This report outlines results and classifications from Water Framework Directive fish surveillance and routine monitoring programmes within rivers of the Foyle and Carlingford areas during 2017.
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<td>Art Niven &amp; Shannon Donnelly</td>
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ACKNOWLEDGEMENTS

The Loughs Agency sponsoring departments, board and staff are gratefully acknowledged for the funding, support and assistance provided to conduct Water Framework Directive fish monitoring in the Foyle and Carlingford areas.

Land owners and angling associations are also gratefully acknowledged for their co-operation.

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EXECUTIVE SUMMARY

Nine Water Framework Directive fish surveillance monitoring stations were surveyed within the Loughs Agency jurisdiction in 2017. All nine sites were within Northern Ireland. 22% of sites surveyed were classified as high status, 33% as good status and 45% as moderate status.

Classification in 2017 was completed using the WFD compliant classification tool, Fish Classification Scheme 2 Ireland (FCS2 Ireland) with the option of a professional judgement over ride. No results were over ridden using professional judgement in 2017. An overview of the classification system is provided and a synopsis of the survey data presented.

Additional data and information has been presented in a series of excel spreadsheets and ESRI Arc GIS shape files. All data reported is stored within the Loughs Agency Geographical Information System (GIS) and is available upon request. Photographs of each site have been included and outline recommendations made for consideration as part of any programme of measures.
Due to high river levels throughout the 2017 survey season additional indicative classifications have not been derived for water bodies within the Foyle and Carlingford areas. A number of recommendations are made to ensure the continued success of Water Framework Directive river fish monitoring.
1.0 INTRODUCTION

This report has been prepared to disseminate results for Water Framework Directive fish monitoring within the Foyle and Carlingford areas as managed by the Loughs Agency. The Loughs Agency reports this information to the Northern Ireland Environment Agency and the Environmental Protection Agency in Ireland. The report provides classifications for water bodies with surveillance monitoring stations within the Loughs Agency jurisdictions of the Foyle and Carlingford areas for 2017. Additional information has been provided in electronic format.

WFD compliant fish surveys at surveillance stations are required under national and European law. Annex V of the WFD outlines that rivers are included within monitoring programmes and that the composition abundance and age structure of fish fauna are examined (Council of the European Communities, 2000).

A synopsis of targeted Water Framework Directive river fish sampling within the Foyle and Carlingford areas has been provided below for fieldwork conducted in 2017.

Other sites outside the Foyle and Carlingford areas have been monitored by the Agri Food and Biosciences Institute (AFBI) under contract to NIEA. Loughs Agency and AFBI have previously collaborated on a number of surveys to ensure continuity of sampling methods, no collaborative surveys were conducted in 2017.

2.0 BASIS FOR WATER FRAMEWORK DIRECTIVE FISH CLASSIFICATION

The Fish Classification Scheme 2 tool for Ireland (FCS2 Ireland) has been developed to classify fish fauna from high status to bad status in order to comply with Water Framework Directive requirements. FCS2 Ireland is a statistical model based on the Environment Agency (England) Fisheries Classification Scheme 2 (FCS2). FCS2 Ireland compares the observed abundance of fish of each species with a site specific prediction of the expected fish community under near undisturbed “reference conditions”. The predicted reference conditions are estimated using models created for each part of the UK and Ireland (UKTAG, 2013).
FCS2 Ireland was used for the first time within the Loughs Agency jurisdiction in 2012 to classify fish in rivers. This methodology is WFD compliant and has replaced professional opinion as the main method of classification. A professional opinion over ride can still be employed if deemed appropriate. Fish classifications will be incorporated into final surface water classifications.

Data collection was conducted in the field during June, July, August and September 2017 and involved the use of a quantitative electrofishing methodology. Electrofishing is the preferred method for WFD surveillance monitoring of fish in rivers to obtain a representative sample of fish from each monitoring station. This method is compliant with the European Committee for Standardisation (CEN) standards for assessing fish stocks in wadeable rivers (CEN, 2003).

Quantitative electrofishing requires the netting off of a section of river using stop nets. Removal sampling is then conducted utilising electrofishing equipment with the numbers, age class and species of each fish being recorded for each pass. After an appropriate depletion has been achieved, which facilitates a density estimation to be made, all fish were returned alive to the river.

Additional habitat variables were recorded and the exact sampling locations were recorded using a Trimble Juno hand held GPS unit.

Professional judgement over ride can be utilised where classifications are deemed to be inaccurate due to the presence of barriers to migration downstream of the sampling stations. Consideration of this issue has not been incorporated into the FCS2 (Ireland) model at this time. Other scenarios for professional judgement over ride include significant deviation from expected classification and higher than normal water levels during survey.
### NURSERY AREA

<table>
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<th>Grade</th>
<th>Requirements</th>
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| Grade 1 | - 50 - 80mm water depth  
- 0.5 – 8% gradient  
- Stable cobble/boulder substrate > or = 70% bed cover  
- Providing adequate cover |
| Grade 2 | Marginally outside grade 1 on one count only                                                      |
| Grade 3 | Well outside grade 1 on one or more counts                                                       |
| Grade 4 | Absent, deep, channelized, silty etc.                                                             |

### SPAWNING AREA

<table>
<thead>
<tr>
<th>Grade</th>
<th>Requirements</th>
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| Grade 1 | - Flow 300 – 600mm/sec  
- Water depth 150 – 700mm  
- 70% substrate 30-80mm diameter  
- Gravel depth:  
  Trout = 50-150mm  
  Salmon = 200-500mm |
| Grades 2-4 | Failing as for nursery habitat above |

### HOLDING AREA

<table>
<thead>
<tr>
<th>Grade</th>
<th>Requirements</th>
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| Grade 1 | - Depth minimum m ideally > or = 2m  
- Suitable cover  
- Bankside/substrate stability |
| Grades 2-4 | Failing as for nursery habitat above |

Table 1. Habitat classification based on Department of Agriculture for Northern Ireland (Fisheries Division) advisory leaflet on the evaluation of habitat for salmon and trout
Figure 1. WFD Fish surveillance river sites within the Foyle area, Northern Ireland and Ireland
Fig 2. WFD fish surveillance river sites within the Carlingford area, Northern Ireland. There are no sites within Ireland in the Carlingford area.
3.0 CLASSIFICATIONS

3.1 F10029 River Mourne at Victoria Bridge GBN1NW010102074
Mourne WFD Fish Classification 2017

MODERATE

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<th>Sal 0+</th>
<th>Sal 1+</th>
<th>Tro 0+</th>
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<th>Eel</th>
<th>Lamprey</th>
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<td>12</td>
<td>2</td>
<td>31</td>
<td>108</td>
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Table 2. Electrofishing sampling results

Fig 3. Site F10029

3.11 Results
Site F10029 was surveyed using a quantitative electrofishing method. This involved a single pass electrofishing method over a defined area. From this data, density estimates have been calculated for all species and age classes present.
Fig 4. Total catch

Fig 5. Density/100m²
Fig 6. Length weight relationship of all Atlantic salmon n = 43

\[ y = 1 \times 10^{-5}x^{3.004} \]
\[ R^2 = 0.9707 \]

Fig 7. Length weight relationship of all Trout caught n = 14

\[ y = 1 \times 10^{-5}x^{2.9902} \]
\[ R^2 = 0.9974 \]
Fig 8. Length frequency distribution for all salmon caught (this can be used to assess the presence of different age classes/cohorts) 2017 n = 43, 2013 n = 18 *Note 2017 survey was single pass electrofishing survey only.

Fig 9. Length frequency distribution for trout caught 2017 n = 14, 2013 n = 1. * Note 2017 was single pass electrofishing survey only.
This site is composed predominantly of grade 3 nursery habitat (70%) with grade 2 holding habitat (30%).

The exact location is given in the spreadsheets supplied which provide grid references for upstream and downstream locations.

3.12 Proposed Programme of Measures

Within the waterbody, potential programmes of measures could include improved riparian land management in the form of stock proof fencing and native buffer zone creation. Treatment of riparian invasive species is required. At the waterbody level riparian invasive species particularly Himalayan balsam is a significant problem. Bank erosion as a result of trampling by cattle is also an issue within the waterbody. Litter is a problem within the water body with significant plastic and other waste forming “trash lines” in the riparian trees which catch debris in high water conditions.
Fig 10. FCS2 (Ireland) output. Bar charts of the probability of class
3.2  F10045  Derg River at Crew Bridge  Derg  WFD Fish Classification 2017
GBNI1NW010102095

Table 3. Sampling results

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<td>6</td>
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Fig 11. Site F10045

3.21 Results
Site F10045 was surveyed using a single pass quantitative electrofishing method. From this data minimum density estimates have been calculated for all species present.
Fig 12. Total catch

Fig 13. Density/100m²
Fig 14. Length weight relationship of all Atlantic salmon $n = 49$

$$y = 7 \times 10^{-6}x^{1.284}$$

$$R^2 = 0.9759$$

Fig 15. Length weight relationship of all Trout caught $n = 8$

$$y = 1 \times 10^{-5}x^{0.068}$$

$$R^2 = 0.9959$$
Fig 16. Length frequency distribution for salmon caught 2017 n = 49, 2014 n = 66, 2011 n = 90
* Note surveys were single pass electrofishing survey only.

* Note surveys were single pass electrofishing survey only.
This site is composed predominantly of grade 2 nursery habitat (70%) with grade 3 spawning habitat (15%) and grade 3 holding habitat (15%).

Additional biological information is available in the spreadsheets provided.
3.22 Proposed Programme of Measures

This water body generally has good channel structure. Flood banks are present throughout. Local impacts within this waterbody include the presence of Himalayan balsam and Japanese knotweed. Water crowfoot (*Ranunculus penicillatis* spp) is present at this site and is one of the primary habitat features for the rivers designation as an Area of Special Scientific Interest (ASSI) and Special Area of Conservation (SAC). There is evidence of some bank protection works which has the potential to disconnect the river from its natural floodplain. The surrounding land use is silage production and grazing with some arable crop rotation. Potential programmes of measure could include riparian fencing set back from the left hand bank and control of invasive species.
Fig 18. FCS2 (Ireland) output. Bar charts of the probability of class
3.3 F10049 Glendergan River at Sraghcumber GBN1NW010102067
Derg WFD Fish Classification 2017

Table 4. Sampling results

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<td>8</td>
<td>1</td>
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3.31 Results

Site F10049 was surveyed using a single pass quantitative electrofishing method. Prolonged high water precluded removal sampling over multiple passes. From this data minimum density estimates have been calculated for all species present.
Fig 20. Total catch

Fig 21. Minimum density estimate/100m²
Fig 22. Length weight relationship of all Atlantic Salmon caught n = 30

Fig 23. Length weight relationship of all Trout caught n = 19
Fig 24. Length frequency distribution for all salmon caught 2017 n= 30, 2013 n = 47 & 2010 n = 73 *Note 2017 and 2013 surveys were single pass electrofishing survey only, 2010 survey were multi method.

Fig 25. Length frequency distribution for all trout caught 2017 n= 19 & 2010 n = 6 *Note 2017 was single pass electrofishing survey only, 2010 survey was multi method.
This site is composed of grade 2 nursery habitat (50%), grade 3 spawning habitat (20%) and grade 3 holding habitat (30%).

Additional biological information is available in the spreadsheets provided.
3.32 Proposed Programme of Measures

Access slipway at site, fly tipping adjacent to site. Potential programmes of measures could include riparian fencing to exclude livestock from the watercourse on the left hand bank, control of Himalayan balsam. Access for cattle to drinking water could be supplied by the installation of a pasture pump.
Fig 26. FCS2 (Ireland) output. Bar charts of the probability of class
3.4 F10101 Fairywater at Mullanatoomog    GBNI1NW010102041
Fairywater WFD Fish Classification 2017

MODERATE

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<th>Sal 1+</th>
<th>Tro 0+</th>
<th>Tro 1+</th>
<th>lamprey</th>
<th>Stickle back</th>
<th>Minnow</th>
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Table 5. Sampling results

Fig 27. Site F10101

3.41 Results
Site F10101 was surveyed using a multiple pass quantitative electrofishing method. From this data density estimates have been calculated for all species and age classes present.
Fig 28. Total catch

Fig 29. Density estimate/100m²
Fig 30. Length weight relationship of all Atlantic salmon caught n = 2

\[ y = 3 \times 10^{-6} x^{3.3658} \]
\[ R^2 = 1 \]

Fig 31. Length weight relationship of all Trout caught n = 6

\[ y = 4 \times 10^{-5} x^{2.7533} \]
\[ R^2 = 0.9991 \]
Fig 32. Length frequency distribution of all Salmon caught 2017 n = 2, 2014 n = 4 & 2011 n = 40

Fig 33. Length frequency distribution of all trout caught 2017 n = 5, 2014 n = 2 & 2011 n = 13
This site is composed of grade 3 holding habitat (65%), and grade 3 nursery habitat (35%). This site lies within a major maintained channel. There is heavy trampling by cattle on the left and right hand bank. Heavy aquatic weed growth is evident at this site. Due to the poor quality habitat present at this site recruiting fish may pass quickly through this area.

3.42 Proposed Programme of Measures

Potential programmes of measures should include installation of stock proof fencing and pasture pump the control of riparian invasive species and potentially the introduction of rubble mats to improve the quality of available nursery habitat.
Fig 34. FCS2 (Ireland) output. Bar charts of the probability of class
3.5  F10128  Drumragh River at Car Park  GBNI1NW010102006
Drumragh  WFD Fish Classification 2017

MODERATE

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<th>Minnow</th>
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Table 6. Sampling results

Fig 35. Site F10128

3.51  Results
Site F10128 was surveyed using a single pass quantitative electrofishing method. From this data minimum density estimates have been calculated for all species and age classes present.
Fig 36. Total Catch

Fig 37. Density estimate/100m²
Fig 38. Length weight relationship of all Atlantic salmon caught $n = 31$

Fig 39. Length weight relationship of all Trout caught $n = 4$
Fig 40. Length frequency distribution for Salmon caught. 2017 n = 31, 2014 n = 59 & 2011 n = 64. *Note surveys were single pass electrofishing survey only.

Fig 41. Length frequency distribution for Trout caught. 2017 n = 4, 2014 n = 6 & 2011 n = 26. *Note surveys were single pass electrofishing survey only.
3.52 Proposed Programme of Measures
Potential programmes of measures should include the control of invasive species. The site is within a major maintained channel with concrete and earth flood banks. In channel habitat improvements could be conducted to improve the salmonid nursery habitat. Channel maintenance is limiting the productive capacity of this waterbody.
Fig 42. FCS2 (Ireland) output. Bar charts of the probability of class
### 3.6  F10148  Faughan River at Mobuoy Road  GBNI1NW020208259

Faughan  
WFD Fish Classification 2017

#### MODERATE

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<th>Trou 1+</th>
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<th>Minnow</th>
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Table 7. Sampling results

![Fig 43. Site F10148](image_url)

### 3.6.1  Results

Site F10148 was surveyed using a single pass quantitative electrofishing method. From this data minimum density estimates have been calculated for all species and age classes present.
Fig 44. Total catch

Fig 45. Density/100m²
Fig 46. Length weight relationship of all Atlantic salmon caught n = 64

\[ y = 1E-05x^{1.0674} \]
\[ R^2 = 0.9325 \]

Fig 47. Length weight relationship of all Trout caught n = 10

\[ y = 3E-05x^{2.8356} \]
\[ R^2 = 0.9908 \]
Fig 48. Length frequency distribution for all salmon caught 2017 n = 64, 2014 n = 41 & 2011 n = 89. *Note surveys were single pass electrofishing survey only.

Fig 49. Length frequency distribution for all trout caught. 2017 n = 10, 2014 n = 7 & 2011 n = 16. *Note surveys were single pass electrofishing survey only.
This site is composed predominantly of grade 1 nursery habitat (70%) with grade 2 spawning habitat (20%) and grade 3 nursery habitat (10%).

Additional biological information is available in the spreadsheets provided.

3.62 Proposed Programme of Measures
Potential programmes of measures could include control of invasive species and removal of litter from the waterbody. This site would merit reconnection with its floodplain.
Fig 50. FCS2 (Ireland) output. Bar charts of the probability of class
### Table 8. Removal sampling results

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#### 3.71 Results

Site F10171 was surveyed using a single pass quantitative electrofishing method. From this data minimum density estimates have been calculated for all species and age classes present.
Fig 52. Total catch

Fig 53. Density/100m²
Fig 54. Length weight relationship of all Atlantic Salmon caught n = 90

\[ y = 2E-05x^{2.9364} \]
\[ R^2 = 0.9267 \]

Fig 55. Length weight relationship of all Trout caught n = 16

\[ y = 2E-05x^{2.949} \]
\[ R^2 = 0.9963 \]
Fig 56. Length frequency distribution for all Salmon caught. 2017 n = 90, 2014 n = 51 & 2011 n = 32. *Note surveys were single pass electrofishing survey only.

Fig 57. Length frequency distribution for all Trout caught. 2017 n = 16, 2014 n = 3 & 2011 n = 5. *Note surveys were single pass electrofishing survey only.
This site is composed of grade 2 spawning habitat (35%) with grade 2 holding habitat (35%) and grade 3 nursery habitat (30%).

Additional biological information is available in the spreadsheets provided.

3.72 Proposed Programme of Measures
Potential programmes of measures could include control of invasive species, reconnection of the river to its floodplain and removal of litter from throughout the water body.
Fig 58. FCS2 (Ireland) output. Bar charts of the probability of class
### Table 8. Removal sampling results

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Fig 59. Site F10644

### 3.81 Results

Site F10644 was surveyed using a single pass quantitative electrofishing method. From this data minimum density estimates have been calculated for all species and age classes present.
Fig 60. Total catch

Fig 61. Density/100m²
Fig 62. Length weight relationship of all Trout caught n = 121

\[ y = 2E-05x^2 + 25 \]

\[ R^2 = 0.9884 \]

Fig 63. Length frequency distribution for all trout caught. 2017 n = 121, & 2012 n = 17 *Note 2017 was a single pass electrofishing survey, 2012 was a multiple pass quantitative electrofishing survey
This site is composed predominantly of grade 2 nursery habitat (80%) with grade 1 holding habitat (10%) and grade 3 spawning habitat (10%).

Additional biological information is available in the spreadsheets provided.

3.82 Proposed Programme of Measures
Potential programmes of measures could include the control of invasive species and the removal of litter from throughout the waterbody.
Fig 64. FCS2 (Ireland) output. Bar charts of the probability of class
3.9 F11335 Camowen River at Cranny Bridge Picnic Area GBNI1NW010108257 Camowen WFD Fish Classification 2017

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Table 9. Removal sampling results

3.91 Results
Site F11335 was surveyed using a single pass quantitative electrofishing method. From this data a minimum density estimates has been calculated for all species and age classes present.
Fig 66. Total catch

Fig 67. Density/100m²
Fig 68. Length weight relationship of all Atlantic salmon caught n = 61

\[ y = 1E^{-05}x^{0.0366} \]
\[ R^2 = 0.9862 \]

Fig 69. Length weight relationship of all Trout caught n = 22

\[ y = 1E^{-05}x^{0.9679} \]
\[ R^2 = 0.9006 \]
Fig 70. Length frequency distribution for all salmon caught. 2017 n = 61, 2014 n = 65 & 2011 n = 71. * Note surveys were single pass electrofishing surveys only.

Fig 71. Length frequency distribution for all trout caught. 2017 n = 22, 2014 n = 47 & 2011 n = 36 * Note surveys were single pass electrofishing surveys only.
This site is composed of grade 2 nursery habitat (40%) with grade 2 holding habitat (40%) and grade 2 spawning habitat (20%).

Additional biological information is available in the spreadsheets provided.
3.92 Proposed Programme of Measures
Potential programmes of measures could include invasive species control, soft bank protection, bush/tree trimming, barrier easement/removal and water quality improvements.
Fig 72. FCS2 (Ireland) output. Density estimates of the EQR variable
4.0 OVERVIEW OF WFD FISH SURVEILLANCE RESULTS

The results for WFD river fish monitoring within the Loughs Agency areas for 2017 are outlined in the table below. In 2017 a total of nine WFD river fish surveillance monitoring stations were monitored. The nine sites were in Northern Ireland. Classifications are outlined in the figure below. FCS2 (Ireland) was the primary classification tool from 2012, prior to this classifications were based on professional opinion. No additional waterbodies were classified using FCS2 in 2017.
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## Table 10. WFD fish surveillance stations surveyed by the Loughs Agency 2008-2017

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Table 10. WFD fish surveillance stations surveyed by the Loughs Agency 2008-2017
Fig 74. Loughs Agency WFD fish surveillance water body classifications 2017 Carlingford area
5.0 SEMI QUANTITATIVE/SALMON MANAGEMENT PLAN CLASSIFICATIONS

No indicative classifications were derived from semi quantitative electrofishing surveys conducted in 2017 due to the poor weather, high water levels encountered and the resultant low number of sites surveyed.

Outlined below is the set of rules for deriving indicative fish classifications for waterbodies in which annual semi quantitative/salmon management plan electrofishing surveys are conducted. Within the Foyle and Carlingford areas approximately 500 sites are semi quantitatively surveyed annually. The ability to derive indicative classifications greatly facilitates the ability to highlight pressures within specific waterbodies and can assist with the development of programmes of measures. The refined rules as of January 2013 are listed below.

1. Only use if there are a minimum of three sites per water body - suggest a minimum of the three largest rivers for which data is available – important to record the stations used.

2. Classify according to the dominant salmonid species within the water body where adequate historical data is available.

3. Classify if ≥ 66% of sites agree

4. Classify as Good or better, moderate or Poor or worse

5. Use the most recent years data

6.0 CONCLUSION

From 2012 classification has been predominantly based on the FCS2 (Ireland) model. This has replaced the professional opinion classification method as the dominant classification method. A professional opinion over ride exists to correct classifications based on a paucity of information including the presence of barriers downstream to a monitored site. The professional opinion override was not utilised in 2017.

2017 marked the third year in the second monitoring period/cycle of the Water Framework Directive. In 2017 a number of sites were surveyed using a single
pass electrofishing survey. When it was not possible to install stop nets due to excessive flow, depth and or width a single pass survey within a defined area was conducted. This approach was instead of the previously utilised multi method approach.

The FCS2 (Ireland) tool has passed the intercalibration process and has now been fully adopted for use across the island of Ireland. Further refinements may be made to the model in the future to incorporate issues such as full consideration of barriers downstream and acceptance of different types of survey data. During the second cycle of the WFD more emphasis will be placed on reasons for waterbody failures and the development of appropriate programmes of measures to address these. This approach will involve wider utilisation of existing fisheries data sets, additional empirical data collection and expert analysis of this information.

A degree of flexibility will need to be maintained in collecting and analysing fisheries data which can be utilised for WFD classification purposes. Early consultation on any potential developments to the FCS2 (Ireland) model should be encouraged through the relevant technical advisory group. A new ten minute timed single pass electrofishing methodology has been developed by Inland Fisheries Ireland to meet the requirements of WFD fish surveillance monitoring. It is recommended that this methodology should be trialled during the Loughs Agency 2018 WFD fish monitoring project.

REFERENCES

