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Assessment of Pollan (*Coregonus autumnalis*) in Lower Lough Erne 2023

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Contents

Introduction 4

Methods 7

Targeted sampling approach 10

Processing of samples 11

Results 12

Length, Biomass and Age 12

Discussion 15

Growth Analysis 15

Biological Characteristics 15

Climate Change and Eutrophication 16

Recommendations for Future Monitoring 16

References 18

Introduction

Lough Erne is located in County Fermanagh, Northern Ireland (Figure 1). This report focuses on Lower Lough Erne, which is characterised by its eutrophic status (McElarney et al., 2023). Lower Lough Erne spans approximately 25,000 hectares, with a maximum depth of approximately 60 meters, providing diverse habitats that support a wide range of aquatic life. Since the 1990's Lough Erne has experienced a number of waves of invasion from high impact invasive species including zebra mussel in 1996 (Rosell et al., 1998) and *Hemimysis anomala* in 2013 (Gallagher and Rosell, 2019, Dick et al., 2013, Gallagher, 2017, Gallagher et al., 2015).

The fish community in Lower Lough Erne is rich and diverse, comprising non-native species such as perch (*Perca fluviatilis*), roach (*Rutilus rutilus*) and bream (*Abramis brama*), alongside native species such as brown trout (*Salmo trutta*) and pollan (Gallagher, 2020, Gallagher and Rosell, 2019, Rosell, 2014). Pike are also present, though their native / non-native status is uncertain (Ensing, 2015, Pedreschi et al., 2014, Pedreschi and Mariani, 2015). The presence of these species reflects the lake's complex food web and ecological interactions, which are crucial for understanding the dynamics of Pollan populations.

Pollan, a species of freshwater whitefish, is native to a limited number of locations in Ireland, with Lough Erne being one of its primary habitats (Harrison et al., 2010). The status of Pollan (*Coregonus autumnalis*) in Lough Erne is a matter of ecological and conservation significance (Harrod et al., 2001, Harrod et al., 2002, Gallagher and Rosell, 2019). The Department of Environment, Agriculture and Rural Affairs Inland Fisheries Branch commissioned AFBI to undertake fish stock assessments and provide scientific advice to support management decisions for fish and fisheries within Lough Erne. This report details the findings of the 2023

targeted Pollen survey within Lough Erne and should be read in conjunction with the AFBI 2022 Fish stock status report for the Lough. These targeted surveys aim to provide presence-absence data and insights into the cohort structure of Pollan in Lough Erne, examining trends in population structure between years, growth and diet.

The data collected through this annual survey provides essential insights that support fishery management plans and inform further research requirements for the conservation of pollan populations. By synthesizing recent data and field studies, this report evaluates the current status of pollan in Lower Lough Erne and offers recommendations to inform effective conservation strategies and management practices aimed at ensuring the sustainability of this unique species.

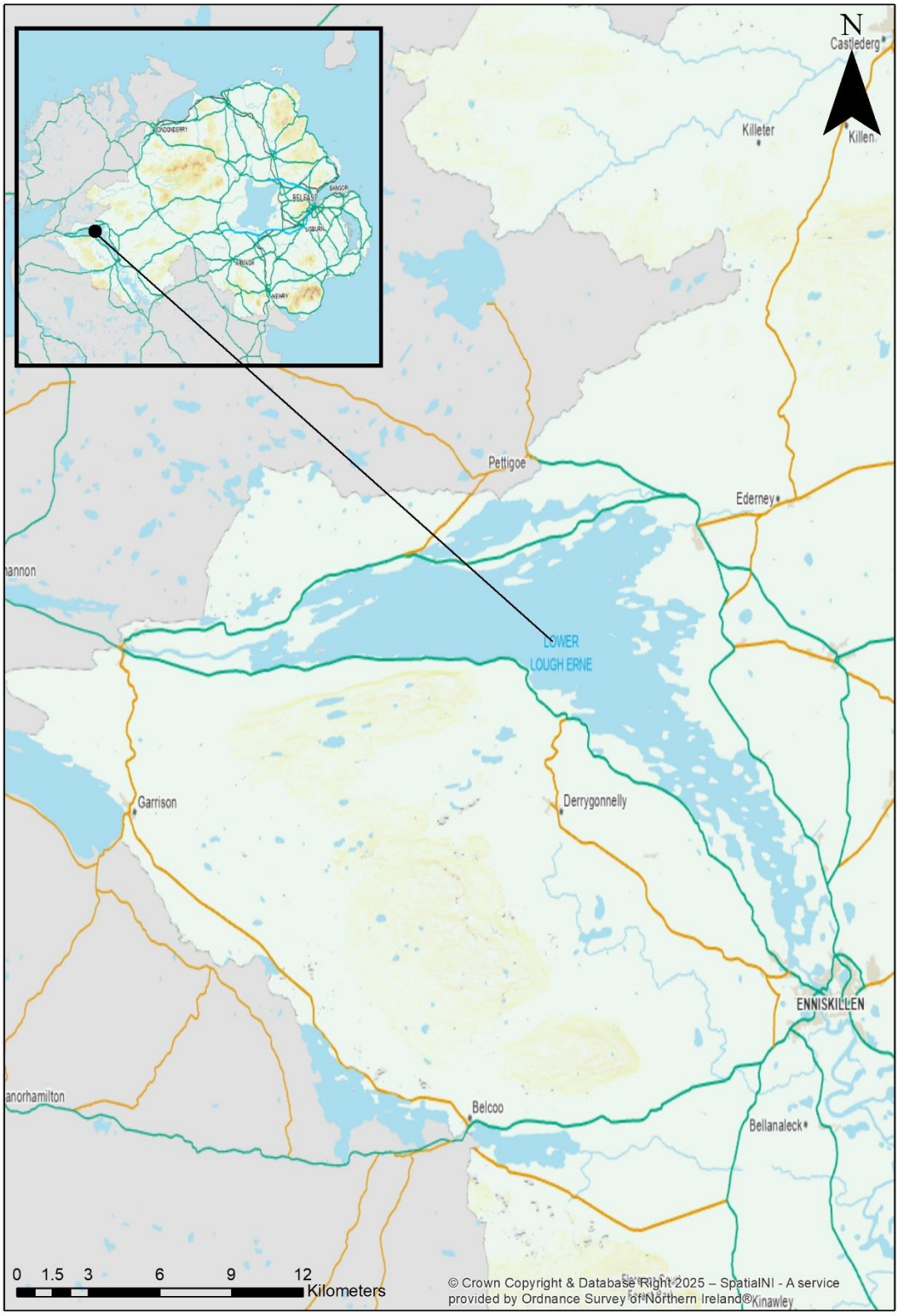

Figure 1: Location of Lower Lough Erne within the context of Northern Ireland, highlighting its proximity to key areas both sides of the NI-ROI border.

Methods

Fish sampling was conducted at 3 areas along the western shore of Lower Lough Erne, Heron Island, Magho and Hill Island on consecutive days in September 2023 (Table 1 & Figure 2).

Table 1: Sampling areas and date sampled in Lower Lough Erne.

Site	**Latitude/Longitude**	**Date sampled**
Heron Island	N54° 28.1384, W7° 47.9479	September 13th 2023
Magho	N54° 28.4514, W7° 54.2556	September 14th 2023
Hill Island	N54° 28.5501, W7° 54.7114	September 15th 2023

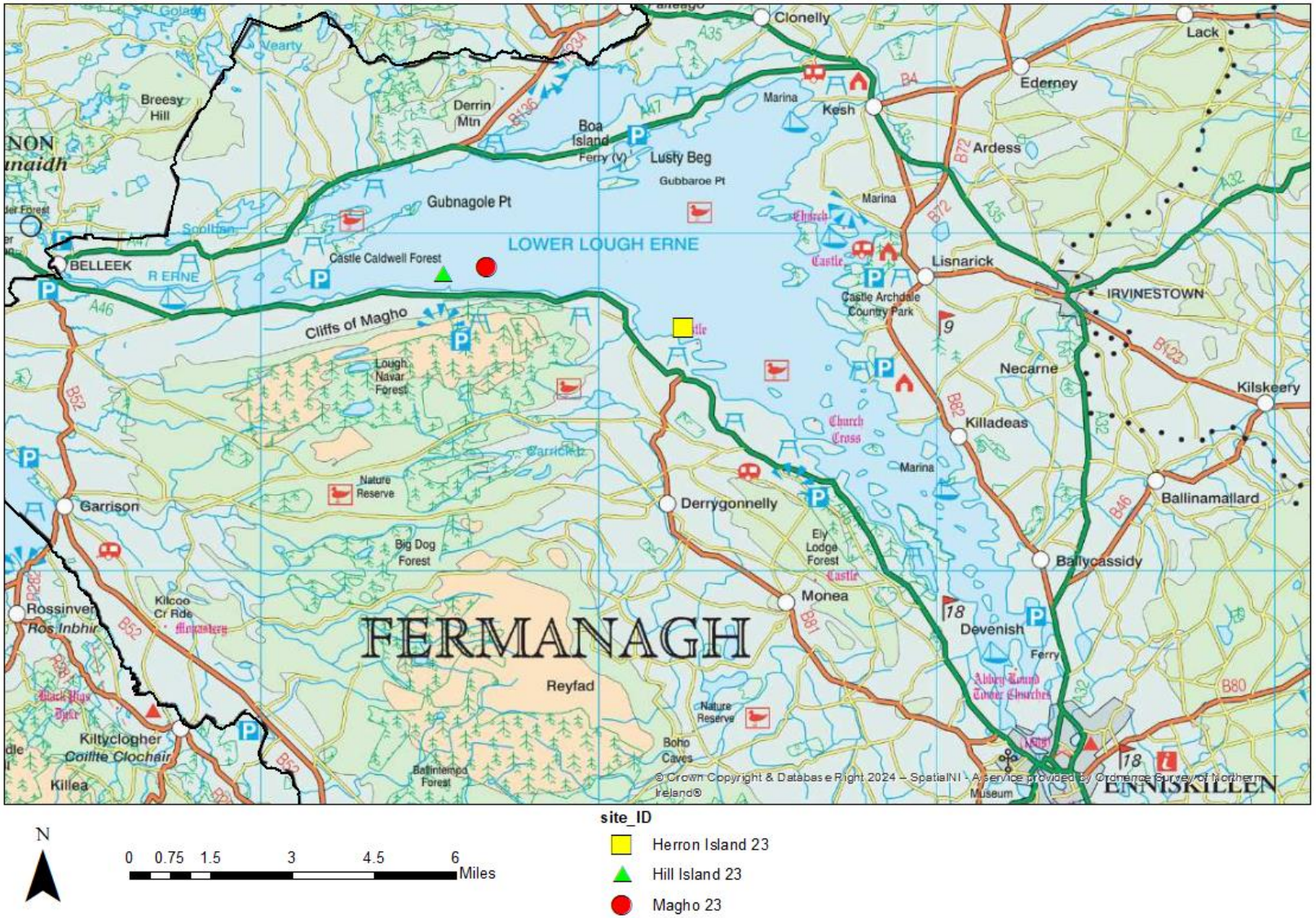

Figure 2: Location of the three 2023 pollan sample sites on Lower Lough Erne.

At each site, 2 floating CEN multi panel survey nets, 2 floating 50mm fixed mesh nets and 2 benthic CEN multi panel survey nets were deployed (Table 2 & Figure 3). The nets were left in situ for approximately 18 hours to allow for one dusk and one dawn (which is the peak fish activity period) to be sampled at varying depths.

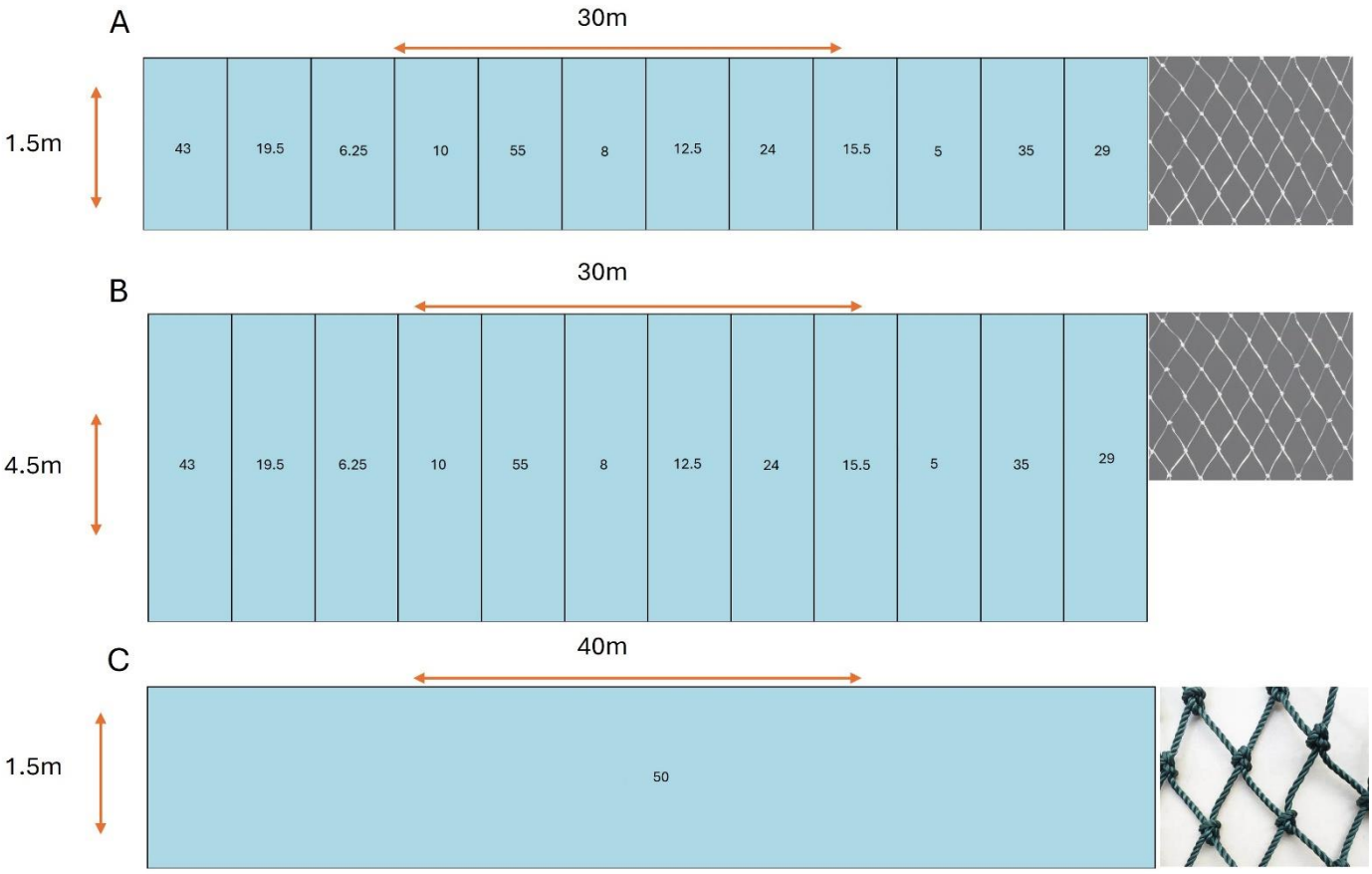

Figure 3: Diagram of the three types of nets used in the survey a) CEN floating net with a length of 30m, depth of 1.5m and 12 panels of varying mesh (5 to 55mm), b) CEN benthic net with a length of 30m, depth of 4.5m and 12 panels of varying mesh (5 to 55mm) and c) a fixed mesh net with a length of 40m, depth of 1.5m and a uniform 50mm mesh. Note numbers inset indicate mesh size in millimetre.

Table 2: Site, net type and maximum depth for each net set during the September 2023 survey.

Site	Net	Depth
Heron Island	CEN Floating 1	16m
Heron Island	CEN Floating 2	18m
Heron Island	Floating 50mm 1	17m
Heron Island	Floating 50mm 2	17.1m
Heron Island	CEN Benthic 1	16.8m
Heron Island	CEN Benthic 2	19m
Magho	CEN Floating 1	17.7m
Magho	CEN Floating 2	15m
Magho	Floating 50mm 1	13m
Magho	Floating 50mm 2	18m
Magho	CEN Benthic 1	13m
Magho	CEN Benthic 2	17m
Hill Island	CEN Floating 1	21m
Hill Island	CEN Floating 2	20m
Hill Island	Floating 50mm 1	18m
Hill Island	Floating 50mm 2	20m
Hill Island	CEN Benthic 1	17.6m
Hill Island	CEN Benthic 2	20.7

Targeted sampling approach

A targeted sampling methodology was undertaken using an echosounder to identify the specific target species of interest. Large signals were targeted to maximise the likelihood of capturing pollan. The echosounder allowed us to identify areas where shoals or individual fish exhibited characteristics associated with pollan, such as their preference for deep water. These deeper signals aligned with known habitat preferences of pollan, particularly colder, oxygen rich waters found at certain depths. This approach ensured the nets were deployed in

areas and depths with a higher likelihood of capturing specimens. These types of survey do not quantify population abundance. Targeted surveys provide samples for presence or absence, growth analysis and stomach content examination.

Processing of samples

Once the nets were retrieved, fish were carefully removed from the nets, identified to species level, enumerated, and placed in labelled polythene bags. These bags were then transported to the DAERA Riversdale base where they were frozen for further analysis back at the AFBI laboratory in Newforge.

All fish samples were processed at AFBI laboratories in Belfast. Fish were measured and weighed and scales were taken for growth and age analysis. Each fish was then dissected to determine sex, and gonads and livers were weighed for potential future comparisons. Additionally, the stomach contents were examined to gather dietary information.

Results

Pollan were only found within the samples collected from the Benthic CEN nets. A total of 38 individual samples were collected across the three study sites: Hill Island, Magho, and Heron Island. The detailed results are summarised in the following sections:

Length, Biomass and Age

The lengths of the pollan captured ranged from 12 to 26.5 cm and multiple size cohorts were captured (Figure 4). The weights of the sampled fish ranged from 39 to 260 g.

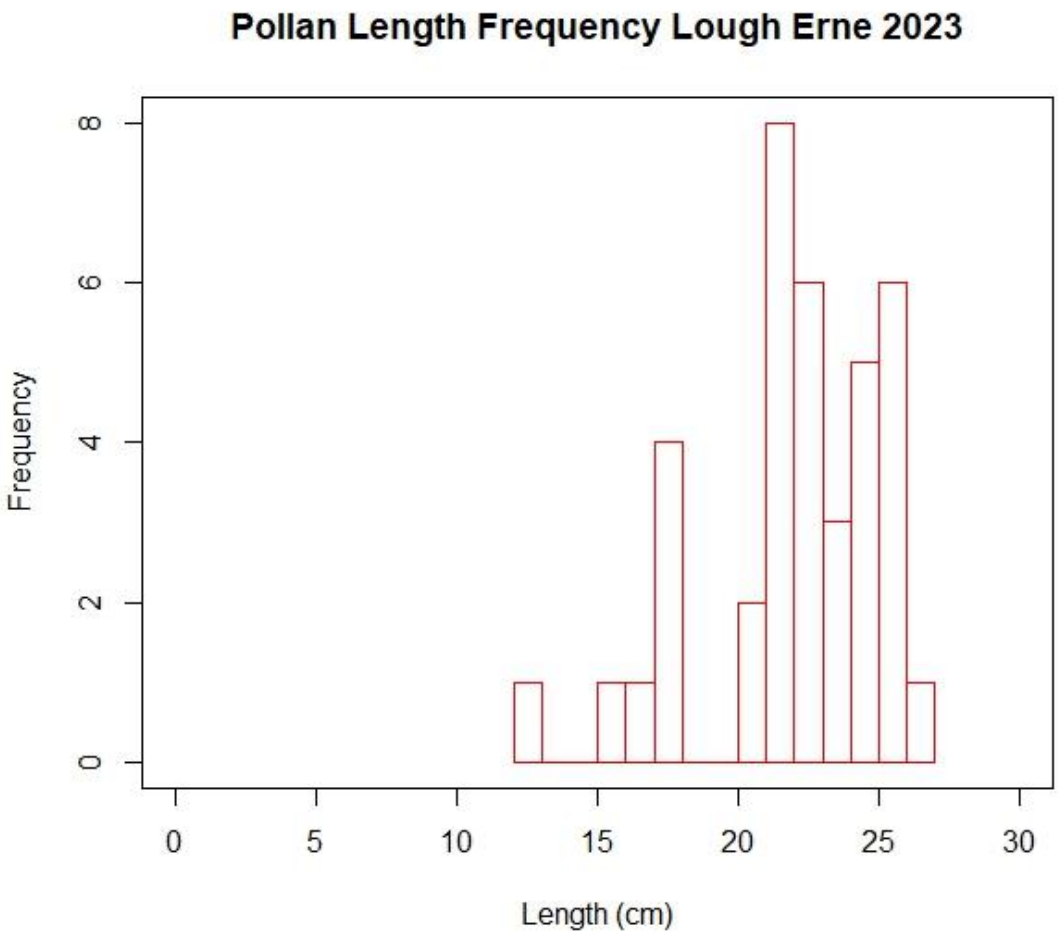

Figure 4: Pollan length frequency from samples taken from Lough Erne in September 2023.

A scale sample from each individual fish (Figure 5) was examined microscopically and the annual growth rings were counted and the interannual spaces between these rings were measured to calculate a growth rate. The growth curve (Figure 6) shows a positive correlation between age and length, indicating that pollan grow steadily as they age. Up to age 1+ there is a sharp increase in length suggesting rapid initial growth. Although decelerating slightly after the first year, growth continues to increase steadily up to 4 years of age (maximum age attained by samples in this study).

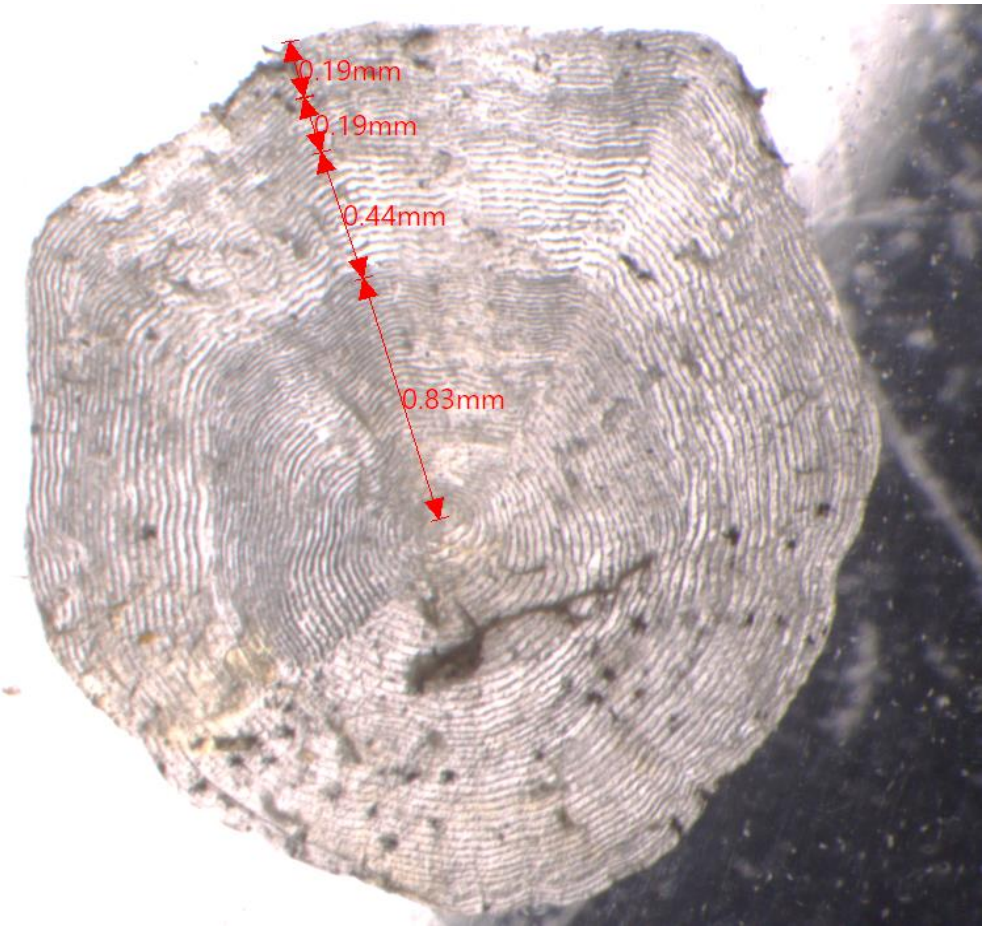

Figure 5: Magnified (10.5x) image of scale taken from a 24.1cm, age 4+ pollan, sampled from Lough Erne during the survey. Measurements of annual growth rings are indicated.

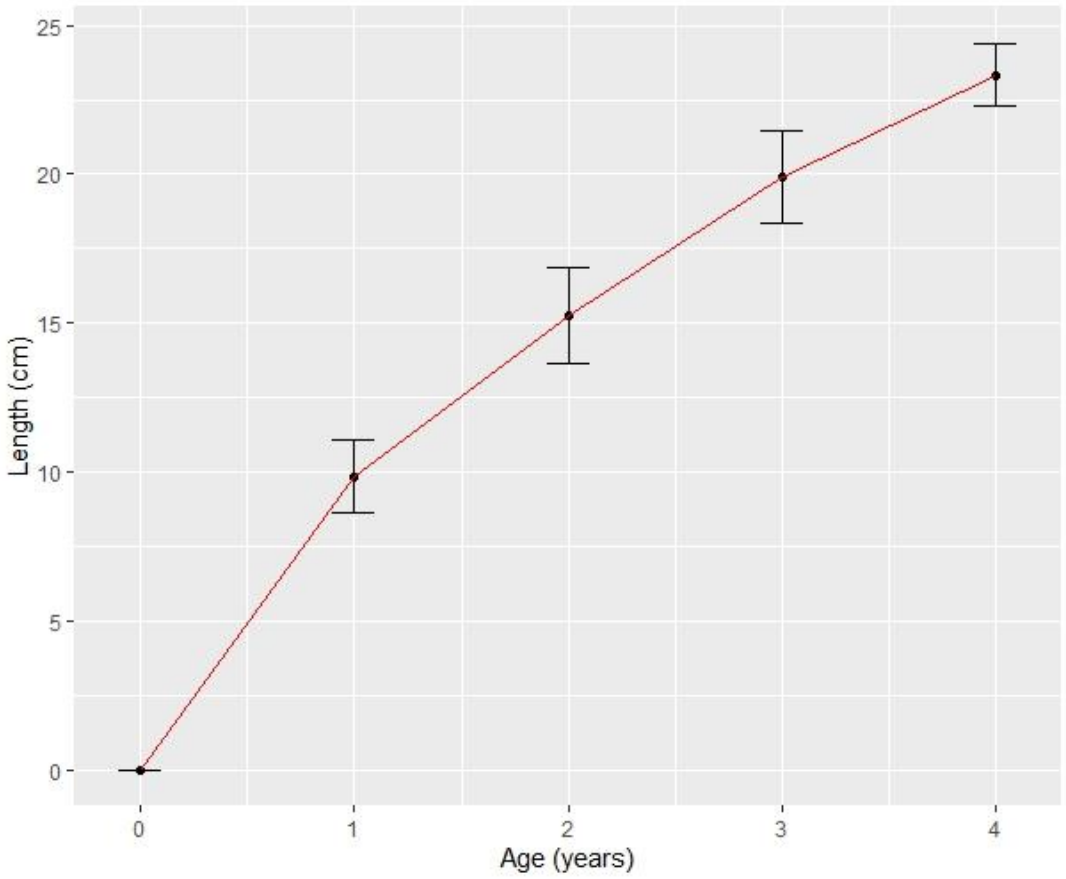

Figure 6: Growth curve from back calculated age data from pollan taken from Lough Erne in September 2023.

Out of the 38 samples taken, the sex could only be determined for 36 individuals with the following distribution:

- Female: 19 individuals
- Male: 17 individuals

Two samples from Heron island had indeterminate sex status. The gonad weights for females ranged from 0.2 to 18.5g while for males it ranged from 0.5 to 2.38g. Weights recorded for all 38 samples ranged from 0.13 to 2.09 g.

The stomach and alimentary canal of all fish were examined and, all except one individual were found to have empty stomachs. A 21cm female pollan contained remnants of *Mysis salemaai,* a freshwater planktonic shrimp in her stomach.

Discussion

The present study provides valuable insights into the growth patterns and biological characteristics of pollan (*Coregonus autumnalis*) in Lough Erne, as obtained from a targeted sampling survey conducted in September 2023. The use of echo sounders enabled precise targeting of fish, ensuring efficient and representative sampling.

Growth Analysis

The growth curve derived from the survey data indicates a steady increase in the length of pollan as they age, with significant growth observed during the initial years of life. Pollan reach an average length of approximately 10 cm by the end of their first year, and continue to grow steadily, reaching around 23-24 cm by the age of four (Figure 6). This linear growth pattern suggests that pollan in Lough Erne experience consistent growth rates, which is indicative of a stable and supportive habitat with adequate food resources (Harrod, 2001).

The observed growth rates are critical for understanding the population dynamics of pollan in Lough Erne. A consistent growth rate implies that the lake provides a conducive environment for their development.

Biological Characteristics

The survey also highlighted various biological attributes of pollan. The sex ratio was fairly balanced, with 19 females and 17 males identified among the 36 samples whose sex could be determined. The variability in gonad weights, particularly among females, suggests differing reproductive conditions, which could be influenced by factors such as age, nutritional status, and environmental conditions. Liver weights showed some variation, but no discernible pattern emerged.

Climate Change and Eutrophication

The health and growth of Pollan populations in Lough Erne are likely influenced by several environmental factors, including nutrient input and climate change. Increasing nutrient input, often resulting from agricultural runoff and other anthropogenic sources, can lead to eutrophication, which may alter the lake's ecological balance. Elevated nutrient levels can enhance primary productivity, potentially leading to increased food availability for pollan. However, excessive nutrient input can also cause harmful algal blooms, deplete oxygen levels, and negatively impact fish health and habitat quality.

Climate change poses additional challenges to the pollan population in Lough Erne. Rising water temperatures, altered precipitation patterns, and increased frequency of extreme weather events can affect the lake's thermal structure, oxygen levels, and food web dynamics. Warmer temperatures can accelerate metabolic rates in fish, potentially influencing growth rates and altering reproductive cycles. Changes in the timing and intensity of thermal stratification can impact the availability of suitable habitats for pollan, particularly during critical life stages such as spawning and juvenile development.

Recommendations for Future Monitoring

Given the potential impacts of nutrient input and climate change on pollan populations, it is essential to implement comprehensive and long-term monitoring programs. Key recommendations include:

- Continue regular Water Quality Assessments: Monitor nutrient levels, oxygen concentrations, and temperature profiles in Lough Erne to detect changes and identify potential risks to pollan habitats.
- Habitat Assessments: Evaluate the availability and quality of critical habitats, particularly spawning grounds and juvenile nurseries, to ensure that pollan have access to suitable environments throughout their life cycle.
- Climate Impact Studies: Investigate the specific effects of climate change on pollan growth, reproduction, and survival. This could include modelling studies to predict future scenarios and guide adaptive management strategies.
- Investigations as to the impacts of invasive species such as the zebra mussel on Pollan.

In conclusion, the findings from this survey underscore the importance of monitoring and managing environmental factors that influence the growth and health of pollan in Lough Erne. Continued research and proactive management strategies are crucial to safeguarding this species in the face of evolving ecological challenges. Finalising and implementing the draft Lough Erne Fishery Management Plan, along with all its key proposals, is essential to enhance the long-term sustainability of the pollan population and the broader fishery ecosystem.

Please note however, that this study's findings should be interpreted with caution, as the targeted sampling methodology utilised primarily provides data on presence/absence and growth characteristics rather than comprehensive population abundance.

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