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**A SURVEY OF THE  
THREE MILE WATER  
WITH PROPOSALS FOR  
RESTORATION & DEVELOPMENT**

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**A Report to the  
Three Mile Water Conservation & Angling Association**

**Funded by  
Groundwork (N Ireland)**

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March 2001



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**CONTENTS**

	Executive Summary	2
1	Introduction	5
2	Water Quality	7
3	Habitat Assessment	11
4	Fish Stocks	16
5	Restoration & Development	20
	References	26
	Acknowledgements	26
	Appendix I - DANI Advisory Leaflet	
	Appendix II - Maps 1-3 (location of proposed developments)	
	Appendix III - Itemised details of proposed developments	

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## ***EXECUTIVE SUMMARY***

### ***1 Introduction***

- 1.1 This study was carried out on behalf of the Three Mile Water Conservation and Angling Association which seeks to develop the river into a usable facility for the benefit of the local community.*
- 1.2 The primary interest of the group is in restoring game angling but they are also interested in the general ecology and conservation of the river corridor.*
- 1.3 The study was principally funded by Groundwork (Northern Ireland).*
- 1.4 Some years ago the river held stocks of brown trout and sea trout with the occasional salmon. Extensive industrial and suburban housing development in the area has led to water quality problems and a number of serious pollution incidents resulting in major fish losses.*
- 1.5 The Association was formed in 1996 and has carried out extensive restorative works in clearing the river channel and implementing a re-stocking programme.*

### ***2 Assessment***

- 2.1 The report examines the environmental conditions on the river and evaluates the quality of fish habitat and the level of juvenile fish stocks. An integrated strategy for development of the fishery is presented with a series of recommendations.*
- 2.2 Water quality is examined by reviewing the results of chemical and biological monitoring by Environment and Heritage Service over a 7 year period; some additional sampling was also carried out as part of the survey.*
- 2.3 It is concluded that chemical quality is reasonable and usually complies with the standards of the EC Fish Directive for salmonid rivers. BOD occasionally rises to an unsatisfactory level and this is thought to be associated with urban run-off or storm water. In terms of biological quality the river was found to be below average and suffering from some degree of pollution.*
- 2.4 There is clearly some scope for improvement in water quality although conditions are adequate for salmonid survival provided there are no further major pollution incidents..*
- 2.5 A full evaluation of salmonid habitats is presented which divides the river into three separate sections. There is excellent nursery habitat throughout the 3 sections of river while spawning gravel is most extensive in the upper section. The best quality and most widespread holding water is in the middle section.*

- 2.6 *Potential productivity of the river is discussed in the light of the habitat survey and the small size of the river - the information would suggest that it is capable of producing modest runs of salmon and sea trout sufficient to generate a reasonable return from angling.*
- 2.7 *A semi-quantitative electrofishing survey of juvenile fish populations was also carried out as a key aspect of the overall study. Substantial numbers of juvenile trout and salmon were caught and these were largely confined to the upper section of the river. This distribution was thought to be due to the pattern of stocking and also the recent pollution incident which did not affect the upper section.*
- 2.8 *The age structure of both salmon and trout populations was consistent with the stocking programme and a seaward migration of smolts at age 2 and 3 respectively.*

### **3 Development**

- 3.1 *The potential for development is examined in relation to the resource and the rationale behind this specific initiative is outlined in the context of the Salmonid Enhancement Programme (EU Special Support Programme for Peace and Reconciliation).*
- 3.2 *It is concluded that there is an opportunity for a modest development on the Three Mile Water and that this should centre on the restoration of sea trout rather than salmon stocks. The Association is well-positioned to qualify for funding through any future salmonid enhancement or angling development scheme which may be introduced.*
- 3.3 *The report highlights the need for maintaining good water quality and suggests a more proactive approach be adopted in the prevention of pollution. It is recommended that EHS be asked to extend their monitoring programme to include a second sampling station.*
- 3.4 *Re-stocking has a major role to play in the regeneration of the river. Normally this should be based on indigenous stocks but this is not yet feasible on the Three Mile Water. Alternative sources of sea trout ova/fry are suggested.*
- 3.5 *The level of exploitation through angling is discussed and it is concluded that over-exploitation is unlikely, but that it would be prudent to impose a bag limit of 2 trout (brown or sea) per day. The practice of catch-and-release is to be encouraged.*
- 3.6 *The potential problem of poaching is noted and the Association is reminded that increasing stocks of fish inevitably attracts illegal activity. Protection will need to be a key feature of the development initiative and it will be*

*especially important to maintain a presence on the river beyond the end of the angling season to protect spawning stocks.*

- 3.7 *A list of in-river works aimed mainly at improving fish passage and the extent of holding water is detailed, at an estimated cost of £25,700. It is hoped that some of this work will be undertaken by Rivers Agency in partnership with Newtownabbey Borough Council.*
- 3.8 *Finally it is noted that a significant level of organisation and commitment will be required by the Association in pursuing their objectives. It is suggested that it may be beneficial to draw on the experience of other groups who have been successful on similar initiatives.*

# **1 INTRODUCTION**

## **1.1 Background**

The consultants were approached in May 1999 on the possibility of conducting a survey on the Three Mile Water. After an initial meeting at the river, and subsequent submission of a proposal/ tender, we were instructed to proceed with the assignment in June 2000.

Funding for the study was secured by the Association through application to Groundwork (N Ireland).

## **1.2 Terms of Reference**

Terms of reference for the survey were agreed as follows:

**River Quality:** All available data on water quality through chemical and biological monitoring should be examined and further analysis undertaken if necessary to determine the status of the river and identify any areas suffering from pollution.

**Habitat Survey:** Each site's suitability for spawning, nursery and holding type habitats to be assessed according to DANI guidelines. The extent and type of water weed should also be noted. Other physical characteristics should be recorded, e.g. the percentage of tree/shade cover on the right and left banks, obstructions to fish passage, bank erosion, surrounding land-use etc.

**Juvenile Fish Stocks:** Electrofishing should be carried out on a semi-quantitative basis at a series of locations and the following data should be recorded.

- a) Numbers of salmon and trout fry (0+) and parr (1+).
- b) Numbers of older and larger trout and salmon
- c) Numbers of other fish species.
- d) Estimated efficiency at each site.

**Improvements:** Where appropriate, specific recommendations to improve the productivity and survival of salmon and trout throughout the catchment should be described. This should also include any possible improvements in angling pools and facilities.

**Recommendations:** General recommendations relating to overall objectives, river management and protection of fish stocks.

## **1.3 Three Mile Water Conservation & Angling Association**

The Association was formed in the 1996 and state their objectives as follows:

***The Association proposes that from Mossley Hill the Three Mile Water and all tributaries should be developed into a game fishery facility. It is***

***the Association's intention, with the help of Newtownabbey Borough Council, to develop what is essentially a derelict water into a usable facility. We feel that this will enhance the spirit of friendship between the people of Monkstown, Whiteabbey and Mossley and all surrounding areas.***

***The "conservation" aspect of the Association was formed to accommodate those interested in the general ecology of the river corridor in relation to plant and other forms of wildlife. This will lead to the erection of bird boxes for nesting and small wildlife ponds for frogs and insects, along with the proposed riverside pathway. It is our intention to involve local schools and nurseries in this project.***

The Association immediately set about a major clean-up of the river corridor through the removal of obstructions, bush cutting and general tidying. These efforts have received recognition from the local council, from Rivers Agency and in the local press.

The Association have also negotiated tenure of the fishing rights to the river from Newtownabbey Borough Council. They initiated a re-stocking programme in 1996 and have observed a steady improvement in fish stocks since then.

#### **1.4 The River**

The Three Mile Water rises to the south of Ballyclare in the Ballyrobert area and flows in a south-easterly direction towards Belfast Lough (Fig 1). The river is roughly 12km (7 miles) in length and drains an area of about 18 km<sup>2</sup> (7 mile<sup>2</sup>). The upper part of the catchment is relatively flat with a low gradient and flow rate through an agricultural area. In contrast the lower half of the river from Mossley to Whiteabbey is a suburban area with a more favourable gradient better suited to trout and salmon populations. This lower section is heavily populated with local industrial centres, urban amenities and housing developments.

#### **1.5 Current Status of Angling**

There has been little serious angling on the river for several years but recently, since the formation of the Association, there has been a greater enthusiasm for angling. The introduction of some catchable sized brown trout has generated a degree of interest and some of the members now visit the river on a reasonably frequent basis. Any fish caught are usually returned to the water.

## 2 WATER QUALITY

In recent years there has been considerable concern about water quality in the Three Mile Water and there have been some serious pollution incidents as a result of discharges from industrial sources. For several years the river has been monitored by DOE (EHS and its forerunners), both chemically and biologically at Whiteabbey, just before the river enters Belfast Lough. Chemical samples are collected and analysed on a monthly basis while biological samples are taken three times a year, in spring, summer and autumn.

A range of parameters are normally analysed in the chemical monitoring programme which describe the character of the water and include features which would be affected by organic or inorganic pollution. On its own however, chemical monitoring can be misleading in that it is unlikely to detect intermittent cases of pollution; nor will it detect pollutants not specifically tested for, such as herbicides or insecticides. However pollution also causes qualitative and quantitative changes to macroinvertebrate communities and such changes can be detected through the biological monitoring programme, as the organisms in question are relatively static and cannot escape the effects of any pollution. Furthermore they are relatively slow to re-colonise a section of river and therefore the effects of a particular problem may be detected several weeks after the actual event.

### 2.1 Chemical water quality

Results of the chemical monitoring programme have been obtained from EHS and annual summaries of the main parameters for the last 7 years are presented in Table 1.

The water is alkaline in character with a fairly stable pH generally in the range 7.7-8.5 and therefore suitable for salmonids. Conductivity is a measure of the amount of dissolved salts in the water and the readings indicate that it is consistently high.

#### 2.1.1 **DO, BOD & Ammonia**

The key measures of chemical quality are dissolved oxygen (DO), biological oxygen demand (BOD) and ammonia – these three are normally selected as indicators of the extent to which waters are affected by waste water discharges and rural land-use. Waste water discharges would include discharges from sewage treatment works (STWs) and from industry while rural run-off refers to diffuse drainage and discharges from agriculture.

Under the terms of the European Community Directive on the quality of fresh waters needing protection or improvement in order to support fish life (EEC, 1979), designated salmonid waters should comply with the following standards:

Dissolved Oxygen (DO)	> 7 mg/l in 100% samples
Dissolved Oxygen	> 9 mg/l in 50% samples
Biological Oxygen Demand (BOD)	< 3 mg/l in 95% samples
Ammonia (NH <sub>3</sub> )	< 0.025 mg/l in 95% samples

Examination of the data from individual samples has indicated that the Three Mile Water generally complies with these standards except for BOD, which a measure of the amount of organic matter in the water - in an urban/suburban area this may be due to a degree of sewage effluent entering the river at some point, or series of points. Over the time series examined 15% of the samples had a BOD in excess of 3 mg/l, so there is clearly scope for improvement. On the other hand, when an elevated BOD was detected there was no suggestion of a corresponding problem with low dissolved oxygen. Elevated BOD readings can usually be linked to changes in other characteristics analysed (see 2.1.2).

### **2.1.2 Additional features**

All other characteristics measured on the river are consistently within acceptable limits reflecting the generally good quality of the water.

From the individual sample data the minor elevations noted in BOD were invariably associated with higher levels of suspended solids, ammonia (NH<sub>4</sub>-N) and a high water level in the river. Usually a rise in suspended solids would result from spate conditions which should increase dilution and reduce both BOD and ammonia. As this is not the case here, the implication is that the elevation of these 3 characteristics may be due to an organic discharge in some way linked to heavy rainfall; this is most likely due to an overflow associated with storm water. The situation is not dangerous but suggests that some degree of minor enrichment may occur periodically.

We understand that there is a specific problem with suspended solids emanating from the old Ballyduff Quarries during periods of heavy rainfall with run-off to the river via storm drains. In addition to this, recent developments of the IDB site at Ballyhenry, including re-alignment of the river channel, have contributed to higher than normal levels of suspended solids in the water.

## **2.2 Biological Water Quality**

There have been several indices employed to provide a practical measure of the condition of streams and rivers. In the UK the most commonly used biotic index is the Biological Monitoring Working Party (BMWP) system. Samples are collected by a 3-minute kick/sweep at each point using a standard pond net and the organisms collected are scored according to the BMWP system. Identification of taxa (classified groups) is to family level only, and no account is taken of abundance. Each family is given a score, between 1 and 10, depending on their perceived susceptibility to pollution (Table 2). The taxa least tolerant, such as families of mayflies and stoneflies, are given the highest scores.

The BMWP score is the sum of the individual scores which is then divided by the number of taxa identified to give the Average Score per Taxon (ASPT). The BMWP total may not adequately reflect quality since the score improves with increasing diversity and sample size. The ASPT however, is largely independent of these factors and can be regarded as a better measure of quality.

### 2.2.1 EHS Monitoring

Using this methodology EHS has been sampling the Three Mile Water at a single location in Whiteabbey for several years. The results of the monitoring programme over the last 7 years (1994-2000) are summarised in Table 3. This data is useful in providing a general indication of biological quality over a time series but is limited in that it only refers to a single location in the whole catchment.

In general BMWP scores of greater than 100 and ASPTs greater than 5.00 indicate consistently good water quality. The EHS results would therefore suggest that the Three Mile Water could be classified as of *Below Average* Biological Quality at least in the lower reaches. This however could be misleading as it is based on a single sampling station located at the lower end of the catchment.

### 2.2.2 Catchment Survey

To gain some information on biological condition throughout the stream a separate survey was carried out at 8 locations in Aug/Sep 2000, as part of the overall study. The results of this investigation are shown in Table 4.

In general the results suggest that the overall biological condition of the river is slightly better than is reflected by the EHS sampling at a single downstream location. However the ASPT is still, apart from one location, below average and suggestive of some degree of pollution.

From the upstream site located at the forest and progressing downstream to the bridge above the tidal reach, all sites were characteristic of invertebrate communities composed of moderately pollution tolerant taxa with a high abundance of Gammaridean amphipods and Baetid mayfly nymphs together with riffle beetles and blackfly larvae. The remainder of the community included organic pollution tolerant groups such as molluscs, leeches, freshwater hoglice, chironomids and worms. Few sensitive taxa were found at any of the sites, although *Ephemerella ignita*, a pollution sensitive mayfly species occurred at all sites in low abundance.

Thus, poor ASPT's reflect the above invertebrate community composition and suggest an element of pollution throughout the stream. The presence of extensive growths of the aquatic filamentous algae *Cladophora*, located in shallow riffles upstream of the Swirly pool site, suggests local nutrient enrichment. However, there was some improvement downstream as indicated by the site located upstream of the tidal stretch which obtained the highest ASPT score. It is likely that this is a result of recovery from any upstream pollutant through dilution factors. In any case, all sites were indicative of sub-standard biological water quality.

Date	Bioscore	No. Taxa	ASPT
10-Mar-94	54	12	4.50
31-May-94	47	10	4.70
13-Sep-94	63	14	4.50
6-Mar-95	55	11	5.00
2-Aug-95	76	16	4.75
9-Oct-95	54	14	3.86
27-Mar-96	26	8	3.25
16-Jul-96	26	6	4.33
25-Sep-96	35	10	3.50
21-Apr-97	25	7	3.57
3-Jul-97	55	12	4.58
23-Sep-97	27	8	3.38
10-Mar-98	56	14	4.00
6-Jul-98	47	10	4.70
14-Sep-98	37	9	4.11
3-Mar-99	48	11	4.36
23-Feb-00	55	11	5.00
12-Jun-00	62	12	5.17
6-Sep-00	44	11	4.00
Min	25	6	3.25
Max	76	16	5.17
<b>Mean</b>	<b>46</b>	<b>11</b>	<b>4.28</b>

**Table 3** Data from EHS biological monitoring, 1994-

(Source: Environment & Heritage Service)

Site no	Location	Grid ref	BMWP score	No. taxa	ASPT
1	Plantation	331849	92	19	4.84
2	Park	338847	68	15	4.53
3	u/s Swirly Pool	339845	73	16	4.56
4	Woodland trust	342840	67	14	4.79
5	d/s Pr school	348838	73	16	4.56
6	u/s Viaduct	353835	53	12	4.42
7	Glenavna	357832	75	16	4.68
8	New houses	359830	62	12	5.16

**Table 4** Results from biological survey

## **3 HABITAT ASSESSMENT**

A detailed survey of the river habitat was carried out August 2000. This exercise extended from the Doagh Road bridge in Mossley downstream to the river mouth at Whiteabbey; tributaries were not included.

### **3.1 Objectives & Procedures**

The aims of the habitat survey were:

- To gain a general assessment of the catchment in terms of salmonid habitat which would indicate which should be the key areas in terms of juvenile fish production ie the distribution, extent and quality of nursery and spawning areas.
- To identify those areas and locations where specific measures could be implemented to improve the different habitat needs of trout and salmon.
- To identify factors such as pollution which may be limiting productivity.

The habitat survey was carried out by walking the complete length of river which could be described as potentially significant levels of salmonid production; in practice this is equivalent to the section of river from the Doagh Road bridge to the sea at Whiteabbey.

The river was sub-divided into 100 metre units previously marked out on 1:2500 maps. Each 100m unit was assessed in terms of its suitability for nursery, holding and spawning by giving a percentage breakdown for each habitat type. Within this breakdown each habitat type was graded in terms of its quality as detailed by DANI (Advisory Leaflet No 1 – see Appendix 1).

Grade 4 was never applied as we took the view that if any area was bad enough to merit this grade, it could not be classified in any of 3 habitat types. Areas of exceptionally poor substrate, such as 100% sand/silt or an engineered stone bed, which would normally be Grade 4, were therefore graded as “unclassified”. At the end of each unit the width was measured or estimated and the extent of tree/bush cover on each bank was also recorded.

Just over 3 miles (5 km) of river with a total area of 22,150 m<sup>2</sup> was surveyed in this way. In analysing the data the river was roughly divided into 3 separate sections of differing general characteristics over varying distances (see 3.2 & 3.3).

The data collected was entered spreadsheets for each section of river or tributary which calculated the area of each unit surveyed and the area of each graded type of habitat within each unit. Through this analysis a summary table was produced for the river showing the total area of each graded type of habitat each section (Table 5).

### **3.2 Analysis**

The river was surveyed from the Doagh Road to the river mouth at Whiteabbey. On the basis of differing general characteristics it was roughly sub-divided into 3 sections:

Section 1;	Doagh Road - Bridge Road	(1.6 km)
2;	Ballyduff Road - Viaduct	(2.4 km)
3;	Viaduct - Whiteabbey	(1.0 km)

(see Figure 2)

Upstream of the Doagh Road the river was not surveyed in detail as it is of little significance in fisheries terms. However some general observations were made and summarised below.

### **3.2.1 Upstream areas - general comments**

Upstream of Section 1 the river has a good gradient and there is reasonable habitat for fish over an additional 750m up to Mossley Bridge. Upstream of the bridge a recent railway development has necessitated the piping of the river over a distance of 160m. Beyond this point a more radical development has taken place in the area of a new IDB site where the channel has been completely re-aligned over a distance of about 850m. To their credit the developers have implemented substantial measures to rehabilitate the river with bank stabilisation, planting and in-stream works using stone and gravel.

However, in this area the river differs significantly in character from the lower reaches, principally because the land is more level and there is little gradient in the river bed - as a result there tends to be more silt and mud in the bed as opposed to natural stone and gravel. Therefore, while the rehabilitation works will be of general environmental benefit, it remains to be seen whether or not they are effective in fisheries terms.

Further upstream beyond the A8 Belfast - Larne road the river is very small with low bed gradient and is of no fisheries interest.

### **3.2.2 Section 1; Doagh Road - Bridge Road**

Immediately downstream of the Doagh Road the river is characterised by good riffles and runs with occasional outcrops of bedrock appearing in the substrate. The habitat is mostly good quality nursery with reasonable holding pools at intervals.

After 500m there is a substantial obstacle in the form of a large weir. The weir has been by-passed allowing the river to flow around this large stone-built structure. In the past this would have been an obstruction to the upstream passage of migratory salmon and sea trout. Although it has now been by-passed, there is much instability in the surrounding area due to bank erosion caused by the re-directed flow.

Downstream of the weir there is a succession of excellent riffles, runs and pools for 4-500m with good intermittent deposits of spawning gravel. The gradient of the river then eases slightly and it enters a narrower channel with high banks and further riffle areas with deep pools on bends. This stretch extends for a distance of 5-600m through the area of the old dam (Nelly's Dam) to the bridge at the Bridge Road.

	N1	Nursery (sq. m.)		H1	Holding (sq. m.)			Spawning (sq. m.)			Unclassified (sq. m.)	Total (sq. m.)	Bank cover (%)	
		N2	N3		H2	H3	S1	S2	S3				(left)	(right)
<b>Section 1</b>	3060	1135	0	165	953	0	0	358	0	30	5700	54%	(left)	
Doagh Rd - Bridge Rd	54%	20%	0%	3%	17%	0%	0%	6%	0%	1%	100%	58%	(right)	
		<b>74%</b>			<b>20%</b>			<b>6%</b>						
<b>Section 2</b>	5770	1675	120	1060	1725	120	0	310	0	120	10900	68%	(left)	
Bridge Rd - Viaduct	53%	15%	1%	10%	16%	1%	0%	3%	0%	1%	100%	78%	(right)	
		<b>69%</b>			<b>27%</b>			<b>3%</b>						
<b>Section 3</b>	2795	1050	600	140	780	60	0	125	0	0	5550	65%	(left)	
Viaduct - W'abbey	50%	19%	11%	3%	14%	1%	0%	2%	0%	0%	100%	70%	(right)	
		<b>80%</b>			<b>18%</b>			<b>2%</b>						
<b>Combined</b>	11625	3860	720	1365	3458	180	0	793	0	150	22150	63%	(left)	
	52%	17%	3%	6%	16%	1%	0%	4%	0%	1%	100%	70%	(right)	
		<b>73%</b>			<b>23%</b>			<b>4%</b>						

**Table 5** Summary of habitat survey showing area (sq.m) of each grade and type of habitat

There is good substantial bank cover from vegetation over most of this stretch except for the last 600m which is more open but receives some cover from the high banks.

### **3.2.3 Section 2;** Bridge Road - Viaduct

Between the Bridge Road and the Monkstown Road (4-500m), there is sequence of riffle, glide and pool with deposits of silt on the bed reducing the quality of the habitat as a nursery. However the frequency of pools in this area provide an excellent range of holding water.

Further downstream the river comes under the influence of Monkstown weir which holds the water back in a substantial pool. The weir itself is an obstacle to upstream fish migration although some attempt has been made to ease the passage of fish over this structure adjacent to the left bank. The weir has also sustained some damage recently and is in urgent need of repair if the large pool upstream is to be retained.

Downstream of the weir the sequence of riffles and runs continues with substantial pools becoming a more regular feature, particularly on bends in the channel.

Bank cover is again substantial throughout.

### **3.2.4 Section 3;** Viaduct - Whiteabbey

The final kilometre of river from the viaduct to Belfast Lough could almost all be defined as nursery habitat, the best of which occurs in the 300m or so immediately downstream of the viaduct.

The river then opens out into a wider channel and a sequence of riffles and glides with sand deposits on the bed reducing the quality of the habitat as a nursery area. In the last 300m the channel again becomes narrower through the final series of bends towards the lough.

There is some reasonable holding water in this section, most notably at the viaduct, and there are two areas of adequate spawning gravel. Bank cover is extensive.

### **3.2.5 Overview**

The Three Mile Water extends about 5 km in length from the Doagh Road bridge to the sea at Whiteabbey - this is effectively the productive area of the river.

The results of the habitat survey have been summarised in Table 5. To illustrate the transition in habitat type and quality, the area and grade of each habitat type is plotted throughout the course of the river in Figure 3. The river as a whole has an abundance of nursery habitat and sufficient spawning gravel with reasonable areas of holding water for larger fish. If there is a deficiency in terms of habitat needs, it is in a lack of holding water. However this is a small river of relatively steep gradient and modest flows which does

not give rise to long, deep holding pools - there is therefore only limited scope for improvement in this respect.

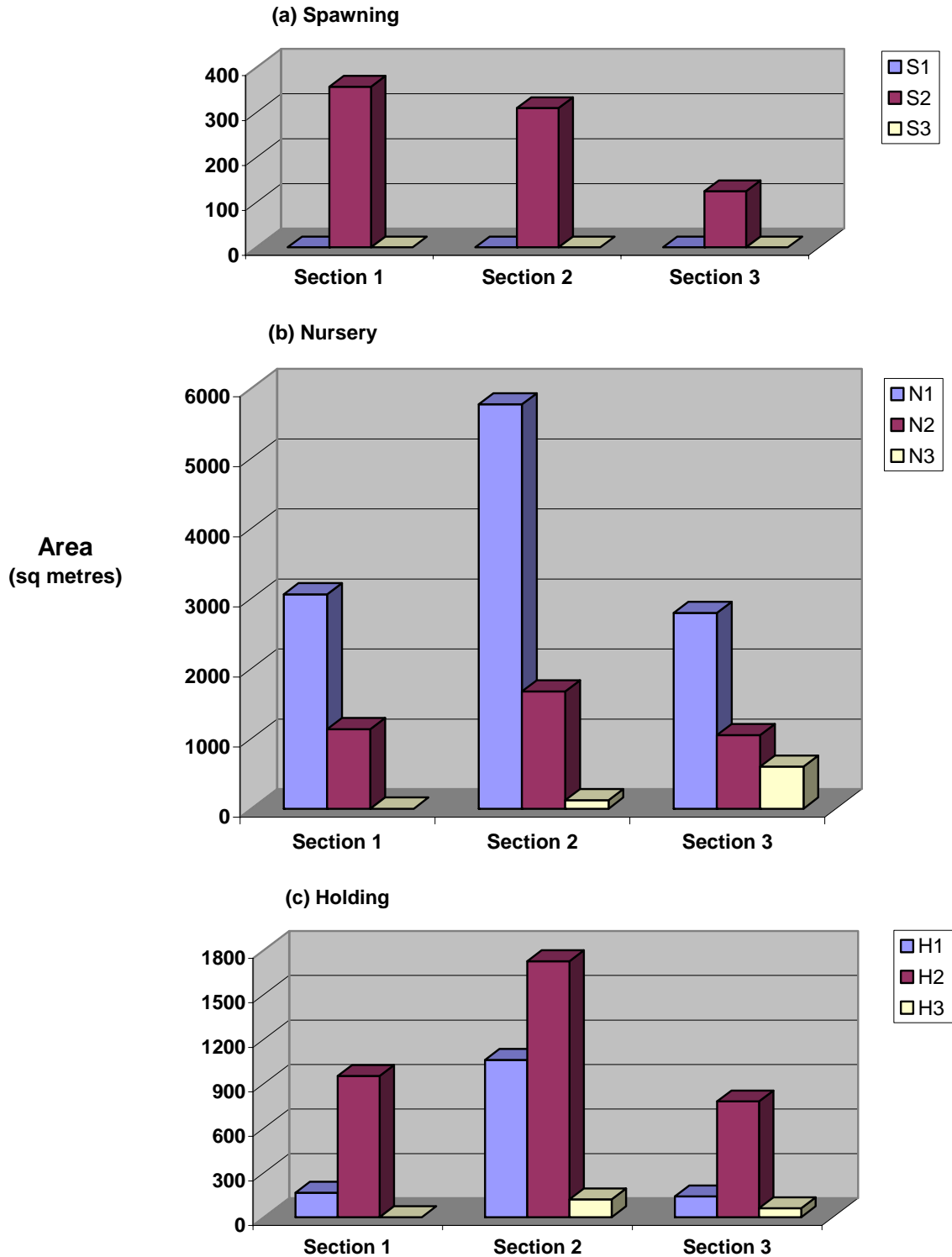


Figure 3 Areas of different type and grade of habitat

There is excellent nursery habitat throughout the 3 sections of river while spawning gravel is most extensive in the upper section declining in occurrence in a downstream direction. The best quality and most widespread holding water is in the middle section 2 - this was the determinant factor in separating the 3 sections for the analysis.

The only notable tributary in the catchment is Cully's Burn which joins the main river a short distance below the Doagh Road bridge - this stream may have some potential for fish production but it was not examined in any detail.

### **3.3 Potential Productivity**

#### ***Salmon***

Through stocking experiments on the R Bush it has been shown that good quality mixed salmonid nursery habitat can carry over 100 salmon fry per 100 m<sup>2</sup> (Kennedy, unpublished report). Applying a range of annual survival rates found in various British and Irish rivers Kennedy has demonstrated that one could reasonably expect a production of 25 age 2 smolts from each 100 m<sup>2</sup> unit of good nursery. (This model assumed that all smolts are 2-year-olds.) In fact production from the Altnahinch stream (R Bush) was estimated at 38.5 age 2 smolts per 100 m<sup>2</sup>. However, taking the lower figure of 25 and applying it to the grade 1 nursery on the main channel of the Three Mile Water, and assuming half this productivity from grade 2 habitat, would produce 3,400 salmon smolts. This number of smolts should in turn result in a grilse run in the order of 200 fish each year, based on a return to the river of 6%. Angler exploitation of around 15% would result in a rod catch of about 30 fish which would be exceptionally good for a small coastal river such as this.

#### ***Sea Trout***

The dynamics of wild trout populations in local rivers have not been as well researched as the salmon and it is therefore difficult to make predictions on the potential productivity of this river in terms of potential productivity and angling. Trout have slightly different habitat preferences to salmon (Kennedy & Strange, 1982); the fry (0+) of both species tend to be found in shallower water (<20 cm), but the older year classes of trout usually appear in deeper water than their salmon counterparts, and trout in general occupy areas of lower gradient with a lower flow rate. As a result, maximum densities of trout do not necessarily coincide with high densities of salmon.

This may not be such an important consideration for sea trout, which will leave the river as smolts at age 2 or 3. In the absence of any reliable local data one could assume a level of productivity for sea trout similar to that for salmon at 25 age 2 fish per 100 m<sup>2</sup> (3400 smolts). Long term observations at the Burrishoole Fishery (Co Mayo) would suggest a return rate of 20-30% resulting in a run of perhaps 650-1000 adult sea trout (SRA, 1984-96).

The recorded rate of catch by rod and line at Burrishoole shows considerable variation from year to year and is greatly dependent on angling effort (Mills *et al*, 1990). However, taking the average exploitation rate of 10.5%, this level of production would result in a rod catch of 70-100 fish, which would be highly significant for this small river.

## **4 FISH STOCKS**

A semi-quantitative electrofishing survey was carried out as part of the current investigation. We have been unable to trace any record of previous survey work of this nature on the Three Mile Water by either DCAL (formerly DANI) or the FCB.

### **4.1 Semi-Quantitative Electric Fishing**

This survey was carried out at 8 locations during August 2000 by 3 operators fishing continuously in an upstream direction for 5-10 minutes using a single anode backpack electrofishing set (24V DC input; 250V, 100W 50 Hz DC output). All or as many as possible juvenile trout and salmon were caught using a dip net and retained for inspection. Any additional 0+ fish seen but not captured were also recorded. The fish were lightly anaesthetised in benzocaine, measured to the nearest mm and then returned to the water live.

As juvenile salmonids have a limited range of dispersal from their parental spawning sites, a survey of this type can provide useful information on the distribution of spawners. In addition, the numbers of 0+ fish detected normally provide an indication of the success of spawning in different stretches as well as overall year-class strength. In this case fish distribution has been largely influenced by the degree of stocking carried out over the last few years, and therefore cannot be as suggested above.

### **4.2 Fish Distribution**

A semi-quantitative survey was carried out as described by electrofishing at 8 sites between the Doagh Road and Whiteabbey. The results are presented in Table 6.

Most fish caught were in excellent condition, particularly the younger age groups. Fish were found at all sites but the vast majority (80%) was confined to the 3 upstream sites above the Bridge Road (Table 7). This concentrated distribution was more pronounced with salmon, 94% of which were found in this upper section of river, while 76% of the trout caught were in this area. There are two principle reasons for these observations:

- A major fish-kill on 14 June 00 resulted from a polluting discharge which entered the river a short distance downstream of the Bridge Road.
- All stocking of fish by the Association has taken place in the upper section of river above the Bridge Road.

It has already been noted that intermittent run-off from the old Ballyduff Quarries produces high levels of suspended solids which may impact on fish stocks in the lower sections of the river.

There may also be a limited amount of natural spawning by trout in downstream areas which results in a slightly higher proportion of trout in the lower section (sites 4-8).

Site no	Location	Grid ref	<u>Salmon</u>		0+	<u>Trout</u>		Older	<u>Total</u>
			0+	1+		1+			
1	Plantation	331849	0	23	20	7	0	50	
2	Park	338847	0	14	78	11	0	103	
3	u/s Swirly Pool	339845	0	8	1	29	1	39	
4	Woodland trust	342840	0	0	1	5	1	7	
5	d/s Pr school	348838	0	1	2	5	0	8	
6	u/s Viaduct	353835	0	0	6	9	2	17	
7	Glenavna	357832	0	1	2	3	2	8	
8	New houses	359830	0	1	4	4	0	9	

**Table 6** Results from electrofishing survey

	Sites	No. fish	% fish
<b>Salmon</b>	1 to 3	45	<b>94%</b>
	4 to 8	3	<b>6%</b>
<b>Trout</b>	1 to 3	147	<b>76%</b>
	4 to 8	46	<b>24%</b>
<b>Combined</b>	1 to 3	192	<b>80%</b>
	4 to 8	49	<b>20%</b>

**Table 7** Summary of fish distribution from electrofishing survey

	Salmon	Sea trout	Brown trout
<b>1996</b>	5000 fry	nil	nil
<b>1997</b>	5000 fry	5000 fry	nil
<b>1998</b>	5000 fry	5000 fry	nil
<b>1999</b>	5000 fry	12400 fry	1000 (3"-2lb)
<b>2000</b>	nil	5000 fry	600 (6-7")

**Table 8** Summary of stocking carried out since 1996

### **4.3 Age Structure**

#### ***Trout***

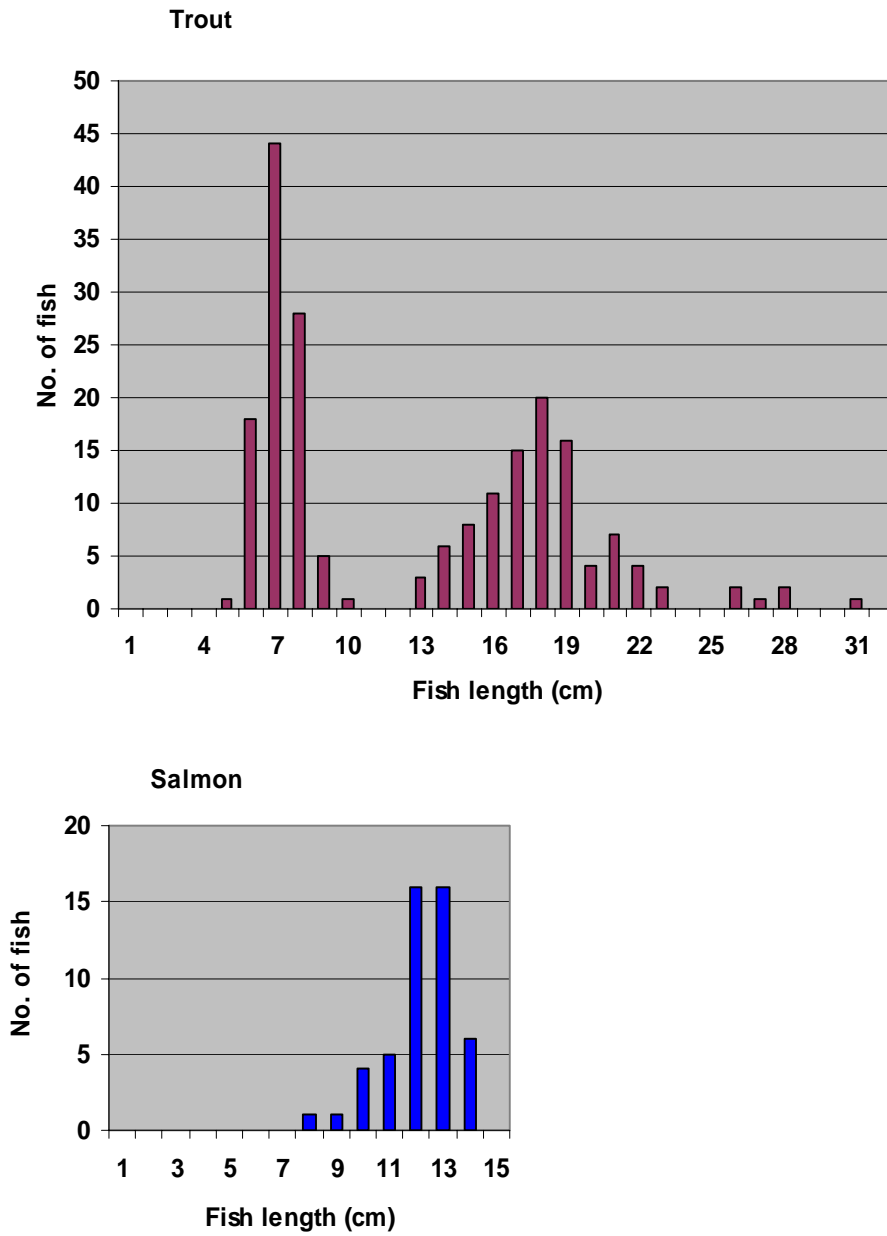
The length distribution of trout caught is represented in Fig 3; this shows two distinct peaks equivalent to two year classes of fish - the 2000 hatch (age 0) and the 1999 hatch (age 1). The small number of fish larger than 25cm is made up of 3-year-olds (1998 hatch).

The bulk of the trout population in the river is probably due to the stocking of sea trout fry each year since 1997 (Table 8). It is likely that most of the sea trout migrate to sea as 2-year-old smolts - the small number of 3-year-olds observed are likely to be stocked brown trout from introductions in '99 and '00, indigenous brown trout, juvenile sea trout which have failed to migrate or a combination of these three groups.

#### ***Salmon***

The length frequency distribution for salmon is shown in Figure 4; there is only one peak in this graph, equivalent to the 1999 hatch (age 1). This is because no fry were stocked in 2000 - therefore no age 0 fish were caught. There are no age 2 or older fish as the salmon would migrate to sea as 2-year-olds in April/May each year and the survey was carried out in August/September.

The absence of salmon fry (age 0) throughout the system would appear to confirm that there is, as yet, no natural spawning of salmon. One might have expected a small return of adults from the initial introduction of fry in 1996 - this should have produced smolts in 1998 with grilse returning to spawn in '99 and age 0 fry present in '00. On the other hand, this sequence of events may have taken place but the resultant fry may have perished as a result of the pollution incident in June 00. Any adults returning in 2001 and subsequent years will clearly have a better chance of survival if serious pollution incidents can be avoided.



**Figure 4** Length frequency distributions for trout and salmon

## **5 RESTORATION & DEVELOPMENT**

This section discusses the potential for development of the river, considers the overall measures necessary for restoration and details the specific recommendations for in-river works.

### **5.1 Rationale**

Although fish productivity on the Three Mile Water is currently well below its optimal level, there is considerable potential for recovery along with a modest development of angling. Productivity appears to be largely limited by water quality problems connected with industrial discharges and urban run-off, both of which can be addressed to improve the river. There is also considerable scope for the physical improvement of salmonid habitats to enhance both fish production and angling facilities.

The restoration of the river will demand a committed approach by the Association which must work closely with government departments, agencies, the local council and others to ensure that the best possible conditions pertain in the river and its surrounding environment. Close liaison with these bodies will also be required in sourcing and securing the necessary financial and advisory support to facilitate a programme of development.

In its Special Support Programme for peace and reconciliation the European Union allocated substantial funding for a Salmonid Enhancement Programme in Northern Ireland. This scheme is now complete but we understand that a similar initiative is likely to be brought forward later this year to provide further funds for salmonid enhancement. The original scheme was administered by DARD (formerly DANI) whose promotional literature described the initiative as follows:

- ***The programme will principally support projects designed to improve salmon stocks throughout Northern Ireland but projects for brown trout enhancement will also be considered.***  
(Projects for sea trout enhancement were also eligible)
- ***Priority will be given to those projects submitted by properly constituted angling clubs and other organisations.***
- ***Projects should provide economic and social benefits to the rural communities through the enhancement proposals.***

It also states that priority would be given to projects which:

- ***Show that salmonid populations in the waters concerned should be significantly improved.***
- ***Make provision for a generous level of access to visiting anglers at reasonable cost.***
- ***Will provide a positive benefit return to the local community and are supported by the community.***

Clearly the Association is well-positioned to qualify for assistance under this type of scheme and should apply for funding through any future scheme, which is likely to be managed by DCAL.

The Association may also consider alternative sources of assistance for the programme of development. Bearing in mind the conservation objectives of the Association they should not restrict their funding applications to fisheries programmes but should consider alternative schemes embracing the ecology of the entire river corridor.

## **5.2 Salmon or Sea trout?**

The nature of the Three Mile Water as a short spate river with limited holding water is probably more suited to sea trout than salmon. Any salmon entering the river are likely to be very late running, possibly after the season has closed. Furthermore, discussions with local anglers would suggest that, in the past, sea trout did feature in the river with only occasional salmon appearing.

With the river flowing through a more densely populated area at its lower end there is always likely to be some level of poaching activity. For various cultural and traditional reasons the presence of salmon inevitably leads to more intense poaching activity; sea trout on the other hand, while still pursued illegally, tend not to attract the same level of activity.

In consideration of these factors we would recommend that future efforts to enhance the river should centre on sea trout rather than on salmon. It is likely that occasional salmon will still run the river and may figure in anglers' catches from time to time.

## **5.3 Objectives**

The Three Mile Water has the capacity to sustain more abundant populations of sea trout and possibly salmon, providing game fishing in a suburban area of Belfast. The Association is also hopeful of securing fishing on Mossley Dam which will extend the season for the membership and will reduce angling pressure on the river. The lake will provide a total contrast in angling in the form of a put-and-take fishery for rainbow trout.

The enhancement of fish stocks is central to this overall plan and may be advanced through the implementation of different measures:

- ❖ **improved water quality**
- ❖ **direct stock enhancement**
- ❖ **control of exploitation**
- ❖ **habitat development**

## **5.4 Water Quality**

The maintenance of good water quality will obviously be fundamental in the restoration of fish stocks in the Three Mile Water. It is a small river with limited capacity for dilution and therefore, in this respect, more vulnerable than a larger river. Moreover, the greater part of the river flows through a mainly urban/suburban area which presents a range of potential problems in terms of industrial discharge, urban run-off and storm water. There have been serious problems in the past with pollution from industrial sources, and our investigations would suggest that there is still some degradation in water quality, probably relating to urban run-off and storm water.

We recommend that the Association should adopt a primarily proactive as opposed to a totally reactive approach to these problems as we believe that this course of action is likely to be more effective. The number of potential pollution sources is not great and it should be possible to approach all owners/occupiers on a personal basis to explain the Association's intentions for the river while emphasising its vulnerability. Inevitably the Association will have to remain vigilant and react promptly and effectively to further indications of pollution.

The limitations of relying on a single sampling station in the monitoring of water quality have been highlighted and we would suggest that EHS be encouraged to extend their sampling to at least one additional station further upstream towards Mossley, perhaps at the Doagh Road bridge. This would provide a reference point for comparison with the downstream site at Whiteabbey.

## **5.5 Direct Stock Enhancement**

Enhancement of salmon and trout stocks through stocking is often regarded as a panacea in terms of the management of specific fisheries. In reality this rarely proves to be the case and it has been shown that improvements in habitat together with removal of obstructions to fish passage and increased protection measures are more likely to produce positive results in the long term.

Large scale stocking with salmon became popular in Scotland during the mid to late 1800s but many schemes were abandoned when improvements in catches did not materialise (Shearer, 1992). The emphasis has gradually shifted to physical river improvements and, although hatcheries are still quite numerous, their main function is now in the re-seeding of spawning tributaries or as a compensatory measure in connection hydroelectric or similar developments.

Normally we would suggest a conservative approach to re-stocking with efforts concentrating on improved water quality, habitat development and efficient protection. However, in this case where the stock of fish has been seriously depleted over the years, stocking clearly has a major role to play in re-establishing a viable stock.

### **5.5.1 Genetic Factors**

The supply of both trout and salmon stocks for enhancement purposes is effectively limited to the DCAL centres at Movanager and Bushmills. The use of non-native stocks in enhancement programmes has been the subject of much discussion in recent years and Solomon (1991) has reviewed the "genetic debate" in some detail.

It has been shown that there are genetic differences between stocks of salmon and trout from different rivers and even between stocks from different parts or tributaries of the same river. These differences are largely maintained by the reproductive isolation of stocks but it is not clear what mechanisms are responsible for the differences. If the differences are adaptive and therefore suit the fish to a particular river, they will be produced by natural selection.

The other possibility is that the differences occur randomly as a result of genetic drift. If however the differences are adaptive then the use of a stock adapted to a different environment may be less effective in an enhancement programme than the use of one adapted to a similar environment. In addition to this the introduction of non-native fish into a depleted stock may change the genetic constitution of the whole stock making it less well-suited to the particular environmental conditions. The evidence for genetically determined adaptive differences is getting stronger but it does not necessarily follow that non-native stocks are poorly adapted to their new environment.

One option arising from this discussion is the possibility of using cross-bred stock from the local rivers and other sources. A supply of eggs/fry can be generated by using the milt from a few male fish of the local stock to fertilise large quantities of eggs from females of a different source. In this way one is positively supplementing the local stock without interfering with natural spawning, while at the same time utilising 50% local genetic material to generate the stock for enhancement.

### **5.5.2 Native stocks and alternatives**

Clearly in any stock enhancement initiative where direct stocking is deemed necessary, native stocks should be used where possible. However, on the Three Mile Water any indigenous stocks of salmon or sea trout may be extinct and therefore non-native fish must be used, at least until a viable stock is established.

In Northern Ireland there are currently two potential sources of sea trout:

- Glens of Antrim Angling Development Association, Ballycastle
- Killeel Angling Club

We have also located an additional source in Scotland from which eyed ova of Loch Maree origin may be purchased at very reasonable cost:

- Seafield Centre, Inverness College

## **5.6 Control of Exploitation**

### **5.6.1 Angling**

In popular fisheries for wild brown trout angling pressure can be intense with the result that, if all takeable-sized fish are killed, it is difficult to maintain a good average size of stock and the sustainability of the population can be significantly reduced by removal of breeding stock. It is therefore common practice nowadays to impose bag limits restricting the number of fish anglers may legally retain in a single day; indeed some fisheries in GB now operate solely on a catch-and-release basis.

Sea trout are probably less vulnerable to over-exploitation by angling than brown trout simply because they are normally resident in freshwater for a shorter period of time. A 20-year analysis of records from the Burrishoole Fishery, Co Mayo indicates that rod exploitation may vary from 4.2-18.8 % of the total run with an average of only 10.5% (Mills *et al*, 1990). This level of

exploitation is unlikely to have a detrimental effect on stock levels but we would urge that a bag limit be applied in the case of both sea and brown trout.

To avoid any ambiguities or confusion over identification we suggest that the same conditions be applied to both types of trout and would recommend an initial bag limit of 2 fish of 10-inch minimum size during the development phase of the fishery.

In some clubs it is now quite common for anglers to return all of their fish even though they may catch several over the takeable size of 10 inches. This is a highly responsible attitude to the conservation of fish stocks and we would encourage more anglers to adopt this practice unless fish are specifically desired for the table.

### **5.6.2 Poaching**

Migratory trout and salmon are obviously at risk to poaching operations outwith the local rivers at sea in the general east coast area. Clearly the Association has no direct control or influence on such activities outside their own waters but should nevertheless seek assurances from the appropriate authorities that suitable levels of protection are in place to minimise exploitation in this manner.

There is no poaching at present as there are no sizeable fish to pursue, but there is little doubt that in this densely populated area this could become a problem if a substantial run of sea trout develops. It is therefore important that effective control be applied during the development phase and beyond, to ensure that fish stocks get the best possible chance to recover to a significant level and that poaching does not become an established activity in the locality that can be practised with impunity.

The Association will need to maintain regular checks on the river to ensure that illegal activities do not develop; this will be particularly important after the angling season has closed and fish are waiting to spawn in November and December. With no anglers to maintain a presence on the river at this time of year, accumulating numbers of spawners will be especially vulnerable if adequate protection is not provided.

## **5.7 Habitat Developments**

The most effective approach to stock enhancement in this situation is through a combination of river habitat development and the direct introduction of stock. On the Three Mile Water there is an abundance of good nursery habitat for trout or salmon but there is scope for improvement in the provision of better pools for older fish and spawning areas for mature adults. In addition there is an urgent need for repairs to be carried out at Monkstown weir where the inclusion of a fish pass would be highly desirable.

The proposed habitat developments are located on maps in Appendix 2 and itemised in Appendix 3 with individual specifications and costs. The overall cost of this programme of work is estimated at £25,700. At time of writing it appears that Monkstown weir will be repaired by DARD Rivers Agency in partnership with the local council, and will incorporate a fish pass. We would be optimistic that these bodies may also co-operate on the removal of the upper weir at Carnmoney, which is currently causing a serious erosion

problem. The cost of these 2 items is estimated at £15,000 and is included in the overall estimate of costs.

## **5.8 Project management & general objectives**

To fulfil the objectives of this overall project and carry out a programme of development will require a fair degree of organisation and commitment by the Association. It would be of benefit to draw on the experience of other clubs in the same situation and with similar objectives such as the Kilkeel Angling Club which has received awards for its initiatives on the White Water, Co Down. This club spent much time attempting to develop a run of salmon in their river but eventually abandoned this objective in favour of sea trout. They have carried out in-river works and have several years' experience in operation of their own hatchery.

We feel that the Association should not have unduly high expectations of the potential of the river as a fishery. Given the right conditions together with good stewardship and protection by the members it does have the potential to sustain a modest run of sea trout supporting a carefully regulated fishery.

The Association should concentrate their efforts on:

- sea trout rather than salmon
- improved water quality
- habitat development
- efficient protection from poaching
- securing fishing on Mossley Dam to reduce angling pressure on the river

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