



Stillwater Status Report: Lough Fad East

Stillwater Fish Stock Survey

Loughs Agency of the Foyle Carlingford and Irish Lights Commission

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A lake fish stock assessment was conducted to record indicative species composition and abundance of Lough Fad East, Co. Donegal during the summer of 2017.

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EXECUTIVE SUMMARY

A Water Framework Directive compliant stillwater fish stock assessment was carried out on Lough Fad East in August 2017. The Loughs Agency commenced a small rolling programme of lake fish surveys in 2010 to gain a better understanding of fish species composition and abundance of the standing waterbodies within the Foyle and Carlingford areas. The information collected can be used for many purposes ranging from formal Water Framework Directive classification, a baseline survey for use in the scrutiny of any future development proposals and for contributing towards the sustainable development of the angling amenity.

Lough Fad East is situated approximately 5km north of Redcastle, Co. Donegal. The lough is nestled in a picturesque area and is utilised by Irish Water/Donegal County Council as a public water supply for Quigleys Point, Merville, Redcastle and Greencastle. A previous depth survey had been conducted and accurate depth (bathymetry) data was available to direct the fish survey.

The 2017 fish stock assessment noted the presence of two fish species in Lough Fad, Brown trout and Arctic charr. Impacts upon the lough noted at the time of survey included significant water abstraction resulting in extremely low water levels and habitat damage from dredging and spoil disposal. Both impacts could be having a significant impact on the population of the vulnerable Arctic charr.

This lake survey report provides a baseline of species presence and their relative abundance to resource managers and anglers. It is anticipated that this survey report could contribute towards the future management and sustainable development of the angling amenity, conservation of the nationally vulnerable Arctic charr population and wider development of the lough by providing the basis for an evidence based approach to the management of the lough.

If access to the Fish in Lakes 2 Water Framework Directive classification tool was available a WFD compliant classification could also be derived for Lough Fad East and provided to the Environmental Protection Agency for national reporting purposes.

1.0 INTRODUCTION

Lough Fad East is located approximately 5km North of Redcastle, in the Foyle catchment. The lake is approximately 40 metres above sea level and its principal dimensions are;

- Length: (718)m long, maximum width (259.2) metres
- Surface area: (13.8) hectares
- Maximum depth: 15 metres



Fig 1. Stillwater Fish Survey being carried out on Lough Fad (East), 2017.

2.0 BATHYMETRY SURVEY

It is a prerequisite of any WFD compliant lake fish survey to have detailed bathymetry data. This enables the survey to be carried out in accordance with the standard sampling methods for the assessment of ecological status in freshwater lakes across the island of Ireland (Eco-region 17). The area of the lake (ha) and the maximum depth (m) are used to determine the distribution and number of gill nets required for the survey. A bathymetry survey for Lough Fad East had previously been completed by AFBI prior to the lake fish survey. This data was obtained from AFBI and used by the Loughs Agency for this survey.



Fig 2. Survey preparations.

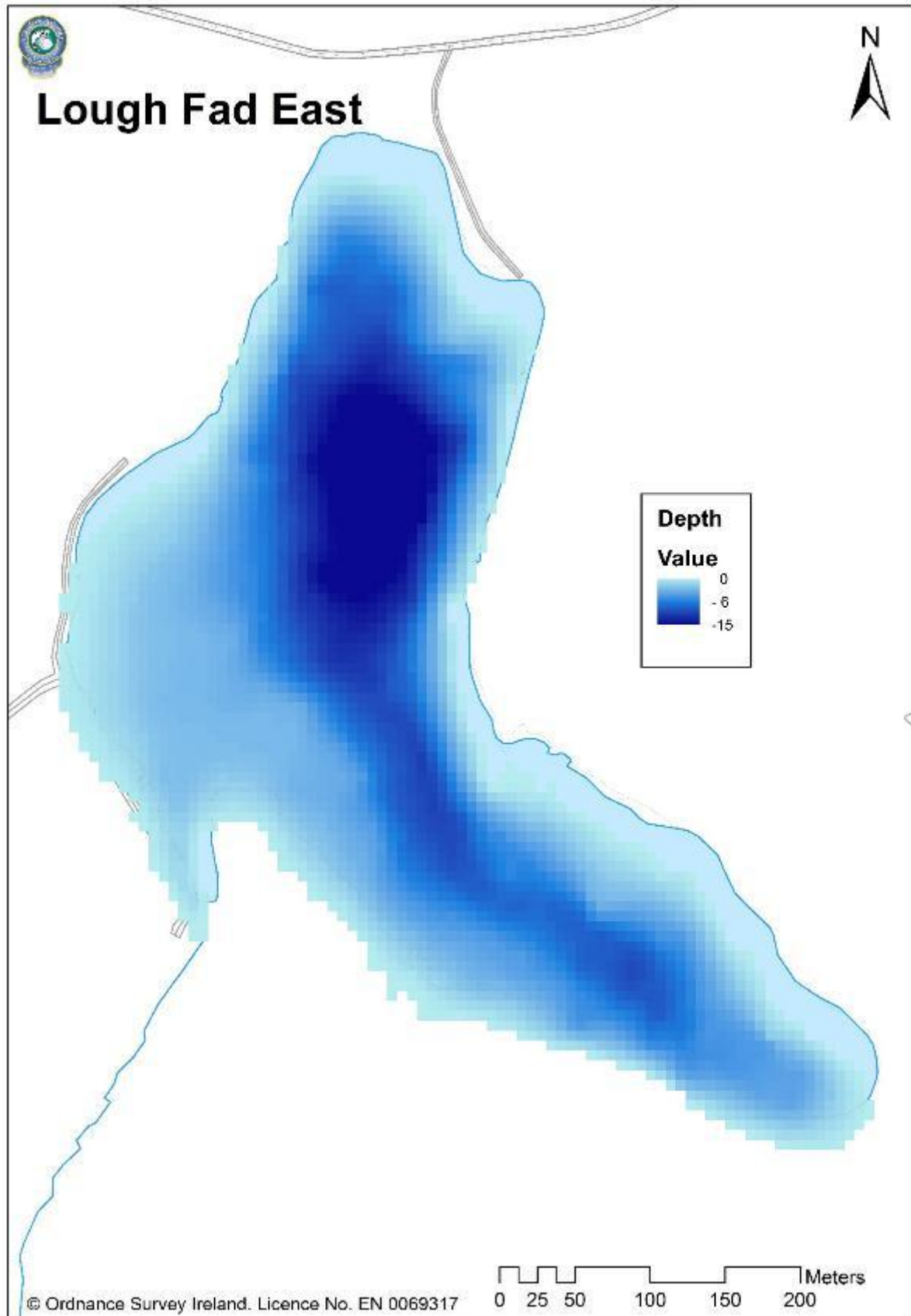


Fig 3 Bathymetry map of Lough Fad East, Co Donegal

3.0 METHODS

Lough Fad East was surveyed over one night from the 2nd of August 2017 according to the methodology described in the Water Framework Directive compliant NS Share Methods Manual for systematic surveying of lakes for fish (NSSHARE, 2008). A total of 12 nets were set as summarised in Figure 3 below.

Net type	No. Deployed	Water depth (m)
Dutch fyke nets (chain of 3)	3	0 – 2.9
Multi-mesh gill nets	2	0 – 2.9
Multi-mesh gill nets	2	3 – 5.9
Multi-mesh gill nets	2	6 – 11.9
Multi-mesh gill nets	2	12 – 19.9
Floating gill net	1	12 – 19.9

Table 1. Details of survey nets deployed on Lough Fad East.



Fig 4. Nets being prepared before being deployed on Lough Fad East.

Survey locations were chosen within randomly selected 50m X 50m grid squares overlaid on a bathymetric map of the lough (Figure 5.). The location and depth of each net is also shown. A handheld Trimble Geo HT GPS was used to record the precise location of each net as shown in (Figure 6). Any fish which were alive and in good condition were measured and released live after removal from the nets. All other fish were removed from the nets and identified and measured at Loughs Agency headquarters.



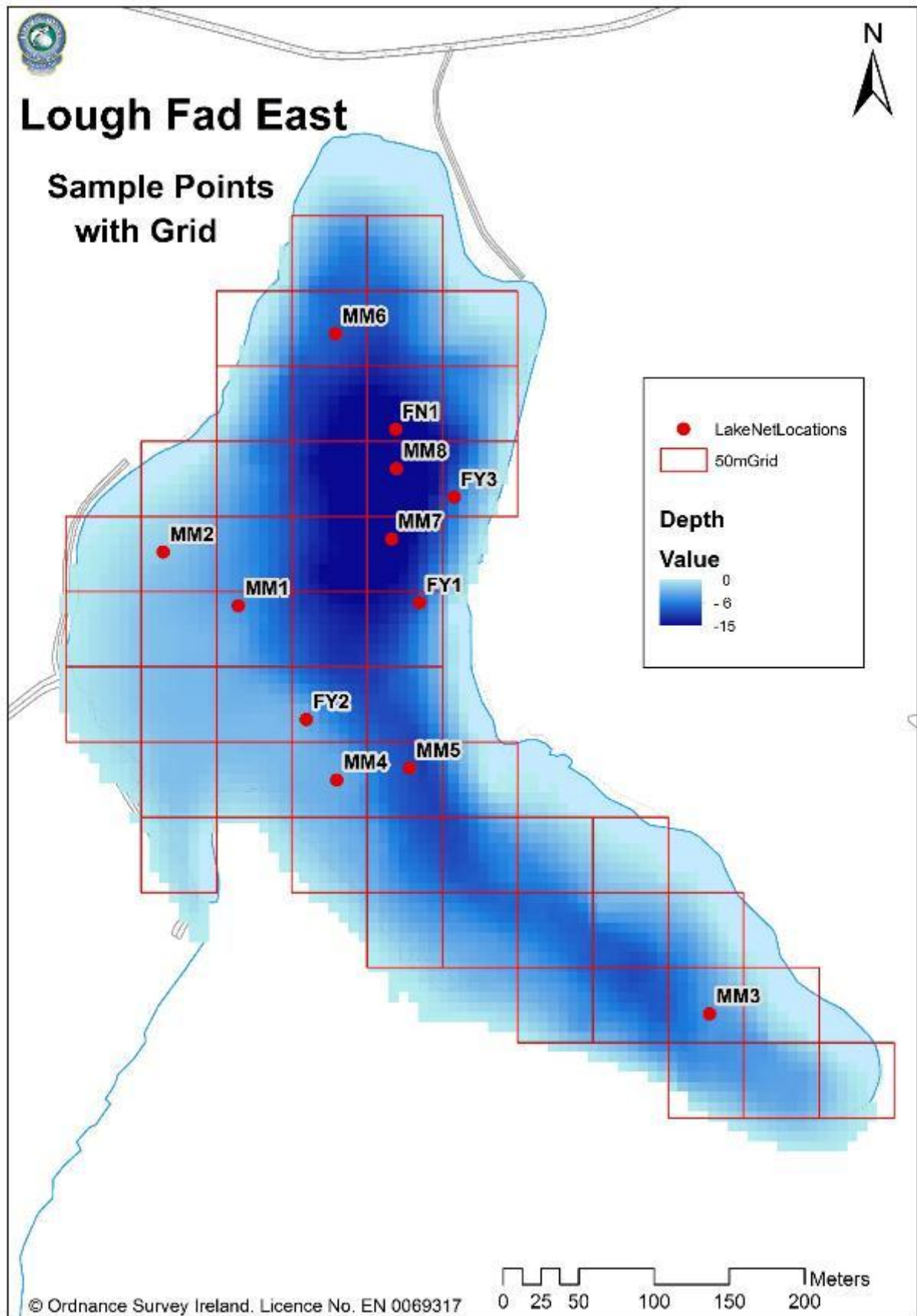


Fig 5 Lough Fad East bathymetry map overlaid on 50m grid squares.

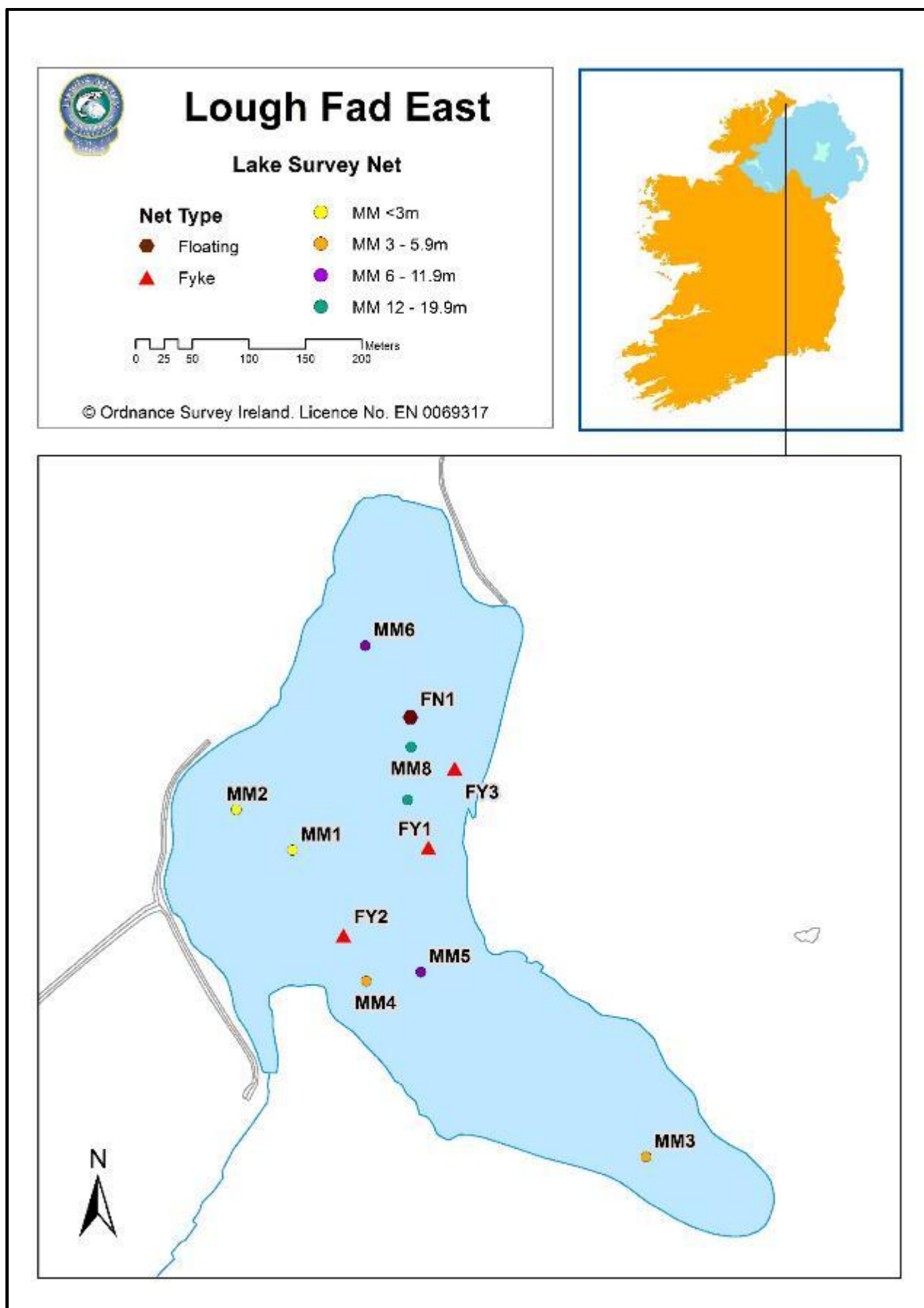


Fig 6. Net locations

4.0 RESULTS

4.1 SPECIES RICHNESS

Two fish species were recorded during the fish survey of Lough Fad East in August 2017 with a total of 10 fish captured during the survey. A list of species captured by each gear type is presented in Table 2. Brown trout (*Salmo trutta*) were the most common fish species encountered in the benthic gill nets. The floating gill nets captured equal numbers of both fish species encountered.

Common Name	Scientific Name	Benthic Gill Nets	Fyke Nets	Floating Gill Nets	Total
Brown trout	<i>Salmo trutta</i>	7	0	1	8
Arctic Char	<i>Salvelinus alpinus</i>	1	0	1	2

Table 2. Number of each species captured by each gear type during the survey of Lough Fad East, 2017.

4.2 FISH ABUNDANCE

Fish abundance, mean catch per unit effort (CPUE) was calculated as the mean number of fish caught per metre of net. Fish biomass, mean biomass per unit effort (BPUE) was calculated as the mean weight of fish caught per metre of net. For all fish species CPUE/BPUE is based on all nets including fyke nets. Weights were not available from those fish which were released alive. In such cases weights were calculated from the length weight relationship of recorded fish. A summary of CPUE and BPUE data for each species is shown in Figure 8 and 9 below.



Brown trout were the dominant fish species in terms of abundance and also in terms of biomass. Arctic Charr were much lower in terms of abundance and also in terms of biomass as shown below in Table 3.

Common name	Scientific name	2017 CPUE	2017 BPUE
Brown Trout	<i>Salmo trutta</i>	0.021 (0.011)	6.54 (3.96)
Arctic Charr	<i>Salvelinus alpinus</i>	0.005 (0.0032)	0.17 (0.12)

Table 3. Mean (\pm S.E.) CPUE and BPUE for all fish species recorded on Lough Fad East, 2017.



Fig 7. Sample of Brown Trout (*Salmo trutta*) top 2 images and Arctic charr bottom image from Lough Fad East, 2017.

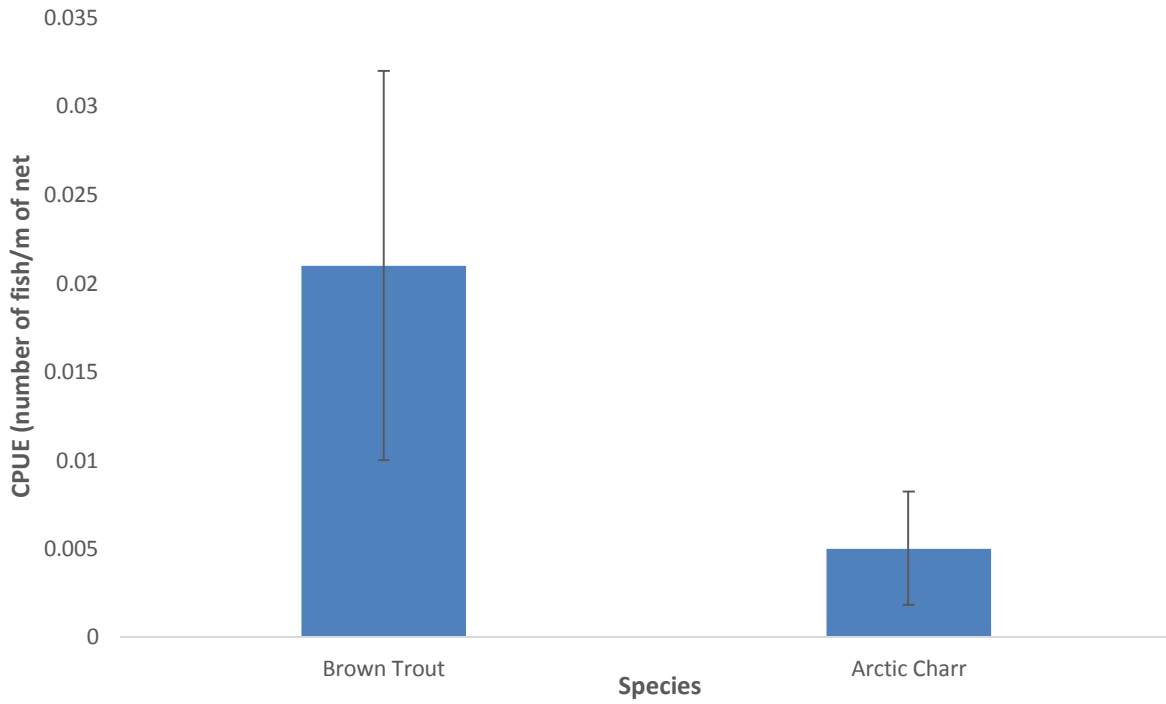


Fig 8. Mean (\pm S.E.) CPUE for all fish species captured in Lough Fad East, 2017.

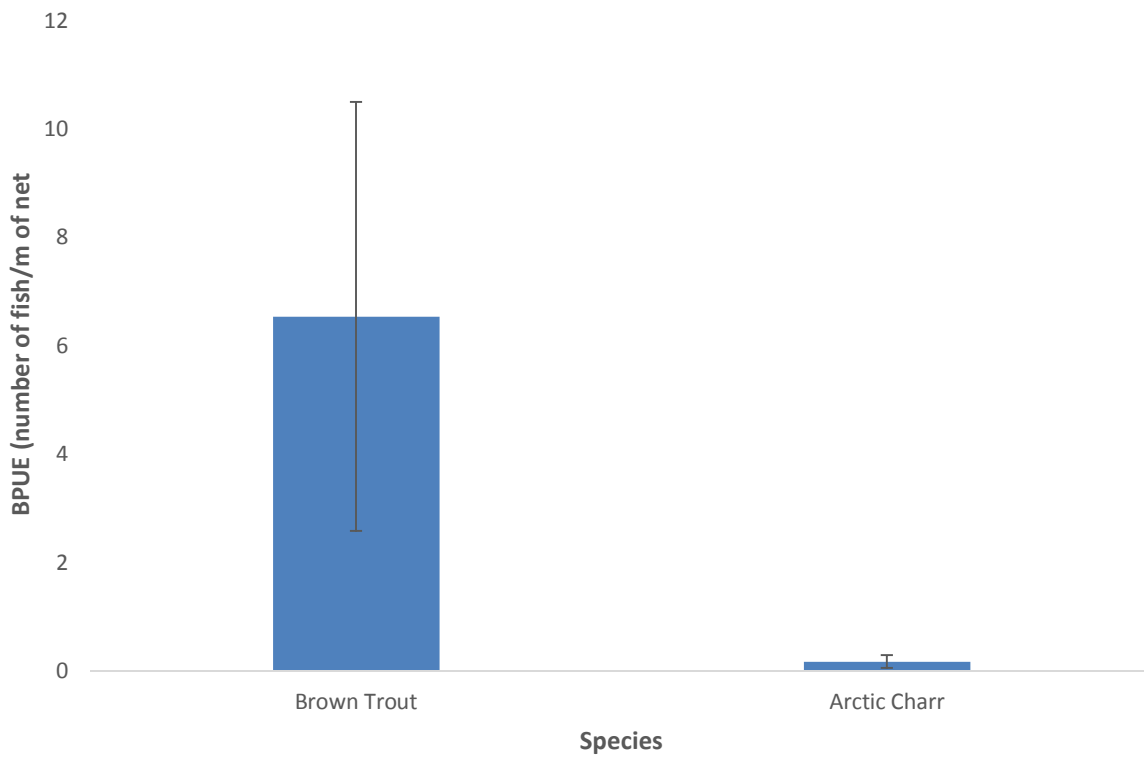


Fig 9. Mean (\pm S.E.) BPUE for all fish species captured in Lough Fad East, 2017.

4.3 BROWN TROUT STOCK DENSITY & POPULATION STRUCTURE

The relative density (CPUE & BPUE) and length frequency distribution of Brown trout is presented below in Figures 10, 11 and 12. Values are also compared with other lakes which have been surveyed within the Foyle and Carlingford areas. A total of 8 Brown trout were recorded during the Lough Fad East survey, lengths ranged from 170mm to 450mm (mean length 277mm). The abundance of Brown Trout from Lough Fad East is significantly lower than other surveyed loughs. 44 Brown trout were recorded from Lough Muck (Donegal) in 2012, lengths ranged from 69mm to 212mm (mean length 168mm). 18 Brown trout were recorded from Lough Alaán in 2013, lengths ranged from 134mm to 314mm (mean length 234mm). 3 Brown trout were recorded from Lough Carn in 2010, lengths ranged from 389mm to 422mm (mean length 406mm). 25 Brown trout were recorded from Lough Ash 2011, lengths ranged from 297mm to 421mm (mean length 343mm). 2 Brown trout were recorded from Lough Mourne 2010, lengths ranged from 205mm to 220mm (mean length 213mm). 59 Brown trout were recorded from Lough Nambradden 2014, lengths ranged from 55mm to 240mm (mean length 147mm). 48 Brown trout were recorded from Lough Trusk in 2016, lengths ranged from 135mm to 325mm (mean length 225mm).

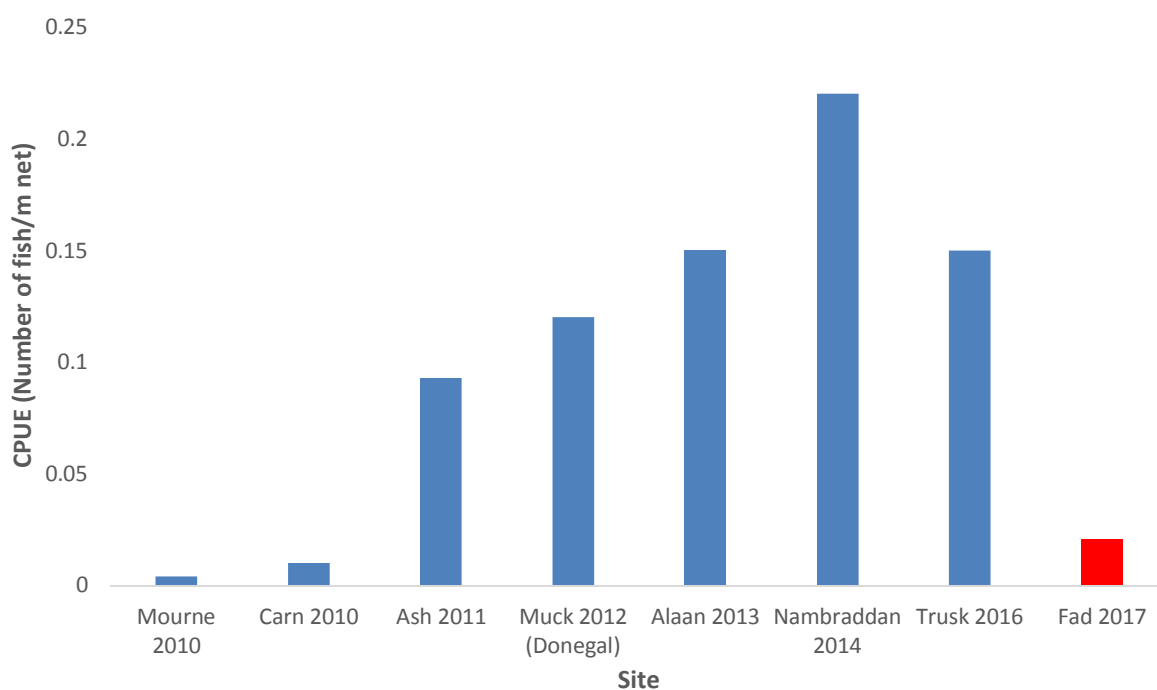


Fig 10. Mean CPUE for all Brown Trout captured in Lough Mourne 2010, Carn 2010, Ash 2011, Lough Muck (Donegal) 2012, Alaán 2013 Nambradden 2014, Trusk 2016 and Lough Fad East 2017.

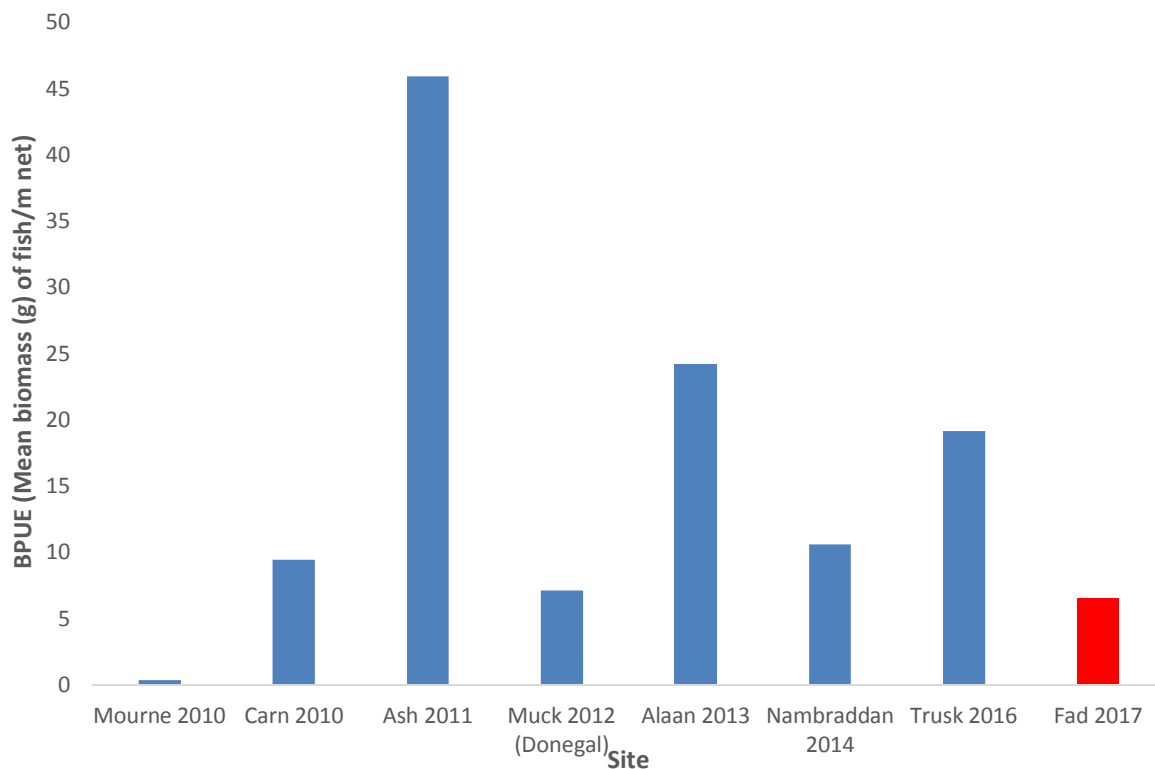


Fig 11. Mean BPUE for all Brown Trout captured in Lough Mourne 2010, Carn 2010, Lough Muck (Donegal) 2012, Nambraddan 2014, Alaán 2013, Ash 2011, Trusk 2016 and Lough Fad East 2017.

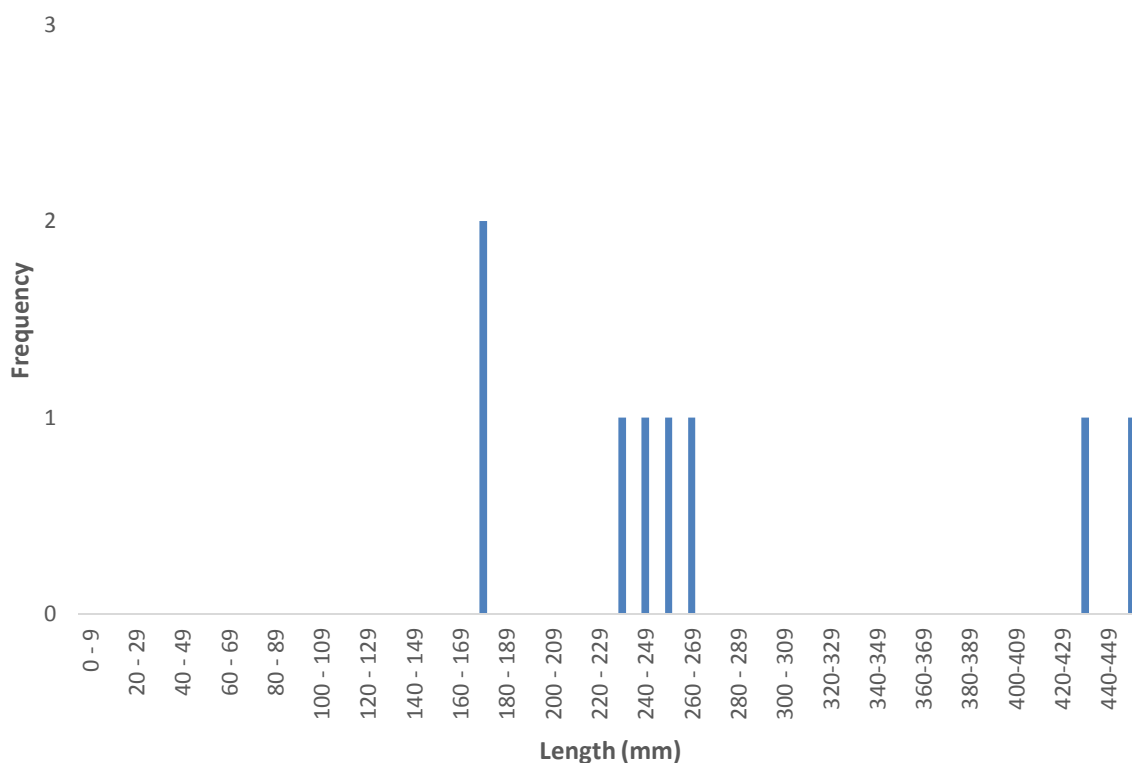


Fig 12. Length frequency Brown Trout, Lough Fad East 2017 (N=8)

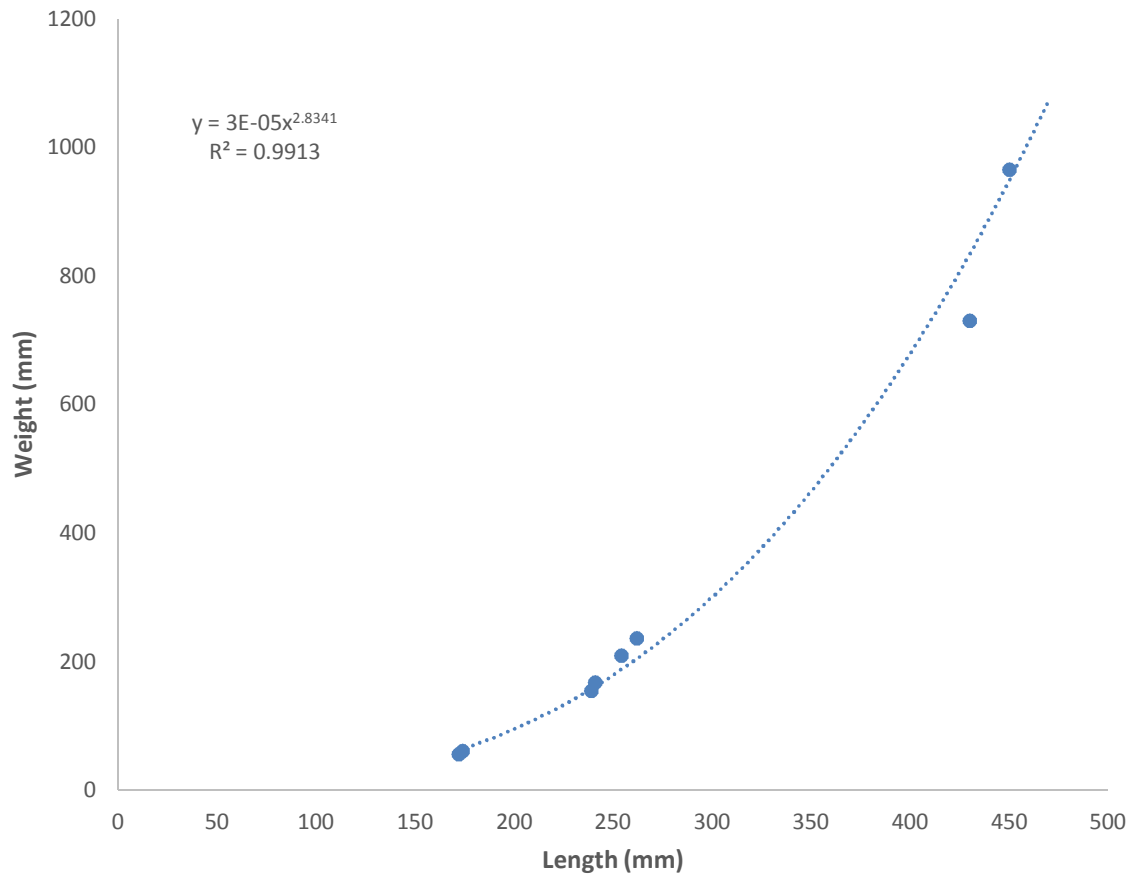


Fig 13. Length weight relationship of Brown Trout, Lough Fad (East) 2017 (n=8)

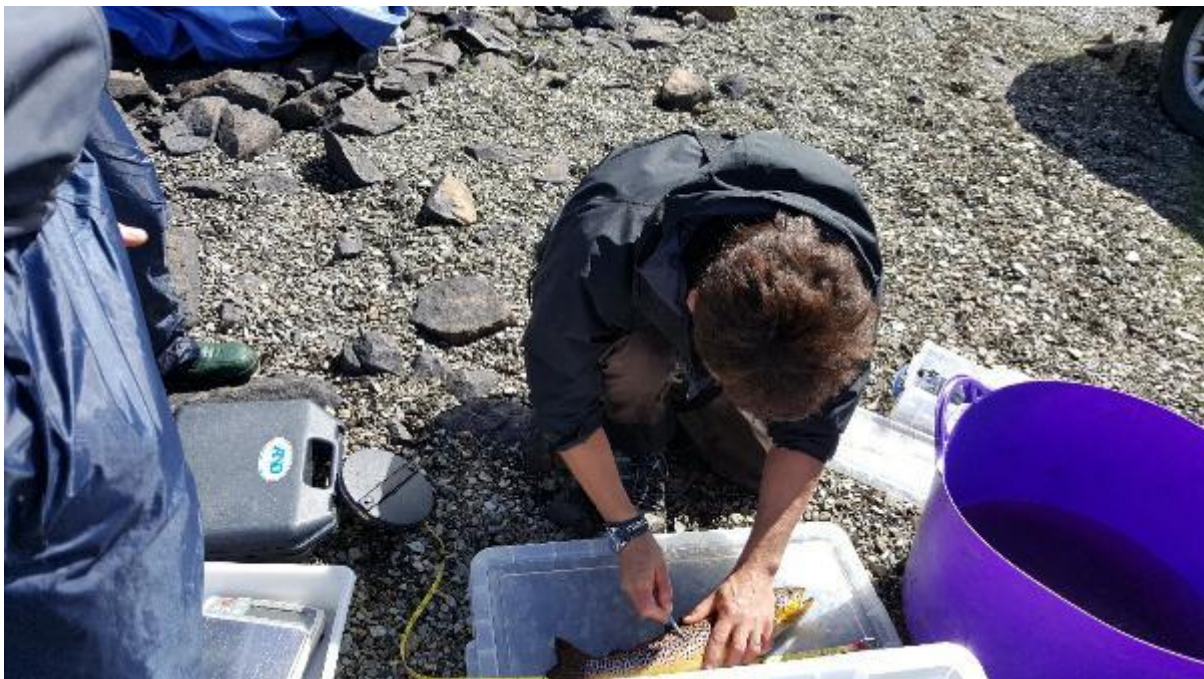


Fig 14. Sampling

4.4 ARCTIC CHARR STOCK DENSITY & POPULATION STRUCTURE

The relative density (CPUE & BPUE) and length frequency distribution of Arctic charr are presented below in Figures 15, 16 & 17. A total of 2 Arctic Charr were recorded in Lough Fad East, lengths ranged from 153mm to 158mm (mean length 156mm). Arctic Charr are only known to be present in two loughs within the Loughs Agency jurisdiction. The other known population is in Lough Finn, Co Donegal. A WFD compliant fish survey was also conducted on Lough Finn in 2017.

The abundance of Arctic charr from Lough Fad East is lower than Lough Finn. 27 Arctic charr were recorded from Lough Finn in 2017, lengths ranged from 60mm to 214mm (mean length 175mm).

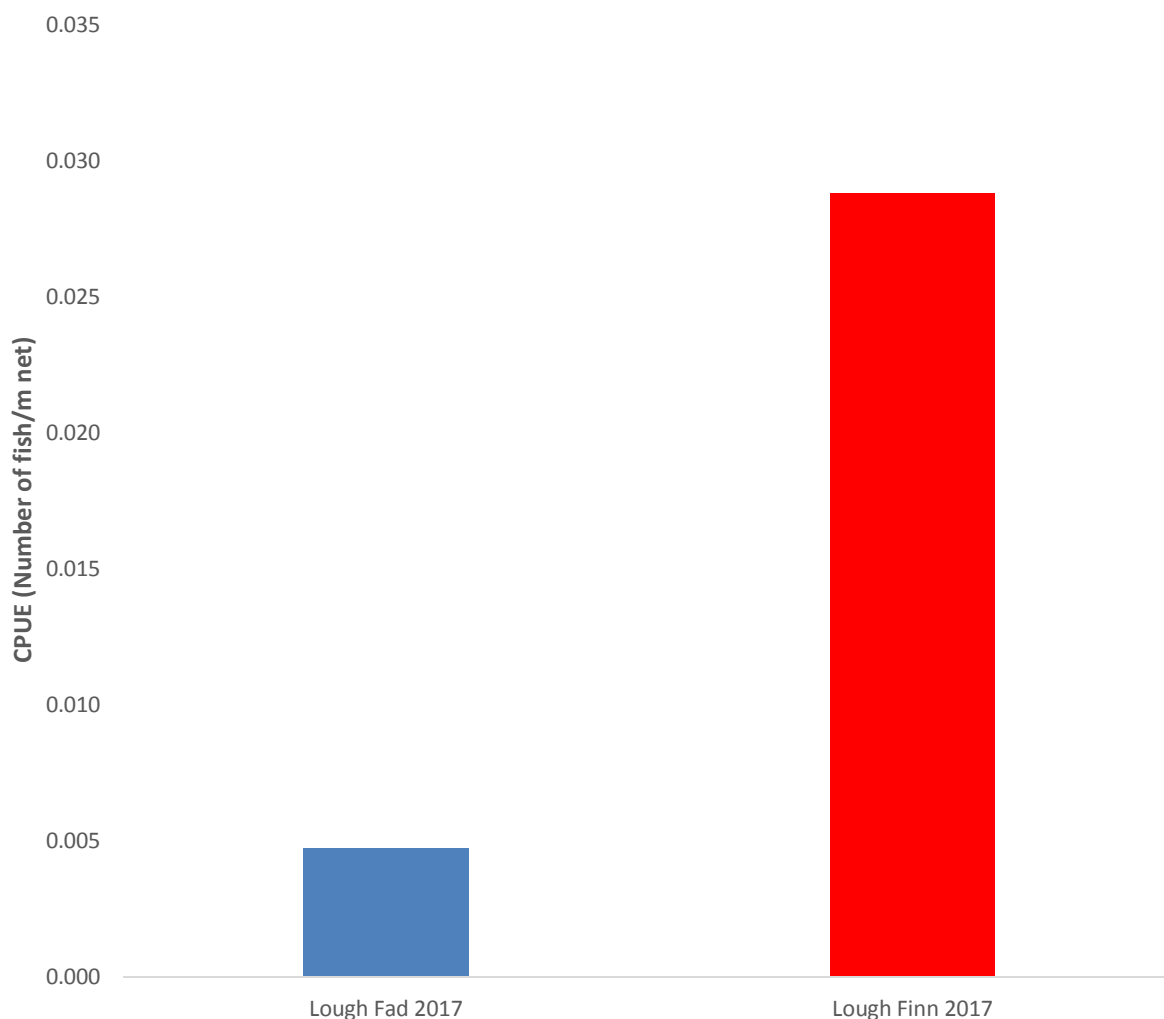


Fig 15. Mean CPUE Arctic Charr, Lough Fad (East) 2017 and Lough Finn 2017

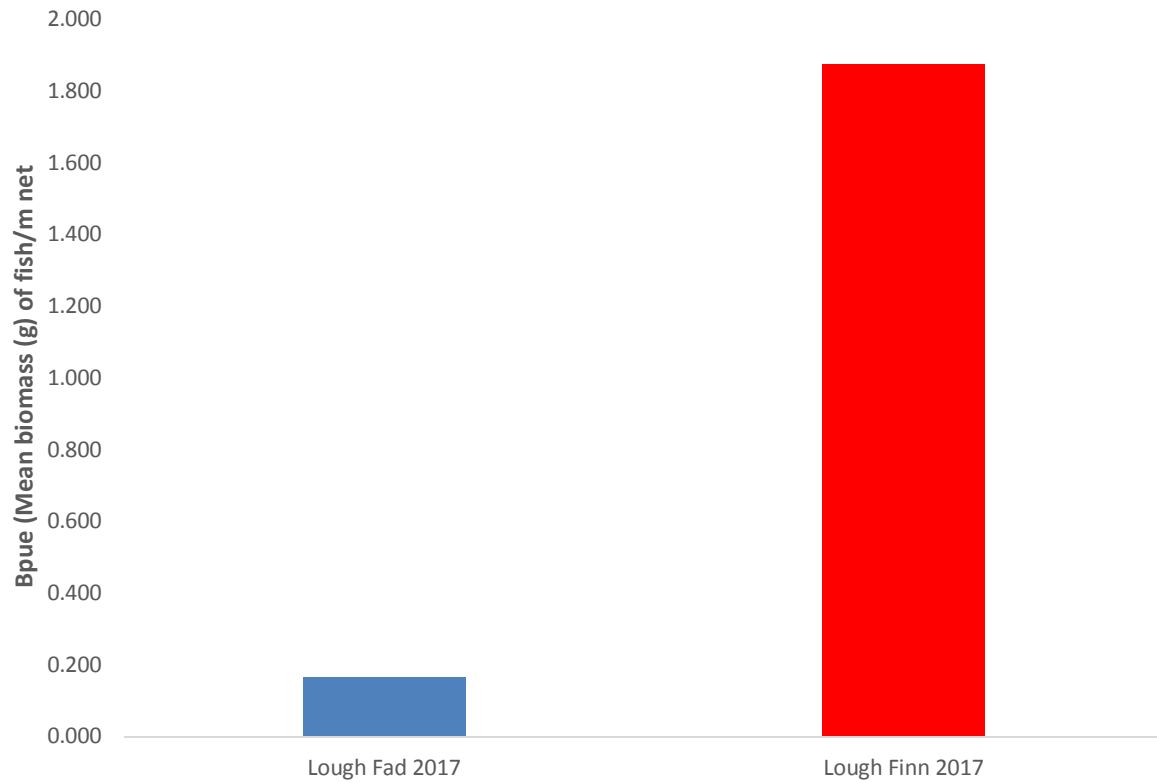


Fig 16. Mean BPUE Arctic Charr, Lough Fad (East) 2017 and Lough Finn 2017

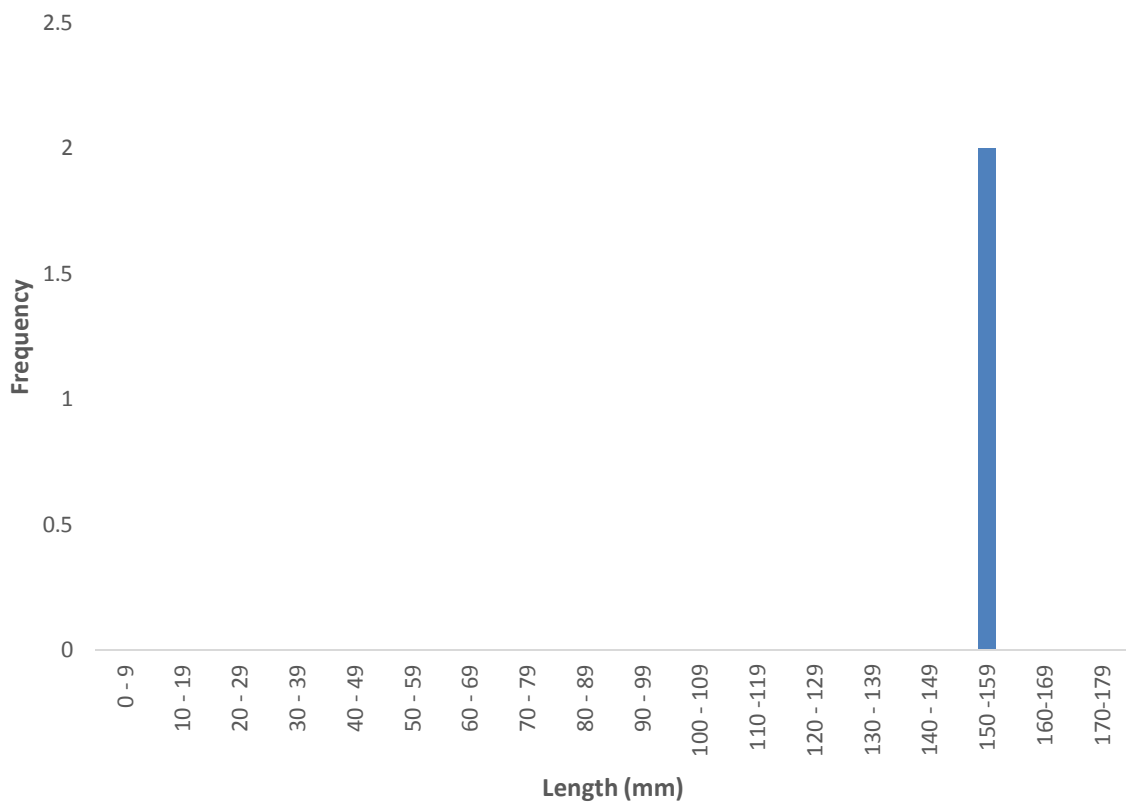


Fig 17. Length frequency of Arctic Charr, Lough Fad (East) 2017 (n=2)

4.5 FISH AGE AND GROWTH

Scales were taken from all 8 Brown trout and both Arctic charr caught during this survey for fish aging and back calculated growth analysis. Figure 18 below outlines the average length at age for Brown trout caught during the Lough Fad East survey and compares them to Brown Trout caught in Lough Muck (2012), Lough Nambraddan (2014) and Lough Trusk (2016). A range of age classes were present in Lough Fad East with the oldest Trout found to be in the 6+ age class.

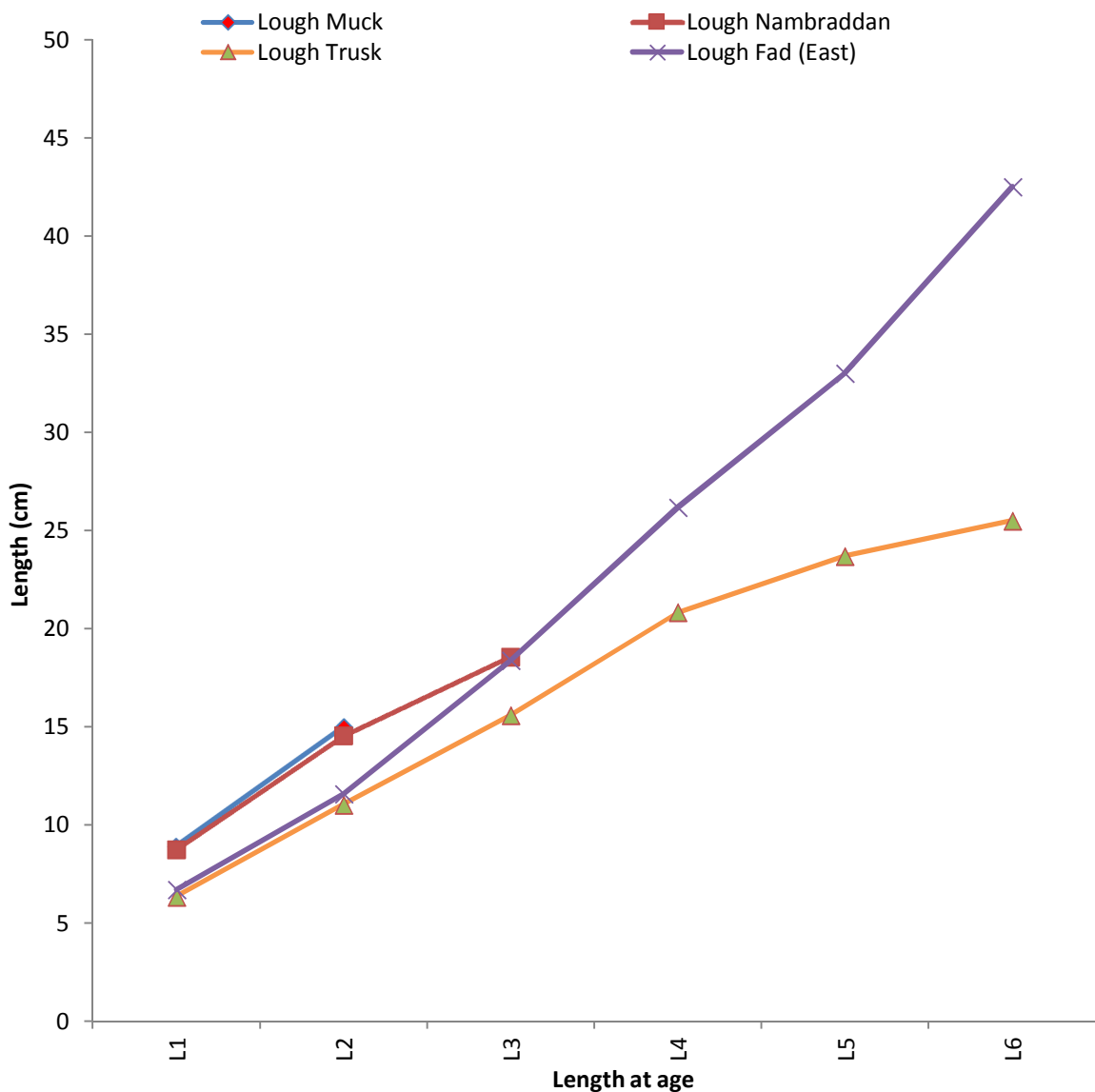


Fig 18. Comparison growth curve showing back calculated length at age for Brown Trout, Lough Muck (2012), Lough Nambraddan (2014), Lough Trusk (2016) and Lough Fad East (2017).

5.0 DISCUSSION

Lough Fad East lies within Magheradrumman Bog SAC. It is also a source of public water supply for the east Inishowen area. Continued abstraction at this site is having a negative impact upon the remaining population of Arctic charr. Previous surveys recorded greater numbers of Arctic charr than were encountered during the 2017 survey. It should also be noted that water levels were at the lowest level observed at the site by the authors. Due to the pressures for water the channel area leading to the weir which impounds Lough Fad has been dredged to maintain abstraction in extremely low water conditions. The dredge spoil had been spread in the adjacent area Figures 19 & 20.



Fig 19 & 20 dredged channel and spoil at Lough Fad East august 2017

As outlined in previous reports by the Irish Charr Conservation Group the population of Arctic charr in Lough Fad East are littoral (shoreline) spawners and are extremely susceptible to water abstraction. Charr require their spawning habitats to be covered in water during their eggs incubation period which probably extends from early November to early May. During this time ova and alevin will be vulnerable to water drawdown. It is also essential that the water level should not be allowed to drop below the level at which spawning commences from November to the following May.

The Arctic charr population in Lough Fad East is one of only two populations within the Loughs Agency jurisdiction. If consideration is not given to managing water levels appropriately it is highly likely that this population of Arctic charr will become extirpated/locally extinct in the near future.

Lough Fad East also holds a population of Brown trout. It is of note that no Brown trout under 13 centimetres were encountered during the 2017 survey which may indicate little or no recruitment to the population in recent years. There is currently no connection between the outflow and the lake due to the presence of a weir, any spawning potential would be limited to the littoral area. It is also possible that Brown trout have been introduced as an angling resource as larger fish. Any unauthorised stocking should be discouraged and it should be noted that it is an offence under the Foyle Fisheries Acts to introduce any fish to a watercourse without prior consent by the Loughs Agency, failure to comply could result in prosecution. In addition any introduced Brown trout may also predate upon the Arctic charr.

This report is a baseline survey of fish stocks in Lough Fad and it is hoped that it can provide the basis for an evidence based approach to the management of the lough. Fishery managers and anglers should also have an opportunity to review the report and consider its recommendations when developing any future angling initiatives for Lough Fad.

The information presented in this report can also be used to compare stocks from any other water body where the same survey method has been used.

6.0 INVASIVE SPECIES

Invasive non-native species are those which have been transported outside of their natural range. They are capable of spreading rapidly and colonising a wide range of habitats. They also exhibit competitive dominance by out-competing native flora and fauna for light, oxygen and food. There is growing evidence to suggest that invasive riparian plants are having an adverse effect on aquatic habitats and species by altering both in-stream processes and terrestrial-aquatic linkages. Invasive species threaten native species as direct predators or competitors, as vectors of disease, and by modifying the native habitats. Invasive species are considered the second biggest threat after habitat loss to biodiversity worldwide by the Millennium Ecosystem Assessment in 2005.

Water is an excellent transport medium for the dispersion of many of these species. Rivers and loughs with their banks and shorelines are amongst the most vulnerable areas to their introduction, spread and impact. The focus for the Loughs Agency is predominantly on aquatic and riparian invasive species as these are a serious threat to our sensitive aquatic habitats. The spread of invasive species can also further threaten already endangered native species. In freshwater habitats the introduction of invasive species is considered the second leading cause of species extinctions. Invasive species are a global problem and once they are established eradication is often costly and extremely difficult. Previous studies suggest that early intervention is a more successful and cost-effective way of preventing the spread of invasive species.

There are a multitude of invasive non-native species across the UK and Ireland at present, many of them with the potential to cause serious environmental harm. Three species in particular, Japanese Knotweed (*Fallopia japonica*), Himalayan Balsam (*Impatiens grandulifera*) and Giant Hogweed (*Heracleum mantegazzianum*) have become an established threat to the streams and rivers of the Foyle and Carlingford areas. Rivers are an excellent means of transporting, dispersing and spreading invasive species, therefore it is no great surprise to see a proliferation along our river corridors.

There is a growing body of evidence demonstrating the damaging impacts of (INNS) invasive non-native species. The problem of excessive soil erosion along

the riparian zone can have grave consequences for freshwater fish species. Atlantic salmon (*Salmo salar*) and Trout (*Salmo trutta*) are reliant upon finding appropriately sized spawning gravel to complete their life cycle. However, Himalayan Balsam will die back in winter time, leaving behind exposed river banks devoid of any natural vegetation. The lack of vegetation on the riparian zone leaves the bank highly susceptible to soil erosion at times of increases flows and floods. Excessive soil erosion will increase the sediment load into the stream reach and can potentially smother the eggs buried in the spawning gravel, starving them of oxygen. Atlantic salmon stocks are at unprecedented low levels and they are also experiencing very high mortality rates during the marine phase of their life cycle. Increased sediment being introduced to rivers and streams has the potential to diminish juvenile abundance even further and merely exacerbates the problem still further.

7.0 BIOSECURITY

Invasive species are an ever present threat in our aquatic and riparian systems and it is imperative that none of our field operations exacerbate the risks to the environment and to the economy that are posed by these species. Fish parasites, pathogens and diseases also represent a significant threat to the health status of our watercourses. The introduction or transfer of such pathogens or diseases has the potential to wipe out large populations of fish in affected waters or catchments. Loughs Agency staff are required to be vigilant to help prevent the spread of fish diseases and invasive species. The agency has incorporated biosecurity protocols into its freshwater fisheries monitoring programme and these guidelines are also adhered to by fishery officers and field staff alike. The Loughs Agency biosecurity protocol for field operations was fully implemented during the Lough Fad fish survey.

8.0 RECOMMENDATIONS

- Communicate the findings of the survey to Irish Water and Donegal County Council with the aim of highlighting the impacts of water abstraction upon littoral spawning Arctic charr.
- Repeat survey every 5 years.

- Compare results against any future surveys in the Foyle area to ascertain comparative growth rates across and within a range of stillwaters of the Foyle and Carlingford areas.
- Communicate findings internally to colleagues and externally to stakeholders
- Continue to conduct stillwater fish surveys temporally and spatially within the Foyle and Carlingford areas.
- Promote Biosecurity awareness with angling community

9.0 REFERENCES

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