



Proposed Marine Fish Farm: Loch Hourn Medicine Minimisation Statement

Mowi Scotland Limited

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Medicine Minimisation Statement

Loch Hourn Marine Pen Fish Farm, Loch Hourn

Scope

This document outlines the fish health and welfare tools and interventions that are available to Mowi Scotland and how their application in an integrated manner reduces reliance on medicine use.

Medicine Minimisation

Whilst the use of medicinal treatments in accordance with licence conditions remains a key veterinary management tool for fish health and welfare, Mowi Scotland, because of investment and development in new methods, now has access to many different and very effective intervention methodologies to manage fish health, including sea lice control. The suite of management measures that are now available to Mowi such as biological control, freshwater treatments, and thermic/mechanical removal of sea lice form part of an integrated fish health and welfare management strategy.

Interventions, such as biological control, medicinal treatments, and thermic/physical removal of sea lice would not be successful without a firm foundation of good fish welfare, husbandry and other preventative measures which include fallow periods, single year class sites and regular sea lice counting.

Mowi Production and Health teams meet weekly to review the fish health status of every operational farm and discuss the appropriateness of management intervention. Our sea lice strategy focuses on early intervention based on an individual pen basis, instead of later treatments based on farm basis. The criteria defining the fish health treatment selected for a site is determined based on many different decision criteria to ensure a diverse range of treatments are applied for continued treatment efficacy and minimal development of resistance. These include the type of treatment last applied, level of efficacy achieved, health status of the fish, as well as the availability and capacity of specific treatment options.

Non-medicinal treatments allow a reduction in the use of medicines at sites and such options are promoted when they best meet the needs and welfare of fish.

Cleaner fish are generally stocked in all farms at the start of the cycle, and top-ups thereafter are decided by factors such as a combination of analysis of farm experience, the available medicinal consent and previous success with cleaner fish. Mowi has committed to the development of in-house cleaner fish (lumpsuckers and ballan wrasse) farming to provide a consistent and sufficient supply to meet requirements. The company has invested significant financial and technical resources into the development of several pioneering cleaner fish hatcheries at locations around the UK.

New operational procedures have been introduced by Mowi Scotland replacing all previous operational procedures on technological sea lice prevention. The new procedures focus on the dynamic use of preventative tools to maximise protection towards lice and keep negative impacts on fish welfare and performance to a minimum. Preventative tools applied on Mowi sites depending on assessment of site-specific fish health, welfare considerations and environmental conditions include deep feeding, deep lights, sea lice skirts and aeration.

Freshwater treatments are increasingly adopted as a non-medicinal treatment to address sea lice. Investment in the use of freshwater as a fish health management tool continues, with the development by Mowi of a regional network of freshwater supplies for wellboats, presented in Figure 1.

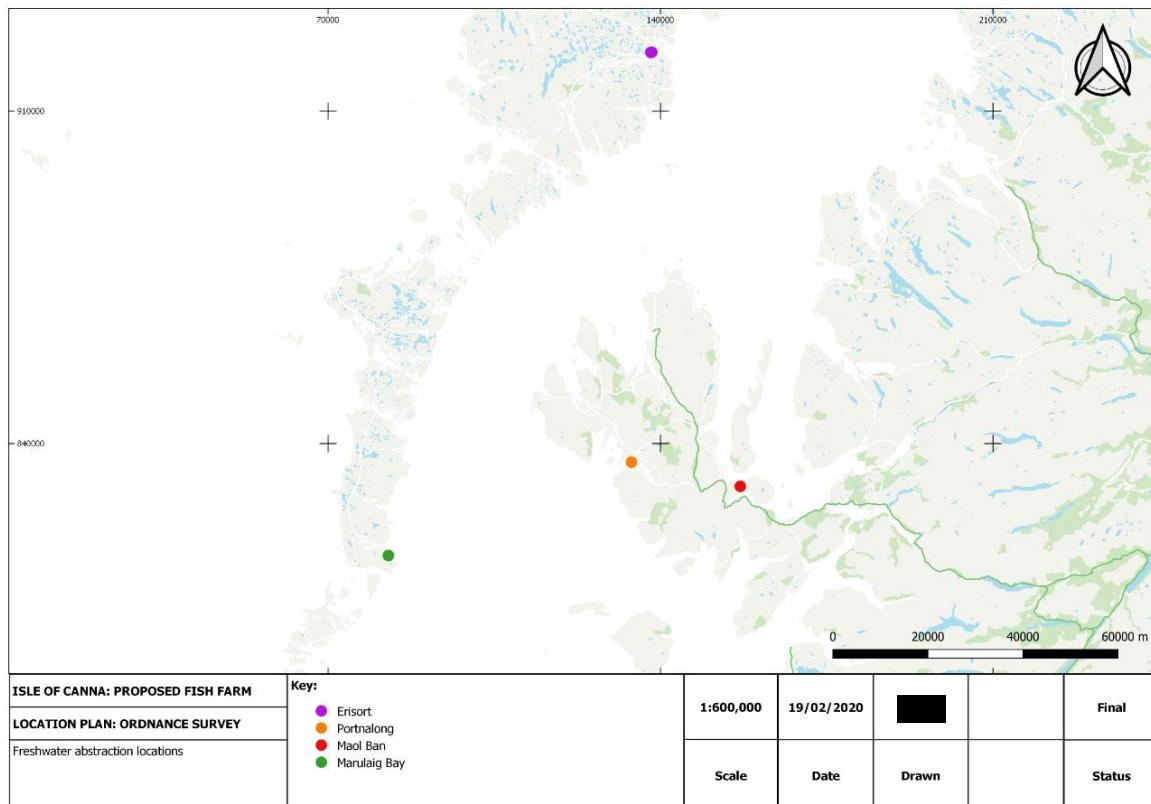


Figure 1: Mowi Scotland wellboat freshwater supply locations (operational and under development)

The sea lice management options available to Mowi and how they would be applied in an integrated approach, reducing reliance on medicine use, at the Loch Hourn fish farm are summarised in Table 1 below.

Table 1: Loch Hourn Fish Health and Welfare Management Tools

Fish Health and Welfare Management Tools	Description
Sea Lice Control Strategies	<p>To control infections, a policy of weekly sampling to assess lice population dynamics is implemented at all sites. From this data the Fish Health and Production Teams decide whether any intervention is required. Monitoring intensity is greater than the industry Code of Good Practice requirements at 20 fish from every pen per week to allow for meaningful decisions to be taken.</p>
Pen Modifications	<p>Snorkel nets have a net "ceiling" at a suitable depth and a snorkel tube that connects the ceiling to the surface. The tube is commonly surrounded by a sea lice skirt to prevent sea lice from entering it. Therefore, the ceiling keeps the salmon below the depths of high (free-swimming) sea lice abundance, while at the same time the tube gives the fish access to the surface to refill their swim bladders. A recent commercial-scale study in Norway found that pens with snorkel nets had 75% fewer newly settling lice on salmon compared to pens with conventional nets (Geitung et al., 2019). The Scottish west coast can have quite different water column conditions than Norwegian fjords, so Mowi Scotland and academic partners are currently trialling snorkel nets to determine their effectiveness on the Scottish west coast.</p> <p>It is not the intention to install snorkel nets at Loch Hourn at this present time pending completion and assessment of a research and development trial being carried out at Mowi's Poll na Gille site.</p>
Preventative Tools	<p>Sea lice skirts: sheets of material that are mounted round the top portion of salmon pens (as sea lice larvae are often found on the first few metres of water below the surface). The skirt acts as a barrier to lice.</p> <p>Sea lice skirts to a depth of 8 m below the water surface will be installed as part of the site redevelopment and 160m pen installation.</p> <p>Deep feeding: the use of deep feeding equipment that has high capacity and spreads the feed spatially at depth, promoting deep feeding behaviours by salmon and its efficacy as a lice prevention measure is presently the subject of developing research.</p> <p>It is not the intention to implement deep feeding at this present time pending completion and assessment of a research and development trial being carried out on the first Mowi sites to transition to 160m pens.</p> <p>Submerged lighting: salmon typically swim deeper with submerged lighting than in periods of low light intensity where the salmon tend to swim shallower. Mowi are therefore undertaking further research trials on the potential for behavioural manipulation of salmon, and the subsequent lice prevalence and the efficacy against infection.</p>
Husbandry	<p>Fish are tended to under conditions that satisfy their biological needs for food, clean water and space, and it is ensured that the fish obtain the necessary nutrients for good health throughout production. The fish are stocked at densities that balance welfare and enhance performance. Coordinated fallowing and synchronised production are integral components of Mowi's farming practices, which reduce biological risk.</p>

Fish Health and Welfare Management Tools	Description
	<p>The Loch Hourn fish farm is located within Disease Management Area (DMA) 14b and is the only site operating in this area. The neighbouring Mowi farms in Lochs Duich and Alsh are located within DMA 14a. To the South DMA 14c covers Loch Nevis and the fish farms located within. While the Loch Hourn farm shares regional resources with other Mowi farms the Loch Hourn farm is able to operate under its own veterinary health plan and follows its own production cycle.</p> <p>Fallow period: the Loch Hourn farm undertakes a minimum 6 weeks of fallow. The 2022 fallow period is anticipated to be 8 months with the current growth cycle completing in January 2022.</p> <p>Single Year Class: the Loch Hourn fish farm will be stocked with new smolts within a defined period which allows all to be harvested out again in time for the agreed fallow.</p> <p>Regional Health Managers: Regional Health Management transfers responsibility to a single individual who can take overall strategic control for interacting sites in an area. The Regional Health Manager for the Loch Hourn fish farm shares responsibility for the Mowi sites to the North thus ensuring an integrated and aligned site management approach when required.</p> <p>Site Specific Veterinary Health Plan: this would be developed by the Manager of the Loch Hourn fish farm in conjunction with the Regional Health Manager or Vet. The plan would contain measures to optimise fish health and welfare.</p>
Biological Control	<p>The use of cleaner fish, typically wrasse and lump suckers, provides a symbiotic 'cleaner' service to other fish species, by the removal of parasites. By 2022 all of Mowi's cleaner fish will be hatchery produced.</p> <p>Cleaner fish have been routinely stocked on a progressively increasing basis at Loch Hourn since 2014. During a fish production cycle hatchery reared cleaner fish will generally be stocked at a ratio of 12% lumpfish and 6% Ballan Wrasse to salmon. This will be on a 'deploy and monitor' basis with further top up stocking as required across the growth cycle.</p> <p>Cleaner Fish Welfare: Mowi (Scotland) takes fish (salmon, wrasse and lumpfish) welfare and health as equal priority to farmed salmon health and welfare. Management of cleaner fish around freshwater treatments, has been an area of focus and improvement. While lumpfish show tolerance to short exposure freshwater treatments, wrasse are extremely sensitive. In the past, the approach has been to limit length of the treatments on sites stocked with lumpfish and recapture cleaner fish pre-treatment at sites stocked with either wrasse or a combination of species. At the same time, Mowi has been working with suppliers to upgrade well boats to ensure cleaner fish can be safely excluded from freshwater treatments. Existing well boats are being equipped with cleaner fish graders, with new well boats having such a requirement built into the design specification. This grader technology provides the ability to efficiently separate both wrasse and lumpfish during freshwater treatments, so cleaner fish can be returned safely and untreated to the destination pen.</p>

Fish Health and Welfare Management Tools	Description
Medicinal Control	<p>There are presently five active ingredients available (in various product formulations) for use as sea lice medicines in Scotland; bath treatments cypermethrin, azamethiphos, deltamethrin, hydrogen peroxide; and the in-feed treatment emamectin benzoate. All medicines are prescribed by the company veterinarian and their use is regulated by the Veterinary Medicine Directorate (VMD) as well as SEPA. There are also strict criteria and procedures for monitoring medicinal residues in farmed salmon under food safety regulations as is the case with terrestrial farmed animals.</p> <p>The present CAR licence for Loch Hourn, authorises the use subject to conditions a suite of fish health medicines, namely Excis, Salmosan, and AMX/ALPHA MAX applied as bath treatments and the in-feed medication Slice®.</p> <p>Medicinal sea lice bath treatments are carried out in one of two ways at Loch Hourn:</p> <ul style="list-style-type: none"> • Bath treatments in-situ. By enclosing the pen in question fully with a large tarpaulin. The net is lifted to gently crowd the fish together in the smallest safe volume. The tarpaulin is passed underneath the net and pulled up around the pen above the water level. When the fish are totally enclosed in the tarpaulin, treatment can begin. Oxygenation equipment is used to ensure the water is well oxygenated and prevent the fish from experiencing stressful suboptimal oxygen levels. Once the treatment is completed the tarpaulin is removed and the nets lowered to uncrowd the fish. • Fish may be treated in tanks on board specialist wellboats. Following treatment, the dislodged lice are collected and disposed of, then the treatment water is discharged into the sea.
Mechanical/ Thermic Control	<p>Mechanical removal of lice from salmon is based on the use of two principal technologies:</p> <ul style="list-style-type: none"> • Hydrolicer units: operation by using pressurised seawater to dislodge sea lice from the salmon without any detrimental impact on the fish; and • Thermolicer / Optilicer units: exposing the fish to lukewarm water for 30 seconds which dislodges sea lice due to the low tolerance of a louse to sudden changes in temperature. <p>Mowi has a fleet of vessels capable of undertaking hydrolicing / thermolicing treatments. The newest vessel is hybrid delicing vessel with a twin line thermolicer and capacity for a 7-line hydrolicer or optilicer units. The proposed biomass of 3100T at Loch Hourn could be treated in less than two days using hydrolicer or thermolicer resources, both of which will be available to the site as required.</p>
Freshwater Treatments	<p>Freshwater treatments have been recognised as an effective strategy for both sea lice and Amoebic Gill Disease (AGD) control. This is undertaken by wellboats specifically designed to undertake freshwater treatments at seawater farms. This boat produces freshwater by desalination but can also obtain water from a number of licensed natural freshwater abstraction sources, i.e., loch and rivers.</p>

Fish Health and Welfare Management Tools	Description
	<p>All water that is discharged from wellboats during the treatment of fish runs through a filtration system. The same treatment water can be utilised for several loads of fish and when the final treatment is completed the water in the tanks will also be filtered through the same filters. The most common filter design on wellboats incorporates a pressure system utilising a 150-micron pore size sufficient to retain sea lice.</p> <p>Mowi has 2 wellboats that can generate their own freshwater through on board reverse osmosis technology. Mowi additionally operates a geographic network of licensed freshwater abstraction locations where freshwater can be stored for wellboat use in pen reservoirs.</p>