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The Sea Trout Project
Annual Report 2023

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The Sea Trout Project – Annual Report 2023

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Status:	**Firum rit nr.:**	**Verkætlan:**
Opin	2024-2	Uppgáva bíløgd av Havbúnaðarfelagnum
Dato:	**Tal av síðum:**	**Ábyrgdarhavi:**
29.02.2024	13	Kirstin Eliasen

Góðkent:

Samandráttur:
Eftir áheitan frá Havbúnaðarfelagnum eru kanningar av sjósílum framdar við tí fyri eygað at kanna nær á árinum sílini fara á sjógv á fyrsta sinni og hvussu trivnaðurin hjá teimum er á sjónum.
Í 2023 var mannagongdin broytt, og mesta orkan varð nýtt til at merkja síl og fáa eina antennuskipan upp at koyra. Skipanin skrásetir merktu sílini so hvørt tey svimja framvið hana. Skipanin er sett upp nærhendis munnanum á Eiðisá í Norðagøtu. Úrslitini frá henni fara tí at lýsa nær síl ferðast á sjógv og um síl ferðast títtari niðan í ánna tá ið lúsatalið á fjørðinum er høgt.
Arbeiðið, har sílafiskarar senda inn roðslu og aðra vitan um fingnu sílini, helt áfram í 2023. Úrslitini vístu, at sílini í 2023 vóru væl fyri og høvdu fáar lýs samanborið við undanfarin ár. Hetta var tó ikki galdandi viðvíkjandi hvussu nógv síl høvdu lús. Eins og undanfarin ár, høvdu sjósílini flest lýs frá juni til august, men í 2023 var á fyrsta sinnið boða frá sílum ið høvdu lús um veturin. Tó eru enn sterkar ábendingar um at sílini lúsa seg av í feskum vatni.

Leitiorð:
Sjósíl, *Salmo trutta*, longd, vekt, aldur, vøkstur, PIT, ferðing, antennuskipan

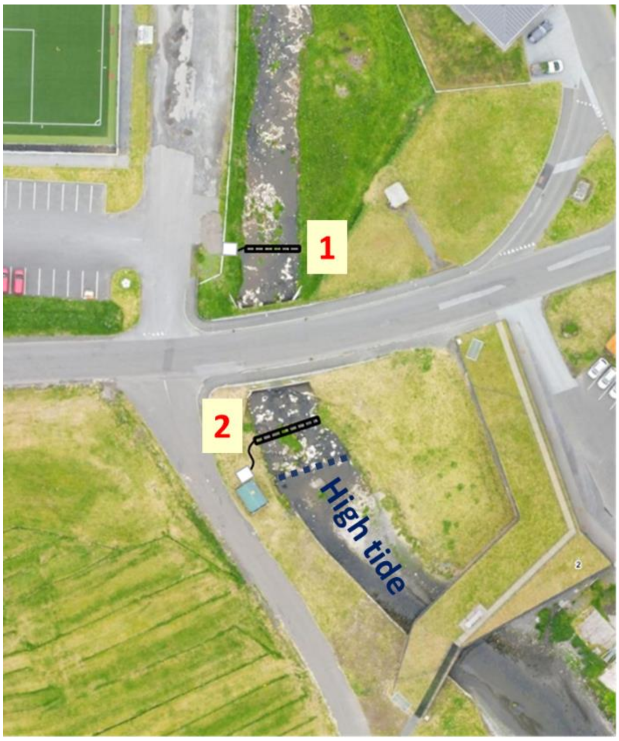
The sea trout project

The aim of the project is 1) to gain knowledge on when and under what circumstances the juvenile sea trout migrate to sea, and 2) to examine annual variations in the condition of adult sea trout at sea.

Project 1: Smolt migration to sea

Material and methods

In early 2023 the decision was made to terminate the use of the trap in Sandá as the method for gaining knowledge on juvenile seaward migration. The trap being a hindrance for returning trout, not sampling at high precipitation levels and its limitation in seasonal coverage, were the main motivations for changing method. Instead, it was decided to use two Litz cord antennas attached to a IS1001 Standalone reader each (Biomark Inc.) reading tagged trout passing by. Using two antennas makes it possible to determine the direction of travel, and by placing one of the antennas as close to the river mouth as possible, yet still in freshwater, the timing of seaward migration and return (Picture 1). However, since we have limited experience with this method, 2023 is considered a pilot year. Due to lengthy delivery time of the antennas, the system was mounted in November, and the results are thus sparse.



Picture 1. The two antennas crossing Eiðisá. Both are placed in freshwater, however, antenna 2 is positioned close to a steep slope (indicated by dotted line) bordering high tides.

The antennas were placed in the river, Eiðisá, passing through the village Norðagøtu (62.198N 006.744W) approximately 30m apart. Trout were collected approximately 50m from the river mouth and 400m upstream. To minimise unnecessary electrofishing of larger specimens, 256 trout were collected on the 1st and 2nd of June 2023 (picture 2), i.e. post the main spring seaward migration of older trout (see previous annual reports). To decrease potential mortalities due to tagging, only fish larger than 80mm were tagged (Pottier *et al*. 2020, Vollset *et al*. 2020), however, due to observed questionable recovery, this was adjusted to 100mm during the tagging events, resulting in 249 fish being tagged in total. All fish were anesthetised (Benzocaine, Tjaldurs Apotek, Tórshavn), measured for full length (mm) and weight (g), and scale samples were stored for potential later age determination. Fish of sufficient length were implanted with a PIT tag (APT12 PL 12.5mm 134.2 kHz ISO FDX-B preloaded tag, Biomark Inc.) in the peritoneal cavity using a MK25 PIT tag implanter (Biomark Inc.). Immediately after tagging the ID number was read with a hand-held reader and written down manually, however, this part of the method must be improved. Following the tagging events, fish were held in live wells until fully recovered and released into the habitat unit where they were captured. Upon subsequent detection, PIT tags serve as unique identifiers that allows identification of the timing and direction of travel, and body size and condition at release. Unfortunately, the handheld PIT tag reader was not functioning properly throughout the process, hindering reading and registration of all tags, and nine fish can thus not be uniquely identified.

Picture 2. Electrofishing in Eiðisá in June 2023.

Results

On average the tagged trout weighed 46.3g (max 257g; min 5g), were 152 mm in length (max 300m; min 86mm) and had a condition factor (Fulton´s *K*) of 1.03 (max 1.91; min 0.17). The majority (approx. 83%) were below 200mm (Figure 1), which likely are juveniles.

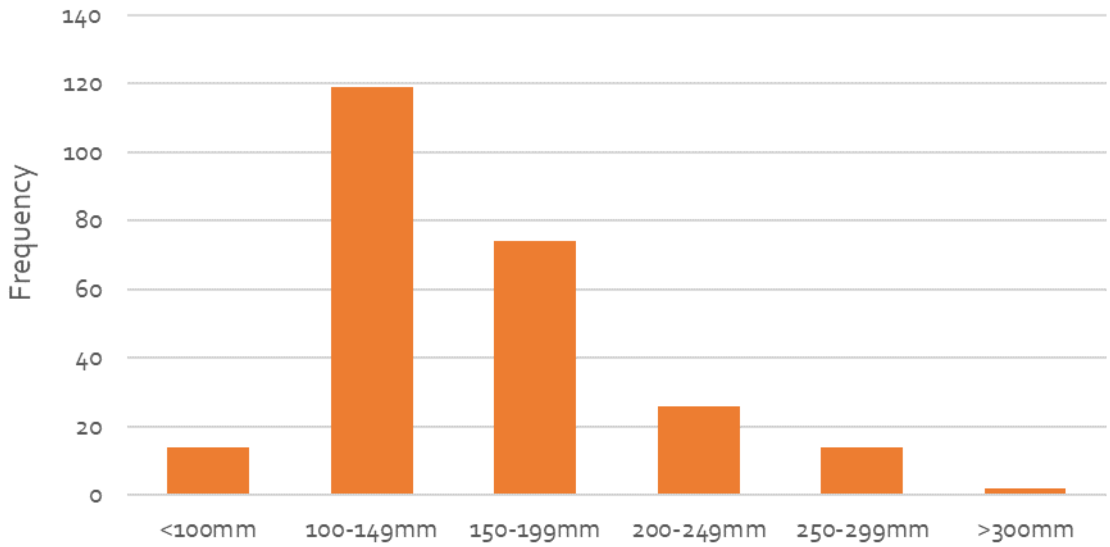


Figure 1. Length distribution of tagged trout.

As we are in the process of getting to know how to operate the antenna system, there have been days when the antennas have not been fully functioning, both due to empty batteries and bad weather which dismantled the antennas. However, improvements have been done which should decrease the likelihood of these events recurring.

20 tagged trout have been registered in the 103 days since the antennas were installed. 14 of them have only been registered by antenna 1, three only by antenna 2, and three by both antennas. Due to the hand-held reader not functioning properly in periods, and most likely also due to miswritten ID numbers, we were only able to positively identify eleven trout. These ranged from 115mm to 217mm in length and from 14g to 104g in weight.

As three of the trout that were registered by antenna 1 were registered on most days (trout 1-3), these seem to mainly occupy the habitat unit close to the antenna, whilst the remaining trout (trout 4-14) were only registered by antenna 1 occasionally. Similarly, trout 15 was registered by antenna 2 on most days, whilst trout 16 and 17 were only registered occasionally. Regarding the trout registered by both antennas, trout 18 was first registered by antenna 1 in early November, then by antenna 2 in mid-/late November, again by antenna 1 in mid-December, then by antenna 2 around Christmas, and finally by antenna 1 around new year, by which it has been registered occasionally since. Trout 19 was registered for the first time by both antennas on the same day, i.e. on New Year's Day, however, it was not registered again by antenna 2 until in late January, which might indicate that it has been at sea for approximately three weeks. And since it still has not been registered by antenna 1, it might have returned to sea. Trout 20 was first registered by antenna 1 in mid-January, but was not registered by antenna 2 until late February, which might indicate that it has been occupying the habitat unit between the antennas in the period in between (Figure 2). Nevertheless, as mentioned earlier, there have been days when the antennas have not been functioning properly, which might influence the results.

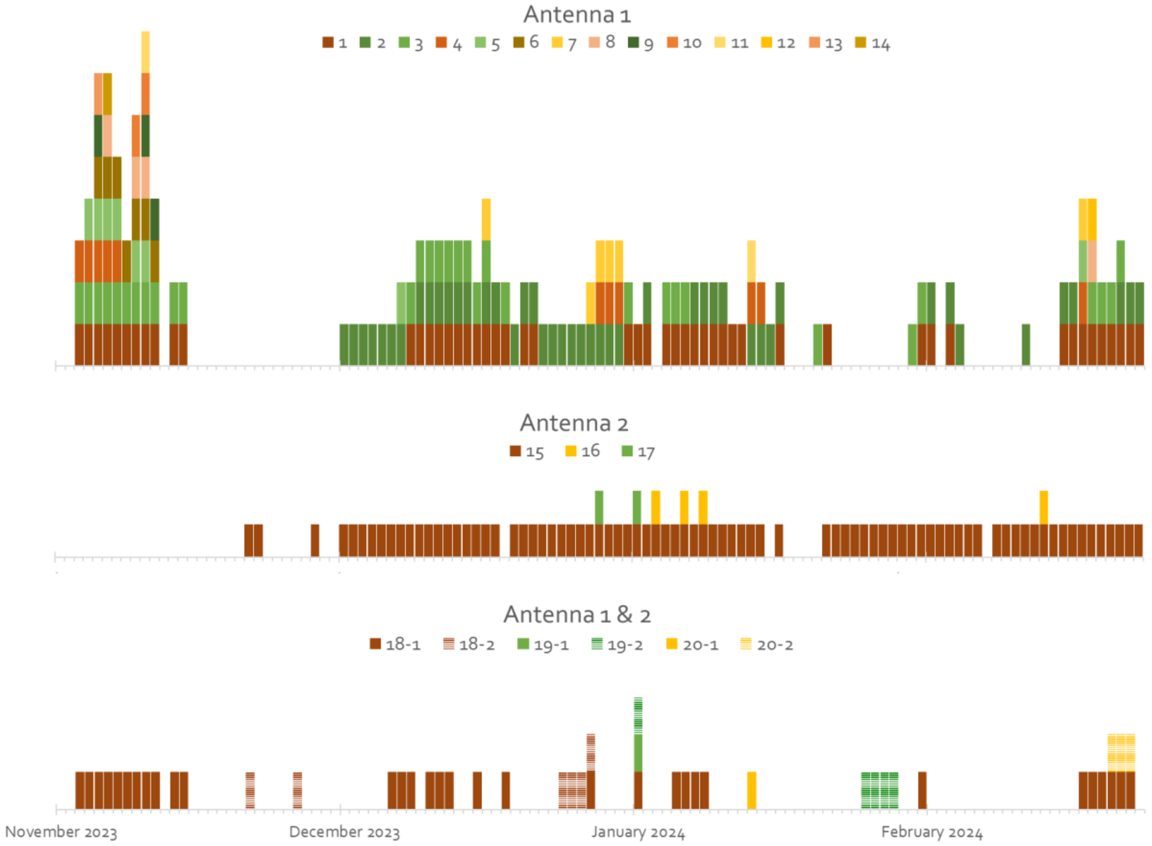


Figure 2. Daily registrations of trout (1-20) by the antennas.

Project 2: The condition of sea trout at sea

Material and methods

As with project 1, adjustments were also made to the methods on gathering knowledge on the condition of sea trout at sea, i.e. sampling of sea trout by gillnets was set on hold, but might be resumed in the future. However, the decision to tag trout from Eiðisá was made based on the river running into a fjord with salmon farming. Differences in timing of returns and return rates between years might thus reflect differences in sea lice load on the farmed fish in the fjord. As in previous years, information on sea trout caught at sea was collected by anglers donating sea trout scales and information such as length, weight and sea lice counts by using special envelopes developed for the purpose (Picture 3), and in return participating in an annual drawing toss for 10,000 DKR. However, in 2023 we did not receive as many envelopes (91) as in previous years. Fortunately, Sílaveiðufelagið (hereafter SVF), and association of Faroese anglers, donated scale from 140 returning sea trout from the river Leynará (62.118N 007.045W), which was sampled during their work with salmon broodstock. Although these trout were sampled in freshwater, and thus had no lice, it was considered such an improvement of the data on physical parameters, that scale from 84 of these fish were read as well. However, as all the trout from SVF were returning fish, this might influence the data comparison, and are thus not always included in the analyses.

Picture 3. The envelopes developed for the anglers to donate sea trout scale and other information.

Results

Scale and/or other information on sea trout caught by anglers and other (gillnets and SVF) has now been sampled from 1009 specimens in total (Table 2).

Table 2. Number of sea trout caught at sea by anglers and other from 2019 to 2023.

	Anglers	Other	Total
2019	147	32	179
2020	168	46	214
2021	127	50	177
2022	147	61	208
2023	91	140	231
Total	680	329	**1009**

Like previous years, the sampling in 2023 was seasonally unevenly distributed, i.e., the majority is from June to August, while the data from the remaining months is more sporadic. When the sea trout are grouped into length categories, the smallest (<20cm) first appear in May and disappear in September. To date, no sea trout larger than 49.9 cm have been reported from September to November, nor any sea trout in the length category 40-49.9cm in October (Figure 3).

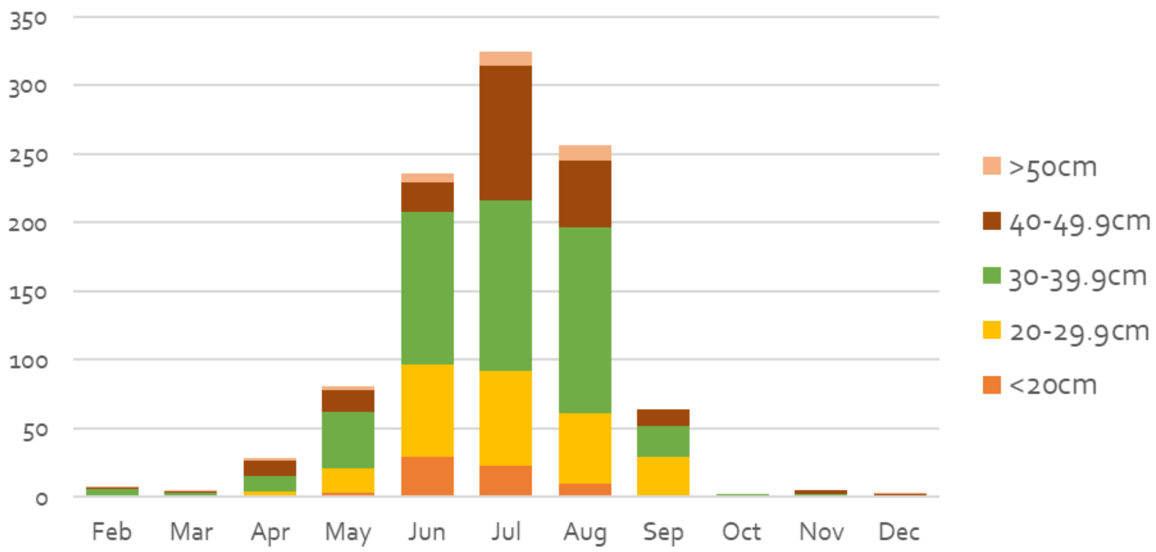


Figure 3. Number of sea trout caught in 2019-2023 divided into length groups.

On average the sea trout sampled at sea by anglers in 2023 weighed 396g (max 1412g; min 47g) and were 33.4cm in length (max 51.0cm; min 16cm). The average sea trout condition factor (Fulton´s *K*) was 0.97 (max 2.04; min 0.70). Although somewhat shorter than in 2020, the sea trout sampled in 2023 were in an overall good condition (Figure 4).

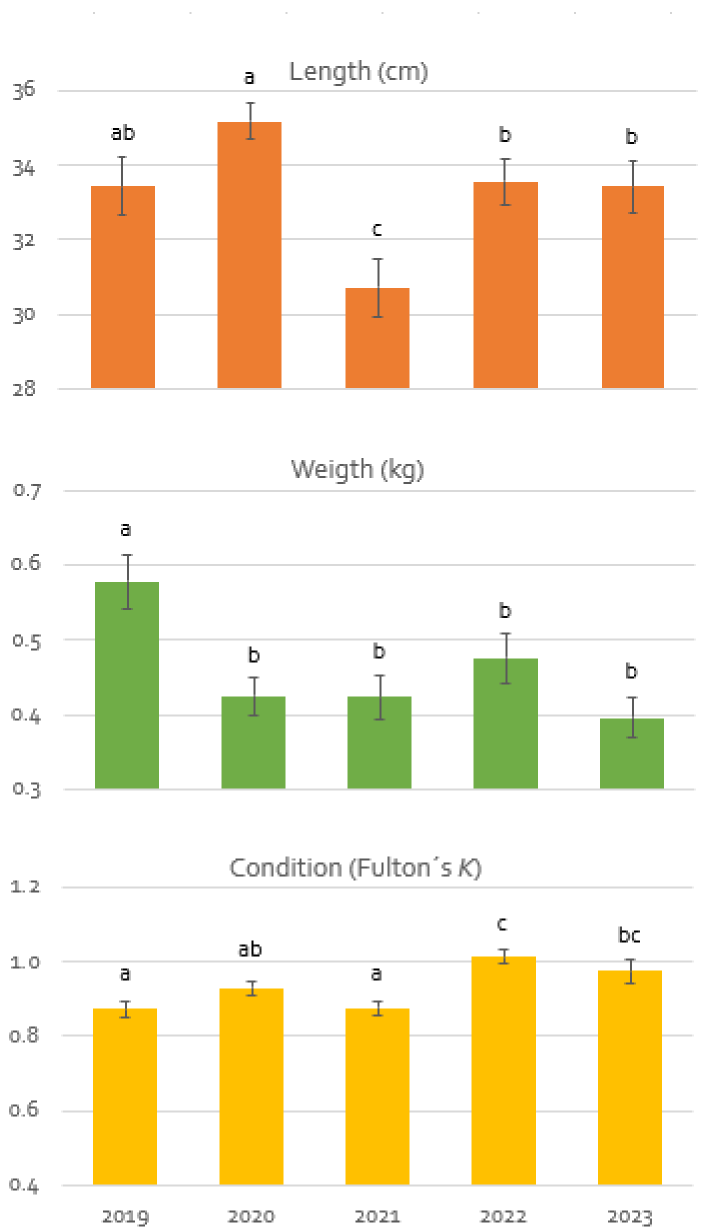


Figure 4. Average length, weight, and condition factor (Fulton´s *K*) of sea trout caught by anglers. Vertical lines indicate standard error. Different letters indicate statistical difference (t-test, p<0.05).

Scale of 184 sea trout sampled in 2023 were analysed, of which, 15 were not readable. The age distribution of the sea trout examined in 2023 (SVF data excluded) was ten 2-years-old, 29 3-years-old, 30 4-years-old, 11 5-years-old and three 6-years-old. Unlike 2019 and 2020, and as in 2021 and 2022, no 7-years-old specimens were caught by anglers in 2023 (Figure 5). Nevertheless, the average age was significantly higher than in previous years, i.e. 3.6 years, when it never exceeded 3.4 years (Anova, p<0.5; t-test, p<0.5). In comparison, the average age of returning trout collected by SVF was 4.5 years, where 6% were 3-yrs-old, 52% were 4-yrs-old, 31% were 5-yrs-old, 9% were 6-yrs-old and 2% were 7-yrs-old.

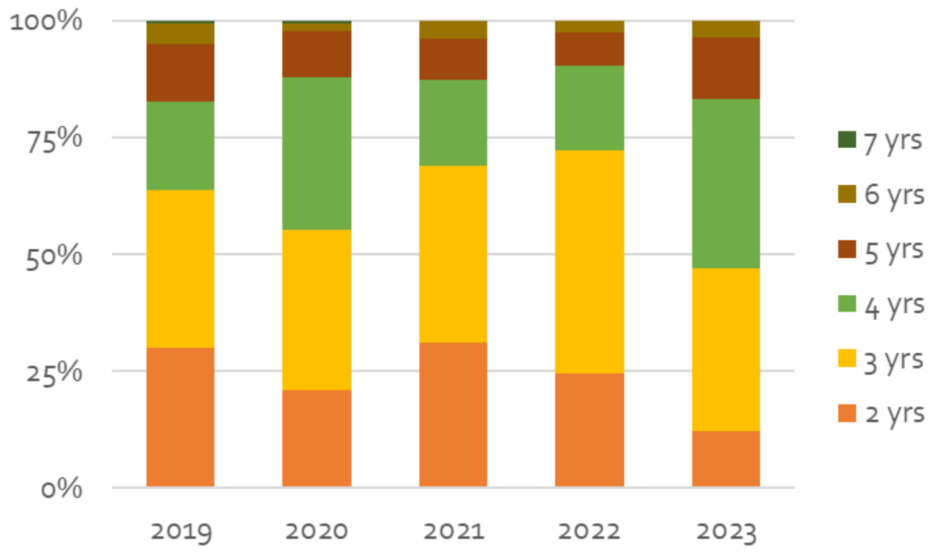


Figure 5. Age distribution of sea trout caught by anglers in the years 2019-2023.

Unlike previous years, a comparison of the growth in the third year of trout that had spent two years in freshwater before migrating to sea, did not, although close, show a significant difference (Anova, >0.05) (Figure 6).

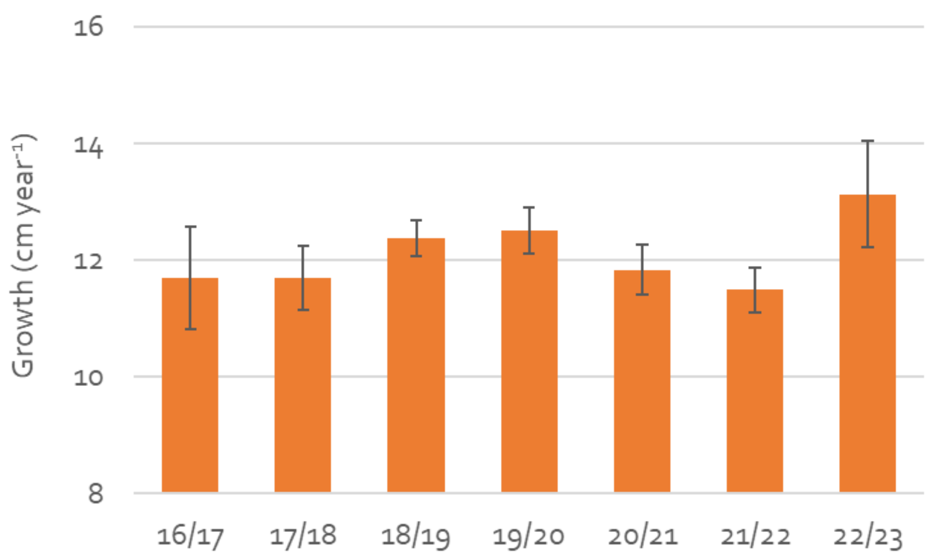


Figure 6. Annual average of the growth the first year at sea of 3-years-old specimens that had spent two years in freshwater before migrating to sea. Vertical lines indicate standard error.

The sea trout caught by anglers in 2023 had on average 1.9 sea lice and a sea lice prevalence of 47% (Figure 7). The sea lice load in 2023 was significantly lower than in previous years (Anova, $p<0.05$; t-test, $p<0.05$). On the other hand, the prevalence of sea lice was on a level comparable to previous years and no significant difference was to be found (Chi-square, $p>0.5$).

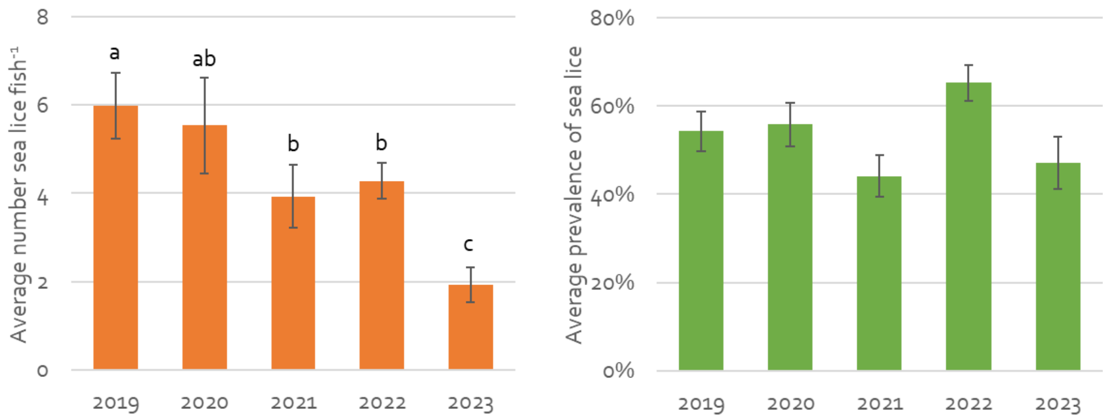


Figure 7. Annual variations in the average number of sea lice fish $^{-1}$ and prevalence of sea lice on sea trout caught by anglers. Vertical bars indicate standard error. Different letters indicate statistical difference (t-test, $p<0.05$). Sea trout caught in rivers and lakes were excluded from the analysis as freshwater can have a delousing effect.

The average number of sea lice fish $^{-1}$ was in 2023 generally lower compared to previous years, nevertheless, the first trout with lice in winter was reported in 2023. The prevalence of sea lice was in 2023 very similar to what has been observed previously (Figure 8).

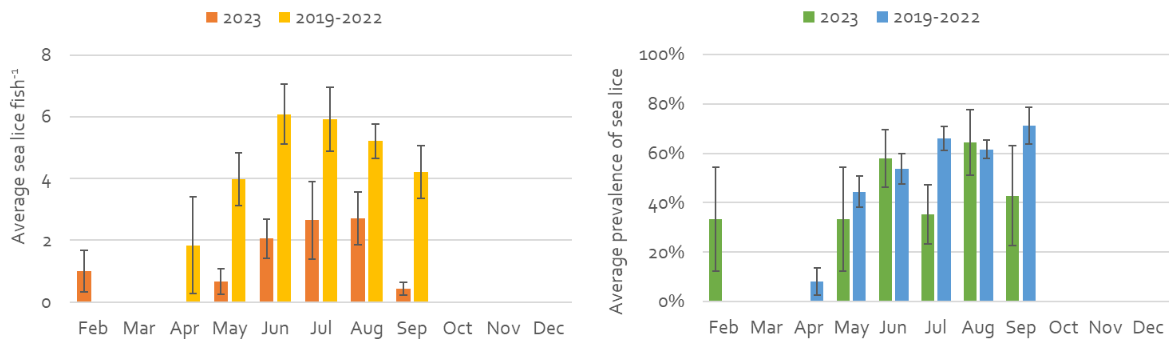


Figure 8. Annual variations in the average number of sea lice fish $^{-1}$ and prevalence of sea lice (%) on sea trout caught by anglers. Vertical bars indicate standard error. Sea trout caught in rivers and lakes were excluded from the analysis as freshwater can have a delousing effect.

Based on the salmon lice index presented by Taranger *et al*. (2012) on how to estimate the influence of salmon farming on wild salmonid stocks, the lice load of sea trout larger than 150g and caught by anglers was grouped into five categories, i.e., <0.025, 0.025-0.05, 0.05-0.10, 0.10-0.15 and >0.15 lice g sea trout $^{-1}$, which represents 0%, 20%, 50%, 75% and 100% expected mortality, respectively. Compared to previous years, the expected mortality due to sea lice was in 2023 the lowest recorded to date (Figure 9).

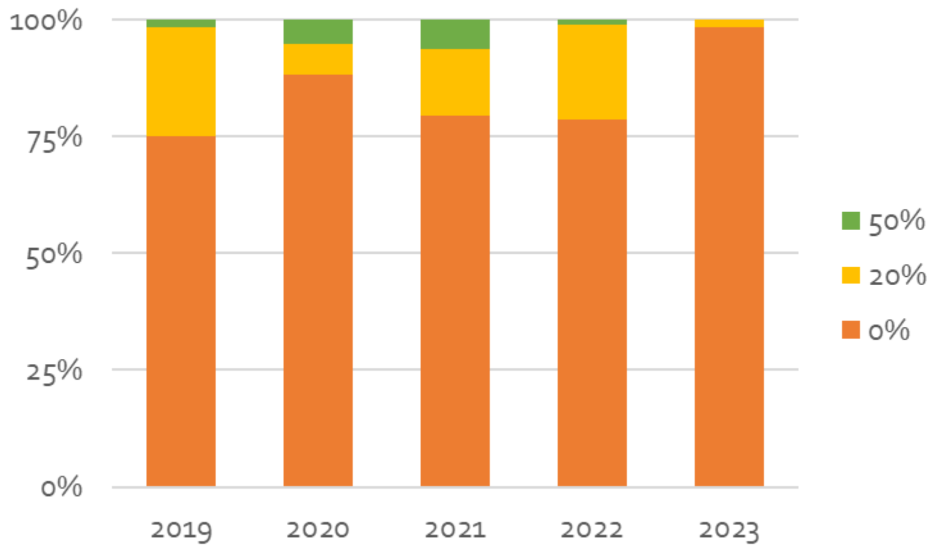


Figure 9. Proportion of sea trout (>150 g) caught by anglers with sea lice loads estimated to result in 0%, 20% and 50% mortalities. Sea trout caught in rivers and lakes were excluded from the analysis as freshwater can have a delousing effect.

Discussion

The effect of lice from salmon farming on wild sea trout populations can be challenging to estimate, as direct correlations between sea lice load and welfare rarely are observed, however, numerous controlled experiments have shown the detrimental effect of salmon lice on trout (Thorstad *et al*. 2015). Documenting the consequences of lice from salmon farming on sea trout, when other factors, e.g. food availability and predators, also influence the welfare of the fish, can be a challenging task. Compromised trout may adjust their natural behaviour to relieve the effect of the lice by prematurely return to freshwater to delouse and restore health. This behavioural adaptation might camouflage the direct effect of lice from salmon farming, however, a method, which has proven successful, is PIT-tagging and subsequent monitoring of tagged fish (Serra-Llinares *et al*. 2018, 2020), which we have modified to the river Eiðisá which runs in to a fjord with salmon farming.
The installation of the antennas did go as planned, however, the initial set up had to be modified, as the original did not stand the test when water levels were high. Fortunately, without damaging the equipment. Additionally, testing of the battery capacity and usage resulted in days when the antennas did not operate. Nevertheless, the preliminary results indicate that the method is working (Figure 2). Since the majority of the trout tagged most likely were juveniles in June 2023 (Figure 1), their seaward migration as smolt should commence within a couple of months.
No large specimens (>49.9cm) have to date been sampled from September to November, indicating a spawning period like that in northern Norway (Figure 3) (Jensen and Rikardsen 2008). 2023 was the third year in a row when no 7-yrs-old specimens were caught by anglers (Figure 5). Nevertheless, as the number of scales from 2-yrs-old had decreased, and the number of 4- and 5-yrs-old increased, the average age was significantly higher than in previous years. The age of the returning sea trout collected by SVF was on average almost a year senior. Although the growth in 22/23 in the first year at sea of the cohort that migrated to sea after two years in freshwater appeared to be better than in previous years, the difference was not significant (Figure 6).

Although the average number of sea lice per fish was the significantly lowest reported to date (Figure 7), this was not reflected in the overall condition of the sea trout caught by anglers in 2023, which was on level with 2020 and 2022 (Figure 4). On the other hand, no significant annual difference has to date been observed in sea lice prevalence. The low sea lice numbers in 2023 were reflected in the groupings regarding expected mortality developed by Taranger *et al*. 2012, which resulted in the lowest expected mortality to date (Figure 9). However, the anglers are not trained sea lice counters, and the actual expected rate of mortality might thus be somewhat higher, as was observed in the years when trained staff also conducted the sea lice counting (see previous annual reports).
The general trend of a summer peak regarding average number of sea lice and prevalence of sea lice continuous, but for the first time trout caught in winter were reported to have lice (Figure 8). Since the abundance of salmon lice in Faroese salmon farming is at its highest in the winter months (Kragesteen *et al.* 2021, www.hfs.fo), the low numbers of sea lice in winter still indicate delousing in freshwater.

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