



3 THE FISHES OF THE TWEED AND THE EYE

B.2

European Eel *Anguilla anguilla*

“In our summer holidays, we fished for eels. There were a tremendous number of them in the river then. Every family at that time kept hens. There wasn’t much to feed them on, so they got the eels.”

Kelso resident, in Moffat (1985), *Kelsae*



Photo B.2.1: Yellow and Silver Eels from the Deloraine Burn on the Ettrick, caught on the same day at the end of August. The Silver Eel has changed colour to suit the next phase of its life-cycle, the crossing of the Atlantic to its spawning grounds and has also fattened up for the journey. The Yellow Eel is going to stay in freshwater longer and has not changed, though almost the same size as the other.

Eels of one species or another live throughout the world, in fresh water and in salt. Their body form is unmistakable and they have only one set of paired fins, the Pelvic or “shoulder” fins, while their unpaired fins (the Dorsal, Ventral and tail) are all joined together to make a “fringe” almost the whole length of their body. The scales of the European Eel are microscopic and deeply embedded in the skin so that they appear to be scaleless (and therefore unusable by Jews as food) and their sliminess is proverbial.

European Eels live in freshwater as adults, males till they are around 35-40cm in length and 7 to 12 years old and females till they are around 45-60cm and from 9 to 19 years old. It is possible that the Eels that push further upriver and remain longer and become larger in freshwater are the



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females, whilst males predominate in the areas nearer to the sea, remaining for shorter periods and not reaching very large sizes. When ready to return to the sea, from being yellowish brown in colour they become silver (and are called Silver Eels) and their eyes enlarge, both alterations suited to deep water conditions in the sea. Their fat content also increases from around 8% to over 30% which must be to provide energy to make their migration back across the sea. Their life cycle was not worked out till the first quarter of the 20th century and is still uncertain in parts – no one has yet seen a European Eel spawn in the wild and have only recently in captivity. By tracing back the journey of the Elvers (juvenile eels, 50 to 70mm in length, the stage that appears on the coasts), across the sea, finding younger and younger stages, the spawning area of Eels was deduced to be the Sargasso Sea, east of the Bahamas and South-west of Bermuda. Tagging of Silver Eels in the sea has shown they can cruise at 12kms an hour for long periods, covering 1200 km in three days, while the larvae drift back from the spawning area on the Gulf Stream, taking about a year to do so (Maitland & Campbell, 1992).

Eels have an acute sense of smell, which they use to find dead flesh on which they can feed. They also feed on invertebrates, insect larvae, worms and molluscs but as they become larger, they begin to eat small fish and frogs as well. Eels feed much less at cold temperatures and indeed, may not eat at all in Winter, remaining quiescent in holes. They are a common and favourite prey of Otters and Herons and, outside the Smolt season, of Goosanders. Whilst very important commercially in Europe, there has only been a small fishery for them on Tweed in recent years, and this ended in 2003. A century ago, however, the Tweed Eel fishery seems to have been on a larger scale (see below). In the 19th Century there was an active dislike of the idea of eating Eels in Scotland which was commented on by English authors :

“It would appear from Partington’s British Cyclopaedia, that the Scottish objection to Eels as an article of food is mainly due to their supposed “unwholesomeness”. In the northern part of Britain, in Scotland especially, the prejudice of the people runs very strong, not only against the form of the Eel, but against the quality of its flesh as an article of food” (Houghton, 1878).

By contrast, it was estimated that an average of 9,797,760 Eels were sold each year in London in the later 19th Century, most of which came from the Netherlands (Houghton, 1878). During the First World War, the Scottish Freshwater Committee issued a pamphlet called *“The Common Eel and its Capture; with Suggestions Applicable to Scotland”* in which it was said

“The prejudice which exists against the Eel in Scotland is most unfortunate, since it prevents Scotsmen taking advantage of a most nutritious fish” (MacKenzie 1935)

As, however, eels are still not much eaten in this country, this attempt to popularize them obviously failed. Their importance elsewhere has given rise to considerable alarm at present over their declining numbers. One cause for this is reckoned to be the export of vast numbers of Elvers to China for Eel-farming but there may be environmental problems as well. The Tweed is

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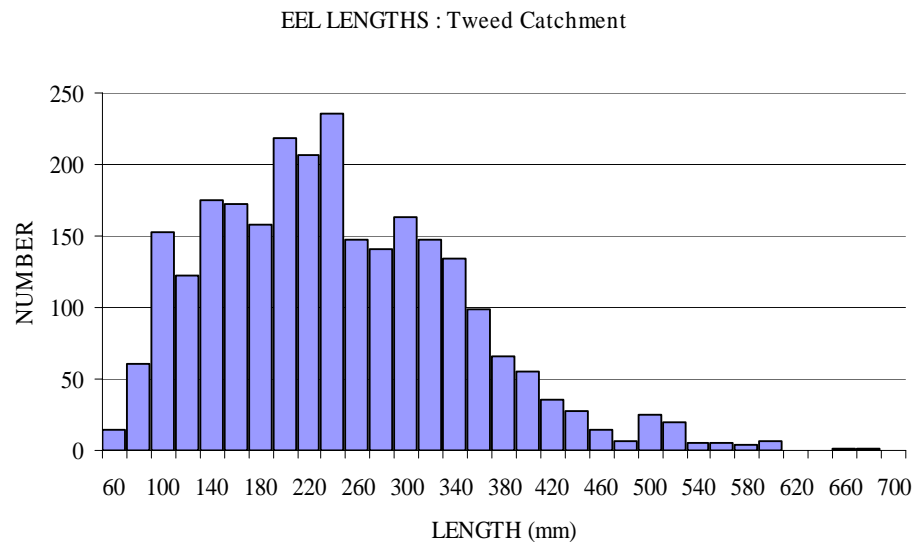
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fortunate in having had a Ph.D. study (Hussein, 1983) made on its Eels in the 1980's from which a great deal of interesting information is available, some of which is summarised below.

The European Eel in the Tweed and Eye catchments: The Eel is found just about everywhere, from ditches and ponds to the main channel of the lower Tweed and data is collected on them during electric-fishing for Salmon and Trout juveniles. The sizes found during this sampling are shown in Graph B.2.1:-

Graph B.2.1:



From this it can be seen that most Eels found in the same habitat in daytime as juvenile Salmon and Trout are from 150 to 300mm in length, with few reaching 500mm or more. If deeper water was sampled – or sampling was carried out at night - many more large Eels would presumably be found. The drop off in numbers around 340mm could be due to larger Eels moving out to deeper areas but is most likely the result of the males returning to the sea at around this size.

The Elvers start to run up the Tweed in late June and one sampling site on the lower Whiteadder which is sampled around that time produces large numbers of them – 189 Eels in all were sampled there on the 29th June 2000 and 137 on June 25th in 2002, many of them less than 100mm in length. This makes the population profile of Eels on the Whiteadder (Graph B.2.2) a quite different shape from that in the upper Tweed (Graph B.2.3) as the young Eels have gained in size by the time they have journeyed that far up the river. Some Elvers can move rapidly upstream and by late July can be seen on the Philiphaugh Cauld at Selkirk. They have considerable ability to get over obstacles and Eels are found upstream of Stichill Linn on the Eden, which is a complete block to both Trout and Salmon – their passage was described by Henderson (1876) :-

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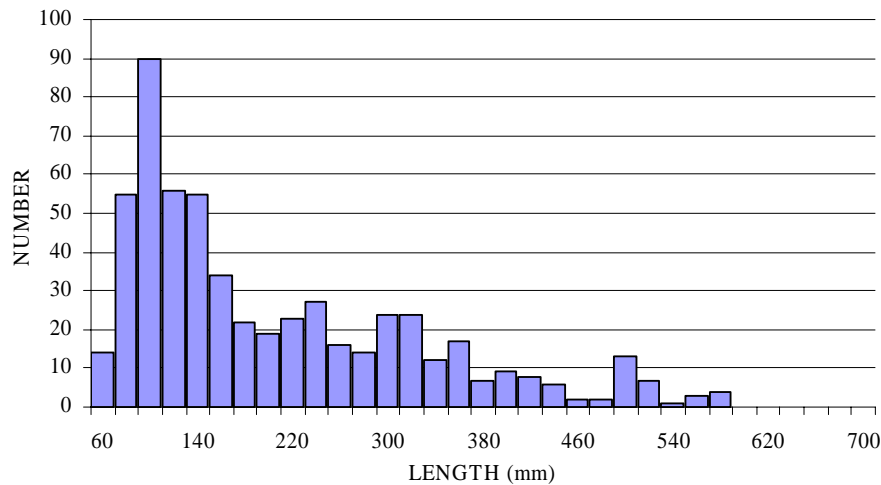
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“The waterfall of Newton Don has always possessed a great interest for me, and more than once have I passed an hour in watching the annual ascent of this rocky barrier by vast multitudes of small eels, who, bred in the brackish tidal waters of the Tweed, are incited by instinct to gain the upper pools of the Eden and its tributaries. These eels were generally about four inches in length, and their determined efforts to ascend, by wriggling and clinging to the wet moss were most remarkable.”

They are also found upstream of Hethpool Linns on the College Burn, which is an almost complete block to Salmon.

Graph B.2.2

EEL LENGTHS : Whiteadder



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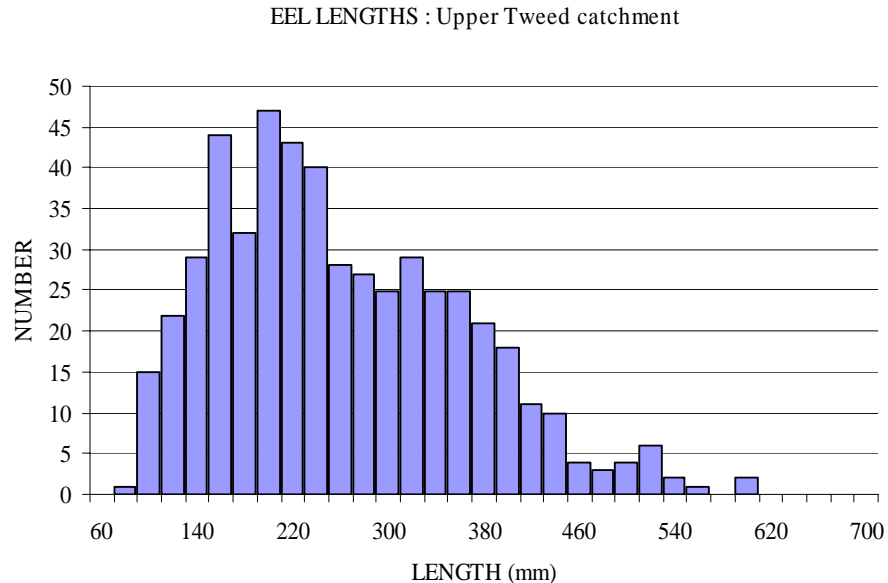
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Graph B.2.3



Abundance: The data available on this is again drawn from Eels sampled during electric-fishing surveys for juvenile Trout and Salmon and so does not show what numbers there might be in prime Eel habitat in the deeper waters of larger channels. The shallow areas which juvenile Salmonids prefer are only secondary habitat for Eels, but Graph B.2.4 shows some interesting patterns :

Table B.2.1: Abundances of Eels in the Tweed and Eye Catchments

	Av. No. per Sample	Average No. per Sample	
		Before 1990	After 1990
WHITEADDER ¹	12.17	8.19	4.1 ¹
TILL	8.04	10.00	6.33
LEET	11.91	na	11.91
EDEN	15.40	43.00	8.50
TEVIOT	10.13	13.86	5.89
MIDDLE TWEED ²	7.00	15.00	4.33
GALA	9.45	8.11	10.05
LEADER	5.07	7.33	3.97
ETTRICK	3.35	4.59	2.92
UPPER TWEED	5.55	10.15	2.56
EYE	3.83	na	3.83

1 Excluding Site WR 05, only sampled after 1990 and being close to the sea produces very large numbers of juveniles : Sample totals were 189 on the 29th June 2000 and 137 on the 25th June 2002, with no comparable pre-1990 data

2 : "Middle Tweed" is sites on the Ellwyn and Bowden Burns, not main channel.

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On the whole, the tributaries nearer the sea have higher abundances than those further upriver (in the table in Graph B.2.4, the tributaries / zones are listed in order of distance from the sea, the Whiteadder being the closest) Such preference may not be due simply to location however, the more lowland tributaries also have lower gradients and therefore slower flows and more stable gravels. It is also very obvious from these results that more recent surveys have found fewer Eels than past ones, which would fit with the pattern of general decline of the species that is causing such concern. The type of habitat from which this data is drawn is secondary rather than prime for the species, but it is precisely in such marginal habitats that population changes are most noticeable. As a species declines in numbers it becomes more concentrated in its prime areas as there is less and less population pressure to drive individuals into poorer habitat to find space for themselves. The decline in Eel numbers poses a number of questions for the future: They are a popular prey item of predators such as Herons, Goosanders and Otters which will have to find other prey if Eels become hard to find. Otters need large territories to survive – 12 miles of river for a Dog Otter – and being so thinly spread are unlikely to have any great effect on Salmon or Trout except at occasional “choke” points such as waterfalls or man-made obstacles where spawning fish can accumulate. Herons and Goosanders, however, exist in large numbers in the Tweed catchment and if Eels fail them, will have to find other sources of food. Herons eat frogs, mice and insects as well as fish and so have more chance of filling any gaps, but Goosanders and Cormorants eat only fish as adults. A 1972-73 study of the stomach contents of 26 Cormorants shot on the lower Tweed found 5 eels amongst the 137 individual fish of all sizes that had been eaten, including one of 67cms in length (MacIntosh, 1978).

Eel Fishing on the Tweed: When the Princess Joanna, daughter of Edward II of England married David, the son of King Robert 1st of Scotland at Berwick in July 1328, the expenditure for the banquet included the cost of 2,200 eels, some of which, if not all, it can be presumed, came from the Tweed (Bolam, 1919). A memoir made on the state of Norham Castle in 1522 noted that the provisions were “...three great vats of salt eels, forty-four kine, three hogsheads of salted salmon, forty quarters of grain, besides many cows, and four hundred sheep, lying under the castle wall nightly...” (Lauder, 1874). Again, it would be a reasonable assumption that these salted Eels had been fished from the Tweed which flows below the castle walls. In the early 20th Century, the Tweed estuary was still being fished for eels, traps baited with fresh Herring being the usual method. In the river itself, night fishing from boats was the technique used and catches were sometimes considerable: In August 1908 there was a catch of 14 stones (196lbs, 88.9kg) of Eels in one night at Cornhill, and another about the same time of 13 stones (182 lbs, 82.5 kg), the largest individual being 2.5lbs (1.1kg) at Twizel on the Till. In 1909, five nights in July at Twizel gave a total of 19.5 stones (273lbs, 123.8kg) (Bolam, 1919). The largest Eel recorded from the Tweed catchment seems to be one of 6.5lbs (2.95kg) taken on a trout being used as bait for Pike fishing on the Till, at Ford, sometime during the First World War (Bolam, 1919). There is a report of an Eel of 9.5 lbs from a pool in Bowden Quarry taken sometime in the 1920’s, which contained a mouse (John Moffat, Ancrum, pers. comm.). The present Scottish record rod-caught Eel, of 6lbs 2 oz, is listed as having come from an “undisclosed” Borders quarry which could be in the Tweed catchment.

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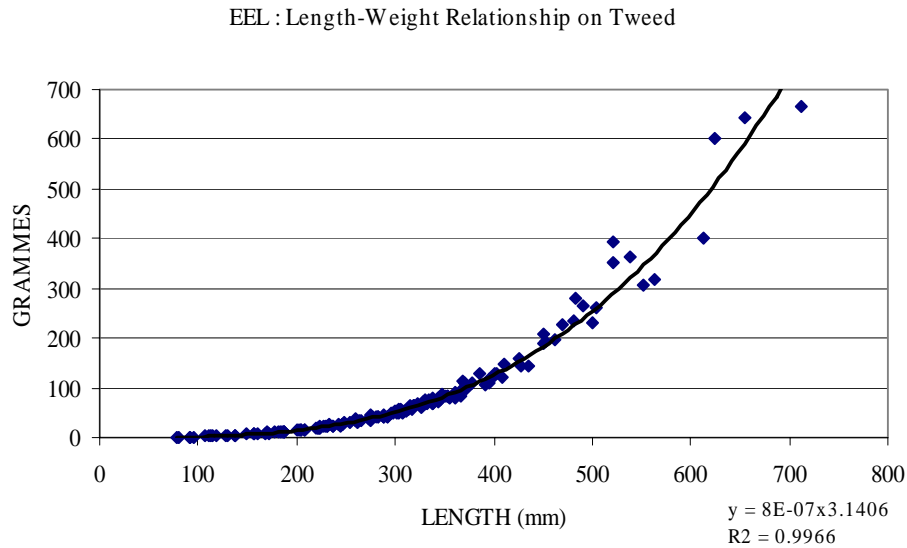


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Lengths and Weights of Tweed Eels : As shown in Graph B.2.4 below Eels in the Tweed become heavier for their length as they increase in size, giving a curved relationship between length and weight :

Graph B.2.4 (data from Hussein, 1983)



Ages and Size of Tweed Eels : As shown in Graph B.2.5, while Eels grow regularly in length from year to year, to give a straight line relationship between age and length, they increase more proportionally in weight as they get older, giving a curved relationship between Age and Weight.

Graph B.2.5 (data from Hussein, 1983)

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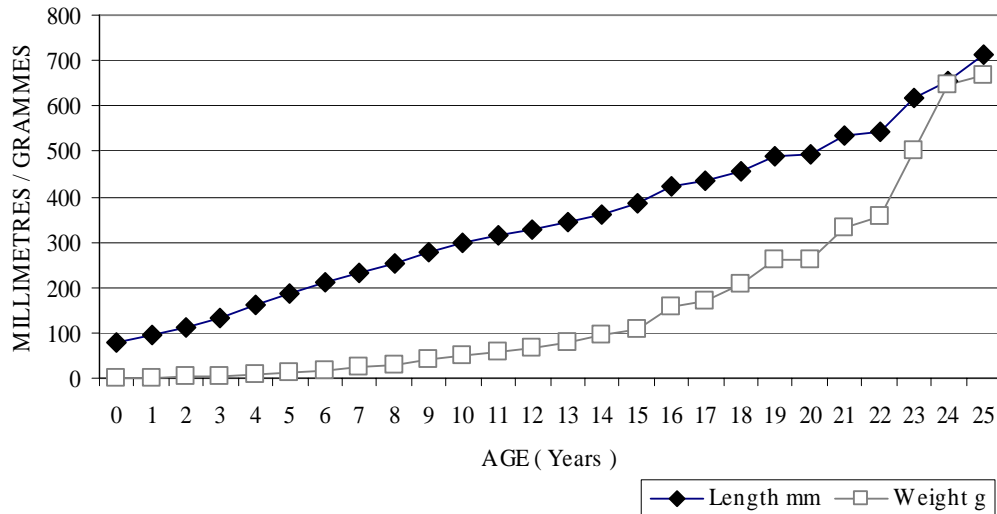
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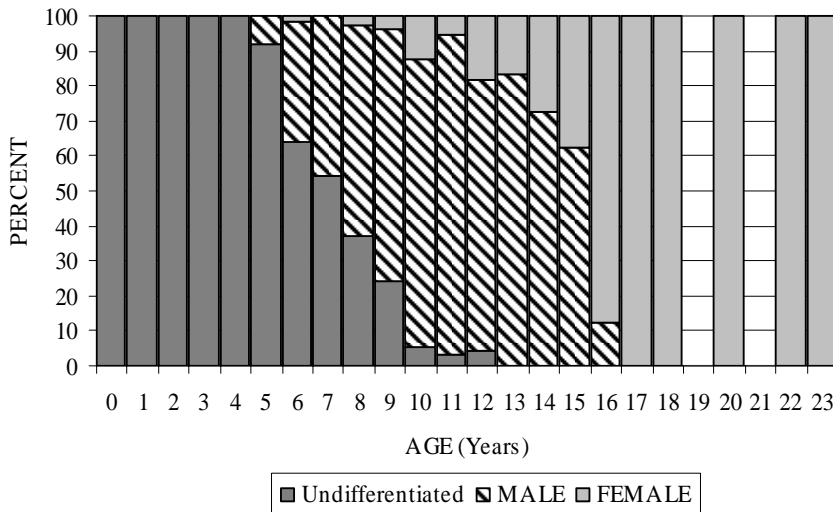
EEL : Average Length and Weight for Age



Age and Sex of Tweed Eels : Eels are a slow growing species in these latitudes, taking many years grow to any great size, as is clear from Graph B.2.5. Sexual maturation is an equally slow process as shown in Graph B.2.6, where it can be seen that that differentiation into the different sexes only begins at five years old and is only completed at 12 :

Graph B.2.6 (data from Hussein, 1983)

EEL: Proportions by Sex in the Leet Water



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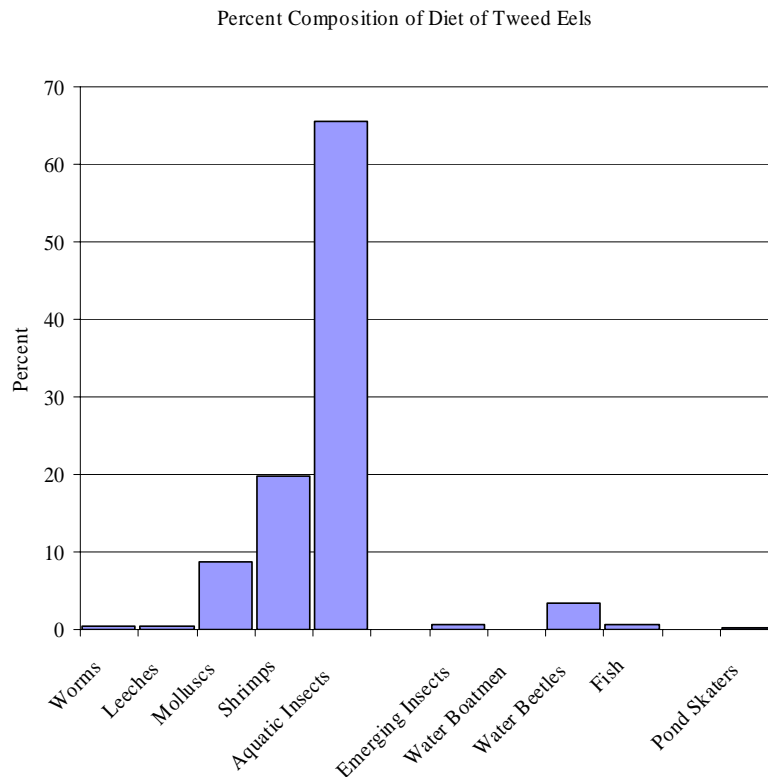
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It is thought, in fact, that the population density at which Eels live determines the sex they “decide” to become. Those living at higher densities lower down in river systems become males, while those living in sparse numbers in more upland areas become females. One of the contributing factors to the present decline in Eel numbers must be the long time that it takes female Eels to mature, though the process is quicker in warmer latitudes.

Diet of Tweed Eels : As would be expected, the diet of Eels on Tweed is dominated by aquatic insect nymphs and larvae – Mayfly; Stonefly; Caddis; Beetle; Shrimps and Snails are the most significant categories. Mid-water animals such as emerging insects and Water-beetles barely feature and surface animals such as Pond-skaters are rarely eaten

Graph B.2.7 (data from Hussein, 1983)



Percent composition of diet is calculated by adding up the totals of all the categories of prey items found in the stomachs of a sample of fish to give the total number of individuals eaten and then expressing the category totals as percentages of this overall total. In this case, 8,296 prey items were found in the stomachs of 989 Eels from the Leet, Eden, Eddleston and Leader Waters.

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Eel Predation on fish in the Tweed : As shown in Table B.2.2 below, fish are not a frequent part of the diet of Eels – an Eel really has to be quite large to be able to take even a small fish. Only in the Eddleston Water in May and June do fish occur with any significant frequency.

Table B.2.2 (data from Hussein, 1983)

	LEET WATER		EDEN WATER		LEADER WATER		EDDLESTON WATER	
	Number of Stomachs		Number of Stomachs		Number of Stomachs		Number of Stomachs	
	<u>with food</u>	<u>with fish</u>	<u>with food</u>	<u>with fish</u>	<u>with food</u>	<u>with fish</u>	<u>with food</u>	<u>with fish</u>
Jan	7	1						
Feb							2	
Mar	11	2						
Apr	42		37	2	8		20	
May	41		33	1	52	2	45	10
Jun	54	2	46	2	60	1	46	6
Jul	29	1	38	1	57	1	25	2
Aug	20		32		40	3	31	
Sep	75	2	23	1	26		23	
Oct	9		11		72	1	3	1
Nov	12		3					
Dec	8	1						

Eel diseases on the Tweed : Around 1980, there was an outbreak of “Cauliflower Disease” in the Eels of the Tweed, an account of which is given in Section 3.4, Fish Diseases.

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