



Lochaber  
Fisheries Trust

**Developing wild fish monitoring techniques  
to better understand interactions between  
farmed and wild fish**

**Final Report – March 2020**

## **Contents**

Introduction and background .....	2
Project Overview.....	3
Year One.....	4
Year Two .....	4
Success and Lessons.....	6
Future Work.....	8
Acknowledgements.....	8

## Introduction and background

In recent years there has been an increasing interest in better understanding, and measuring, any potential impacts on wild fish arising from the finfish aquaculture industry.

Most research undertaken to date has focussed on assessing impacts on wild fish over large geographical scales, rather than local impacts. Whilst broad-scale information is important, it is also crucial to understand and measure potential impacts at a local level, at a scale relevant to interactions between wild and farmed fish. The issue of there not being a single authority with responsibility for ongoing management of wild-farmed interactions has long been recognised. Local authority planners have tried to address this gap through the inclusion of Environmental Management Plans as a condition of planning consent. In addition, third-party certification standards such as the Aquaculture Stewardship Council require monitoring of wild fish in order to assist in clarifying the link between the health of wild and farmed fish through objective information.

Since the start of this project, two Scottish Parliamentary inquiries have investigated the current situation, and both concluded that the *status quo*, in terms of regulation and enforcement was no longer an option. This has placed this project in a new and exciting position of being able to directly inform a number of live and relevant workstreams. Fisheries Management Scotland has two places at the Interactions Working Group, established by the Scottish Government to make recommendations, for a future interactions approach, including changes to the regulatory regime, planning advice and environmental monitoring and the potential use of 'adaptive management' techniques.

In parallel, a Technical Working Group has been tasked by the Scottish Government with developing a practical framework for assessing the level of risk posed to wild salmon and sea trout. This spatial planning framework will be an important component of the changes to regulation agreed by the Salmon Interactions Working Group. Monitoring of lice levels in the environment and assessment of impacts on wild salmonids will be an integral part of this approach.

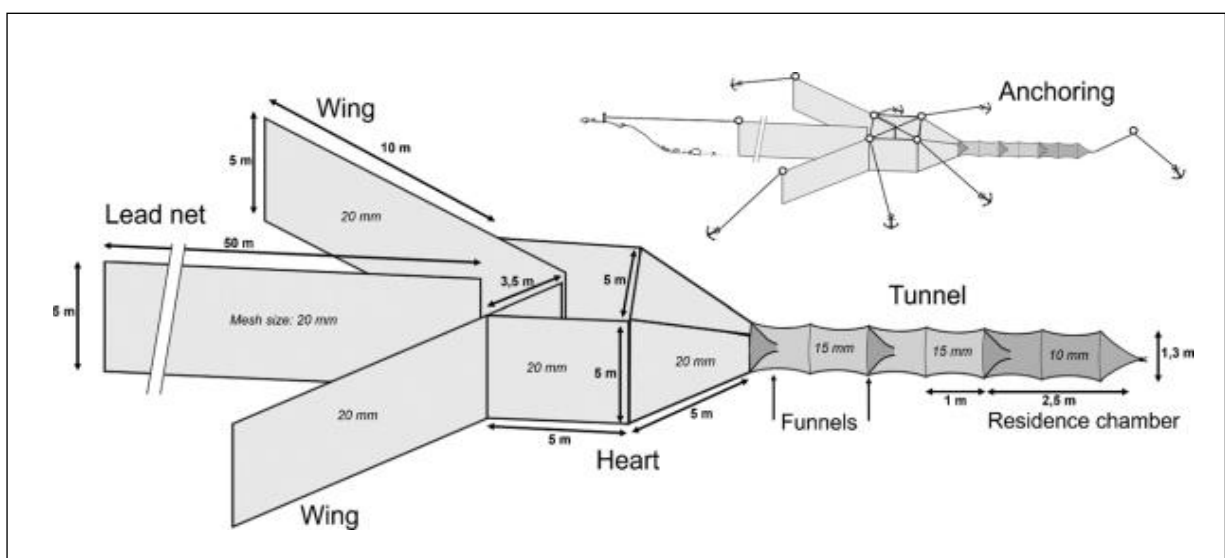
In 2017, Fisheries Management Scotland and Lochaber Fisheries Trust, along with MOWI (then Marine Harvest Scotland) approached Crown Estate Scotland with a proposal to develop and refine techniques to monitor wild fish in an agreed and objective manner, ultimately with the objective of providing an appropriate feedback loop to salmon farm management.

The project was based initially in the Linnhe system in Lochaber. All of the farms in inner Loch Linnhe are operated by MOWI Scotland.

A steering group, comprising Fisheries Management Scotland, MOWI Scotland, Lochaber Fisheries Trust, Argyll Fisheries Trust, Marine Scotland Science and Crown Estate Scotland was established and it was agreed that the focus would be to ground-truth monitoring techniques during the wild smolt run, to determine the practicality and resources required. This work was undertaken by the Lochaber Fisheries Trust view to extending such monitoring over a greater geographical area in future.

## Project Overview

An important element of this project was to compare the established technique of beach seine netting for wild sea trout with the deploying of a bag net system, which has been trialled in Ireland and Norway, but not yet in Scotland. Beach seine netting is an established technique and the Scottish Government have funded sea trout monitoring in this manner for several years. However, seine netting is restrictive as it cannot be used on steep rocky shores, or over seabed with significant seaweed or boulders. In addition, fixed nets have the potential to capture a more representative sample of the local population of fish and have the potential to allow the capture of juvenile salmon, as well as sea trout. The net design is similar to that of a commercial fixed engine salmon net (see Figure 1). A 'leader' net extends perpendicular from the shore and diverts fish into a v-shaped system of nets. Wild fish swim freely in the net until released, following sampling for sea lice by researchers.



**Figure 1:** Schematic of a coastal fyke net.

Lochaber Fisheries Trust developed the net design with help from wild fish researchers in Ireland and Norway. Appropriate licenses and permissions were secured from Marine Scotland Licensing Operations Team and Crown Estate Scotland, following liaison with relevant local coastal stakeholders.

It was initially anticipated that MOWI would help Lochaber Fisheries Trust deploy and retrieve the net, but that Lochaber Fisheries Trust would undertake routine checks and monitoring of fish. However, it was soon apparent that the project would not be possible without taking a more collaborative approach. MOWI therefore played a crucial role in the project through daily provision of boat and staff time. This was an extremely positive element of the project and is discussed further below. The net was deployed close to an established beach seine netting site in order that comparisons between the two techniques could be drawn.

## **Year One**

Year one was primarily focussed on learning the logistics of anchoring and deploying the net. The net took several weeks to get working successfully, during this time wild and farmed sectors worked together to fine-tune the design and approach. The final solution has overcome most of the challenges likely to be faced working in the tidal environment. It was not possible to deploy the net in time for the wild salmon smolt run, but this aspect would be considered further in year two.

Once the net was successfully deployed the net caught 114 sea trout over 16 days, with a peak of 36 in one 24 hr period. Whilst it was not possible to directly compare the fixed net with the beach seine net in any statistically significant manner, it was observed that the fixed net was able to catch fish more consistently, without the restraints of weather and tide which affect the ability to seine net. Seine netting just north of the fixed net has on occasion caught 50+ fish but in terms of time and effort the fixed net is more reliable at sites with strong tides, or when weather conditions would make seine netting unfeasible (either too windy for netting or too still and sunny when seine netting is less effective).

## **Year Two**

Following a meeting of the steering group after year one, it was agreed that Fisheries Management Scotland would approach Marine Scotland for additional funding, in order to deploy an additional net at a site with a specific focus on intercepting salmon smolts during their marine migration. A net was therefore deployed in Loch Sunart for this purpose. Whilst this was not part of the core project, protocols developed in year one were used to inform this additional work, and Lochaber Fisheries Trust and MOWI were fully involved in the deployment of the net.

In advance of the second sampling season, Lochaber Fisheries trust worked with MOWI to commission two further fyke nets to be constructed by a Scottish net manufacturer. The promised deliver date of these nets was not in time for the salmon smolt run, and therefore the original net from year one was deployed in Loch Sunart. The new nets were deployed in Loch Linnhe.

The spring of 2019 was very dry. A lack of any meaningful rainfall for the project period meant that it is likely that the peak of the smolt run had not yet occurred. It is not clear whether this dry period affected the potential for intercepting salmon at sea, but unfortunately no salmon were caught whilst the net was deployed.

The two nets commissioned for 2019 season were produced using mesh larger than the 15mm specified in the design. This meant that smolts could pass through the mesh in the leader and heart sections. The net manufacturers felt the net would still work as fish would follow the line of the net, seeing it as a barrier. This was tested by placing 15 salmon and sea trout smolts (caught in a seine net) into the heart of the net and sewing it shut. The fish could only swim into the fyke section or swim through the mesh. When we checked the net three of the fish were in the fyke section, the rest had escaped through the mesh. We removed the new net and replaced it with the 2018 net, which caught 49 fish on its first day (compared to 4 the day before with the old net). The nets were therefore returned at no cost to the project.

The aim of the 2019 Linnhe study was to try a site with different characteristics, and to try and identify any patterns in when the nets fished best (to focus fishing effort). We chose a second site with much deeper water which required more collaboration between MOWI and LFT to make it successful. Unfortunately, the aim to monitor patterns in fish numbers relating to tides etc was

hampered by the issues with the new nets. By the time we had the old net back in place there were only two weeks of the sampling season remaining. However this period proved invaluable in allowing us to develop an extra understanding of the nets and how they work in different situations.

In Loch Linnhe some salmon smolts were caught, even with the larger mesh nets, demonstrating that the nets also work for salmon. We used magnifying goggles to look for copepodid stages of sea lice on wild fish, with some success. Although it was possible to see copepodids quite well on the skin and fins of fish it was not possible to check gills etc which may hold significant numbers of copepodid lice. This was an extremely important development, as it opens the possibility that coastal fyke nets can be used to generate important information on sea lice infestation pressure on salmon, as opposed to sea trout. This will be very important in informing monitoring approaches for the future regulatory regime.

## Success and Lessons

It was clear that the coastal nets work best on sites with a steep intertidal zone as this allows the net to be fishing throughout the tidal cycle. On shallow beaches the leader needs to be very long or at low tides the wings will be left dry and the net will not fish. Rocky outcrops work particularly well.



**Figure 2:** Shallow shore at low tide: all the leader is dry and net not fishing



**Figure 3:** Steep shore: even at extreme low water the net is still fishing

Lochaber Fisheries Trust and MOWI worked in close collaboration throughout the project and have developed a good understanding of deploying the net and the logistics of sampling wild fish. MOWI staff generally had a good understanding of knots, anchors and extensive boat driving expertise, which was invaluable to the overall success of the project. For setting the net we had 2 MOWI staff and 2 Fisheries Trust staff. The deployment took a full day the first time, and two hours after some practice.



**Figure 4:** Fisheries Trust and MOWI staff preparing to set net



**Figure 5:** Discussing the net set-up

For checking the net, we worked with one MOWI and one Fisheries Trust person, this typically took half an hour, plus travel time. In cases where large numbers of fish were caught it would be longer.

This allowed MOWI staff to observe wild fish and the sea lice burdens they carry first-hand. The project has resulted in the wild fish and aquaculture sectors working closer together and developing a better understanding of each other's work and viewpoints. The expertise of MOWI staff was crucial in the success of both setting and checking the net, and the collaborative working integral to this project developed a sense of respect and understanding. MOWI staff added great value to the project with local knowledge of currents, water depth and practical skills. The opportunity for discussion and learning between the two sectors led to better understanding on both sides about

the challenges we face and potential solutions. In addition to developing a more positive working relationship at a local farm level, the project has also resulted in enhanced communication with MOWI head office staff, leading to further collaboration and data sharing.



**Figure 6:** Processing the fish



**Figure 7:** Checking the net on a windy day

The collaborative nature of this project was also highlighted as part of a BBC Landward programme on wild and farmed salmon. Due to the successful deployment of nets in both years of the study, a number of additional nets have now been purchased with a view to deploying these across the 'aquaculture zone' in 2020.

One of the major outputs of this project was the development of a Standard Operating Procedure covering the equipment, preparation and deployment of a fixed coastal fyke net for the purpose of sampling wild salmonids. This will be made available to wild fisheries managers and finfish farming companies to inform wild fish monitoring for the purposes of Environmental Management Plans and monitoring as part of the future regulatory regime.



## **Future Work**

We have now proved the nets can work in a wide range of situations we had hoped to roll them out across the west coast. We had planned to deploy coastal fyke nets in Lochaber (x2), West Sutherland (x1), Wester Ross (x1), Argyll (x1) and Western Isles (x1-2). Discussions between aquaculture and wild fish interests had identified a number of strategic sampling sites (using lice dispersion models and local knowledge of wild fish) which were designed to further our knowledge of the interaction between wild fish and lice dispersion from fish farms.

However, the development of this project has been hit hard by the current COVID-19 pandemic. The current lockdown has meant that, quite understandably, finfish farmers have taken the decision not to allow external contractors onto their sites. It would also be impossible to deploy coastal fyke nets whilst following current social distancing guidelines. On that basis the planned deployment of nets in 2020, is on hold until 2021.

We would therefore like to use 2020 to liaise closely with the industry to build an understanding of the outputs of this project and seek agreement on clear protocols for the use of such nets for wild fish monitoring as part of current and future Environmental Management Plans and the spatial planning framework being developed by the Technical Working Group referred to in the introduction. With this in mind, and assuming that the current restrictions are relaxed later in 2020, we would like to hold a training event for wild fisheries managers, finfish farmers and regulators where we demonstrate the deployment and use of a coastal fyke net.

## **Acknowledgements**

We would like to thank Crown Estate Scotland for supporting this project and Marine Scotland for the additional support for the net in Loch Sunart.

MOWI's support was crucial to the success of this project. In particular the following MOWI staff made a huge contribution: Stephen MacIntyre, Ian Cameron, Alan Murdoch and Kevin Mathers.