Hillsborough Lake and Hillsborough Castle Ornamental Water Bodies Fish Survey

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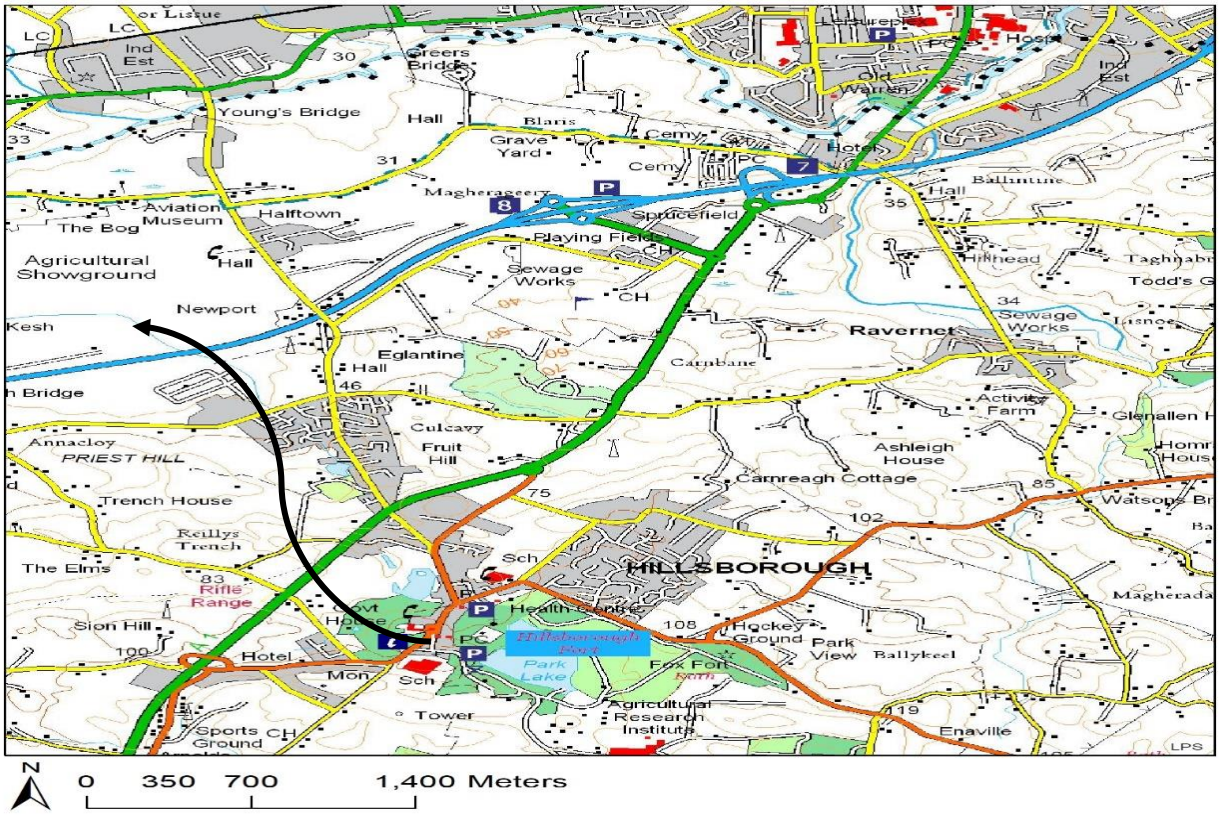


Figure 1. Drainage path from Hillsborough lake basin flows northerly into the River Lagan

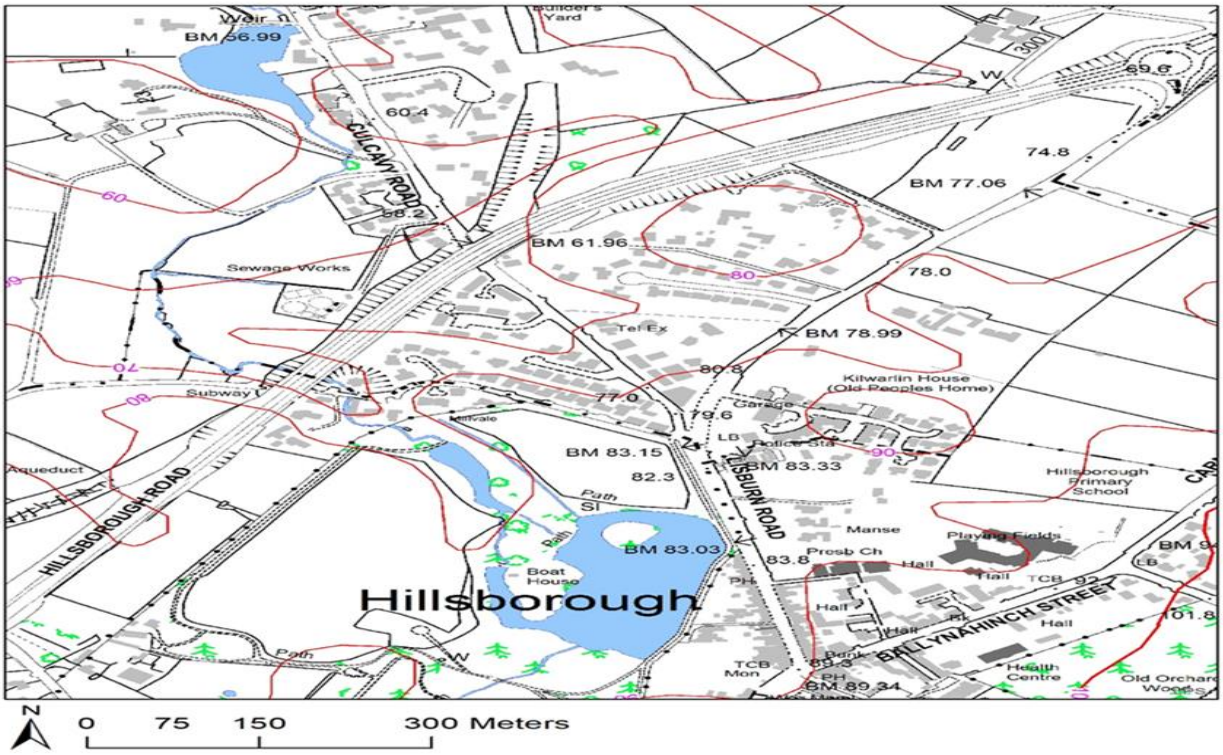


Figure 2. Fluvial connectivity between the 4 Hillsborough water-bodies surveyed

Introduction

The small system of Hillsborough lake and its linkage to the series of ornamental ponds in Hillsborough Castle are connected to the main stream of the River Lagan via a small stream which flows northward from Culcavy Pond into the Lagan close to the Down Royal (fig. 1)

The 4 small water bodies are interconnected (fig. 2) however, this linkage is via a very minor stream, in particular the stretch flowing through the grounds of Hillsborough Castle connecting the ornamental ponds. Given its shallow and sinuous nature this stream is unlikely to be a suitable transitory route for fish other than eels. Additional infrastructures in place at various outflow points through the system such as mesh screens, raised walls would be a further barrier to coarse fish movements, yet accessible to eels.

Stocking History

1) Hillsborough lake: is the only one to be routinely stocked by the Department,

- currently with Rainbow trout on an annual basis
- in 2004 with Carp (Common and Mirror Carp variants).
- in 2014 with glass eels (see below)

2) ornamental ponds and lakes within Hillsborough Castle grounds: In the past it would have been the norm for privately owned lakes/ponds such as those at Hillsborough Castle to have been stocked with ornamental varieties of fish, typically Cyprinids such as Roach, Rudd, Tench, Carp and occasionally varieties of Goldfish.

Recent surveys

Previous fyke net survey in 2013 by AFBI to determine the eel population of Hillsborough lake found zero eels, 6 juvenile Common Carp {<148mm length}. 11 Tench, 54 varied Roach and Rudd.

As a result of the 2013 survey finding an absence of eels, Hillsborough lake was deemed suitable to be stocked in 2014 with 2kg (6 000) of glass

eels from the River Severn. 3 000 of these glass eels had been chemically marked with SrCl to place a “strontium ring” in the first annulis of their otolith for future age and growth rate verification.

A more recent fyke net survey carried out by DAERA Inland Fisheries of Hillsborough lake in 2018 recorded 500+ Roach/Rudd, 101 Tench and 55 juvenile Carp (<130mm length) of a mix of common and mirror variants.

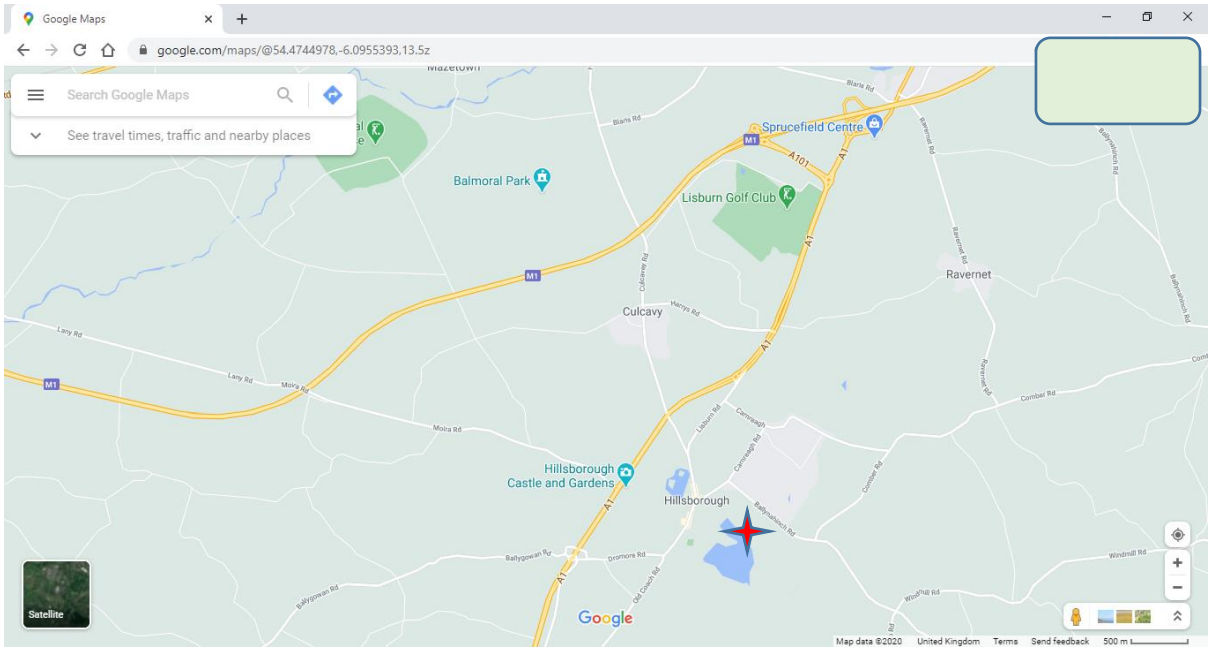
Current Survey 2020

Following the 2014 stocking, long term eel ageing analyses by AFBI suggested that 2020 was seen as the first tentative year that recapture of these marked eel in Hillsborough lake, now 6 years old and just on the edge of fyke net selectivity might be possible.

2021 is also the next round for Eel Management Plan reporting to the EU (UK Reports will be sent to DERFRA following EU Exit) and as part of the GB_NorE River Basin District, data from this survey could be used as part of this tri-ennial reporting exercise.

This planned survey into eel populations within this RBD provided the additional opportunity to widen the survey base and examine the fish fauna within this small region following some questions in relation to Carp distribution locally.

1.0 Lake 1: Hillsborough Lake



1.1 Survey methodology

Area – 16.2ha Mean depth 1.3m Water temp. 14.8c (Lat Long: 54.457, -6.076)

Trophic status – eutrophic, main waterbody had mild weed cover & macrophytes, with denser weed cover around the lake margins.

Netting effort - one night set: 9-10th September, 18 fyke nets, fished as 6 sets of 3 fyke nets in a chain as in 2013 sites. All fish measured for length (mm). Eel sub sampled.

1.2 Results

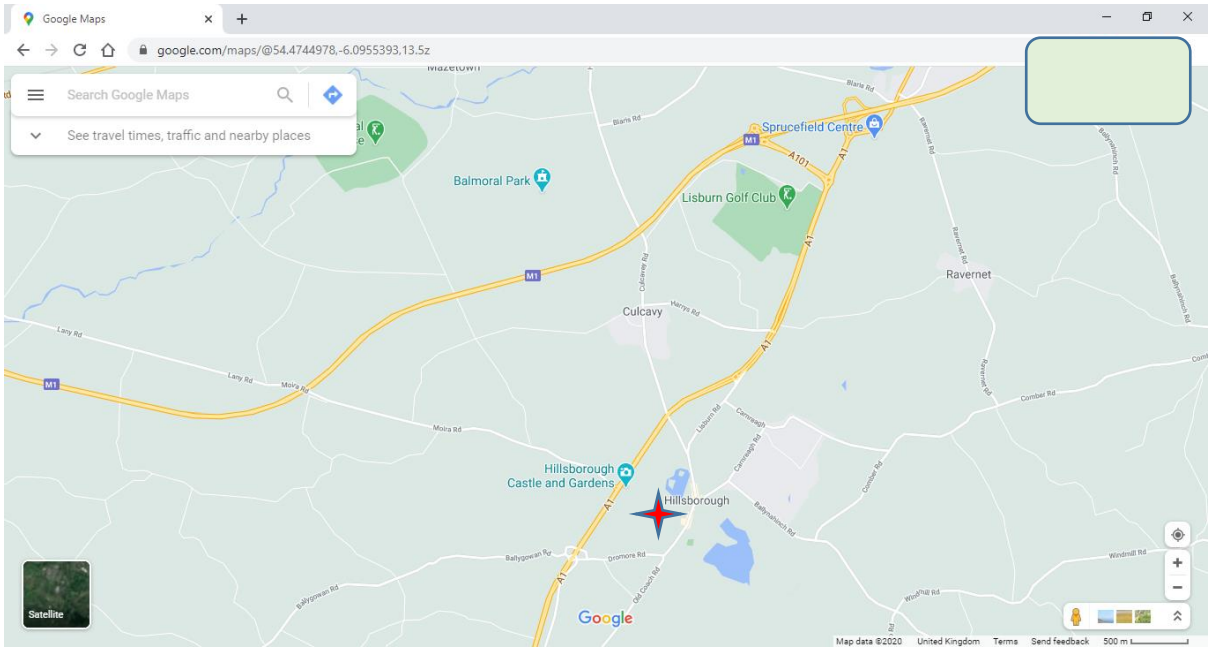
Species

METRICS	Eel	Tench	Roach	Rudd	Carp
number	114	90	522	240	0
CPUE	6.3	5	29	13.3	
mean Lt mm	499	197	132	128	
Lt range mm	330-730	100-260	90-230	90-220	
	16 silvers				

Table 1.1 Hillsborough Lake summary stats

A total of 966 fish were caught after one nights fishing in Hillsborough Lake, over half of which were Roach. (Table 1.1). Of the 114 eels, 16 (14%) were migrating silver eels preparing to exit the lake, with a mix of 7 males and 9 females.

2.0 Lake 2: Hillsborough Castle Ornamental Pond



2.1 Survey methodology

Area – 0.29ha Mean depth 1.5m Water temp. 15.4c Lat Long: 54.461, -6.086

Trophic status – eutrophic: ornamental pond planted with large macrophytes & aquatic foliage

Netting effort – one night set: 10-11th September, 1 fyke net stretched across the pond, effectively splitting it in 2 halves. All caught fish measured for length (mm)

2.2 Results

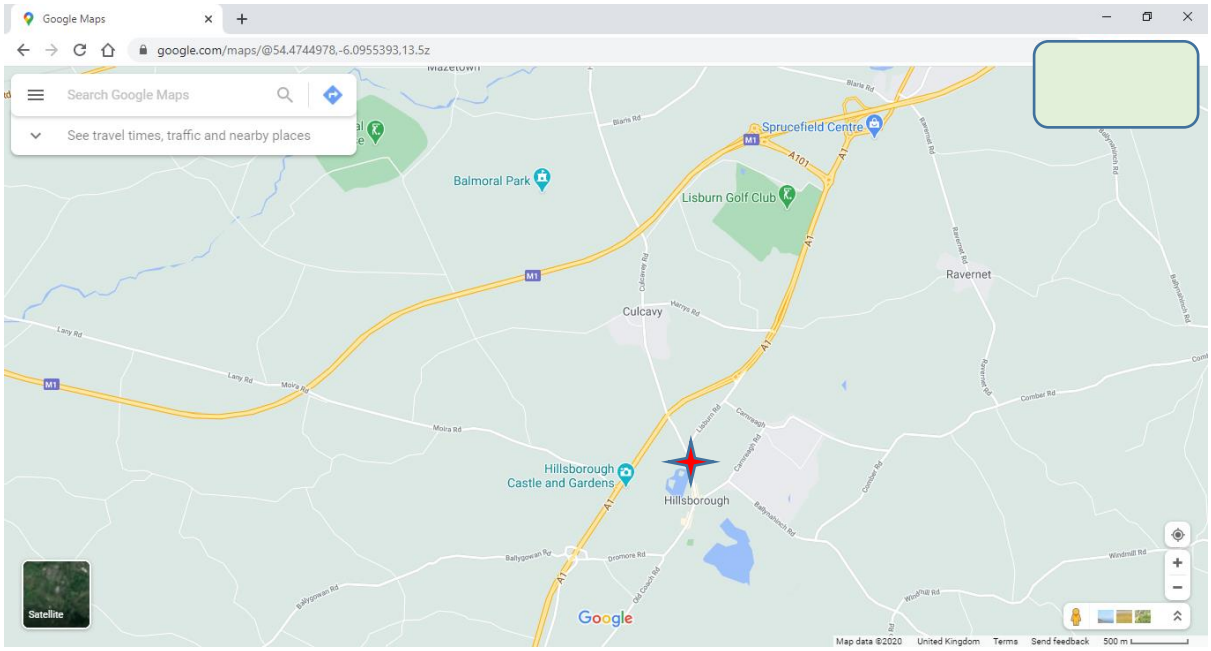
Species

METRICS	Eel	Tench	Roach	Rudd	Carp
number	1	4	2	3	0
CPUE	1	4	2	3	
mean Lt mm	390	220	130	150	
Lt range mm	390	130-270	130	140-160	
	1 silver				

Table 2.1 Hillsborough Castle Ornamental Pond summary stat

A total of 10 fish were caught after one nights fishing in Hillsborough Castle Ornamental Pond, with only a few individuals from each of the coarse species found, and 1 male silver eel transiting out from this pond (table 2.1).

3.0 Lake 3: Hillsborough Castle Ornamental Lake



3.1 Survey methodology

Area - 3.06ha Mean depth 1.4m Water temp. 14.8c Lat Long: 54.464, -6.085

Trophic status – eutrophic, heavy weed cover throughout entire lake; south west portion inaccessible.

Netting effort – one night set: 10-11th September, 15 fyke nets, fished as 5 sets of 3 fyke nets in a chain. no nets in SW corner. All fish measured for length (mm) Tench sub sampled.

3.2 Results

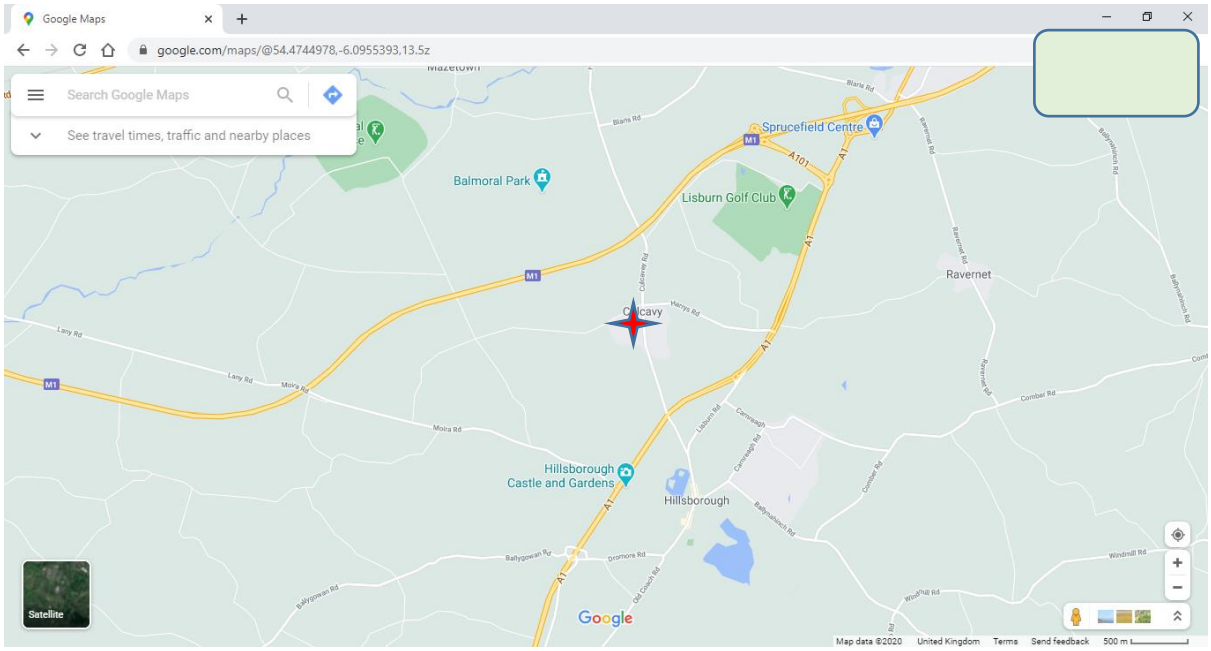
Species

METRICS	Eel	Tench	Roach	Rudd	Carp
number	6	65	27	22	0
CPUE	0.4	4.30	1.8	1.46	
mean Lt mm	618	238	140	154	
Lt range mm	460-650	130-310	120-230	90-190	
	3 silvers				

Table 3.1 Hillsborough Castle Ornamental Lake summary stats

A total of 120 fish were caught after one nights fishing in Hillsborough Castle Lake, which was dominated by Tench (N=65) covering the full range of sizes from juveniles to large females and an equitable mix of Roach and Rudd (N=49) (Table 3.1). Of the eels, 3 were migrating female silver eels. .

4.0 Lake 4: Culcavy Mill Pond



4.1 Survey methodology

Area - 1.0ha Mean depth 1m Water temp. 15.2c Lat Long: 54.475, -6.091

Trophic status – eutrophic, dense weed & macrophyte cover through most of the pond and margins. Some clear water in mid pond where fyke nets could be set.

Netting effort – one night set: 11-12th September, 3 fyke nets, fished as 1 set of 3 fyke nets in a chain. All caught fish measured for length (mm)

4.2 Results

Species

METRICS	Eel	Tench	Roach	Rudd	Carp
number	3	0	1	0	0
CPUE	1		0.3		
mean Lt mm	450		110		
Lt range mm	390-640		110		
	2 silvers				

Table 4.1 Culcavy Pond summary stats

A total of 4 fish, 3 eels and 1 Roach were caught after one nights fishing in Culcavy Pond ((Table 4.1). Of the 3 eels caught 2 were migrating silver eels, a male (390mm) and a female (640mm), like other silvers found in the system at this time exiting to make their way to the Lagan on their seaward migration.

5.0 Combined Species Analysis

5.1 Eel (N = 114, sub sample of 50 removed for detailed analysis)

5.1.1 Length Distribution

Eel were found in each of the waters surveyed. Eels from all length classes were caught, right up to female silver eels in excess of 800mm length (fig. 3). The range of length distributions are indicative of excellent connectivity from the main River Lagan as only Hillsborough Lake was stocked with glass eel of mean length 67mm in 2014.

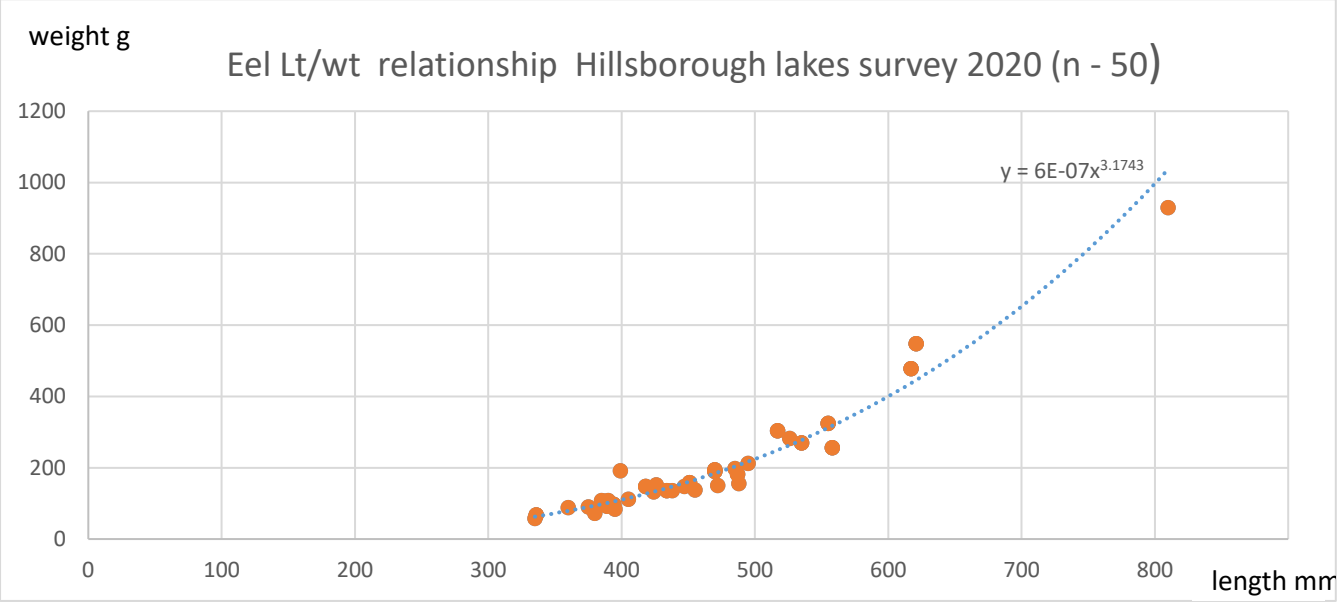


Fig. 3. Length/ weight relationship of eel from sub sample covering length ranges caught in Hillsborough lake

5.1.2 Age

Using the length at age key developed from thousands of eel samples retained by AFBI, the eels caught would range in age from 5/6 to 16-18 years old. The migrating male silver eels will ordinarily be between 10-12 years and the larger females upwards of 18+.

Samples of eels <330mm length have had otoliths removed for detailed aging in the hope they may just be on the edge of 6 years old and contain a Strontium ring in their year 1 annulus as part of the 2014 stocking exercise and age verification study.

5.1.3 Health status

External macroscopic examination showed no signs of any symptomatic health concerns. Similarly microscopic examination did not find any eels with the swimbladder nematode worm *Anguillicola crassus*.now considered ubiquitous across the eels natural range.

5.2 Tench (N = 159)

5.2.1 Length Distribution

Significant numbers of Tench were only caught in Hillsborough Lake and Hillsborough Castle Ornamental Lake. Their length frequency distribution (fig. 4) would suggest several cohorts across their size range, indicative of locally established breeding populations within these 2 water bodies.

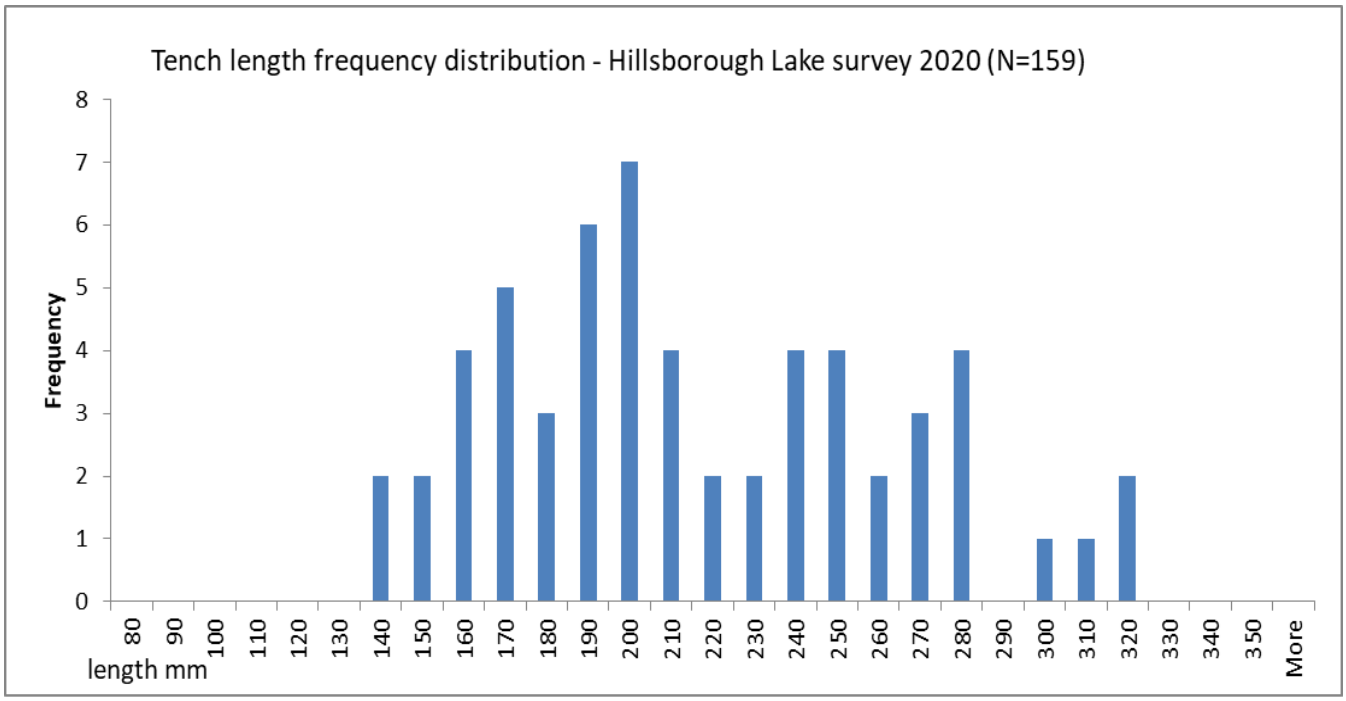


Fig. 4 Length frequency distribution of Tench in Hillsborough lake system

Access to these fish provided additional metrics via sub sampling which enabled the production of a length by weight correlation (fig. 5). Few Tench populations in N Ireland have been examined in detail so this analysis has provided a useful condition factor index for any future assessments of Tench populations, which seem to be expanding in number across N Ireland and may feature in coarse angling interests.

5.2.2 Age

No 0+ fry were caught, a common feature of fyke net selectivity for Cyprind species. A length range from 150mm-330mm suggests an age range of 2+ - 7+ and is further indication of this introduced species finding suitable habitats and environmental conditions for them to breed in both Hillsborough lake and Hillsborough Castle Ornamental lake (Tench becoming sexually mature at age 3-5 years old).

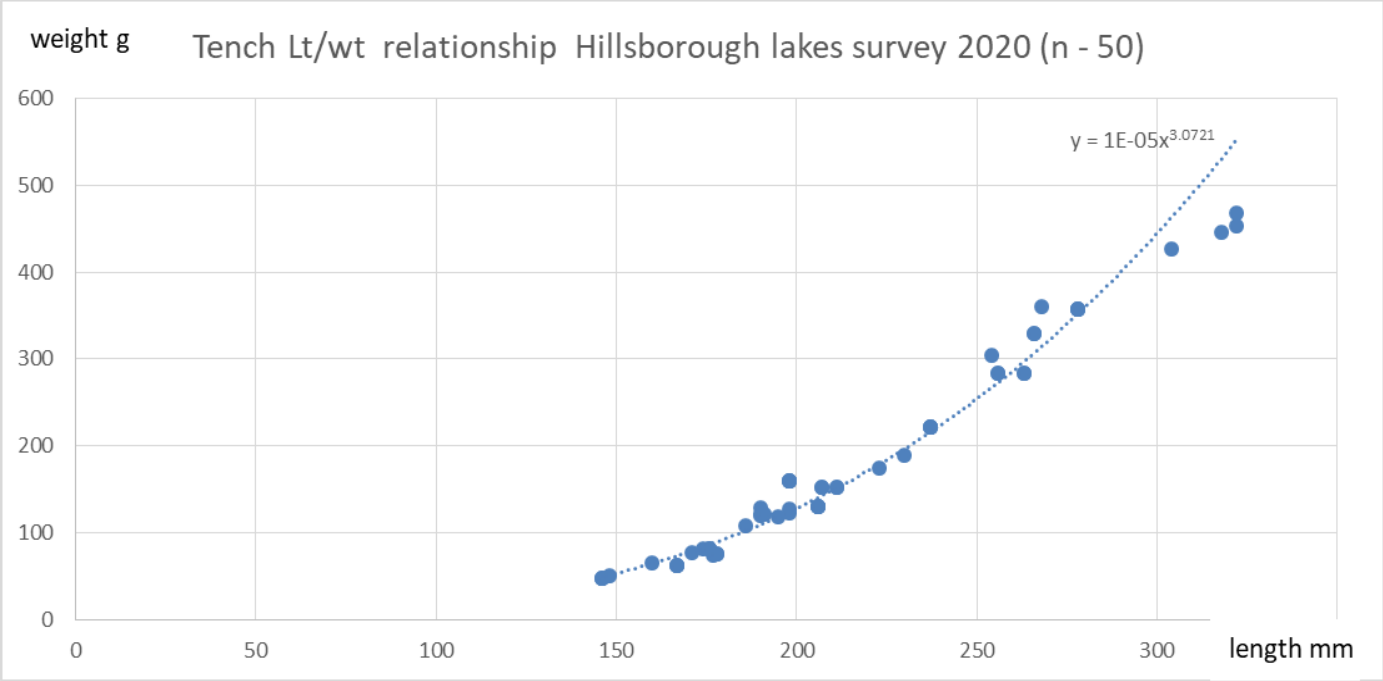


Fig. 5 Length by weight correlation of Tench in Hillsborough lake system

5.2.3 Health status

One of the larger Tench (274mm) from Hillsborough Castle Ornamental lake was noted as displaying external signs consistent with the common Aeromonad bacterial infection *Aeromonas hydrophila* (red petechiael streaks on the lower flanks and ventral under belly {example in Fig.6}). This is an endemic bacterial infection common in water bodies, often seen in Autumn amongst fish in high densities, which would fit with the numbers of Tench seen in the smaller confined area of the Castle Ornamental Lake.

Fig. 6 Atypical example of the external pathology exhibited by Cyprinids with *Aeromonas hydrophila* infection.

5.3 Roach/Rudd (N = 867)

5.3.1 Length Distribution

Roach and Rudd were found in every one of the waters surveyed. Roach is one of the most common introduced fish species across N Ireland, and over time is known to have displaced Rudd (similarly an earlier introduced ornamental species) from certain areas. The length ranges recorded in this survey suggest successful breeding and recruitment of both species in the 2 major water bodies in this system (fig. 7). The presence of such comparatively high numbers of Rudd is a useful note by way of possible Rudd refugia populations.

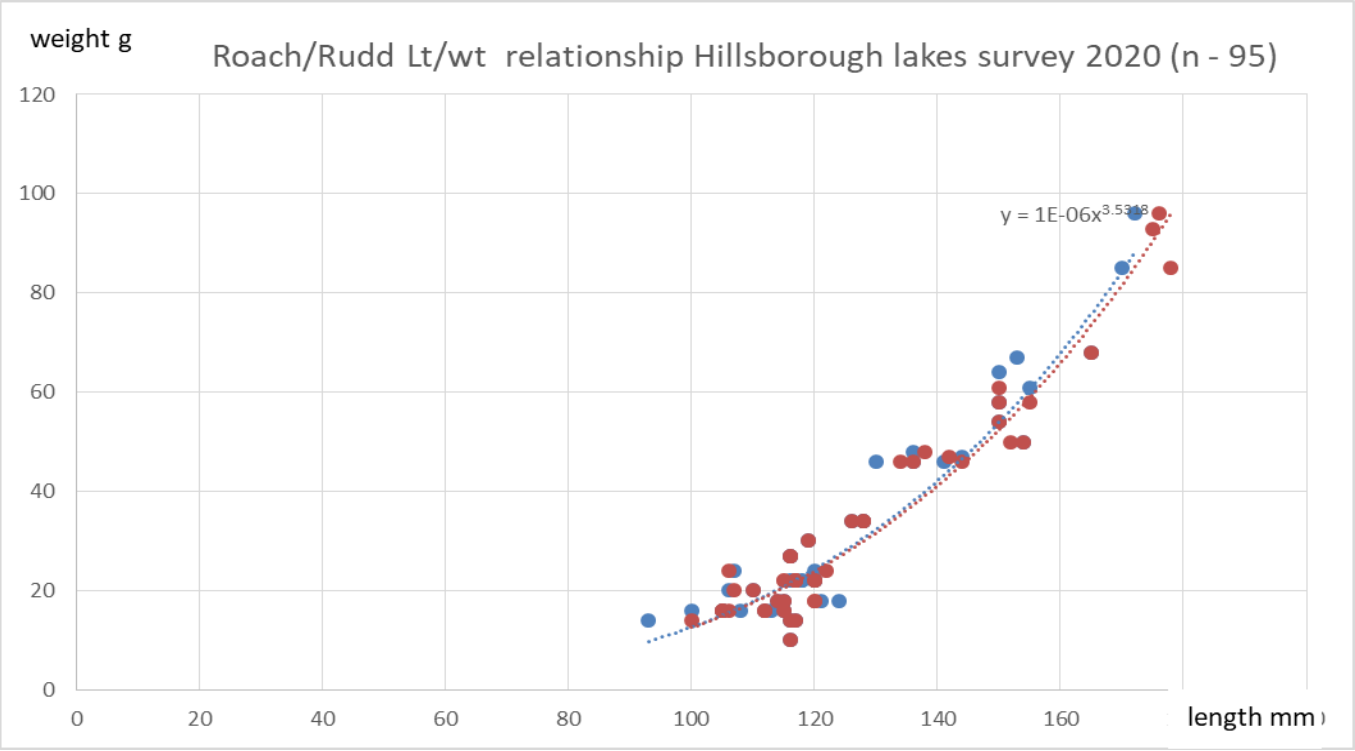


Fig. 7 Length by weight correlation of Roach and Rudd in Hillsborough lake system

5.3.2 Age

No 0+ fry were caught, (which is typical for fyke net mesh sizes,) whilst a length range from 90 – 180mm is suggestive of an age range of 2+ to 8-9+ for both Roach and Rudd.

5.3.3 Health status

No health concerns were noted, all fish appeared healthy on a macroscopic basis.

5.4 Carp

No Carp were caught in any of the lakes surveyed at this time, despite using the same methodology and similar timing as the surveys which recorded their presence in Hillsborough lake in both 2013 & 2018.

During the survey a member of the public commented on “having seen a big Carp swimming along the bank of Hillsborough lake” – this is completely possible given the history of Carp in the lake, but even to a trained eye a large broad backed, dark green Tench will often resemble Carp in the water.

There were no historic records of Carp in any of the other ornamental ponds/lakes within the Hillsborough Castle grounds and the survey would confirm this to still be the case.

6.0 CONCLUSIONS

- This survey recorded the presence of Roach, Rudd, Tench and Eel, with eel being the only species found in each of the 4 water bodies netted.

- No predatory species such as Perch or Pike were found.

- Despite 2 previous surveys (2013 & 2018) recording Carp in Hillsborough lake (following their introduction in 2004), a similar netting strategy of this lake failed to capture any in 2020.

- Even though Hillsborough lake is a heavily stocked waterbody, no Rainbow trout were caught (a typical feature of Salmonids avoidance of fyke nets).

- The distribution patterns and the relative species abundance recorded in this survey indicate that the Cyprinid fish assemblages in the Hillsborough system are essentially in 2 discrete locations ie the 2 main water bodies of Hillsborough lake and Hillsborough Castle Ornamental lake.

- This distribution confirms the unsuitable nature for coarse fish migration as a consequence of the in stream infrastructure and the fluvial nature of the small interconnecting stream running between all 4 waterbodies. Coupled with very low catches of only a single Roach in outflowing Culcavy Pond would suggest a low risk of Carp escape to the Lagan River.

- However, the presence of such a diverse range of eel lengths (which can ascend damp vertical surfaces), in particular migrating silver eel, illustrates excellent migratory access for this species to both the River Lagan and its offshoots into the Hillsborough waterbodies. This is an important and useful finding to report in the 2021 EMP Review to the UK.

- The habitat and prevalent species would suggest that the area is best suited to coarse fish, which flourish in the larger water bodies.

- The length ranges of the Tench indicate that they have an established breeding population, and the presence of several cohorts suggests that this has been established for some years. In turn, this means that at times the environmental conditions in Hillsborough lake has been such that spawning and recruitment of juveniles was successful – such conditions would be similar to those needed for Carp to breed, and whilst NOT seen in this survey, the presence of small Carp in 2018

suggest this may have occurred but that the spread of any progeny throughout this small inter-connected system has been limited to Hillsborough lake.

- The disease and health status of the fish caught and observed during this survey was of a high standard and in particular the absence of the eel parasite *Anguillicola crassus*, often considered ubiquitous across the eel distribution range was an encouraging finding.

7.0 RECOMMENDATIONS

Given the size selectivity of fyke nets and its bias towards catching eels >360mm, it will be necessary to repeat this survey in the near future as preliminary eel ageing suggest that the youngest eels caught are between 7 and 8 years old, just missing the cohort stocked from 2014.

The absence of Carp from Hillsborough lake was unexpected – to establish further their true presence or indeed absence, it would be useful to employ a small gill net survey in conjunction with an eDNA examination of the lakes and surrounding waters (keeping in mind the upstream Carp fishery at Dromore) to test further the presence or not of carp given anecdotal reports.