	1994	8.9	-
		1	4+	1992	22.6	-
Silver bream	**Naburn weir**	2	8+	1988	21.4	20.2-22.6

Table 3.1.4 Age and Growth

SPECIES	SITE	NO. OF FISH	AGE (YEARS)	YEAR-CLASS	MEAN LENGTH (cm)	LENGTH RANGE (cm)
Bleak	**Linton (u/s weir)**	3	1+	1995	6.4	5.6-7.8
		11	2+	1994	10.6	9.0-12.6
		1	4+	1992	12.4	-
	Linton (d/s weir)	7	1+	1995	8.2	6.8-9.7
		8	2+	1994	9.6	8.9-10.4
		1	4+	1992	12.4	-
	Beningbrough	4	1+	1995	6.4	4.7-8.7
		21	2+	1994	9.7	8.5-11.1
		7	3+	1993	12.9	11.9-14.4
		4	4+	1992	12.5	12.1-13.2
	Nether Poppleton	5	1+	1995	7.0	5.7-7.7
		1	4+	1992	13.4	-
	Acaster Malbis	1	1+	1995	7.6	-
		13	2+	1994	10.6	8.7-12.2
		10	3+	1993	12.4	11.6-13.2
		4	4+	1992	13.1	12.4-14.0
	Naburn weir	10	1+	1995	7.7	5.8-9.2
		32	2+	1994	10.8	10.6-11.3
		4	4+	1992	13.0	12.0-13.7
		1	5+	1991	14.3	-

Table 3.1.5 Age and Growth

SPECIES	SITE	NO. OF FISH	AGE (YEARS)	YEAR-CLASS	MEAN LENGTH (cm)	LENGTH RANGE (cm)
Gudgeon	**Linton (u/s weir)**	15	1+	1995	8.1	6.5 - 8.7
		7	2+	1994	10.3	9.6 - 10.8
	Linton (d/s weir)	3	1+	1995	8.5	7.5 - 9.0
		3	2+	1994	11.3	11.2 - 11.6
	Beningbrough	6	1+	1995	8.0	6.9 - 9.1
		7	2+	1994	10.1	9.4 - 11.0
	Nether Poppleton	1	2+	1994	9.5	-
	Acaster Malbis	1	1+	1995	8.6	-
		9	2+	1994	11.2	10.4 - 12.5
		4	3+	1993	13.7	12.6 - 14.2
Ruffe	**Nether Poppleton**	1	2+	1994	9.5	-

Table 3.1.6 Age and Growth

SPECIES	SITE	NO. OF FISH	AGE (YEARS)	YEAR-CLASS	MEAN LENGTH (cm)	LENGTH RANGE (cm)
Perch	**Linton (u/s weir)**	52	1+	1995	9.9	8.2-14.6
		11	2+	1994	15.0	15.1-18.7
		1	3+	1993	21.0	-
		3	5+	1991	22.8	20.0-26.6
		1	6+	1990	31.1	-
	Linton (d/s weir)	2	1+	1995	9.6	9.2-9.9
		2	2+	1994	12.6	12.3-12.9
		1	3+	1993	16.5	-
		1	5+	1991	28.0	-
	Beningbrough	11	1+	1995	10.0	8.9 - 10.5
		15	2+	1994	14.0	11.9 - 16.5
		1	3+	1993	17.4	-
		4	4+	1992	18.6	17.4 - 21.1
	Nether Poppleton	13	1+	1995	8.9	7.4 - 10.1
		5	2+	1994	14.3	12.4 - 16.7
		1	3+	1993	17.8	-
		2	4+	1992	20.5	21.0 - 19.9
		1	7+	1989	22.1	-
	Acaster Malbis	8	1+	1995	9.5	7.6 - 10.3
		6	2+	1994	12.5	13.7 - 16.4
	Naburn weir	11	1+	1995	10.6	9.1 - 12.0
		1	2+	1994	16.3	-
		1	4+	1992	22.6	-
		4	5+	1991	28.7	25.8 - 32.6
		1	6+	1990	29.2	-
		1	9+	1987	38.9	-

Table 3.1.7 Age and Growth

SPECIES	SITE	NO. OF FISH	AGE (YEARS)	YEAR-CLASS	MEAN LENGTH (cm)	LENGTH RANGE (cm)
Pike	**Linton (u/s weir)**	2	1+	1995	30.9	29.5-32.2
		4	2+	1994	41.8	40.2-43.3
		1	3+	1993	50.0	-
		1	4+	1992	50.6	-
		2	5+	1991	66.7	59.6-73.7
		1	7+	1989	87.5	-
	Linton (d/s weir)	2	6+	1990	77.7	71.3-84.1
	Beningbrough	1	1+	1995	24.5	-
		2	2+	1994	40.8	40.3 - 41.3
		1	4+	1992	59.5	-
	Nether Poppleton	1	1+	1995	25.6	-
		4	2+	1994	40.8	35.4 - 45.2
		3	4+	1992	56.1	55.1 - 57.9
		2	5+	1991	61.7	57.6 - 65.7
		1	6+	1990	71.5	-
	Acaster Malbis	4	4+	1992	62.1	58.8 - 65.3
		1	7+	1989	71.0	-
	Naburn weir	1	2+	1994	51.5	-
		3	4+	1992	65.0	59.3 - 69.3
		2	5+	1991	64.9	64.4 - 65.4
		7	6+	1990	70.0	64.5 - 77.6
		3	7+	1989	80.3	77.2 - 81.9
		1	8+	1988	84.7	-

Fig. 3.1.1 Length:frequencies of dace

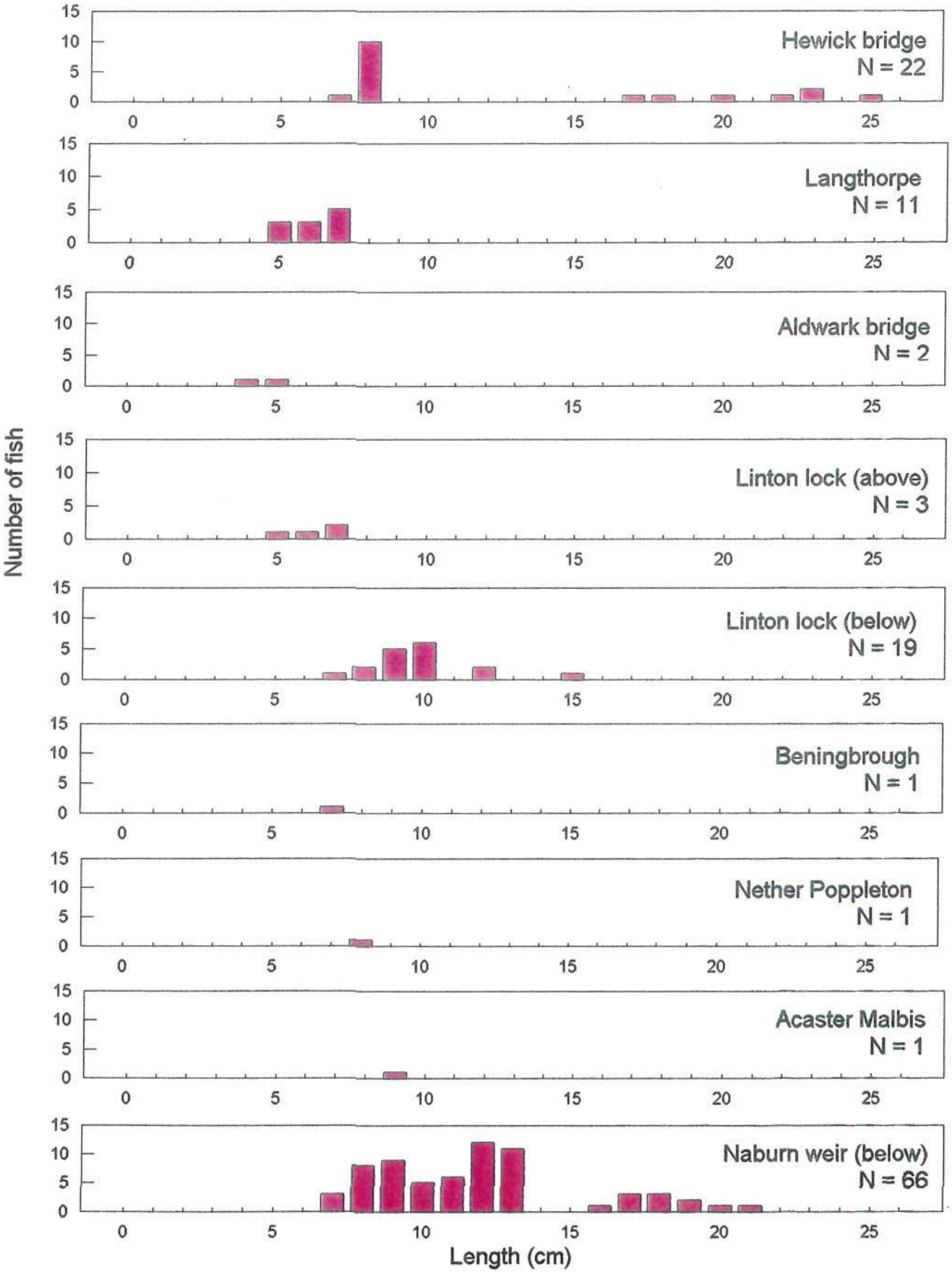


Fig. 3.1.2 Length:frequencies of chub

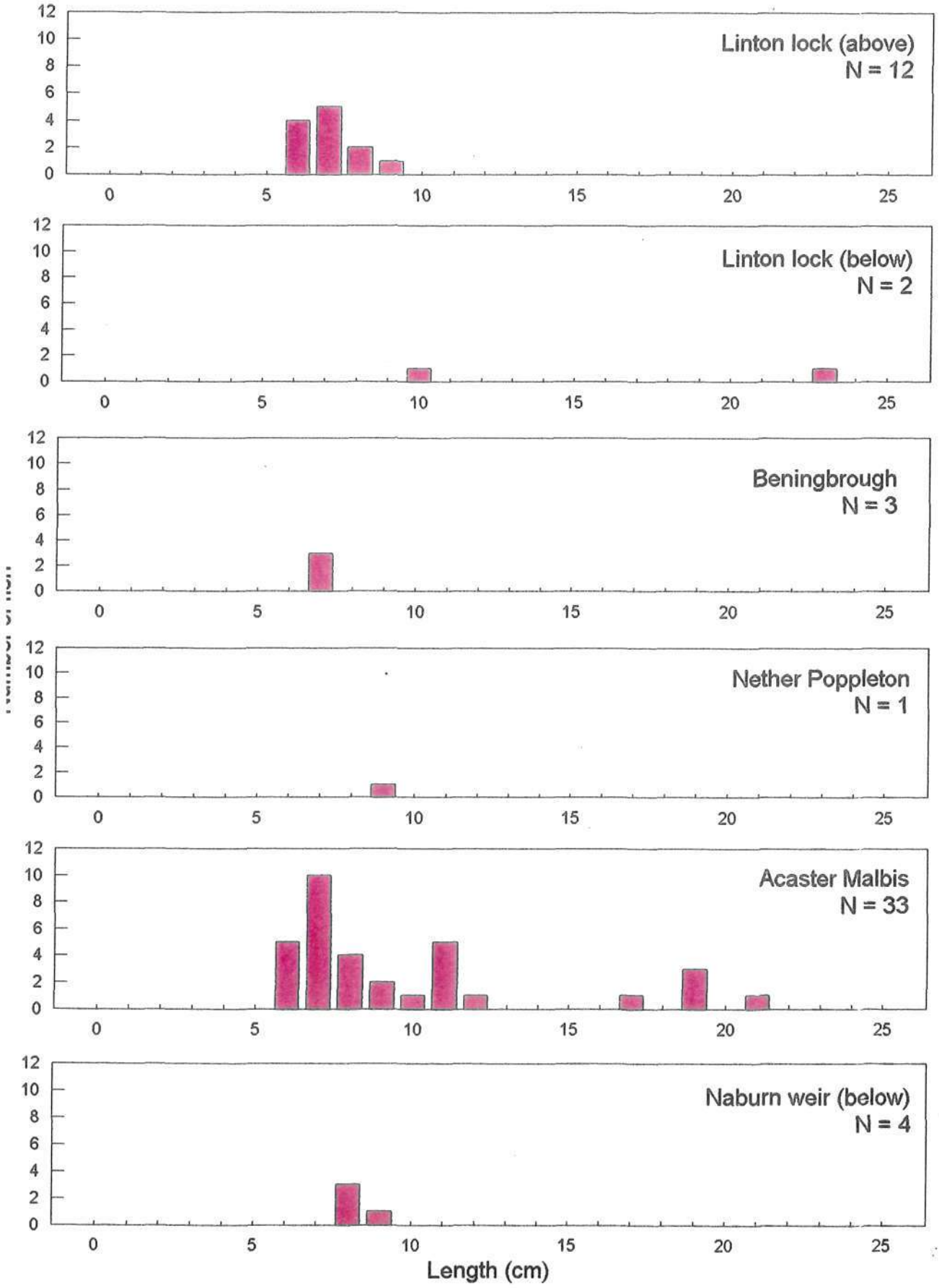


Fig. 3.1.3 Length:frequencies of roach

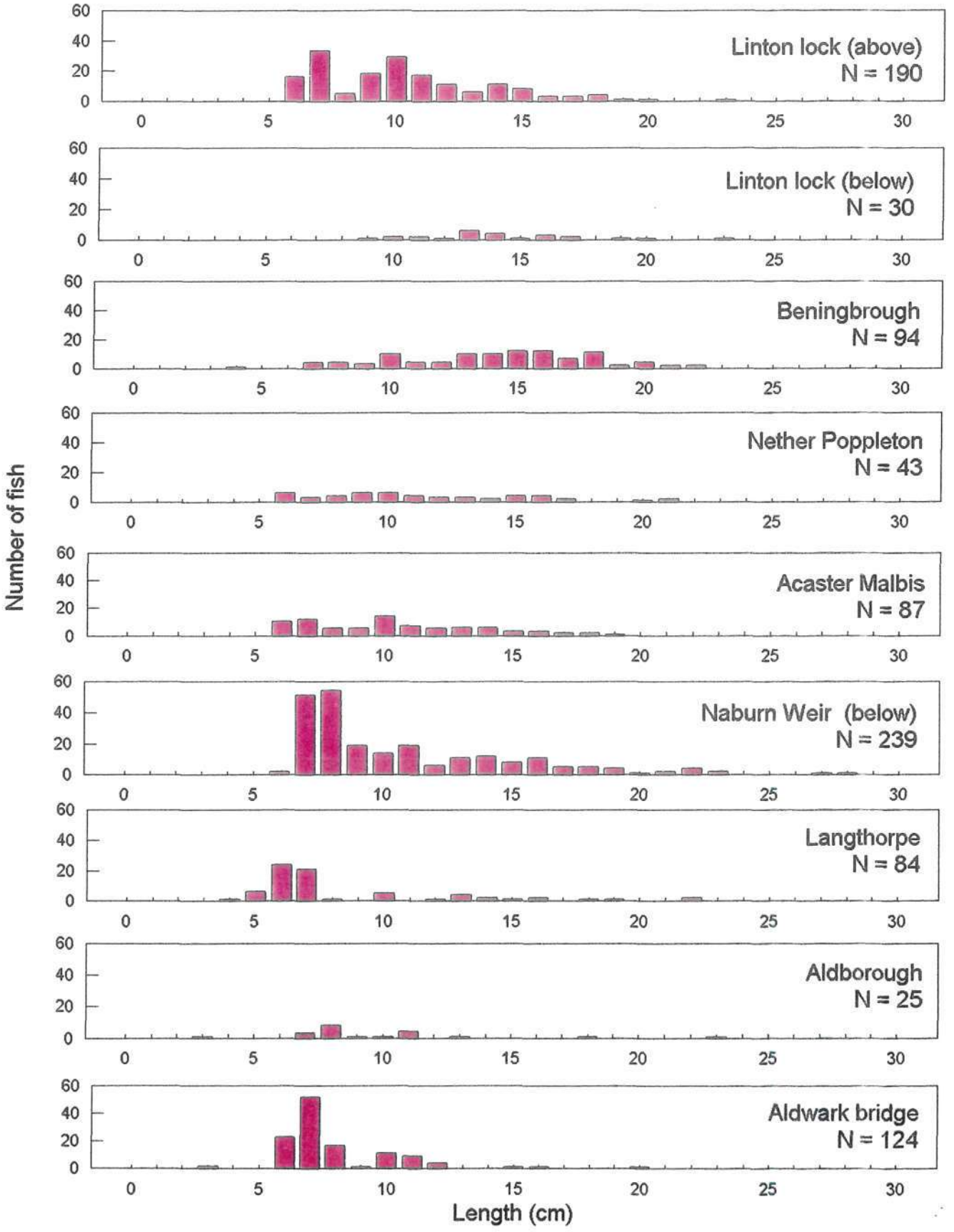


Fig. 3.1.4 Length:frequencies of bream

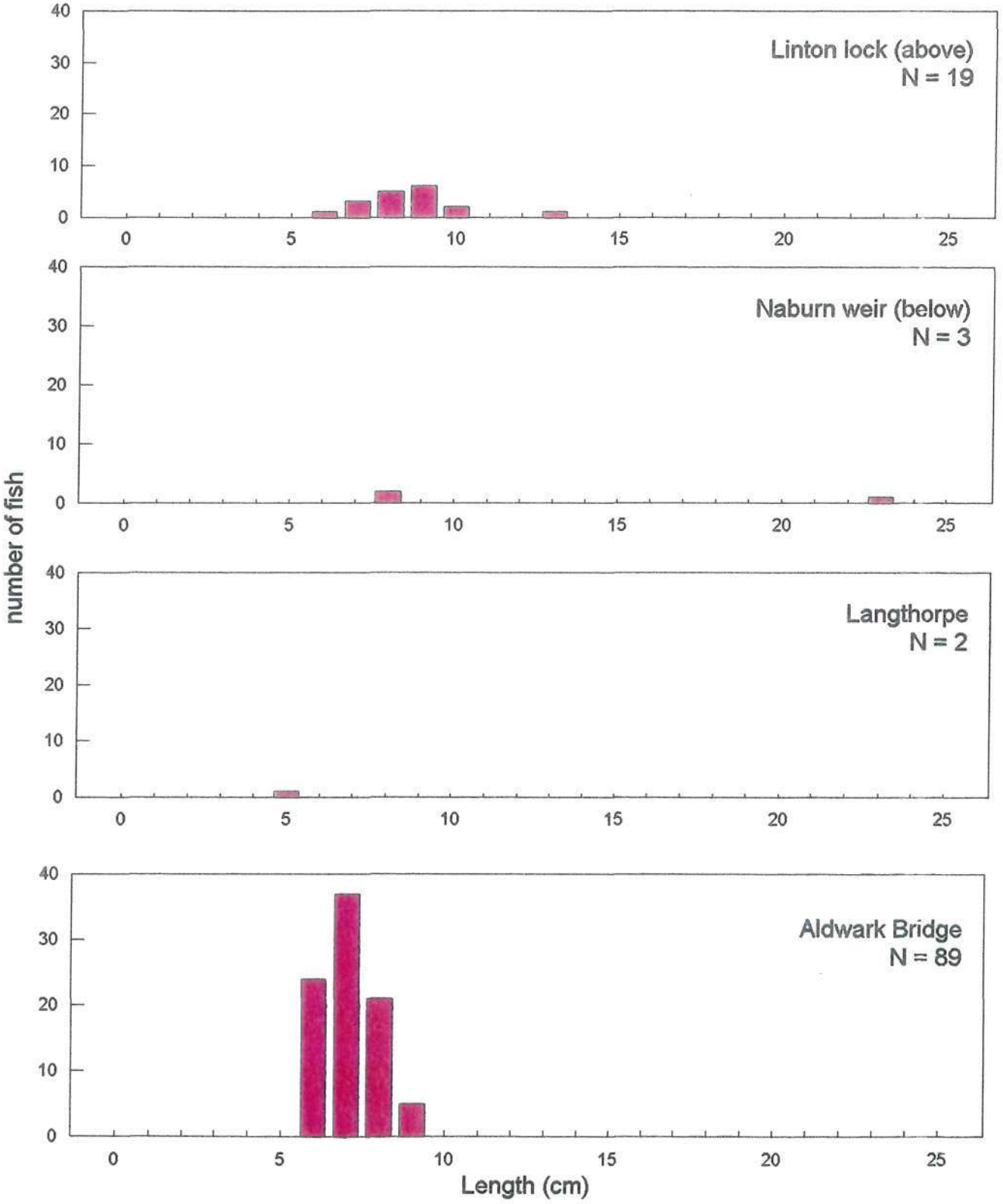


Fig. 3.1.5 Length:frequencies of silver bream

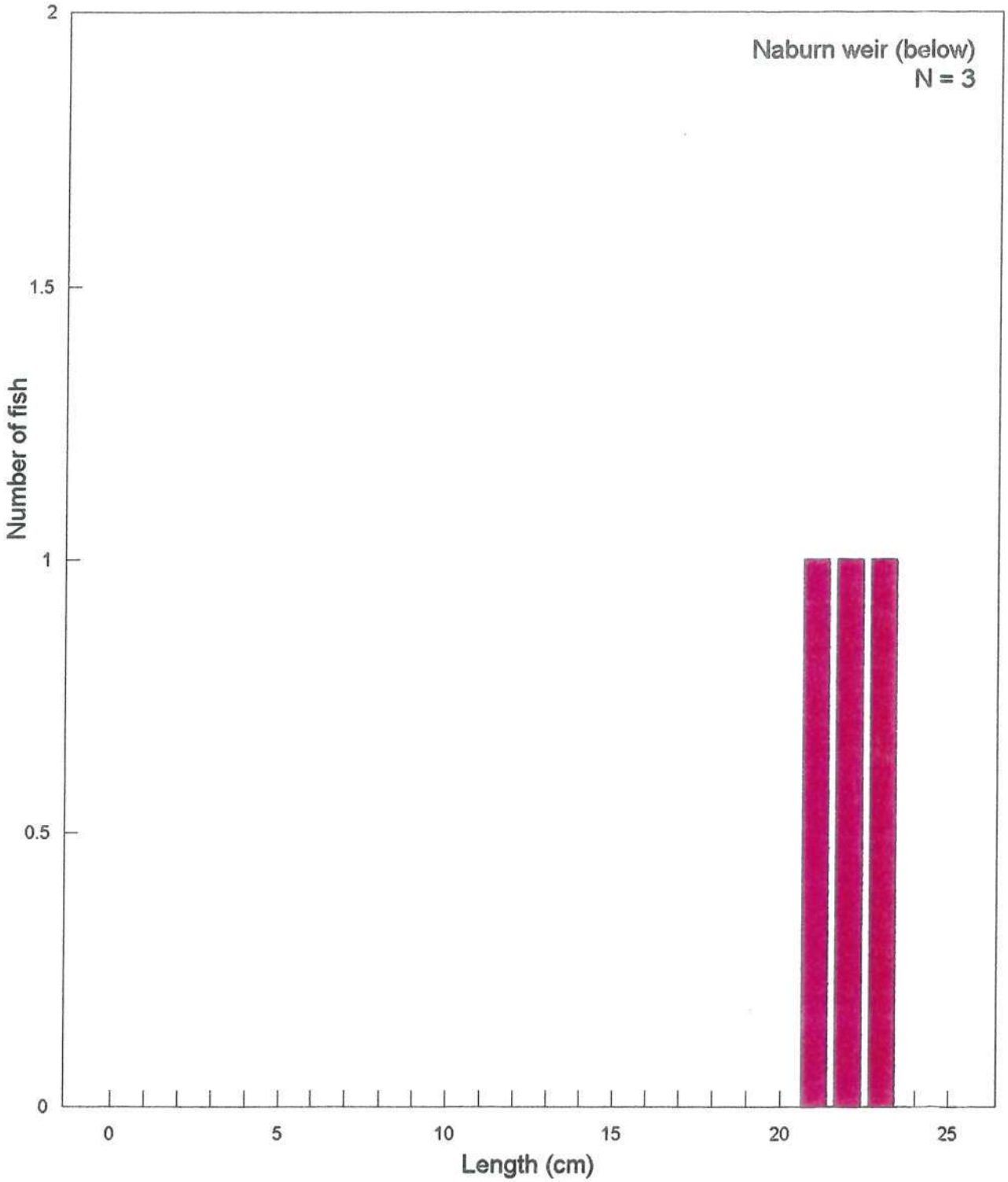


Fig. 3.1.6 Length:frequecies of bleak

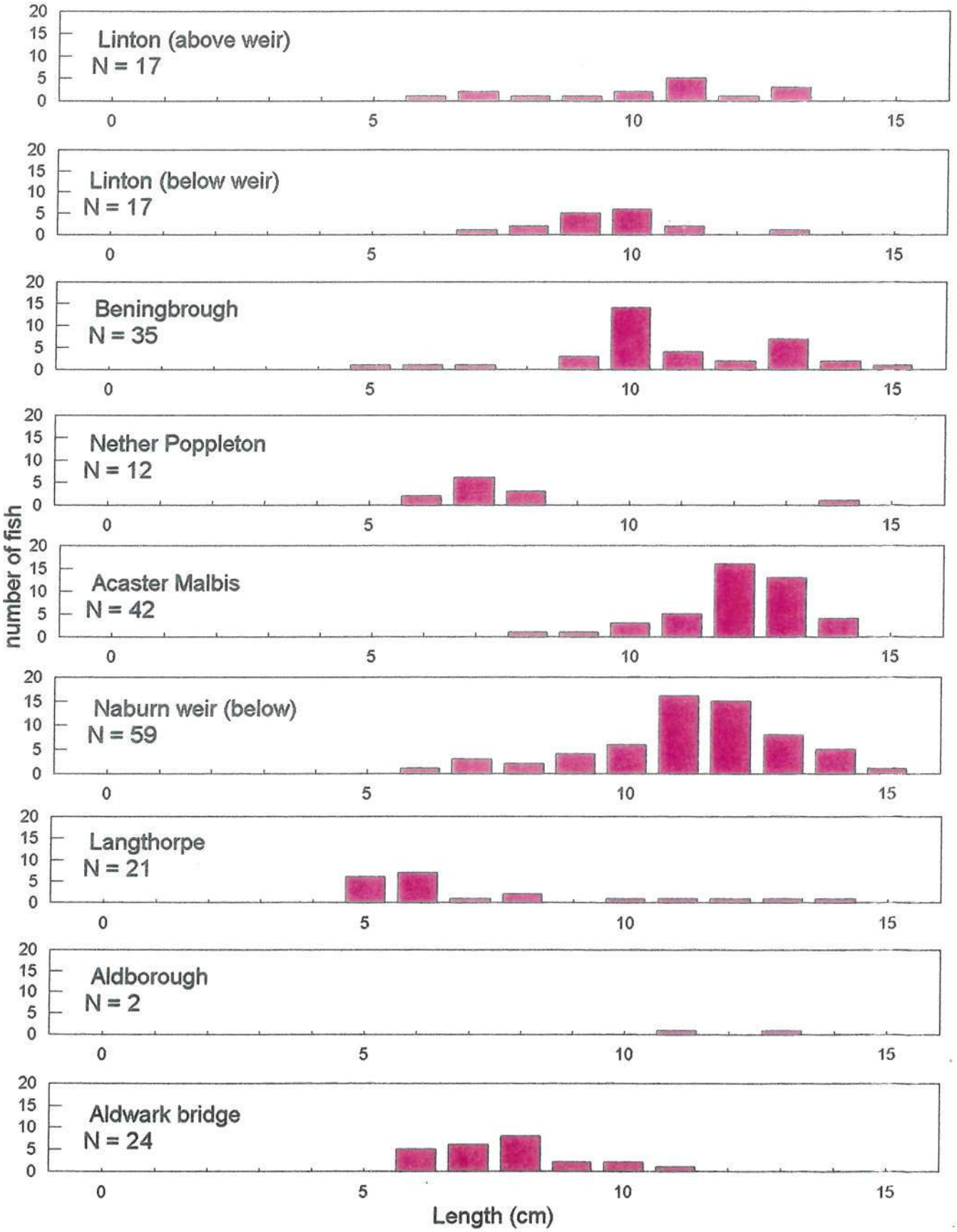


Fig. 3.1.7 Length:frequencies of gudgeon

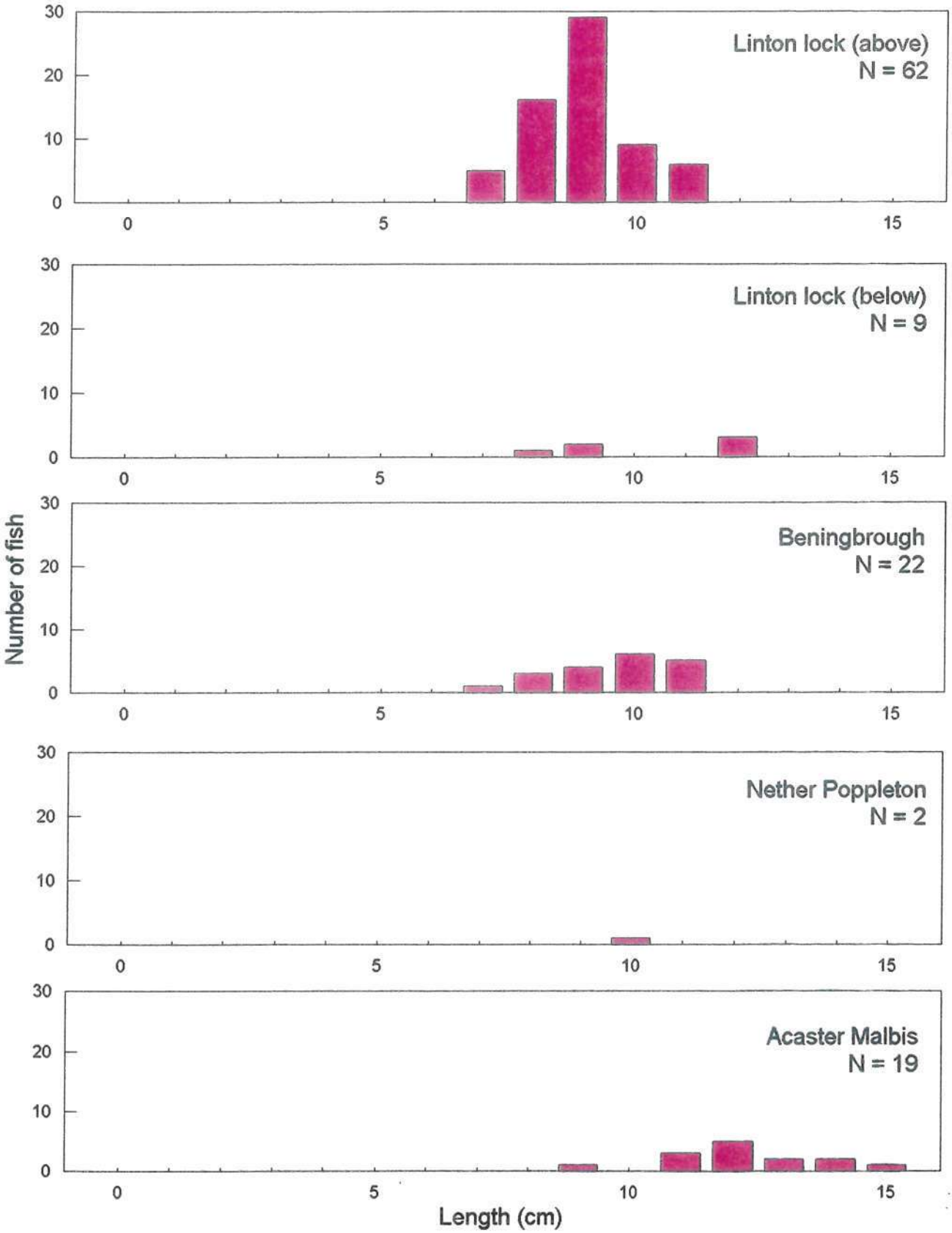


Fig. 3.1.8 Length:frequencies of ruffe

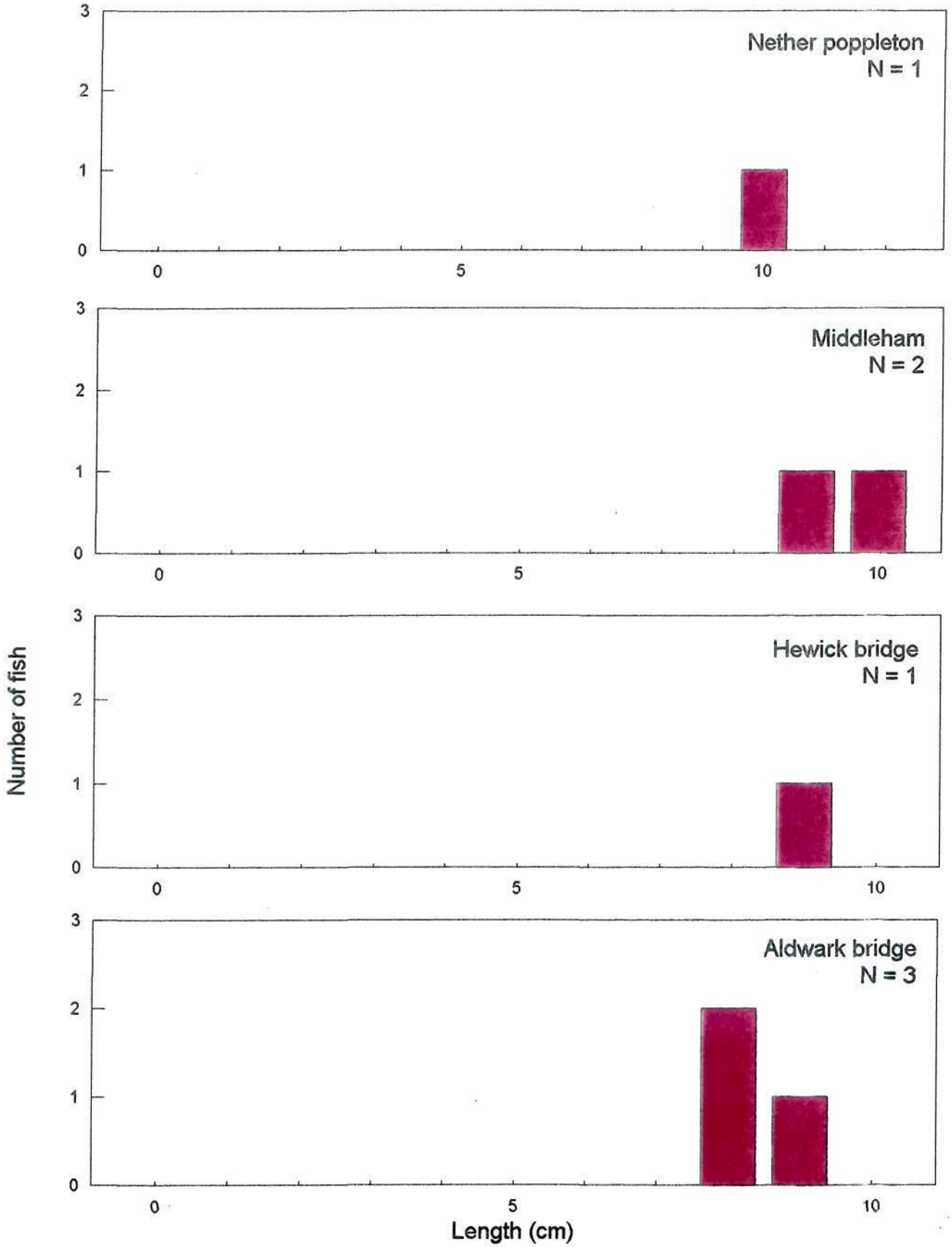


Fig. 3.1.9 Length:frequencies of perch

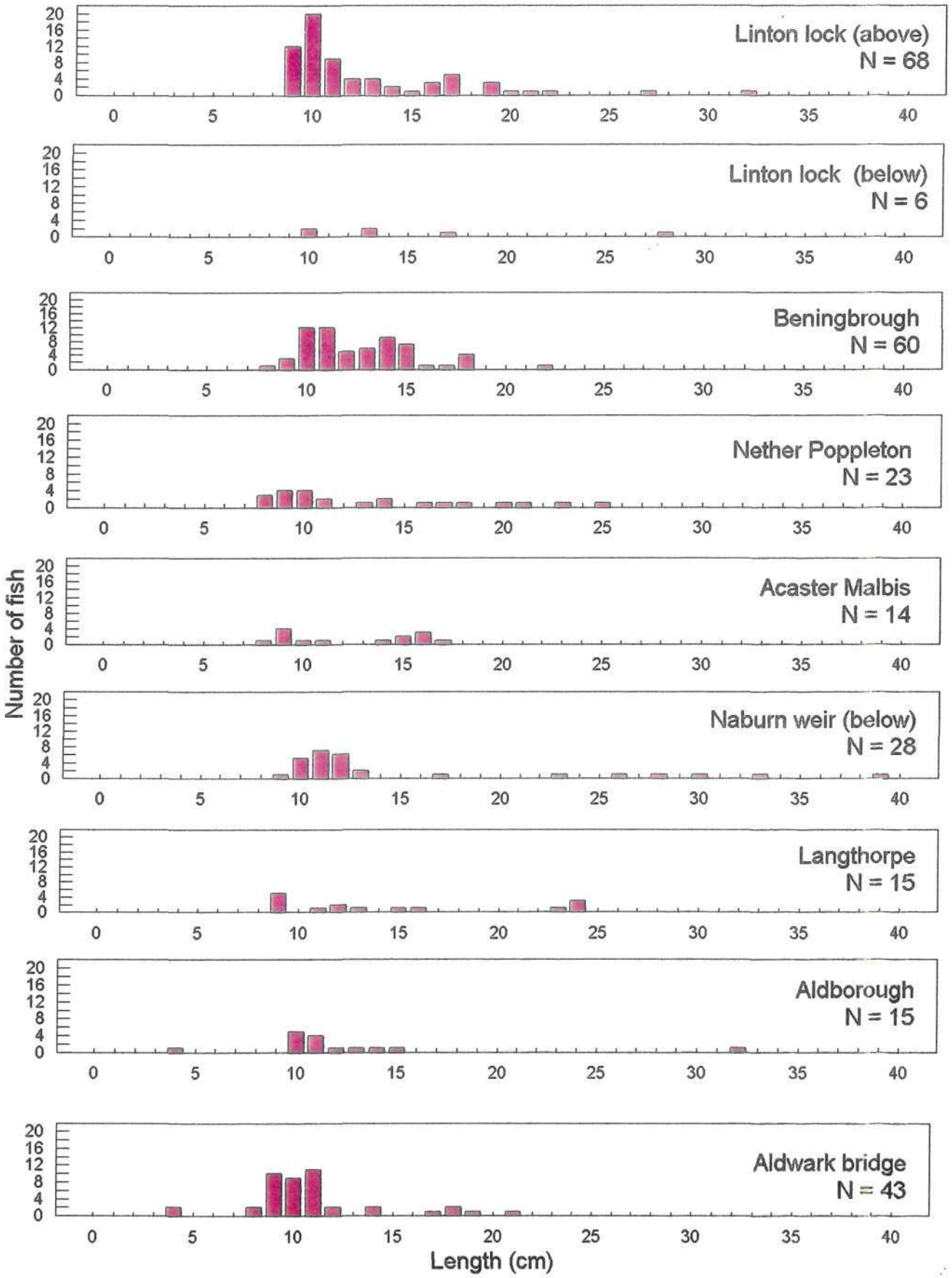


Fig. 3.1.10 Length:frequencies of pike

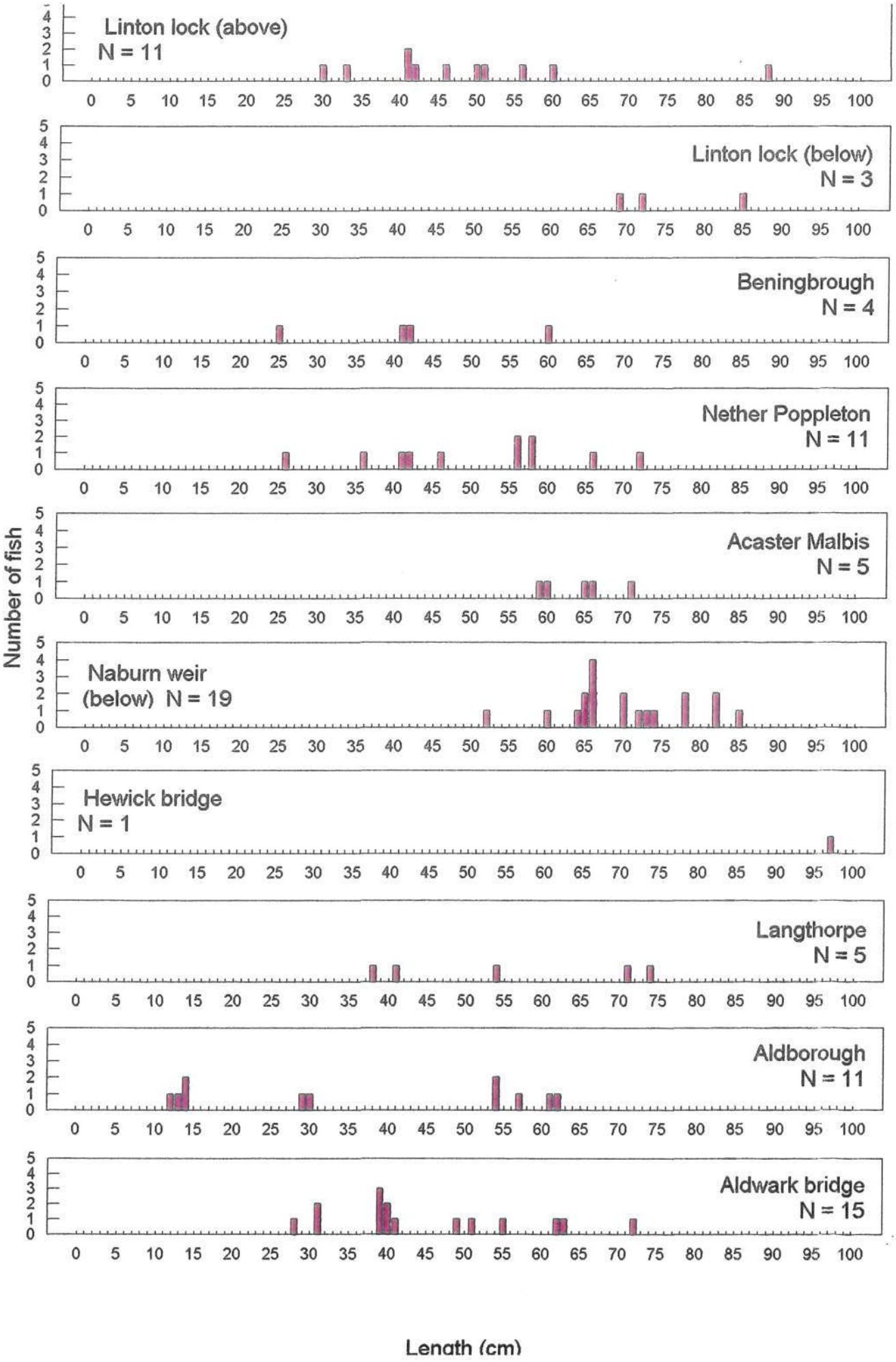


Fig. 3.1.11 Percentage species composition by number at each site

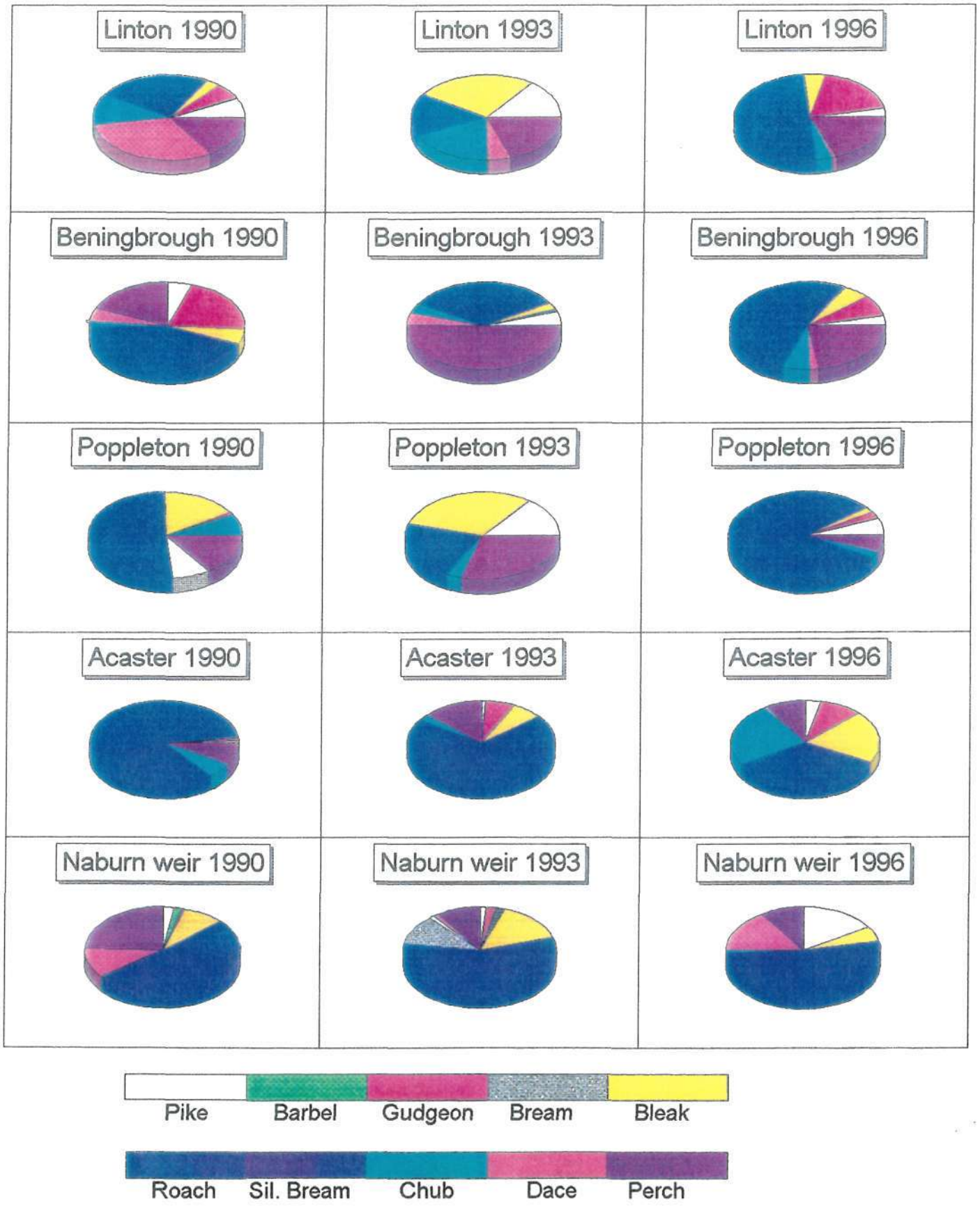
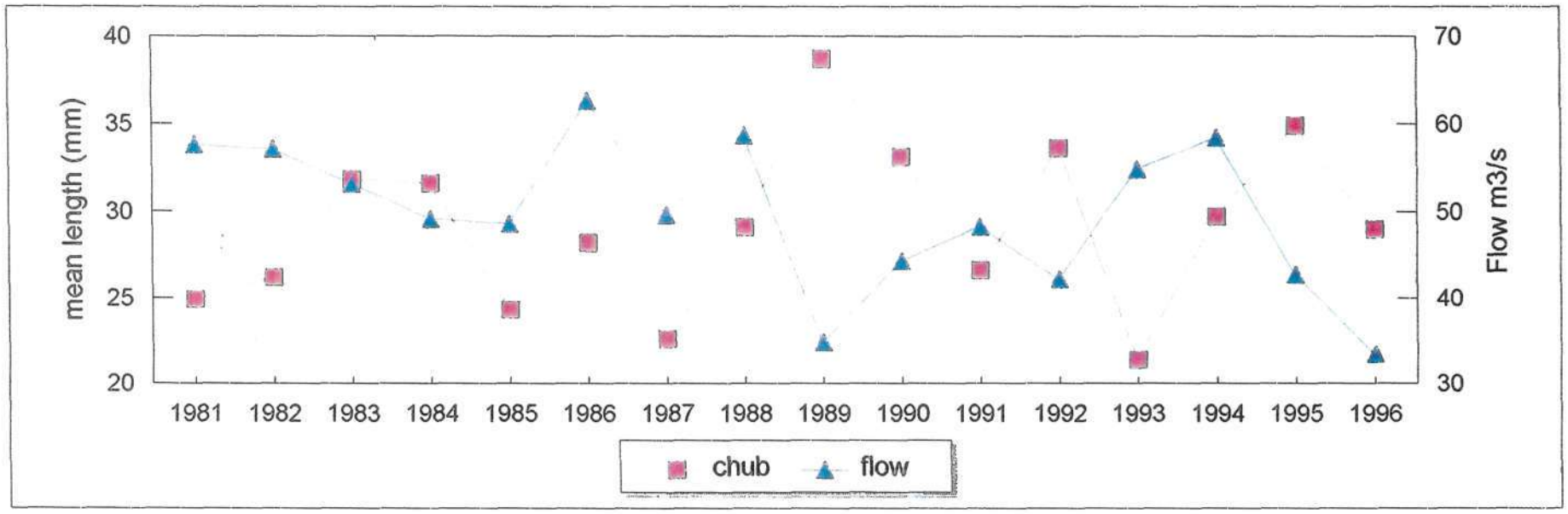


Fig. 3.2.1 Fry growth at Beninbrough Vs annual mean flow at Skelton



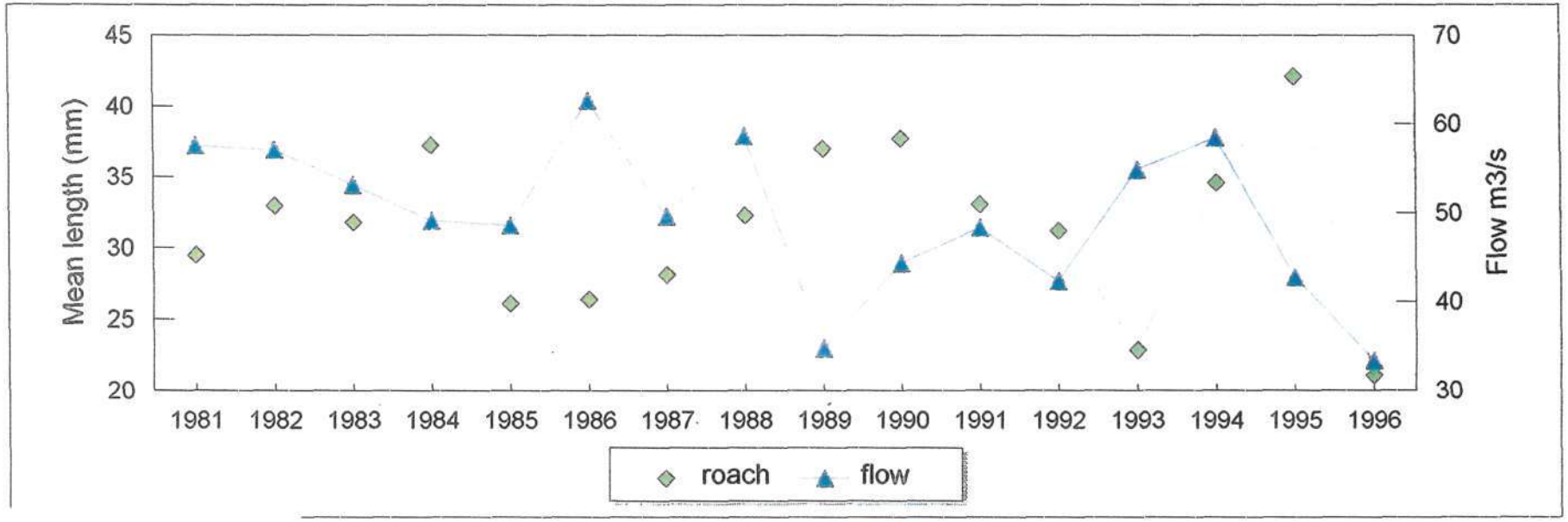


Fig. 3.2.2 Fry growth: water temperature relationship at Beningbrough