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Fish stock assessment
of Spelga Dam and
determination of Pike
(*Esox Lucius*) status.

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Introduction

Spelga reservoir is located in the Mourne Mountains of County Down. It sits at a latitude of 370 m above mean sea level. It occupies a catchment area of approximately 5.5 km². The reservoir and dam were built between 1953 and 1957 with the aim of providing potable water to parts of Belfast and County Down. During drought periods (including during this survey), the water level drops significantly thus greatly reducing the wetted area of the lake and exposes the original main Belfast to Kilkeel road including several civil engineering structures such as bridges which are likely important habitat for fishes. Spelga reservoir is deemed by the Department of Agriculture, Environment and Rural Affairs (DAERA) as an important game angling (wild Brown Trout) fishery. The lake was previously sampled for fish in 1981 (Cragg-Hine, 1981).

Materials and Methods

The reservoir was sampled over 2 nights from the 6th to the 8th October. The early October sampling schedule was determined to preclude interruption to anglers during the angling season. Considering Spelga reservoirs size and maximum depth (Figure 1) a total of two gangs of double trap Dutch fyke nets, seven EU standard monofilament multimesh gill nets (12 panel, 5 - 55mm) (CEN, 2005) and five braided nylon gill nets (mesh = 40mm) were utilised. Nets were positioned at 14 sites in varying depth strata. Nets were deployed in the afternoon and retrieved the following morning. The location of each net was precisely recorded using a handheld GPS. During the 1981 survey a similar technique was likely utilised with a 6 panel braided net (13 - 46mm)

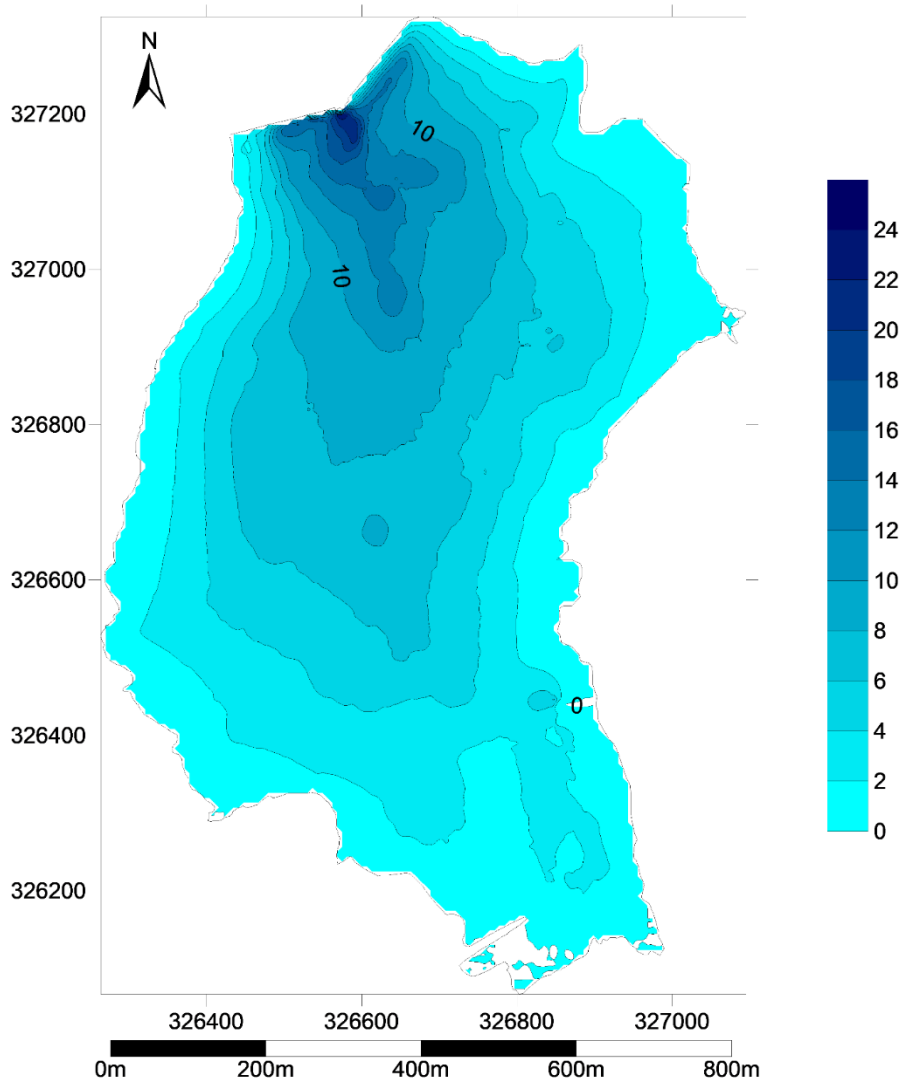


Figure 1: Bathymetric profile of Spelga Dam. Kindly provided by Colin Daly (NIEA).

On retrieving the nets, any live trout were recorded and released. All other fish were removed from the nets, placed in sample bags, labelled and returned to the lab to be frozen for later analysis. In the laboratory, thawed fish were identified to species level and measured (fork length ± 1 mm, blotted wet mass ± 0.1 g). Ageing structures were removed from each wild fish: scales were taken from brown trout and opercular bones and cleithra from pike. In all fish, a longitudinal ventral incision from the vent to a line level with the pectoral fin was made. The sex of each individual fish was recorded following visual assessment of gonads following Nikolsky (1963). Presence or absence of endoparasites was also recorded.

In addition two feeder streams were electrofished. A northern feeder stream proximal to the main car park was electrofished at 2 sites and a southern stream at Deer’s Meadow was electrofished at 3 sites. At each site electrofishing consisted of a 10 minute upstream sweep using an electrofishing backpack to provide semi-quantitative data. Due to the local geology water conductivity is low and as such the voltage on the electrofishing gear was set to 275 V at 70 Hz. Captured specimens were measured and returned to the stream alive.

Results

Reservoir Net Survey

In the reservoir netting survey we captured 46 fish of three species; Brown Trout (n = 20), Pike (n = 1) and 3 Spined Stickleback (n = 25) See Table 1.

Table 1: Number of each species captured per net.

Date	Net	Net Type	Brown		
			Trout	Pike	Stickleback
05/10/2021	CEN1	CEN 9-12m	1	0	0
05/10/2021	CEN2	CEN Floating	2	0	0
05/10/2021	CEN3	CEN 25m	0	0	0
05/10/2021	CEN4	CEN Floating	0	0	0
05/10/2021	CEN5	CEN 0-3m	0	0	0
05/10/2021	CEN6	CEN 3-6m	0	0	0
05/10/2021	CEN7	CEN 6-12m	0	0	0
05/10/2021	F1	Fyke	0	0	11
05/10/2021	F2	Fyke	0	0	14
06/10/2021	B1	Braided 40mm	6	0	0
06/10/2021	B2	Braided 40mm	11	1	0
06/10/2021	B3	Braided 40mm	0	0	0
06/10/2021	B4	Braided 40mm	0	0	0
06/10/2021	B5	Braided 40mm	0	0	0

Calculations of catch per unit effort (no. of fish m⁻¹ of net) are presented in Table 2.

Table 2: Catch per Unit Effort of net caught fish from Spelga reservoir. Note calculations for 3 spined sticklebacks were excluded from 40 mm braided nets.

	Brown Trout CPUE	Pike CPUE	Stickleback CPUE
Mean CPUE	0.0353	0.0017	0.0925
Standard Deviation	0.0749	0.0062	0.1854

Brown trout ranged in length from 26 to 37.5 cm, in mass from 212 to 752 g and were aged 3+ (n = 12), 4+ (n = 7) and 6+ (n=1). Brown trout exhibited a male : female sex ratio of 4 : 5.5. Examination of their stomach contents revealed a diet dominated by three spined sticklebacks.

The individual captured pike was a male, measured 60cm, weighed 1840g and aged 2+. This specimen's stomach and gastrointestinal tract was empty.

The retained samples of three spined stickleback ranged in length from 3.5 to 4.5 cm.

A previous study by Cragg-Hine (1981) utilised a similar netting technique. In this study only brown trout were recorded, they ranged in length from 15 to 25.5cm. These nets could not have caught sticklebacks. See Figure 2 for comparative presentation of length frequency data from the 1981 and 2021 studies.

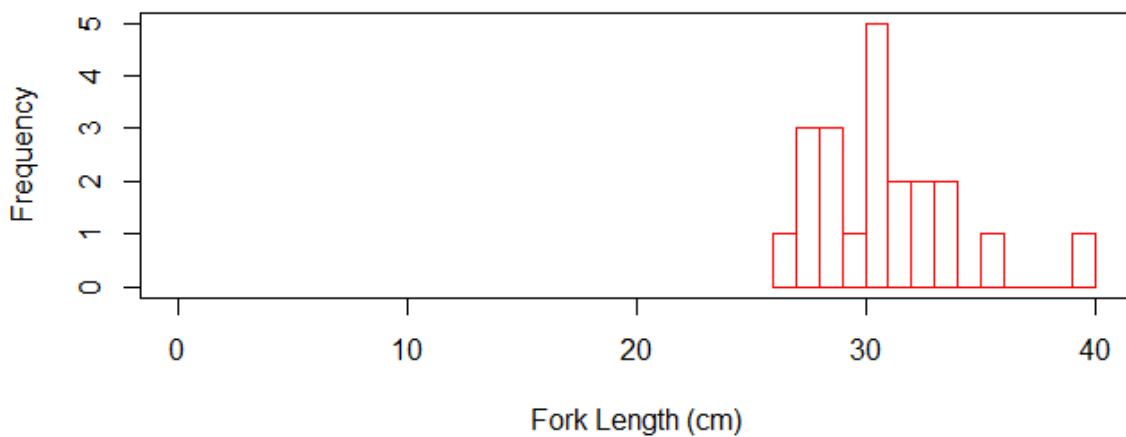
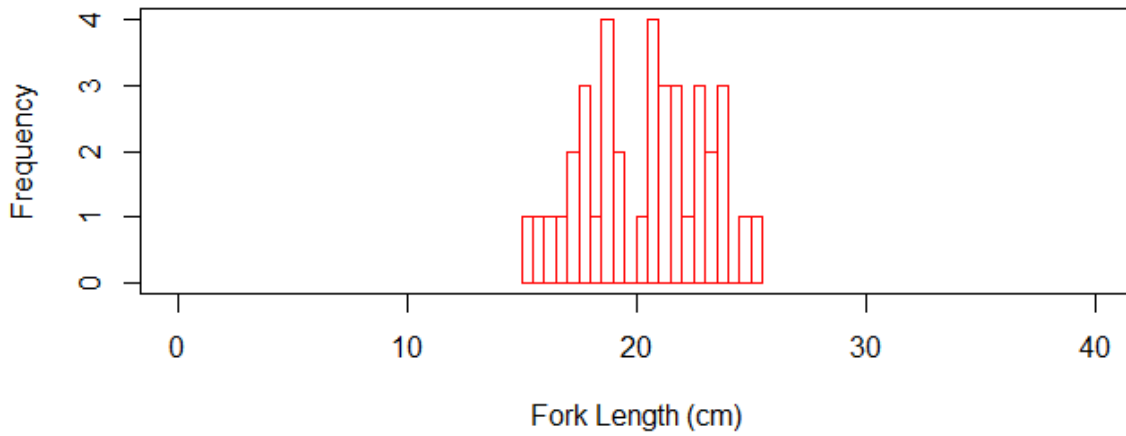


Figure 2: Length Frequency Histogram of Brown Trout captured in 1981 (top) and 2021 (bottom).

Statistical analysis comparing the fork lengths of Brown Trout from the 1981 study against the 2021 study reveal that the reservoir is now dominated by larger fish with an absence of smaller cohorts ($t = -13.383$, $df = 41.038$, $p < 0.001$) (Figure 3).

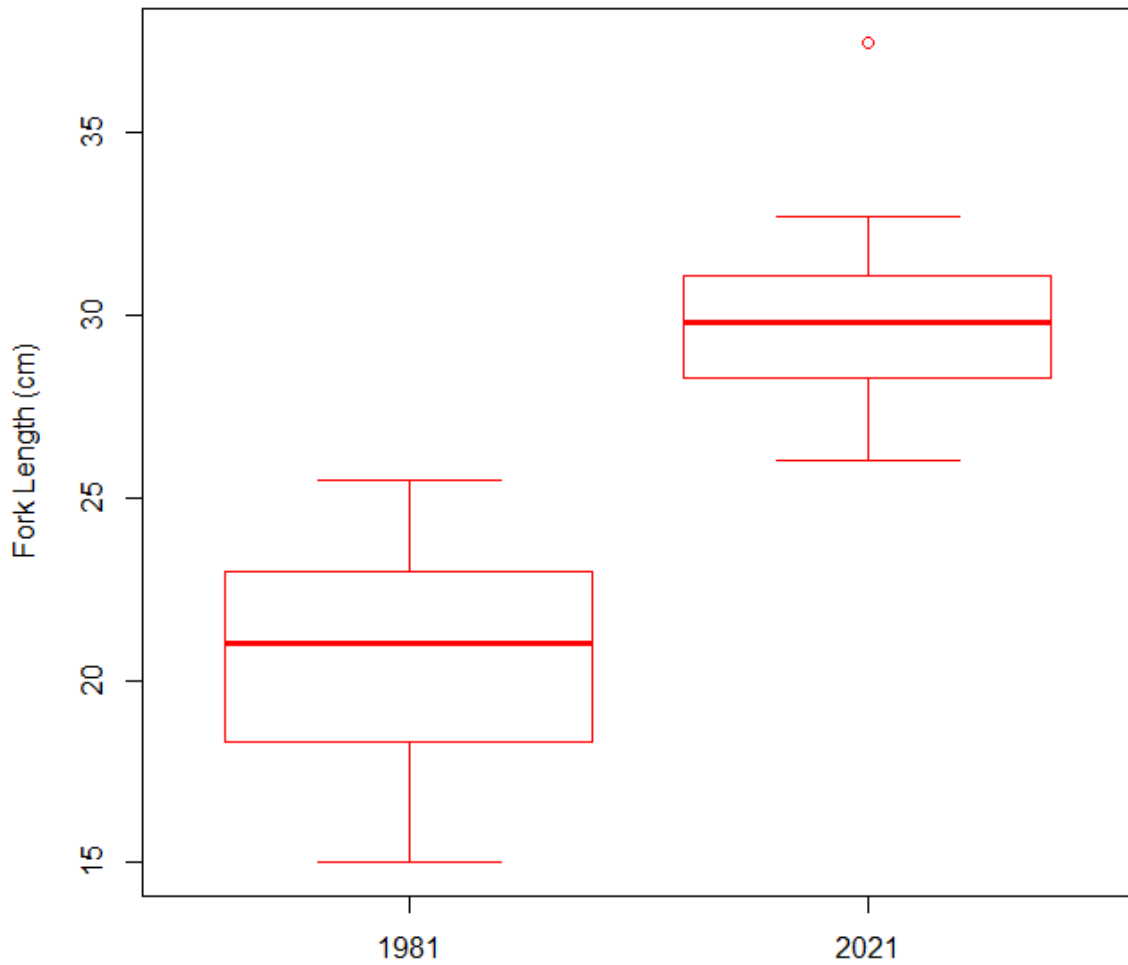


Figure 3: Boxplot illustrating the size difference in Brown Trout between surveys in 1981 and 2021 ($t = -13.383$, $df = 41.038$, $p < 0.001$).

Electrofishing Survey of Feeder Streams

The semi quantitative electrofishing passes captured brown trout ($n = 29$) and three spined stickleback ($n = 15$). Brown trout ranged in size from 5.5 -18.8 cm (Figure 4) and three spined stickleback ranged in size from 3 – 5.3 cm.

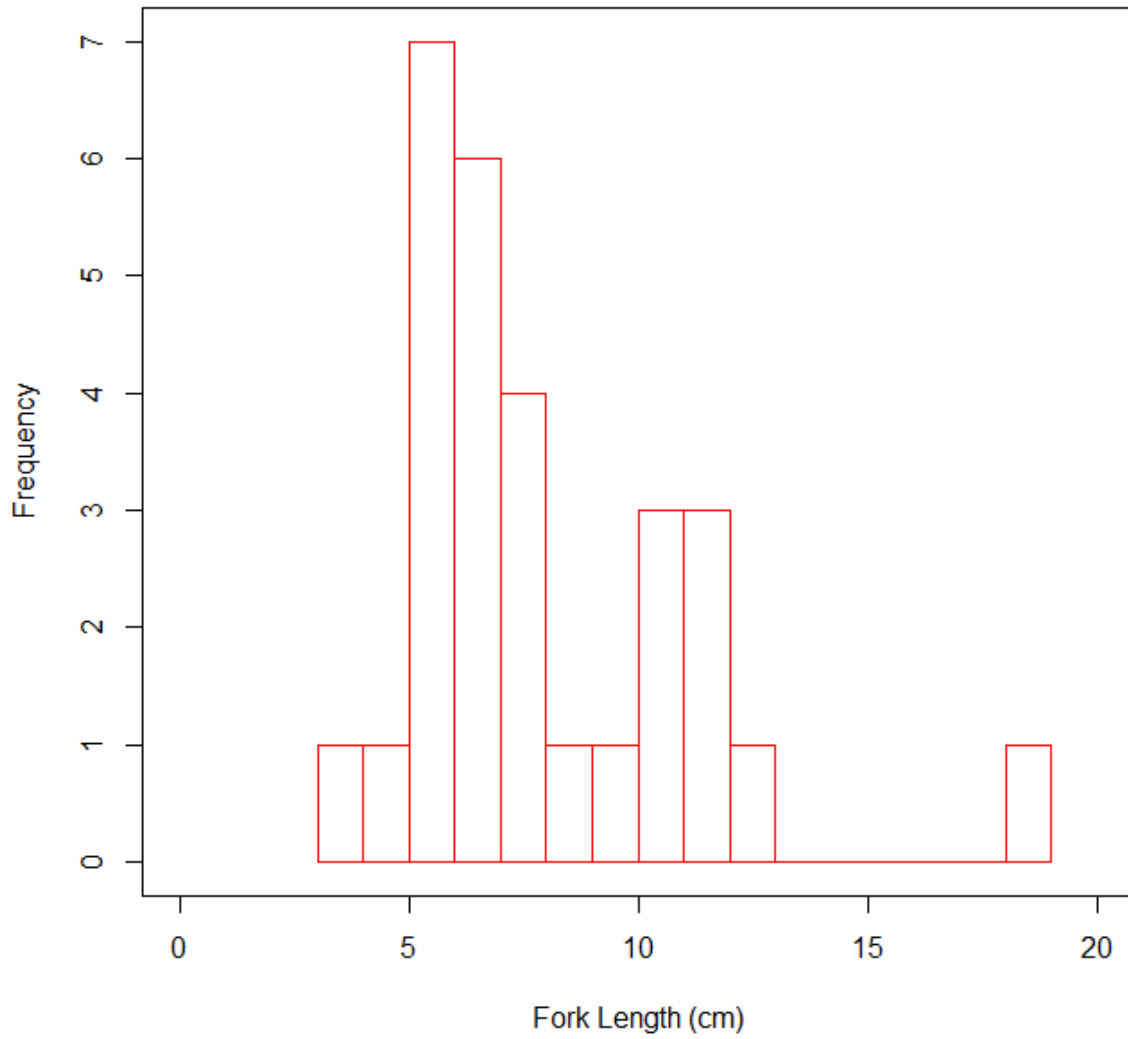


Figure 4: Length Frequency histogram for Brown Trout sampled from the feeder streams.

There was no significant difference between length of Brown Trout from the northern and southern streams ($t = 1.783$, $df = 26.178$, $p > 0.05$) (Figure 5).

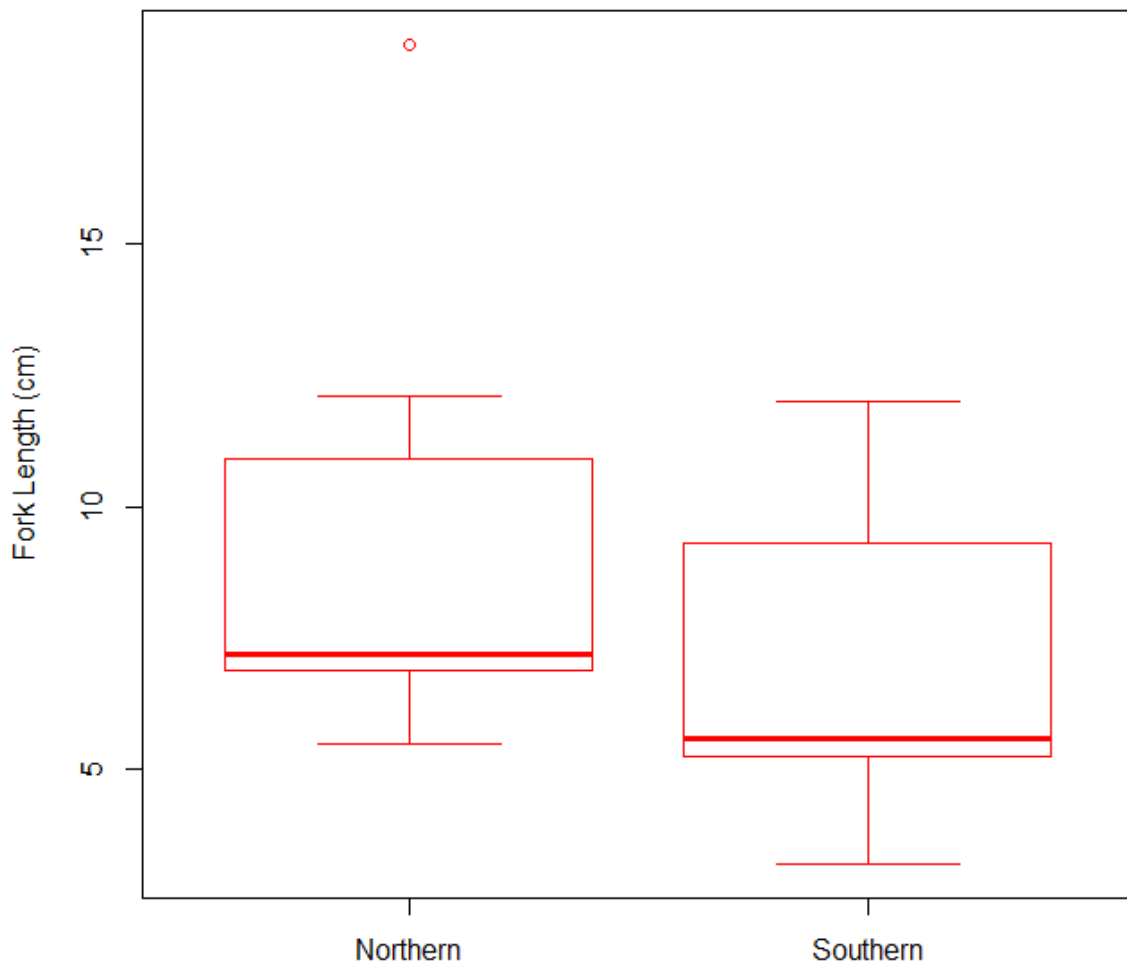


Figure 5: Comparison of Brown Trout fork length between northern and southern streams ($t = 1.783$, $df = 26.178$, $p > 0.05$).

Discussion

This survey found the Spelga fish community consists of three species, brown trout, a sizeable three spined stickleback population and pike. The capture of a single pike in Spelga reservoir during this study, although in terms of CPUE is currently at the lowest end of the scale when considering Irish lakes where both species are present, is of ecological concern and probably indicative of a small population. Pike status in Ireland has been controversial in recent years with conflicting theories about their origins (see Pedreschi et al. (2014), Ensing (2015) and Pedreschi and Mariani (2015)). McLoone

et al. (2018) states that pike are present in 522 Irish lakes and they coexist with trout in 97 of these. McLoone et al's spatial models suggest that lakes with a greater surface area and maximum depth show a higher probability of coexistence of the two species. Spelga has a relatively small surface area (55ha) and is generally shallow except for a small deep depression close to the dam wall, for these reasons the introduction of pike likely creates a vulnerable situation for the trout stock.

At the time of this study electrofishing revealed good numbers of juvenile trout in the Spelga feeder streams however the netting survey in the reservoir failed to capture any trout < 3+ years of age. The inference here is that there is likely a high predation pressure on the juvenile trout once they reach the reservoir from the nursery streams. The individual pike we examined was 60 cm at age 2+, this is quite fast growth for a typical unproductive high altitude waterbody.

Pike exhibit a well-documented ontogenetic switch at a size ranging from 4.5 – 10 cm when they switch from planktivory to piscivory (Mittelbach and Persson, 1998). At the time of sampling Spelga had a large population of small three spined sticklebacks which possibly facilitates this dietary shift at the lower end of the size range thus providing a high protein food source and consequential rapid growth at an early age. Conversely there is a building body of research from the Baltic region that describes the interaction between early stage pike and the three spined stickleback (Nilsson et al., 2019, Donadi et al., 2020). Several studies have established that body size and growth rate are key life history traits which influence mortality (Persson et al., 1996). Nilsson et al. (2019) found size selective predation on pike juveniles by three spined stickleback suggest that it is crucial for pike to outgrow the stickleback predation window, their analyses further suggests that reaching a critical size of 80 mm will allow pike juveniles to start taking advantage of the significant resource constituted by high stickleback densities, which further manifest the importance of fast juvenile growth.

Fishery managers should consider follow up work to determine if the pike are recruiting successfully. One means of doing this would be further survey work during the pike spawning season in spring with targeted netting in areas with potential spawning habitat using 40 and 50 mm mesh (denier - 210/2), this could be further followed up by targeted marginal electrofishing to detect small fish and establish if the pike are successfully recruiting. Further spring and summer fyke net surveys would be non-destructive to salmonids and may establish if pike are recruiting successfully. An examination of trout stomach contents in early summer may indicate the presence of young of year pike. It would be useful to engage with local anglers and ask them to record the fork length of any pike caught, this may provide evidence of cohort strength.

If it is established that pike are recruiting successfully, eradication may be difficult but management is likely achievable. A discussion could be had with NI Water regarding water levels, a viable prospect could be to hold the water level high during the pike spawning season which would provide ample marginal spawning habitat, then subsequently before the pike eggs hatch reduce the water levels and allow the pike eggs to dry naturally thus destroying them and minimising recruitment. If this is not feasible annual targeted netting with suitable mesh in spring at likely spawning sites would reduce successful recruitment and thus limit population size.

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