

***Cryptocotyle lingua* infestation of juvenile gadoids from coastal fyke net at Boor, Loch Ewe, autumn 2022.**

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A coastal fyke net was set up in Loch Ewe by Boor at the end of August 2022 to find out whether this sort of fish trap could be a good way to sample sea trout in the sea for sea lice monitoring purposes.

The coastal fyke is like a large floating lobster pot with long leaders (instead of bait) to guide fish into the trap. An otter guard is fitted to the entrance to prevent an otter from entering; the guard also prevents larger fish from going in.

(below) the coastal fyke by Boor at high tide, September 2022. The heart of the trap was located just below low spring tide level; most of the fish caught would have been moving over kelp and intertidal habitats at high water.



(below) the coastal fyke at Boor at low tide, with most of the leader exposed (photo by Roger McLachlan)



The trap was set to fish over four days during the following two weeks. The trap was redeployed in early November to gain more experience and fished for a further three days.

(below) checking the coastal fyke. Fish were transferred from the fyke net into a tub on the row boat.



Many fish were caught! Most of the fish were lightly sedated and processed (length, weight [of larger ones], photo). When all wide-awake again or near enough, they were returned to the sea - several hundred metres away from the trap to minimise the likelihood of recaptures.

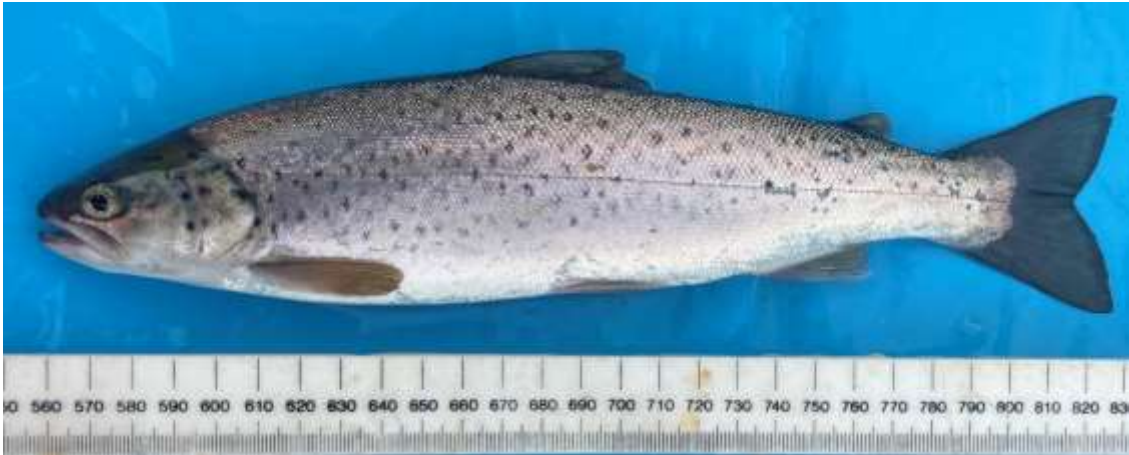
(below) processing fish and recording data



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The catch included six sea trout (183mm to 278mm) demonstrating that the trap can work as intended. By late summer, many smaller sea trout (finnock) have returned to freshwater. With the River Ewe and Loch Maree nearby, we were not expecting to catch large numbers of trout. Were the trap to be deployed earlier in the summer, the numbers of smaller sea trout in the area would probably be much higher. We look forward to being able to deploy the trap again in late May or early June next year.

(below) plump finnock, taken in the Boor coastal fyke net, Loch Ewe on 29th September 2022. Photo by Roger Mclachlan.



Sea lice (*Lepeophtheirus salmonis*) were seen on all of the trout with counts ranging from 4 lice per fish to 31 lice per fish.

(below) Sea lice (*Lepeophtheirus salmonis*) including adult female with egg strings and mating pair on sea trout. Photo by Roger Mclachlan



Most of the fish recorded were gadoids (members of cod family); several hundred were recorded. These comprised of coalfish, cod, pollack, poor cod and several whiting. The most numerous fish were juvenile coalfish, followed by pollack, cod and poor cod (poor cod were more abundant than cod in August and September). Most of the gadoids were small fish, assumed to be young of the year, of between 10cm and 17cm in length.

(below) Gadoids from the fyke net at Boor, 3rd November 2022. Top to bottom, left to right: pollack, coalfish, poor cod, cod, whiting. Photo by Roger Mclachlan.



Several larger cod, pollack and coalfish were caught.

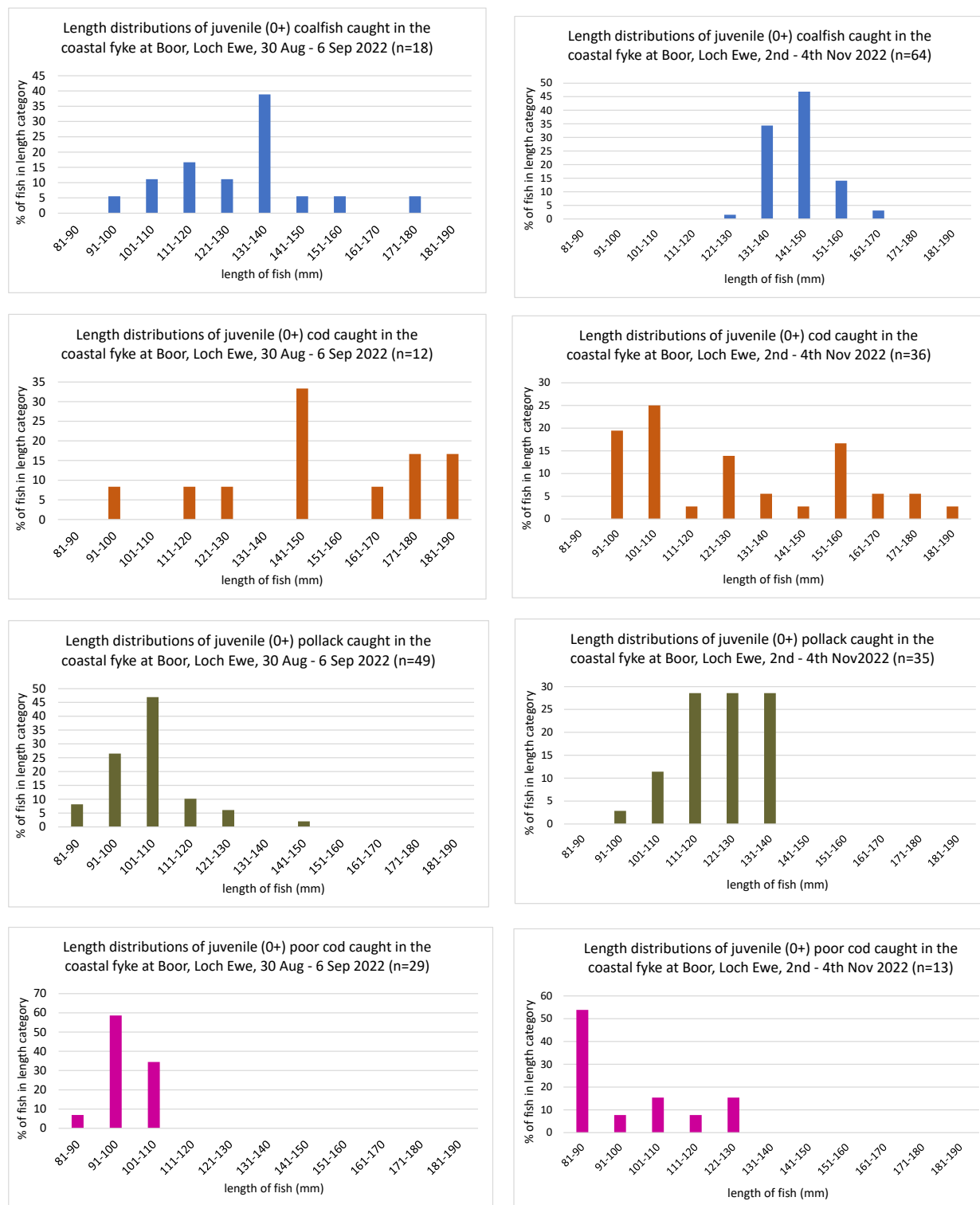
(below) cod [top] and pollack [below] from Boor fyke. Picture by Roger Mclachlan



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Sub-samples were measured; the length - frequency graphs in Figure 1 below show how the lengths of age 0+ (assumed) fish varied. Coalfish were on average longer than pollack; and pollack were on average longer than poor cod. Cod lengths were more variable than those of other fish; some of the larger cod towards the right side of the graphs for cod in Figure 1 may have been age 1+ fish.

Figure 1 length – frequency graphs for random sub-samples of juvenile gadoids caught in the coastal fyke net at Boor on (left) 30th August to 6th September; and (right) 2nd to 4th November 2022. All of these fish were assumed to be young of the year, except possibly some of the larger cod.



Many of these fish were infested with 'black spot' caused by the parasitic trematode fluke, *Cryptocotyle lingua*. The dark pigment forming each black spot is where a metacercaria has become encysted. The trematode fluke *Cryptocotyle lingua* has a complex life cycle which typically includes a common wrinkle, a fish and a gull. A video about the life-cycle of *Cryptocotyle lingua* can be found here (highly recommended):

<https://www.youtube.com/watch?v=PbXEGii2IOE>

To gain a measure of the number of black spots on the fish close up photographs were taken of a random sub-sample of fish on 4th November.

(below) juvenile cod infested with *Cryptocotyle lingua*. The dark pigment forming each black spot is where a metacercaria has become encysted. Photo by Roger Mclachlan.



Some of the little fish had upwards of an estimated 100 black spots (range 4 to 340 spots per fish), based on counts from photographs.

Spots could be seen on the eyes of half of the fish in photos.

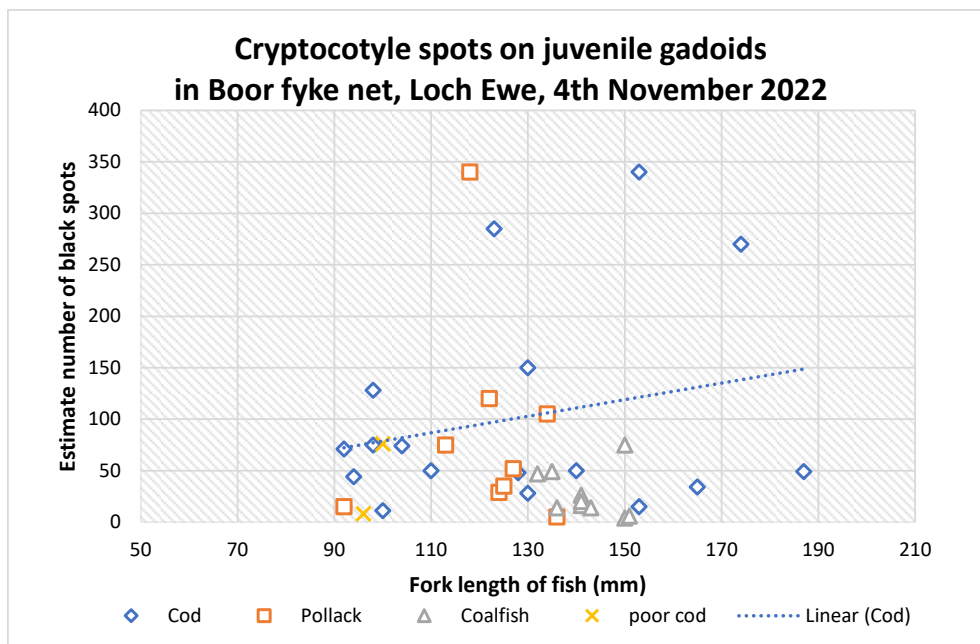
(below) Fourteen black spots were counted on the eye of this juvenile cod. Photo by Roger Mclachlan.



The 17 juvenile cod in the sample were of average length 128mm (92mm to 187mm) and had an average of 101 (estimated) blackspots per fish; the 9 juvenile pollack were of average length 121mm (92mm to 136mm); the 10 juvenile coalfish were of average length 142mm (132mm – 150mm); and two poor cod were included 88mm and 118mm. All these fish are assumed to be young of the year (age 0+).

Figure 2 shows the estimated numbers of black spots on juvenile gadids, based on counts from close up photographs of fish, caught in the trap at Boor on 4th November 2022. Counts are conservative. The sample size is small, though representative of fish caught in the trap.

Figure 2 Estimated numbers of *Cryptocotyle lingua* spots on a small random sample of gadoids from the coastal fyke net at Boor by Loch Ewe, 4th November 2022. Numbers are based on counts of spots see n in photographs.



Projects with other pictures and stories about the Boor fyke net and the parasite *Cryptocotyle lingua* can be found on the ispot website; please follow the following links:

<https://www.ispotnature.org/communities/uk-and-ireland/view/project/850315/the-boor-coastal-fyke-net-sea-louse-survey>

<https://www.ispotnature.org/communities/uk-and-ireland/view/observation/854188/horace-wesley-stunkard-1889-1989-and-the-strange-lifecycle-of-cryptocotyle-lingua>

Discussion

WRFT has routinely recorded black spots on sea trout. Some sea trout in Loch Gairloch have been particularly heavily infested; however, to date WRFT has not been too concerned about the effects of this parasite on the health of the trout. A story about *Cryptocotyle lingua* on trout can be found on page 20 of the [WRFT Review May 2011](#).

However, for small gadoid fish, for example cod and pollack, infestation by *Cryptocotyle lingua* can cause premature mortality. Kilburn *et al* 2005 report that juvenile cod could be killed if free-swimming infective cercaria released from the intermediate periwinkle host penetrate the brains or hearts of the cod.

Some questions

To what extent are cod numbers (especially of larger cod) around Wester Ross affected by this parasite? Are most little cod gobbled up by gulls or other seabirds before they get big because they are infested with black spot? Or are there also large numbers of juvenile cod and pollack away from the shore in places where they are less exposed to infection by *Cryptocotyle lingua*?

Does the distribution and foraging behaviour of gulls (especially herring gulls) affect the abundance of *Cryptocotyle lingua* and infestation of juvenile cod? In Loch Gairloch, hundreds of gulls have been seen to congregate around the outflow pipe of Inverkerry fish farm.

Why have populations of larger cod not recovered in recent years around Wester Ross? The latest ICES advice for cod in the West of Scotland can be found here: https://ices-library.figshare.com/articles/report/Cod_Gadus_morhua_in_Division_6_a_West_of_Scotland_/19447889?backTo=/collections/ICES_Advice_2022/5796935 . Reference is made to grey seal populations and bycatch taken by Nephrops trawlers but no mention is made of parasite infestation.

[Ryberg et al \(2022\)](#) investigated parasite infestation of cod in the Baltic Sea and suggested that the nematode *Contraecaecum osculatum* which parasitises cod livers could affect the productivity of Baltic cod stocks.

Within the west of Scotland area, one possibility is that more juvenile cod have been pushed into coastal margins where they are more vulnerable to *Cryptocotyle* infestation because cover for small fish is still present in these areas which no longer exists in offshore areas where the seabed, for example maerl habitat, has been levelled by scallop dredging. However, within the Wester Ross MPA the sea floor is now protected from scallop dredging; some inshore fish habitats may be slowly recovering. Will there be a recovery in cod stocks?

It's easy to point fingers at unsustainable fishing practices for cod when stocks are lower than they were; however, in some situations there may be other factors, albeit sometimes indirectly associated with other human impacts to coastal ecosystems, that can also contribute to reduced life expectancy for cod in coastal waters.

Samples of small fish with blackspots have been sent to Marine Scotland Science marine lab to learn more.

Acknowledgements

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References

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Ryberg, M.P., Huwer, B., Nielsen, A., Dierking, J., Buchmann, K., Sokolova, M., et al. (2022) Parasite load of Atlantic cod *Gadus morhua* in the Baltic Sea assessed by the liver category method, and associations with infection density and critical condition. Fisheries Management and Ecology, 29, 88– 99. <https://doi.org/10.1111/fme.12516><https://onlinelibrary.wiley.com/doi/epdf/10.1111/fme.12516>