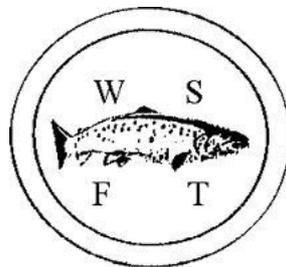


Coigach & Assynt

LIVING LANDSCAPE

Coigach & Assynt Living Landscape Partnership (CALLP) Scheme P03 Freshwater Lochan Survey: An inventory of the fish populations of 20 of the Coigach & Assynt lochs

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Executive Summary

With over 680 individual lochans in Assynt alone (Evans, Evans & Rothero 2002), this is an important habitat within the Assynt & Coigach area. This creates an opportunity to develop angling within the area as an economically important resource. Indeed, a study undertaken in 2011 found that angling was worth £345,840-£432,300 per annum to the Assynt communities (Brown 2012).

The freshwater lochs of Assynt and Coigach are, however, little understood with regards to the fish populations. This has allowed the *ad hoc* development of management policies. This project was developed to enable an initial study of 20 lochs within the area. West Sutherland Fisheries Trust staff time was supplemented by an estimated 96 hours of volunteer time to capture and analyse 136 fish of various species from these lochs.

Of the 7 species which occur in Sutherland area only 3, trout (*Salmo trutta*), arctic charr (*Salvelinus alpinus*) and minnows (*Phoxinus phoxinus*), were captured. This reflects the sampling methods used and the timing of the samples. Trout were the dominant species found within the area, occurring in each loch, minnows found in 4 of the 11 lochs sampled by gill net and charr in 3. Of the 3 charr populations recorded, one did not appear in the national database.

Growth rates were only calculated for trout within this study, reflecting the number of individuals analysed. Growth rates were found to be relatively similar throughout the area and combination of these data enabled a more robust analysis. Few older fish were assessed, but analysis of those captured, indicated a change in growth rate at about 7 years of age. This is likely to indicate a change to a more piscivorous diet. These data also allowed the determination of a length-weight relationship for the Assynt-Coigach area.

While potential management recommendations from such a small study are limited, these data have enabled more informed decisions to be made. In particular, the use of size limits can be based on the findings of the study, such that all fish are enabled to spawn and therefore recruitment is retained.

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Introduction

Background

The Freshwater Lochan Survey forms part of the Coigach & Assynt Living Landscape Partnership (CALLP) Scheme which is delivering 28 heritage projects from 2016-2021. The Freshwater Lochan Survey involves Scottish Wildlife Trust and is funded by National Lottery Heritage Fund and Scottish Natural Heritage and has the following vision:

- *'To generate greater awareness and knowledge of Assynt and Coigach's freshwater environment and its importance to the health of the wider environment and also economy of the area. The survey work will specifically focus on the fish species present in the area's freshwater lochans: identifying the extent and range of different species, and what factors determine their presence or otherwise.'*

Within this vision are the main activities of the project:

- *An audit of the fish populations in the area and an indication of their health.*
- *Recommendations for a management plan for the freshwater fishery within the Assynt & Coigach area.*

Project Description

A myriad of Lochans, including over 680 individual lochans in Assynt alone (*Evans, Evans & Rothero 2002*) lie interspersed between the knolls and small hills. Angling is economically very important within the area, with a vast resource of freshwater rivers and lochs, set in spectacular scenery, attracting a large number of visitors to the area annually. Indeed, a study undertaken in 2011 found that angling was worth £345,840-£432,300 per annum to the Assynt communities (Brown 2012).

The freshwater lochs of Assynt and Coigach are, however, little understood and as such management is presently rather *ad hoc* in nature. This has the potential to impact on the biodiversity of the area, as well as the economic value of the fisheries themselves. While the diversity is low in Assynt and Coigach and many of the trout populations have been affected by human activity, the area is still retains a more pristine structure than that found in more urbanized areas. In particular the low occurrence of introduced species and the presence of numerous charr populations are important on a national level.

Arctic charr were the first fish species to colonise freshwaters following the retreat of the ice after the last ice age. Despite being one of the most numerous species in many of the Sutherland lochs, its lifestyle means that it is seldom seen. Their resident life cycle also means that there is a vast diversity in phenotypic characteristics and evolutionary processes between lochs.

By gaining a greater knowledge of the population structure it will be possible to improve the management of the waters and as such help to protect the biodiversity of the area whilst also ensuring their long term sustainability from an angling perspective.

CALLP tendered for research to be undertaken, and awarded the work to the West Sutherland Fisheries Trust to sample the lochs using the Nordic Gill Net Sampling Method and through the recorded catch of local angling volunteers. The lochs of interest were identified within the project and agreed through communication with the local Estates, Angling Clubs, SNH, SEPA to identify the most interesting and relevant lochs to the local population and the scientific community.

Aims

The aims of the research were:

- To identify fish species composition of lochs
- To understand the dietary parameters of each lochan
- To understand growth rates for each species
- To assess health and parasitisation of each species community

Methodology

During 2018 and 2019 a total of 12 volunteers assisted WSFT staff in the collection of data on the fish populations in 20 lochs within the Assynt & Coigach area (Table 1). Sampling was undertaken by either gill netting alone, a combination of gill netting and angling or angling alone. This combination allowed a greater spread of lochs to be sampled than the use of gill nets alone.

Assynt and Coigach have low fish diversity, with only 6 species naturally present in the area. In addition to the salmon (*Salmo salar*), trout (*Salmo trutta*), arctic charr (*Salvelinus alpinus*), eel (*Anguilla anguilla*), stickleback (*Gasterosteus aculeatus*) and flounder (*Platichthys flesus*), minnows (*Phoxinus phoxinus*) have been introduced to the area by bait fisherman. Charr and minnows are unlikely to be taken by rod and line, and therefore found only in the gill net samples. Unfortunately, eels, stickleback and flounder are unlikely to be captured by either method and therefore information on these populations will be missing from this study.

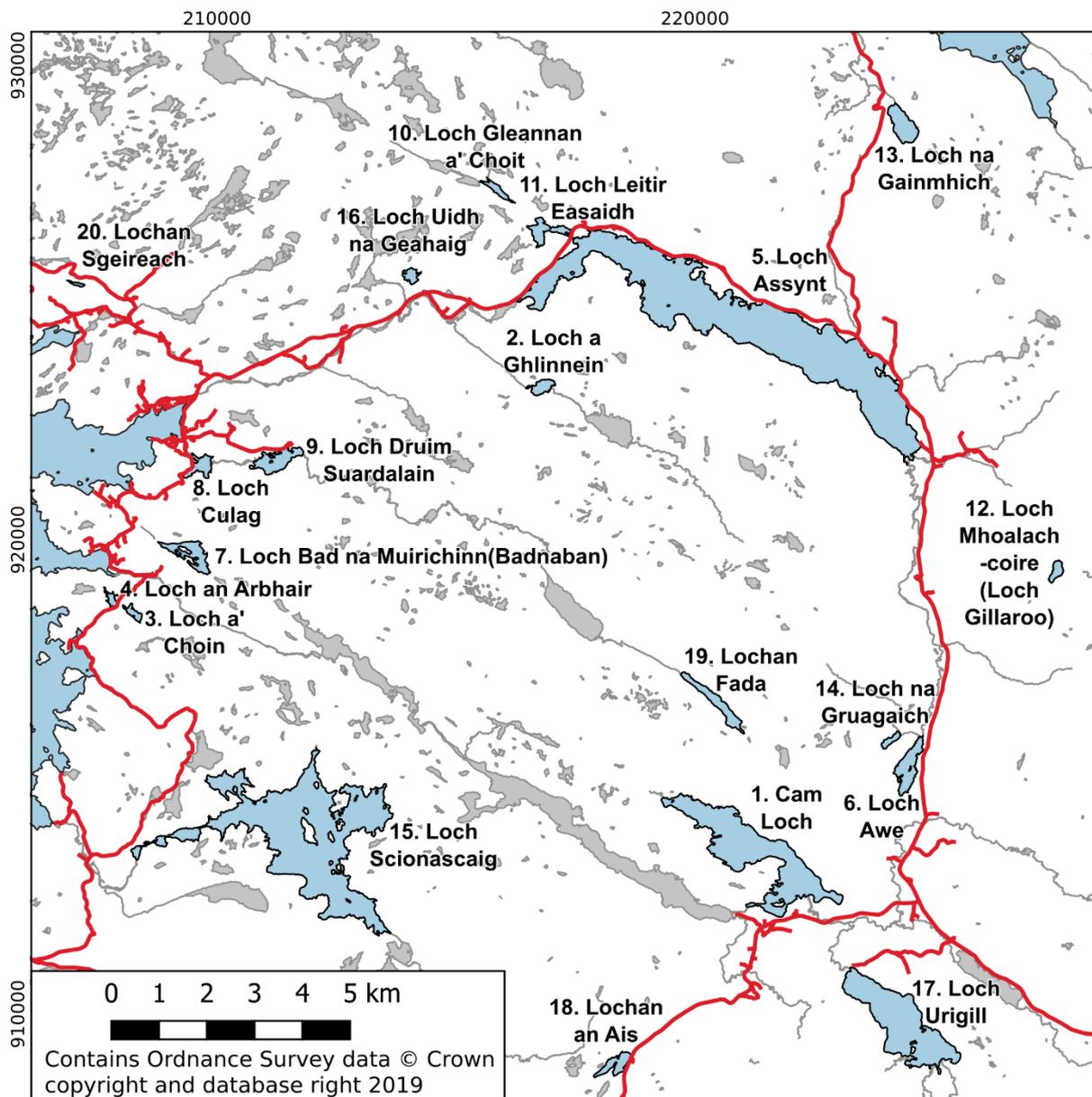


Figure 1. Location of lochs within the study .

Gill netting was undertaken in 11 lochs around the area (Figure 1). As a result of the presence of divers (both black and red throated) within the survey areas, the use of gill nets was restricted to after the departure of black-throated divers. Two multi-mesh survey gill nets were set by boat and allowed to fish for several hours before being retrieved. The nets were set in different locations, with one closer to the shore and the other towards the middle of water body. After retrieval the nets were emptied and the fish returned to the laboratory. Species, length and weight were recorded and a scale sample taken before the fish were dissected in order to determine sex, diet and parasite loading.

Participating anglers were supplied with scale packets and details of how to collect scale samples before they returned the fish to the water. They recorded date, location and length, together with any comments on the appearance of the fish. All scale

samples were subsequently analysed in the laboratory and the growth rates determined using the back calculation method (Bagenal 1978).

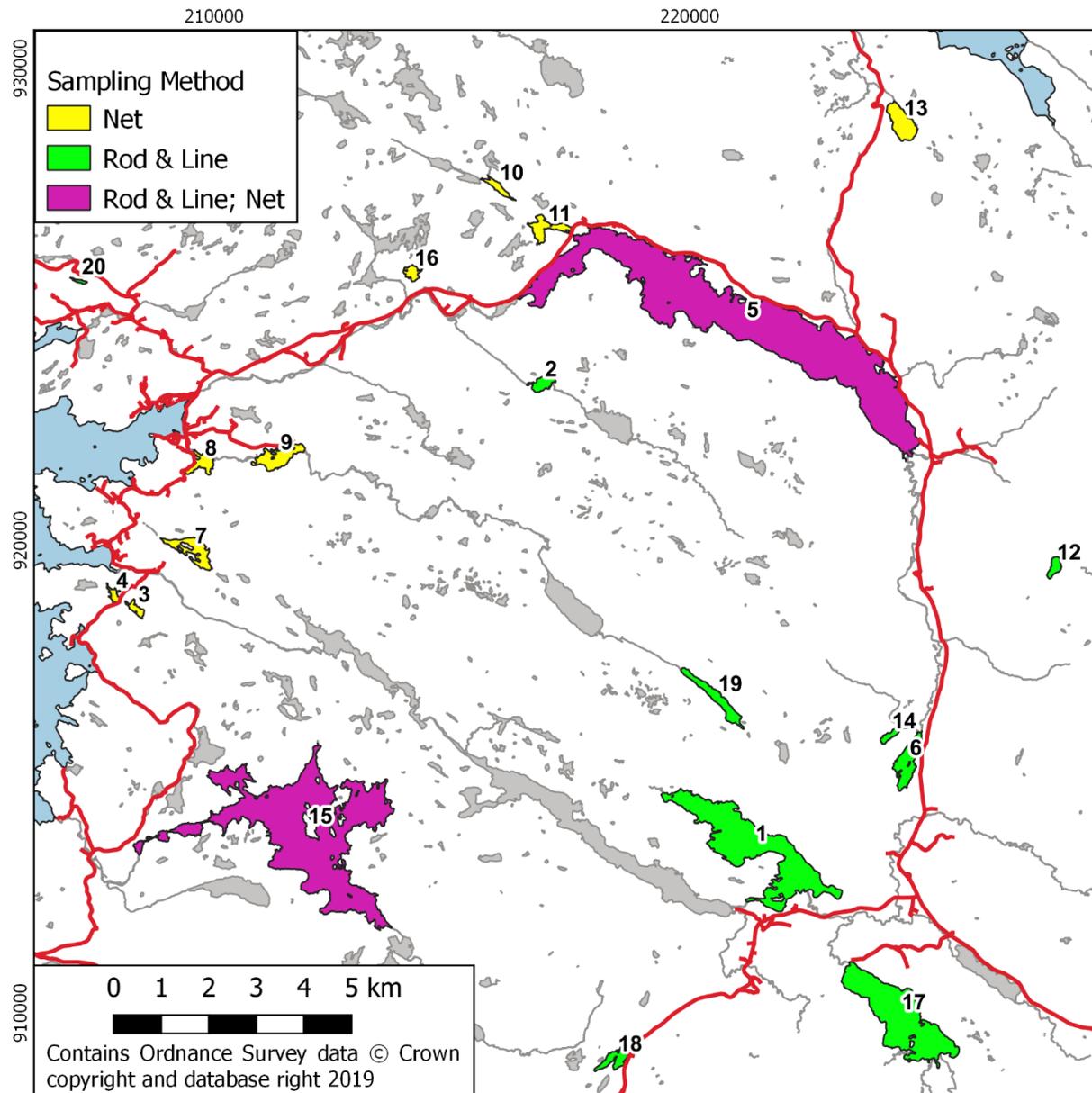


Figure 2. Location of lochs within the study by sampling methods.



Image 1. Researchers in the process of recovering the gillnet (A. Rawlings).

Results

Species

A range of species were recorded in the samples, with the presence of trout, Arctic charr and minnows noted. No salmon were recorded within this project, despite known populations in some of the lochs. This is likely to reflect the location of the nets and the lifecycle of the species.

Trout were the dominant species found within the area, occurring in each loch with minnows found in 4 of the 11 lochs sampled by gill net and charr in 3 (Figure 3). Maitland & Adams (2018) recorded charr in a further 3 of the lochs sampled by rod and line, with minnows noted in 2 of the rod and line only lochs. Within this study, charr were recorded in Loch Uidh na Geahaig, a population not previously been recorded within the literature.

The presence of the invasive non-native minnow reflects an historic use of bait fishing as an angling method within the lochs. Minnows are a fast breeding fish species and known to impact on the trout populations of many of the lochs in which they are found. Bait fishing is now illegal, as is the unlicensed movement of fish between water courses.

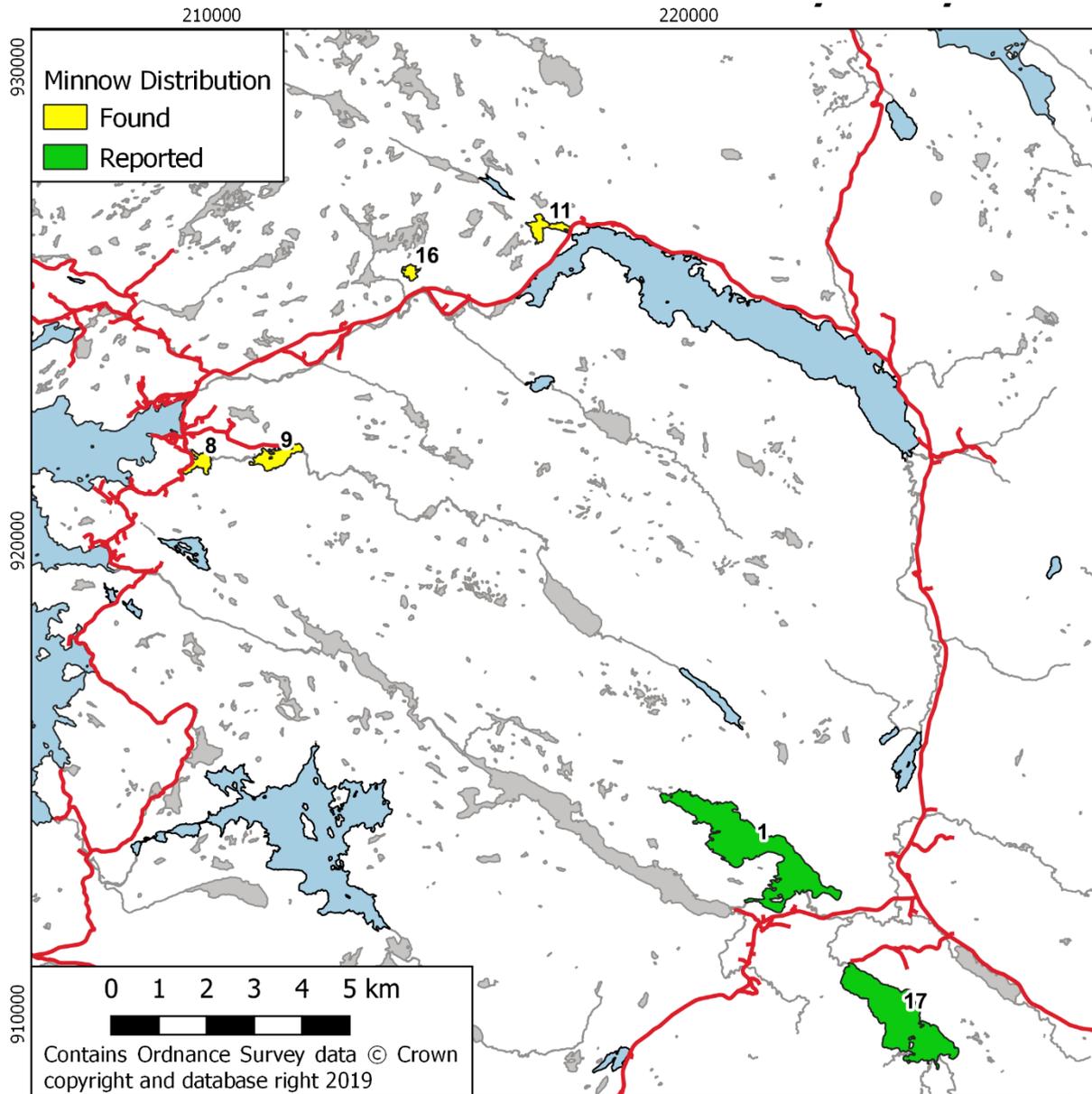


Figure 3. Distribution of Minnow (*Phoxinus phoxinus*) reported in Maitland & Adams (2018) and found by study.



Image 2. Arctic charr (S. Marshall).

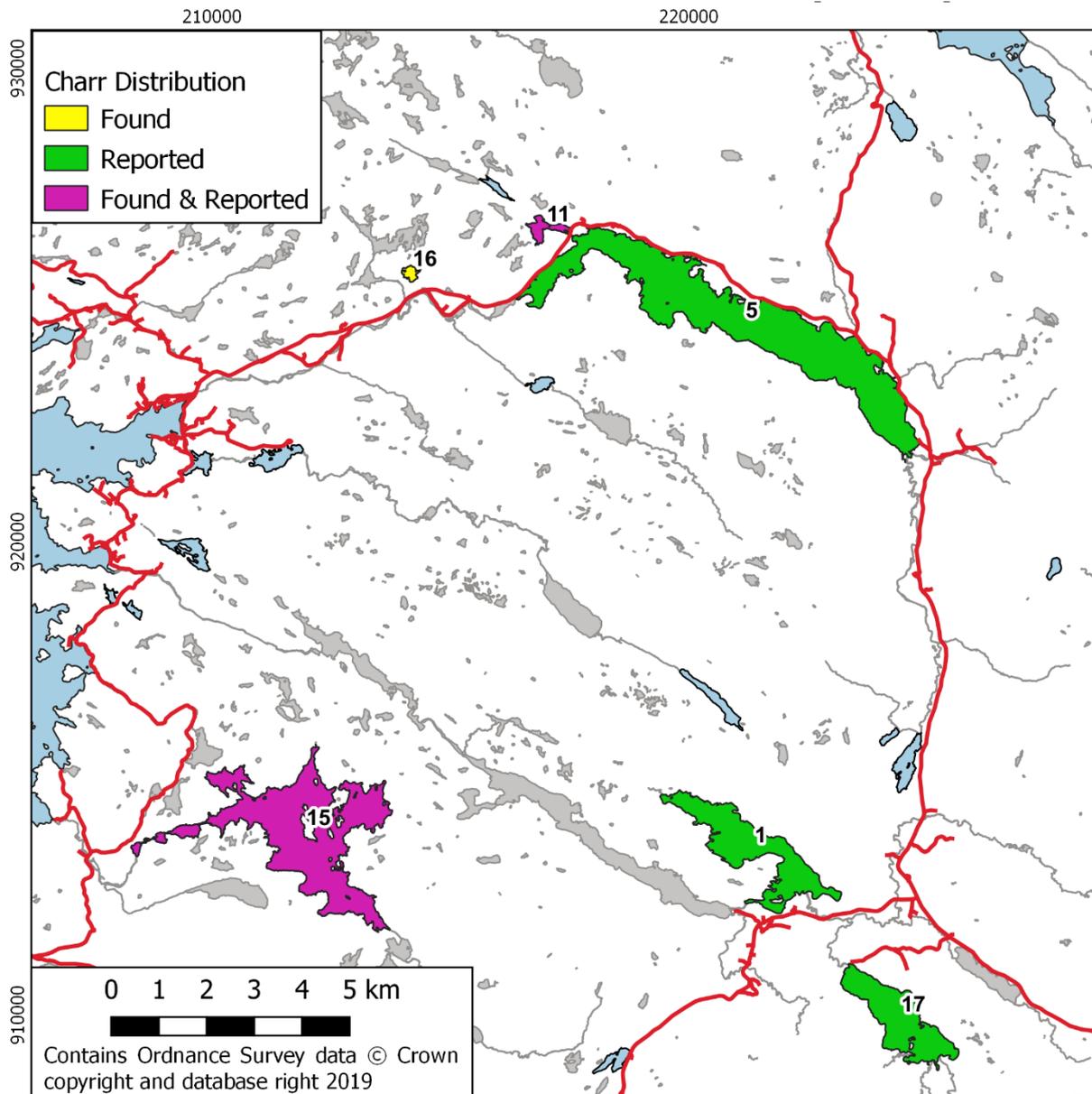


Figure 4. Distribution of Atlantic Charr (*Salvinus alpinus*) reported by Maitland & Adams (2018) and found by study.

Diet

Diet was found to be mixed, with fish from the same loch generally showing similar diets. Given the opportunistic nature of a trout diet this is as expected and reflects prey availability at that point in time. This is not a reflection of the overall diet of the species within the area but can highlight some unusual species and combinations. Interest was expressed by Mr I. Evans in the presence of snails in Loch Uidh na Geahaig, where knowledge of aquatic invertebrate populations is limited. In addition, the presence of green bottle maggots in large numbers within the stomachs of trout in Loch Uidh na Geahaig is also unexpected. These maggots feed on carcasses but are not aquatic and therefore likely to reflect the trout feeding around a deer carcass in particularly shallow water.

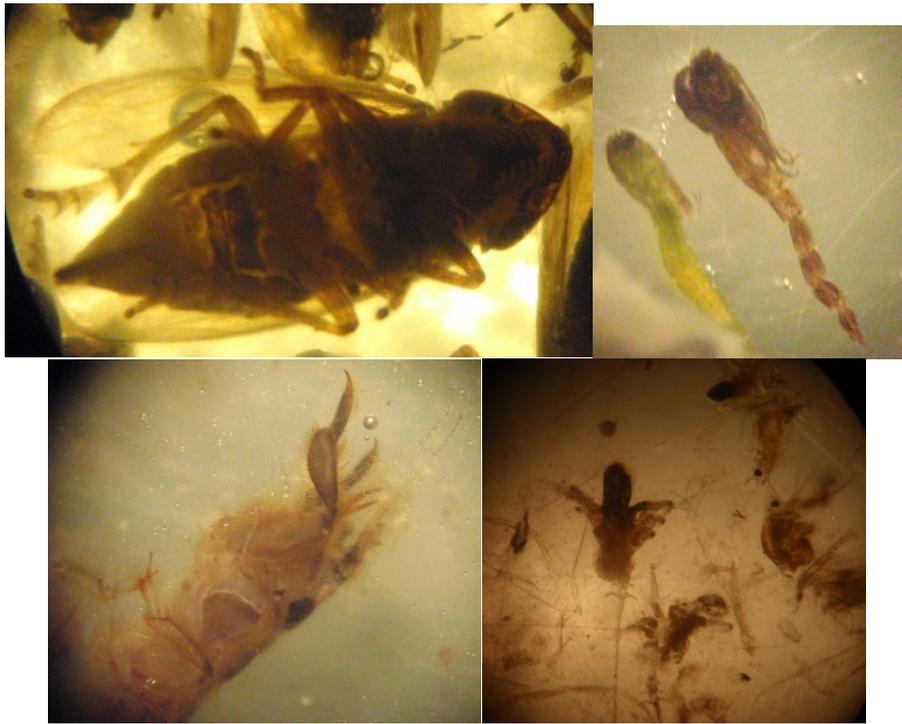


Image 3. Some of the species found within the diet (from top left to bottom right: frog hopper; Chaoborus; nymph; crustacean larvae) (S. Marshall).

Growth rates

Growth rates were calculated for trout only, as the number of charr sampled was not sufficient to provide a meaningful analysis. The average length at age for the Assynt-Coigach area is given in the graph. While variations exist between the lochs, this is not significant and length at age is broadly similar throughout the area. The exception to this was Loch Scionascaig, which returned larger fish but with a generally slower growth rate in the earlier stages than the other lochs.

A change in growth rate was observed for the trout of Loch Scionascaig at about 7 years of age, when the growth rate increased significantly (Figure 5). While this is based on a small sample size – one to two fish – it is likely to be indicative of a change to a more fish based diet.

The use of catch and release is an important tool in fisheries management. However, this can lead to problems for anglers determining the weights of their fish. While a number of length – weight guides are available, the data collected from this area has enabled an Assynt-Coigach conversion to be produced. This will hopefully be of interest to anglers fishing the lochs.

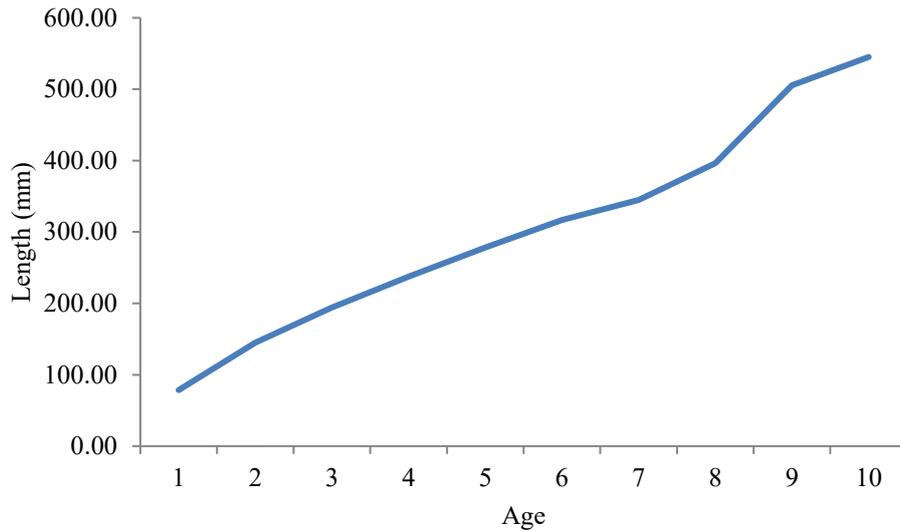


Figure 5. Average length at age for the Assynt & Coigach trout populations.

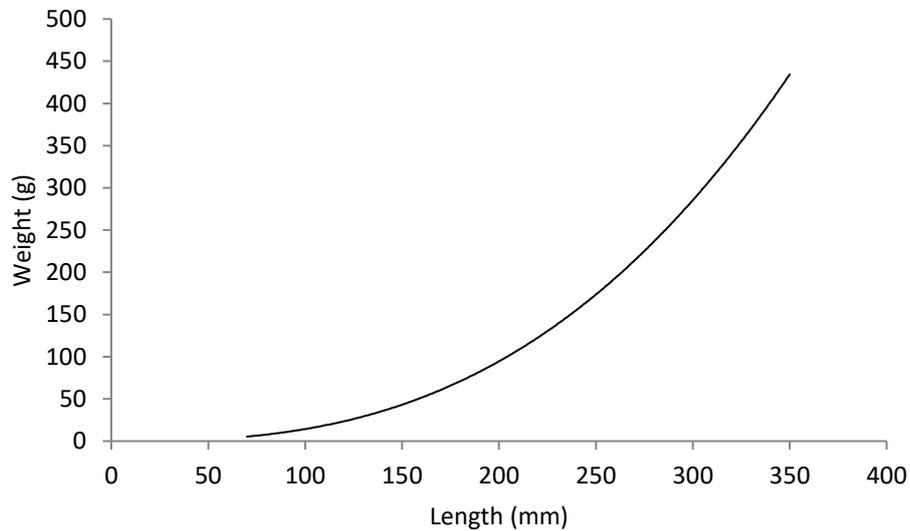


Figure 6. Average weight at length for the Assynt & Coigach trout populations.

Parasites and health

The fish examined were in good condition, with 95% having a condition factor >1. This reflects relatively healthy populations, with no particularly thin individuals encountered. In addition, while present in several of the fish examined, parasite densities were not high in any individual.

Conclusion

This project has produced an initial assessment of the fish populations of the Assynt – Coigach area. Although small in scale, it has enabled data to be collected which has added to the National Fish Biological Network¹. From this study, the trout population within the area would appear to be healthy with good condition and a well-mixed, natural diet. There are few observed differences in the trout populations between the different lochs.

This is a pilot study into the fish populations. It does not examine the environmental or physical properties of the different lochs and this should be considered for future research. The use of eDNA in the survey of freshwaters is being developed at a significant rate and this technique would be recommended for future research into fish distribution within the area.

Management Recommendations

Management of the loch systems within Assynt & Coigach is under the control of the various proprietors and tenants. Within the Assynt area, most of the lochs are co-managed as a single fishery under the Assynt Angling Group, with permits acquired on the basis of a 'beat' giving a number of lochs fishable with one permit. The survey area is largely covered by a Brown Trout Protection Order, which sets restrictions on angling, in particular the methods used, but leaves open the ability to control other issues such as number of permits supplied and catch and release considerations.

While this project has not produced data signifying loch specific management requirements, it has highlighted where additional information would be helpful and enabled a number of recommendations to be proposed for the management of the Assynt and Coigach lochs. This will be communicated to the various managers within the area.

A number of recommendations are proposed within this report:

1. Fishing records

All management decisions need to be made from a sound knowledge base. As such, the maintenance of good fishing records should be considered essential. At the least, catch per loch but an idea of fishing effort would also assist with proactive management decisions.

2. Minimum size

In order to maintain a fish population, and therefore the fishing resource, it is important to ensure that the population is not over-exploited. To do this, it is important that all females are able to spawn at least once. Within this study the average length of ripe females was about 20 cm. It is therefore recommended that a minimum size limit of 30 cm (12 inch) be introduced, thus allowing at least 2 years of spawning per female.

3. Bag limit

¹ <https://species.nbnatlas.org/species/NHMSYS0000544751>

This will vary by loch and therefore this study is unable to make any recommendations as to appropriate bag limits within the different lochs. For example, a limit of 3 may be acceptable in one loch but potentially fish out another. However, this is worth considering and the use of catch returns would help.

4. Access

Fish are a migratory species, be that between fresh and salt water, like salmon, sea trout and eels, or within and between lochs and rivers. It is therefore important that access is maintained within the system, particularly to spawning grounds. Within this area the most likely cause of blockages are litter and poorly designed or damaged culverts and bridges. It is therefore recommended that tracks are checked to ensure that they do not block fish access where they cross burns and that rivers are walked occasionally to ensure that litter is removed.

5. Check Clean & Dry

Biosecurity is an important, if often overlooked, aspect of freshwater management, particularly within this area. There are few invasive non-native species present within Assynt & Coigach and it is recommended that this situation is maintained. As such, the use of the Check Clean & Dry procedure between beats as a minimum is recommended.

- Check - All clothing and equipment should be thoroughly inspected and any visible debris (mud, plant or animal matter) should be removed and left at the water body where it was found. Particular attention must be paid to the seams and seals of boots and waders. Any pockets of pooled water should be emptied.
- Clean - Equipment should be hosed down or pressure-washed on site. If facilities are not available equipment should be carefully contained, e.g. in plastic bags, until facilities can be found. Washings should be left at the water body where the equipment was used, or contained and not allowed to enter any other watercourse or drainage system (i.e. do not put them down the drain or sink). Where possible, clean equipment should be dipped in disinfectant solution (e.g. Virkon) to kill diseases, but note this is unlikely to kill non-native species.
- Dry - Thoroughly drying is the best method for disinfecting clothing and equipment. Boots and nets should be hung-up to dry. Equipment should be thoroughly dry for 48 hours before it is used elsewhere. Some non-native species can survive for as many as 15 days in damp conditions and up to 2 days in dry conditions, so the drying process must be thorough.

Further details from:

<https://secure.fera.defra.gov.uk/nonnativespecies/checkcleandry/>

References

Bagenal, T. (1978) Methods for Assessment of Fish Production in Fresh Waters. Blackwell Scientific Publications.

Brown (2012) The Social, Economic, and Environmental Benefits of Angling. Substance.

Evans, P. A., Evans, I. M. & Rothero, G.P., Flora of Assynt, P.A. & I.M. Evans, 2002.

Maitland, P.S. & Adams, C.E. (2018) Arctic Charr in the Lochs of Scotland. An assessment of distribution and status. Fast Print Publishing.

Appendix

Table 1. List of lochans surveyed and distribution of fish species.

Number	Loch Name	Year Sampled	Sampling Method	Trout Present	Minnow Present	Charr Present
1	Cam Loch	2019	rod and line	✓	✓ (Reported Maitland & Adams 2018)	✓ (Reported Maitland & Adams 2018)
2	Loch a ' Ghlinnein	2018	rod and line	✓		
3	Loch a Chion	2018	net	✓		
4	Loch an Arbhair	2018	net	✓		
5	Loch Assynt	2019	both	✓		✓ (Reported Maitland & Adams 2018)
6	Loch Awe	2018	rod and line	✓		
7	Loch Bad na Muirichinn (Badnaban)	2019	net	✓		
8	Loch Culag	2019	net	✓	✓	
9	Loch Druim Suardalain	2019	net	✓	✓	
10	Loch Gleannam Choir	2018	net	✓		
11	Loch Leitir Easaidh	2018	net	✓	✓	✓ (Also reported Maitland & Adams 2018)
12	Loch Mhoalach-coire (Gillaroo Loch)	2018	rod and line	✓		
13	Loch na Gainmhich	2019	net	✓		
14	Loch na Gruagaich	2019	rod and line	✓		
15	Loch Scionascaig	2018	both	✓		✓ (Also reported Maitland & Adams 2018)
16	Loch Uidh na Geahaig	20119	net	✓	✓	✓
17	Loch Urigill	2018	rod and line	✓	✓ (Reported Maitland & Adams 2018)	✓ (Reported Maitland & Adams 2018)
18	Lochan an Ais	2018	rod and line	✓		
19	Lochan Fada	2018	rod and line	✓		
20	Lochan Sgeireach	2019	rod and line	✓		