ATLANTIC SALMON AND TROUT POPULATIONS AND FISHERIES

Carlingford Area & Tributaries Catchment Status Report 2007

The Loughs Agency (FCILC)

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Carlingford Area and Tributaries Catchment Status Report

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Cover picture of salmon kelt courtesy of Atlantic Salmon Trust

TABLE OF CONTENTS

Carlingford Area and Tributaries Status Report

1.0 INTRODUCTION

The Carlingford Area and tributaries catchment status report has been updated in 2008 to include results and reviews for 2007. This catchment status report introduces the major issues affecting the fishery resources of the Carlingford Area and its tributaries. It is anticipated that circulation of this report will encourage debate between stakeholders and the Loughs Agency. Feedback would be welcomed and will contribute towards future reports.

The fisheries of the Foyle and Carlingford systems are of great environmental, social and economic importance. It is within this context that the Loughs Agency aims to manage, conserve, protect, improve and develop the inland fishery resources, preserving native biodiversity and contributing towards the sustainable development of the catchments.

The Carlingford Area and tributaries status report provides background information on the freshwater aquatic environment within the Carlingford area, presents the results of survey work carried out by the Loughs Agency, disseminates catch statistics and outlines planned action.

The primary fish species present within the Freshwater elements of the Carlingford Area and tributaries include Atlantic salmon (*Salmo salar* L.), Trout (Sea Trout and resident Brown Trout) (*Salmo trutta* L.), Sea Lamprey (*Petromyzon marinus*), River/Brook Lamprey (*Lampetra sp.*), European Eel (*Anguila anguila* L.), Pike (*Esox lucius*), Roach (*Rutilus rutilus*), Bream (*Abramis brama*), Roach x Bream hybrids, Tench (*Tinca tinca*), Perch (*Perca fluviatilis*) and Rudd (*Scardinius erythrophthalmus*). Flounder (*Platichthys flesus* L.), Grey Mullet (*Chelon labrosus*) and Bass (*Dicentrarchus labrax*) are present within estuaries of the Carlingford area.

Activities that have the potential to contribute negatively on the fishery resources and the habitats that support these populations are outlined and remedial activities presented.

1.1 The Carlingford Area and Tributaries

Located in the North East of the island of Ireland and composed of significant areas of County Armagh, County Down and County Louth, the Carlingford catchments cover an area of approx 544 km^2.

The catchments of the Carlingford area can be broadly divided into 4 main landscape types, the Newry basin, Slieve Roosley, Carlingford Lough and Mourne mountains. The Newry basin is characterised by a large scale rolling drumlin landscape (this drift geology is composed of deposits left by retreating glaciers) situated between the Ring of Gullion and the Mourne Mountains. The Newry basin is drained by the Newry/Clanrye River and tributaries. The main land use consists of improved pastures of good condition becoming

increasingly rough on the fringes of the Mourne foothills. To the southeast drumlins are displaced by broader ridges separated by narrow, flat-bottomed valleys with ribbon loughs and bogs such as Derryleckagh Lake and Greenan Lough. The underlying solid geology is composed of basalt, sandstones and shales.

The Slieve Roosley landscape lies between Newry and the Mourne Mountains and is characterised by open, exposed hills with a rugged profile, which are dissected by a number of river valleys. The Rostrevor Glen and Killbroney River together form a marked feature along the eastern boundary of the area, which is underlain by a complex geology of igneous and sedimentary rocks. The hills are used for sheep grazing and are characterised by rough, open, unfenced pastures of moorland grasses, gorse, bracken and sedges. The fringes comprise semi-improved pastures of small fields enclosed by stonewalls and gorse hedgerows.

The Mourne Mountains Landscape (particularly associated with the Whitewater River catchment) is characterised by steep rock and scree covered mountain slopes capped with granite torrs, falling to the sea on their eastern edge. It is largely a wild upland landscape composed of exposed heath, thin grass cover, rock and scree slopes with rough grazing for sheep and some cattle. The underlying geology is dominated by granite which is reflected by the characteristic torrs which cap the mountain tops. Rocky mountain streams occupy the steep glens which dissect the mountain ridges.

Carlingford Lough is a low energy estuary filling a structurally controlled (NW-SE fault) glacially scoured depression. The estuary mouth is shallow which allows wave focusing of southwesterly storms onto the northern shoreline where erosion has left a number of bays dominated by gravel beaches. Carlingford Lough supports a range of unusual and rich littoral/shoreline communities, including sheltered sands, muddy sands, muds and boulder shores. It exhibits a good natural transition from lower shore communities, through upper shore saltmarsh to fen vegetation. Mill Bay in particular supports the largest intact block of saltmarsh in Northern Ireland and the area is internationally important in terms of numbers of wildfowl and waders that over-winter on the site.

The Carlingford area and tributaries are impacted upon by a wide range of anthropogenic influences within both the terrestrial and aquatic environments. A diverse array of impacts include amongst others; agriculture, aquaculture, sand and gravel extraction, quarrying, commercial forestry, commercial and recreational fishing, industry, water abstraction, sewage treatment, diffuse and point source pollution, invasive plant species, urban sprawl, flood defences and heavily modified water bodies. Increasing pressures on the aquatic environments within the Carlingford area and tributaries requires appropriate monitoring, control and remediation if native biodiversity is to be preserved and enhanced. The proximity of some of the Carlingford area and tributaries to a large urban area exacerbates many of these issues.

As the competent authority for fishery issues within the catchment the Loughs Agency are required to fulfil a variety of national and international obligations. European Directives including the Habitats Directive and Water Framework Directive and the transposing national legislation have assisted in creating a legislative framework in which to drive forward sustainable management of riparian and aquatic habitats and the species which inhabit them.

Fig 1.1 Carlingford area looking east from the Newry River estuary towards the mouth of Carlingford Lough

Fig 1.11 Carlingford area looking west from the Newry River estuary towards Newry

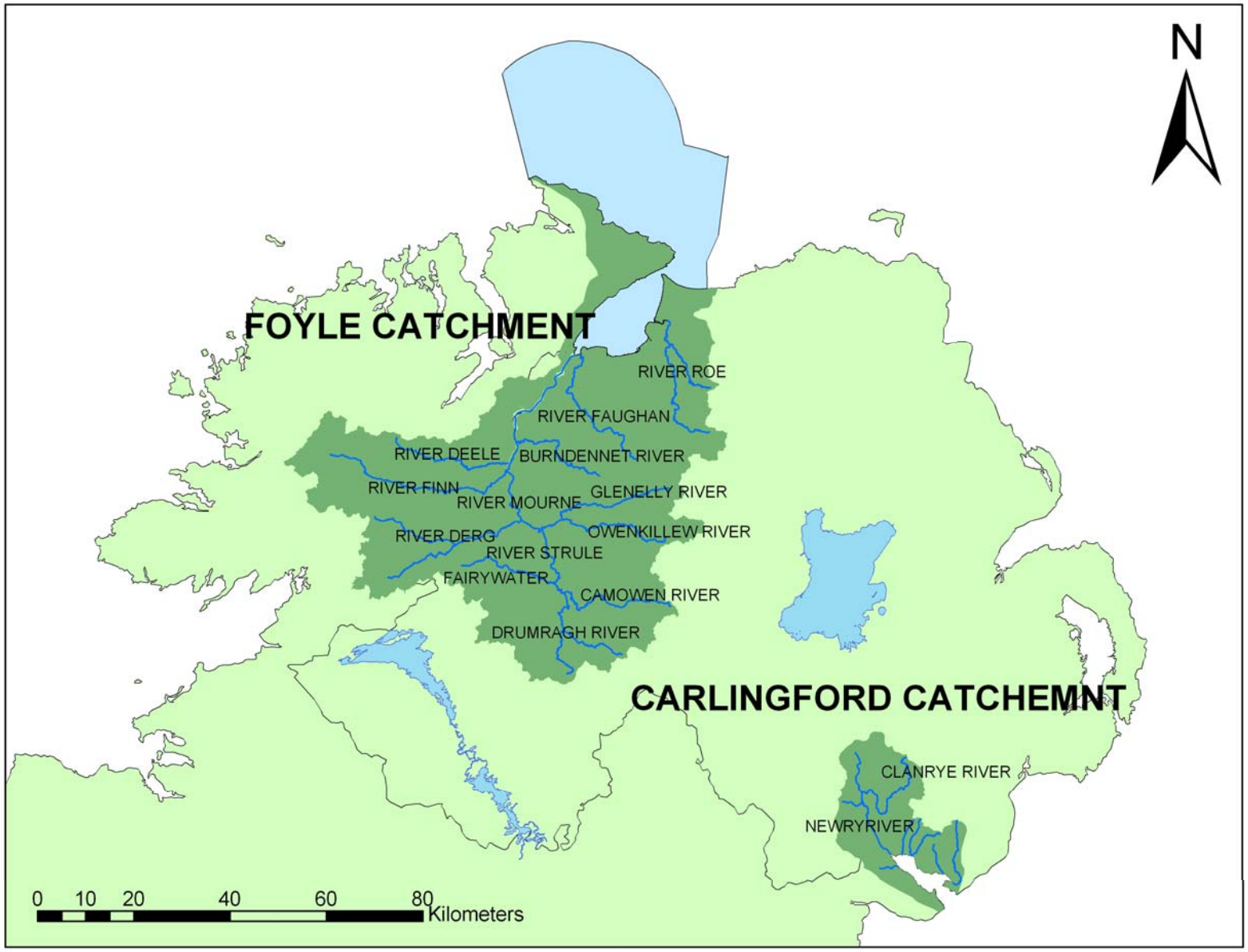

Fig 1.12 Foyle and Carlingford catchments illustrating some of the main tributaries.

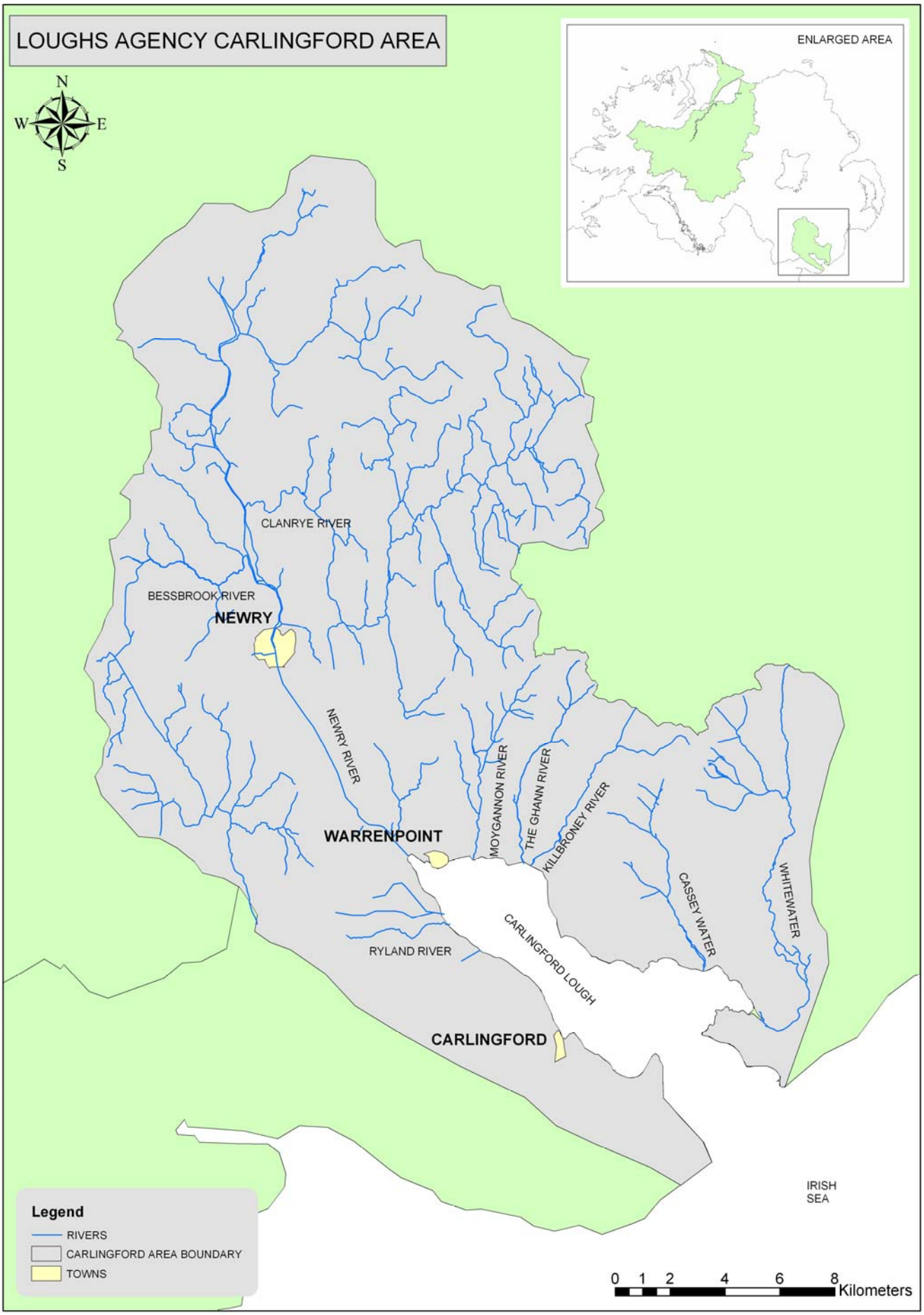

Fig 1.13 Carlingford area and tributaries.

1.2 Atlantic Salmon and Sea Trout

Salmon and Sea Trout are referred to as being anadromous meaning that they migrate between the freshwater and marine environments returning to freshwater to reproduce. This complex life history exposes them to varied environmental pressures and recreational and commercial fisheries. Adult Atlantic salmon return to their natal rivers where spawning takes place. Sea trout also demonstrate an ability to return to their natal river but their homing instinct may not be as strong as those of the Atlantic salmon. After the eggs hatch the juveniles (initially referred to as fry and then parr) remain in freshwater for up to three years.

Smoltification is the physiological adaptation, which occurs when the juvenile salmon change from the parr stage (freshwater phase) to the smolt stage (marine phase). Smoltification at the latitudes of the Foyle and Carlingford areas tends to occur after one, two or three years. Most salmon from the north of Ireland (referred to as post smolts) will remain after smoltification in the North Atlantic for one year and are referred to on their return to the coast and rivers as grilse. Salmon that stay at sea for longer than one year are referred to as multi sea winter (MSW) salmon.

1.3 Non Salmonid Fish Species

As highlighted earlier populations of other non-salmonid fish species occur within the Carlingford catchments. At present monitoring is targeted at salmonid and to a lesser degree coarse species however with obligations under the Water Framework Directive it is envisaged that other non salmonid fish species will be monitored more closely in the future. Fish species presence and abundance can act as a good environmental/ecological indicator demonstrating the ability of the aquatic habitat to support a diverse array of native species. Populations of the European Eel, Bass, Grey Mullet, River/Brook and Sea Lamprey form an important part of the native fisheries biodiversity of the Carlingford catchments. Maintaining high standards of water quality and appropriate habitat for these species is essential for the overall health of the aquatic ecosystem. In the Carlingford area significant non-native fish species have colonised heavily modified and artificial water bodies such as Newry canal and Camlough. The Loughs Agency recognises the importance of the coarse fish populations in terms of a recreational resource for both local residents and tourists and views the improvement and development of the infrastructure to sustainably exploit this resource as a core responsibility.

Fig 1.3 Bream specimens recovered during a coarse fish survey of Newry Canal in 2002

2.0 ATLANTIC SALMON STOCKS

In order to describe the status of salmon stocks each of the following points need to be considered:

- Redd Counts
- Juvenile abundance
- Marine survival
- Adult abundance
- Exploitation

2.1 Redd Counts

Redds are spawning nests created by salmon or trout. Differentiation between salmon and trout redds can be made as salmon redds tend to be larger in size and trout tend to spawn earlier than salmon. Research within the Foyle system using extensive annual redd count data has highlighted a good relationship between the number of redds and the total annual catch of salmon. Water flow is of great significance when monitoring redds as in high water conditions the ability to see and count redds in rivers is impaired. The Loughs Agency will be expanding redd counting in the 2007/2008 spawning season to incorporate the Whitewater River and sections of the Clanrye River.

2.2 Juvenile Abundance

Within the Loughs Agency jurisdiction trends in abundance of juvenile salmonids are monitored by annual semi-quantitative electrofishing surveys. The numbers, age and species of fish captured during five minute timed electrofishing surveys are compared with previous years data allowing for change to be monitored, facilitating suitable fishery management practices to be implemented. In 2006 a total of 70 sites were semi-quantitatively electrofished within the Carlingford system. The results for each site for salmon and trout are classified as excellent (>25 fish), good (15-24 fish), fair (5-15 fish), poor (1-4 fish) and absent (0 fish), Table 2.2. Figures 2.22-2.29 outline the salmon 0+ electrofishing results and site classifications for the Carlingford catchments over recent years.

Semi-quantitative electrofishing was developed to monitor 0+ salmonids (fry/young of the year). In order to quantify the abundance of 1+ salmonids (parr and older) fully quantitative electrofishing surveys are required which can be used to calculate fish densities within a defined area. Rivers and tributaries with good environmental quality are more likely to support good populations of each year class.

Fish populations can vary considerably over time and location, it is therefore necessary to monitor the populations over a period of years to highlight meaningful trends before considering remedial activities such as habitat improvement works. These trends are being continually monitored by the Loughs Agency and the most appropriate management options considered.

There are a variety of reasons why electrofishing sites may be perceived to be under producing, these can include, lack of suitable juvenile habitat, the presence of impassable obstacles to migratory fish species on lower sections of a tributary, pollution, inconsiderate channel maintenance, tunnelling by bank side vegetation, stream gradient and poor forestry practices etc. The critical point is to recognise the major factors at play and to investigate all possible reasons for underproduction accepting that there may be inherent reasons as to why production may not be improved upon in certain areas. When the same areas are surveyed for other non salmonid species it may be discovered that they provide habitat more suited to these species. Habitat improvement works and the rational behind them are discussed in greater detail later. Obligations under the Water Framework Directive will drive future quantitative surveys of both salmonid and non salmonid species under proposed Surveillance, Operational, Investigative and Protected Area monitoring programmes.

Symbol	Grade	Number of 0+ Salmonids
	Excellent	>25
	Good	15-24
	Fair	5-14
	Poor	1-4
	Absent	0

Table 2.2 Loughs Agency semi-quantitative electrofishing classification system for 0+ salmon and trout

Fig 2.21 Electrofishing on the Clanrye River and salmon parr

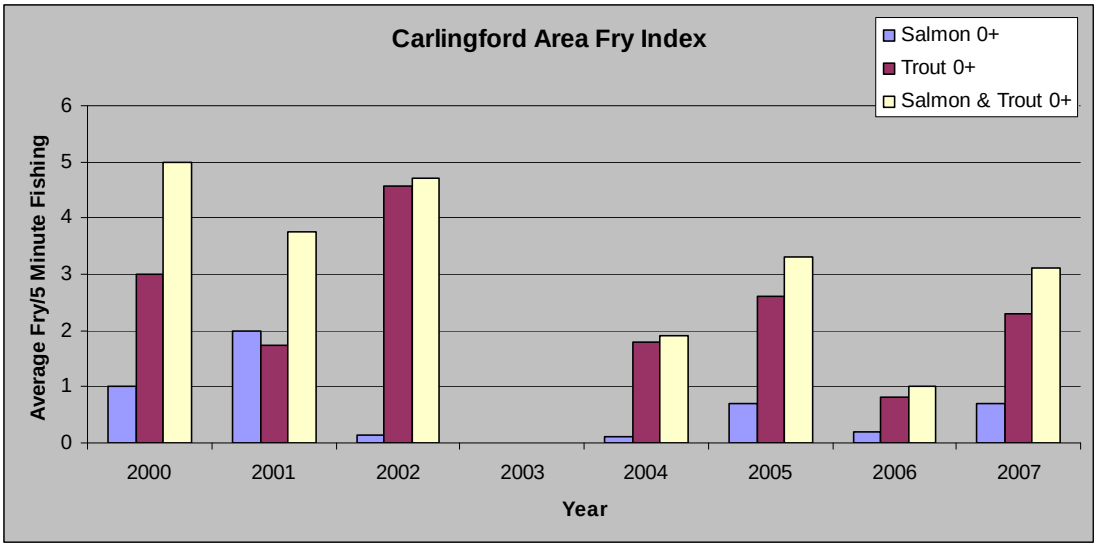

Fig 2.22 Carlingford Area fry index 2000-2007.

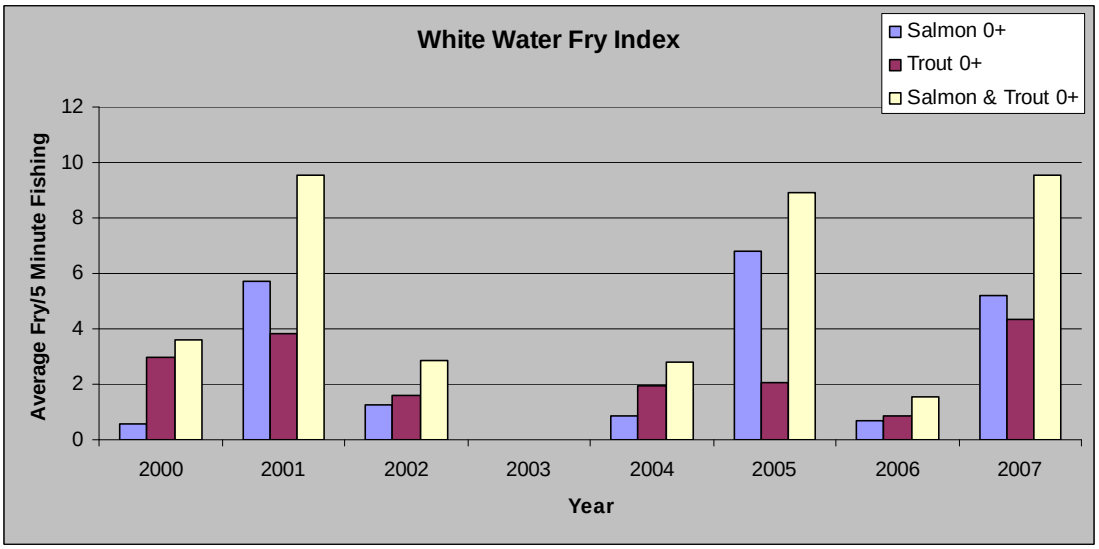

Fig 2.23 White Water catchment fry index 2000-2007.

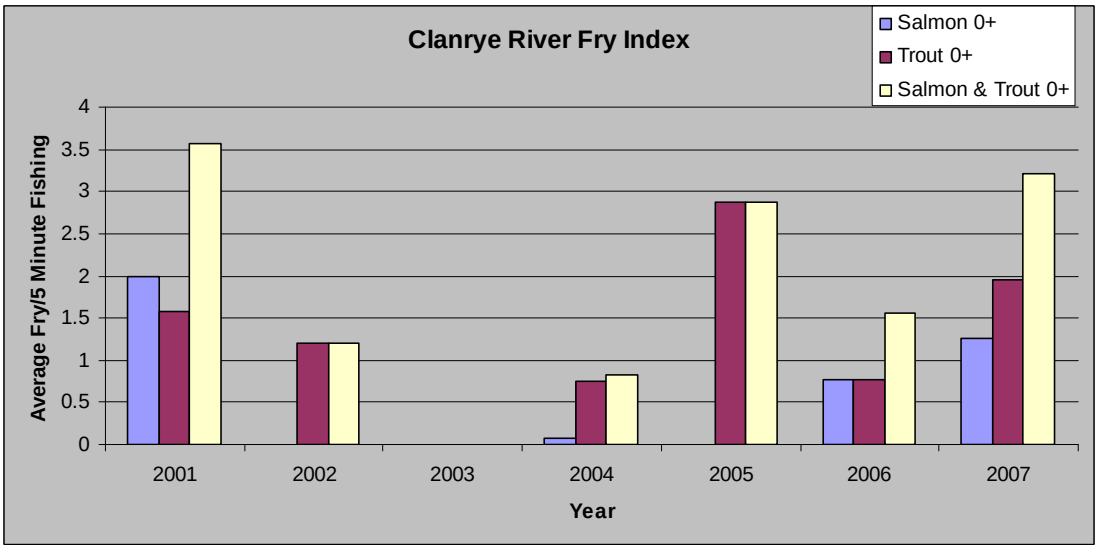

Fig 2.24 Clanrye River catchment fry index 2000-2007.

Fig 2.25 Salmon 0+ electrofishing site classification 2007

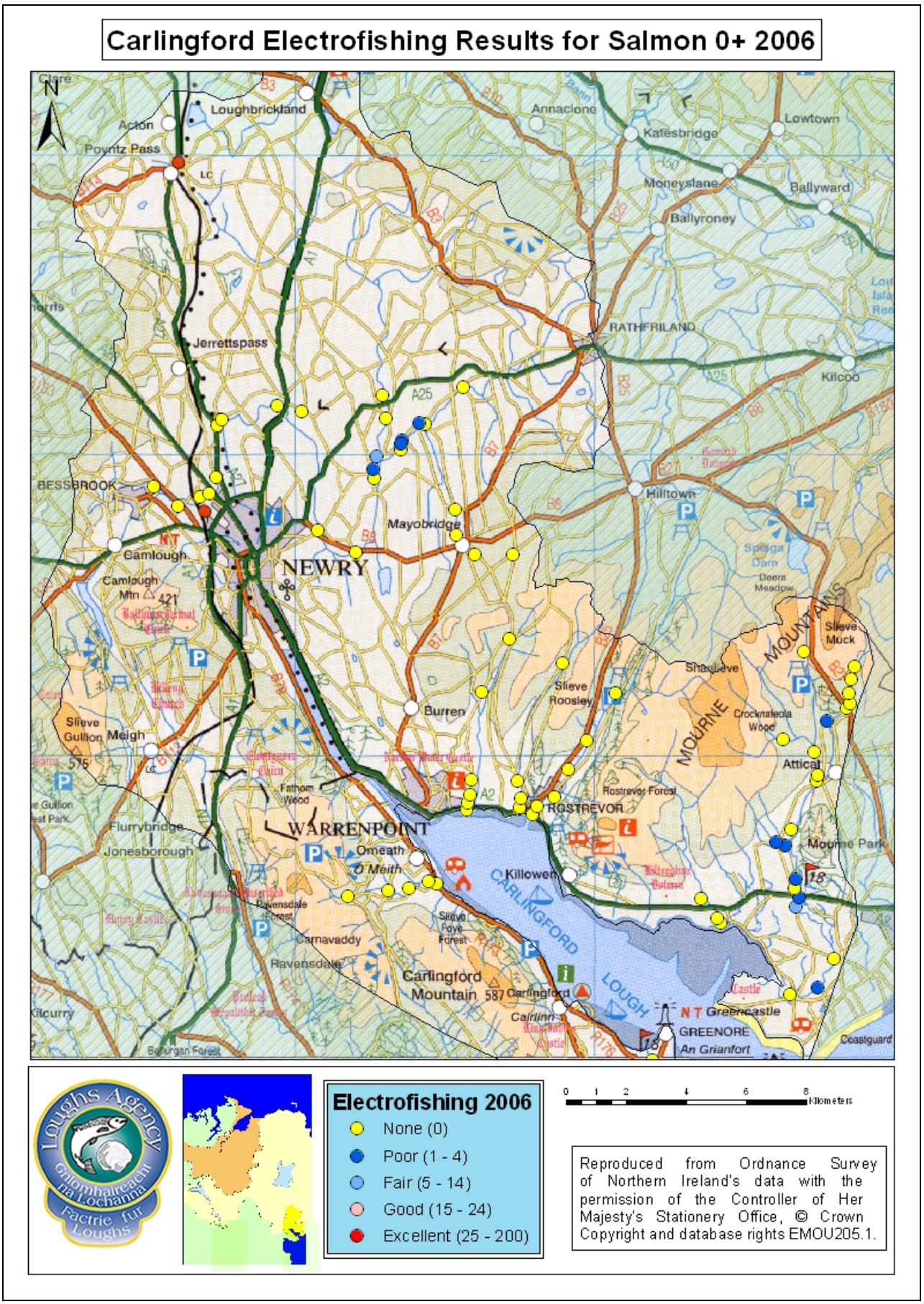

Fig 2.26 Salmon 0+ electrofishing site classification 2006

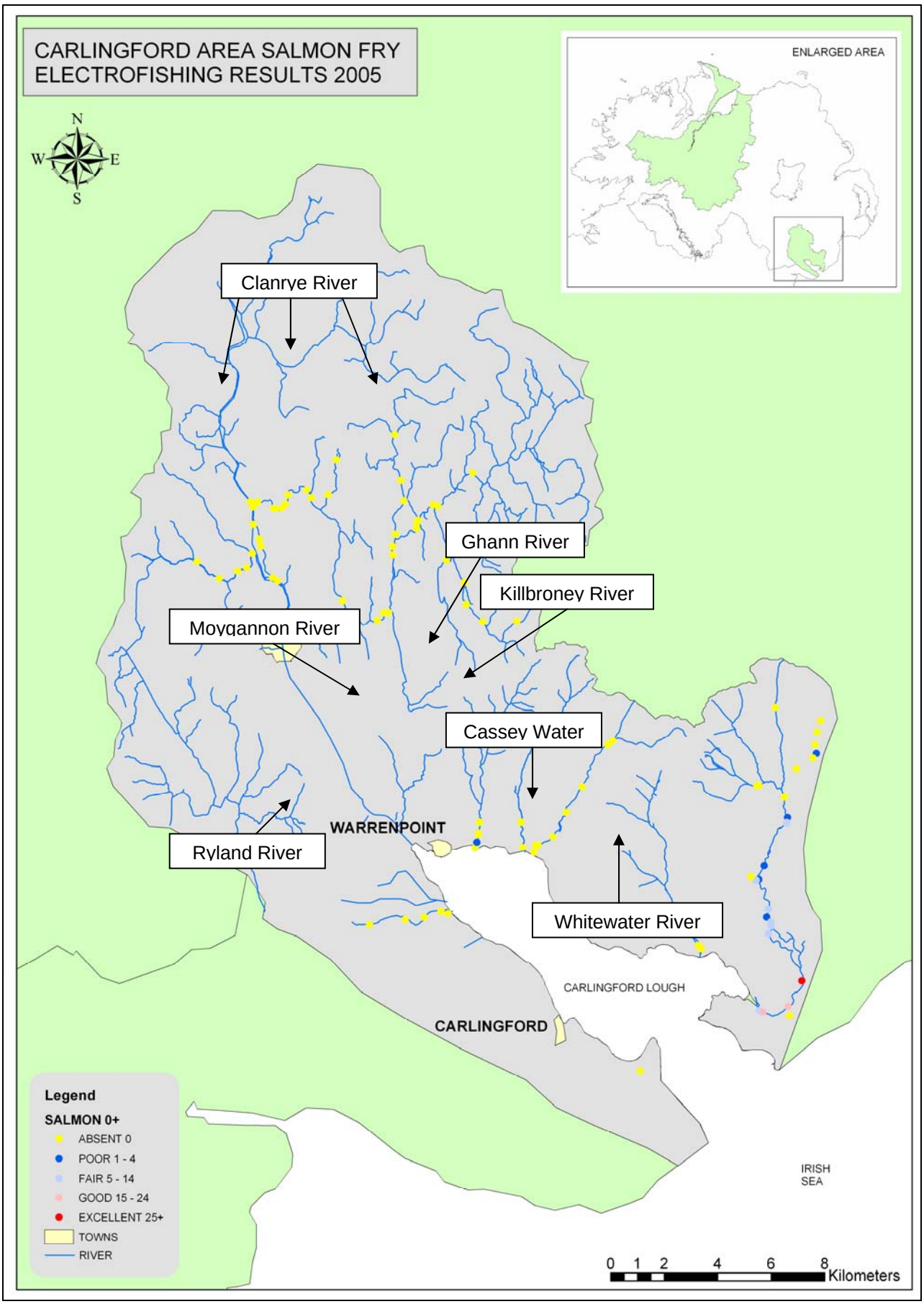

Fig 2.27 Salmon 0+ electrofishing site classifications 2005

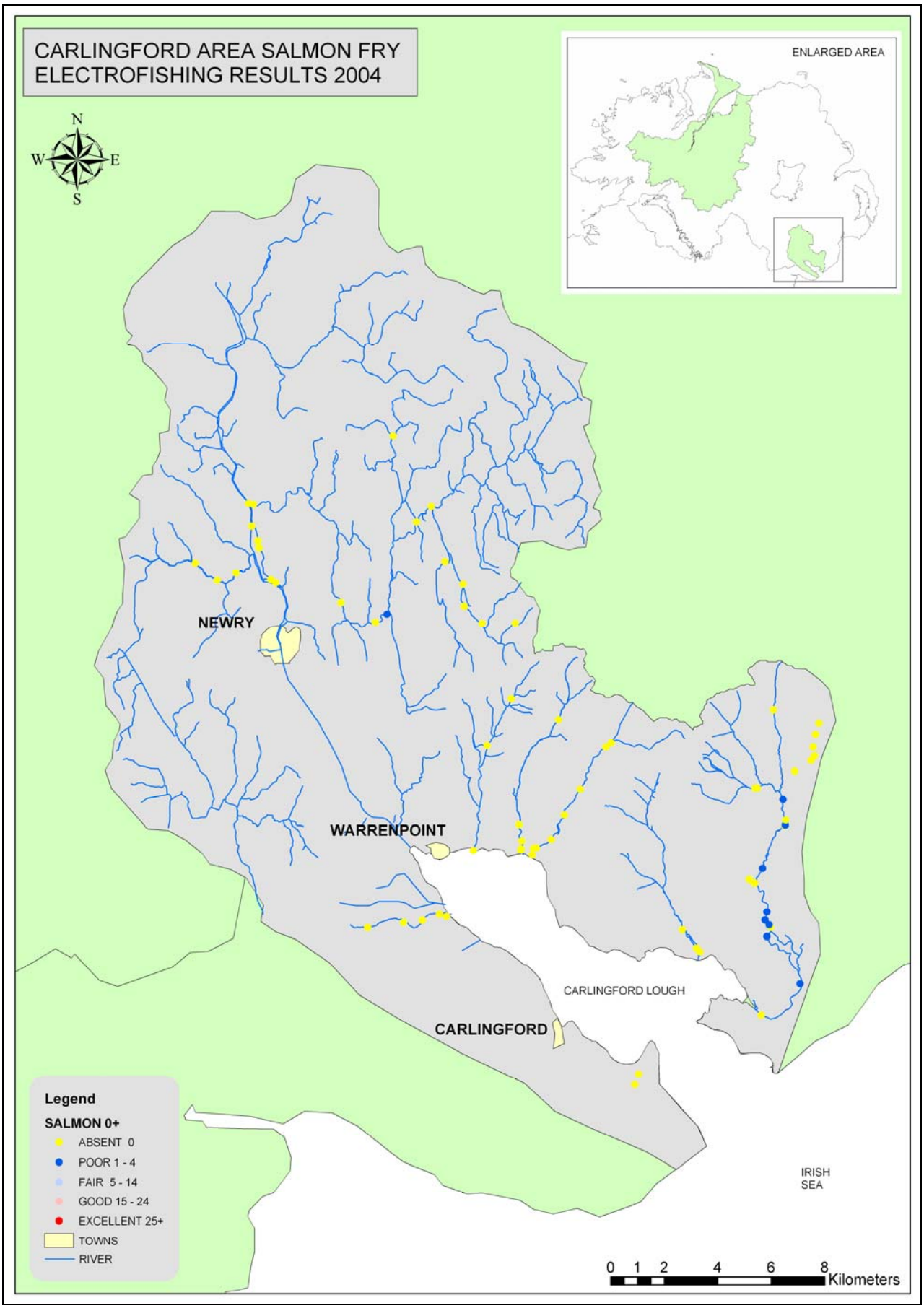

Fig 2.28 Salmon 0+ electrofishing site classifications 2004

3.0 TROUT STOCKS

Annual trends in the populations of juvenile trout are also monitored within the Loughs Agency jurisdiction using the same methodology and classification system as those employed for salmon. The semi quantitative electrofishing results for trout fry in the Carlingford catchments and site classifications are displayed in Figures; 3.1, 3.11, 3.12, 3.13, 3.14 & 3.15.

Fig 3 Electrofishing survey and trout parr

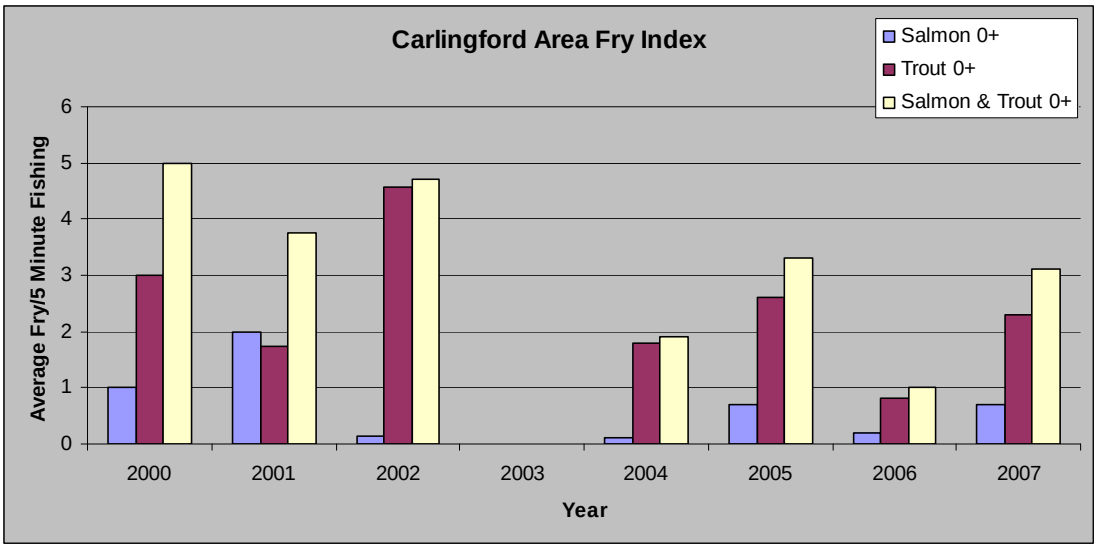

Fig 3.1 Carlingford Area fry index 2000-2007.

Fig 3.11 Trout 0+ electrofishing site classification 2007

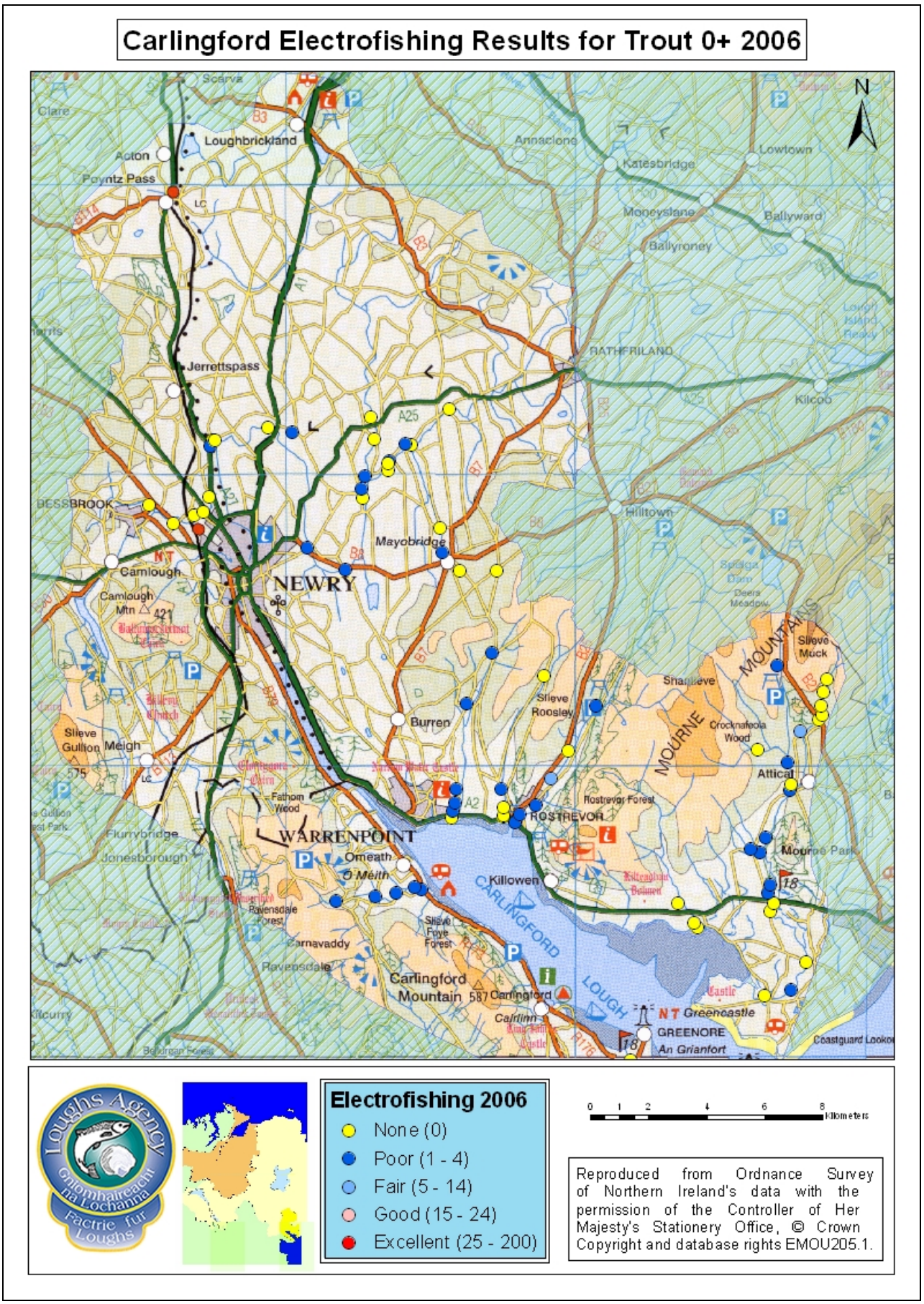

Fig 3.12 Trout 0+ electrofishing site classification 2006

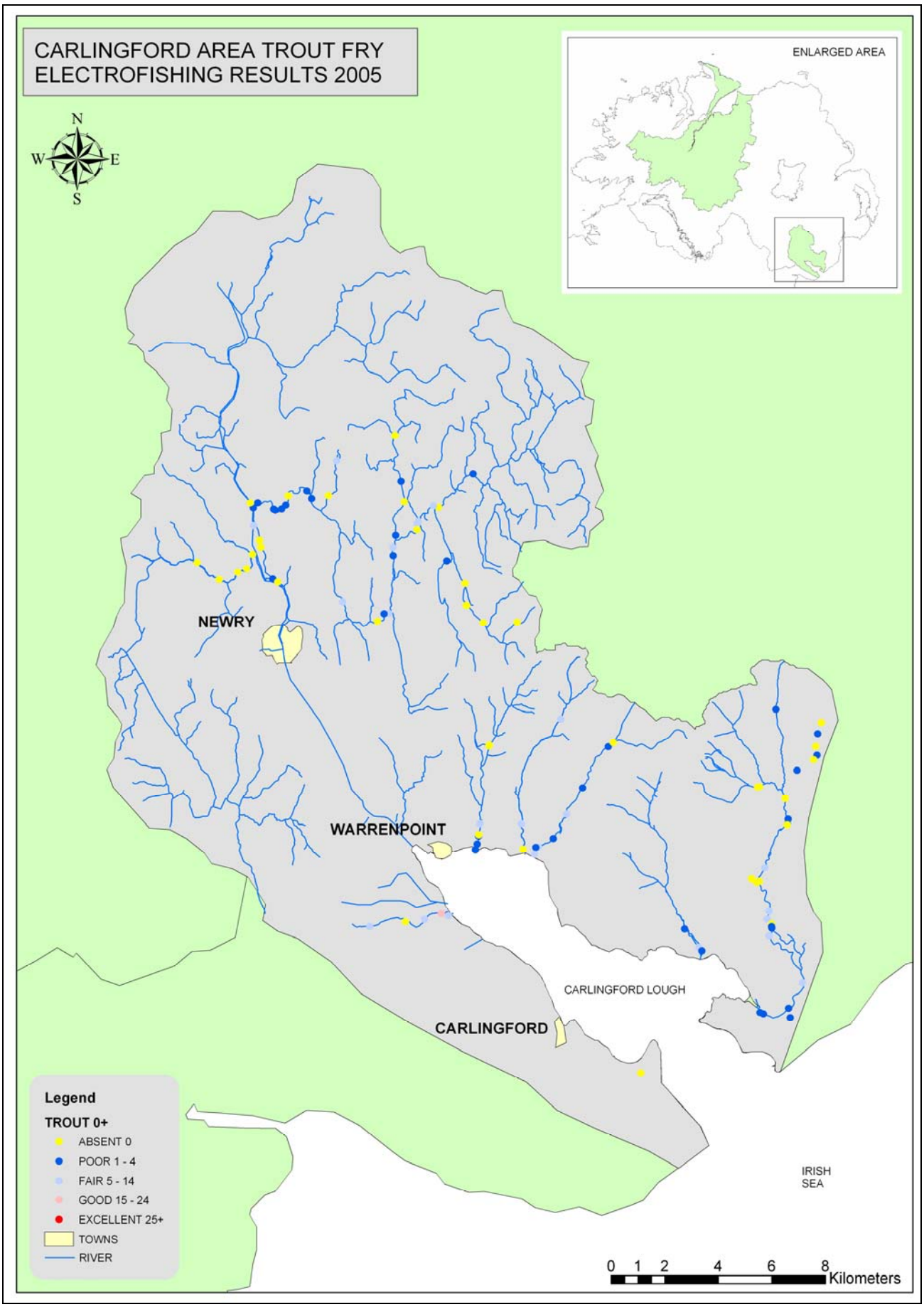

Fig 3.13 Trout 0+ electrofishing site classifications 2005

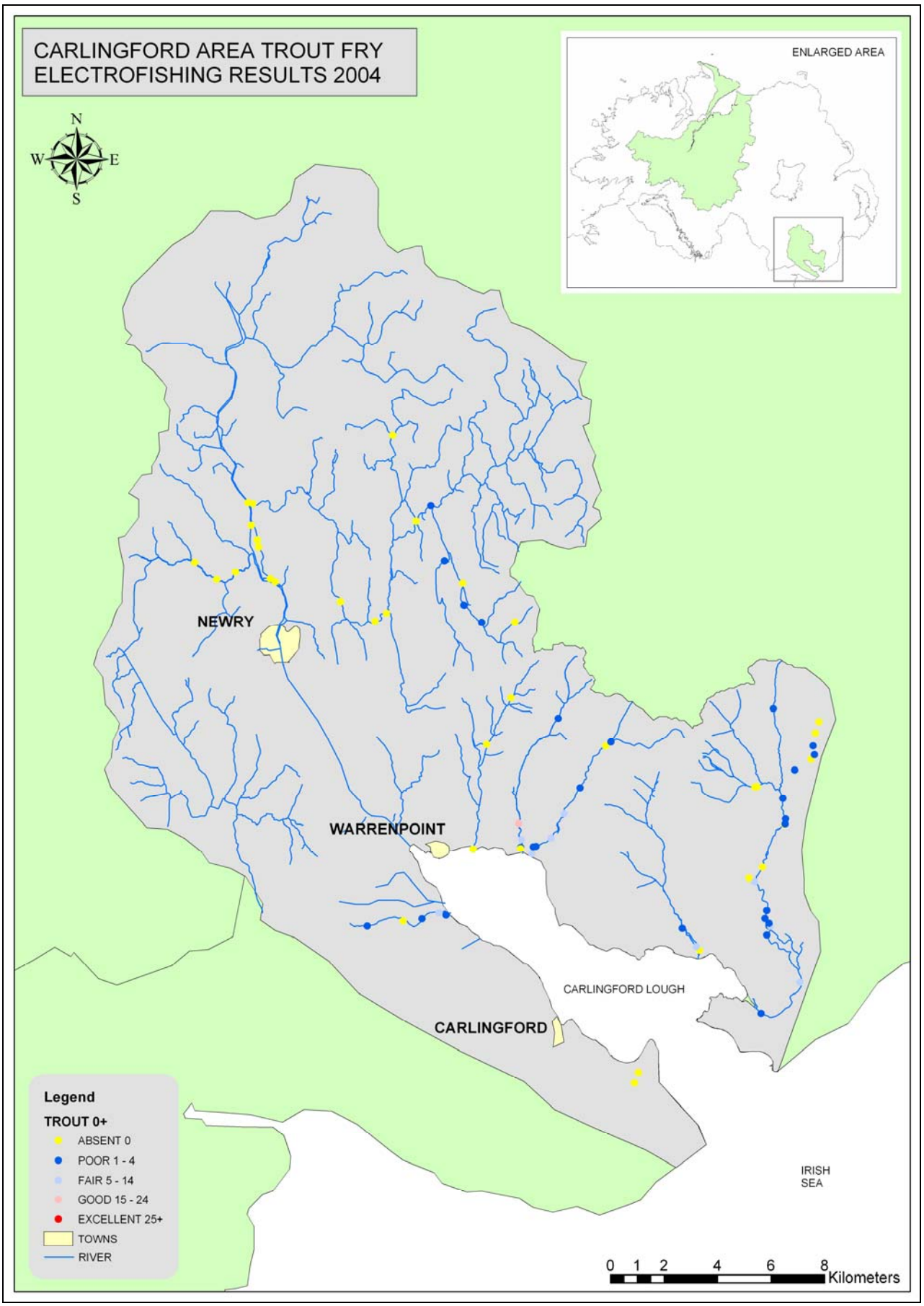

Fig 3.14 Trout 0+ electrofishing site classifications 2004

4.0 MARINE SURVIVAL

The numbers of salmon that survive to return to the freshwater environment are greatly influenced by conditions in the marine environment. Climate change leading to changes in sea surface temperatures, prey abundance, high seas fishing, marine pollution, sub lethal levels of pollution and predation all have an effect on the Atlantic salmon and indeed other migratory fish species chances of survival.

Marine survival trends are monitored on a number of index rivers in the North East Atlantic where total trapping facilities are available for both migrating juvenile and adult populations. Total trapping allows for an accurate count of all migrant smolts (total freshwater production) and returning adults to be made and therefore an accurate estimate of marine survival. These projects are facilitated by the use of Coded Wire Tags (CWT). Coded wire tags are small (2-3mm long) micro tags that are injected automatically by a CWT device into the snout cartilage of anaesthetised fish remaining there for the duration of the life of the fish. CWT fish also have their adipose fin (small fin between the dorsal fin and caudal fin (tail fin)) removed so that they can be identified in the various fisheries that may intercept them. In Ireland a comprehensive screening programme is conducted at all major landing ports and markets. This programme is important in monitoring the effect of the salmon fisheries on salmon stocks from rivers both within and outside of the island of Ireland.

Trends in marine survival for the River Bush (nearest index river to the Foyle system) confirm patterns observed elsewhere on the southern stocks of North Eastern Atlantic salmon, which indicate that marine survival can be variable between stocks and years. In the River Bush marine survival has decreased considerably over recent years as outlined in Table 4.

Year of Smolt Cohort	Year of Returning 1SW Grilse	Marine Survival %
Pre 1996	Pre 1998	Circa 30%
2002	2003	5.9
2003	2004	4.3
2004	2005	4.6
2005	2006	4.2
2006	2007	13.0

Table 4 Marine survival rates for the River Bush of 1SW grilse (after exploitation at sea) pre 1996 and 2002-2006 smolt cohort. Data supplied by Agri Food and Bioscience Institute, River Bush Salmon Research Station

The figures outlined in table 4 are mirrored by those for other index rivers monitoring the southern stocks of North Eastern Atlantic salmon populations. These figures suggest that salmon are facing increased pressure for survival at sea. A major new international research project called SALSEA - Merge has been developed by scientists from the North Atlantic Salmon Conservation Organisation (NASCO) parties and its research wing the International Atlantic Salmon Research Board (IASRB). There are twenty

consortium members in total including the Loughs Agency. SALSEA aims to monitor how Atlantic salmon use the ocean; where they go; how they use ocean currents, and the ocean's food resources, and what factors influence migration and distribution at sea. Research cruises commenced in 2008 to collect the necessary data to answer the questions listed above. Over 426 post smolts were caught by the two Irish cruises and 363 post smolts caught by the Faroese in the areas highlighted below. Further information and project details can be found at: http://www.nasco.int/sas/salsea.htm

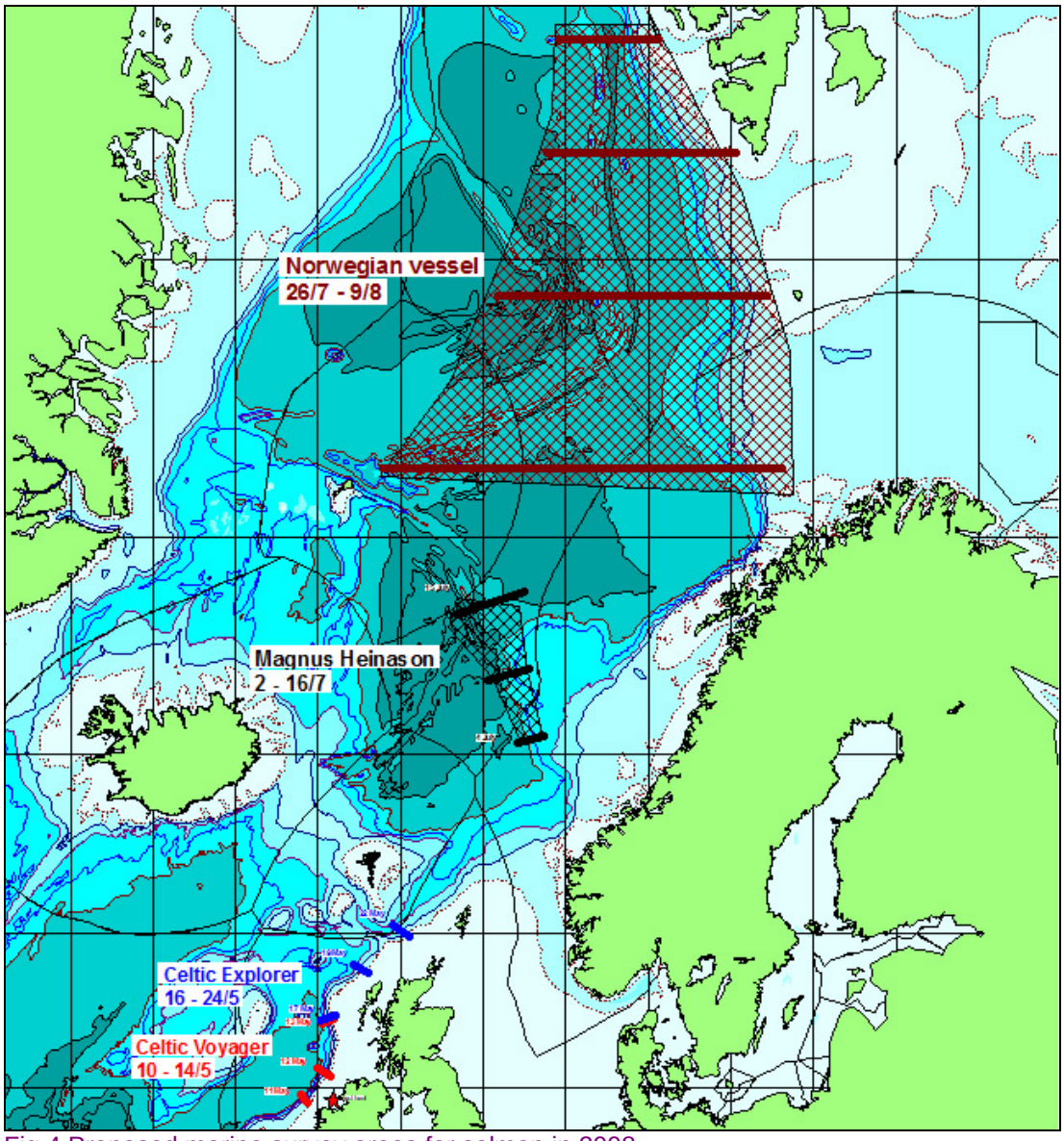

Fig 4 Proposed marine survey areas for salmon in 2008

Fig 4a RV Celtic Explorer

Figure 4b Picture from the Irish Research Vessel Celtic Explorer taken during the second SALSEA research cruise 16-24th May 2008

Since 2003 partial smolt trapping including CWT tagging has been conducted in the Faughan catchment (Foyle System) using a rotary screw trap, Fig 4.

Figure 4c Rotary screw trap in position on the River Faughan directly below the fish pass at Campsie barrage.

Smolt trapping can have a number of objectives including the monitoring of both salmonid and non salmonid species. Sampling of the age composition, obtaining information on run timing and recording length/weight data is conducted in tandem with the tagging programme. As mentioned above total counts of migrating smolts can be made on rivers. Where this is unfeasible due to the absence of total trapping facilities, total smolt migration can be estimated by means of a mark-recapture experiment.

In 2004 an estimate of total smolt production for the Faughan catchment was made by a mark-recapture study resulting in a minimum run size estimate of 33,854 migrating salmon smolts. The estimate was a minimum due to a

number of high water events that prevented the smolt trap from fishing for a period of time during the peak smolt migration period. Tables 4.1 and 4.12 outline numbers of salmon smolts tagged from 2003-2006 and recapture data for 2003 and 2004.

Year	No of Salmon Smolts Tagged	Average Length (mm)	Average Weight (g)
2003	2113	149	33.45
2004	2500	134	24.6
2005	2210	133	23.6
2006	1025	133	25.36
2007	2062	135	27.1

Table 4.1 Numbers and average weight and length of salmon smolts tagged on the River Faughan 2003-2007. Coded Wire Tagging equipment was purchased by the Loughs Agency in 2005 with funding secured from the European Regional Development Fund through the INTERREG IIIA Programme, administered by the Environment and Heritage Service, on behalf of the Department of Environment.

Year Tagged	Year Recaptured	Numbers Recaptured	Recapture Location
2003	2004	12	Greencastle, Burtonport, Malin Head, Belmullet and Torr Head
2004	2005	16	Greencastle, Malin Head, Donegal and Galway Bay
2005	2006	3	Greencastle

Table 4.12 Recapture data from River Faughan CWT programme. Data for fish tagged in 2006 and recovered in 2007 will not be available until 2008.

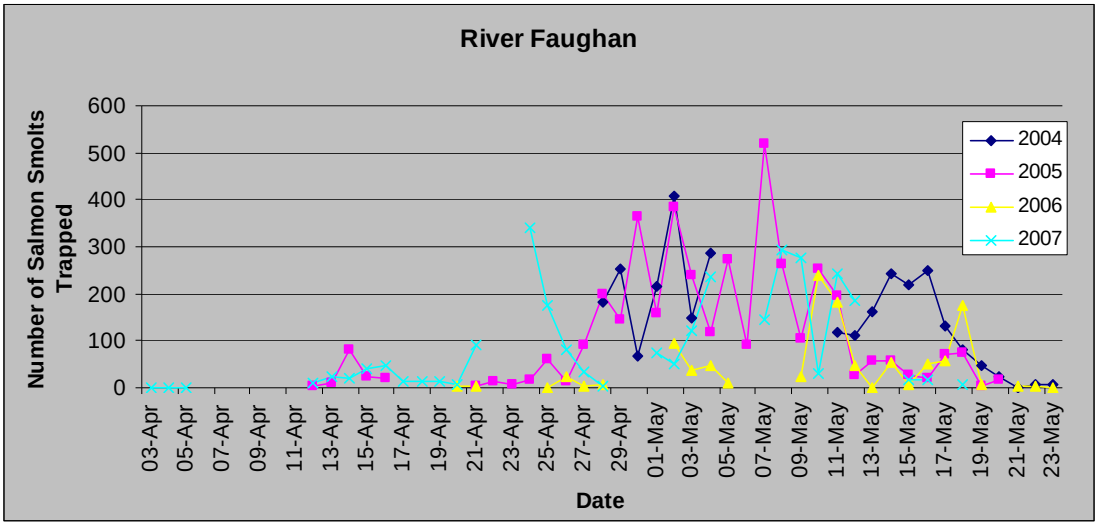

Figure 4d Salmon smolt run timing and abundance from rotary screw trap sub sample, River Faughan 2004-2007. Breaks in data are due to closure of trap during high water conditions

In 2004 a detailed examination was carried out on the age class of migrating salmon smolts in the Faughan catchment, Table 4.13.

Age at Smolting	%
1	13
2	83
3	4

Table 4.13 Age class of salmon smolts migrating from the Faughan catchment in 2004

Fig 4.14 From top to bottom, Atlantic salmon smolts from the Faughan Catchment, brook lamprey, river lamprey and sea lamprey also caught in the River Faughan smolt trap

5.0 ADULT ABUNDANCE

Adult Atlantic salmon and sea trout abundance is assessed in three ways: directly by using commercial netting/recreational rod catches and fish counters and indirectly by reference to conservation limits/spawning targets.

Using catch data as a measure of population status is a well established and extensively used technique. In the Foyle system annual commercial and recreational catch data has been recorded since the establishment of the Foyle Fisheries Commission in 1952, with some data available before this period. Within the Carlingford area catch data is available from 2001. No commercial salmonid fisheries are pursued in the Carlingford system. The relationship between catch and stock is complex and care should be applied in interpretation. A more precise measure of catch incorporates fishing effort (number of licences issued or the amount of time fished) and is referred to as catch per unit effort (CPUE).

5.1 Recreational Fisheries

One problem encountered when analysing catch data is unreported catch. All recreational fishers are required by law to make catch returns. This information facilitates management decision making and therefore it is vitally important that all catch returns are accurate and made promptly at the seasons end.

Year	Declared Rod Catch Salmon	Declared Rod Catch Sea Trout	Returns as a % of Licences Issued
2000	723	417	2.55
2001	3188	450	17.68
2002	5117	1010	27.93
2003	1844	361	15.5
2004	2285	75	13.99
2005	4084	413	25.77
2006	3476	469	37
2007	4929	379	22.11

Table 5 Declared rod catch returns for salmon and trout in the Foyle and Carlingford areas. Note figures include the Clanrye and Whitewater in the Carlingford area from 2001 onwards. Carcass tagging was introduced in 2001.

Year	Declared Catch Carlingford System (Salmon)	Declared Catch Carlingford System (Sea Trout)
2003	0	0
2004	17	3
2005	0	33
2006	3	8
2007	44	46

Table 5.1 Declared catch from the Carlingford system for salmon and sea trout 2003-2007

Fig 5.11 Recreational fisher

5.2 Commercial Fisheries

Commercial fisheries have traditionally operated within the Foyle sea area, Lough Foyle and tidal River Foyle. As mentioned above no commercial fisheries for salmon are pursued within the Carlingford system. Within the Foyle area the drift net and draft net fisheries as well as the rod fisheries have been closely regulated with a real time management regime in place to monitor the numbers of fish migrating up key rivers. If predetermined numbers of fish have not been counted by the strategically placed electronic fish counters at Sion Mills weir (River Mourne), Campsie Barrage (River Faughan) and the Plumb Hole (River Roe) then specified closures of the commercial and/or recreational fisheries are enforced.

Year	Drift Catch	Draft Catch	Total Drift and Draft
1998	31296	11141	42437
1999	15397	7893	23290
2000	22333	10339	32672
2001	13500	9476	22976
2002	28851	11917	40768
2003	15741	16991	32732
2004	12800	9490	22290
2005	13391	12143	25534
2006	5558	6031	11589
2007	2598	2774	5372

Table 5.2 Declared catch from the commercial salmon fisheries (Foyle system) 1998-2007. Note 100% rate of catch returns

Fig 5.21 Commercial Fishing. Draft netting on the tidal River Foyle and drift netting at sea

5.3 Counters

Within the Foyle system a number of river catchments have electronic fish counting facilities that provide estimates on the run timing and abundance of fish >45cm. A Logie resistivity fish counter is currently being installed on the Newry River within the Carlingford system (figure 5.3), it is anticipated that this facility will be operational before the end of 2007. The new counting facilities will provide valuable information on the run timing and abundance of fish in the Newry/Clanrye River and facilitate future fisheries management decision making. Counts for the Newry River catchment within the Carlingford area are outlined in table 5.3 and for the four main strategic counters on the Foyle system, figure 5.32.

Fig 5.3 Fish Pass and counter construction on the Newry River.

Year	Number of fish >45cm
2007	*32

Table 5.3 Newry/Clanrye River fish counter figures. *Note the Newry/Clanrye fish counter was installed in September 2007. The figures reported are indicative and form the initial output from the commissioning phase of the counter installation.

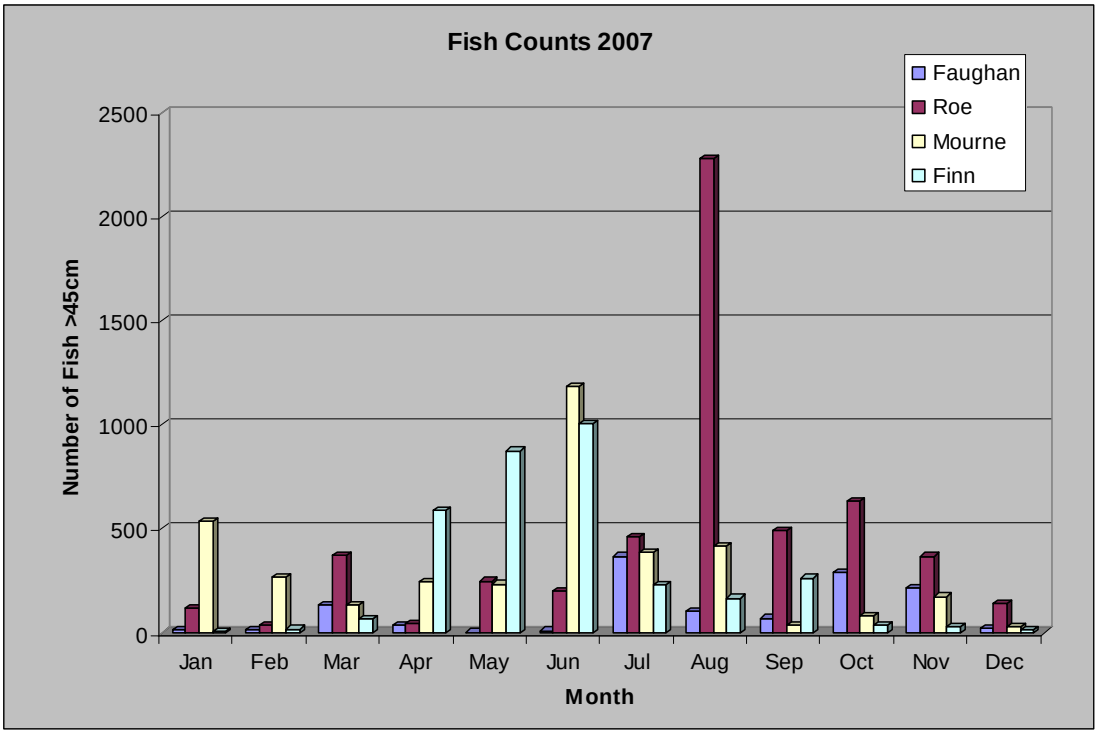

Fig 5.32 Monthly fish counts on the River Faughan, River Roe, River Finn and River Mourne at Sion Mills (Foyle system) in 2007

5.2 Conservation Limits/Spawning targets

Another way to assess adult salmon stock status is to monitor run sizes on rivers and to compare them with predefined reference points called conservation limits. Conservation limits define a level of spawning that optimises the sustainable catch by commercial and recreational fisheries. If exploitation rates increase above the sustainable catch levels the catch may increase in the short-term but the stock will eventually reduce. Conservation limits demarcate the undesirable spawning stock level at which recruitment would begin to decline significantly (NASCO). The real time management regime incorporating the setting of management targets and spawning targets implemented in the Foyle aims to manage the fisheries and spawning populations in a sustainable manner. The management and spawning targets are set for the various river catchments based on the amount and quality of nursery habitat present. River habitat surveys are carried out along each stretch of river and graded according to the type and quality. Egg deposition levels are set according to the quality grading of each section of nursery habitat.

There are four grades of nursery habitat, however for the purpose of setting egg deposition levels only grades 1-3 are utilised. Grade 1 denotes the best quality habitat. The egg deposition rate/carrying capacity is set as follows. Grade 1 = 10 eggs per m^2, grade 2 = 5 eggs per m^2 and grade 3 2.5 eggs per m^2. The total number of eggs is calculated by multiplying the area of each grade of nursery habitat by the appropriate density of eggs per m^2. 25% is deducted from the management target allowing for loss of salmon by angling (15%) and poaching and predation (10%). The remaining figure is referred to as the conservation limit/spawning target.

Once the number of eggs required for each river has been established this can be converted to a total number of fish required to achieve the management targets and conservation limit/spawning targets. The average fecundity (number of eggs produced per female) of Foyle salmon has been estimated at 2500 and the ratio of female to male salmon estimated at 60:40. When combined with the amount of nursery habitat of the various grades this equates to the conservation limit/spawning target.

In the Carlingford area targets can be set and monitored once adequate information has been collated from both fish counting facilities and recreational catch returns from the salmon fisheries. Where necessary catchments which do not meet their targets may have fishery conservation measures imposed and or fish stock rebuilding programmes instigated.

6.0 COARSE FISH STOCKS

Coarse fish species differ significantly from most salmonid species in that their lifecycle is completed solely in freshwater. Coarse species also utilise differing habitat types than salmonid species preferring slower moving deeper water. Newry canal and Camlough are good examples of coarse fish habitat within the Carlingford area. The coarse fish species present within the Carlingford area are not native to the island of Ireland but have been introduced over the last few hundred years as a source of food, for sport and by escaping from fish farms. Irelands natural water courses are defined primarily as salmonid waters however artificial water bodies such as canals and reservoirs provide ideal habitat for a variety of coarse fish species. These artificial or heavily modified water bodies facilitated the colonisation by coarse fish species providing suitable habitat for spawning, nursery areas for juveniles and appropriate conditions and feeding opportunities for adult populations.

The Loughs Agency aims to provide sustainable social, economic and environmental benefits through the conservation, protection and development of the coarse fisheries of the Foyle and Carlingford areas by promoting the sustainable exploitation of the resource to achieve maximum benefit to local communities.

In 2007 a resurvey of the coarse fish populations of the Newry Canal was conducted by the Loughs Agency in collaboration with the Agri Food and Biosciences Institute and the Central Fisheries Board. The 2007 survey

consisted of both netting and horizontal hydro-acoustic techniques during day time and night time hours. The hydro-acoustic method results in fewer gill nets being set and records data passively. The full report on the Newry Canal Fish Stock Assessment can be downloaded from the Loughs Agency website www.loughs-agency.org . The canal was surveyed from the Albert Basin to Victoria Lock. Table 6 outlines summary results from the 2007 survey.

Species	Number Caught	Length Range (cm)
Roach	144	8-26
Bream	1	21
Roach x Bream	16	8-30
Pike	5	44-75
Perch	36	9.7-27
Tench	4	26

Table 6 Fish survey results from Newry canal 2007. Eel and Flounder were also recorded.

Newry Canal fish stock assessment 2007

In 2001 and 2002 the Loughs Agency in collaboration with the Central Fisheries Board conducted baseline surveys of the fish species present within Newry canal between the town of Newry and Victoria Lock. This was designed to assess the population status of the fish stocks. Gill and fyke nets were used to capture fish with a proportion of all fish being measured, weighed and scaled for subsequent age analysis. Tables 6.1 and 6.2

Species	Number Caught	Length Range (cm)	Weight Range (kg)
Pike	118	13-96	0.03-7.5
Roach	207	12.5-25	0.1-0.3
Bream	26	15-38	0.05-0.9
Roach x Bream	9	26-29	Average 0.95
Tench	2	34 & 37.5	0.9 & 0.95
Eels	>250	N/A	>0.5-1.4
Brown Trout	1	23.5	0.2

Table 6.1 Fish survey results from Newry canal 2001

Species	Number Caught	Length Range (cm)	Weight Range (kg)
Roach	437	5-27	Up to 0.43
Bream	36	20-46	Up to 1.8
Roach x Bream	58	26-35	0.35-0.85
Pike	40	35-73	Up to 3.45

Table 6.2 Fish survey results from Newry canal 2002. Perch, Brown trout and Eels were also caught in 2002

Fig 6 Left to right Perch, Pike and Bream

7.0 HABITAT MONITORING

The Loughs Agency has carried out extensive habitat surveys on all the major salmonid rivers and tributaries within the Foyle and Carlingford catchments. Habitat surveys are carried out on foot. Although time consuming this is at present the best method for classifying the various grades of salmonid habitat. Habitat is classified into one of three life cycle units Fig 7, the presence and order of which is essential to the productive capacity of a salmonid river. Other non salmonid species also benefit from diverse in-channel habitat. The life cycle unit categories include spawning, nursery and holding habitat. Each category is then graded on a scale of 1-4, 1 representing the best quality attainable and 4 the worst. Other data collected during these surveys include channel width and impassable barriers to migratory fish species.

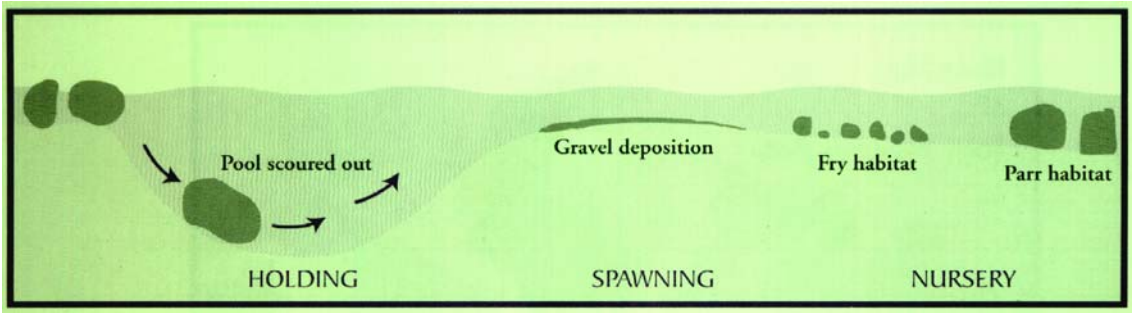

Fig 7 Life cycle unit depicting the type of habitat found in spawning, nursery and holding zones

Fig 7.1 Examples of spawning, nursery and holding habitat

8.0 LAND USE

Land use classification is an important tool when assessing the potential impacts within a particular river catchment or indeed when looking at specific land use and land management practices. Land use impacts could have either a positive or negative impact on rivers and tributaries. A good understanding of the land use within a catchment is therefore imperative in managing at a catchment scale.

Land use in Northern Ireland has been captured using satellite imaging technology and classified to type. The following figures outline the broad land use classification within the Carlingford Area.

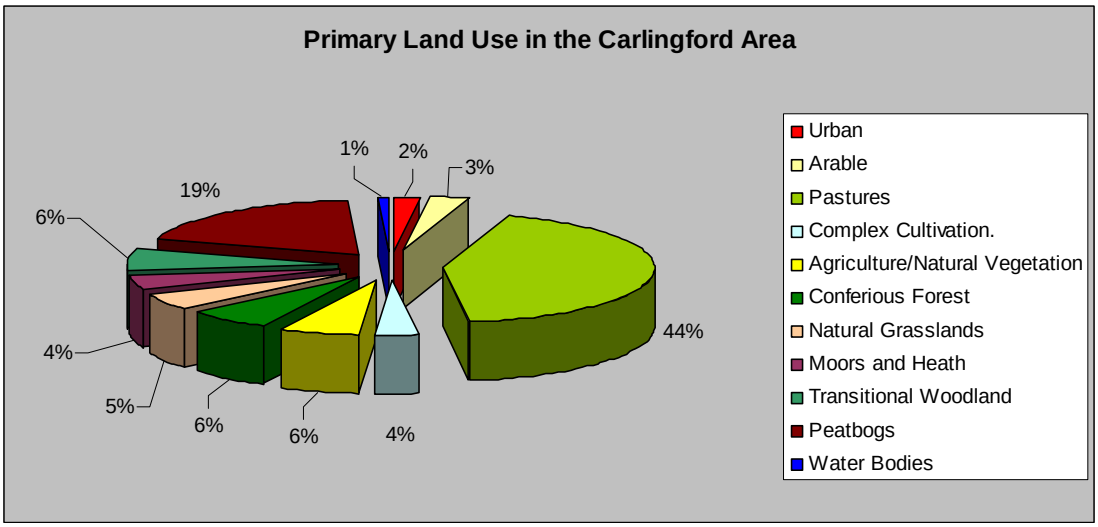

Fig 8 Carlingford Area land use classification

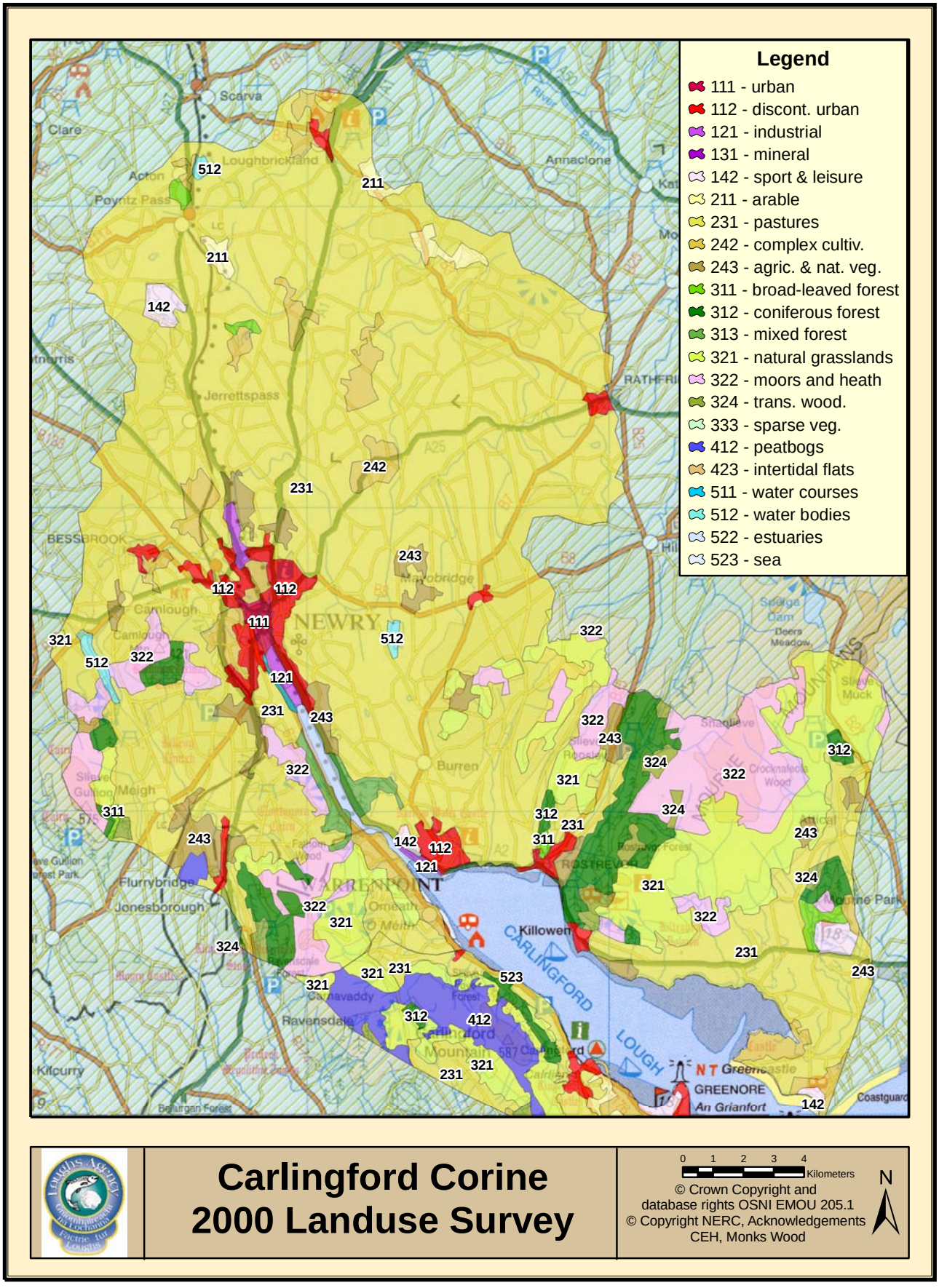

Fig 8.1 Carlingford Area land use classification map

9.0 WATER QUALITY

Routine water quality monitoring within the Foyle and Carlingford areas is conducted by the Northern Ireland Environment Agency (NIEA) of the Department of the Environment for Northern Ireland and the County Councils in the Republic of Ireland (Donegal County Council and Louth County Council). Routine sampling is conducted regularly for both chemical and biological General Quality Assessments (GQA).

In addition to the routine river monitoring carried out by the NIEA and the County Councils the Loughs Agency conducts proactive and reactive pollution investigations to investigate or highlight problems or potential problems which may have an effect on the aquatic environment and ultimately on the fish species and aquatic habitats.

In 2007 the Loughs Agency instigated a programme of monitoring at the tributary level for assessments of chemical and biological water quality. Nine stations on tributaries within the Carlingford area were monitored for chemical water quality parameters including Biological Oxygen Demand (BOD), Suspended Solids, Ammonia and Phosphorous. Biological water quality was assessed using the Biological Monitoring Working Party (BMWP) a biotic scoring index.

Fig 9.0 Loughs Agency chemical water quality testing in the laboratory

The Loughs Agency also maintains a mobile pollution response unit containing aerating equipment and absorbent and non absorbent booms for oil and chemical spills. The unit can be rapidly deployed to the site of a pollution incident.

Water Quality Parameters

The following water quality parameters are monitored through the Loughs Agency monitoring programme and determined from water samples in the laboratory:

- Biochemical Oxygen Demand (BOD)
- Ammonia
- Phosphorus
- Suspended Solids

BOD

Any organic matter discharged into a river provides an immediate source of food for bacteria. These bacteria will break down the organic matter eventually into simple compounds such as carbon dioxide and water. Biochemical Oxygen Demand or Biological Oxygen Demand (BOD) is a chemical procedure for determining how fast biological organisms use up oxygen in a body of water. It is considered as an indication of the quality of a watercourse

Ammonia (NH_3)

Ammonia is generally found in small amounts in rivers and streams. This is due to microbiological activity and the resultant reduction of compounds containing nitrogen. High levels of ammonia can occur as a result from sewage pollution and have detrimental impacts on fish species.

Phosphorus (PO_4)

The over-loading of nutrients such as phosphorus in watercourses often leads to a process known as eutrophication. Eutrophication is a major environmental issue in Irish rivers and lakes. Sources of phosphorus include agricultural fertilizers and household detergents.

Suspended Solids

Particulate matter may be organic or inorganic in nature. Organic solids may consist of algal growths, indicative of eutrophic conditions. Inorganic solids generally are the result of discharge washings from sand and gravel extraction activities or quarries. Suspended solids can affect plant growth and fish habitats.

The following parameters are also recorded at each sample station by means of an electronic measuring probe:

- pH
- Temperature
- Dissolved Oxygen

- Conductivity

pH

This is a measure of the hydrogen ion concentration of a solution and therefore an indication of whether a liquid is acid or alkaline. The pH scale ranges from 0 (very acid) to 14 (very alkaline), with results generally influenced by geological conditions. Fish can be susceptible to changes in pH. Low pH levels are generally found in catchments with high forestry operation impacts.

Temperature

The effect of changes in temperature on living organisms, such as fish, can be critical. Thermal discharges from urban and industrial sources can lead to temperature increases in watercourses and increased stress on aquatic habitats and associated species.

Dissolved Oxygen

Sufficient levels of oxygen saturation in fresh waters are generally an indication of good ecological status and ideal for fish life. The main point to remember about oxygen solubility is that it has an inverse relationship with temperature. This helps explain why DO levels are generally lowest during summer low flow conditions, increasing the risk of pollution from discharges at this time.

Conductivity

The conductivity or electrical conductivity of a watercourse is a measure of its ability to conduct an electric current. Electrical conductivity estimates the amount of total dissolved salts, or the total amount of dissolved ions in the water. Electrical Conductivity is controlled by geology and any variations may be sourced to increased ions from wastewater from sewage treatment plants or urban run-off from roads.

Fig 9.01 Carlingford area average suspended solids results 2007. Values are in mg/l

Fig 9.02 Carlingford area Ammonia results 2007. Values are in mg/l

Fig 9.03 Carlingford area phosphorous results 2007. Values are in mg/l

Fig 9.04 Carlingford area Biological Oxygen Demand (BOD) results 2007. Values are in mg/l

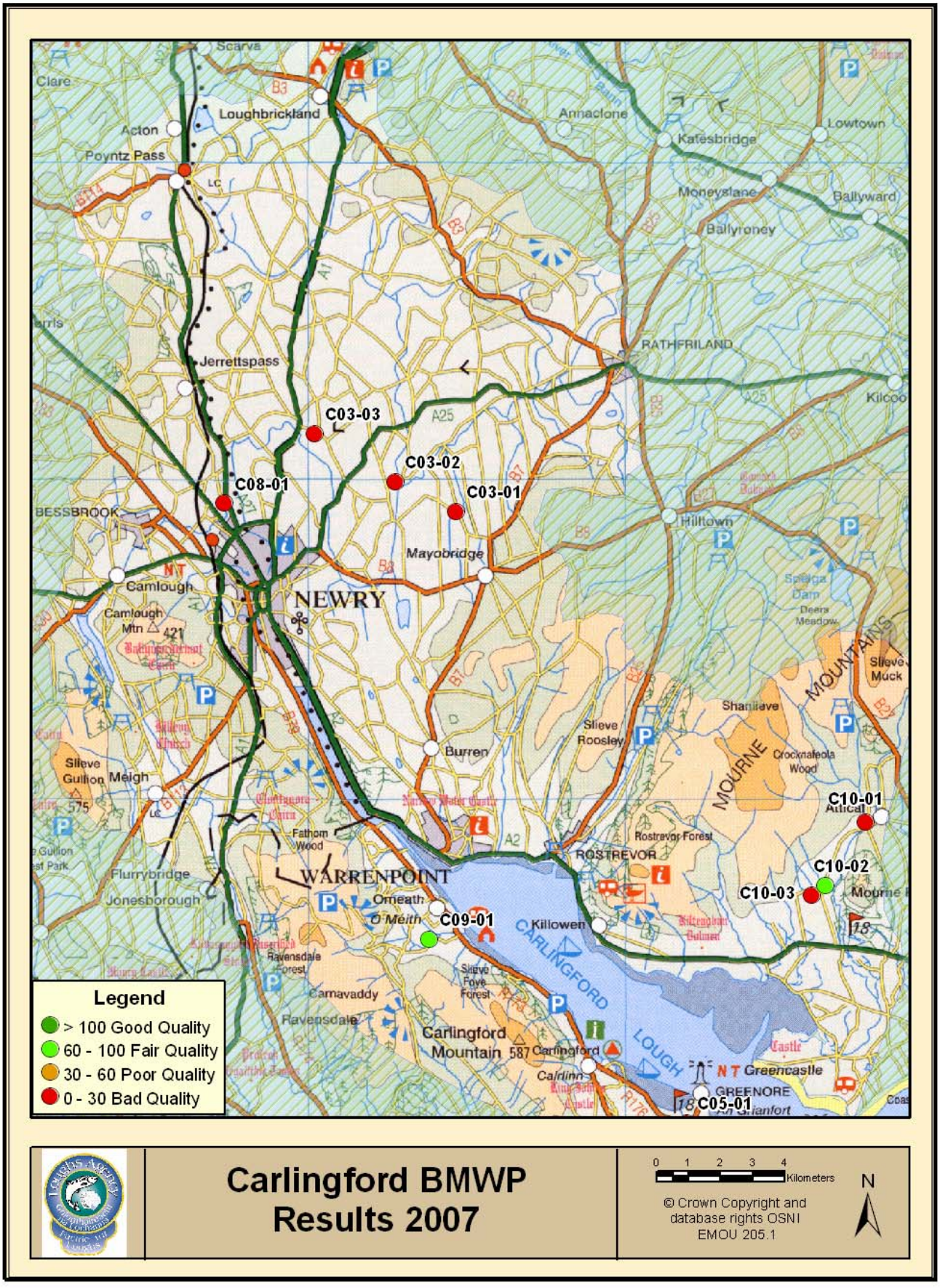

Fig 9.05 Carlingford area Biological Monitoring Working Party results 2007 * Note Loughs Agency invertebrate monitoring was conducted during the summer months of 2007

NIEA routinely monitor both the chemical and biological water quality within the rivers of Northern Ireland. In relation to chemical monitoring an extensive network of sampling stations are monitored for a variety of chemicals. The General Quality Assessment (GQA) is defined by limits for the concentrations of Biological Oxygen Demand (BOD), ammonia and dissolved oxygen (DO). The measures listed are indicators of the affect on water quality by waste water discharges and agricultural run-off containing organic material. Water quality can be affected by a variety of sources and the GQA determinands provide a recognised assessment of water quality.

The overall GQA class assigned to a section of river is based on the worst performing of the three measures (BOD, ammonia and DO). Table 8.01 outlines the standards for the chemical GQA.

GQA Class	Dissolved Oxygen (% Sat) 10-percentile	BOD (mg/l) 90-percentile	Ammonia (mg/l) 90-percentile
A (Very Good)	80	2.5	0.25
B (Good)	70	4	0.6
C (Fairly Good)	60	6	1.3
D (Fair)	50	8	2.5
E (Poor)	20	15	9.0
F (Bad)	<20	-	-

Table 9.01 chemical GQA class limiting criteria

The above table can be summarised as follows: for BOD and ammonia the section of river should contain less than the stated levels for at least 90% of the time. DO levels must not fall below the stated levels for more than 10 percent of the time.

In relation to biological monitoring an extensive network of sampling stations is also routinely monitored. The biological GQA is defined by observed measures of the abundance and diversity of macro invertebrates (for example freshwater shrimps, insect larvae and molluscs) compared to expected values as derived from a UK computer model adapted for Northern Ireland called River Invertebrate Prediction and Classification System (RIVPACS)

Different species of macro invertebrates are more sensitive to specific forms of pollution and therefore environmental quality indices (EQIs) based on biological results may be used to assess water quality. Macro invertebrates are also the dominant prey of both salmonid and some non salmonid fish species. The measure of diversity of a macro invertebrate community can be a more reliable indicator of the pollution pressures within a catchment than relying solely on an assessment of chemical water quality. The impacts of pollution on a macro invertebrate community are longer lasting and can highlight intermittent pollution impacts that may be missed through chemical water quality monitoring.

Biotic scoring systems have been developed to assign a score based on a standardised system to each sample site. One such system is the Biological

Monitoring Working Party (BMWP). Generally the higher the BMWP score the better quality of the macro invertebrate community which reflects better water quality.

Based on a combination of biotic scoring systems biological GQA classes are assigned to sections of river. The two EQIs used are as follows:

$$EQItaxa = \frac{\text{BMWP Observed Number of Taxa}}{\text{BMWP Predicted Number of Taxa (as derived from UK model)}}$$

$$EQIASPT = \frac{\text{BMWP Observed ASPT (Average Score Per Taxon)}}{\text{BMWP Predicted ASPT (as derived from UK model)}}$$

Biological Class	EQI for ASPT	EQI for Taxon
A (Very Good)	1.00 or above	0.85 or above
B (Good)	0.90-0.99	0.70-0.84
C (Fairly Good)	0.77-0.89	0.55-0.69
DC (Fair)	0.65-0.76	0.45-0.54
E (Poor)	0.50-0.64	0.30-0.44
F (Bad)	<0.50	<0.30

Table 9.02 Biological GQA class limiting criteria

Figure 9.06 Flattened mayfly nymph from the order *ephemeroptera* high scoring macro invertebrate indicative of good water quality.

European Council Directive 92/43/EEC of the 21st of May 1992 on the Conservation of Natural Habitats and on Wild Flora and Fauna (Also known as the Habitats Directive) was enacted in Northern Ireland under the European Communities Nature Conservation (Natural Habitats etc.) Regulations (Northern Ireland) 1995.

This indicates that those areas designated as areas of nature conservation designated for salmon should strive to achieve the water quality targets that are necessary for the designated species, which has additions to the GQA standards.

While it is current government policy for all rivers to meet the General Quality Assessment Standards, the Agency feels that favourable conditions standards as detailed below should be the water quality targets for all salmonid rivers within its jurisdiction.

9.1 Favourable Condition Tables, Target Levels

Natural Heritage of Northern Ireland Environment Agency have suggested guidelines for the determination of water quality, the first being the proposed UK Guidance on Conservation Objectives from monitoring designated sites and includes the following, which are considered as the favourable conditions tables.

They recommend Biological GQA Class A or B with no drop in class from the existing station, and Chemical GQA Class A or B depending on which type. This is in addition to no drop in class from the existing station. In addition to these favourable conditions tables, based on publications from Conserving Natura 2000 Rivers, the European Life Series, Ecology Series; No 7 Ecology of the Atlantic Salmon, *Salmo Salar* L. these publications have indicated that there are specific favourable conditions for this species.

An annual mean of less than 10 milligrams per litre suspended solids for nursery grounds, and annual mean of less than 25 milligrams per litre for migratory passage and the setting of soluble reactive phosphorous targets in relation to river reach types which should be as near background levels.

Parameter	Level	Percentile	Reason
BOD mg/l	2.5	90	GQA class A
Ammonia mg/l	0.25	90	GQA class A
Dissolved Oxygen % Saturation	80	10	GQA class A
Unionised Ammonia mg/l	0.025	95	Favourable Conditions Habitat Forming
Suspended solids mg/l **Nursery grounds** **Migratory passage**	 10 25		Specific for Atlantic Salmon
Soluble Reactive Phosphorous mg/l	Background	-	Specific for Atlantic Salmon

Table 9.10 Favourable condition targets for Atlantic salmon

The Water Quality data in the reports has come from the Northern Ireland Environment Agency, Water Management Units Water Quality Archive. It is accepted by the Agency that monitoring is designed to ensure that water quality is monitored to ensure compliance with European Union directives. The monitoring however does not tie in well with the habitat and electrofishing survey monitoring carried out by the Loughs Agency, and as such the Loughs Agency instigated its own monitoring programmes in 2007 to link fish life, macro invertebrates and water quality into one holistic site evaluation. Additionally Northern Ireland Environment Agency, Water Management Unit data is not released in real-time and the data displayed in the above evaluation is for 2006, where the Loughs Agency status report is for 2007. By collecting and analysing water quality data the Loughs Agency can react to local water quality issues more effectively.

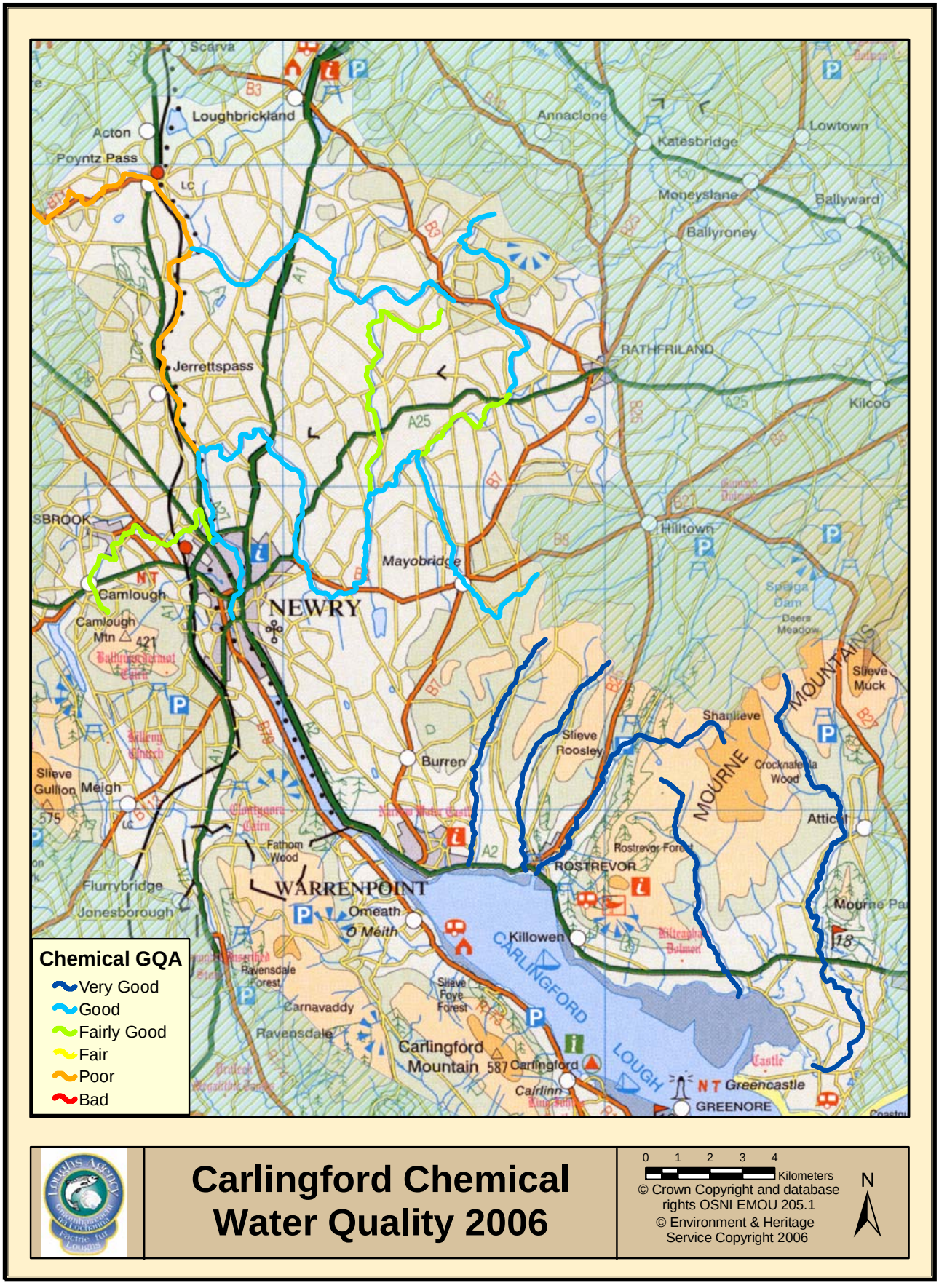

Fig 9.07 Chemical General Quality Assessment (GQA) Carlingford area 2006. Data supplied by NIEA

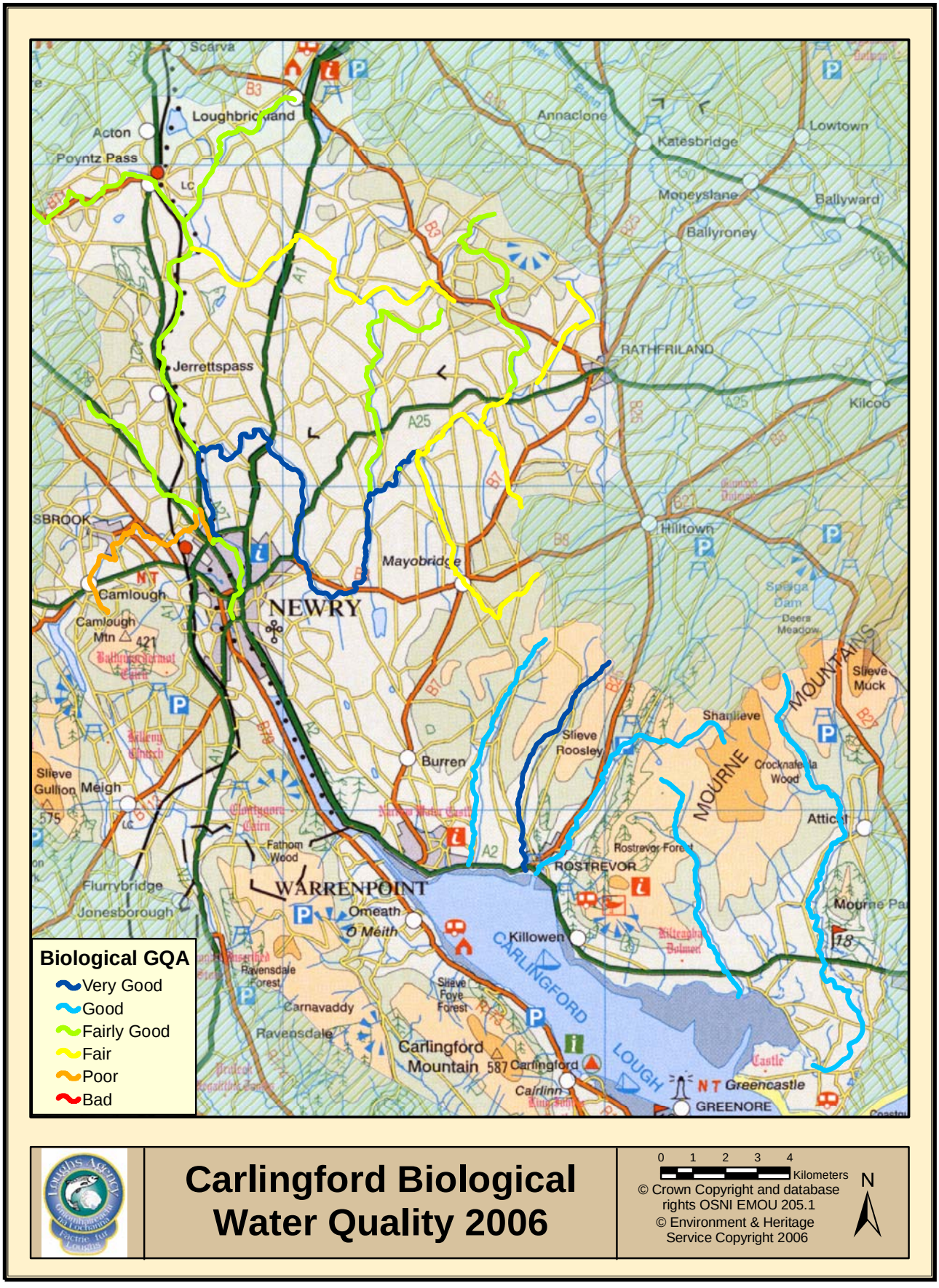

Fig 9.08 Biological General Quality Assessment (GQA) Carlingford area 2006. Data supplied by NIEA

10.0 CONSERVATION AND PROTECTION

The Loughs Agency continues to carry out an active fishery protection role throughout the catchments of the Foyle and Carlingford areas including the sea area, tidal River Foyle and on all tributaries. Tables 8 and 8.1 outline some of the duties carried out by the Loughs Agency staff in the Carlingford catchments and seizures for the Foyle and Carlingford areas.

A team of Fishery Officers based in Carlingford are responsible for the catchments within the Carlingford area. In addition to fishery protection duties the team is responsible for conducting sampling within Carlingford Lough.

Year	No of Licence Checks	Joint Patrols	On-site Inspections
2005	786	3	230
2006	550	4	267
2007	410	0	110

Table 10 Breakdown of conservation and protection duties 2002-2007

Year	2007	2006	2005	2004	2003	2002
Nets	100	97	114	181	198	207
Salmon	56	91	118	130	155	94
Rod&Reel	85	26	10	16	12	22
Vehicles	0	2	1	0	0	0

Table 10.01 Seized nets, salmon, rod/reels and vehicles in the Foyle and Carlingford systems 2002-2007

10.1 Habitat Improvement Works

In addition to the traditional protection duties carried out by the Loughs Agency staff conservation and improvement of habitat has been increasing over recent years.

Over time man has imposed significant changes on the natural courses of many rivers and flood plains. The driving forces behind these changes have included amongst others; arterial drainage schemes to provide more suitable land for agricultural purposes, urban sprawl, infrastructure expansion (roads etc.), flood defences, water abstraction and hydro power generation. All have had a significant impact on the natural meanderings and discharges of rivers and tributaries resulting in faster runoff of floodwaters ultimately leading to a change in the morphology and flow regime of rivers and resultant impacts on fisheries.

While all these processes have had some impact within the Foyle and Carlingford systems, they are still considered to be relatively natural systems with natural river structure present in the catchments headwaters. In areas that have been altered methods for reinstating lost habitat are investigated and where appropriate action taken.

In 2005 a series of in-channel habitat improvement works were instigated on the Clanrye River, funding was secured with a joint bid with the Department of Culture and Leisure under a Financial Instrument of the European Economic Area (EEA).

The following information highlights the sites where work was undertaken on the Clanrye River and a brief description of the type of work carried out.

Specification 1

River	Clanrye	**Site Ref**	CN 1
Grid Ref	156323	**Townland**	Mill Farm/Ballykeel
Site description	Upstream of bridge has very good nursery/spawning habitat with riffle & glide sequence to rock outcrop and small waterfall after 200m (beyond this is poor). Downstream of bridge also quite good. Banks in reasonable condition but fencing is lacking.		
Objectives	Fencing will provide protection from livestock thereby increasing bank stability and preserving nursery and spawning habitat. Will promote bankside vegetation improving cover and increase overall quality of habitat.		
Specification	Fencing of both banks.		
Estimated quantities	Fencing: 1080m stock-proof (sheep)		

Specification 2

River	Clanrye River	**Site Ref**	CN 2
Grid Ref	144312	**Townland**	Croan Bridge/Ryans Church
Site description	Long section of low gradient channel with poor substrate enters gorge and gives way to 400m of very good nursery. Lack of spawning gravels		
Objectives	Create spawning area at the head of good nursery habitat.		
Specification	Addition of gravel to specified area. Gravel will have to be tipped from high bank and raked into place to form level area. Repair/replace fencing as necessary to permit access		
Estimated quantities	Rock: 32t rounded gravel of 30-70mm mixed with 10% fines Fencing: short section to be replaced		

Specification 3

River	Clanrye River	**Site Ref**	CN 3
Grid Ref	136305	**Townland**	Ryan Bridge
Site description	Known spawning area around Ryan Br with limited nursery habitat. Downstream river enters second gorge with initially good nursery, progressively deteriorating to section with reasonable gradient but lacking in spawning gravel and nursery substrate.Channel too wide at lower end of section serious erosion and lack of fencing on right bank		
Objectives	Addition of gravels to create spawning areas Development of nursery areas Re-instatement of bank		

	Creation of scour pool
Specification	Excavate riverbed materials to form 5 spawning areas. Spawning areas to be filled with rounded gravel of 30-70mm mixed with 10% fines. Include retaining rocks at 2 sites in gorge area. Construct 2 deflectors – 10m x 2m x 300mm and 6m x 3m x 300mm infilled with crushed rock. Bank protection of rock revetment to base of banks to be provided opposite deflectors where necessary (some sections of bank have rock revetment.) Addition of rubble mat downstream of lower deflector 15x4m x 250mm Repair 65m of eroded/damaged right bank using log/xmas tree revetment. Infill using material excavated from river for other features. Construct vortex weir at specified location to create scour pool downstream Planting of 2 groups of willow saplings downstream of Ryan Br on right bank adjacent to riffle. Fencing: 300m stock proof fence (sheep) to be erected on left bank 1m back from river's edge.
Estimated quantities	Rock: 120t (various grades); 65t gravel Fencing: 320m stock-proof (sheep), left bank: C-D; 3-strand barbed wire, 180m right bank: A-B; 300m left bank: A-E Log/xmas tree: 65m of 250-300mm diameter (xmas tree tops supplied) Trees: 20 willow saplings

Fig 9.11 Pictures of completed works (specification 3)

Specification 4

River	Clanrye River (Shinn Burn)	**Site Ref**	CN 4
Grid Ref	127300	**Townland**	Hawkins Bridge
Site description	Reasonable quality tributary with resident trout and some large fish spawning Lower end of channel obstructed Some damage to banks		
Objectives	Create scour pool and spawning areas Develop nursery habitat and improve access from main channel Protect banks from over-grazing and erosion		
Specification	Construct single vortex weirs and scour pool downstream of Hawkins Br – add gravel at tail of pool Excavate riverbed material to form second spawning area - infill with rounded gravel of 30-70mm mixed with 10% fines. Include retaining rocks keyed into riverbed.		

	Clearance of lower end of channel: removal of all fallen trees, dead wood etc. Addition of rocks (300-450mm) at two locations to develop nursery and parr holding areas Fencing: 210m of 3-strand barbed wire on each bank - 1m back from river's edge.
Estimated quantities	Rock: 40t (various grades); 7t gravel Fencing: 420m 3-strand barbed wire

Fig 8.12 Pictures of completed works (specification 4)

Specification 5

River	Clanrye River	**Site Ref**	CN 5
Grid Ref	126295	**Townland**	Croreagh
Site description	Good holding area with some spawning and nursery. Lack of instream diversity. Rock stock-piled on-site and available for specified		

	works.
Objectives	Addition of gravels to create spawning areas Development of nursery areas and parr holding areas Enhancement of holding pool
Specification	Excavate riverbed materials to form 5 spawning areas. Spawning areas to be filled with rounded gravel of 30-70mm mixed with 10% fines. Addition of supplementary gravel to further specified area Addition of rocks (300-450mm) at two locations to develop nursery and parr holding areas – new materials required Construct 2 deflectors – 6m x 3m x 300mm using stock-piled rock and infilled with crushed rock. Bank protection not required - existing revetment on opposite bank.) Addition of rocks (300-600mm) at two locations to develop nursery and parr holding areas – use stock-piled rock Planting of 3 groups of alder/willow saplings adjacent to nursery and holding areas. Fencing: 700m barbed wire fence to be erected on each bank on specified sections 1m back from river's edge. Drinking points to be provided if requested by landowner. Disposal of excess excavated materials to be negotiated with landowners.
Estimated quantities	Rock: 10t (various grades); 45t gravel Fencing: 1400m 3-strand barbed wire. Trees: 30 native alder/willow saplings

Specification 6

River	Clanrye River	**Site Ref**	CN 6
Grid Ref	127283	**Townland**	Benagh
Site description	Existing spawning area with limited nursery and some		

	holding water. Lack of in-stream diversity.
Objectives	Development of nursery areas Creation of scour pool with associated spawning and nursery area
Specification	1 Excavation of riverbed materials to form 3 rubble mat nursery areas in-filled with crushed rock 150-300mm, upstream of farm bridge 2 Addition of similar rubble mat to further specified area, also upstream of farm bridge 3 Construct single vortex weirs with associated bank protection downstream of farm bridge; excavate scour pool downstream 4 Excavation of riverbed materials downstream of scour pool to form rubble mat nursery area in-filled with crushed rock 150-300mm 5 Planting of 2 groups of alder/willow saplings adjacent to new rubble mat area. Disposal of excess excavated materials to be negotiated with landowners.
Estimated quantities	Rock: 100t (various grades) Trees: 20 native alder/willow saplings

In addition to the works listed above habitat improvement works were carried out on the Ryland River in 2006. Works included the introduction of spawning gravel and the creation of spawning fords and bankside protection. The following pictures highlight the before and after works (left hand side outlines the before works)

11.0 ENIRONMENTAL ISSUES

Some environmental issues affecting water quality have already been outlined previously. The following list presents some of the main pressures on fish populations within the Carlingford area:

- Agricultural activities – enrichment from natural and artificial fertilisers often make their way into watercourses, enhancing problems with eutrophication.
- Forestry activities – planting and felling operations can lead to increased loading of suspended solids in watercourses. Established forestry as a major upland land use has been attributed to increased acidification.
- Barriers to migration – a range of natural and anthropogenic features on rivers can lead to barriers for migrating salmonids and other fish species. These can include weirs and hydro-electric schemes.
- Gravel removal – gravel is extremely important for the creation of redds for spawning fish. Removal of gravel from the river bed in sensitive areas can destroy potential spawning and nursery habitat.
- Quarrying activities – the extraction of aggregates such as rock, sand and gravel has the potential to cause increased levels of suspended solids in nearby watercourses. Sufficient mitigation measures should be in place at such sites to trap increased sediment loads entering rivers and streams.

- Abstraction – water abstraction from watercourses for a range of uses is increasing throughout the Foyle and Carlingford catchments. Unless appropriately assessed and licenced, these activities have the potential to reduce residual flow levels and alter the ecological status of our rivers. This is even more concerning in the light of climate change.
- Peat harvesting – Peat harvesting still occurs in small upland pockets throughout the Foyle system. It has the potential to increase sediment loading in receiving waters.
- Sewage treatment – sewage and waste water treatment works are under considerable pressure with the increase in urban development in our towns and villages. Several inadequate systems throughout the Foyle system continue to pollute rivers.
- Hydropower – small-scale hydropower schemes are beginning to appear on rivers throughout the Foyle and Carlingford catchments. Baseline fishery data must be provided to allow for sufficient assessment of any proposed scheme, unless located above an impassable fish barrier.
- Urban development – the expansion of large-scale housing developments and the associated pressures on waste water and sewage treatment works are a potential source of water pollution in the event of overflows.
- Drainage and canalisation – these have direct impacts on the quality of available fishery habitat within the catchments. Canalisation in particular can lead to the removal of important spawning, nursery or holding areas of rivers.
- Industrial discharges – larger urban areas with industrial discharges have the potential to cause pollution through toxic discharges and can alter the temperature of the watercourse.
- Septic tanks – a proliferation of single dwellings and their septic tanks is an ongoing area of concern. Initial research from parts of the Foyle system indicate that this is major contributor to decreased water quality and local increases in suspended solids.

12.0 DESIGNATED AREAS

The European Commission Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (EU Habitats Directive 92/43/EEC) requires that all member states designate Special Areas of Conservation (SACs) in order to protect threatened habitats and species. The European Commission Directive on the Conservation of Wild Birds (Birds Directive 79/409/EEC) also requires the designation of Special Protected Areas (SPA's). Together the designated SAC's and SPA's create the NATURA 2000 network of protected sites. A number of rivers have been designated as SAC's both in Northern Ireland and in the Republic of Ireland however no rivers within the Carlingford area have been designated.

NATURA 2000 sites within the Carlingford area include Derryleckagh SAC, Rostrevor Wood SAC, Slieve Gullion SAC, Carlingford Mountain SAC, Carlingford Shore SAC and Carlingford Lough SPA.

The Mourne Area of Outstanding Natural Beauty lies partially within the Carlingford area as does the Ring of Gullion AONB. The area is also covered by a variety of nationally designated sites including Areas of Special Scientific Interest (ASSI) and National Nature Reserves (NNR).

Designated sites are required to attain high environmental quality standards set at both the European and national scale. The maintenance of a network of sites represents great opportunities for co-ordinated environmental management with issues such as water quality and habitat conservation having a direct link to the quality of the fisheries resource.

13.0 POLUTION MONITORING

The Loughs Agency has a statutory obligation to monitor the pollution of watercourses. In conjunction with the Environment and Heritage Service and Louth County Council all reported pollution incidents are investigated.

14.0 FISHERY OFFICERS CARLINGFORD AREA REPORT 2007

In 2007 a review of the issues impacting fishery production within the Carlingford area was conducted by Fishery Inspector David Clarke and Fishery Officers Damien O'Malley, Steven Moates and Donal Cassidy in response to specific issues highlighted by Loughs Agency monitoring programmes. Areas of low production were highlighted based on poor electrofishing results, poor water quality results and habitat survey information. These areas were investigated by the fishery officers.

14.1 Fishery Officers Report

Whitewater/Yellowwater was highlighted for further investigation. Additional sampling was carried out in November 2007, see below.

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
0	0.04	0.29	0.98	43

Patrols of the Whitewater catchment revealed very few issues with point source pollution. The nature of the catchment (mostly upland, low intensity agriculture, little/no industrial activity and relatively low population) and routine patrols by both the agency and local Kilkeel Angling Club mean that very few if any point pollution sources go un-noticed. The following issues were identified.

On the Red Moss River (tributary of the Whitewater) an intermittent issue has been identified. Field clearing/ground preparation activity is generating a peat rich mud/slurry which is occasionally entering the river contributing significantly to the suspended solids load and presumably nutrients. This issue will be monitored closely and action taken if required.

Attical Waste Water Treatment Plant appears to be no longer in use, however effluent has been observed entering the river from the site. The volume is relatively low but some sewage fungus has intermittently appeared. This will be monitored on a regular basis.

Habitat assessment did not identify any barriers to migration. There may be an issue with the availability of suitable spawning habitat upstream of the Mourne Park. There is ample nursery habitat but an absence of extensive spawning beds.

The additional chemical and biological sampling conducted on the Whitewater indicated that water quality may not be as poor as first indicated, particularly in the main channel. However the elevated phosphorous is still of some concern. The pollution sources outlined above are likely to be contributing to this problem. In addition the headwater tributaries of the Whitewater are deficient in gravel which may be as a result of the gradient and could be exacerbated by the lack of native riparian and upland tree cover which could reduce flows reducing the rate of gravel transport downstream.

Cassey Water. The initial environmental review raised a number of action points for the catchment including further chemical and biological sampling and identification of factors leading to poor fish populations. Sampling was conducted in Nov 2007, the results are displayed below.

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
0	0.03	0.15	1.57	34

Land use in the Cassey Water catchment consists mostly of rough sheep grazing. There is almost no slurry storage or silage pits. Sheep dipping does not appear to be a problem and there is no industrial activity. There is however a coniferous forestry plantation in the headwaters of the catchment. There are also intermittent problems with septic tank overflows.

No barriers to migration were observed, however the tidal nature of Millbay means that fish can only enter the system at high tide. Most of the river is high gradient with good nursery habitat but lacking in spawning habitat. Upland planting with native species may improve the colonisation of suitable spawning gravel.

Kilbroney River. There were a number of action points raised during the environmental review, including further chemical and biological water quality sampling, identification of pollution sources and habitat assessment.

Additional sampling was conducted in Nov 2007, the results are displayed below.

Kilbroney (Upper site)

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
0	0.04	0.14	0.90	36

Kilbroney (Lower site)

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
1	0	0.24	1.05	43

During the assessment no point sources of organic pollution were detected in the channel. There is an intermittent sewage discharge at the mouth of the river. Construction work in the channel of a tributary was found to be releasing suspended solids, mitigation measures were put in place.

The Kilbroney contains good nursery habitat and has some good spawning habitat in the lower reaches. There is however an absence of good spawning gravel in the upper reaches. The river also has a poorly defined channel in the inter-tidal area. Migrating fish require high water /spring tides and good river flow to facilitate migration. There is a series of high gradient riffle habitat through Rostrevor Park which could pose difficulties for migrating fish.

Ghann River. The environmental review raised a number of action points for the Ghann catchment including further biological and chemical water quality sampling, identification of pollution sources and habitat assessment.

Additional sampling was conducted in Nov 2007, the results are displayed below.

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
0	0.03	0.23	1.64	48

No pollution point sources were identified. However high phosphorous levels are an indication of diffuse sources. Land use in the catchment is dominated by cattle and sheep grazing. Farm/stocking sizes are relatively small resulting in a low density of slurry storage facilities. Silage storage is mainly in round plastic covered bails.

The Ghann catchment contains good nursery habitat but has limited spawning habitat, tunnelling by trees may also be a localised problem. In the past three years the Ghann has suffered from low summer flows resulting in three of the

electric fishing stations having no surface flow. In addition a partial barrier to migration has been identified at the mouth of the river.

Moygannon River. The environmental review highlighted the following issues. The need for further water quality monitoring and habitat assessment.

Additional sampling was conducted in Nov 2007, the results are displayed below.

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
0	0.08	0.29	2.05	45

No point pollution sources were identified at the time of survey. The Moygannon catchment has good spawning and nursery habitats. There is a lack of holding habitat in the lower reaches. A number of barriers/partial barriers to migration were identified. Agriculture appears to be more intensive in this catchment when compared to other northern shore catchments which may explain the elevated phosphorous levels.

Clanrye/Newry River. The environmental review highlighted the following issues for further investigation. Additional water quality monitoring in the main channel, habitat assessment and point source pollution assessment.

Additional sampling was conducted in Nov 2007, the results are displayed below.

Clanrye (Sheep Bridge)

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
0	0.12	0.57	5.46	N/A

Clanrye (Mount Hill)

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
0	0.12	0.60	6.16	N/A

Clanrye (Dooley's Bridge)

BOD mg/l	TOTAL AMMONIA mg/l	TOTAL PHOSPHOROUS mg/l	SUSPENDED SOLIDS mg/l	BMWP
0	0.11	0.63	5.15	37

No major point sources of pollution were identified in the main channel during the survey, however this could have been affected by raised water levels. It was observed at many points in the catchment that slurry spreading continued throughout the “closed season”.

The RBS sewage package plant at Crown Bridge has recently been upgraded and does not appear to be giving problems at present. A Waste Water Treatment Works in the upper catchment was giving problems and has been subject to enforcement action by NIEA. There is also an intermittent problem in the Sheep Bridge area.

Continuing civil engineering works appear to be causing intermittent mobilisation of suspended solids and are being monitored. No major barriers to migration were observed.

The catchment is relatively low gradient and slow flowing as it winds its way through a landscape dominated by glacial deposits, which may account for the significant quantity of sand in the river downstream of Rathfriland. Sections of the catchment are canalised with low gradient including Derryleckagh Bridge area and the Dooley’s Bridge area. Bank erosion has been identified as a problem in some sections.

Bessbrook River. The environmental review identified the following action points. Further monitoring of water quality and habitat assessment.

Due to the fact that the Bessbrook River discharges into the Newry canal the route for migratory fish species will be significantly impacted.

One point source of organic pollution was identified near the confluence with the canal. There is also ongoing intermittent high suspended solids due to civil engineering works. There has also been an intermittent problem with oil/fuel contamination of the river.

Ryland River. The environmental review identified that the status of this catchment is quite good. No point sources of pollution were identified during the survey.

The habitat within the catchment is quite good, however there is an impassable waterfall which prevents fish from migrating further upstream. Habitat improvement works were carried out on the lower section in 2006. Some of the spawning gravel placed in the river has since been “washed out”.

15.0 ACTIONS FOR 2008

In order to fully utilise the extensive data resources collected and held by the Loughs Agency on the fish populations and habitats of the Carlingford area it is necessary to focus attention on specific management objectives.

The Loughs Agency has stated in its corporate plan 2008-2010 that it will conserve, protect, manage and improve the fisheries of the Foyle and Carlingford areas. By way of fulfilling these objectives a targeted series of actions utilising data collected over recent years will be implemented. Fishery owners and angling associations/clubs will continue to be consulted regarding any proposed works and stakeholder input sought.

15.1 Foyle and Carlingford Areas Ongoing Actions for 2008

Good water quality is essential for the conservation of productive aquatic ecosystems. Fish populations rely on unpolluted water for survival and feeding. The Loughs Agency is committed to ensuring deleterious matter does not enter any watercourse. Routine monitoring is conducted throughout the Foyle and Carlingford areas. Proactive pollution visits and water quality monitoring will continue in 2008.

Water quantity is becoming an increasingly important issue from a fisheries management perspective with continuing demand from a variety of sources including industry, hydro power generation and abstraction for meeting the ever growing needs of industry and the wider population. The Loughs Agency are aware of the conflicting needs of aquatic environments and water resource users and comment on development issues which may have an impact on the important aquatic resources of the Foyle and Carlingford areas with reference to national and international obligations.

In-channel and riparian habitat improvement projects provide an important mechanism by which to improve and protect valuable fishery resources. Over recent years the Loughs Agency has developed a number of projects designed to improve the survival and production of robust populations of juvenile salmonid and other native fish species. These programmes will continue where funding is available, The Loughs Agency also encourages local stakeholder groups to source appropriate funding to develop collaborative habitat improvement projects. The Loughs Agency can provide advice and recommendations for in-channel and riparian improvements and are eager to facilitate the development of such programmes.

Work is continuing to assess and record all **Barriers to Migration** within the catchments of the Foyle and Carlingford areas and these will be incorporated into the Loughs Agency Geographical Information System (GIS). Where finances are available the removal of artificial barriers will be investigated.

Predation by cormorants and seals of economically important fish species continues to be a contentious issue. The Loughs Agency will continue to promote the development of a management strategy incorporating economic, social and environmental factors.

The Loughs Agency will continue to monitor the salmon and inland fishery resources of the Foyle and Carlingford areas, utilising best practice methods including fish counters, juvenile population surveys and catch returns. The importance of the Atlantic salmon resource has been

further highlighted by recent genetic studies which have identified the presence of genetically distinct populations of salmon between and within main river catchments. This information will be utilised when developing habitat improvement programmes to ensure the presence of a diverse resource capable of withstanding change.

Invasive species in both aquatic and riparian habitats have become an important issue in fisheries management and in wider environmental management. Invasive species have the potential to significantly alter ecosystems and their function. The Loughs Agency is contributing towards the development and implementation of invasive species codes of practice.

15.2 Carlingford area Specific Actions for 2008

- Conduct redd counts on the Whitewater in association with the Kilkeel Angling Club
- Conduct a coarse fish stock assessment of Derryleckagh Lough
- Collect genetic samples from juvenile Atlantic salmon in the Whitewater catchment for inclusion in a genetic baseline study of the remaining populations of Atlantic salmon in Northern Ireland
- 2008/2009 collect genetic samples from juvenile trout populations throughout the Carlingford area in all main catchments
- Conduct a barriers to migration study on the Clanrye/Newry and Whitewater catchments
- Develop potential habitat improvement projects including riparian buffer zone creation, fencing, native species planting and in-channel habitat improvements including spawning bed and nursery habitat improvement.
- Monitor forestry operations adjacent to watercourses or areas likely to impact on watercourses.
- Monitor all referred development proposals.
- Conduct ongoing water quality monitoring and investigate areas highlighted as being of concern.
- Assist with Water Framework Directive fish monitoring programme.
- Conduct annual fish population surveys and spawning specific habitat surveys.
- Monitor all sand and gravel extraction sites and onsite water management practices.

- Ensure all fish passes, dams and mill races meet required standards.
- Conduct quantitative electrofishing on the Whitewater to estimate salmonid densities
- Monitor all ongoing developments with particular focus on the major road building schemes currently underway within the Carlingford/Newry area
- Investigate the potential for improving the coarse fish stocks of Newry Canal