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Shot Head Integrated Pest Management / Single Bay Management Plan

AQUACULTURE LICENCE APPLICATION SHOT HEAD, BANTRY BAY
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MARINE HARVEST ASA

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Introduction

During 1997 Single Bay Management (SBM) arrangements involving separation of generations and annual fallowing of sites were in place in all salmon farming areas. Since then these plans have been regularly updated.

Single Bay Management arrangements for fin-fish farms are designed to co-ordinate husbandry practices in such a way that best practice is followed and that stocking, fallowing and treatment regimens on individual farms are compatible with the arrangements on neighbouring farms. The goal is to ensure that practices on individual farms act synergistically to enhance the beneficial effects to the bay as a whole. A major component in this process is the build-up of a communication network between the operators. The non-confrontational environment of SBM meetings between licensed operators has proved a valuable forum in the process of conflict resolution and avoidance both within the industry and between the industry and its neighbours. The SBM process has proved very effective in enhancing the efficacy of lice control and in reducing the overall incidence of disease in the stocks. Single Bay Management plans are subject to revision for each production cycle. This arises out of changes in production plans related to:

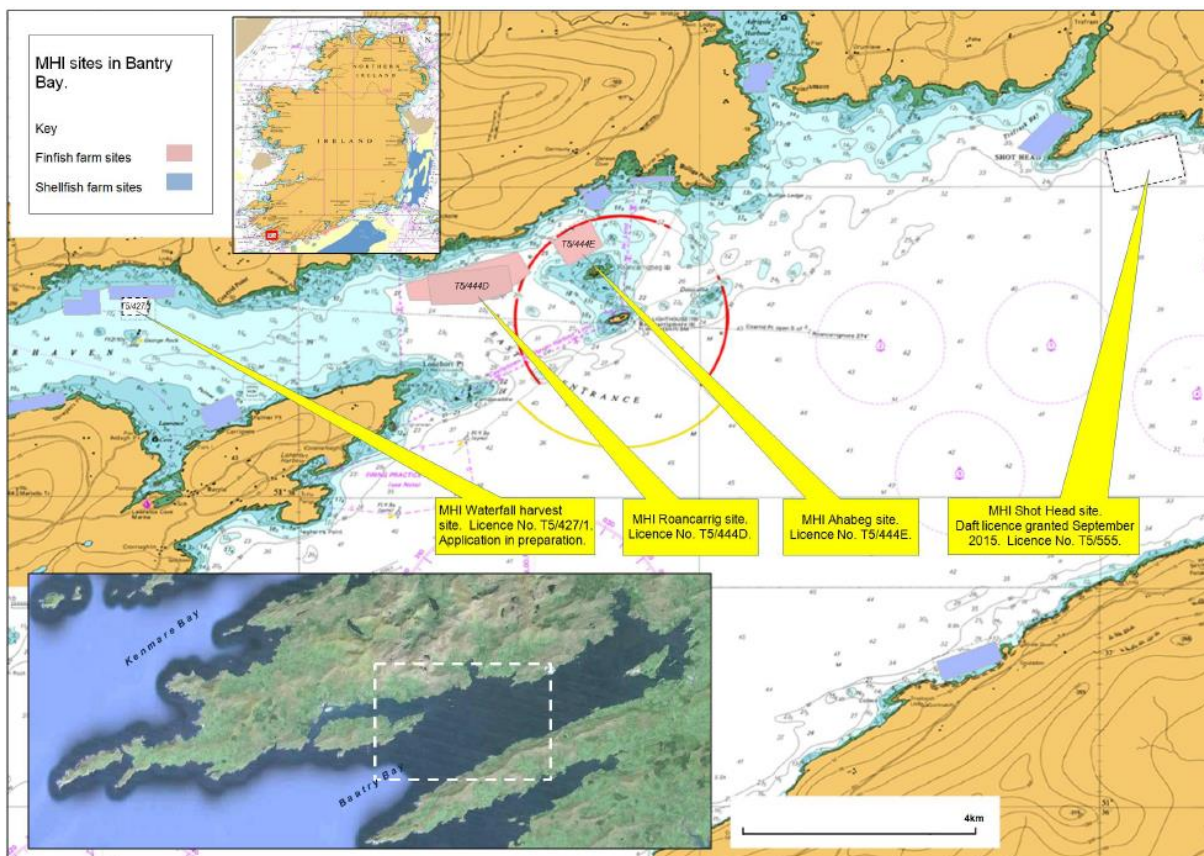
- New license applications
- In response to changing markets
- New husbandry requirements
- Both internal company restructuring and inter-company agreement

Crucial elements in the success of this plan are identified as;

- separation of generations
- annual fallowing of sites
- strategic application of chemotherapeutants
- good fish health management
- close co-operation between farms

This management strategy was endorsed by the then Dept. of Marine, the Sea Trout Task Force and the Irish Salmon Growers Association as fundamental to the rational management of the salmon farming industry. This practice has since been re-enforced with the introduction by the Department of Agriculture, Fisheries and Food (DAFF) of “A strategy for improved pest control on Irish salmon farms”, published in May 2008. This strategy seeks to establish a new role for SBM (Single Bay Management) as a focus for management cells to manage sea lice control at a local and regional level

This plan outlines how Marine Harvest Ireland (MHI) intends to control sea lice infestations in its' proposed Shot Head site (Draft Aquaculture Licence Number T5/555A) which incorporates existing salmon farm sites in Bantry Bay.



Monitoring of Sea lice:

The lice monitoring methodology set down in Protocol No. 3 comprises the inspection and sampling of fish on every salmonid farm site in each Single Bay Management Area a minimum of fourteen times per annum. Inspections must be carried out monthly, with the following exceptions:-

- During the “susceptible spring period” for migrating wild salmonid smolt especially sea trout smolt, during March to May, when there are two inspections per month.
- Over the two-month period of December to January, when lice growth is slow and therefore only one inspection is required.

On each inspection, two samples of 30 fish are taken, under standard conditions. The first sample is taken from a standard pen, sampled on every inspection, whilst the second is taken from another pen, selected at random.

In addition to the statutory monitoring of Sealice, MHI will examine at least 10 fish from each salmon pen, every week. During the susceptible spring period, if levels of ovigerous female lice numbers reach an average of 0.5 per fish and/or a total of 5 per fish then a treatment is mandatory. At all other time of the year the treatment trigger level is 2.0 ovigerous lice per fish.

Strategies to combat sea lice infestation in Bantry Bay.

Health status of input stock

All salmon stock introduced into Bantry Bay, including Shot Head by MHI will comply with the European Communities (Health of Aquaculture Animals and Products) Regulations 2008 (S.I. No 261 of 2008), as amended by the European Communities (Health of Aquaculture Animals and Products) (Amendment) Regulations 2010 (S.I. No. 398 of 2010).

Prior to sea transfer, all salmon smolts will be inspected and certified as disease and parasite free. All such movements into and within Shot Head shall be notified to the fish Health section of the Marine Institute.

Management and disposal of biological wastes

Dead fish and runts will be removed regularly, to maintain the health of stocks. The frequency of mortality dives will be determined by the site manager based on time of year and numbers/type of mortalities but at minimum this will be weekly. Records of mortalities shall be maintained for each pen. All dead fish will be sent for incineration to an approved Animal By-Product rendering plant.

Where harvesting is carried out at sea, all harvest water including blood will be collected with harvest fish in the wells of the harvest vessel. Thereafter all fish and waste products will be transferred to insulated food tankers and transported by road to the fish processing plant at Rinmore, Co. Donegal. Blood and waste water is treated in a licenced, on-site effluent treatment facility at Rinmore.

Medicinal treatments:

The principal objective in lice treatment is to avoid the development of ovigerous female lice, since it is the Nauplius larvae hatched from egg strings carried by ovigerous female lice, that

initiates the spread of infestation. Reduction in ovigerous female lice numbers can be achieved by killing them directly or otherwise by killing any settled lice stage, so that fewer remain viable to develop to maturity. MHI focuses its lice treatment regime around the pre-spring treatment.

MHI will only use treatments that are effective against all lice stages. This can be achieved using the oral treatment Slice[®], and the bath treatments Alpha Max[®] or Hydrogen Peroxide, using either well boat tanks or fully bagged pens. The MHI treatment strategy is to rotate Slice[®], Hydrogen Peroxide and Alpha Max[®].

Slice[®] in-feed treatment.

Slice[®] was developed specifically as an oral treatment against salmonid lice infestation. Slice[®] is a proprietary pre-mix containing 0.2% Emamectin Benzoate (EmBZ), for surface coating onto salmon feed, at 5kg Slice[®] / tonne of feed. Slice[®] is supplied in 2.5kg sachets, containing 5g of EmBZ in an inert matrix. Thus one sachet of pre-mix is sufficient for wet-coating or dry-coating onto feed pellets, to produce 500kg of medicated feed. The recommended dosage is 50µg EmBZ per kg fish biomass per day for seven consecutive days. Thus each tonne of biomass requires 5kg of medicated feed per day (that is at a feed rate of 0.5% body weight per day) for the seven-day treatment period. Slice[®] -medicated feed is supplied by the feed manufacturer, using the appropriate quantity of Slice[®] pre-mix supplied under veterinary prescription.

If required, MHI shall apply one Slice[®] treatment to Shot Head stocks in the spring of the first input year. This will at latest be applied in April Maximum Treatable Biomass for the site will be 396 tonnes (See Mean Total Biomass, Table 16. of the accompanying EIS).

Alpha Max[®] bath treatment.

Alpha Max[®] active ingredient is the synthetic pyrethroid, Deltamethrin. Pyrethroids are a group of natural and synthetic chemicals which act on insects and related organisms (such as sea lice) by blocking neural transmission pathways. Deltamethrin does not bio accumulate in fish and, if released into the environment, less than 10% persists (and this part is widely dispersed) after 10 days. Its half-life in sediments under treated fish pens has been found to be 140 days, with 90% biodegraded by 12 months. MHI use enclosed well boat tanks for Alpha Max[®] treatments.

Treatment dosage is 0.2ml Alpha Max[®], equivalent to 2µgm of Deltamethrin) per m³ seawater in the well tank for 40-45 minutes.

The well boat MV Grip Transporter, which is used for Alpha Max[®] treatments, has two 600m³ tanks. These require a total dose of 120ml of Alpha Max[®], containing 1,200µg

(1.2mg) of Deltamethrin, per tank, per treatment. The well tanks have the combined capacity to treat 100 tonnes of fish per treatment.

Alpha Max[®] treatment by well boat is conducted on a 24-hour-day basis, with each treatment period lasting a maximum of four hours, from the crowding and pumping of the fish from the fish pens into the well tanks, to their release, post treatment, back to the pens. Thus, in the worst case scenario, to treat the total MAB of one of the proposed Shot Head site, of 2,800 tonnes of stock (see Table 5.2 of accompanying EIS), a total of 24 four-hourly treatment periods would be required, lasting a total of 96 hours (4.00 days).

Hydrogen peroxide (H₂O₂) bath treatment.

This treatment is carried out either in well boat tanks or in lifted, fully bagged pens, in rotation with the other available treatments. Hydrogen peroxide is a powerful oxidising agent which kills pre-adult and adult lice by the formation of gas bubbles on and within the organisms. As with other lice medicines, H₂O₂ must be used with care, in rotation with other treatments.

Dosage is 1,500ppm H₂O₂ for 12 to 15 minutes, starting once the full dose has been released into the well. One advantage of H₂O₂ use is that its breakdown products are oxygen and water, which have no environmental impact whatever.

Coordination of Treatments:

MHI shall focus its lice treatment regime around the pre-winter treatment for all fish in Bantry Bay including Shot Head, which will be over-wintered. During the months of January to May, numbers of ovigerous female and total *Lepeophtheirus salmonis* will be maintained as close to zero as possible using appropriate treatments where necessary. Where two sites are stocked in the Bay, treatments will be carried out on both during the same time period and with the same chemical class.

Rotation of Treatment Products:

In order to reduce the risk of resistance development by sea lice to lice pharmaceuticals it is imperative that the limited number of treatment products is rotated in use. MHI rotation rules are as follows;

- Where there is more than one chemical class available, there will be no more than 2 consecutive treatments with the same chemical class or product on the same site

- Following 2 consecutive treatments with the same chemical class/product then an alternative chemical class/product will be used on the same site, even with a break of several months (due to fallowing and/or a new generation being stocked)
- Treatments with products having shown resistance will not resume until sensitivity is restored
- Resistance bioassays will be conducted
 - If there are indications of reduced sensitivity to a particular product after any single treatment
 - If more than 2 consecutive treatments are planned
 - If resistance to another product/chemical class exists
 - to document restoration of sensitivity
- Product rotation will be applied as a zone management tool, targeting coordinated rotation also within neighbouring sites in the same area/ zone.

Site Fallowing:

The stocking / fallowing strategy is designed to break sea lice infection and infestation cycles by fallowing for a minimum of one month per cycle. The proposed fallow plan for the Bantry Bay sites is illustrated as follows;

BANTRY BAY - SINGLE BAY MANAGEMENT PLAN

SITE	Licence No.	YEAR 1												YEAR 2												YEAR 3											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Roancarrig & Ahabeg	T5/444 D & E	Grow out																								Grow out											
Shot Head	T5/555													Grow out																							
Waterfall Harvest	T5/427/2	Harvest			Harvest						Harvest			Harvest						Harvest																	

Non medicinal sea lice management:

Since the Shot Head aquaculture licence application and accompanying EIS was submitted to the Department of Agriculture, Food and Marine in 2011, MHI has developed a new non medicinal strategy to control sea lice using cleaner fish. Cleaner fish are species which display a natural behaviour of removing parasites and dead skin from other fish species in the wild. The main interest is in wrasse of the genus *Labroides*, of which there are a number of species indigenous to European waters, and also the Lump sucker (*Cyclopterus lumpus*) are also used for this purpose.

MHI intend to stock all their sites in Bantry Bay with cleaner fish. This will involve the stocking of hatchery-reared wrasse and lump sucker at a rate of 6% of the salmon pen population. Cleaner fish are already deployed in MHI farms in Ireland with good success. Results to date illustrate that cleaner fish will maintain ovigerous lice levels on salmon in pens at below 0.1 lice per fish. It also has the beneficial effect of radically reducing the use of chemical treatments and, therefore, treatment dispersal. MHI's objective is to have a 100% supply of hatchery-reared cleaner fish, available for all its sites, by 2017.

In Shot Head, Lump sucker (*Cyclopterus lumpus*) fish will be deployed at time of salmon transfer (November) to a ratio of 6 cleaner fish per 100 salmon. These will be supplemented with locally caught wrasse during summer months. Cleaner fish can be re-captured using baited lobster pots or creels. As a precaution, cleaner fish are removed from the pens before size-grading of salmon, bath treatments and when fasting salmon prior to harvest.

Marine Harvest Ireland is a partner in a multinational research proposal, CleanFishTech, submitted for approval under the EU Horizon 2020 Research Funding call. The key areas of this proposal are:-

1. Sustainable Production of Cleaner Fish.
2. Cleaner Fish Survival & Welfare.
3. Study of Local Environmental Effects of Cleaner Fish Technology.