The assessment of sea trout (*Salmo trutta* L.) stocks can be challenging since many are data-limited and lack formal state assessments or biological reference points (Shephard *et al*., 2019). Rod catch often represents an available data resource that can be collated across numerous rivers and utilised for stock assessment (Millane *et al*., 2017). The interpretation of rod catch statistics is not without challenge (Shearer, 1986; Laughton, 1991) and extensive research has examined the relationships between rod catch, catchability, effort and stock size in migratory salmonid populations (Gee, 1980; Small, 1991; Evans, 1996; Small, 1996; Smith *et al*., 1996). Although angling catch is frequently used to indicate the performance of a fishery in quantitative terms only (Harris, 2000; 2006) it should also, ideally, reflect the background biological dynamics of the sampled stock for factors such as size or age structure (Smith *et al*., 1996). Basic biological information derived from rod catch data may, however, prove biased if conditions, technique, season or fishery location concentrate effort on a particular size or age component within the migratory stock (Evans, 1996; Thorley *et al*., 2007).

In the current study length and age data were collected for sea trout from the rod fishery and from two electric fished survey sites in the Shimna River (Fig 1a). The Shimna is a small coastal spate river ≈ 12 km long which drains into the Irish Sea at Newcastle in Northern Ireland (Kennedy *et al*., 2016). This study aimed to assess whether the rod catch derived data reflected the background biological dynamics of the sea trout stock (size structure) as determined by fishery independent electric fishing surveys. In addition, the size structure of the sea trout stock from the two discrete survey locations (tidal influenced and spawning areas) within the river were also compared.

The Shimna river has a single angling association (Shimna Angling Club) focused mainly on sea trout fishing. During 2009-2017 the anglers recorded the capture date, location and fork length (L_F) to the nearest 0.1 cm from as many angled fish as possible. Scale samples were taken from a sub-sample of rod captured fish. Electric fishing surveys were also undertaken at two standard monitoring sites between 2009-2019. Surveys occurred between August – October when fish had migrated into the sampling areas. An upstream survey site was located ≈ 1.5 km from the sea (length 109 m) and represented the main holding area for migratory salmonids accessing spawning habitats on the river. A downstream site was located ≈ 0.4 m from the sea (length 130 m) within the tidal influenced lower river section. During electric fishing surveys stop nets were deployed at the top and bottom of each site and three operators equipped with electric fishing units (E-Fish 500W 7.5Ah and Hans Grassel IG600 7.5Ah backpacks) conducted at least two sweeps of the site. Both survey sites had excellent sea trout holding habitat with areas of bankside cover, woody debris and depths up to 1.7 m. All captured sea trout had L_F measured (nearest 0.1 cm) and scales were taken from a subsample. Scale samples were captured digitally using a Q-Imaging microscope camera linked to Image-Pro software and age was determined visually in accordance with the Celtic Sea Trout Manual (2010). The L_F data for sea trout were pooled across all the available years for each sampling technique / area including; all rod caught fish, the electric fished sample from the downstream site and the sample from the upstream site. The length-frequency distribution of each sample was collated and size structure compared using a non-parametric Kolmogorov-Smirnov (K-S) test.

In total 1053 sea trout were sampled including 689 from the rod fishery and 201 and 163 from the downstream and upstream survey sites respectively. The majority of the rod catch (679) were taken in the downstream, tidal portion of the river with only 10 fish recorded from upstream areas. In total 443 sea trout scale samples were successfully aged (Table 1a). The mean L_F of sea trout which had returned to freshwater in the same year they had emigrated as smolts (e.g. x.0+ age class), was 27.8 cm (σ = 3.4 cm) with the L_F range for this group extending from 20.0 – 38.0 cm (this group < 38.0 cm L_F were defined as finnock). The mean L_F of sea trout after one marine winter (i.e. x.1+ or x.1Sm+) was 45.0 cm (σ = 4.5 cm) whilst the oldest fish recorded had experienced 6 marine winters, spawned 6 times and was 74.5 cm L_F.

Rod catches commenced in June with peak catches recorded in August (Table 1b). The length-frequency distribution of rod caught sea trout (n = 689), was dominated by sea trout < 38 cm L_F which contributed 89.5 % of the total sample (Fig. 1b). The size structure of sea trout sampled by electric fishing at the downstream survey site (n = 201) was also dominated by finnock, composing 78.6 % of the sample. The cumulative frequency distribution of the rod catch and the downstream electric fishing sample were not significantly different (K-S test; D=0.14; $P > 0.05$). When rod catches from August-October (n = 397) were selected, to match the temporal distribution of electric fished samples, no significant difference was evident compared to the downstream electric fishing sample (K-S test; D=0.19; $P > 0.05$). The size structure of sea trout sampled by electric fishing at the upstream survey site (n = 163) was not dominated by smaller individuals with only 35.6% of fish < 38 cm L_F (Fig. 1b). The upstream sample exhibited a significantly different size structure from both the downstream electric fished sample (K-S test; D=0.43; $P < 0.05$) and the overall rod catch (K-S test; D=0.53; $P < 0.05$). Sea trout were significantly more abundant at the downstream electric fishing site (Mean = 2.9 fish 100 m^{-2}) than the upstream survey site (Mean = 1.2 fish 100 m^{-2}) (Mann-Whitney U Test; U=15.0; $P < 0.05$).

The potential of rod catch to accurately reflect the size and age composition of sea trout within a river is an important consideration for stock assessment. The complexity of life-history strategies and variety of sea age at return is characteristic of sea trout biology (Went, 1962; Evans, 1996) and potentially problematic for angling based assessments. LeCren (1985) for example, suggested that rods may not reflect the proportion of larger sea trout present in a fishery, potentially biasing any stock estimates built around catch. The rod catch on the Shimna river reflected the background sea trout population demographics as sampled by electric fishing in the downstream portion of the catchment and is consequential of angling effort on the Shimna being concentrated on the lower tidal sections. Harvey *et al*., (2017) also showed that rod catch on the River Etne in Norway demonstrated close agreement between the sizes of *S. salar* harvested by angling, and the size distribution of the population sampled through a trap.

The lower abundance of finnock in upstream areas may be a consequence of behavioural variance between age classes, sexual maturity or vagrancy. It is unlikely that finnock were missed in the upstream surveys or were resident in alternative habitats because the upper sampling site represented the primary and only resting area for migratory fish in that section of river and the entirety of the holding habitat (966m^2) was sampled during surveys. Additionally, the upstream survey site had no migratory barriers preventing the access of finnock to that portion of the river. The lower abundance of finnock upstream may be because only a proportion of these smaller fish were sexually mature and therefore fewer individuals from this group ascended towards the spawning habitats. Previous research has shown that the proportion of mature finnock sampled from other rivers in Ireland and the UK has ranged from 25 – 48% (Solomon, 1994; Mills *et al*., 1990; Poole et al., 2006).

The high abundance of finnock in downstream tidal areas of the Shimna may also be a result of vagrancy by young sea trout from other catchments. King *et al*., (2016) demonstrated significant vagrancy by non-natal origin sea trout into the tidal and lower reaches of the River Tamar and Degerman *et al*., (2012) also documented vagrancy by hatchery origin sea trout amongst rivers in the Baltic Sea. Gargan *et al.,* (2006) further observed that immature finnock returned to other Irish rivers after their first summer at sea to overwinter. River size has been linked with early riverine return of sea trout with larger channels offering more stable environmental conditions for overwintering fish since the available freshwater habitat in small adjacent streams may become restricted (Bunt *et al*., 1999). Many of the finnock sampled in the current study carried sea lice (*Lepeophtheirus salmonis*) (Krøyer, 1837), and a few fish (< 5%) had burdens of > 10 lice/fish. Heavy lice infestations can provoke the early return of post-smolts to freshwater in late spring (Pert *et al*., 2009), although this premature return of post smolts has not been observed on the Shimna it is possible that some fish had returned to freshwater simply to delouse. Although the Shimna River is relatively small, it is one of the larger streams within its local region and therefore may attract straying fish into the lower reaches to overwinter or delouse, however more detailed behavioural research perhaps using telemetry techniques would be required to adequately resolve this issue.

The potential for differential population demographics between downstream and upstream areas in a small sea trout river presents challenges for the interpretation of rod catch, assessment of stock and for fisheries management. Although the Shimna rod catch adequately reflected the stock present in the lower river, it was not necessarily representative of the reproductive stock. Rivers with significant catches derived from estuarine, tidal or lower reaches may need to be treated with caution if catch data is used for stock assessment. Further work focused on the migratory behaviour of finnock would be advantageous in order to understand the diversity, extent and contribution of early returning sea trout across a range of river types and regions.

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