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INLAND FISHERIES IRELAND

National Programme

Habitats Directive and Red Data Book Fish Species Summary Report 2014

IFI/2015/1-4291

PROTECT

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National Programme: Habitats Directive and Red Data Book Fish species

Summary Report 2014

Nicola M. O'Gorman, Sean M. Rooney, Daniel Cierpial, James J. King

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Habitats Directive and Red Data Book Fish species 2014: Executive Report

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1 Introduction

2014 was the second year of the current six-year reporting cycle to the EU (2013 – 2018), under Article 17 of the Habitats Directive (92/43/EEC). A substantial survey programme was undertaken, aided considerably by the long period of dry and warm weather which led to low water levels in rivers and streams.

Barriers to fish passage are identified as being a major impactor on some of the anadromous species that form the remit of the Habitats team. Surveys of major barriers on the SAC channels, using the SNIFFER barrier passability technique, were commenced in 2014, working with colleagues from the South Eastern RBD.

1.1 Lamprey investigations in 2014

As per the sampling strategy for 2013-18, two further Special Areas of Conservation - SAC catchments were selected for catchment-wide juvenile lamprey surveys. The Munster Blackwater and Laune were targeted and completed. In both cases, the whole catchment was surveyed as opposed to sampling within the SAC only. The ambitious sampling effort was strongly facilitated by the long periods of dry, fine weather that extended through September and into early October.

The programme of sampling Index or Reference Channels was further developed in 2014. The purpose of this network is to permit a more robust assessment of 'trends' in larval lamprey presence, population size and structure, as required under Article 17 (Monitoring and Assessment) of the Habitats Directive. The Habitats team plans to have annual or biennial sampling completed on a series of the selected Index Channels when the next reporting date (June 2019) to the EU falls due. Initial examination of data from some channels surveyed in 2013 and 2014 showed some trends and also a degree of stability in some cases.

A rigorous review of the sampling protocols for larval lamprey led to development of a new survey form designed to provide ease of use in the field and elimination of any ambiguity. The form was tested and further modified during the autumn larval survey period.

1.2 Shad investigations in 2014

As in previous years Bongo netting was employed in 2014 to sample for post-larval and early free-swimming stages of shads in the estuaries of the designated SAC rivers of the south east. Sampling for Killarney shad was undertaken in Lough Leane. Trials using a new catamaran-type boat undertook hydroacoustic surveys, along with sampling using a trawl for adult fish and also using pelagic nets set overnight at different depths in the water column.

The IFI's Marine Sport Fish team undertook sampling for bass via trawling in Waterford Harbour and adjoining water of the lower Suir and Barrow estuaries in September 2014. Habitats team provided some support and a sample of young-of year shad was obtained as by-product of the bass trawling.

1.3 Pollan investigations in 2014

Three surveys provided information on pollan in 2014. The Habitats team undertook a series of samplings, using bongo nets, to look for post-larval pollan in Lough Allen in late spring. The sampling effort proved successful and recorded post-larval fish in small numbers in a substantial series of trawls.

Lough Allen was re-visited in June for an intensive sampling study. The sampling formed part of the doctoral research being undertaken by Ms. Emma Morrissey of IFI. Hydroacoustics, trawling and pelagic netting were all undertaken and the outcomes complemented the different investigative approaches. In addition, the team was joined by a Masters student from UCD who undertook simultaneous sampling of zooplankton, the principal food item of pollan.

A major spring survey of the fish community on Lough Ree was undertaken. This survey used the traditional braided nylon netting regime involving 200 m lengths of net, comprised of individual sheets from 5 cm to 12.5 cm. The survey was principally focused at brown trout but a sample of pollan was also collected and was further analysed by the Habitats team.

1.4 Smelt investigations in 2014

The estuarine bongo netting for shad also served as a smelt recruitment assessment mechanism. The smelt samples provided an opportunity to collect more detail on length –weight relationships for the very young life stages of smelt. In addition, counting of gill rakers was undertaken for the young post-larval fish.

IFI undertook sampling for bass *via* trawling in Waterford Harbour and adjoining water of the lower Suir and Barrow estuaries in September 2014. Substantial samples of smelt were obtained as by-product of the bass trawling.

1.5 Char lake surveys in 2014

Surveys were conducted on Derryclare Lake and Lough Athry in the Ballynahinch system in Galway in late May 2014 with staff of IFI's Western RBD. Char were found in Lough Athry but not in Derryclare Lake. In early autumn surveys were conducted on Derriana Lake and Iskanamacteery Lake, both in the Cummeragh system in Co. Kerry. The Habitats team is particularly grateful to the local fishery owners and angling clubs who facilitated the surveys.

The netting procedure is identical to that used by WFD, enabling a sharing of data sets on char lakes. The Habitats team surveys lakes NOT on the WFD listing, to ensure maximum national coverage of waters.

2. Lamprey Programme

2.1 Larval Lamprey investigations

2.1.1 Munster Blackwater

Introduction

The Munster Blackwater (MBW) is one of the largest catchments in the south of the country, spanning counties Kerry, Cork and Waterford. The river drains an area of 3317km^2 and is 169 kilometres in length. The source of the river is at Knockanefune in the Mullaghareirk Mountains, County Kerry at approximately 400 meters. The river flows in a general west to east direction, through the towns of Mallow, Fermoy and Lismore (Figure 2.1). At Capoquin the river changes direction and flows south to Youghal where it exits to the sea. The combined length of the rivers within the catchment is 3083 kilometres. The Munster Blackwater is joined by a number of tributaries, from the north, the Owentaraglin, Dalua, Allow, Awbeg, Funshion, Araglin and the Finisk. To the south of the catchment, the river is supplied by the Rivers Glen and Bride. Under the Habitats Directive of 1992, the Muster Blackwater main channel and major tributaries are a designated Special Area of Conservation for a number of species and habitat types. The tributaries contained within the SAC include the Owentaraglin, Dalua, Allow, Awbeg, Araglin, Finisk, Licky, Bride and Glen. The species and habitat types designated under the Muster Blackwater SAC include (of fisheries interest):

- Freshwater pearl mussel (*Margaritifera margaritifera*) [1029]
- White-clawed crayfish (*Austropotamobius pallipes*) [1092]
- Sea lamprey (*Petromyzon marinus*) [1095]
- Brook lamprey (*Lampetra planeri*) [1096]
- River lamprey (*Lampetra fluviatilis*) [1099]
- Allis shad (*Alosa alosa*) [1102]
- Twaite shad (*Alosa fallax fallax*) [1103]
- Salmon (*Salmo salar*) [1106]

The Munster Blackwater was sampled for larval lamprey between 18th August and 18th September 2014. Prior to the survey 135 sites were preselected across the catchment in a desk study. The number of sites was based on the area of the catchment and also the wetted area. Previous to this investigation, a catchment-wide survey was undertaken by the Central Fisheries Board in 2003. At this time a total of 88 sites were investigated for ammocoete status. The 2014 survey endeavoured to provide a platform for comparison of the ammocoete population distribution, density and structure in relation to results from 2003. Under the Habitats Directive, 1992, IFI are tasked with reporting on the status of lamprey spp. This involves determining if lamprey populations are increasing or decreasing. Direct comparison between individual sites, sub catchments and the catchment as a whole provide an invaluable insight into population structure,

density and trends in lamprey status. Sites which were sampled in 2003 were repeat-surveyed in 2014 to determine the status of the ammocoete population.

In 2003 the catchment wide sampling method was in its infancy. In the years since, the criteria for determining the number of sites to survey within a catchment has been modified, thus accounting for the extra sites sampled during 2014.

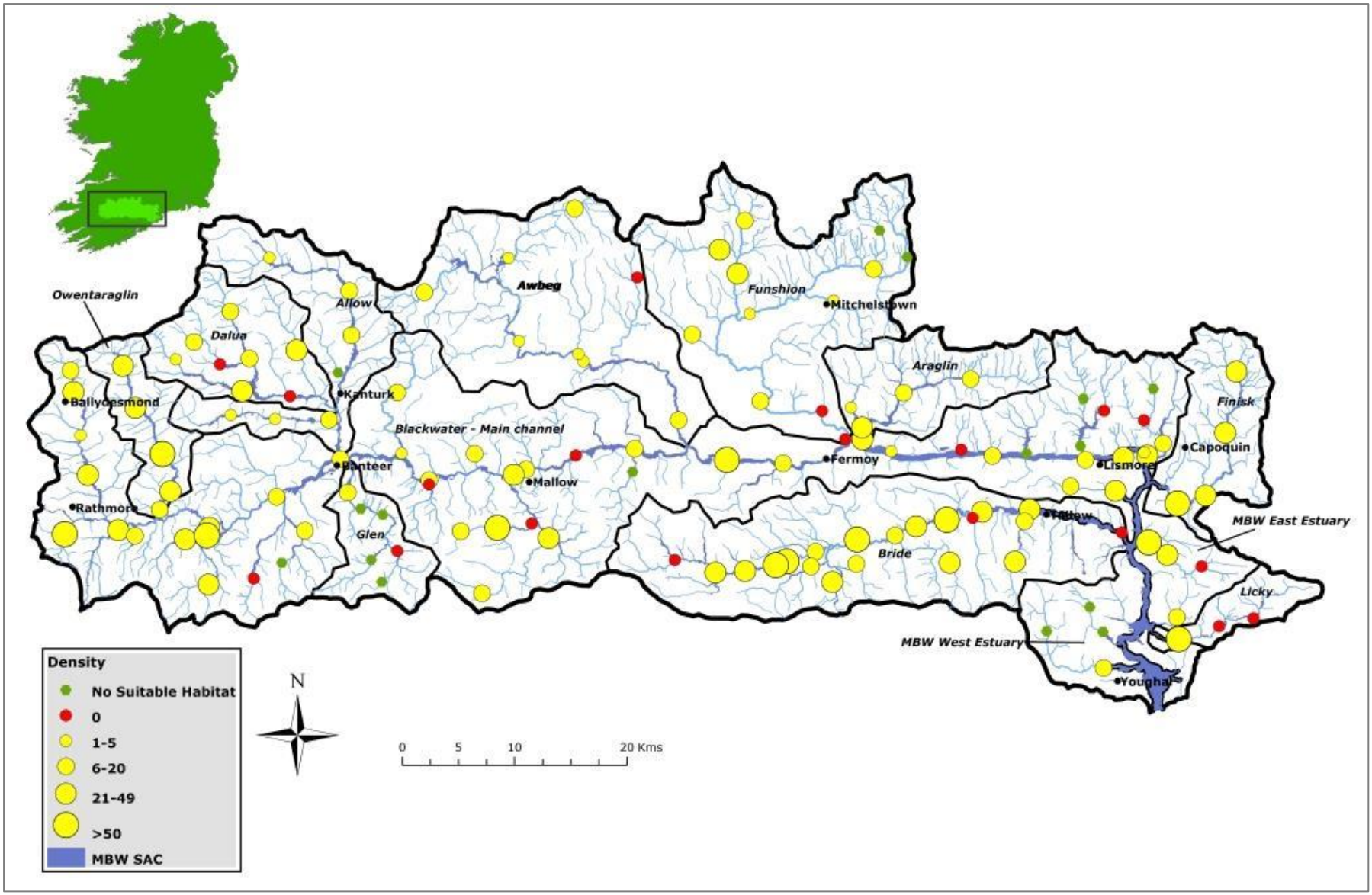

Figure 2.1. Locations of sampling sites on the Munster Blackwater, August-September 2014.

Materials and methods

Prior to the survey being undertaken, sites were preselected using Geographical Information Systems (GIS-ArcMap10). A number of criteria were examined when selecting sites. These included the sampling of sites used in the 2003 survey in order to ascertain the population status, also, based on the area of the catchment, it was endeavoured to sample one site per 25km^2. The sites were pre plotted on the relevant Discovery maps 1:50 with a unique code. On arrival at site, the section of river was examined for suitable ammocoete habitat. This generally involved walking 200 meters upstream and downstream of an access point. Once a suitable location was chosen, the area was electric fished. The electric fishing consisted of delivering a 20 second current to the water, followed by a five second rest period (after Harvey and Cowx, 2003). This process was repeated six times during the fishing. All ammocoetes were removed from the water and placed in water containing clove oil, to subdue them for later measurement. After a rest period of five minutes the electric fishing process was repeated with ammocoetes from the second fishing retained separately from those captured during the first fishing. A push net was used to further sample an adjoining area in order to capture any smaller fish which were not represented in the electric fishing sample. Once the fishing and push netting was complete, all fish were measured, allowed to recover from the anaesthetic and returned to the site. Additional fish recorded outside the sampling area and attracted by the electric current were recorded as 'extra' fish on data sheets.

A number of on-site measurements were also collected during the survey, these included Global Positioning System - GPS reference, photographs of the site, water depth, in stream vegetation, sediment type and bankside vegetation. Other species of fish present were also noted.

Results

All sites

In total 135 sites were sampled. Juvenile lamprey were present at 100 sites. Of the sites at which there were no lamprey encountered, there was no suitable habitat at 15 sites.

Overall synopsis

Altogether 2412 ammocoetes were captured across the 100 positive sites sampled. The length of fish surveyed varied between 5 and 160 mm (Figure 2.2). The length distribution indicated a population structure in which all size classes were represented. This would indicate ongoing recent recruitment. Across the catchment, 79 fully transformed ammocoetes were encountered. A large number of fish were recorded which were in the early stage of transformation but not fully transformed. This demonstrated ongoing adult recruitment.

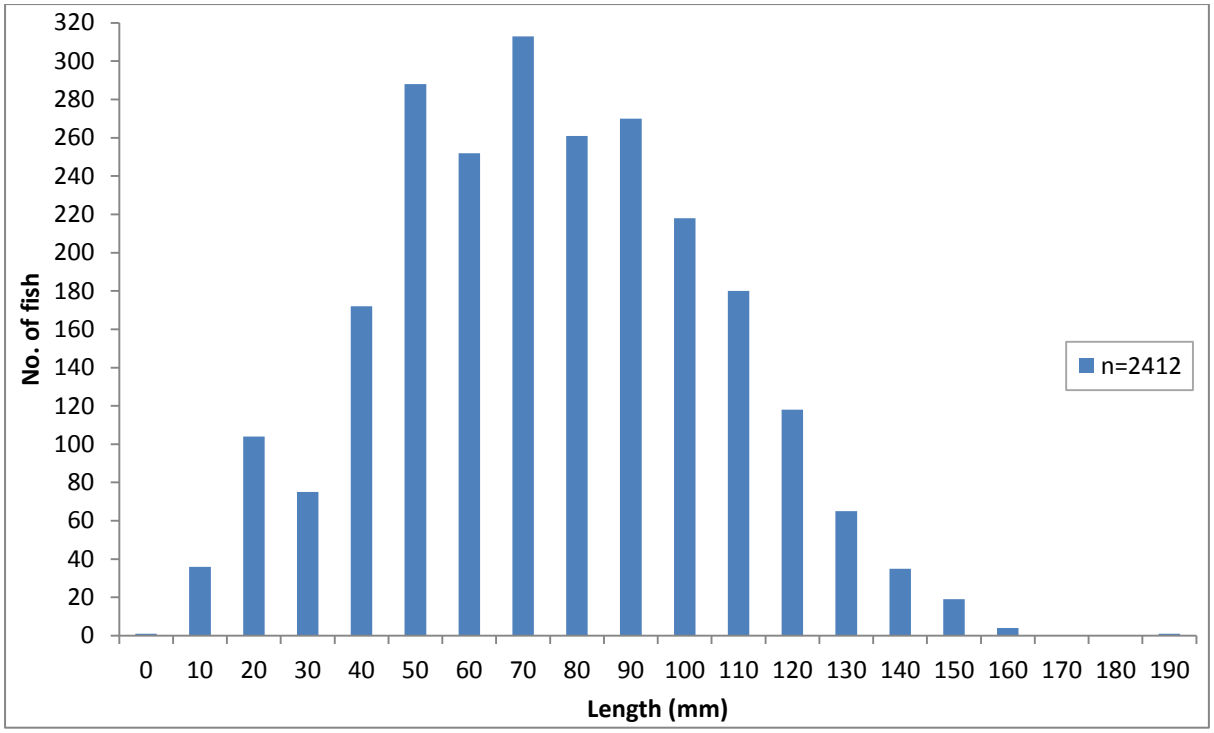

Figure 2.2. Length frequency of ammocoetes across all sites sampled on the Munster Blackwater.

A comparison of mean densities recorded on a sub catchment by sub catchment basis revealed the highest mean density was recorded on the Finisk sub catchment (41.25 fish/meter^2) (Figure 2.3). The sub catchment with the lowest mean density was the Awbeg (4.6 fish/meter^2), eight sites being sampled in this sub catchment with densities varying between 0 and 14 fish/meter^2. The maximum density (90 fish/m^2) was recorded at a site on the River Goish, located in the Munster East Estuary sub catchment.

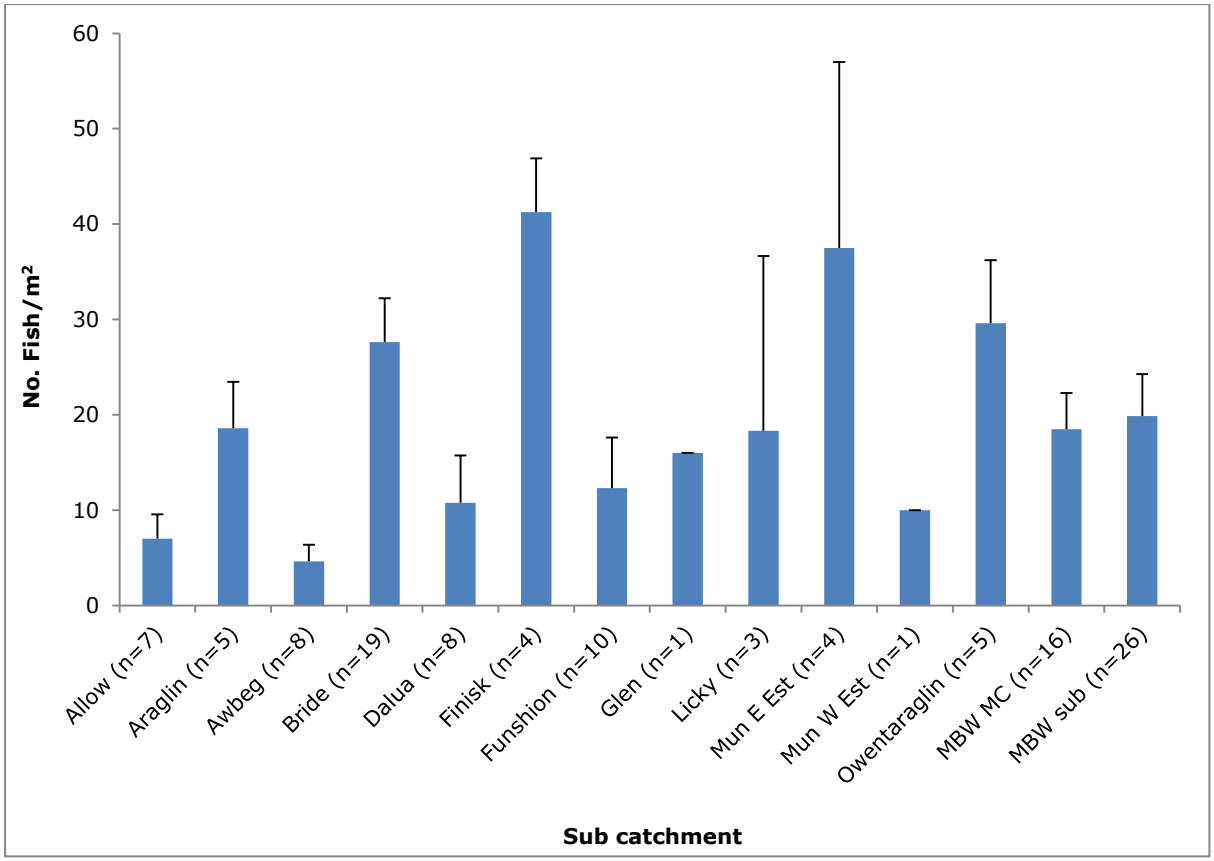

Figure 2.3. Mean densities of ammocoetes across sub catchments on the Munster Blackwater, including Standard Error. (Only sites with suitable habitat included in the calculation of mean values).

MBW Main channel – sub catchment

This sub catchment contained the main MBW channel and a number of tributaries. This was the largest sub catchment sampled within the survey at 1197 km^2. In total, 48 sites were examined across the MBW sub catchment, including 15 sites located on the main channel MBW. Of these sites there was no suitable habitat at six sites. Of the remaining sites, lamprey were present at 36 sites and absent from seven.

For presentation of results, the MBW sub catchment has been separated into the tributary sites of the MBW main channel and the River Blackwater main channel sites. Thirty one sites were sampled across the MBW sub catchment excluding the main channel sites. Of these 5 presented with no suitable habitat. Nineteen sites were positive for ammocoetes, a further 7 sites displayed suitable juvenile lamprey conditions but none were present(Figure 2.4). The length of fish captured varied between 11 and 169 millimetres (Figure 2.5). All size classes were represented displaying a robust population structure.

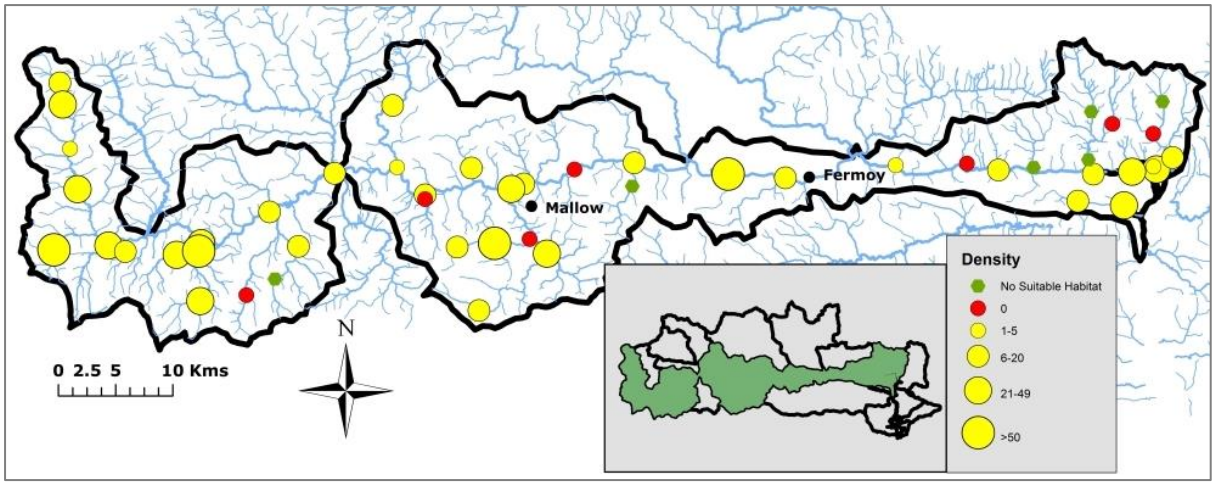

Figure 2.4. Locations of sampling sites on the Munster Blackwater sub catchment, August-September 2014.

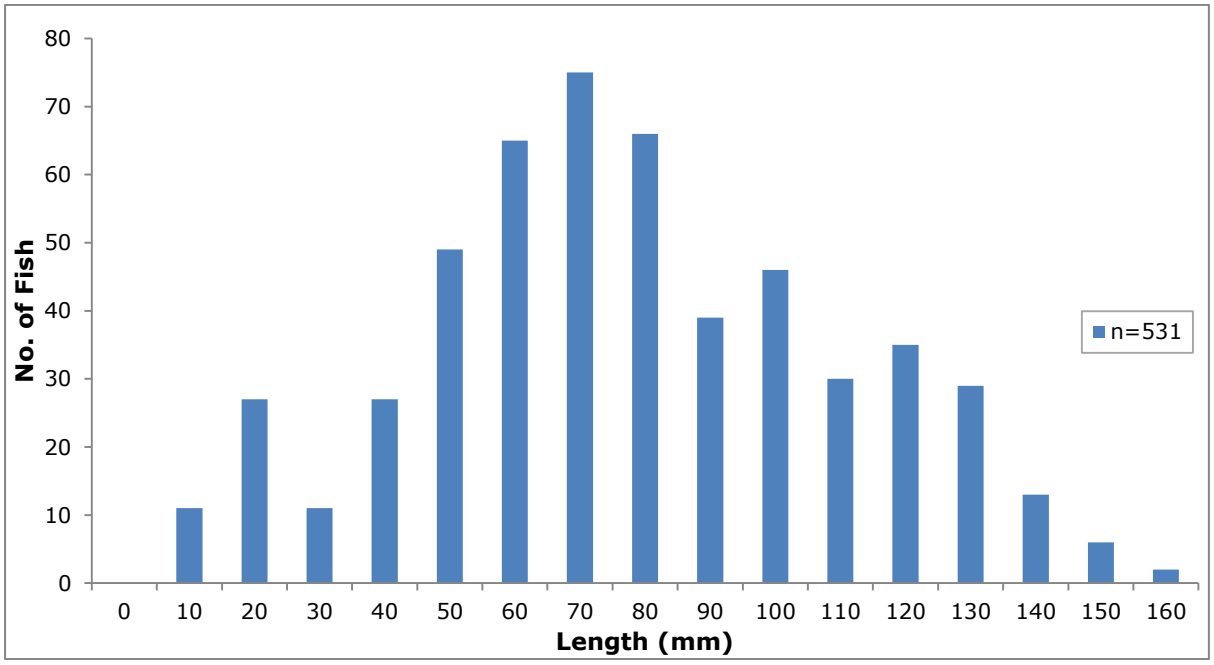

Figure 2.5. Length frequency of ammocoetes across on sites sampled on the Munster Blackwater main channel sub catchment (excluding those on the main channel).

The density of fish recorded at sites on the MBW sub catchment varied between 1 and 88 ammocoetes/m^2 (Figure 2.6).

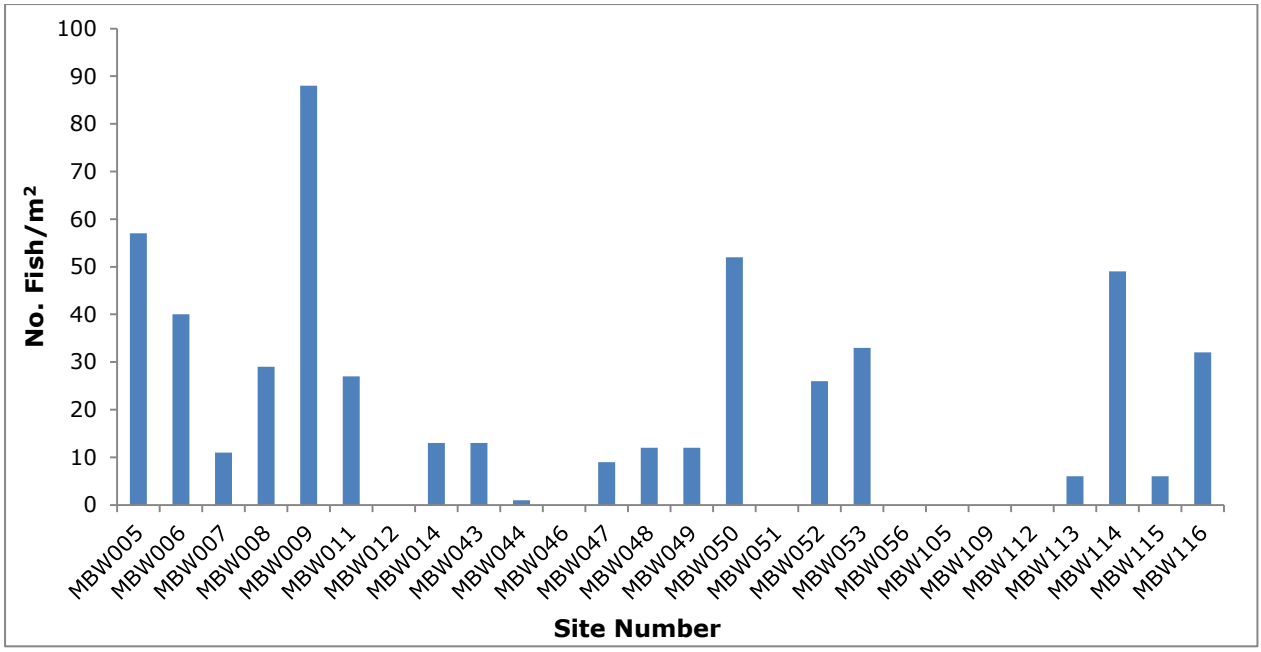

Figure 2.6. Density of ammocoetes on the MBW sub catchment excluding main channel sites.

MBW - main channel

On the MBW main channel, fifteen sites were due for sampling. Unfortunately one of these sites was inaccessible and therefore was not sampled. Of the remaining fourteen sites sampled, juvenile lamprey were present at all sites (Plate 2.1). The length of fish varied between 19 and 147 millimetres (Figure 2.7).

Plate 2.1. Most upstream site on the MBW main channel at Doctors Hill Bridge, August 2014.

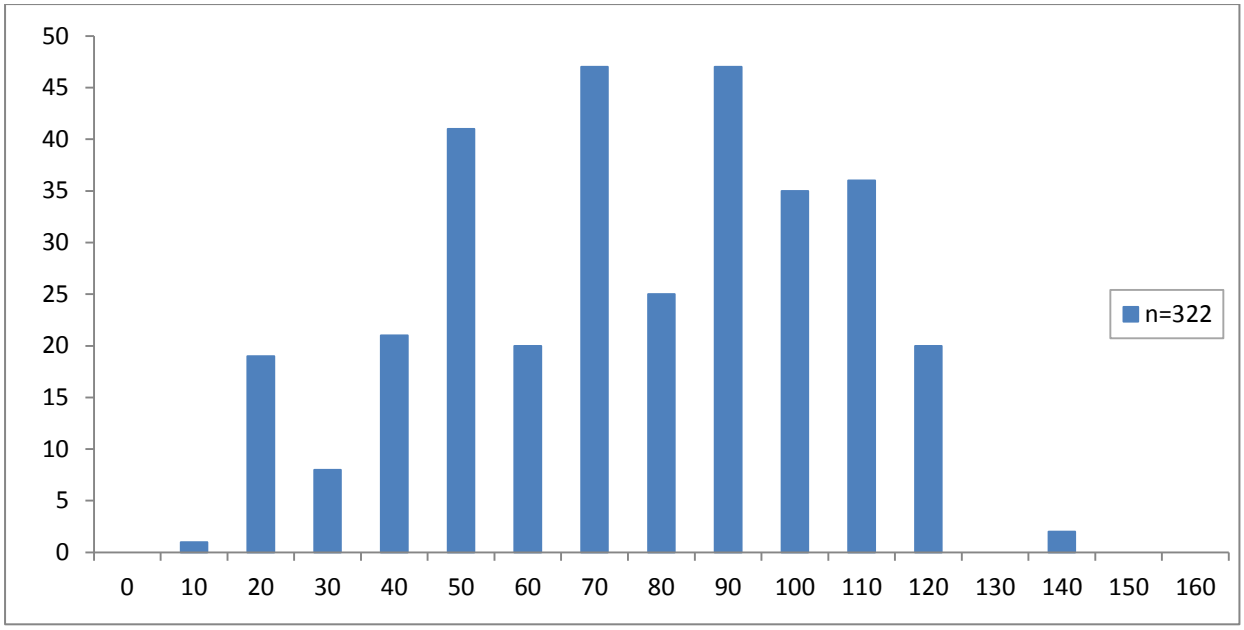

Figure 2.7. Length frequency of ammocoetes across sites sampled on the Munster Blackwater - main channel.

The density range of fish recorded across the main channel was 1 to 53 ammocoetes/m^2 (Figure 2.8).

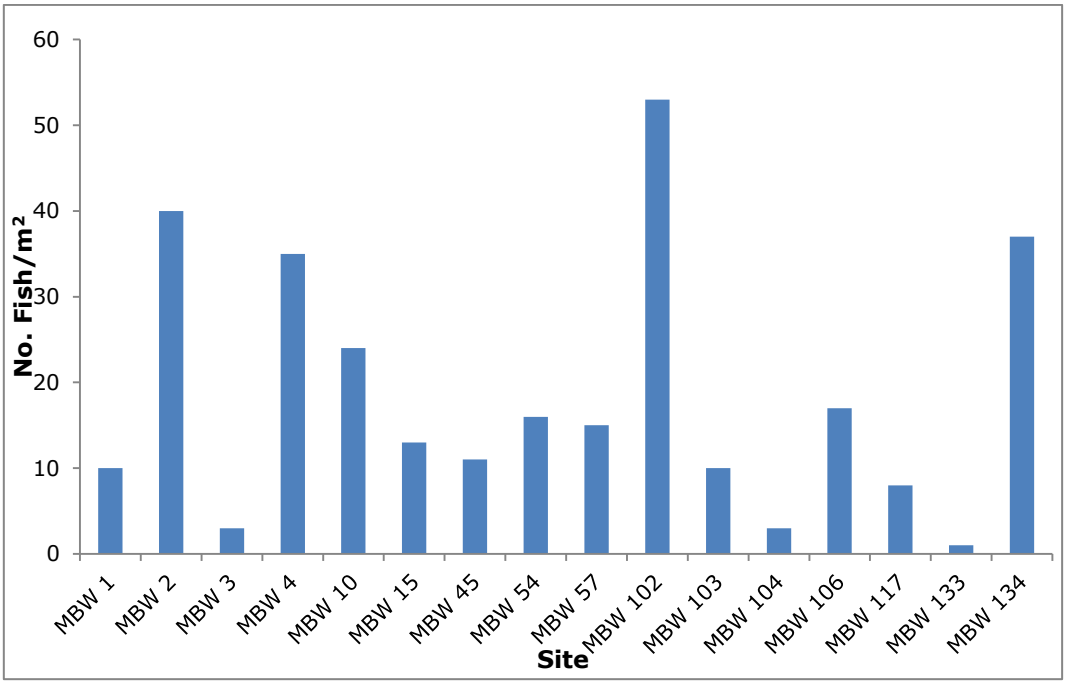

Figure 2.8. Densities of ammocoetes on the Munster Blackwater – main channel.

River Allow sub catchment

The River Allow flows through the towns of Kanturk and Freemount before joining the MBW Main channel at Banteer. The catchment comprises an area of 172km^2. Eight locations were sampled across the River Allow sub catchment(Figure 2.9). Juvenile lamprey were present at seven of these sites. There was no suitable habitat at the remaining site. The length of fish captured varied between 21 and 156 mm (Figure 2.10).

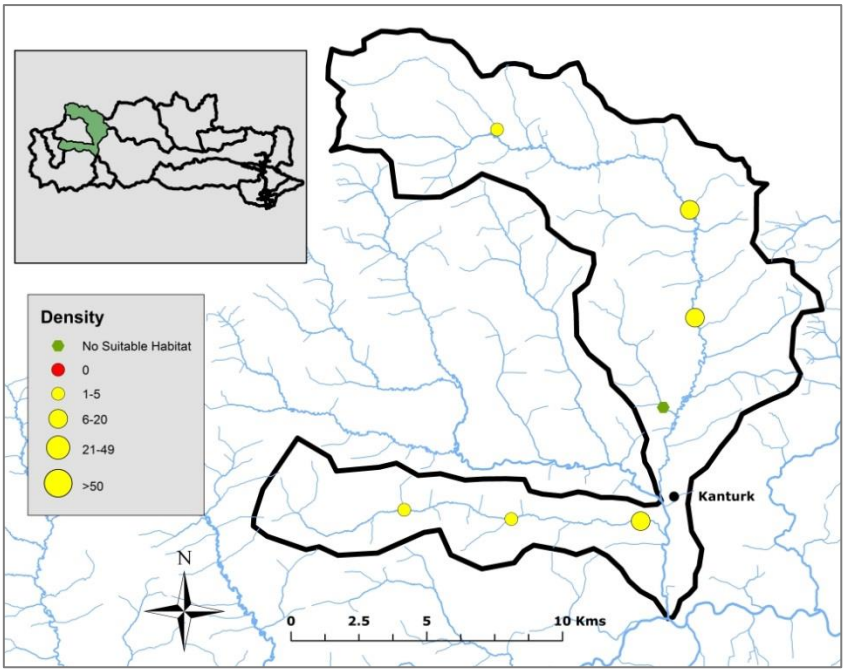

Figure 2.9. Locations of sampling sites on the Allow sub catchment, August-September 2014.

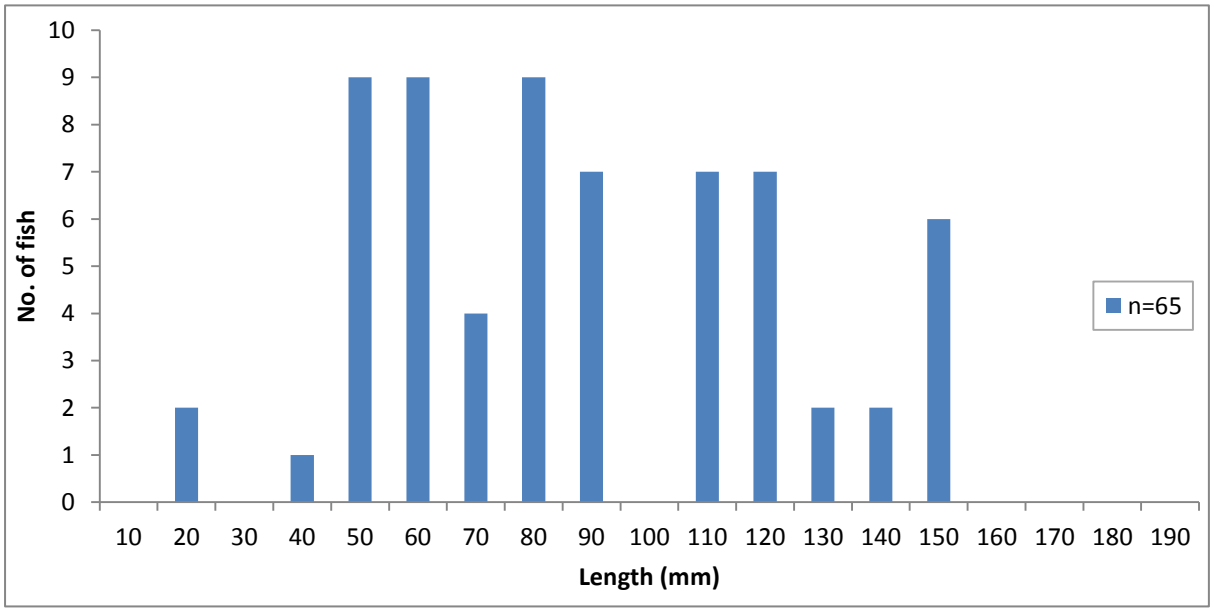

Figure 2.10. Length frequency of ammocoetes across on sites sampled on the Allow sub catchment.

The range of size classes represented a robust population distribution with ongoing recruitment. The density of fish varied between 1 and 18 fish/m^2 (Figure 2.11).

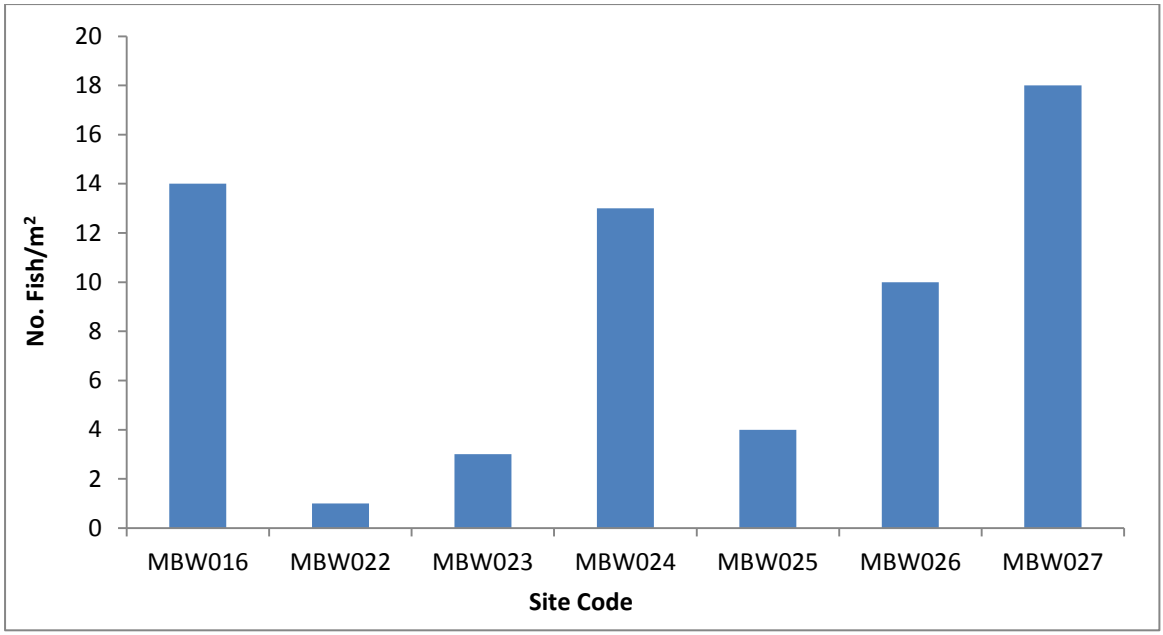

Figure 2.11. Densities of ammocoetes on the Allow sub catchment.

Araglin River sub catchment

The Araglin sub catchment drains an area of 127 km^2. The river flows through the village of Araglin and joins the MBW main channel approximately 3.5 kilometres downstream of Fermoy. Five sites were preselected for sampling with ammocoetes encountered at all sites (Figure 2.12). The length of fish captured varied between 12 and 152 mm (Figure 2.13). In total 98 fish recorded in the sub catchment.

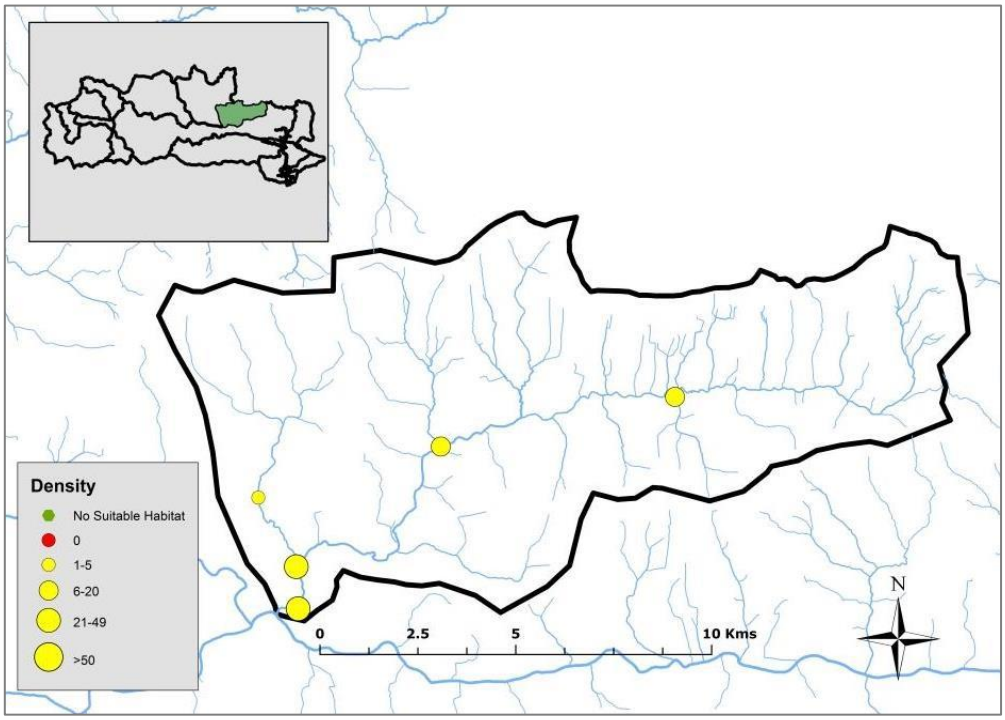

Figure 2.12. Locations of sampling sites on the Araglin sub catchment, August-September 2014.

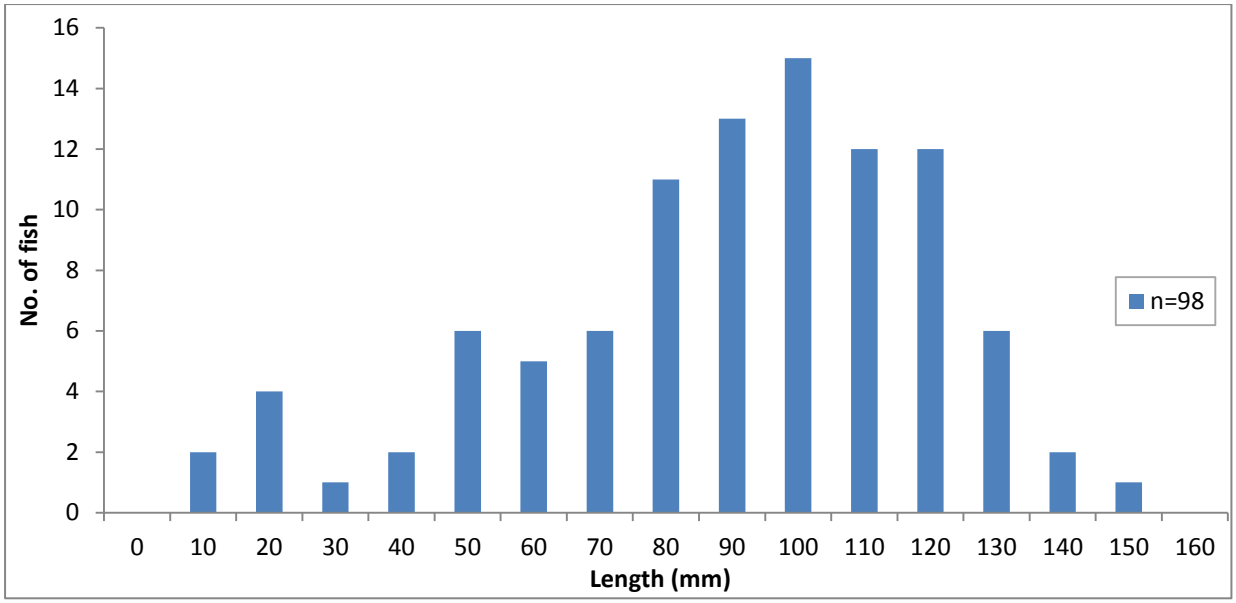

Figure 2.13. Length frequency of ammocoetes across on sites sampled on the Araglin sub catchment.

There was a number of size classes present, indicating ongoing recruitment. The density of fish recorded on the Araglin varied between 2 and 32 fish/m^2 (Figure 2.14).

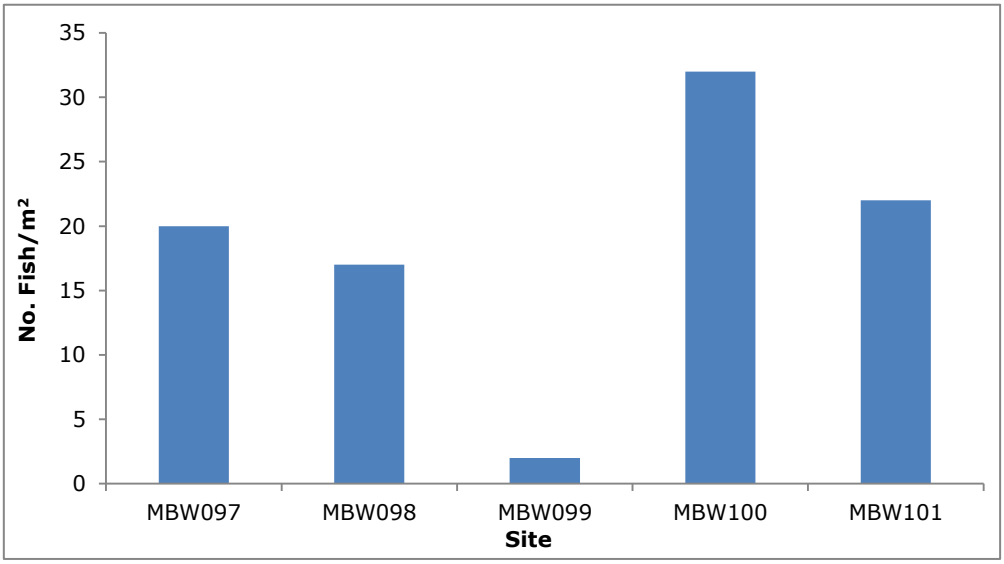

Figure 2.14. Densities of ammocoetes on the Araglin sub catchment.

Awbeg River sub catchment

The Awbeg sub catchment drains an area of 358 km^2. The Awbeg River flows through the towns of Buttevant and Doneraile and joins the MBW main channel at Ballyhooly. Across the sub catchment 8 sites were selected for ammocoete investigation(Figure 2.15). Of these seven presented with juvenile lamprey. At the remaining site, despite suitable habitat, no ammocoetes were encountered. The length of fish varied between 22 and 151 millimetres (Figure 2.16).

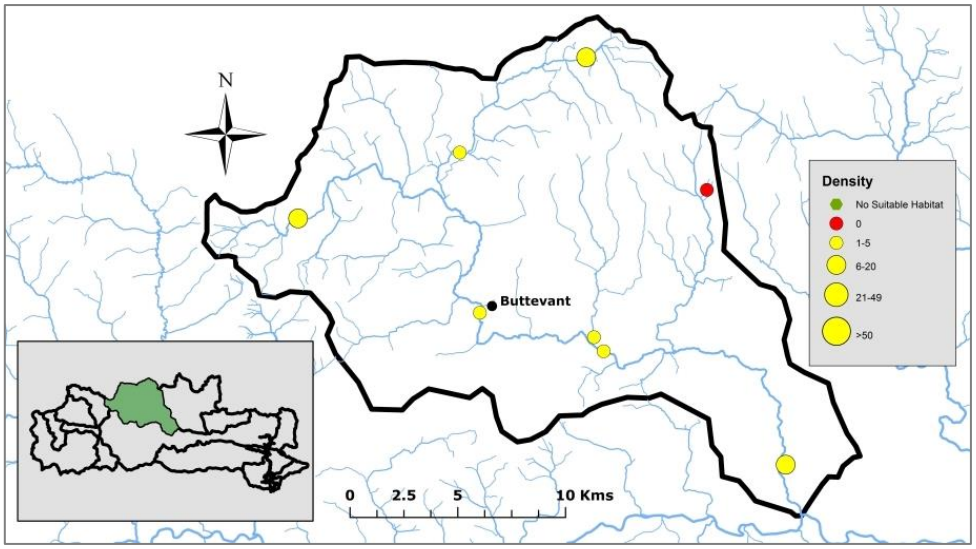

Figure 2.15. Locations of sampling sites on the Awbeg sub catchment, August-September 2014.

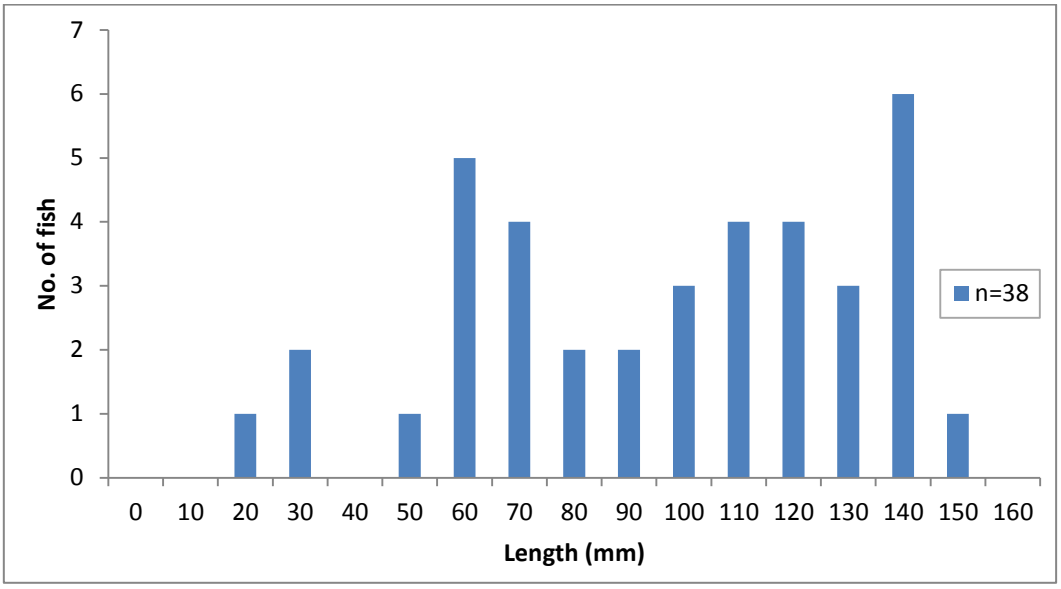

Figure 2.16. Length frequency of ammocoetes across on sites sampled on the Awbeg sub catchment.

The results indicated the presence of a number of different size classes, demonstrating the ongoing recruitment and regeneration of the population. The density of fish recorded varied between 1 and 14 fish per meter squared (Figure 2.17).

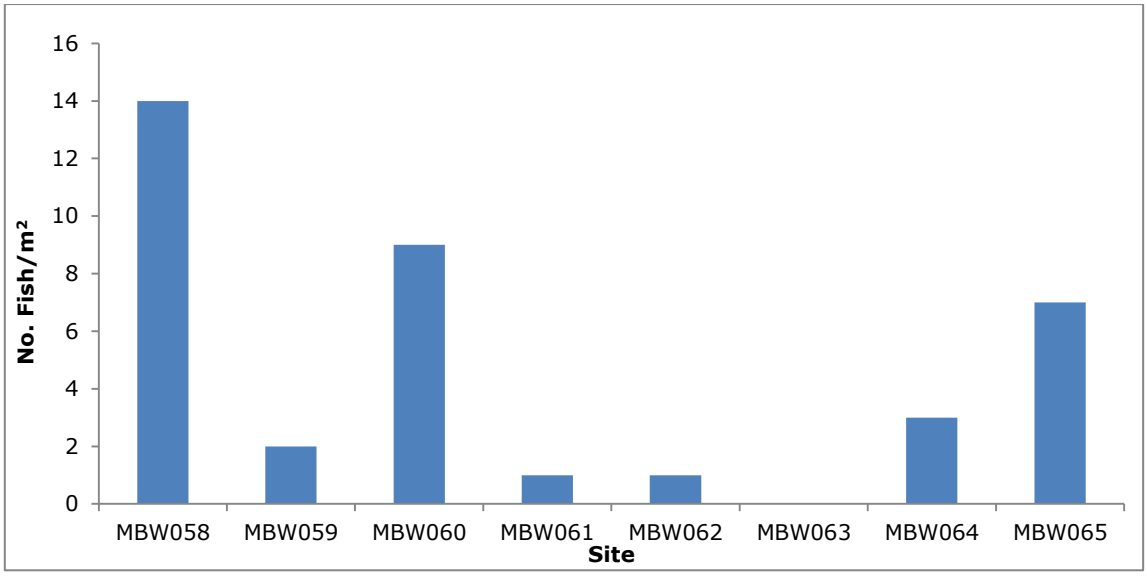

Figure 2.17. Densities of ammocoetes on the Awbeg sub catchment.

River Bride sub catchment

The River Bride is the largest tributary of the MBW. The river rises in the Nagle Mountains and flows in a west-east direction, similar to the main MBW channel. The river flows through the towns of Rathcormack and Tallow before joining the MBW main channel approximately 5 kilometres upstream of Youghal, in the tidal stretch of the river (Plate 2.2).

Plate 2.2. River Bride at Rathcormack, September 2014.

Twenty sites were selected for investigation (Figure 2.18). Lamprey were absent from three sites, one of which presented with no suitable habitat. The length of fish varied between 13 and 193 millimetres (Figure 2.19). Ammocoetes were distributed across all size classes, indicating the presence of on-going recruitment to the population.

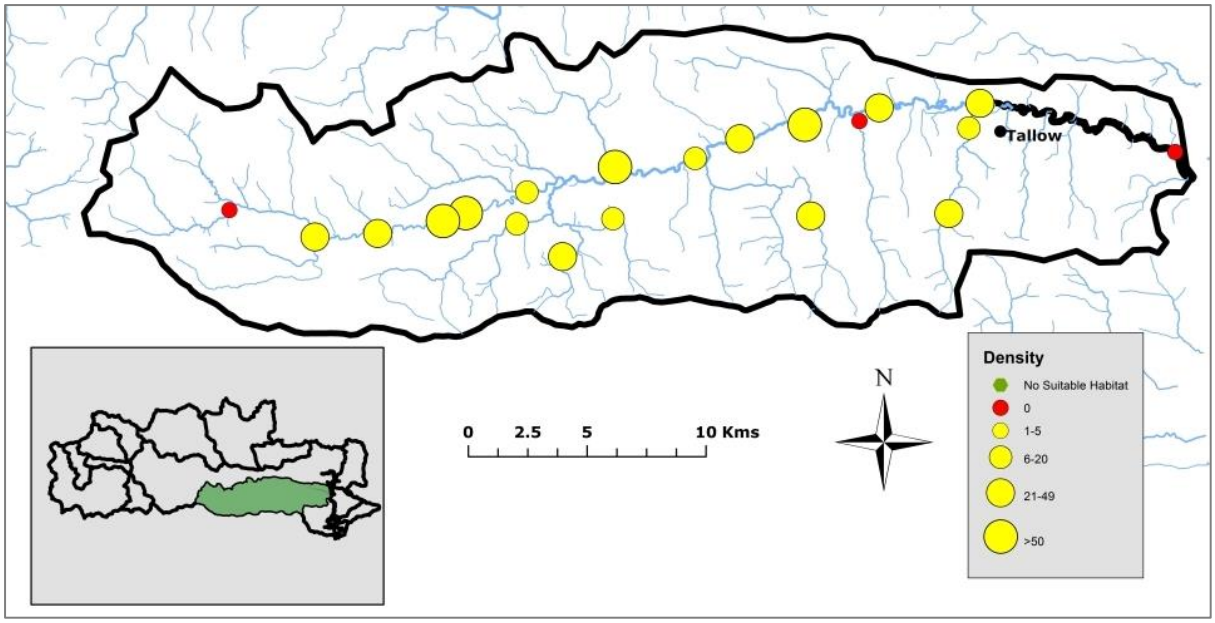

Figure 2.18. Locations of sampling sites on the Bride sub catchment, August-September 2014.

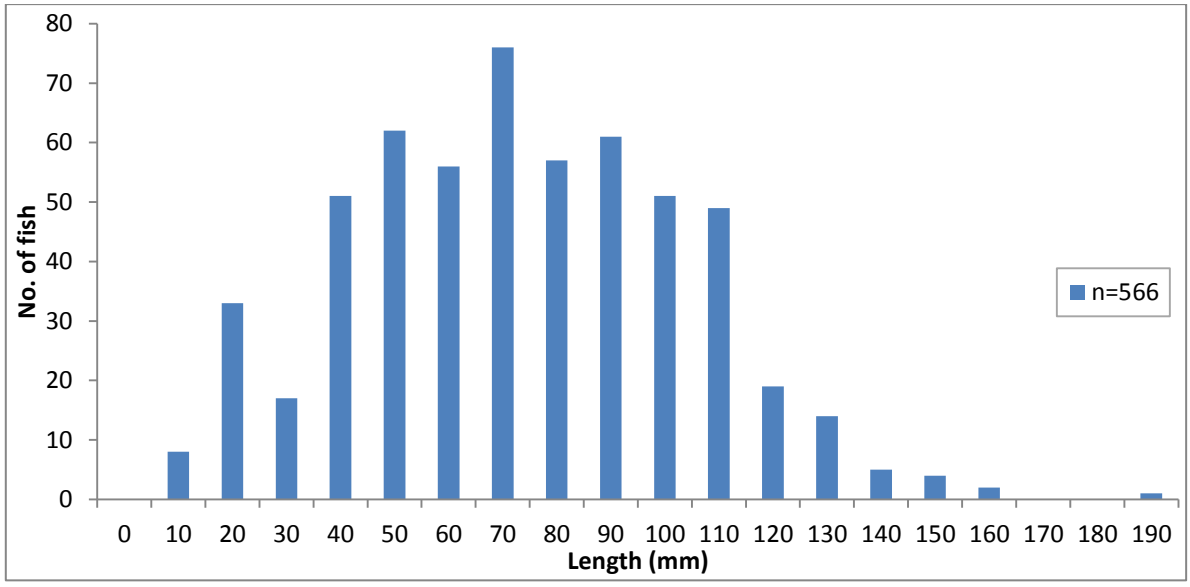

Figure 2.19. Length frequency of ammocoetes across on sites sampled on the Bride sub catchment.

The density of fish recorded varied between 6 and 68 fish per metered square (Figure 2.20).

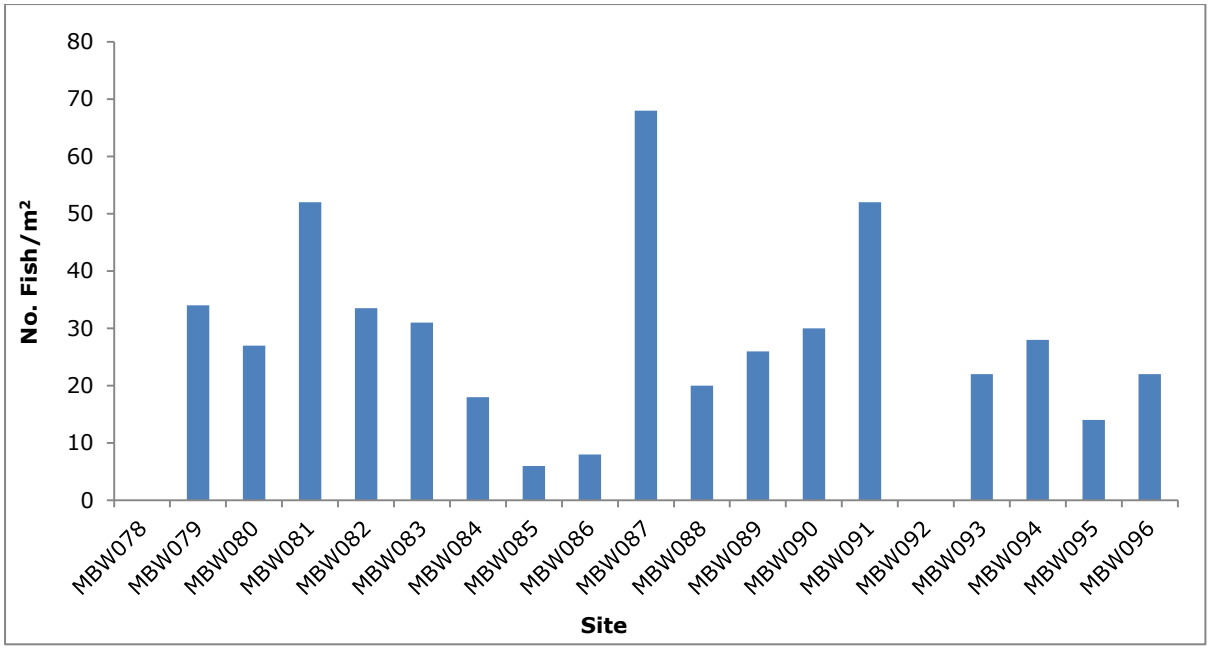

Figure 2.20. Densities of ammocoetes on the Bride sub catchment.

River Dalua sub catchment

The Dalua sub catchment expands over an area of 140 km^2. The Dalua is a major tributary of the River Allow which it joins in Kanturk. Eight sites were selected for survey in the Dalua sub catchment (Figure 2.21). Of these six sites were positive for ammocoetes. The remaining sites, although suitable sediment was present, were negative for ammocoetes. The length of fish varied between 38 and 144 millimetres (Figure 2.22).

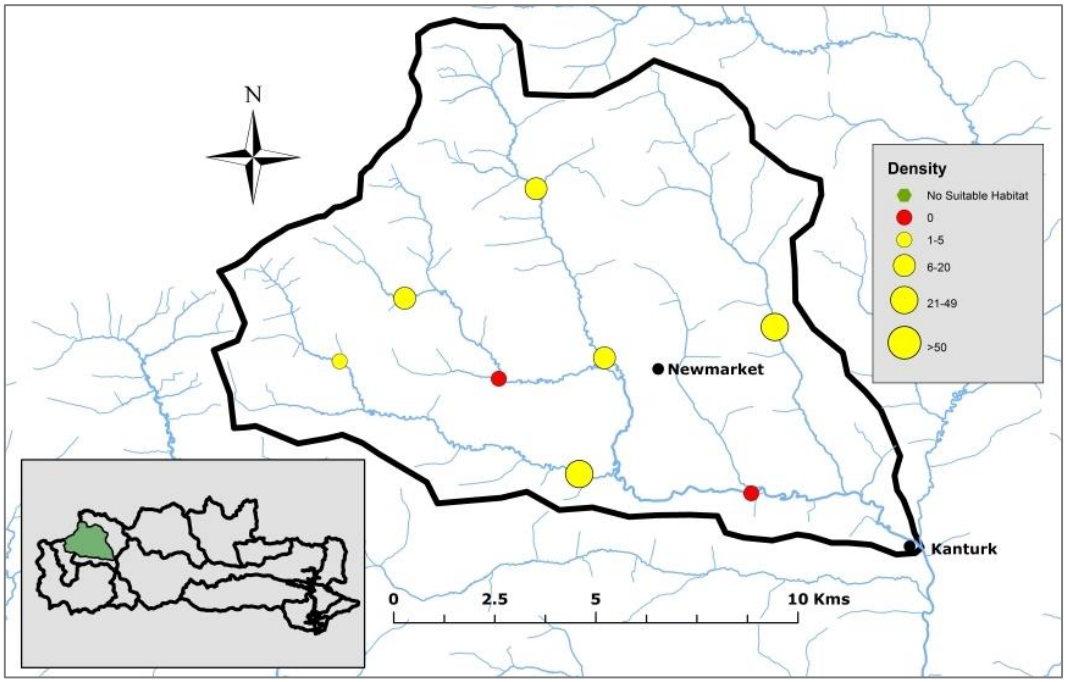

Figure 2.21. Locations of sampling sites on the Dalua sub catchment, August-September 2014.

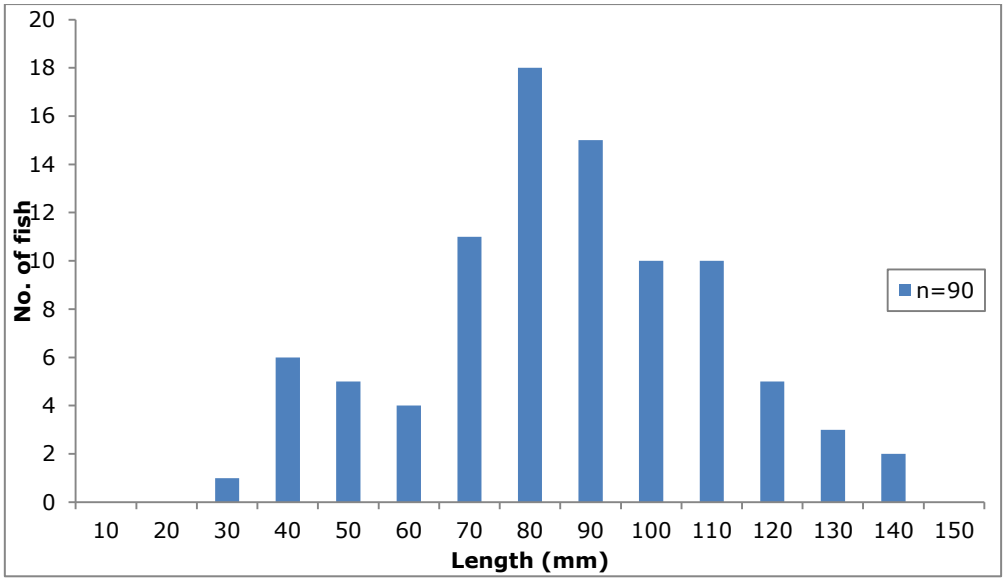

Figure 2.22. Length frequency of ammocoetes across on sites sampled across the Dalua sub catchment.

The density of fish recorded varied between 2 and 41 fish per metre^2 (Figure 2.23).

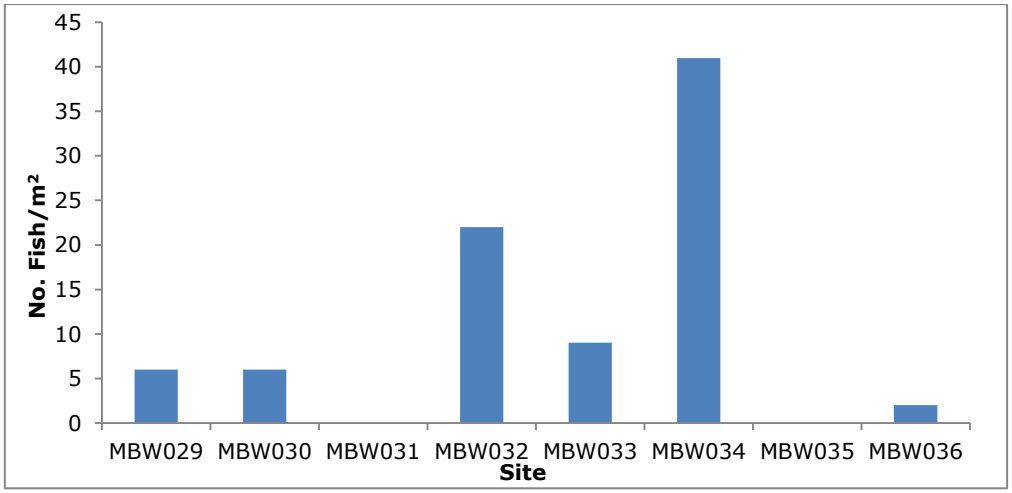

Figure 2.23. Densities of ammocoetes on the Dalua sub catchment.

River Finisk sub catchment

The Finisk sub catchment drains an area of 128 kilometres squared. The river flows in a general north to south direction. It joins the MBW main channel immediately downstream of Cappoquin. Four sites were selected for sampling across the Finisk sub catchment (Plate 2.3).

Plate 2.3. River Finisk at Bridgequarter, September, 2014.

Ammocoetes were recorded at all sites (Figure 2.24). The length of fish recorded varied between 14 and 136 millimetres (Figure 2.25). The population structure was dominated by fish less than 70 millimetres. While the results indicate recent recruitment, the small number of larger fish could indicate few adult fish spawning in the coming season.

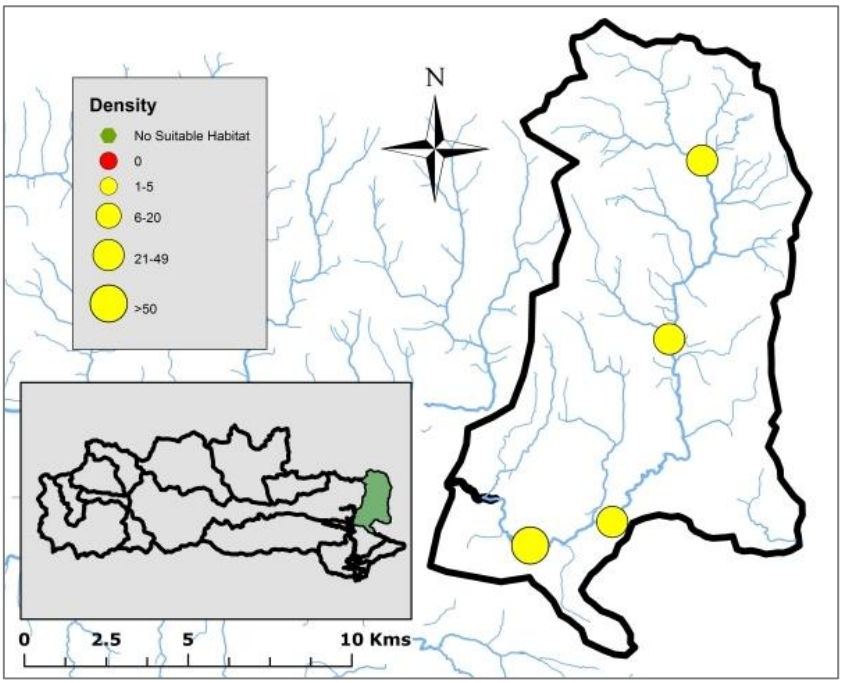

Figure 2.24. Locations of sampling sites on the Finisk sub catchment, August-September 2014.

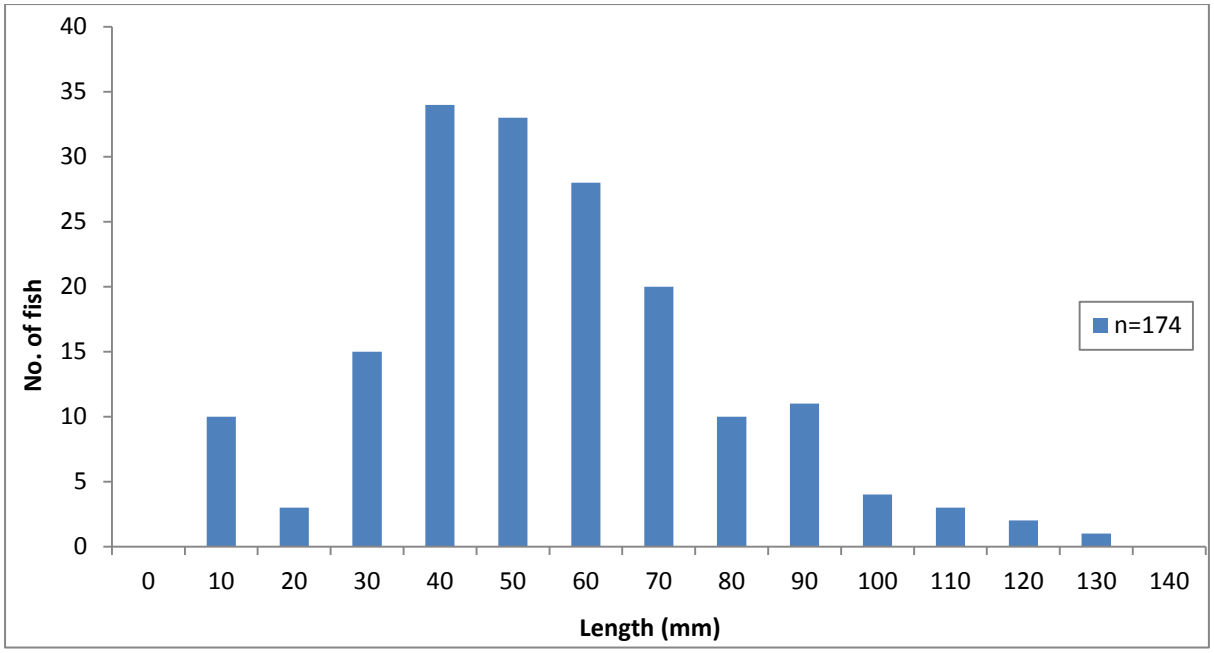

Figure 2.25. Length frequency of ammocoetes across on sites sampled on the Finisk sub catchment.

The density of ammocoetes recorded varied between 31 and 56 fish per meter squared (Figure 2.26). The densities of fish recorded across the Dalua indicated good populations of juvenile lamprey.

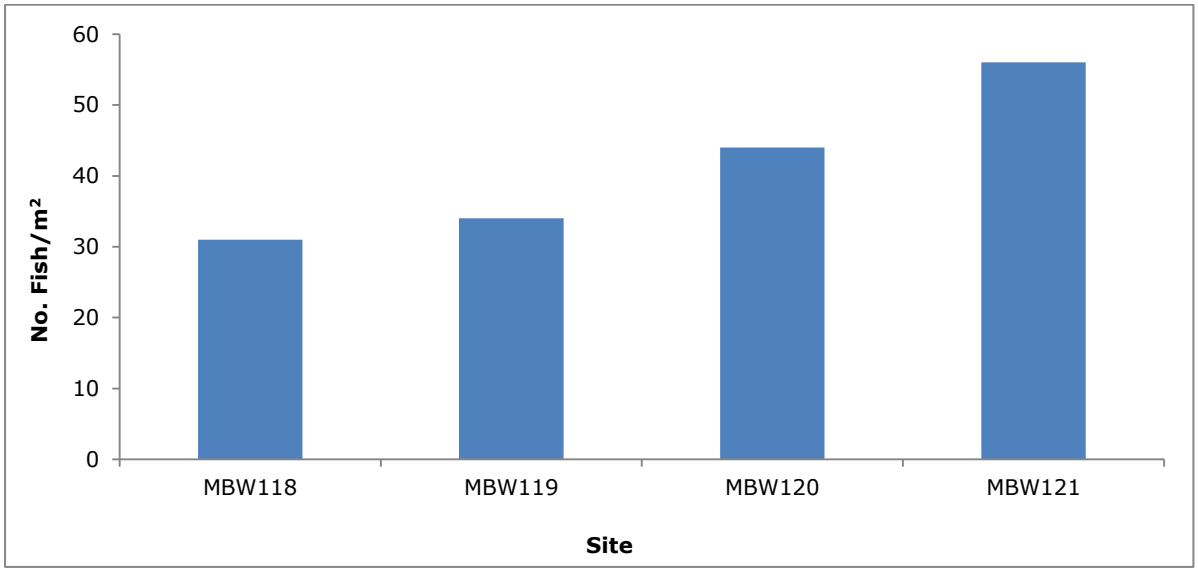

Figure 2.26. Densities of ammocoetes on the Finisk sub catchment.

River Funshion sub catchment

The Funshion sub catchment covers an area of 377 km^2, included in which is the town of Mitchelstown. The River Funshion flows through the town of Glanworth until it joins the MBW main channel approximately 3 kilometres downstream of Fermoy. Twelve sites were selected for ammocoete investigation in the Funshion sub catchment (Figure 2.27). Of these, ammocoetes were present at eight sites. Of the remaining sites, two had no suitable habitat, and two

presented with suitable habitat whilst no juvenile lamprey were encountered. The length of fish captured varied between 16 and 142 mm (Figure 2.28).

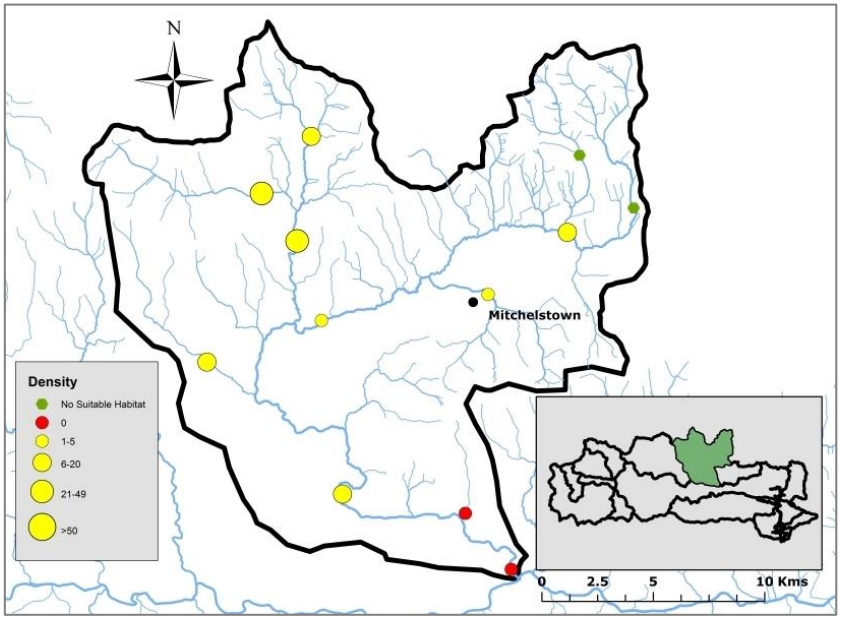

Figure 2.27. Locations of sampling sites on the Funshion sub catchment, August-September 2014.

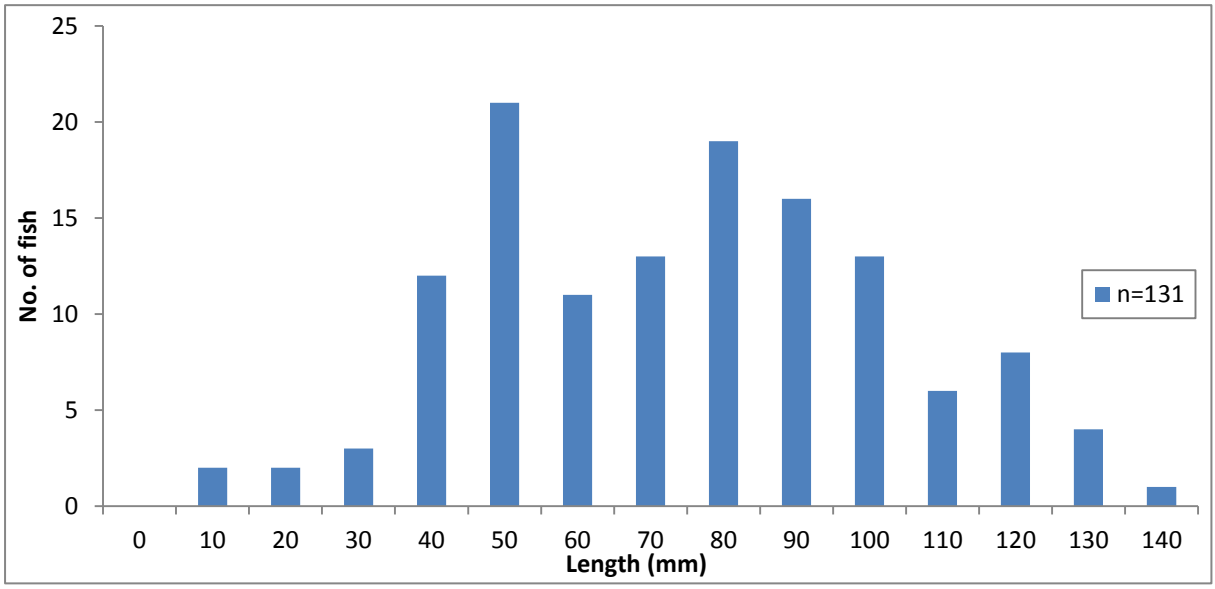

Figure 2.28. Length frequency of ammocoetes across on sites sampled on the Funshion sub catchment.

The density of juvenile lamprey at positive sites varied between 1 and 46 fish/m^2 (Figure 2.29).

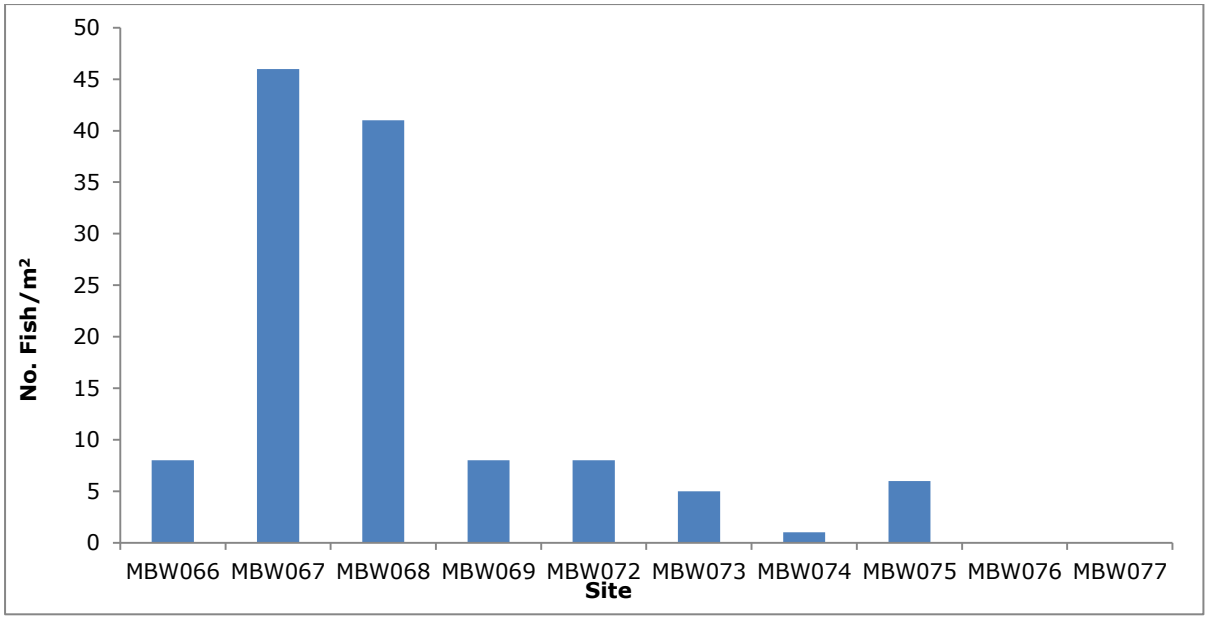

Figure 2.29. Densities of ammocoetes on the Funshion sub catchment.

Glen River sub catchment

The Glen sub catchment is located to the south east of the MBW catchment and drains an area of 76 km^2. The River Glen joins the MBW main channel at Banteer. Six sites were located within this sub catchment (Figure 2.30). Ammocoetes were only present at one site. Of the remaining sites, one presented with suitable habitat and the rest had no suitable habitat. The length of fish varied between 66 and 150mm (Figure 2.31). The density of fish recorded was 16 fish/m^2.

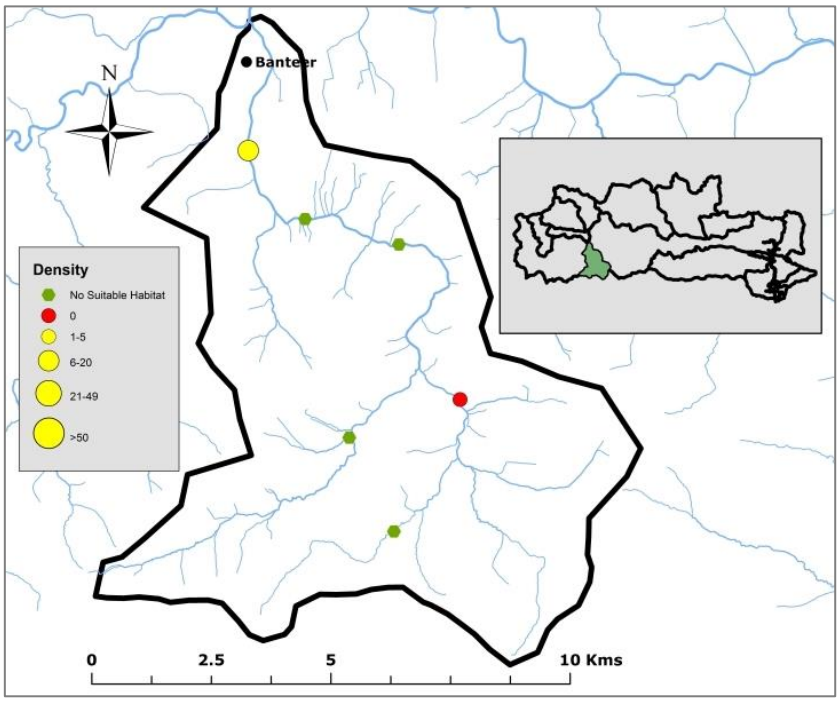

Figure 2.30. Locations of sampling sites on the Glen sub catchment, August-September 2014.

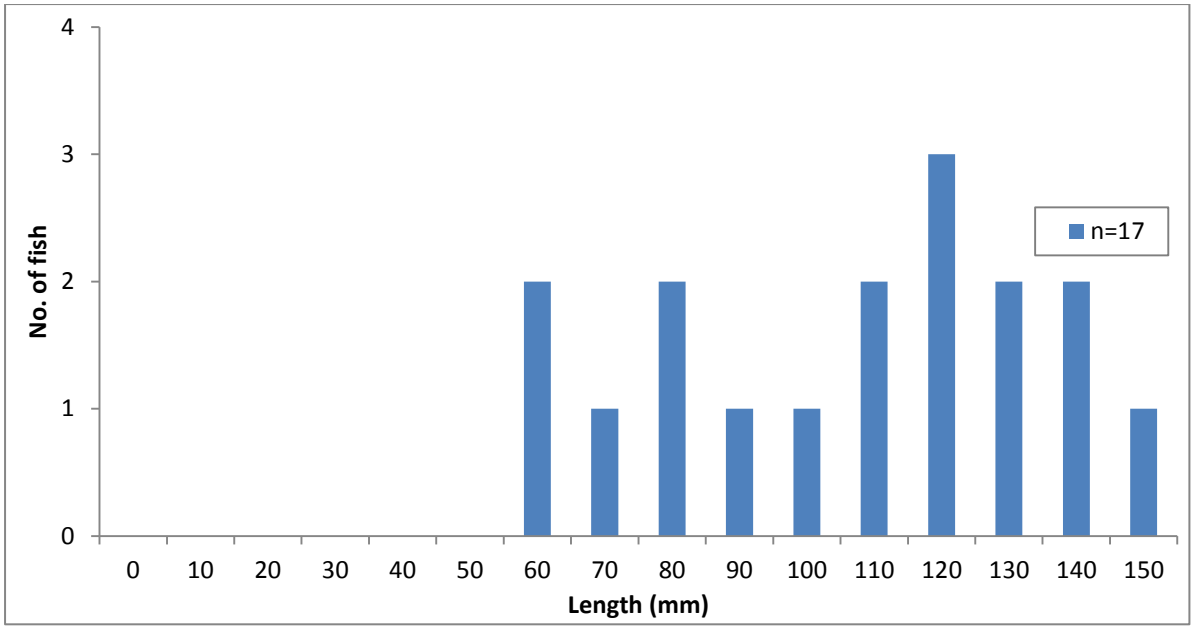

Figure 2.31. Length frequency of ammocoetes across on sites sampled on the Glen sub catchment.

River Licky sub catchment

The River Licky sub catchment is located in the south east of the MBW catchment and drains an area of 48km^2. The river flows in a general east west direction to where it joins the MBW main channel in the tidal area downstream of Clashmore. Three sites were sampled, with juvenile lamprey present at one site (Figure 2.32). All sites had suitable ammocoete habitat present. The length of fish varied between 48 and 118mm (Figure 2.33). This distribution represented a number of age classes. The density of fish recorded was 55 fish/m^2.

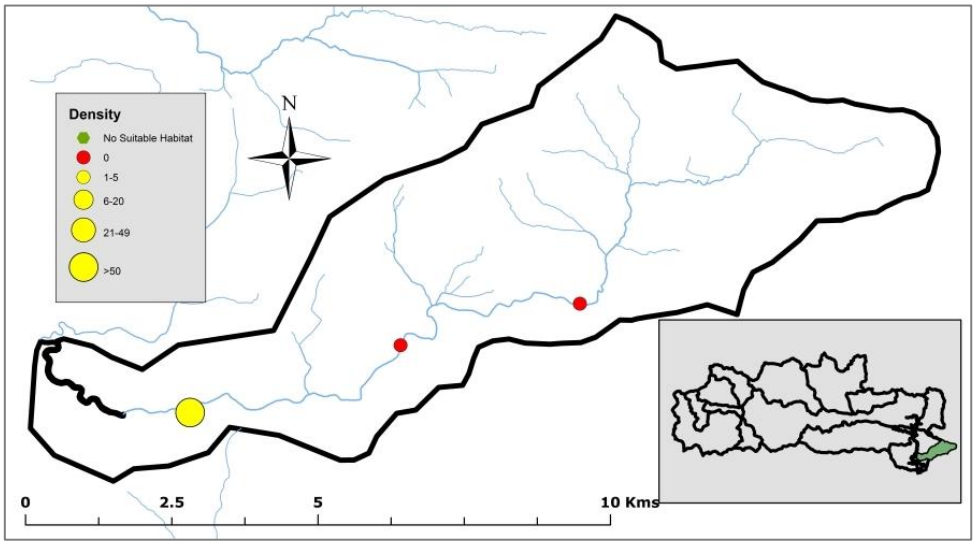

Figure 2.32. Locations of sampling sites on the Licky sub catchment, August-September 2014.

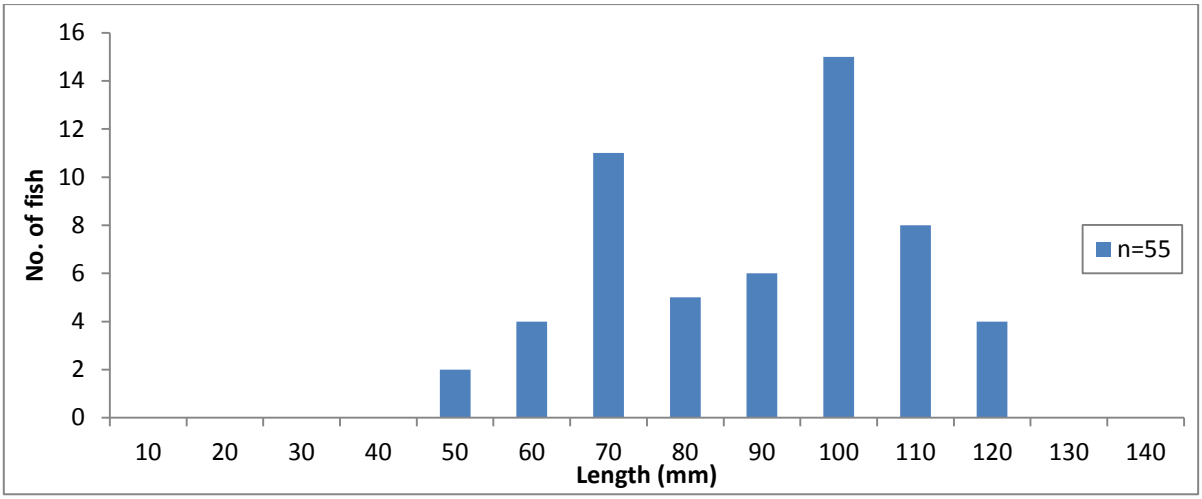

Figure 2.33. Length frequency of ammocoetes across on sites sampled on the Licky sub catchment.

Munster East Estuary sub catchment

The Munster East Estuary covers an area of 87km^2. The River Goish is the main river draining the sub catchment. Four sites were sampled across the sub catchment, all of which had suitable habitat present (Figure 2.34). Ammocoetes were present at three sites. The length of fish varied between 18 and 127mm (Figure 2.35).

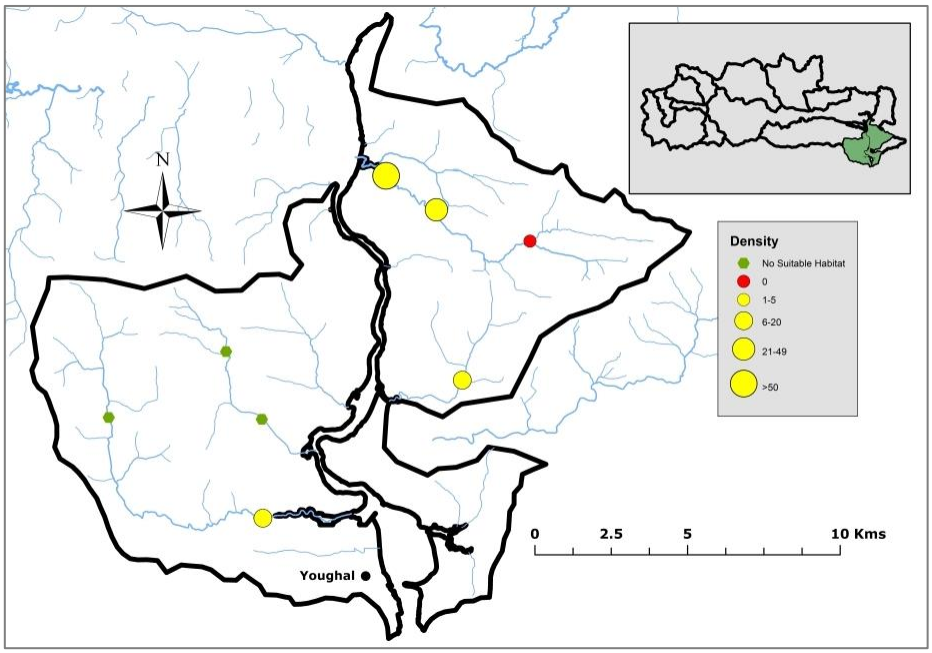

Figure 2.34. Locations of sampling sites on the East and West estuary sub catchment, August-September 2014.

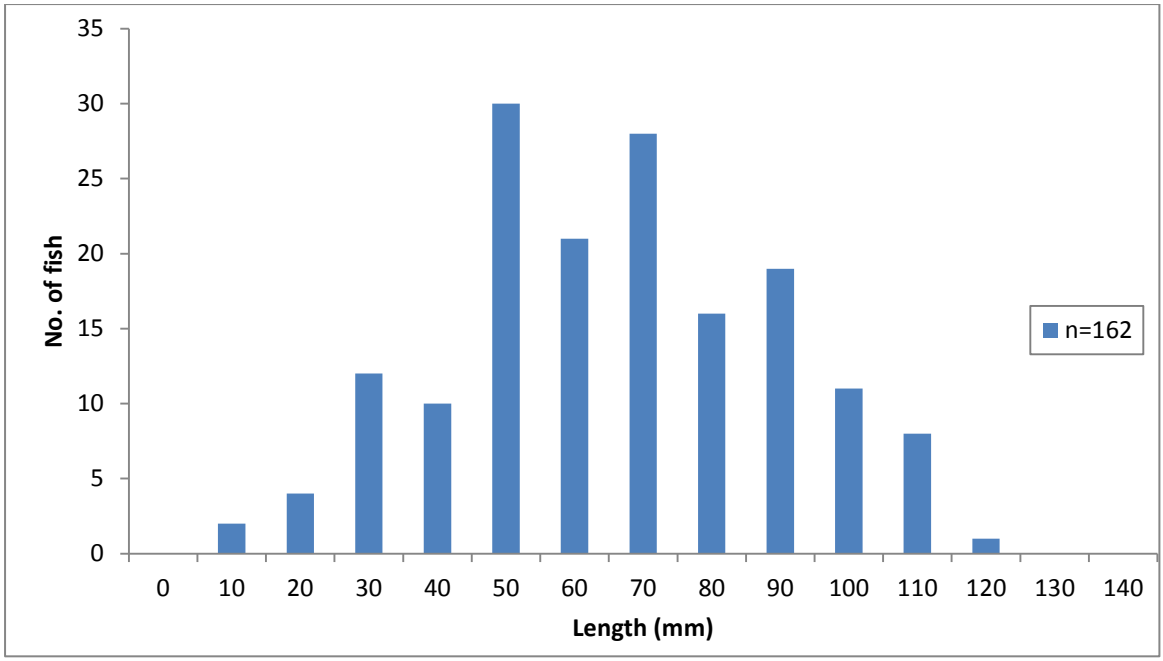

Figure 2.35. Length frequency of ammocoetes across on sites sampled on the Munster East Estuary sub catchment.

The density of ammocoetes captured across the three positive sites varied between 18 and 90 fish/m^2 (Figure 2.36). This was the highest density of fish recorded across the entire catchment.

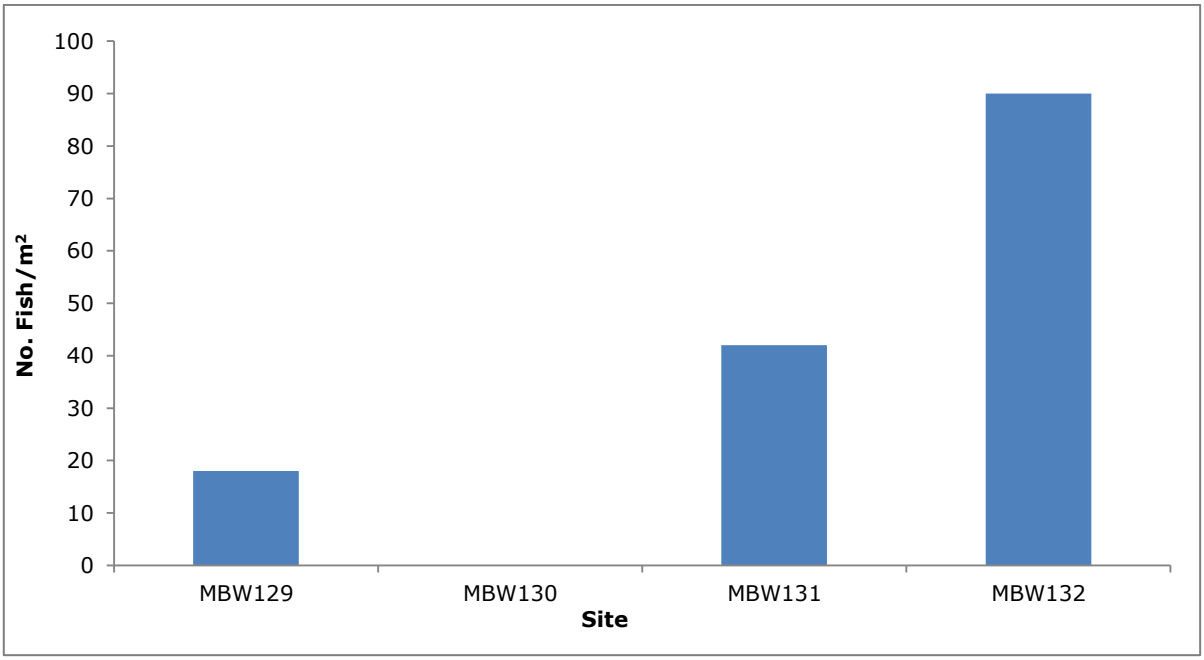

Figure 2.36. Densities of ammocoetes on the Munster East Estuary sub catchment.

Munster West Estuary sub catchment

The Munster West Estuary drains an area of 100km^2. The principal river in the sub catchment is the River Goish which joins the tidal section of the MBW main channel at Youghal. Four sites were surveyed for ammocoete distribution (Figure 2.34). Only one of these sites had suitable sediment and also the presence of larval lamprey. The length of lamprey varied between 47 and 97mm (Figure 2.37). The density of ammocoetes was 10 fish/m^2.

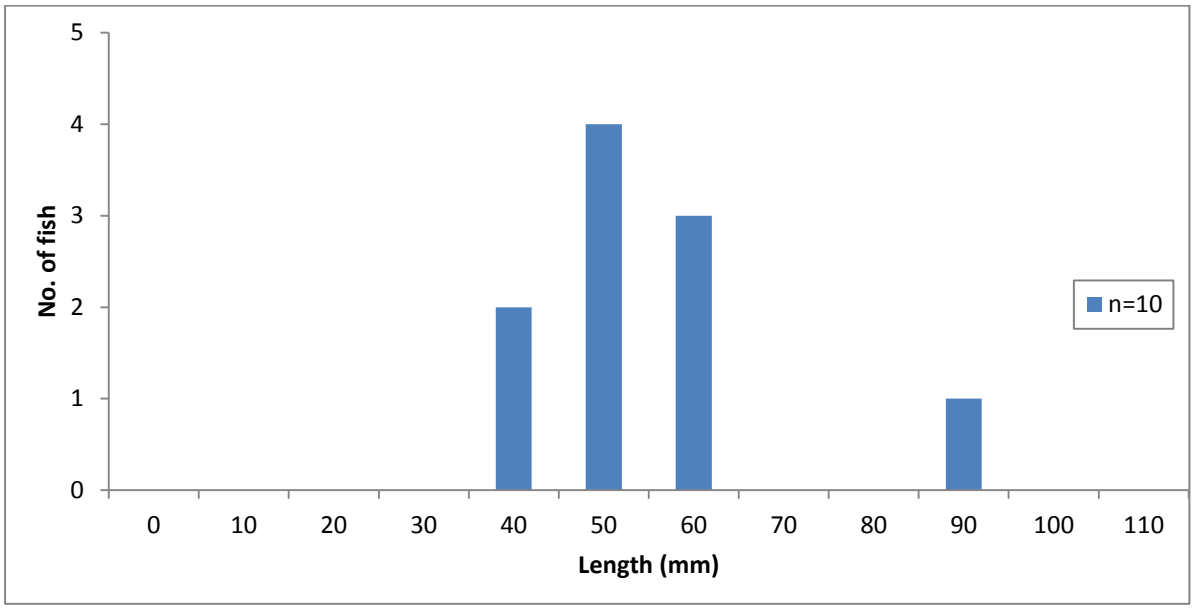

Figure 2.37. Length frequency of ammocoetes across on sites sampled on the Munster West Estuary sub catchment.

Owentaraglin River sub catchment

The Owentaraglin sub catchment spans an area of 81 km^2. The River Owentaraglin flows through the village of Ballydesmond and Rathmore where it joins the MBW main channel. Five sites were preselected for sampling across the sub catchment (Figure 2.38). Ammocoetes were recorded at all sites surveyed. The length of fish varied between 5 and 132mm (Figure 2.39).

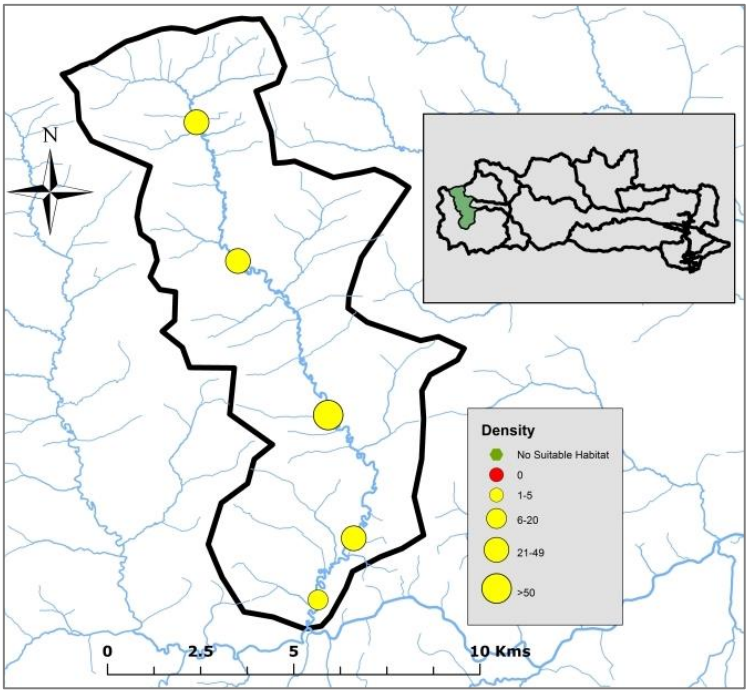

Figure 2.38. Locations of sampling sites on the Owentaraglin sub catchment, August-September 2014.

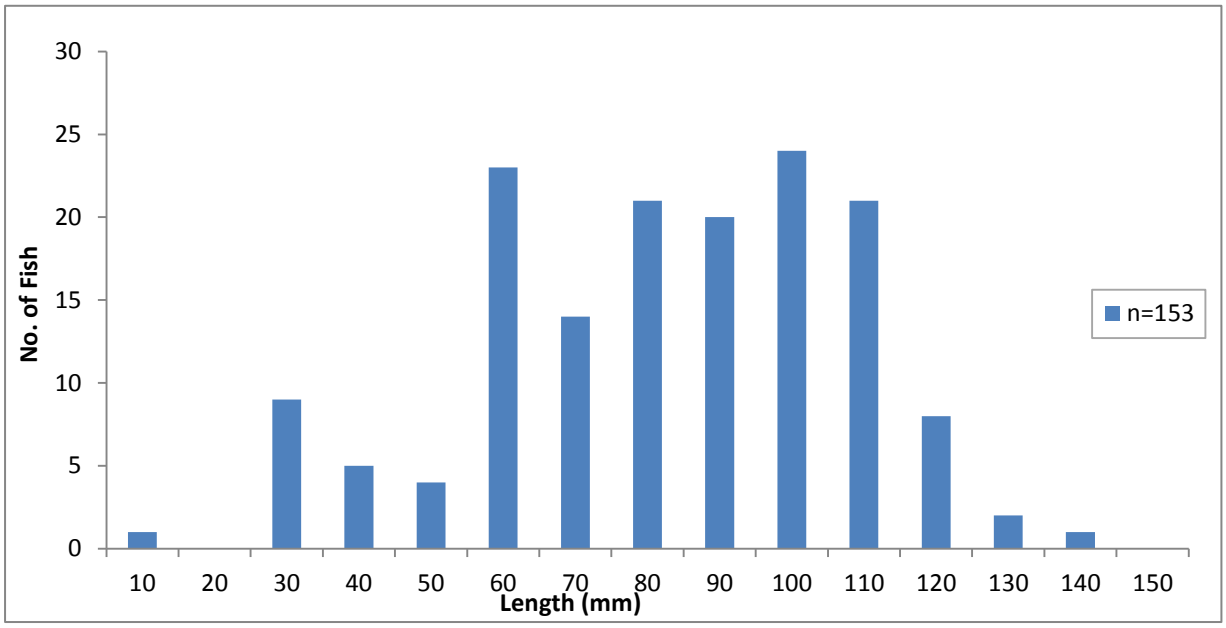

Figure 2.39. Length frequency of ammocoetes across on sites sampled on the Owentaraglin sub catchment.

The density of fish captured varied between 16 and 55m^2 (Figure 2.40).

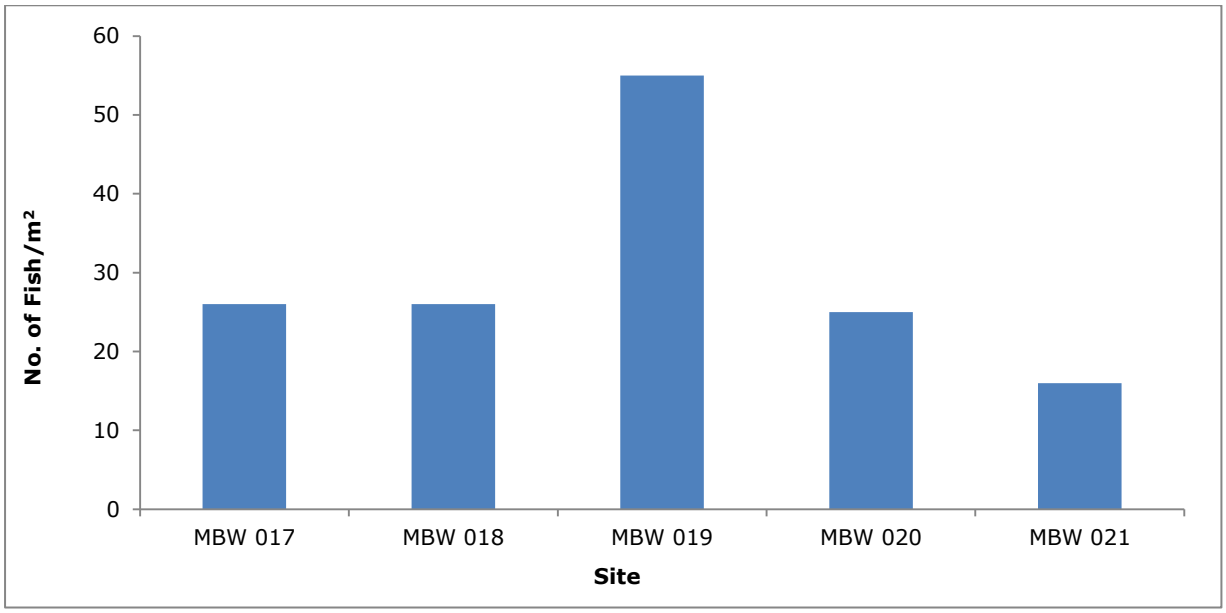

Figure 2.40. Densities of ammocoetes on the Owentaraglin sub catchment.

Comparison of 2003 and 2014 larval lamprey surveys

Sixty of the sites surveyed during 2014 were in the same locations as those sampled in 2003. Using the information gleaned from both surveys a comparison could be made into the population distribution, density and structure. The number of fish captured during the 2014 survey was 43%

greater than those encountered during the 2003 survey (Figure 2.41). Overall the population structure does not vary greatly between the 2003 and the 2014 survey, with the majority of fish between 50 and 120 millimetres in both surveys.

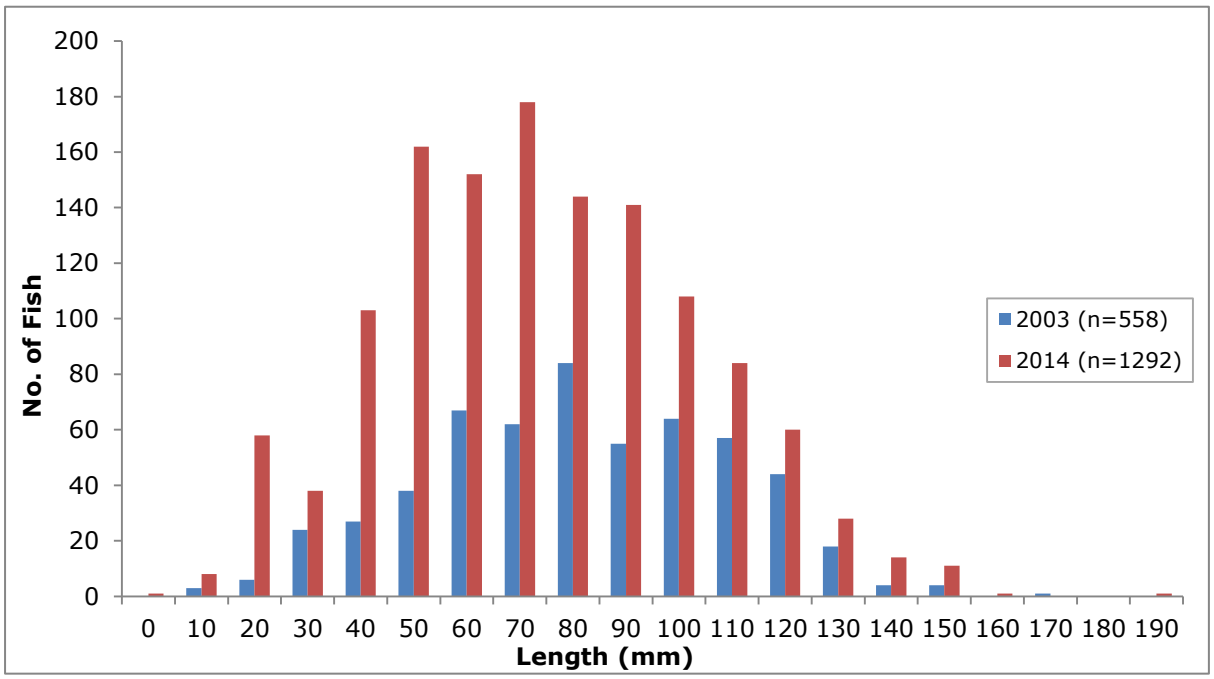

Figure 2.41. Comparison of length frequency of sites sampled in 2003 and 2014 on the Munster Blackwater.

Mean densities were calculated for sub catchments sampled in both 2003 and 2014 (Figure 2.42). The mean densities were calculated based on the 'like for like' sites sampled during both surveys. Across all sub catchments a higher mean density was recorded during the 2014 survey. This difference was especially visible in the Finisk and Bride sub catchments. The increase recorded across both surveys varied between 1.15 times the number of ammocoetes on the Licky sub catchment, to 9.21 times the number recorded in 2003 on the Finisk. An almost fivefold increase in the number of juvenile lamprey was recorded on the Bride sub catchment between the two surveys.

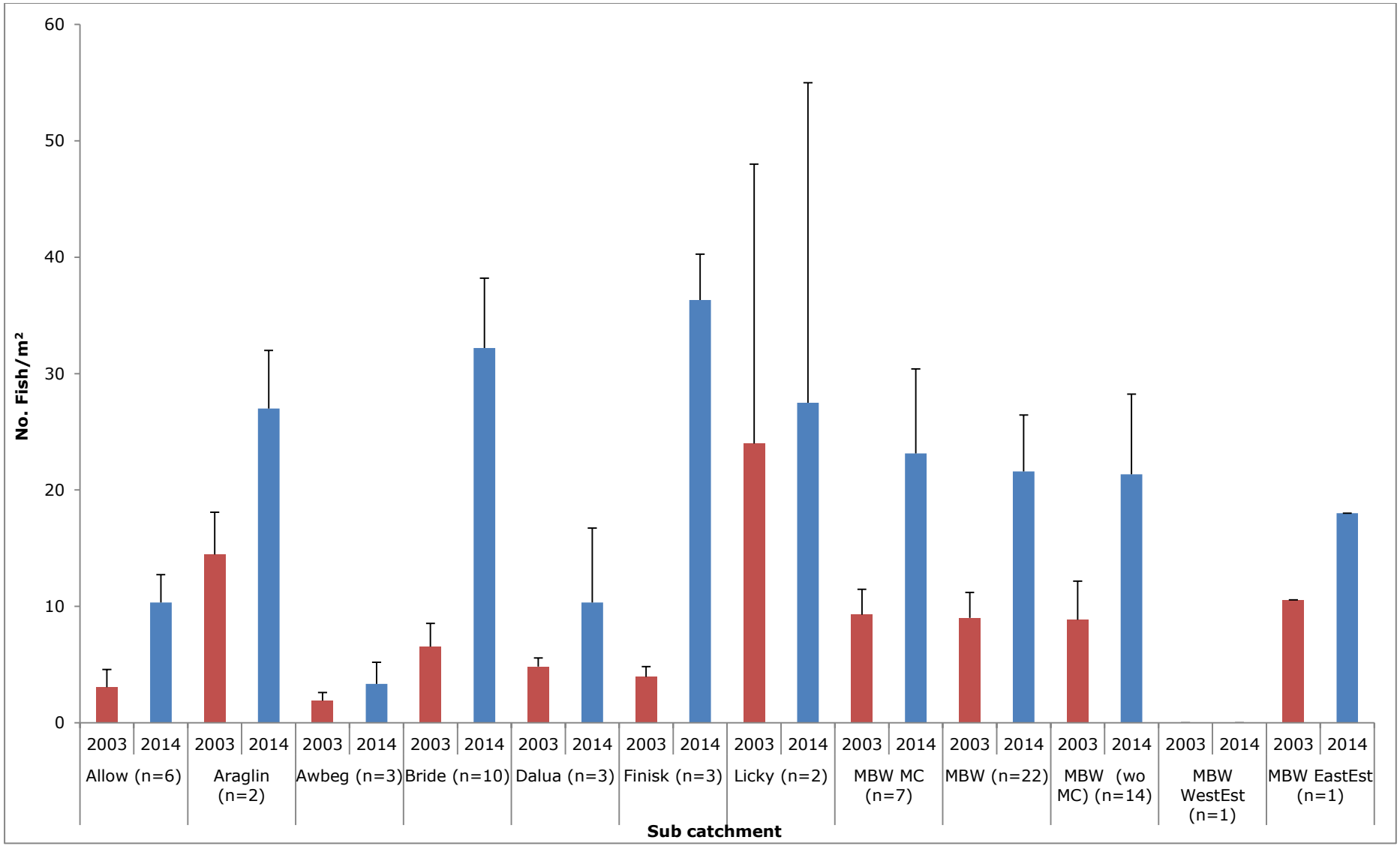

Figure 2.42. Comparison of Mean densities of ammocoetes per sub catchment between 2003 and 2014 (Standard Error bars also included).

Discussion

The survey of the Munster Blackwater SAC gave a very useful insight into the population structure, density and distribution of ammocoetes across the catchment. The extensive number of sites sampled across all the sub catchments provided useful management tools for future population trend analysis. It is proposed to monitor a sub catchment on an annual basis within the Habitats Directive programme in order that any fluctuations in population structure be monitored.
The population structure of the ammocoetes sampled during the survey indicated a suitable proportion of all size classes present. Young fish were represented along with maturing transformers and a number of age classes were represented in the 50 to 100 mm size categories.

Ammocoetes were present at 75% of sites which indicated a wide distribution across the catchment. When this was compared to an adjacent catchment, the River Lee, ammocoetes were present at 51% of sites.

Harvey and Cowx, 2003 suggest that in order to assess the conservation status of a catchment where suitable habitat is present the density of ammocoetes should be greater than 10 fish per meter squared. Of the 14 sub catchments sampled, only two mean densities were less than 10 fish per meter squared, these were the Allow and the Awbeg. The highest mean density was recorded on the Finisk (41.25 fish/m^2). This would indicate that if this criterion were to be implemented the Munster Blackwater would be excellent in relation to the density of ammocoetes present.

Previous data available from the 2003 was invaluable in order to gain an insight into the population dynamics of the juvenile lamprey population across the MBW catchment. When the length frequency of ammocoetes for 2003 was compared to that of 2014 (Figure 2.41) the population recorded in 2014 was 131% greater than that recorded during 2003. This may due to a difference in the personnel undertaking the survey or there may have been a genuine increase in the population. Further ongoing trends by sampling a sub catchment annually may clarify this further.

A number of sites, where ammocoetes were absent in 2003 and were present in 2014, may have had a change in physical characteristics e.g. a change in the flow regimes of the survey site. For instance, deposition may have occurred in the intervening 11 years. Survey conditions during 2014 were excellent due to the exceptionally dry summer of 2014.

The comparison of mean densities between 2003 and 2014 displayed a huge increase in the number of fish recorded across all sub catchments. This once again could be as a result of the different personnel undertaking the surveys, or the fact that there was a genuine increased in the ammocoete population.

The availability of results from the two comprehensive surveys further endorse the necessity to continue annual or bi-annual surveys of a sub sample of trend sites in order to monitor more closely the population dynamics of ammocoete populations.

2.1.2 Laune Catchment Wide Survey

The catchment of the River Laune is one of the primary drainage areas in south Kerry. It comprises the rivers Flesk and Laune, as well as the Killarney Lakes system. The eastern and southern sections of the catchment are dominated by the Derrynasaggart Mountains and Macgillycuddy's Reeks, respectively. The River Flesk and its tributaries (the Loo, Clydagh, Beheenagh, Quagmire, Owneyskeagh, Finow and Woodford rivers) drain the eastern half of the catchment, flowing into Lough Leane immediately south of Killarney town. The Killarney Lakes system (Upper Lake, Muckross Lake and Lough Leane) also receive input from mountain streams and rivers (Galway's, Owengarriff, Owenreagh, Gearhameen (Plate 2.4) and Cummeenduff, for example) emanating from the centre of the Macgillycuddy's Reeks. In addition, the Deenagh River drains an area directly north of Killarney, flowing around the western side of the town and entering Lough Leane on the north shore. The River Laune exits Lough Leane on its north-western shore and flows 15km in a north-westerly direction to Killorglin where it becomes tidal. Along this section it is joined by several tributaries originating from the north facing flanks of the Macgillycuddy's Reeks (the Loe, Gaddagh, Glasheenasheefree and Cottoners rivers), as well as rivers which drain the north of the catchment, the Gweestin River being the principal of these (Figure 2.43). The River Laune ultimately empties into Dingle Bay, 3.5 km downstream of Killorglin town.

Plate 2.4. Headwaters of the Gearhameen River, Black Valley, Killarney

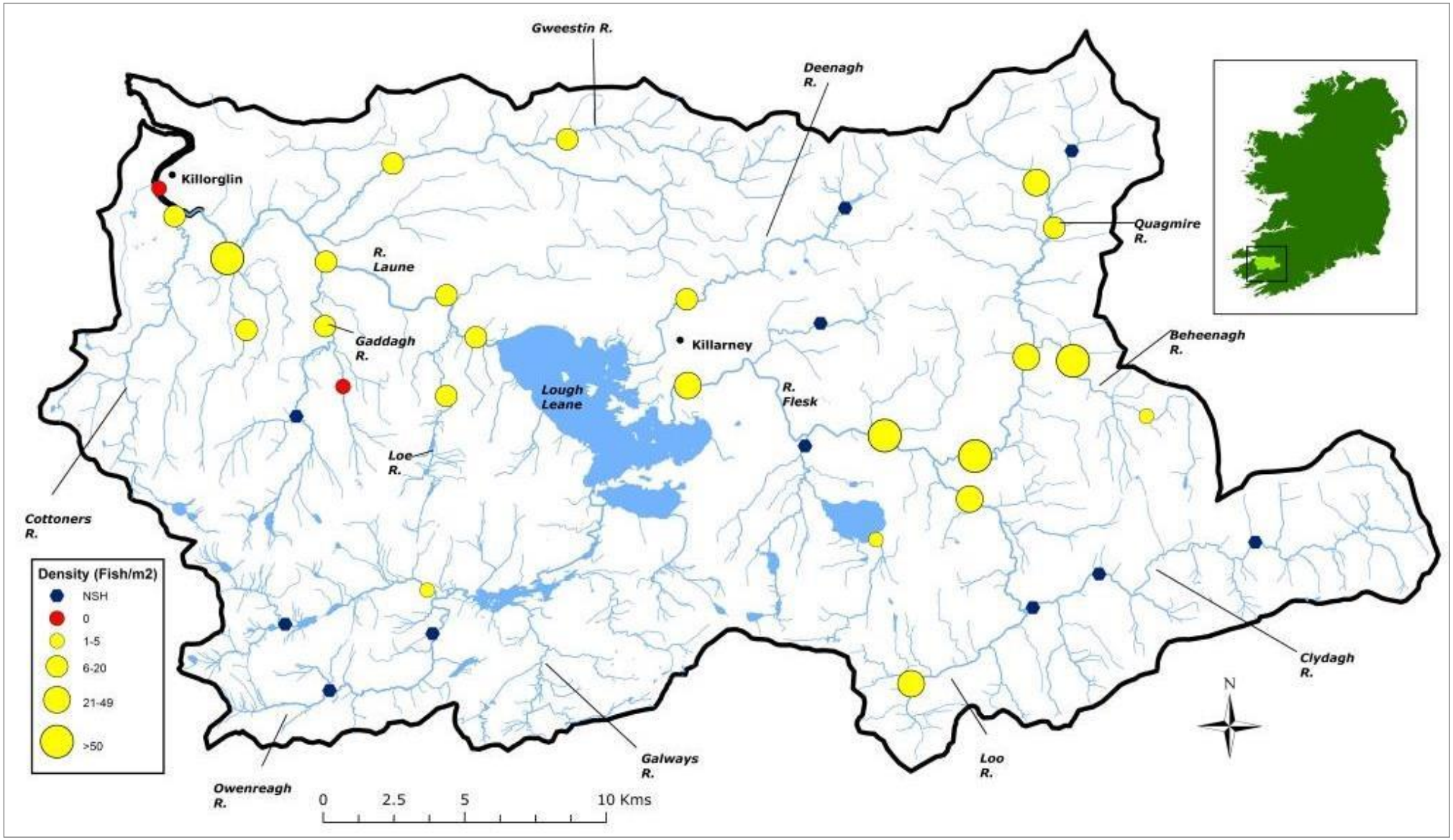

Figure 2.43. Map displaying densities of ammocoetes recorded across the Laune catchment during Autumn, 2014.

Catchment wide surveying of ammocoete distribution and abundance across the Laune system, undertaken initially in October 2010, was repeated in late September-early October 2014.

During the 2010 survey a total of 40 sites were visited. Qualitative push net sampling was undertaken at 20 of these sites, with semi-quantitative electrofishing carried out at the remaining 20 sites (after Harvey and Cowx, 2003). Presence was confirmed at 19 (48%) of the 40 sites with a total of 337 river/brook ammocoetes (22-145mm) encountered (Figure 2.44). A single sea lamprey ammocoete (93mm) was also captured at a site on the main stem River Laune downstream of Lough Leane. Densities of river/brook ammocoetes at positive sites ranged from 1-34 individuals per square metre (Figure 2.45).

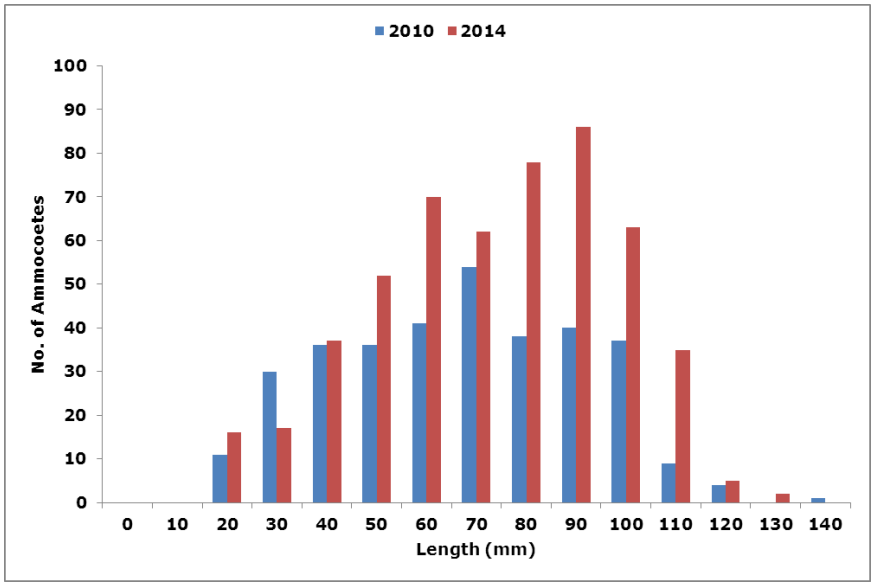

Figure 2.44. Length frequency distribution of *Lampetra* spp. ammocoetes captured at locations across the Laune catchment in 2010 (n=337) and 2014 (n=523).

During the repeat survey in 2014, a total of 36 sites were visited. Semi-quantitative electric fishing surveying was undertaken at all locations. Seven sites, previously visited in 2010, could not be surveyed due to poor access or elevated water levels. Exact locations to those in 2010 were surveyed at 30 of the sites, with a further 4 sites necessitating surveys at adjacent suitable habitat. A further 2 novel sites were visited, namely a location on the Gaddagh River at Gaddagh Bridge, as well as a site on the River Laune in Killorglin at the upper tidal limits where the possible presence of *Petromyzon marinus* ammocoetes was speculated. Ammocoetes were encountered at 23 (64%) of the 36 sites, with river/brook individuals (Total n=523) confirmed at 22 locations. A broad range of age classes (20-136mm) were represented (Figure 2.44). Densities of river/brook ammocoetes at positive sites ranged from 2-71 individuals per square metre (Figure 2.45). Sea lamprey ammocoetes (n=3) were recorded at 3 separate locations, twice in sympatry with *Lampetra* spp. ammocoetes and on one occasion in allopatry.

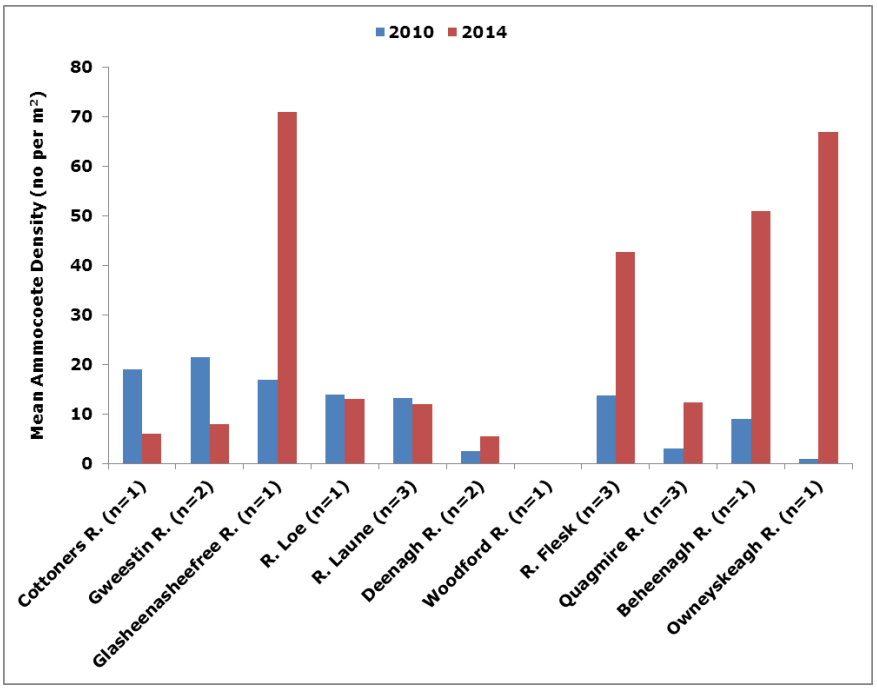

Figure 2.45. Comparative densities of *Lampetra* spp. ammocoetes recorded on tributary and main stem channels of the Laune during 2010 and 2014.

Following the 2014 survey, river/brook ammocoetes remained absent at 12, predominantly upland locations. Presence was noted at 22 sites; at 17 sites where presence was confirmed in 2010, at 4 sites where absence was previously noted and at 1 new site (Gaddagh Bridge, Plate 2.5).

Plate 2.6. A positive site for river/brook ammocoetes on the Gaddagh River at Gaddagh Bridge.

Sea lamprey ammocoetes were encountered at 1 location during 2010, namely on the River Laune at Ballymalis Castle. *P. marinus* ammocoetes had a broader distribution in 2014 with presence of single individuals noted on the River Laune downstream of Lough Leane at Beaufort Bridge (68mm), on the River Flesk upstream of Lough Leane at Flesk Bridge in Killarney (115mm) and on the Gearhameen River (104mm) in the Black Valley, upstream of the Upper Lake (Plate 2.6).

Plate 2.6. A positive site for sea lamprey ammocoetes on the River Laune at Beaufort Bridge

When compared with 2010 electrofishing results, observed densities of *Lampetra* ammocoetes in 2014 showed increases at 11 sites and decreases at 6 (Figure 2.33). Pronounced increases were evident on the Owneyskeagh River, the Glasheenasheefree River, the Beheenagh River and the Flesk. Decreases recorded on the Cottoners and Gweestin Rivers may be attributed to elevated water levels and colouration following rainfall, allowing ammocoetes evade detection and capture (Plate 2.7).

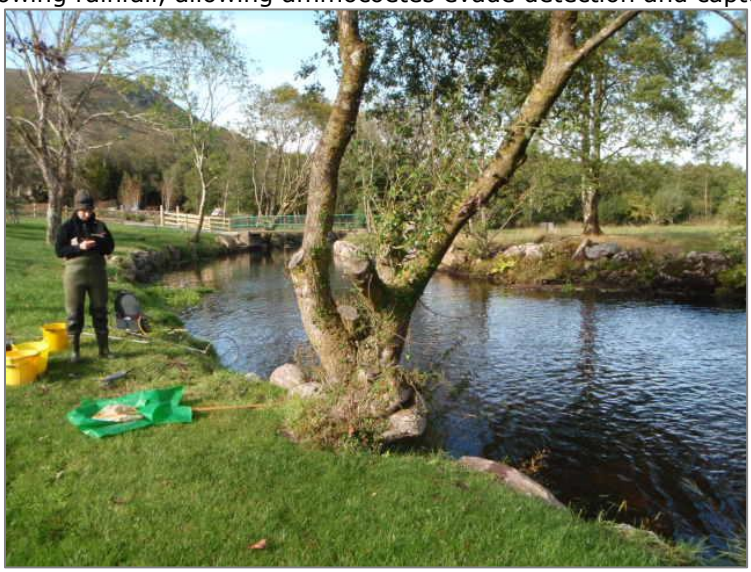

Plate 2.7. Surveying on the River Loe, Gap of Dunloe, Killarney

Repeat surveying in 2014 expanded the distribution records for *Lampetra* spp in the Laune catchment by confirming presence at locations on the Quagmire, Cappagh and Gaddagh rivers. In 2011 a survey of spawning adult brook lamprey witnessed redd building on a tributary of the Glasheenasheefree River at Kilgobnait, with individual adult brook lamprey also recorded on the Owneyskeagh River at Barraduff and on the Gearhameen River in the Black Valley. The presence of sea lamprey ammocoetes at three widely dispersed locations indicates a number of recent spawning events, both upstream and downstream of Lough Leane on the Flesk and Laune rivers, respectively. The occurance of a *P. marinus* ammocoete in the Gearhameen River, 1.5 km upstream of a previously documented spawning location at Lord Brandon's Cottage, suggests adult redd building further into the Black Valley and represents a significant upstream spawning migration through a complex system of interconnected lakes (Plate 2.8).

Plate 2.8. A positive site for sea lamprey ammocoetes during 2014 on the Gearhameen River, Black Valley, Killarney.

2.2.3 Ammocoete Reference Channels

Article 17 reporting continually makes reference to 'trends' and the importance of placing findings from one six-year period in context. Naturally, a repeat survey process, reporting every six years, will permit a degree of trend analysis, with six-yearly intervals. However, it is recognised that more comprehensive analysis of trends may be feasible if more frequent data collection is undertaken. To address this issue, IFI embarked upon a programme of surveying from 2013 that will provide for data collection to permit a degree of trend examination at the catchment and the individual channel level. Based on the SAC network and on catchments surveyed in the 2009 – 2012 period, a series of 'Reference' or 'Index' channels or sub-catchments has been selected (Figure 2.47). These will be surveyed annually or biennially over the six-year period up to 2018, providing scope for a more detailed trend analysis. The channels have been selected to represent geographic range, stream order and water chemistry and the list includes those that displayed large populations of ammocoetes as

well as those with adequate habitat but moderate or low presence of ammocoetes.

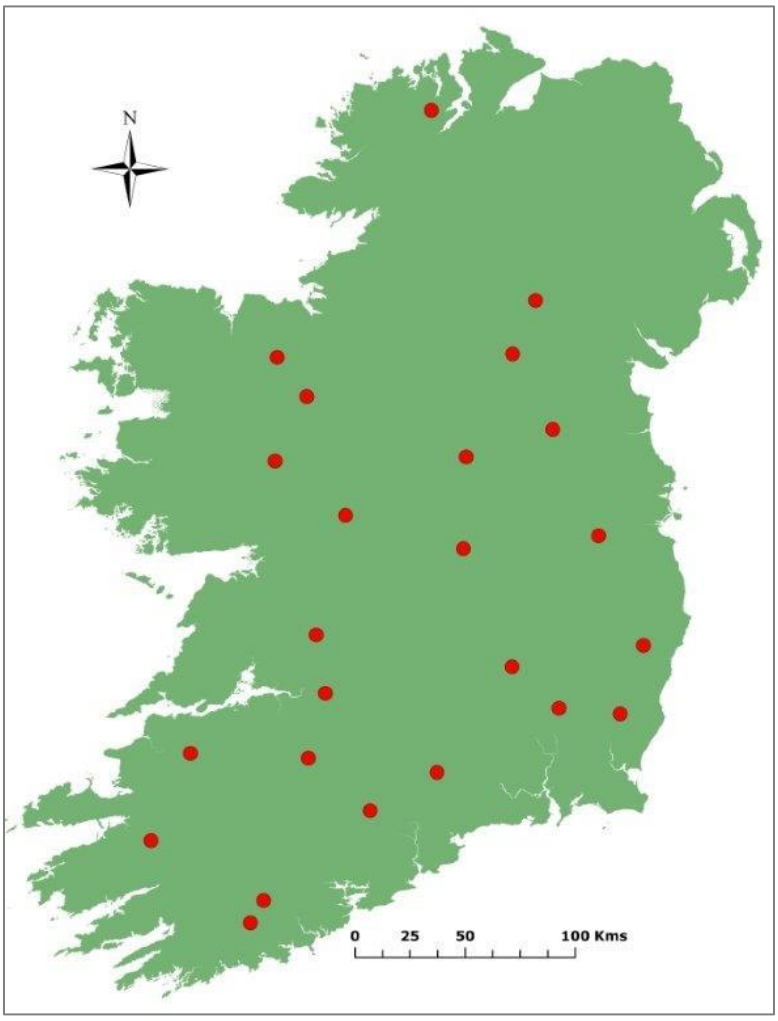

Figure 2.47. Location of ammocoete reference channels throughout Ireland.

2.2 Adult lamprey surveys

2.2.1 Monitoring Sea Lamprey Spawning Activity 'Hot Spots'

During 2014 it was decided to commence upon a program to monitor sea lamprey spawning activity annually. A list of sites for annual appraisal was compiled, based upon previous observations and ease of access (Table 2.1). The list includes a number of well known 'hot spots' for annual sea lamprey spawning, namely the Mulkear River at Annacotty, Co. Limerick, the River Suir in Clonmel, Co. Tipperary and the River Fergus in Ennis, Co. Clare. Also included were locations such as Beaufort Bridge on the River Laune, Co. Kerry – a section with excellent habitat but lacking spawning records.

Table 2.1. List of sea lamprey spawning 'hot spots' for annual appraisal

River	Spawning Location
Slaney	Enniscorthy – Town Section
Barrow	St Mullins – Island Section (d/s St Mullins Weir)
Nore	Thomastown
Suir	Clonmel – Town Section
Munster Blackwater	Clondulane (d/s Fermoy)
Laune	Gearhameen (Lord Brandon's Cottage) Beaufort Bridge
Corrib	Cong – Abbey Street / Circular Road
Lower Shannon	
Shannon	Plassey - University of Limerick 'Living Bridge' Castleconnell – ESB Angling Beats
Mulkear	Annacotty
Annagh	Clonsingle Bridge
Newport	Section d/s of Newport town to Portryan Bridge
Kilmastula	Section d/s of Birdhill
Owengarney	Sixmilebridge – Town Section
Fergus	Ennis –Town Sections

2.2.1.1. Mulkear

The River Mulkear at Annacotty, Co. Limerick was visited on 4 occasions during June and July 2014. Extensive redd building activity (>20 structures) was recorded in the vicinity of the old road and bypass bridges by the 3rd visit on June 26th. Redd building was still underway in early July with 4 animals noted in this section. Accompanying water temperatures increased from 15.2°C to 18.3°C during this period.

2.2.1.2. Shannon

A section of the River Shannon running through the grounds of the University of Limerick at Plassey was visited on 3 occasions during June and July 2014. A pedestrian bridge (the 'Living Bridge') spans the river at this point and serves as an excellent viewing location over a noted section of spawning habitat. No sea lamprey or signs of spawning activity were noted on the first visit on June 8th. Four days later a single animal was observed. By July 2nd an expansive area of recent excavation comprising several compound redds was noted. Spawning was still underway with 2 pairs of sea lamprey excavating redds.

Further upstream of this location at Castleconnell, the River Shannon splits into a number of channels with sections of riffles and glides noted for sea lamprey spawning (Plate 2.9). A section in the town was visited on July 2nd, in the vicinity of ESB Fishing Beats 2 & 3. Redds, some with animals present, were noted at 5 separate sites along this section. One short section of side channel contained 7-8 redds. Water temperature was 20.3°C on this occasion.

Plate 2.9. A channel of the River Shannon at Castleconnell, Co. Limerick

2.2.1.3 River Fergus

Sea lamprey typically spawn at a number of locations along the section of the River Fergus flowing through Ennis town (Plate 2.10). The town section was surveyed for spawning activity on June 26th. Redds were noted at five general locations from Clon Bridge to the Mill Road Weir. A particularly high level of activity (17 structures) was noted along the Newbridge Road- New Road section of the river, behind Cusack Park GAA pitch. Further upstream towards the town centre at Bank Place Bridge-Harvey's Quay another area of prominent spawning activity was noted with 6 structures and 4 adult fish observed. Water temperature was 18.5°C during this visit.

Plate 2.10. Extensive redd excavation on the River Fergus in Ennis town centre

2.2.1.4 Owengarney River

The Owengarney or 'Ratty' River contains a section of excellent spawning habitat as it flows through Sixmilebridge, Co. Clare (Plate 2.11). On June 26th a cluster of 8-9 redds was observed immediately downstream of the single bridge in the village. No spawning sea lamprey were noted during this visit.

Plate 2.11. Sea lamprey redds on the Owengarney River in Sixmilebridge village, Co. Clare.

2.2.1.5 River Suir

The River Suir in Clonmel, Co. Tipperary was visited on two occasions (June 19th and July 3rd). Two redds were noted during the initial visit along the town quays, upstream of the Old Waterford Road Bridge. No additional redds were observed along this section during the follow-up visit.

2.2.1.6 River Nore

Six redds were identified on the River Nore in Thomastown during a single visit on June 19th. Adult sea lamprey were reported digging redds at this location on the previous day by a member of the public.

2.2.1.7 Other Locations

Following reports of a dead sea lamprey on the River Maigue, Co. Limerick (Plate 2.12) a number of potential spawning locations at Adare and Caherass were visited on June 12th. No evidence of sea lamprey spawning was identified. The remnants of a dead sea lamprey was found on the Kilmastula River at Birdhill, Co. Tipperary during a visit on June 26th. Two redds were observed nearby at a previously noted spawning location. Upon examination, however, the redds did not appear sufficiently recent and therefore could not be positively attributed to 2014.

Plate 2.12. Suitable sea lamprey spawning habitat on the River Maigue at Caherass, Co. Limerick

2.2.2 Main-stem Float-over and Walkover Surveys

Surveys to investigate location and extent of sea lamprey spawning were undertaken in mid/late July 2014 on main stem sections of the River Boyne and River Feale, respectively. A combination of kayak and two-person canoe were used on the Boyne, in conditions of low flow, dry weather and bright sunshine (Plate 2.13). In the case of the River Feale, extended river sections of moderate to high gradient with rapids, exposed bedrock and limited access potentially made for inefficient and uncomfortable float-over surveying. Walkover surveying along suitable sections of this river and some its major tributaries was favoured in this particular instance.

Plate 2.13. Preparing for float-over survey on the River Boyne at Slane, Co. Meath

2.2.2.1 River Boyne Float-over Survey

This float-over survey was undertaken over a single day (July 16th) and covered a 10km section of main channel in the lower reaches from Slane to Stalleen. A number of low-head obstacles (n=8) were passed during the survey, none of which would pose a significant barrier to sea lamprey passage. Three sea lamprey carcasses had been earlier reported to local IFI staff by anglers from a location within this survey section at Rossnaree. Extensive searching in suitable spawning habitat immediately upstream of this location during float-over revealed no redds. Further downstream at Roughgrange, however, a single sea lamprey redd was recorded in a fast flowing side channel where the river splits (Plate 2.14). Dimensions were recorded and a substrate sample was taken adjacent to the structure. This location is 0.8km upstream of a previously noted spawning location under the pedestrian footbridge at Brú na Bóinne Visitor Centre. The predominance of filamentous algae and heavy calcification throughout many sections of riffle and glide habitats, as noted by O'Connor (2006), was still in evidence during this survey. It is noteworthy that the single redd encountered was located in a clean, un-encrusted section of riffle.

Plate 2.14. Location of sea lamprey spawning on the River Boyne at Roughgrange, Co. Meath.

2.2.2.2 River Feale Walkover Survey

This survey was undertaken over three days (29th-31st) in July. Significant barriers to upstream migration exist in the lower reaches of the Feale, namely Scartleigh Weir 4km downstream of Listowel and the footings of a pedestrian bridge in Listowel town centre. Surveying commenced in the upper catchment near Mountcollins, Co. Limerick, where the river and its tributaries, the Caher and Clydagh, are spate in nature (Plate 2.15). Closer inspection of seemingly suitable spawning habitat often revealed a thin layer of cobbles and rocks overlying bedrock, thereby precluding deep excavation as favoured by sea lamprey during redd construction. Several significant natural rock barriers were also noted. A section of highly suitable spawning habitat with the possible remnants of an old redd was in

evidence at Poll an Earraig upstream of the Glashacooncore confluence. Additional sections of suitable habitat were noted at the Owveg confluence downstream of Wellesley Bridge.

Plate 2.15. The River Feale downstream of Mountcollins, Co. Limerick

Further downstream at Abbeyfeale a stretch of suitable habitat extends 100m either side of the Listowel Road Bridge. A possible old redd was noted 80m upstream of the bridge. From Abbeyfeale, the next convenient access point is 6.5km downstream at Duagh Bridge. Two recently excavated sea lamprey redds were observed 150m and 200m downstream respectively of this road bridge. Redd dimensions were recorded and a representative substrate sample was taken at this location. The walkover survey proceeded to the next accessible section of suitable spawning substrate, located 7.4km downstream from Duagh Bridge immediately downstream of the confluence with the Smearlagh (Plate 2.16). A single redd was noted 250m downstream of this convergence. No further redds were identified during subsequent searches of suitable habitat 4km downstream of this location in Listowel.

Plate 2.16. The River Feale at Duagh Bridge

For 2014, walkover surveying on the Feale confirmed successful passage for a number of sea lamprey over Scartleigh Weir followed by upstream migration as well as a minimum number of spawning events. The exercise was also successful in locating sections of suitable spawning habitat which can be monitored in subsequent years.

2.2.3 Sea Lamprey Telemetry

A number of unsuccessful attempts were made on the River Moy during May and June 2014 to capture and radio tag adult sea lamprey in order to follow their upstream spawning migration and to identify spawning locations (Plate 2.17). Five sets of fyke nets were deployed overnight at locations downstream of the Cathedral beat in Ballina on three occasions (May 29th, June 5th & June 16th). No migrating sea lamprey were captured during these netting exercises. Underwater searches *via* snorkelling to locate resting sea lamprey were also undertaken downstream of the Salmon Weir in the Ridge Pool section of the river, again with no success.

Plate 2.17. The Salmon Weir and Ridge Pool section of the River Moy, Ballina, Co. Mayo

2.2.4 River Lamprey Surveys

A general paucity of data exists for adult river lamprey, *L. fluviatilis*, in Irish river systems. During 2014 it was decided to concentrate monitoring activities on the River Boyne catchment, a declared SAC for this species. A consultation and briefing session was held in April with relevant IFI staff from the Eastern River Basin District. Sightings records were collated and a number of channels with spawning potential were identified. These included sections of the Mattock, Yellow, Boycetown, Knightsbrook and Tremblestown rivers. A number of these sections were visited during May and June, however no outward signs of river lamprey spawning activity were apparent.

Specially constructed traps can be a useful method for sampling adult river lamprey during their upstream spawning migration (Harvey and Cowx, 2003). It was decided to construct and deploy a

number of funnel traps in locations around the Boyne catchment in an effort to monitor the movements of river lamprey in this SAC (Plate 2.18). As a trial, six traps were constructed following the design of Morris and Maitland (1987). The traps were deployed during November and December 2014 at locations on the Mattock (n=2), Yellow (n=1) and Tremblestown (n=1) rivers as well as on the main stem Boyne at Bective Bridge (n=2), midway between Trim and Navan. Traps will be checked on a weekly basis from December 2014 to May 2015 (Plate 2.19). No river lamprey were encountered in traps during December 2014.

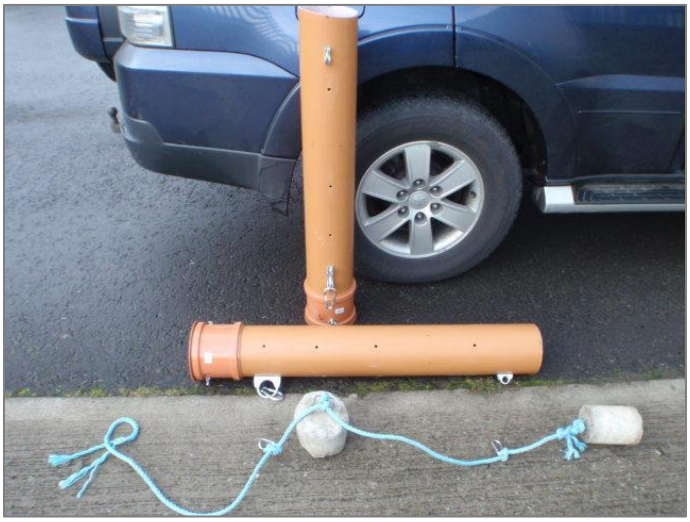

Plate 2.18. A pair of river lamprey traps prior to deployment

Plate 2.19. Retrieving a river lamprey trap from the Mattock River, Co. Meath

Newly transformed river lamprey (n=4) were captured in 3 trawls in the lower Suir at Belview Port and at the confluence in Cheekpoint and Great Island during sampling in September 2014. These four fish ranged from 136mm to 175mm in length.

3. Shad Programme

3.1 Juvenile Shad Programme

Introduction

Sampling for juvenile shad was undertaken on the larger southern estuaries during July 2014. The rivers sampled were the Barrow, Nore, Suir, Blackwater and the Slaney. Shad are known to spawn in June. Using this information sampling was planned for six to eight weeks post-spawning. This was to ensure that the shad eggs had hatched and the fish has attained a sufficient size to make correct species identifications.

Materials and Methods

Sampling was undertaken using bongo nets, from downstream of known spawning areas to the lower reaches of each estuary (Plate 3.1). The net was suspended from the bow of the boat, and the two nets fished either side of the boat. The sampling was against the tide along a depositing bank. This slacker water provides shelter for juvenile fish with limited swimming abilities at such a fragile phase in their lifecycle. A GPS location reference was recorded at the commencement of each sampling trawl. Each trawl was 10 minutes in length. In order to sample each river using the same effort, trawls were located 2 kilometres apart. Another GPS reference was recorded at the end of the trawl, at which time the contents of each bongo net were sieved and, where fish were present, retained in 70% alcohol for preservation and later identification. Using ArcView10 and the GPS reference points the length of each trawl was calculated. Using the length of each trawl, the volume of water sampled was determined:

Volume Filtered (VF) = $[(\pi * D^2)/4] * L$

- L is distance travelled
- D net diameter

The density of fish was then calculated as:

Number Shad/meter^3 = No. Shad/VF

- After Navodaru (2001)

Plate 3.1. Bongo net used to undertake juvenile fish surveys.

Results

In total 70 trawls were undertaken across 129 kilometres of river (Table 3.1). Juvenile Shad were only present at two locations, one on the River Barrow and one on the River Suir. No Shad were captured on the Rivers Nore, Slaney or Munster Blackwater.

Table 3.1. The number of trawls performed on each river during both sampling periods, Shad, 2014.

	Distance Sampled (km)	No. of Trawls	Max. length Trawl (m)	Min. length Trawl (m)	Mean length Trawl (m)	No. positive locations
Barrow	35	16	1188	300	533	1
Nore	14	7	820	381	490	0
Suir	40	21	955	350	682	1
Slaney	20	12	548	132	307	0
Munster Blackwater	20	14	545	185	341	0

The two locations where shad were identified were close to the confluence of both rivers (Figure 3.1). In previous years positive sites were more widely distributed along the length of the river sampled. Two juvenile shad were captured on the River Barrow (25 and 28mm) and three fish on the River Suir.

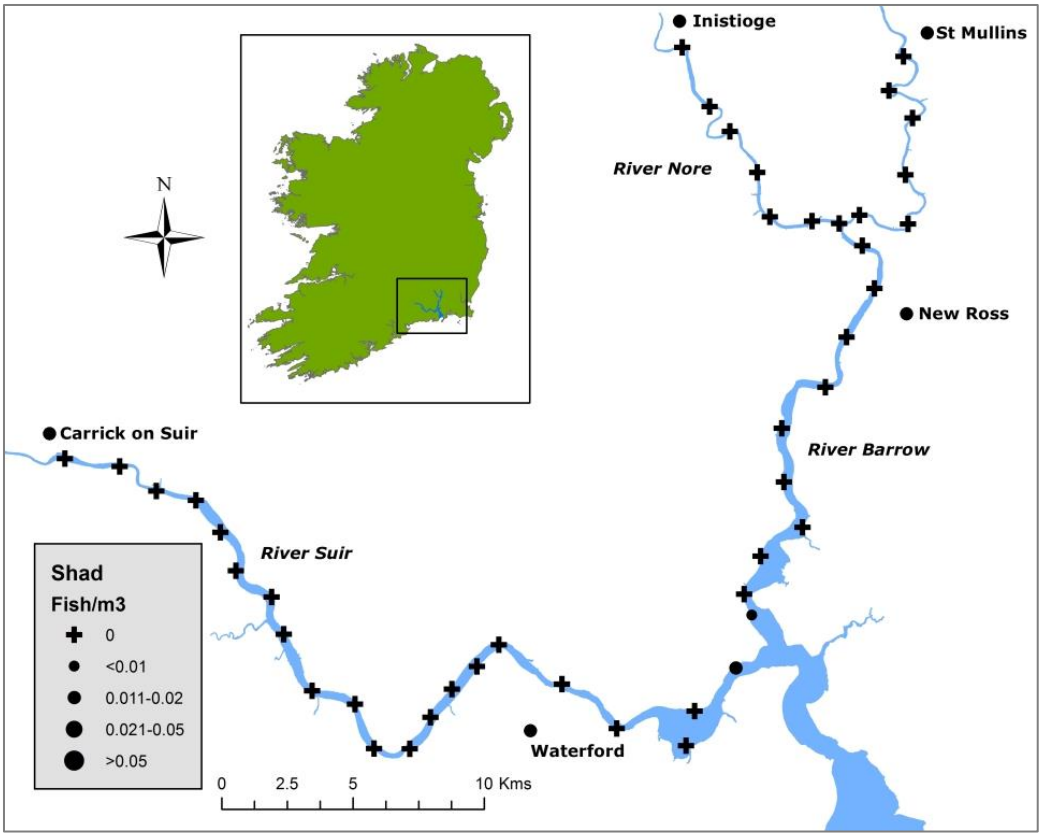

Figure 3.1. Distribution of juvenile shad on the Rivers Barrow, Nore and Suir during July 2014.

Discussion

The results obtained during the 2014 bongo netting were very poor in relation to previous sampling excursions. It may be possible that the adult shad had spawned earlier in May, thus accounting for the distribution at the lower end of the tidal reaches. However, the size of the fish were very small to indicate this. Alternatively, the spawning population of adults may have been smaller than in previous years thus accounting for the low numbers of fish recorded. In 2011, sampling was undertaken in June and July with positive results. It may be necessary in the future to commence the sampling programme in June in order to maximise results. Little is known about the movements of juvenile shad. This programme is still in its infancy, with adjustments and alterations made annually in order to gain a more comprehensive understanding of the density, distribution and growth rates of shad in this life stage.

3.2 Waterford Harbour Trawling Survey

During early September 2014 (Monday 8th - Friday 12th) a trawling survey was undertaken in Waterford Harbour to provide data for IFI's National Bass programme. Trawling was conducted by a commercial trawler and crew (Plate 3.2) with IFI staff also on board to process catches. Surveying was mainly concentrated in the lower estuarine sections of the Suir and Barrow close to their confluence and also in the upper section of Waterford Harbour between Great Island and Passage East, areas where it was hoped to encounter juvenile and adult bass. A total of 34 trawls were conducted over 5 days with 35 species of estuarine and coastal fishes recorded including smelt, shad and river lamprey.

Plate 3.2. Trawling survey along a transect in Waterford Harbour.

Shad (n=26) were encountered in three trawls (Figure 3.2) conducted in the lower Suir (King's Channel), lower Barrow (Fisherstown) and immediately downstream of the confluence at Great Island. Shad ranged in length from 61mm to 288mm (Figure 3.3).

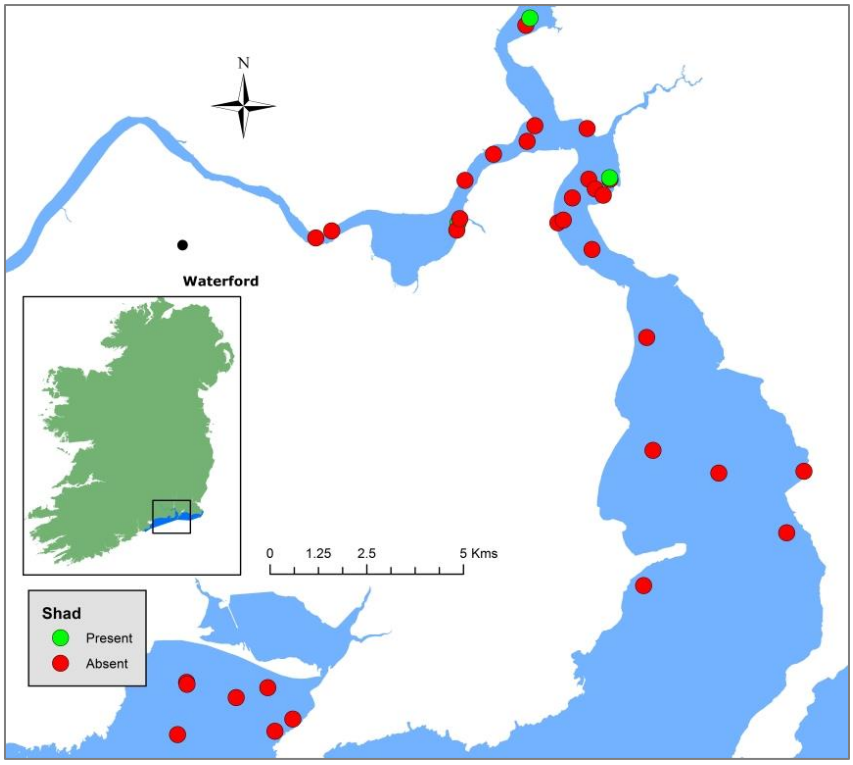

Figure 3.2. Location of survey trawls throughout Waterford Harbour and associated incidence of shad capture.

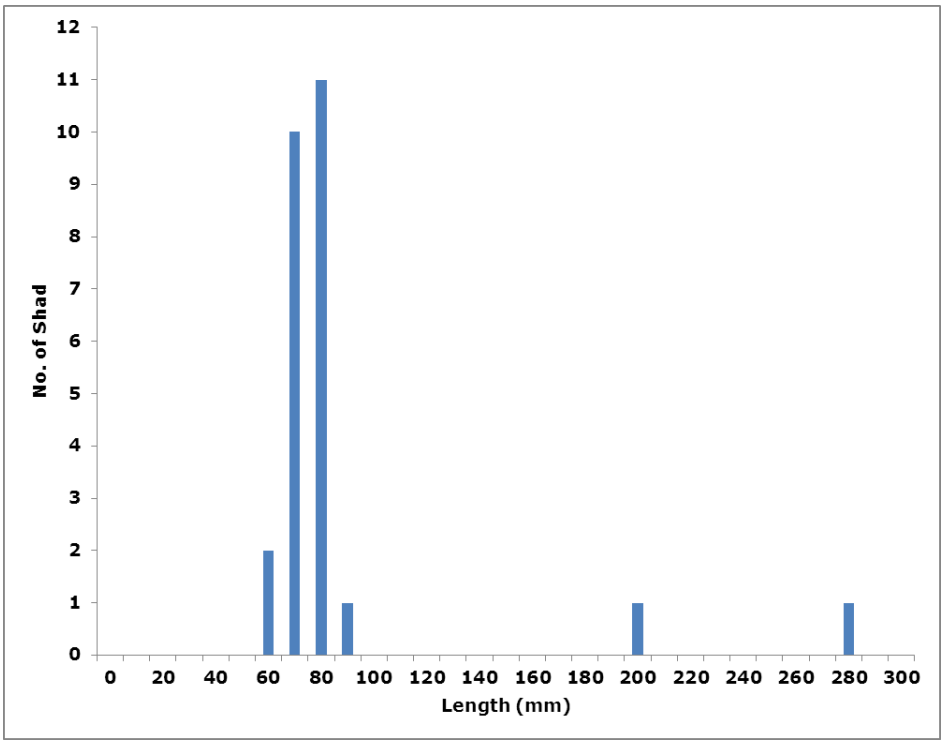

Figure 3.3. Length frequency distribution of shad (n=26) captured during trawls on Waterford Harbour.

3.3 Anadromous Shad investigations

No specific or focused scientific investigations on adult shad were undertaken in 2014. However, a number of samples of adult shad became available and valuable information was harvested from these samples.

Six fish came from Youghal Bay, off the mouth of the Munster Blackwater (MBW) estuary, a water designated as a SAC for Twaite shad, and a further four fish came from the Munster Blackwater estuary itself, taken in an a illegal net. The marine samples coming as a by-catch of commercial inshore fishing and kindly passed on to IFI. The overall collection of fish contained one Allis shad (gill raker count = 116) and nine Twaite shad (Table 3.2). What is of interest in regard to the Twaite samples is:

- Occurrence of Twaite and Allis shad in marine habitats proximal to the Munster Blackwater
- Occurrence of young Twaite shad of 18 – 22 cm taken in September within the Blackwater estuary

Table 3.2. Summary information on adult shad collected by staff of IFI Macroom in the Munster Blackwater and adjoining coastal waters during 2014.

Month	Year	Species	Location	Length cm	Weight g	Gender	Gonad maturity	Gill rakers
3	2014	Allis shad	Youghal Bay	40.3	742	M	II	116
12	2014	T.Shad	Youghal Bay	39.1	968	F	II	44
12	2014	T.Shad	Youghal Bay	43.6	1024	F	II	42
10	2014	T.Shad	Youghal Bay	43.5	1156	F	I-II	43
12	2014	T.Shad	Youghal Bay	44.7	1184	F	I-II	42
12	2014	T.Shad	Youghal Bay	41.3	1012	F	I-II	41
9	2014	T.Shad	MBW	40.5	1006	F	I	44
9	2014	T.Shad	MBW	22.5	168	F	I	39
9	2014	T.Shad	MBW	20	110	M	I	41
9	2014	T.Shad	MBW	18.2	82	F	Immature	40

The issue of by-catch of shads at sea is of considerable interest to IFI. Any large-scale marine capture of shad, as a by-catch of legal commercial fishing operations, has potential to impact adversely on the two species, Allis and Twaite shad. IFI has been operating a collegial process with BIM, Marine Institute and the Sea Fisheries Protection Authority for some years whereby port-based staff of these agencies retain samples of shad that present themselves in commercial landings. Additional information from the three marine agencies emerges from specific surveys undertaken by them for target species, where shad arise as by-catch. The agencies retain the bodies, along with information on date and location of capture, and IFI staff subsequently collect information from the bodies, including length, weight, sex, gonad condition and a sample of scales for ageing. Two samples of Allis shad were submitted by BIM's Galway office during 2014 (Table 3.3). These were taken in trawling west of the Arran Islands.

Table 3.3. Summary information on marine-caught Allis shad collected by staff of BIM Galway from commercial trawling off the Aran Islands, 2014.

Year	Species	Location	Length cm	Weight g	Gender	Gonad maturity	Gill rakers
2014	Allis shad	W. Aran Islands	27.6	268	F	I	107
2014	Allis shad	W. Aran Islands	39.8	434	M	I	101

3.4 Killarney Shad investigations

This species is unique to Lough Leane in Killarney. The shads are members of the herring family and the Killarney shad is closely related, genetically, to the anadromous Twaite shad. The Killarney shad is a shoaling species and is known to spawn in the May – June period. Fish aggregate in large shoals at night and have been reported to spawn on gravel beds adjacent to some of the islands west of Ross Castle and along the Muckross shore.

Two fish sampling events took place in Lough Leane in 2014. In May, a sampling programme focused on Killarney shad in the pelagic zone of the lake, was undertaken using hydroacoustic gear, pelagic trawling and pelagic gill nets. The May survey formed part of the investigations for a doctoral thesis, aimed at developing non-lethal methods to assess population features of pelagic fish species listed as Red data Book species and/or listed in Annex II of the Habitats Directive. The September sampling was part of the 3-year programme of lake sampling undertaken by IFI.

The May investigations were highly informative in discrete placement of pelagic gill nets and capture by these of Killarney shad in a range of sizes (Figure 3.4). In some cases the fish were taken very close to the shoreline in deep water.

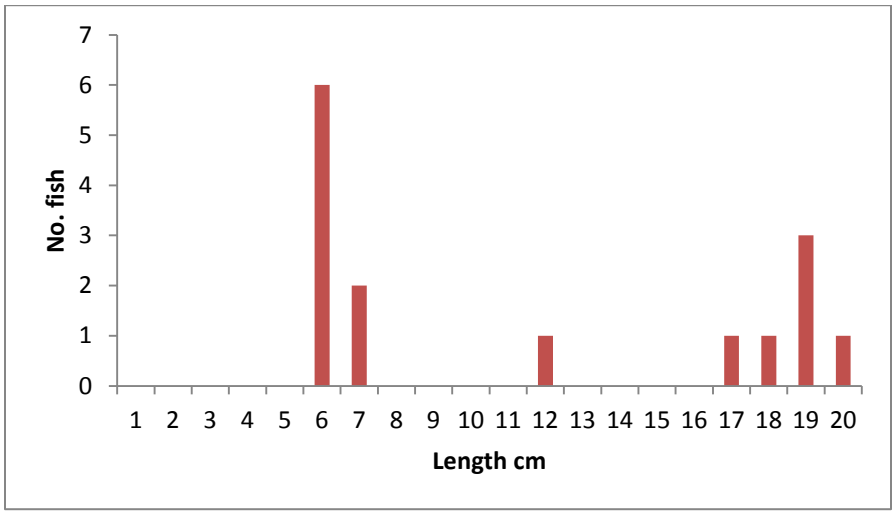

Figure 3.4. Length frequency distribution of Killarney shad captured in pelagic nets Set in Lough Leane, May 2014 (n=15).

The length frequency data point to three size or age groups captured. Scale reading of a sample of the smaller 6 – 7 cm fish indicated an age of 0+ equals 1, i.e. the fish had completed the first full year of life, with known spawning time of May – June (Figure 3.5). No 'plus' growth was present on these scales, pointing to an 'end' of growth for that birth-year. The fish in the12 cm size category was 2 years of age and the larger fish (17 – 20 cm) were 4 years of age. Some of the fish displayed evidence of small amount of 'plus' growth i.e. growth in the 2014 season.

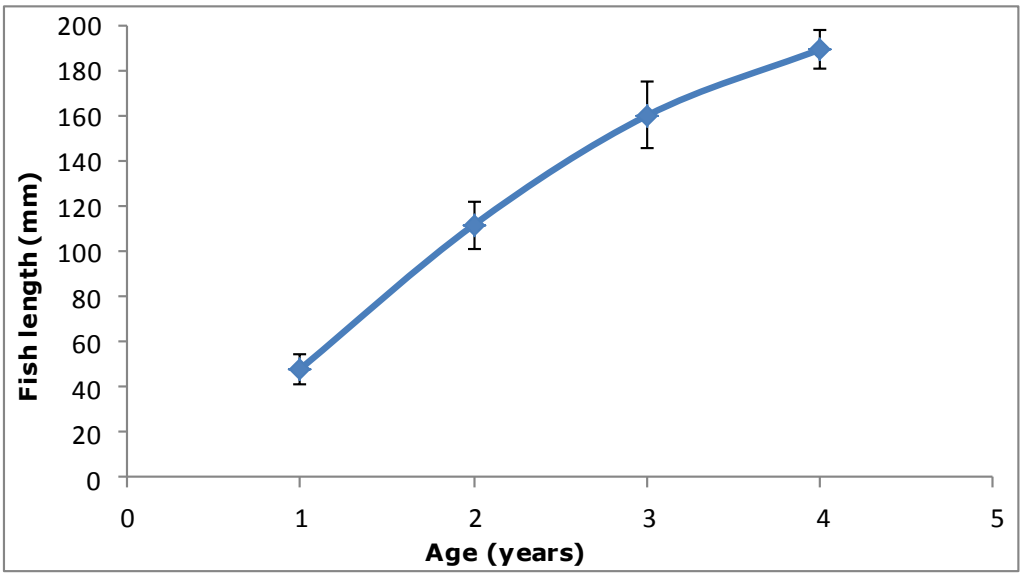

Figure 3.5. Length-at-age of Killarney shad captured in pelagic nets set in Lough Leane, May 2014 (n=15).

The gonads and gonad condition of all fish was examined to determine sex and the degree of gonad development. The smaller fish i.e. those of 6 - 7 cm were classified as immature with little development of gonad. The fish of 12.6 cm was female but its gonad condition did not indicate a likelihood of spawning in the 2014 spawning period. The six larger fish were categorized as in gonad condition range IV – VI, indicating a degree of gonad development and a likelihood of spawning. Of these six fish three were male and three were female. The Gonadosomatic Index (GSI), an indication of gonad development, in the female fish ranged from 7 – 16%. This Index value rises as gonads become more enlarged prior to spawning and values of circa 25% are common in anadromous shads at spawning time.

The gill raker counts ranged from 41 to 55.

4. Pollan Investigations

4.1 Post-larval pollan investigations (Bongo netting)

A post-larval survey of Lough Allen for juvenile pollan was undertaken between the 7th and 9th April 2014. In total 24 trawls were undertaken across the lake using the bongo netting technique. Trawls were taken in transects across the lake in order to gain as full an insight into the distribution as possible. The length of trawls varied between 383 and 1680 meters. Of the 24 trawls undertaken, juvenile fish were present in sixteen samples, widely distributed across the lake (Figure 3.1). The fish caught were very immature, some still had egg yolks attached. This proved a great difficulty in identifying the species of the fish. Ideally, sampling later in the season when the fish had developed more would be ideal. Unfortunately, having undertaken further development, the fish drop to the benthos, making sampling more problematic.

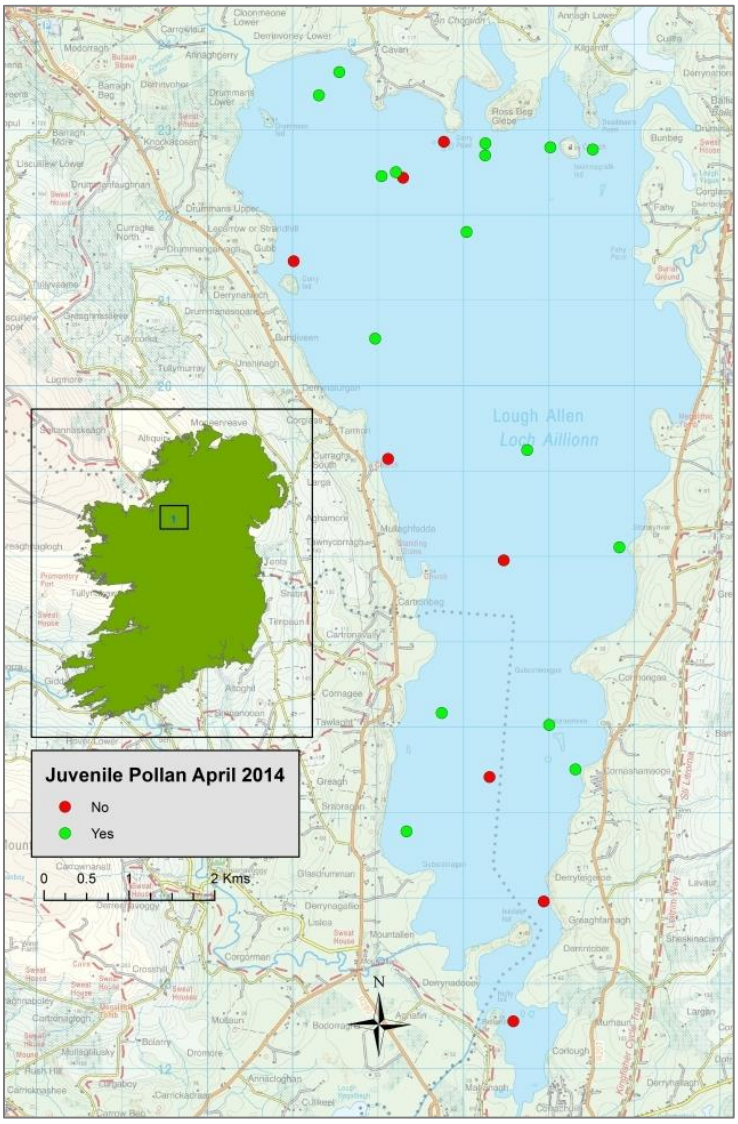

Figure 3.1. Locations of juvenile pollan on Lough Allen, Spring 2014.

4.2 Multi-species fish survey of Lough Ree

A whole-lake netting survey was undertaken in spring 2014 on Lough Ree using braided gill nets (Figure 3.2). The nets were set in gangs of seven, with mesh sizes grading up in half-inch increments of 2.5" – 5.5". Each gang measured 210 meters in length. The technique was designed to capture post-immature fish in excess of circa 15 cm fork length. The primary focus of the survey was to examine the status of brown trout. In the course of the survey a sample of pollan was captured.

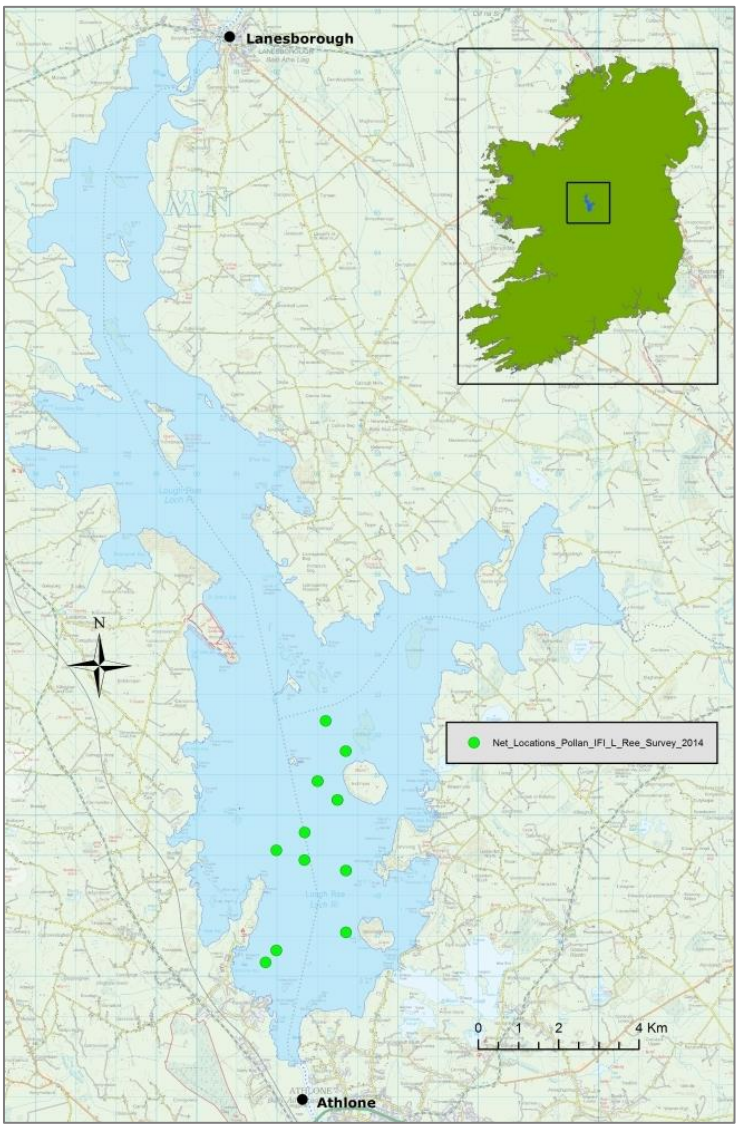

Figure 3.2. Net locations for pollan during IFI Lough Ree Survey, March 2014.

Twenty eight pollan were recorded and data was collected on each fish for length, weight, sex and gonad condition, and a set of scales for ageing (Figure 3.3 and Table 3.1). The fish sample ranged in

size from 20 – 31 cm. The fish were captured in a small number of net gangs, with several fish taken in some gangs.

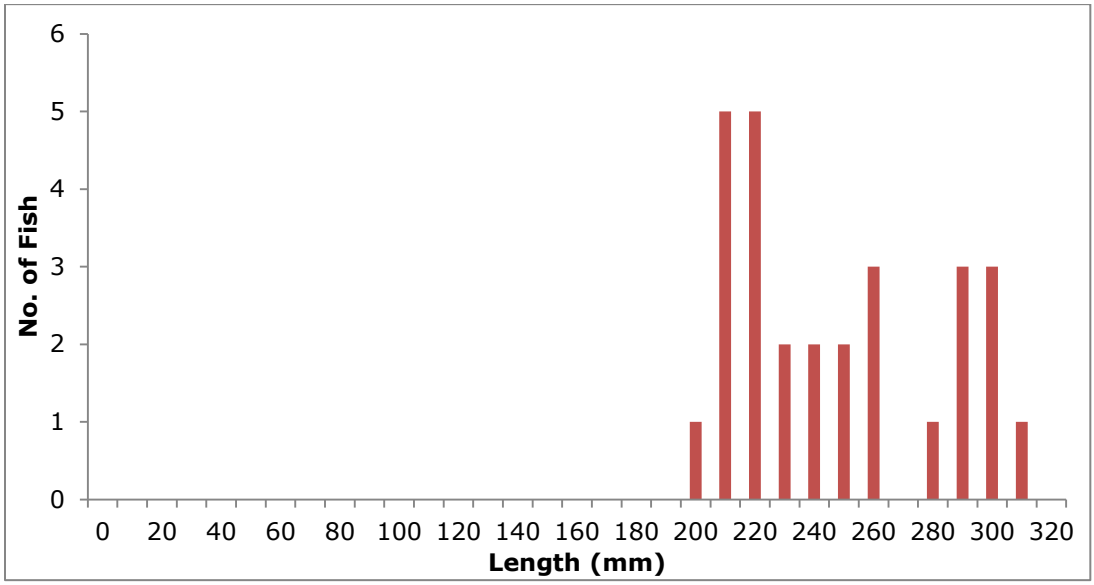

Figure 3.3. Length frequency distribution of pollan captured in netting survey of Lough Ree, Spring 2014 (n=28).

Table 3.1. Summary information on adult pollan collected in Lough Ree, spring 2014.

	Gonadosomatic Index		Gill raker count	
	Female	Male	Female	Male
Mean	0.78	0.68	38.53	38
N	16	11	15	12
Std. Dev	0.56	0.52	3.14	3.88

4.3. Investigations on adult pollan in Lough Allen

The Habitats team again linked up with the WFD team to undertake a series of focused pollan samplings in Lough Allen. A suite of sampling strategies was deployed in late June 2014, paralleling the sampling strategy for pelagic species described for Killarney shad (see Section 3.4 Killarney Shad investigations). A detailed hydroacoustic survey undertaken over one night in ideal calm conditions indicated the presence of substantial fish activity in the lake's pelagic zone. Targeted deployment of individual pelagic nets, of 3 metres depth, in specific depth zones over the following night confirmed the presence of pollan. In fact, almost all of the fish taken in the pelagic nets were pollan.

A pelagic trawl was deployed on a subsequent night and this, again, captured a sample of pollan. The

majority of pollan taken were in a size range with median values in the 16 cm range. No pollan of larger size were captured by any method. Some young-of-year pollan were captured.

On one night a series of zooplankton samples were taken by the vertical-haul method. Sampling occurred where a series of pelagic nets had been deployed at varying depths, to provide a full-depth net sampling effort from surface to lake bed. Pollan captured in the nets were analysed and, in tandem with the usual information compiled, stomachs were removed and preserved. A comparative study of stomach contents and vertical zooplankton hauls was subsequently undertaken by a Masters student from UCD.

The outcomes of the Lough Allen survey are very encouraging in regard to the population size of pollan. An issue of concern is that a wider range of sizes of pollan was observed in the hydroacoustic outputs than was taken in the gill netting surveys. The high quality of the hydroacoustic outputs means that an assessment of population size and length distribution can be generated. The estimate of population size is of particular importance in Article 17 reporting to the EU.

5. Smelt Programme

5.1 Juvenile Smelt Programme

Introduction

Sampling for juvenile smelt was undertaken on the larger southern estuaries during July 2014. The rivers sampled were the Barrow, Nore, Suir, Blackwater and the Slaney. Smelt are known to spawn in March or April. Thus, by the time sampling was undertaken, the fish were approximately three months of age.

Materials and methods

Sampling was undertaken using bongo nets, from downstream of known spawning areas to the lower reaches of the estuary (Plate 5.1). The net was suspended from the bow of the boat, and the two nets fished either side of the boat. The sampling was against the tide along a depositing bank. This slacker water provides shelter for juvenile fish with limited swimming abilities at such a fragile phase in their lifecycle. At the commencement a GPS location reference was recorded. Each trawl was 10 minutes in length. In order to sample each river using the same effort, trawls were located 2 kilometres apart. Another GPS reference was recorded at the end of the trawl, at which time the contents of each bongo net were sieved and where fish were present, retained in 70% alcohol for preservation and later identification. Using ArcView10 and the GPS reference points the length of each trawl was calculated. Using the length of each trawl, the volume of water sampled was determined:

Volume Filtered (VF) = $[(\pi * D^2)/4] * L$

- L is distance travelled
- D net diameter

The density of fish was then calculated as:

Number Smelt/meter^3 = No. Smelt/VF

- After Navodaru (2001)

Plate 5.1. Bongo net used to undertake juvenile fish surveys.

Results

In total 70 trawls were undertaken across 129 kilometres of river (Table 5.1). Juvenile Smelt were captured on the Rivers Barrow, Nore and Suir (Figure 5.1). No smelt were present in samples from the Rivers Slaney or Munster Blackwater.

Table 5.1. The number of trawls performed on each river during both sampling periods, Smelt, 2014.

	Distance Sampled (km)	No. of Trawls	Max. length Trawl (m)	Min. length Trawl (m)	Mean length Trawl (m)	Max. no. fish/ m^3	Mean no. fish/ m^3	No. positive locations
Barrow	35	16	1188	300	533	0.062	0.01	5
Nore	14	7	820	381	490	0.049	0.006	3
Suir	40	21	955	350	682	0.016	0.016	1
Slaney	20	12	548	132	307	0	0	0
Munster Blackwater	20	14	545	185	341	0	0	0

The smelt captured on the River Suir were halfway between the upper and lower tidal limit in the area of Pollrone (Figure 5.1). Inistioge was a positive site for smelt on the River Nore. The remaining positive locations on the Rivers Barrow and Nore were in the vicinity of the rivers confluence and downstream towards New Ross.

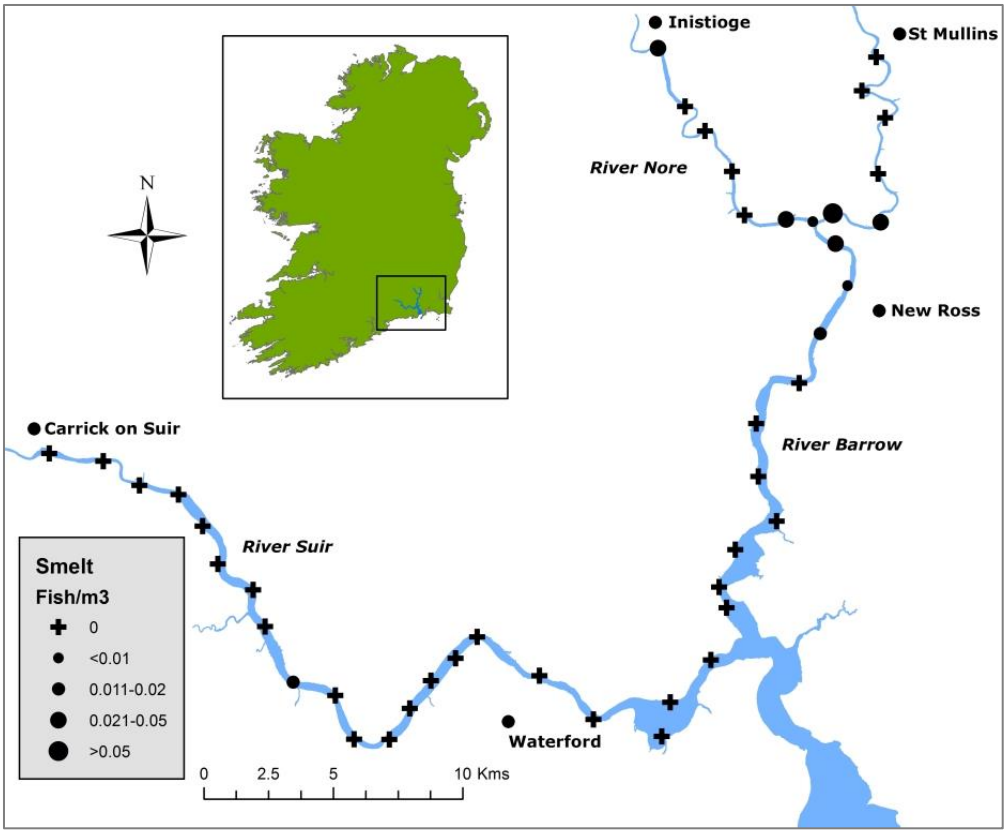

Figure 5.1. Distribution of juvenile smelt on the Rivers Barrow, Nore and Suir during July 2014.

The length of smelt varied between 23 mm (River Nore) and 59 mm (River Suir) (Figure 5.2). The majority of the fish were captured in the River Barrow, Contribution may have been made to this Barrow sample by the Nore fish downstream of the confluence of both rivers.

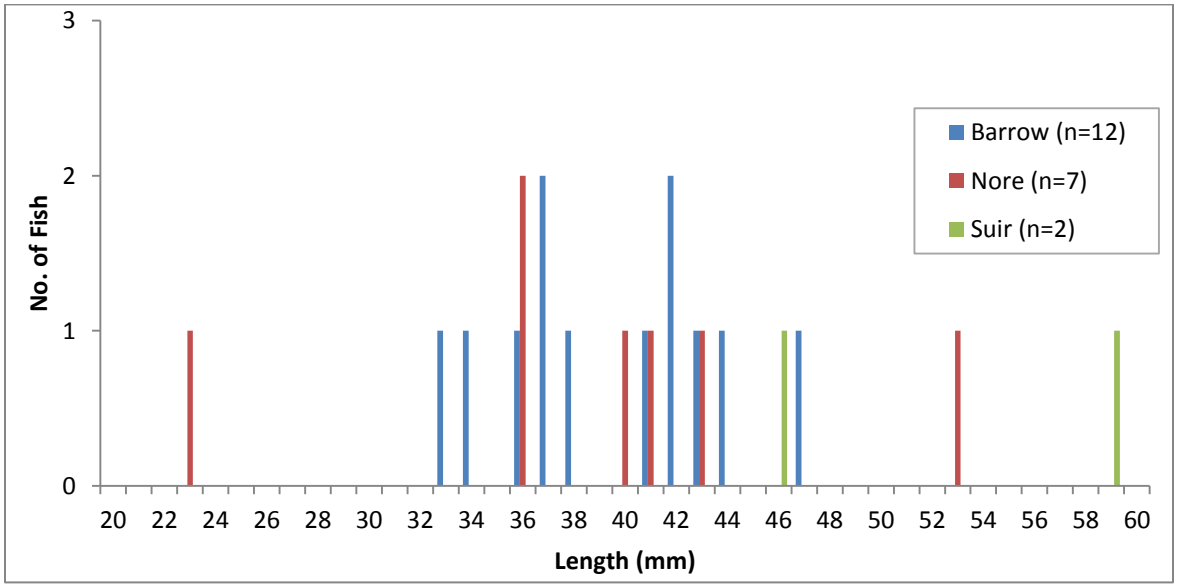

Figure 5.2. length frequency of juvenile smelt on the Rivers Barrow, Nore and Suir, July 2014.

Discussion

The numbers of smelt captured on the Rivers Barrow, Nore and Suir were low. The results revealed a large variation in the length of fish suggesting a number of spawning events. This was further evident by the fish caught close to Inistioge, the spawning area for smelt. It would be assumed that in July, a fish born in March/April would have migrated further downstream than Inistioge. In future greater numbers may be sampled if the survey work is undertaking closer to spawning time. Future sampling would also include replicate sampling at positive locations.

5.2 Waterford Harbour Trawling Survey

As mentioned in a previous section, a trawling survey undertaken in Waterford Harbour during September 2014 to provide data for IFI's National Bass programme (Plate 5.2) encountered a range of species, including smelt.

Plate 5.2. Emptying the contents of a trawl within Waterford Harbour.

Smelt (n=186) were present in 16 trawls (Figure 5.3) covering the lower Suir at Waterford City, King's Channel, Belview Port and Cheekpoint, the lower Barrow at Fisherstown and Waterford Harbour from Great Island to Passage East. Smelt ranged in length from 10mm to 260mm (Figure 5.4).

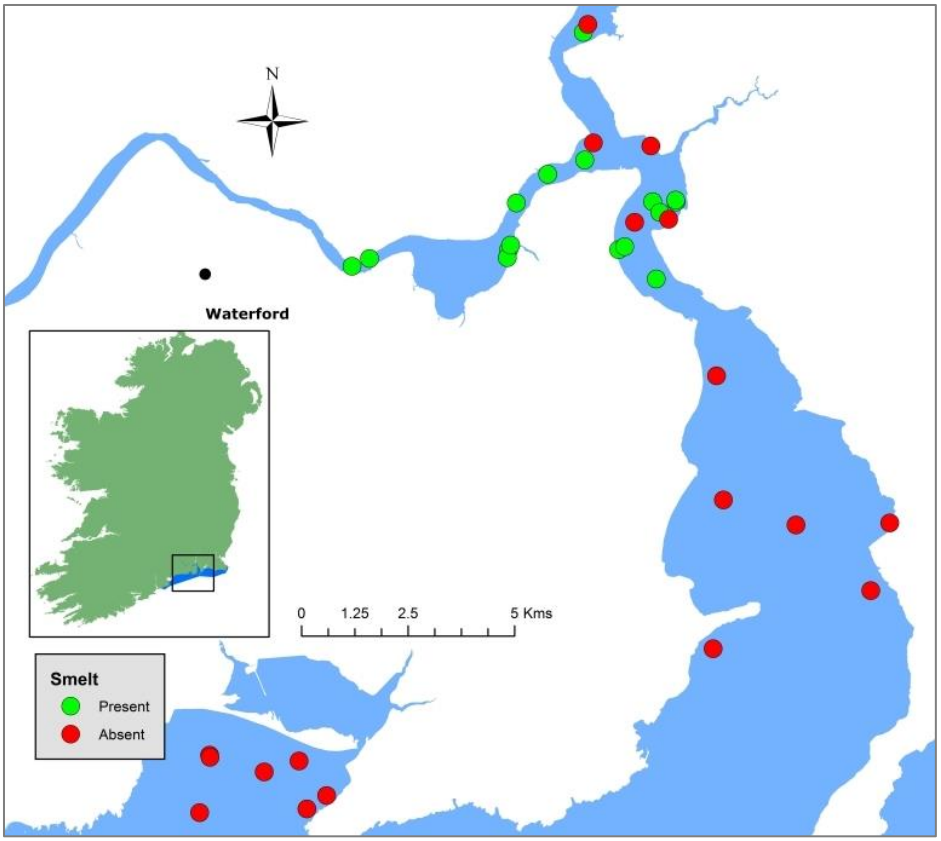

Figure 5.3. Location of survey trawls throughout Waterford Harbour and associated incidence of smelt capture.

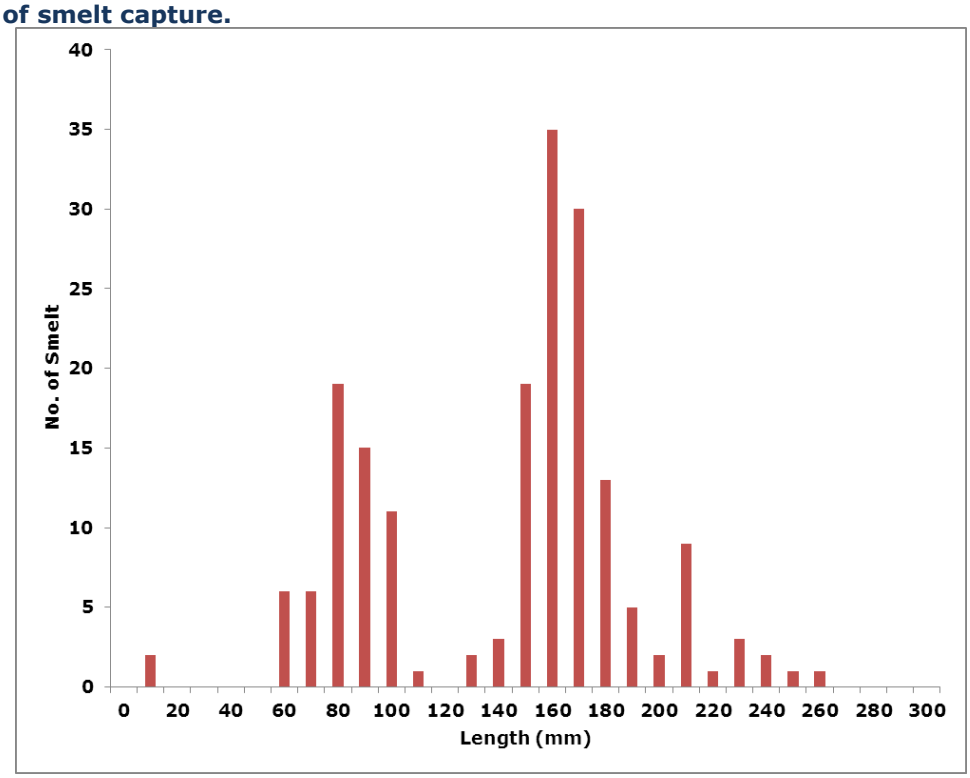

Figure 5.4. Length frequency distribution of smelt (n=186) captured during trawls on Waterford Harbour.

6. Char Programme

6.1 Introduction

In order to expand the existing knowledge and gain an up to date picture of char populations, the Habitats Directive team undertake sampling on a number of lakes every year. In 2014, four lakes were surveyed in order to ascertain the status of Arctic char populations. Two of the lakes, Loughs Derryclare and Athry were in Co. Galway and the others, Loughs Derriana and Iskanamacteery, were located in Co. Kerry. Prior to the surveys little was known on the status of Arctic char in these lakes. Historical information from Went (1945) was the most recent available for Loughs Derryclare and Iskanamacteery (Igoe 2003). Anglers occasionally encountered Arctic char on Lough Athry (Igoe 2003). No records of Arctic char were known for Lough Derriana.

All of the lakes surveyed were within designated SACs. Loughs Derryclare and Athry are within The Twelve Bens/Garraun Complex (Figure 6.1 and Table 6.1). This is an SAC for a number of species including freshwater pearl mussel, salmon and otter. Loughs Derriana and Iskanamacteery are within The Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment. This is an SAC for a number of plant and animal species including the three lamprey species, Killarney shad, salmon and otter (Figure 6.1 and Table 6.1). The SACs also includes a number of habitat types. Both SACs are considered Oligotrophic waters containing very few minerals of sandy plains. The Killarney National Park SAC is also designated for Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojunaete habitat type. Lakes which are located within these habitat types are ideal to support char populations due to their lack of pollution and low nutrient levels.

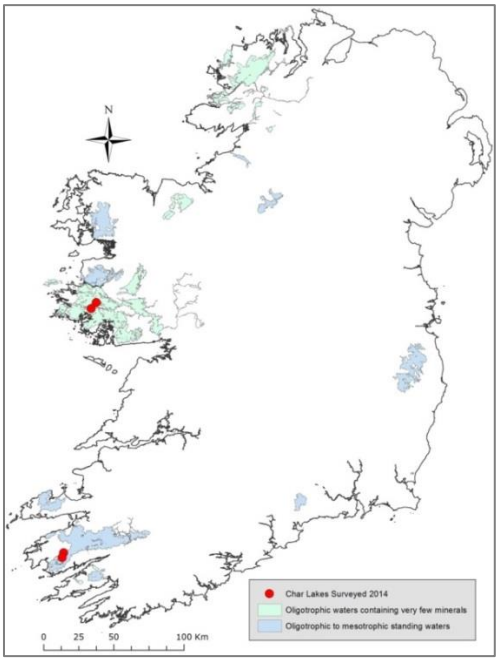

Figure 6.1. Map outlining locations of lakes surveyed during 2014.

6.2 Materials and Methods

Lake surveys were undertaken using CEN Standard Guidelines for lake monitoring. Using the area and maximum depth of the lake the number of nets in the differing depth zones was calculated (Table 6.1). Prior to each survey a bathymetric survey was undertaken in order map the depth of the lakes. Using this information, a model of the lake was created. This yielded the different contours identifying the differing depth zones. A numbered grid was placed over the lake. Using this information, random net locations were chosen in the different depth zones. Three different types of nets were used, these were fyke nets, benthic monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets and surface floating monofilament multi-mesh (12 panel, 5-55mm mesh size) CEN standard survey gill nets (Table 6.2). The random net locations were uploaded to a handheld GPS (Global Positioning System). This GPS was used on site to determine where the nets were deployed. The lake depth was measured at the beginning and end of each net in order to position them in the correct depth zone. Nets were deployed in random directions in relation to the shoreline.

Table 6.1. Physical characteristics of the individual lakes, 2014.

	Lough Derryclare	Lough Athry	Lough Derriana	Lough Iskanamacteery
Area (hectares)	223	33	239	23
Maximum Depth (m)	20	24	37	63
SAC	3110	3110	3110&3130	3110&3130
Conductivity (µS)	82.2	93.7	78.9	93.7
Temperature (ºC)	13.2	16.6	17.7	16.6

3110 - Oligotrophic waters containing very few minerals of sandy plains.
3130 - Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Iso-to-Nanojuncete

Table 6.2. Number and type of nets deployed in different depth zones.

Net Type	Depth (m)	Lough Derryclare	Lough Athry	Lough Derriana	Lough Iskanamacteery
Benthic Nets	0-2.9	4	2	4	2
	3-5.9	4	2	4	2
	6-11.9	4	2	5	3
	12-19.9	4	2	4	3
	20-34.9	-	-	4	3
	35-49.9	-	-	-	2
Surface Nets		4	2	4	2
Fyke Nets		6	3	6	3
Total		**26**	**13**	**31**	**20**

As the nets were retrieved, any fish which were alive were measured; a few scales collected and the fish were released. The remaining fish were removed from the nets and the fish from each net retained in a labelled bag, individual to each net. These fish were frozen until such time that they were dissected. During the dissection process the species, length, weight, scales, sex, maturity and stomach contents were collected. Scales were used to determine the age of the fish.

6.3 Results

In total six species of fish were recorded across the four lakes (Table 6.3). Brown trout and eel were present in all lakes. Arctic char was absent from Lough Derryclare but present in the other three lakes sampled.

Table 6.3. Number and species of fish captured in different nets and depth zones.

	Net Type	Lough Derryclare	Lough Athry	Lough Derriana	Lough Iskanamacteery
Brown Trout	**Benthic Nets**	91	62	106	100
Salmo trutta	**Surface Nets**	6	2	4	2
	Fyke Nets	2	1		1
Sea trout	**Benthic Nets**			1	
Salmo trutta	**Surface Nets**				
	Fyke Nets				
Arctic Char	**Benthic Nets**		9	16	63
Salvelinus	**Surface Nets**		1		
alpinus	**Fyke Nets**				1
Minnow	**Benthic Nets**	31	21		
Phoxinus	**Surface Nets**				
phoxinus	**Fyke Nets**	2			
3-Spine Stickleback	**Benthic Nets**	8		1	
Gasterosteus	**Surface Nets**				
aculeatus	**Fyke Nets**	2			
European eel	**Benthic Nets**				
Anguilla	**Surface Nets**				
anguilla	**Fyke Nets**	20	1	4	9

6.3.1 Lough Derryclare

Lough Derryclare is located within the Ballynahinch catchment in Connemara, Co. Galway (Plate 6.1). No comprehensive sampling survey had been undertaken prior to this investigation. Lough Derryclare was sampled over two nights between the 20 and 22nd May 2014.

Plate 6.1. Lough Derryclare with the famous Connemara tourist location, Pine Island in the background, May 2014.

Based on the bathymetric survey twenty six nets were deployed at predetermined locations (Figure 6.2).

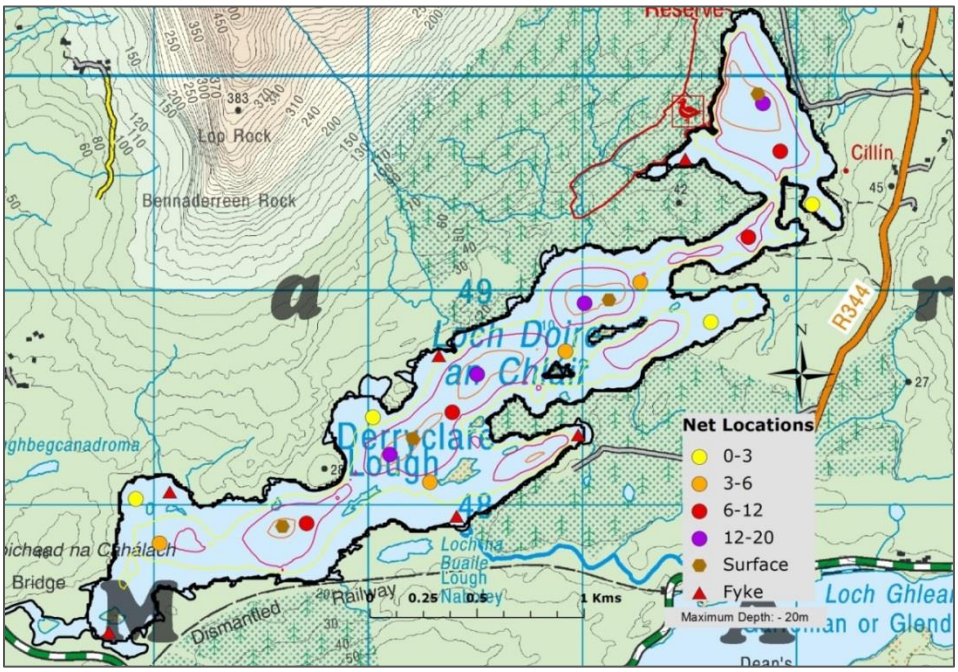

Figure 6.2. Map displaying net locations for Lough Derryclare.

Four species of fish were captured during the survey; these were brown trout, minnow, three spined stickleback and eel. Brown trout was the dominant species, comprising 61% of the fish population (Table 6.4). Minnow were the second most common species, followed by eel and stickleback. No char were identified during the survey.

Table 6.4. Number of each fish species captured by each gear type during the survey on Lough Derryclare, May 2014.

Net Type	**Depth (m)**	Brown trout *Salmo trutta*	Minnow *Phoxinus phoxinus*	3-Spine Stickleback *Gasterosteus aculeatus*	European eel *Anguilla anguilla*
Benthic Nets	0-2.9	32	17	5	
	3-5.9	35	8	2	
	6-11.9	18	6		
	12-19.9	6		1	
Surface Nets		6			
Fyke Nets		2	2	2	20
Total		**99**	**33**	**10**	**20**

The length of brown trout caught varied between 9.9 and 36.5 centimetres (Figure 6.3). The smaller age classes indicated recent recruitment has occurred, conversely, the larger fish represented those fish which will be ready to spawn over the coming winter. Based on scale reading analysis the brown trout were estimated to be between 'young of the year' and 7 to 8 years of age. The length of eels surveyed varied between 28 and 61 centimetres.

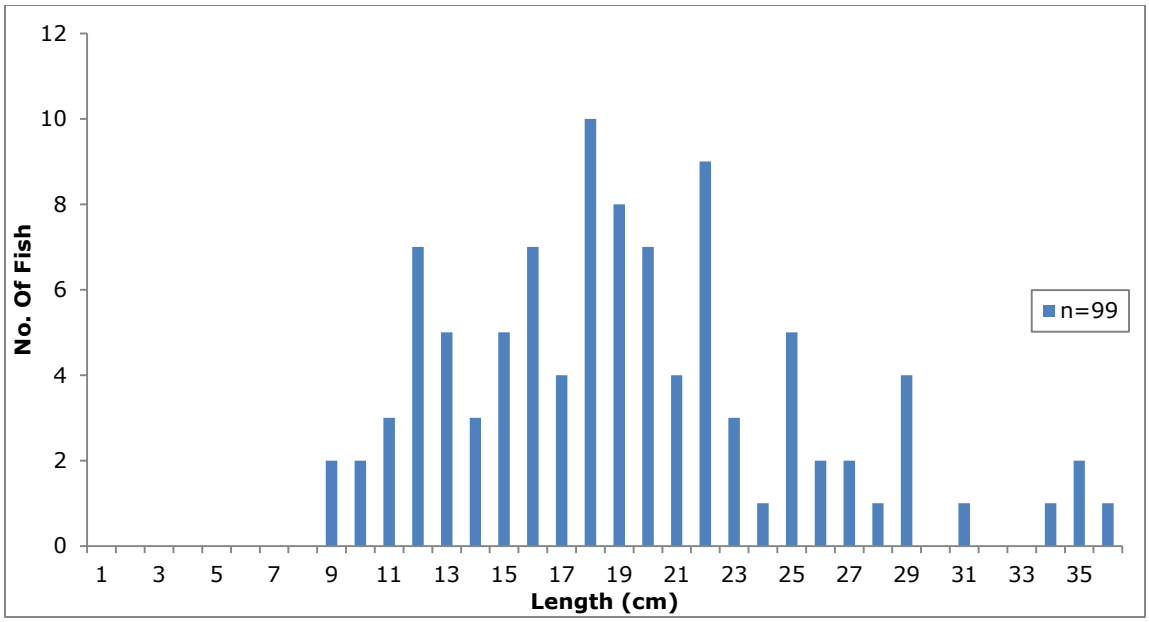

Figure 6.3. Length frequency of brown trout, Lough Derryclare, May 2014.

Lough Inagh is approximately 1 kilometre upstream of Lough Derryclare. Char are regularly caught on rod on line by anglers in Lough Inagh. It was unusual no char were recorded during the survey of Lough Derryclare given its proximity to Lough Inagh. The population of brown trout would be deemed healthy with all sizes classes represented and good numbers of fish recorded. This is the first comprehensive study of Lough Derryclare so there is no previous data to compare the current stock assessment with.

6.3.2 Lough Athry

Lough Athry is located in the Ballynahinch catchment in Connemara, Co. Galway (Plate 6.2). No comprehensive sampling survey had been undertaken prior to this investigation. Lough Athry was sampled on the night 28th May, 2014.

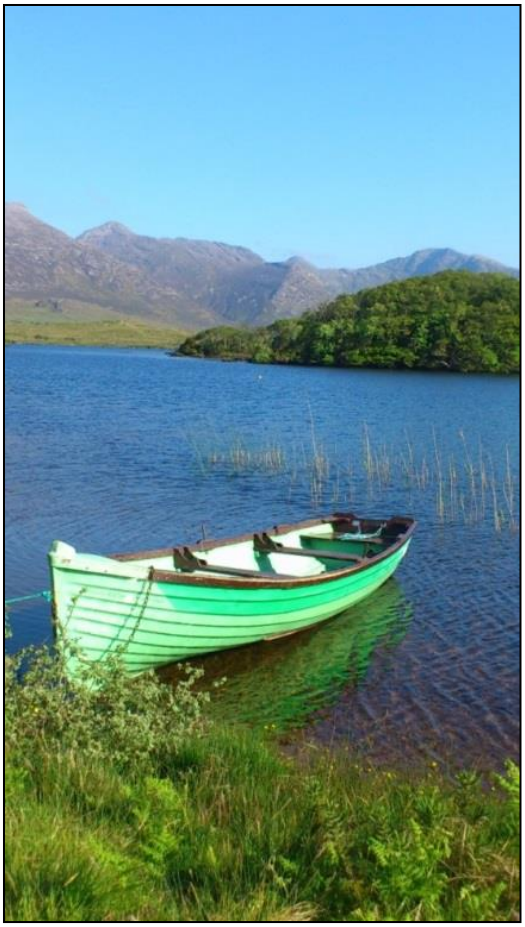

Plate 6.2. Lough Athry, May 2014.

Based on the bathymetric survey sixteen nets were deployed at predetermined locations (Figure 6.4).

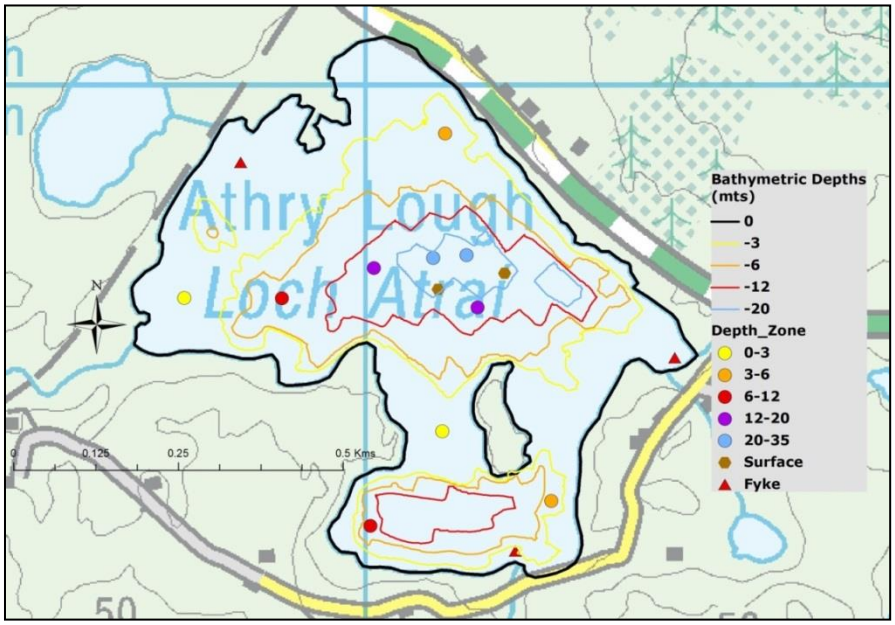

Figure 6.4. Map displaying net locations for Lough Athry, May 2014.

Four species of fish were recorded in Lough Athry, brown trout, arctic char, minnow and eel (Table 6.5). In total 98 fish were captured during the survey. The dominant species was brown trout, followed by minnow. This is the first time the lake has been comprehensively surveyed so there is no previous date to compare fish stock populations with.

Table 6.5. Number of each fish species captured by each gear type during the survey on Lough Athry, May 2014.

Net Type	Depth (m)	Brown trout *Salmo trutta*	Arctic Char *Salvelinus alpinus*	Minnow *Phoxinus phoxinus*	European eel *Anguilla anguilla*
Benthic Nets	0-2.9	26	4	17	
	3-5.9	27	1	2	
	6-11.9	9	4	2	
	12-19.9				
Surface Nets		2	1		
Fyke Nets		2			1
Total		**66**	**10**	**21**	**1**

A total of 66 brown trout were captured during the survey period, the length of fish recorded varied between 8.4 and 28.8 centimetres (Figure 6.5). The sample comprised of 10 char, these varied in length between 8.1 and 20.1 centimetres (Figure 6.5). From the variation in lengths of both brown trout and char, the younger fish demonstrate recent recruitment as displayed in the smaller size classes. The larger fish in the sample were mature and at a stage where they would be ripe for spawning in the coming season.

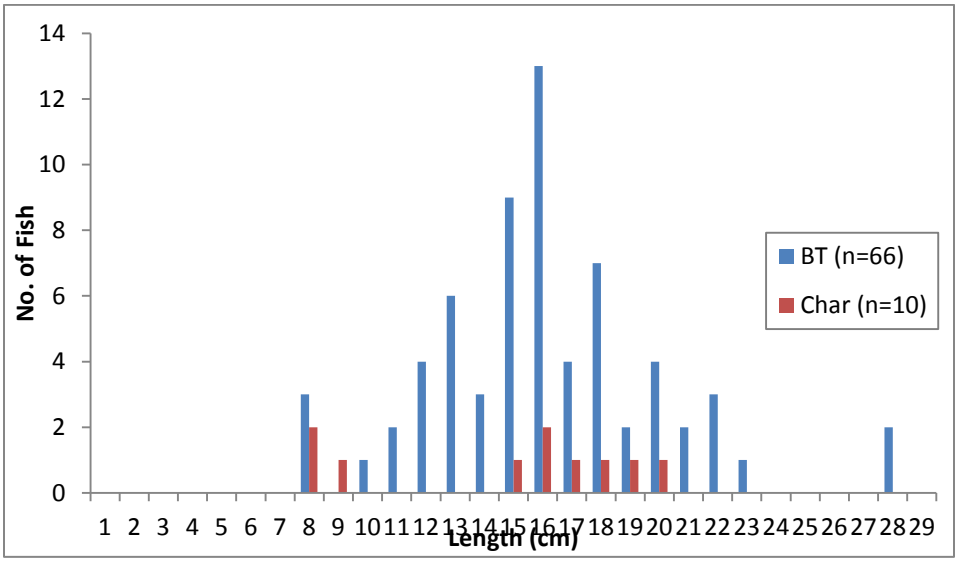

Figure 6.5. Length frequency of brown trout and Arctic char, Lough Athry, May 2014.

The population of brown trout recorded on the lake was assessed as good. However, the population of char, although the length frequency distribution displayed a number of different size classes, the numbers captured were low. The char represented 10% of the total fish recorded during the survey in

comparison to trout representing 61% of the population. Although it is good to see there is still a char population in the lake, the numbers present should not decrease any further.

6.3.3 Lough Derriana

Lough Derriana is located in the Cummeragh catchment in County Kerry (Plate 6.3). No comprehensive sampling survey had been undertaken prior to this investigation. Lough Derriana was sampled over two nights between the 7 and 9th July 2014.

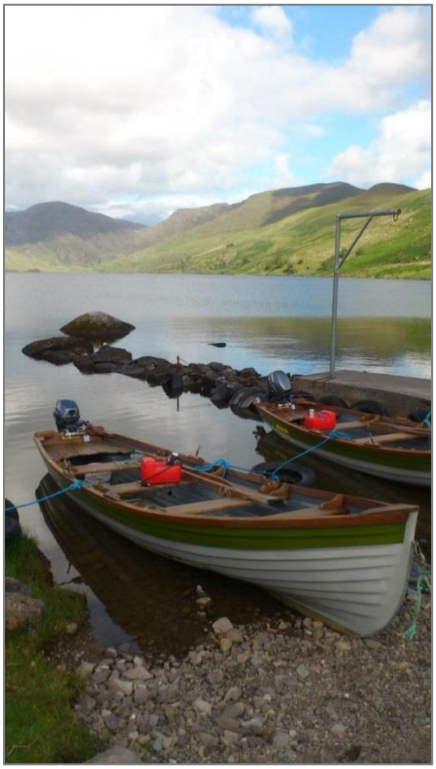

Plate 6.3. Lough Derriana, July 2014.

Based on the bathymetric survey thirty one nets were deployed at predetermined locations (Figure 6.6).

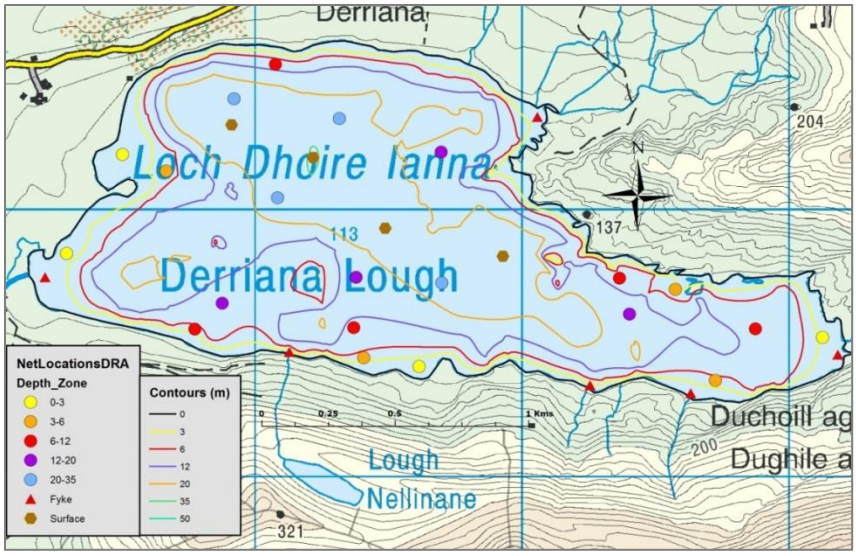

Figure 6.6. Map displaying net locations for Lough Derriana, July 2014.

In total four species of fish were recorded on Lough Derriana during the survey (Table 6.6). Brown trout was the dominant species comprising 78% of the fish population surveyed. Char was the second most dominant species, followed by eel.

Table 6.6. Number of each fish species captured by each gear type during the survey on Lough Derriana, July 2014.

Net Type	**Depth (m)**	Brown trout *Salmo trutta*	Sea trout *Salmo trutta*	Arctic Char *Salvelinus alpinus*	3-Spine Stickleback *Gasterosteus aculeatus*	European eel *Anguilla anguilla*
Benthic Nets	0-2.9	43	1			
	3-5.9	32				
	6-11.9	18		1		
	12-19.9	10		8		
	20-34.9	3		7	1	
Surface Nets		4				
Fyke Nets						4
Total		**110**	**1**	**16**	**1**	**4**

The length of brown trout encountered during the survey varied between 10.5 and 46.8 centimetres (Figure 6.7). The fish in the smaller size category are a little too large to be considered 'young of the year'. Based on scale analysis the fish were deemed to be between one and seven years old. These larger fish represent mature adults which would be ready to spawn in the coming season. One sea trout was captured during the sampling, measuring 31.2 centimetres.

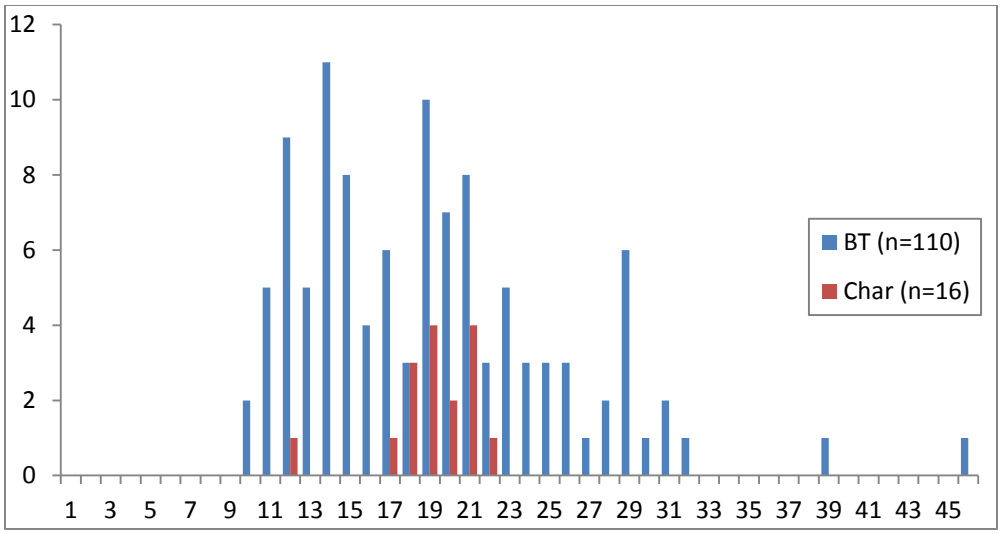

Figure 6.7. Length frequency of brown trout and Arctic char, Lough Derriana, July 2014.

The length of char captured during the survey varied between 12 and 22.9 centimetres (Figure 6.7). Once again those in the smaller size class are too large to be considered 'young of the year'. From scale analysis the fish were deemed to be between two and three years old. From dissection information many of the fish were ripe, thus displaying the ability to reproduce in the coming season.

As no previous survey had been undertaken to investigate the fish population of Lough Derriana these was no previous data to compare the fish stock assessment with. There is no reference to Lough Derriana in the review of Irish char (Igoe 2003). The Arctic char identified during this survey are considered the first record of char in this lake.

6.3.4 Lough Iskanamacteery

Lough Iskanmacteery or Loch na hEisce as it is also known is located in the Cummeragh catchment in County Kerry (Plate 6.4). Lough Iskanamacteery was sampled over two nights between the 9 and 11th July 2014.

Plate 6.4. Lough Iskanamacteery, July 2014.

Based on the bathymetric survey twenty nets were deployed at predetermined locations (Figure 6.8).

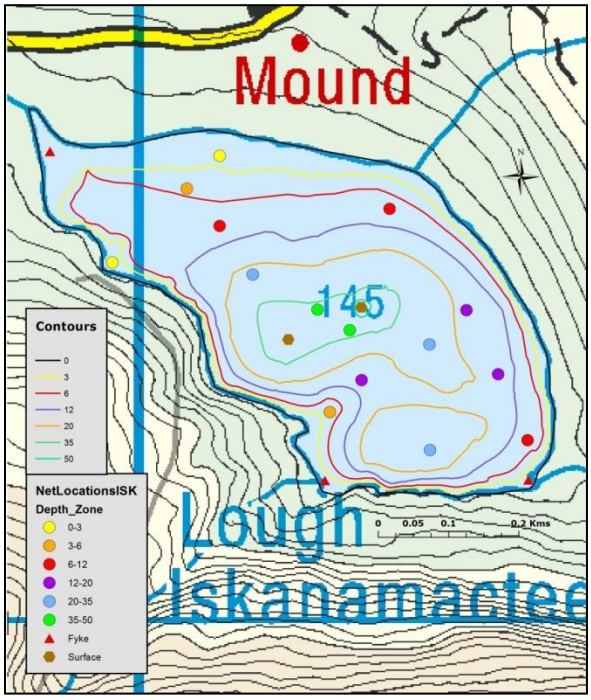

Figure 6.8. Map displaying net locations for Lough Iskanamacteery, July 2014.

Three species of fish were identified during the survey, these were brown trout, arctic char and eel (Table 6.7). Brown trout were the dominant species comprising 59% of the sample, followed by char consisting of 36% of the fish population.

Table 6.7. Number of each fish species captured by each gear type during the survey on Lough Iskanamacteery, July 2014.

Net Type	Depth (m)	Brown trout *Salmo trutta*	Arctic Char *Salvelinus alpinus*	European eel *Anguilla anguilla*
Benthic Nets	0-2.9	35	1	
	3-5.9	24	9	
	6-11.9	14	20	
	12-19.9	26	17	
	20-34.9	1	5	
	35-49.9		11	
Surface Nets		2	1	
Fyke Nets		1		9
Total		**103**	**64**	**9**

The length of brown trout captured varied between 9.5 and 36.1 centimetres (Figure 6.9). The fish in the smaller size categories are too larger to be 'young of the year' but estimated to be a year old from their scales. From the number of fish captured during the survey and the span of different sized fish, the trout population would appear healthy with ongoing recruitment.

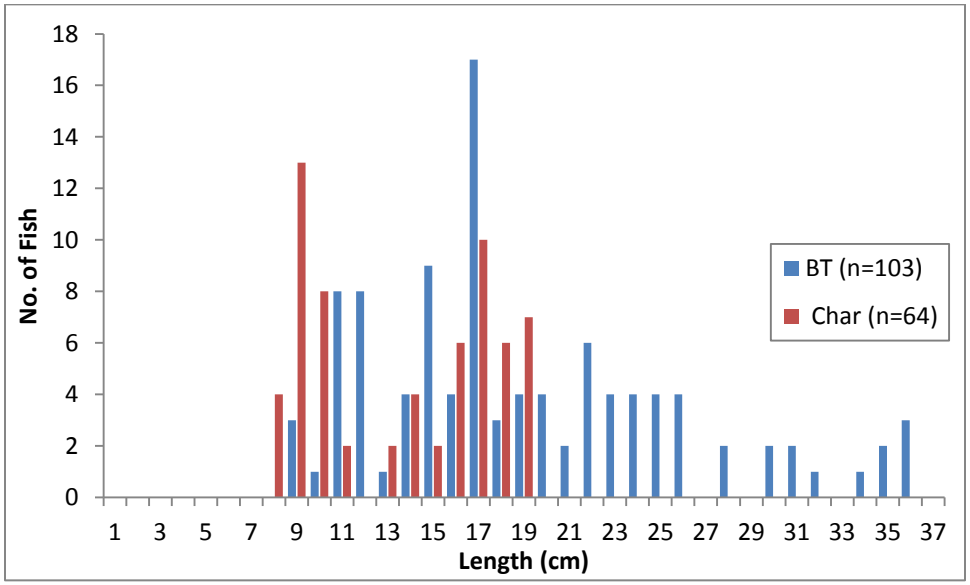

Figure 6.9. Length frequency of brown trout and Arctic char, Lough Iskanamacteery, July 2014.

The length of arctic char captured varied between 8.3 and 19.5 centimetres (Figure 6.9). Based on scale reading information the fish were categorised as aged between 'young of the year' and two years old. From dissection information it was deemed that the larger fish were maturing in preparation for the oncoming spawning season over winter.

As no previous survey had been undertaken to investigate the fish population of Lough Iskanmacteery no comparisons could be made on the fish populations or structure.

Utilising information collected from the fish sampled across the four lakes, comparisons were made on the length versus weight, the growth rates and the ratio of males to females. Using aging from scales collected brown trout, the age of fish was determined (Table 6.8 and Figure 6.10). Using this information differences in the growth rates between the four lakes could be identified.

Table 6.8. Mean lengths at age of brown trout in for lakes surveyed during May and July 2014.

	1	2	3	4	5	6	7	8
Derryclare	6.33 (n=48)	10.62 (n=43)	15.83 (n=31)	19.65 (n=18)	24.17 (n=8)	28.18 (n=5)	31.28 (n=2)	33.74 (n=1)
Athry	5.77 (n=18)	10.70 (n=18)	15.46 (n=15)	19.79 (n=6)	22.94 (n=1)			
Derriana	6.82 (n=39)	12.7 (n=32)	19.28 (n=21)	23.87 (n=12)	28.39 (n=3)			
Iskanamacteery	6.68 (n=34)	12.7 (n=23)	20.19 (n=10)	25.36 (n=3)	29.77 (n=2)			

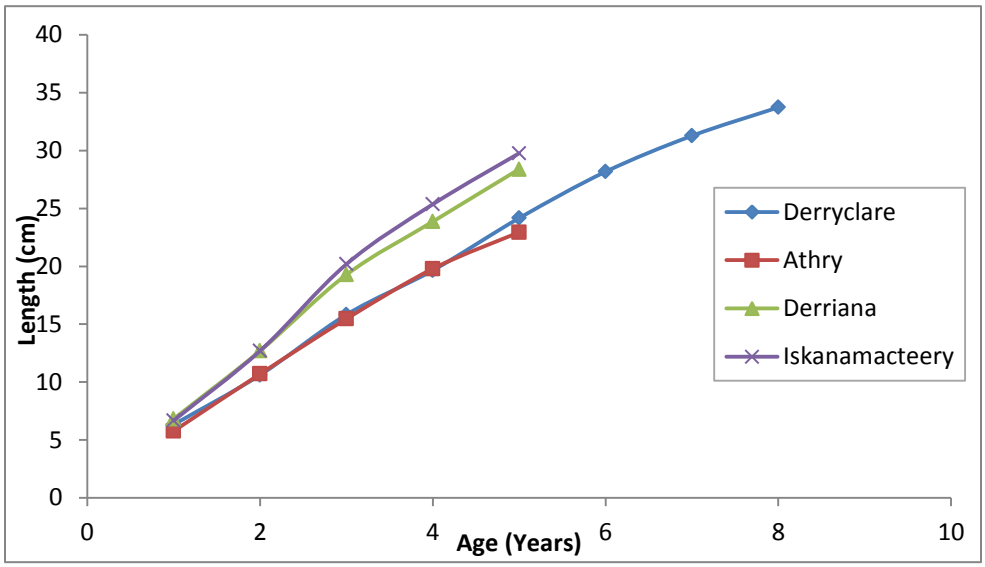

Figure 6.10. Mean lengths at age of brown trout in for lakes surveyed during May and July 2014.

Using the same techniques, the age of Arctic char was determined. This allowed growth rates to be estimated in order to compare the three lakes in which Arctic char were captured (Figure 6.11 and Table 6.9).

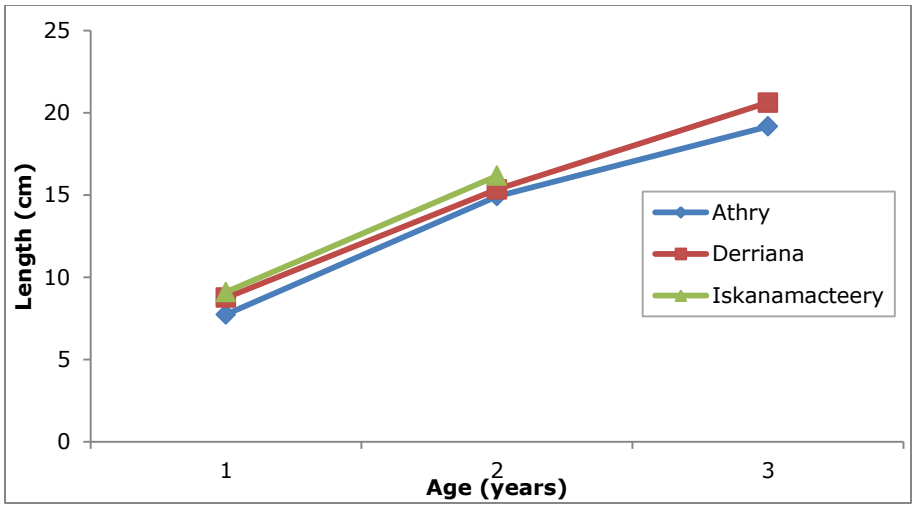

Figure 6.11. Mean lengths at age of Arctic char in for lakes surveyed during May and July 2014.

Table 6.9. Mean lengths at age of Arctic char in for lakes surveyed during May and July 2014.

	1	2	3
Athry	7.74 (n=10)	14.92 (n=7)	19.17 (n=2)
Derriana	8.76 (n=10)	15.34 (n=9)	20.61 (n=5)
Iskanamacteery	9.10 (n=18)	16.17 (n=9)	

The length versus weight was also compared for brown trout across the four lakes sampled (Figure 6.12). Up to approximately 25 centimetres, the ratio of length to weight is similar. Bigger fish were captured on Lough Iskanamacteery than in the other lakes.

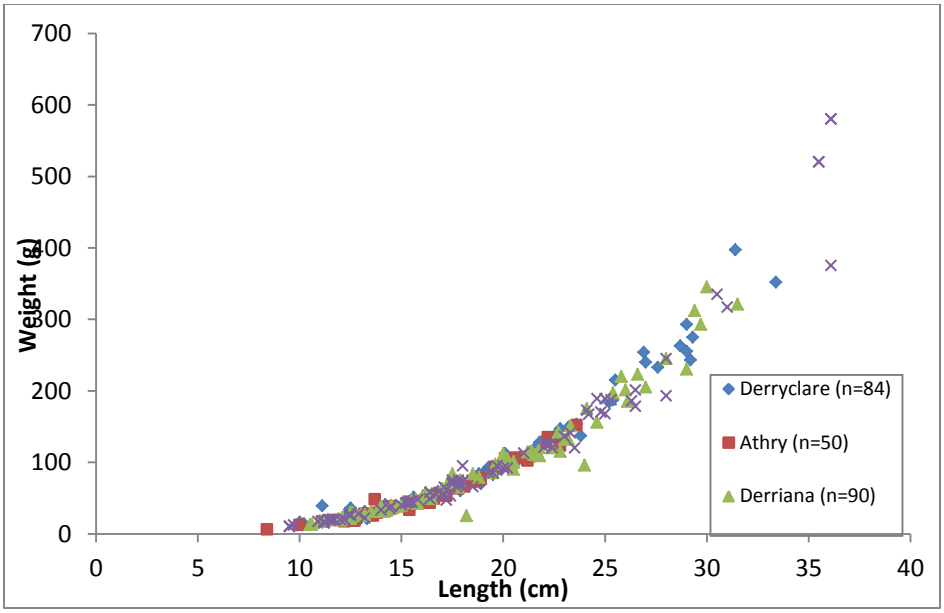

Figure 6.12. Length versus weight for brown trout in lakes surveyed during May and July 2014.

The length versus weight for Arctic char was examined (Figure 6.13). Similar relationships between length and weight were observed on Loughs Athry and Iskanamacteery. However, on Lough Derriana there was no relationship between the length and weight with differences observed between the weights of fish at similar sizes.

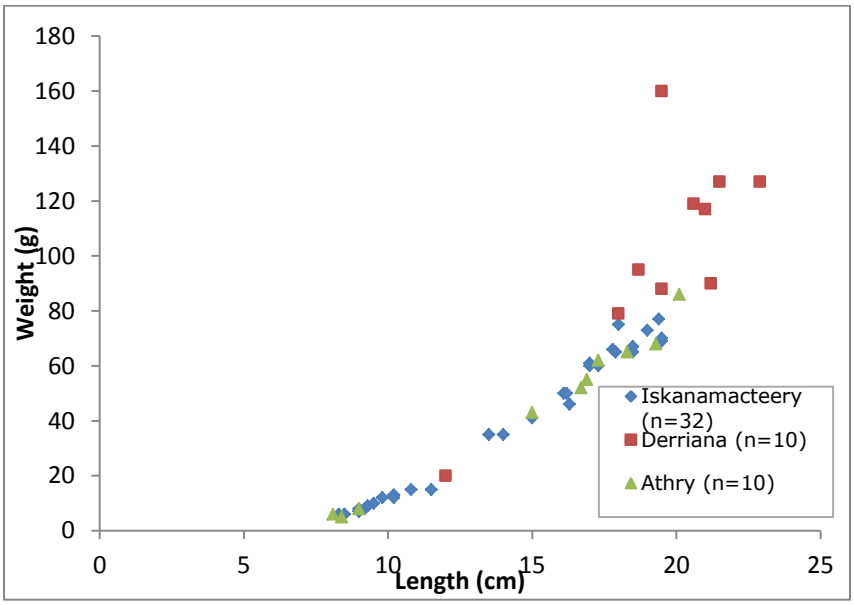

Figure 6.13. Length versus weight for Arctic char in lakes surveyed during May and July 2014.

The ratio of male to females, of brown trout and Arctic char was compared across the four lakes (Table 6.10). Ratios of brown trout were similar across all four lakes, also there was little difference in the ration of males to females. In relation to Arctic char, Loughs Athry and Iskanamacteery displayed a similar sex distribution, also the ratio of males to females did not vary greatly. On Lough Derriana males comprised of 25% of the population captured.

Table 6.10. Ratio of males to females in brown trout and Arctic char samples.

	Brown trout			Arctic Char		
	Male	Female	n=	Male	Female	n=
Derryclare	0.41	0.59	78	0	0	0
Athry	0.53	0.47	45	0.40	0.60	5
Derriana	0.48	0.52	82	0.25	0.75	8
Iskanamacteery	0.54	0.46	76	0.46	0.54	26

The length versus weight of brown trout and Arctic char were compared for specimens caught on Lough Iskanmacteery. This was the lake with the largest number of Arctic char captured (Figure 6.14). Both species of fish displayed a similar length weight relationship, however, there were no char sampled greater than 20 centimetres.

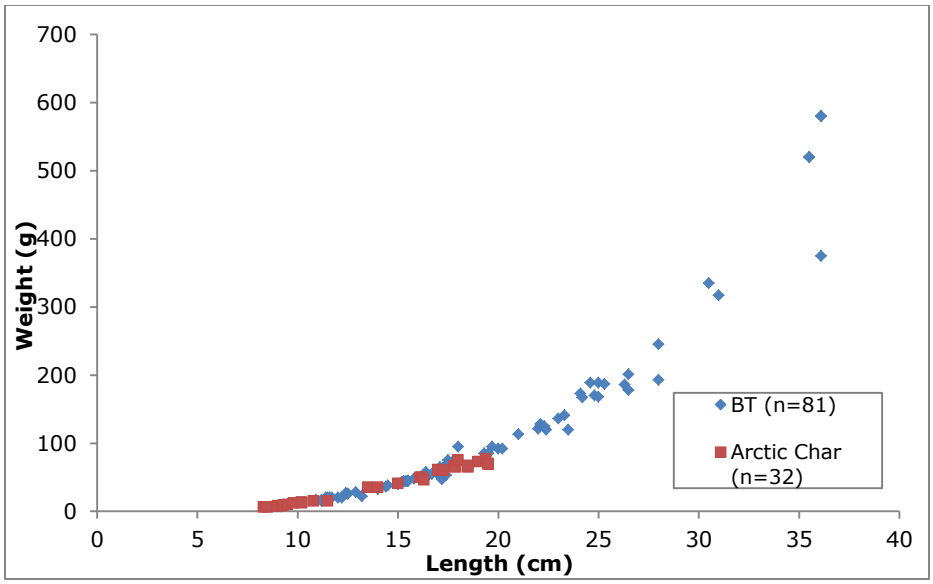

Figure 6.14. Length versus weight for Brown trout and Arctic char on Lough Iskanamacteery during July 2014.

Based on the age of fish from scale reading analysis, the growth rate of brown trout and Arctic char on Lough Iskanamacteery ware also compared (Figure 6.15 and Table 6.11). The Arctic char represented in the sample were only a maximum of two years old so there was no information on further growth rates.

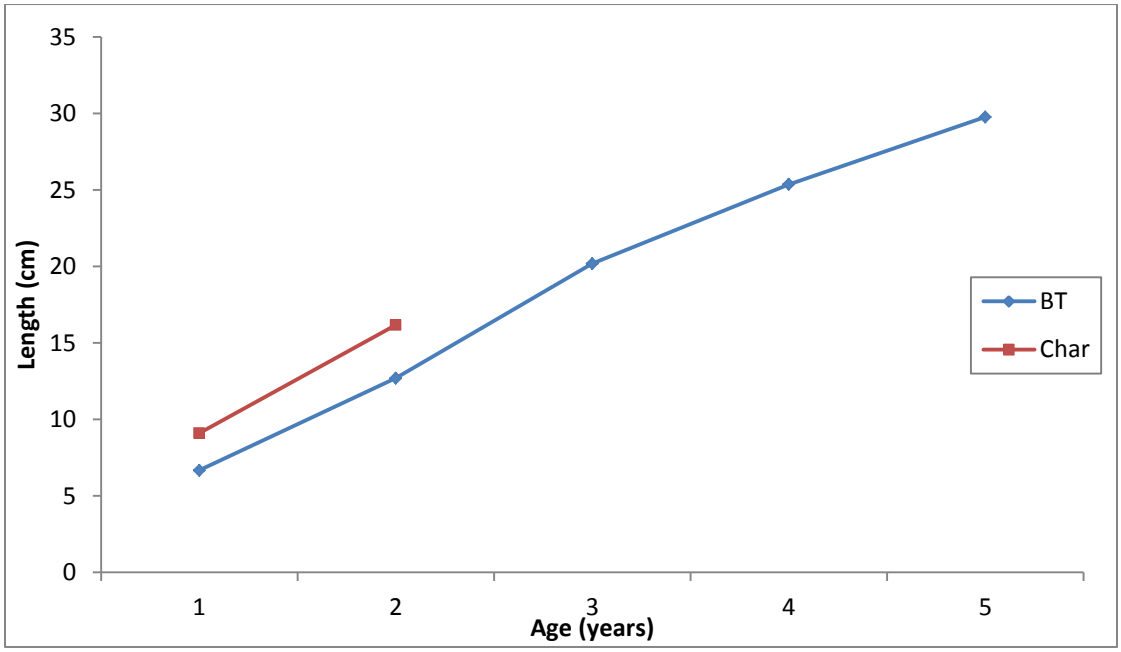

Figure 6.15. Mean lengths at age of Brown trout and Arctic char on Lough Iskanamacteery during July 2014.

Table 6.11. Mean lengths at age of brown trout and Arctic char on Lough Iskanamacteery during July 2014.

	1	2	3	4	5
BT	6.68 (n=34)	12.7 (n=23)	20.19 (n=10)	25.36 (n=3)	29.77 (n=2)
Char	9.10 (n=18)	16.17 (n=9)			

Thirty four eels were captured across the four lakes (Figure 6.16). The length of eels varied between 28 and 61 centimetres (Lough Derryclare). Eels were most abundant on Lough Derryclare with twenty individuals capture. Lough Derryclare displayed the largest number of size classes with a number of different life stages present. The low numbers recorded on the remaining lakes could represent a cause for concern. All eels were released after measuring.

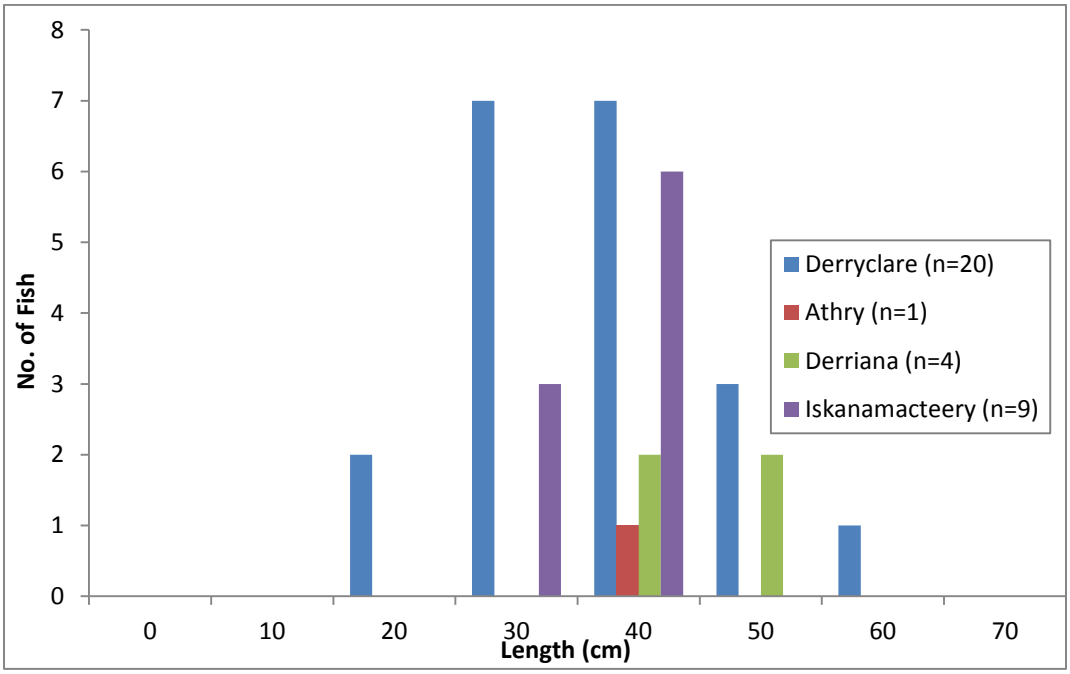

Figure 6.16. Length frequency of eels across all four lakes, 2014.

6.4 Discussion

The results of these lake surveys yielded interesting results. It was invaluable to gain an up to date picture of the fish population structure and also an insight into the Arctic char distribution. The length frequency of brown trout in all four lakes displayed a number of size classes with young and old fish represented within the populations. It was disappointing not to have encountered any Arctic char on Lough Derryclare, especially given its' proximity to Lough Inagh with a known Arctic char population. While it was a positive result to capture Arctic char in the remaining three lakes, the numbers recorded on Loughs Athry and Derriana (10 and 16, respectively) were low. The large numbers of Arctic char on Lough Iskanamacteery represented a healthy population. In the three lakes, a number of size classes were represented, indicating a number of life stages and ongoing recruitment.

The growth rates of brown trout were in the two Connemara lakes (Loughs Derryclare and Athry) and the two Kerry lakes (Loughs Derriana and Iskanamacteery). At age one all the lakes displayed similar growth rates. From year two it appeared the fish from the Kerry lakes grew faster than those in Connemara. Conductivity results, which is a function of alkalinity, known to impact on fish growth rates, displayed little variation between the four lakes. There was little variation displayed in the growth rates of Arctic char on the three lakes.

Similar lengths versus weights were displayed in brown trout populations across the four lakes until approximately 25 centimetres. There was a variation in the weight of larger fish, the spawning condition or stomach contents may be factors which accounted for the difference. In relation to Arctic char, Loughs Athry and Iskanamacteery displayed similar relationships between the length and weight of fish. No pattern was observed in the fish captured from Lough Derriana, with similar sized fish varying in their weight. Once again this could possibly have been as a result of stomach contents or spawning condition contributing to the fishes' weight.

Further investigations into the relationship between brown trout and Arctic char on Lough Iskanamacteery displayed a similar length versus weight relationship between the two species of fish. In the brown trout greater than 30 centimetres there was no relationship between the length and weight of the fish with a greater weight variation present.

The comparison of mean growth rates between brown trout and Arctic char was interesting, there was a 2.42 centimetres difference in the mean length at year one. The Arctic char grew faster than the brown trout. By year two the mean difference had widened to 3.47 centimetres. Unfortunately there were no larger Arctic char captured from which to compare further growth rates.

Eels were captured in all four lakes. On Lough Athry only one eel was present in the sample which could possibly be a cause for concern. A similar situation was encountered on Lough Derriana with 4 individuals present. The largest population was present on Lough Derryclare with a number of different size classes present, indicating a healthy population.

As there was a paucity of information on Lough Derriana it was noteworthy to establish it supported an Arctic char population as this was the first record of the species in this lake. Further studies within the Habitats Directive team would aim to undertake further investigations into lakes within SACs designated as Oligotrophic waters containing very few minerals of sandy plains and also Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the Iso-to-Nanojuncete SACs. The lakes within this habitat type are ideal environments to support char populations and bearing this in mind it is hoped to expand our knowledge on the status and distribution of Arctic char within these lakes. The aim for the Habitats Directive team is to survey further lakes from the Igoe *et al* paper in order to ascertain the status of Arctic char populations, whilst also gaining information on fish species composition.

7. Looking Forward: 2015 - 2018

The on-going focus for the Habitats team is the six-year reporting requirement to the EU under Article 17 of the Habitats Directive. The development of the Index Rivers network for long-term monitoring of larval lamprey was a goal achieved in 2014 and this will be bedded down on an annual basis moving to 2018.

Three areas targeted for focused activity in 2015 include:

- Data collection on land-locked or non-migratory sea lamprey
- Data collection on shads in the marine environment
- Seasonal collection of pollan samples from a specified lake in the Shannon system

Lamprey: The programme of completing catchment-wide larval lamprey surveys on all of the lamprey SACs in the period 2013-2018 is a demanding one and is dependent on having suitable weather and river flow conditions over an extended survey period in late summer. The SACs were first surveyed in the early 2000s (2003 – 2006) in a series of contracts issued by National Parks and Wildlife Service. The aim is to have all of these re-surveyed by IFI's team by 2018. To date, the Corrib, Laune and Munster Blackwater SACs have been surveyed, in addition to the Feale catchment within the Lower River Shannon SAC. A clear programme to cover the remaining SACs by 2018 is in place.

The network of Index Rivers has been established and minor adjustments will be made in 2015. The adjustments may be needed to allow for representativeness in regard to geographical spread of sites, channel size, current lamprey status in context of water/habitat quality and prospects of the quality issue improving.

Examination of lamprey ammocoetes by eye cannot distinguish between the river and brook lamprey. There is a pressing need to populate GIS-based maps with locations of river lamprey adult sightings. This is a very challenging task – as is borne out by the negative experience to date on this matter in the Boyne catchment, as per this report. Successful sightings will enable information to be compiled on the attributes of spawning sites and the habits of river lamprey at these sites.

The Habitats team plans to sample for and collect data on land-locked lamprey in selected Irish waters, where they are demonstrated to occur, in 2015. To date, samples have come *via* anglers and it is hoped that this welcome source of information will again be fruitful in 2015. Sampling of actual adult lamprey, for body dimensions and for genetics (*via* tissue samples), is envisaged, in addition to data collection on occurrence of lamprey attachment marks on angler-caught fish.

Shads: The bongo netting procedure for post- larval shads provides a structured and repeatable sampling methodology. The extent of zero results in successive years is a cause of concern. Does it signify an absence of shad recruitment? Or does it signify a shortcoming in the sampling

methodology? The latter will be addressed in 2015, and beyond, in order to assess and address any shortcoming in the methods.

The use of telemetry to examine adult shad in the Waterford Harbour – Suir – Nore – Barrow complex, commenced in 2012, will be continued in 2015. A major aim is to capture and tag adult fish in substantially more downstream sites in Waterford Harbour in order to maximize the value of the listening stations and to pick up on pre-spawning movements as well as movements in the lower harbour area from summer onwards, following spawning. In the short – to - medium term, the Habitats project proposes to establish an array of listening stations in Waterford Harbour and the 'Three Sisters' estuaries in order to monitor adult shad movements both during the spawning season and also during the post- spawning period when adult fish drop down into Waterford Harbour and re-commence feeding. It is hoped that the array can detect fish that may migrate out of the estuary into the open sea. The establishment of such an array is intended to synergise with other IFI projects involving telemetry, notably in regard to bass and European eels. The current programme has been synergising with the IFI National Eel Programme from the outset, with tagged eel and tagged shad activating the listening stations in the estuarine Barrow.

A degree of data on shad occurrence in the open ocean has been collected over a number of years, with particular assistance from the sister state bodies – the Marine Institute, Sea Fisheries Protection Authority (SFPA) and Bord Iascaigh Mhara (BIM). It is hoped to examine this material in 2015, in the context of internationally-available discard and by-catch information and in the context of scientific literature on the marine life cycle of adult shads. Advances in genetics and in micro-chemistry techniques may enable allocation a river-of-origin to IFI's current collection of marine-caught shad material. Partnering with academic institutes, as well as use of IFI's own analytical resources, may help to advance this issue.

Pollan: The present positive outcomes of hydroacoustic studies on the three pollan lakes – Lough Derg, Lough Ree and Lough Allen are very encouraging and it is hoped that these will provide a quantitative basis for reporting on population structure and size of the pollan communities in these lakes for the 2018 EU reporting deadline. The hydroacoustics is being undertaken by IFI's Lakes Survey team with specialist doctoral work being undertaken by Ms. Emma Morrissey.

The success of the pelagic netting approach to sampling pollan during 2014 will be followed up in 2015 on Lough Allen with a limited seasonal sampling regime to look at pollan use of the water column, growth of fish as indicated on scales, feeding etc.

Char: Sampling of char will continue in 2015, using the standard multi-mesh gill net approach as used by IFI's WFD team. Lakes have been selected for sampling in Kerry and in Donegal. This programme has been ongoing since 2009. While small in terms of annual effort, a significant number of lakes has been sampled for char occurrence and new data gleaned on occurrence and status of char populations. The two Donegal lakes selected for 2015, Lough Nalughramen and Lough Greenan, were previously

surveyed by Habitats team in 2009. One aspect of a long-term monitoring programme is to undertake repeat surveys on waters. The Donegal repeats will be pertinent as both lakes are used as potable water supplies by the Local Authority. Management of the lakes for water supply can lead to fluctuations in water level in the littoral zone. Char are known to spawn in this zone of the lake and fluctuations in levels could adversely impact on char recruitment.

Smelt: The post-larval shad surveying via bongo netting also provides an opportunity to sample for juvenile smelt. During September 2014, trawling surveys for juvenile bass undertaken by IFI's Marine Sport Fish team provided a by-catch of smelt that was retained for data collection by the Habitats team. Similar synergies are planned for 2015.

Project Personnel and Acknowledgements

The IFI Swords team involved in the Habitats Directive and Red Data Book fish investigations during 2014 comprised Dr. James King, Ms. Nicola O'Gorman, Dr. Sean Rooney and Mr. Daniel Cierpial. In all waters surveyed, the team received full support from our colleagues within the individual IFI River Basin Districts (RBD) and thanks are due to the RBD Directors and their Inspectors, who organised logistics and support, and to officers within each area where surveys were undertaken.

The R&D Division recruited staff on 6-month contracts to assist in a series of project areas. Dr. Fiona Bracken worked for the full period with the Habitats team and Ms. Sarah Healy was shared by the National Eel Monitoring team and the Habitats team. Both Fiona and Sarah became an integral part of the Habitats Directive's survey team, particularly during the long period of catchment-wide larval lamprey surveying. They both contributed substantially to development and trialling of a new survey sheet designed to optimize field data collection for the larval lamprey.

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