

ANNEX D

USE OF SCIENCE AND EVIDENCE IN AQUACULTURE CONSENTING AND THE SUSTAINABLE DEVELOPMENT OF SCOTTISH AQUACULTURE

The Aquaculture Regulatory Framework

Information provided by the Scottish Government Aquaculture policy division and the Central Analysis Division.

Regulations

Setting up a new finfish or shellfish farm, or expanding an existing one, requires planning permission through the local authority planning system, in addition to a number of licenses and consents obtained from different public authorities (e.g. a seabed lease from Crown Estate Scotland, a marine license (for finfish farms only), to install equipment from Marine Scotland, a Controlled Activities Regulation License from SEPA and an Aquaculture Production Business Licence (APB)¹ which is administrated by Fish Health Inspectorate (Marine Scotland). Figure 1 demonstrates the extensive planning permission journey involved when proposing a new aquaculture development, highlighting the organisation responsible at each stage, and Table 1 details the specific legislation associated with each application. Assessment of sustainable development is considered with local, economic and environmental issues at its core, with fish farming development subject to an Environmental Impact Assessment (EIA) and Habitats Regulation Procedures. Development decisions must be taken in accordance with National Planning Framework 4² and Scotland's National Marine Plan³.

¹ [Aquaculture Production Business \(APB\): forms and guidance - gov.scot \(www.gov.scot\)](https://www.gov.scot/publications/aquaculture-production-business-licence/forms-and-guidance/pages/1.aspx)

² [National Planning Framework 4 \(www.gov.scot\)](https://www.gov.scot/publications/national-planning-framework-4/pages/1.aspx)

³ [Scotland's National Marine Plan - gov.scot \(www.gov.scot\)](https://www.gov.scot/publications/scotland-national-marine-plan/pages/1.aspx)

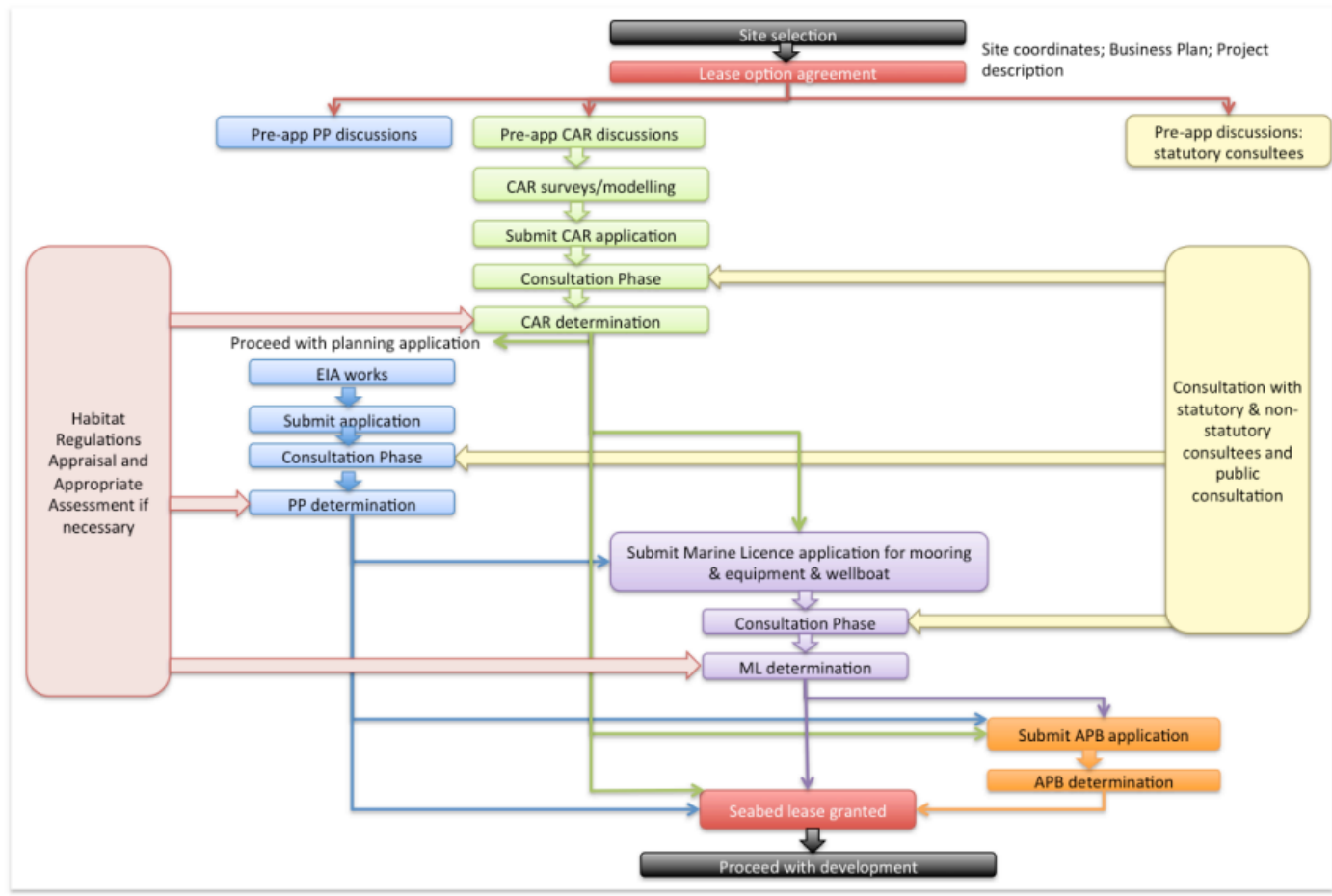


Figure 1. Requirements for planning permission for an aquaculture (marine finfish and shellfish) development⁴

Key to colours: Blue = Local Authority, Green= SEPA, Purple = Marine Scotland, Orange = FHI

Key to acronyms: PP = planning permission, CAR = Controlled Activity Regulations Licence, EIA = environmental impact assessment,

ML = marine licence, APB = Aquaculture Production Business.

N.B. Since this diagram was created wellboat discharges are now regulated by SEPA⁵ and they will not be part of a marine licence from Marine Scotland

⁴ [Independent Review of Scottish Aquaculture Consenting \(www.gov.scot\)](http://www.gov.scot)

⁵ [Discharges from wellboats | Scottish Environment Protection Agency \(SEPA\)](http://www.sepa.gov.scot)

Table 1. Licences, consents and assessments required for each aquaculture sector, in Scotland⁶

Application	Authorising Regulator	Legislation	Aquaculture Type		
			Finfish	Shellfish	Seaweed
Planning Permission	Local Authority (LA)	Town and Country Planning (Scotland) Act 1997	✓	✓	
Environmental Impact Assessment (if necessary, mainly relevant to FF, but can be required for SF)	Local Authority (LA)	The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011	✓	✓	
Marine Licence	Marine Scotland Licensing Operations Team (MS-LOT)	Marine Scotland Act 2010	✓	✓	✓
Seabed Lease	The Crown Estate	The Crown Estate Act 1961	✓	✓	✓
Authorisation to operate an Aquaculture Production Business (APB)	Marine Scotland Science Fish Health Inspectorate (MSS-FHI)	The Aquatic Animal Health (Scotland) Regulations 2009	✓	✓	
Controlled Activity Regulations Licence (CAR)	Scottish Environment Protection Agency (SEPA)	The Water Environment (Controlled Activities) (Scotland) Regulations 2011	✓		
Habitats Regulations Appraisal (if necessary)	All of the above	The Conservation (Natural Habitats, &c.) Regulations 1994 and its amendments	✓	✓	✓
Works Licence	Shetland Islands Council	Zetland County Council Act 1974			✓

⁶ [Independent Review of Scottish Aquaculture Consenting \(www.gov.scot\)](http://www.gov.scot)

Environmental Standards

The Water Environment (Controlled Activities) (Scotland) Regulations 2011, or CAR, is authorised by SEPA, which is responsible for protecting the marine environment by ensuring that the aquaculture industry meet environmental standards⁷.

To protect the marine environment, the quantity of wastes released from fish farms must match the sea's capacity to disperse and assimilate them so that they do not reach levels that would harm sea life. It is SEPA's role as environmental regulator to make sure this is the case, and the standards that they use are outlined in Table 2.

Table 2. List of common standards for protecting the seabed⁷. Please note that within this table the emamectin benzoate has a new interim standard, of 131 ng per kg of sediment (dry weight) at mixing zone edge, awaiting finalised update of Directions from Scottish Ministers⁸.

What the standard applies to	Where the standard applies	The type of standard	How the standard is measured	What the standard is
Condition of invertebrate animals living in soft sediments	At mixing zone limit & beyond	Good status standard	Infaunal quality index method as specified under 2014 Standards Directions ↗	0.64 as minimum value at any time
Most extreme permitted effect of waste deposition on sea bed invertebrate animal communities	In mixing zone	Basic seabed functioning standard	Number of species, and abundance, of the re-worker polychaete worms: <ul style="list-style-type: none"> • all polychaete species listed as "AMBI Group V" 1 species; • Ophryotrocha species; and • Boudemos species 	A minimum of 2 species with a combined abundance of more than 1,000 individuals per m ²
Maximum concentration of in-feed sea lice medicine, emamectin benzoate	At mixing zone limit & beyond	Good status standard	ng per kg of marine sediment (dry weight)	23.5
	In mixing zone	Basic seabed functioning standard	ng per kg of marine sediment (dry weight)	235
<p>Note</p> <p>1. "AMBI Group V" species as listed in Borja, A., Franco, J., Perez, V. (2000). A Marine Biotic Index to Establish the Ecological Quality of Soft-Bottom Benthos Within European Estuarine and Coastal Environments. Marine Pollution Bulletin 40: 1100-1114</p>				

Around fish farm pens there is typically an area in which waste from the pens falls onto the seabed, and this is the mixing zone (Figure 2). The SEPA regulatory framework limits the maximum area of the mixing zone, allowing for the differing shapes of deposited material resulting from tides and seabed topography at each site.

⁷ [Environmental standards | Scottish Environment Protection Agency \(SEPA\)](#)

⁸ [position-statement-embz-july-2022.pdf \(sepa.org.uk\)](#)

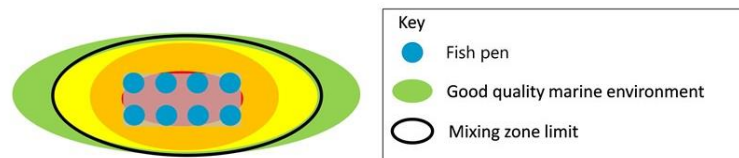


Figure 2. Mixing zone around a fish farm⁹

For all proposed fish farm developments, SEPA ensure that mixing zones are not permitted that would extend into locations where they would be likely to compromise the conservation status of marine protected areas or priority marine features; or other people's use of the sea. They developed a statistical model which uses the Infaunal Quality Index (IQI; set out in the 2014 Standards Directions¹⁰) to assess the size of the observed mixing zone area¹¹. An IQI of 0.64 represents the good-moderate quality boundary¹². The observed mixing zone is defined as the area of seabed degraded to an IQI of less than 0.64. The value of the IQI was developed by the UK Technical Advisory Group (UKTAG) to assess the ecological status of the microbenthic invertebrate assemblages of sediment habitats in UK coastal and transitional water bodies for the Water Framework Directive (WFD), and the methods for its development are outlined in the evidence paper for Infaunal Quality Index¹³.

SEPA regulate discharges of sea lice medicine residues from bath treatments into the sea. Under the regulatory framework, fish farm operators have to ensure that, within specified periods of time after a medicine's discharge from a bath into the sea, it has been sufficiently diluted to achieve the environmental standards defined for each of those periods of exposure to the medicine (Table 3).

As it is impractical to monitor and collect data on the medicine discharge plumes themselves, modelling is used to assess whether the environmental standards will be met following bath treatments, and the quantity of medicine that farms are allowed to use is regulated. Modelling also shows where the plume from the discharge is likely to travel as it disperses and assimilates into the surrounding sea.

Discharges of treatment solutions from well-boats are also regulated by SEPA, transferred from Marine Scotland to SEPA in November 2020¹⁴.

SEPA collect observational data to check for cumulative impacts of medicine discharge, for example a sea loch wide survey programme where they have fixed stations and monitor the quantity of chemical at those locations.

Within the regulatory framework SEPA now require operators to carry out enhanced data monitoring, with a performance scheme for sample collection, storage and analysis set out. Monitoring requirements are outlined in individual site permits and associated

⁹ [Environmental standards | Scottish Environment Protection Agency \(SEPA\)](#)

¹⁰ [Coastal and Transitional Waters - Benthic Invertebrate Fauna \(IQI\) | wfd uktag](#)

¹¹ [seabed-mixing-zone-limit compliance-assessment-method.pdf \(sepa.org.uk\)](#)

¹² [Assessing Scotland's water environment: use of environmental standards, condition limits and classification schemes - gov.scot \(www.gov.scot\)](#)

¹³ [Heading 1 \(publishing.service.gov.uk\)](#)

¹⁴ [Discharges from wellboats | Scottish Environment Protection Agency \(SEPA\)](#)

environmental monitoring plans, as well as published performance standards¹⁵. All existing sites are being transitioned onto the new framework during 2022 and 2023. While that transition is underway, SEPA are using a Temporary Regulatory Position on sampling¹⁶ to ensure consistency across all sites.

Table 3. Environmental standards for topical medicines¹⁷⁷.

Medicine	Maximum allowable concentration (ng per litre)						Annual average (ng per litre)
	3 hours after discharge	6 hours after discharge	12 hours after discharge	24 hours after discharge	48 hours after discharge	72 hours after discharge	
Azamethiphos	250	n/a	n/a	150	n/a	40	
Deltamethrin	9	6	4	2	1	n/a	
Cypermethrin	0.06						0.008

The UKTAG is a group of experts from environment and conservation agencies, formed to provide technical advice to the UK government and devolved administrations on the technical and science aspects of the Water Framework Directive¹⁸. This group have been responsible for developing the environmental standards, such as the IQI, creating a standard in line with equivalent standards in Europe. The UKTAG are also responsible for reviewing new evidence and, if appropriate, revising standards such as the recent revision of the emamectin benzoate standard¹⁹. SEPA are currently in the process of commissioning a study to review the evidence around deltamethrin to see if the evidence has changed since standards were set.

All farms require an authorisation from SEPA to discharge the anti-parasitic, hydrogen peroxide. The current permit also requires that operators report the quantities of each anti-parasitic used each month. SEPA are reviewing their current controls on hydrogen peroxide to take account of the latest science on environmental risk to ensure the controls are appropriate for protecting the environment.

Open Data

Scotland's Aquaculture Website²⁰ gives a single point of access to aquaculture information held by the main regulators of the Scottish aquaculture industry. It is primarily a source of data provided by Marine Scotland, SEPA, Food Standards Scotland and The Crown Estate. This website provides data on such aspects as sea lice numbers, fish escapes, biotoxin monitoring and sealine in-feed treatment residues. Currently, the information on quantities of hydrogen peroxide used is not available on Scotland's Aquaculture Website (although is

¹⁵ [Operator Monitoring | Scottish Environment Protection Agency \(SEPA\)](#)

¹⁶ [trps-sampling-final.pdf \(sepa.org.uk\)](#)

¹⁷ [Environmental standards | Scottish Environment Protection Agency \(SEPA\)](#)

¹⁸ [Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy \(legislation.gov.uk\)](#)

¹⁹ [position-statement-embz-july-2022.pdf \(sepa.org.uk\)](#)

²⁰ [Scotland's Aquaculture | Home](#)

available on request from SEPA). SEPA are in the process of making the changes necessary to enable them to upload the data onto the Website going forward.

Modelling overview

Modelling, as required in support of applications for licenses under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR), is intended to provide SEPA with:

1. Evidence that compliance with environmental standards is likely
2. An assessment of any additional, case-specific perceived risks
3. Estimates of sustainable biomass levels
4. Estimate of appropriate licence limits for anti-parasitic medicines
5. Information with which to base effective environmental monitoring

Note that the final permitting decision made by SEPA may not simply reflect the results obtained via modelling²¹, as results obtained are evaluated with regards to the capabilities and limitations of the modelling, as well as other available information, such as the performance of an existing farm at the location.

NewDEPOMOD

Particle tracking model developed by the Scottish Association for Marine Science (SAMS), but used operationally by SEPA to predict the impact of marine pen site discharges on the seabed to optimise operation of aquaculture sites to match environmental capacity²².

NewDepomod is the successor to AutoDepomod which was used for regulatory purposes in Scotland from 2006 and sites submit their modelling to SEPA.

BathAuto

Collection of simple models - simulate release and dispersion of bath medicines from farm pens. Consists of a short-term and long-term model, using Microsoft Excel.

Short-term model represents simple geometric calculation of the dilution of a medicine plume in the hours after a treatment. Calculation based on the plume as an elliptic cylinder which expands through time according to measured flow speeds at the site.

Long-term model simulates interaction and dilution of multiple medicine plumes over a period of several days to address the longer-term environmental standards. Plume movements based on tidal oscillation plus a net residual flow, and dilution according to conservative dispersion coefficient.

Sea lice Regulations – Sea Lice Risk Assessment Framework

Sea lice are native parasites that infect both farmed and wild salmon, and salmon farms have been shown to be an important contributor to the numbers of sea lice in the Scottish

²¹ [regulatory-modelling-guidance-for-the-aquaculture-sector.pdf \(sepa.org.uk\)](https://sepa.org.uk/regulatory-modelling-guidance-for-the-aquaculture-sector.pdf)

²² [1015768_method_statement.pdf \(sepa.org.uk\)](https://sepa.org.uk/1015768_method_statement.pdf)

coastal zone (Penston and Davies, 2009)²³. Therefore, all countries with aquaculture have requirements for sea lice regulations. Table 4 outlines the current sea lice management strategies in the UK, Norway and British Columbia, Canada.

SEPA is developing a new framework to reduce the risk to wild salmon and sea trout from sea lice from fish farms²⁴. The framework is designed to protect wild Atlantic salmon and sea trout during their migration to sea by defining wild salmon protection zones. Wild salmon protection zones are constrained areas that wild salmon and sea trout smolts pass through as they migrate away from the coast. SEPA will set a sea lice exposure threshold which will apply during smolt migration from rivers, designed to reduce the risk of exposure of wild salmon and sea trout to sea lice during their migration to sea.

All proposals for new marine finfish farms or increases in fish numbers at existing finfish farms will be subject to an assessment of the risk posed to wild salmonids. SEPA will protect wild salmonids when identifying a risk by setting permit conditions to limit sea lice losses from the farm. SEPA will also take action to reduce the loss of sea lice from existing farms where it is identified that losses contribute to the harm caused to salmon and sea trout.

Responses to the initial consultation SEPA ran (December 2021 – March 2022) were received from a range of organisations and individuals, and feedback resulted in some changes including protecting sea trout as well as Atlantic salmon, extending the time period over which protection is provided, alterations to wild salmon protection zones and a commitment from SEPA to carry out assessment of the social and economic implications of the framework.

SEPA is engaging with relevant stakeholders to ensure that the controls are proportionate to the risk, and a further consultation will run in early 2023. SEPA's intention is to implement the controls as a phased approach from late 2023, which will initially cover the release of sea lice from new and expanded farms to prevent additional impacts upon the 2024 smolt run.

²³ Penston, M.J. & Davies, I.M. (2009) An assessment of salmon farms and wild salmonids as sources of *Lepeophtheirus salmonis* (Krøyer) copepodids in the water column in Loch Torridon, Scotland. *Journal of Fish Diseases* 32, 75-88.

²⁴ [New framework will help create world-leading approach to protecting Scotland's most iconic fish | Media | Scottish Environment Protection Agency \(SEPA\)](#)

Table 4. Sea Lice Management – International Comparison

Country	Counting sea lice	Who manages this?	Consequences of crossing sea lice threshold
Scotland ²⁵	<p>Aquaculture companies are required to report weekly average adult female sea lice numbers per fish on farm sites to Scottish Ministers, via Marine Scotland.</p> <p>The average number of adult female <i>Lepeophtheirus salmonis</i> counted should be calculated by applying the following formula: A/B A = the total number of adult female (gravid and non-gravid) <i>Lepeophtheirus salmonis</i> counted on sampled fish in a site in the reporting week, and B = the number of fish sampled in that site in that reporting week.</p>	<p>Where sea lice counts reach / exceed an average of 2 adult female sea lice per fish, Marine Scotland will increase monitoring of that site and will continue to do so until either the weekly lice count per fish is reduced to below 2, or an intervention limit of an average of 6 adult female sea lice per fish (or above) on any fish farming site is reached.</p>	<p>Reaching the intervention limit requires the Aquaculture Production Business to take action which will reduce the weekly average number of adult female sea lice per fish at the site below the increased monitoring level of 2. If satisfactory measures cannot be demonstrated then enforcement action will be taken.</p>
Norway ²⁶	<p>According to the Salmon Lice Directive²⁷ lice are to be counted at least every 7th day when sea temperatures => 4°C, and at least every 14th day when temperatures <4°C. When a facility has more than 3 pens, the lice from a selection of fish from at least half of the pens should be counted each time, so that all pens are included in 2 consecutive counts. If the facility has 3 pens or fewer, lice on a selection from all pens should be counted each time.</p> <p>From 1 June to 31 January, counts should be conducted on 10 randomly selected fish, and from 1 February to 31 May on 20 fish.</p> <p>Lice should be counted and categorised in 3 stages: female adult, pre-adult and chalimus. The average number is based on the number in each stage from all fish examined, divided by the total number of fish examined.</p>	<p>Reports are made to the Food Safety Authority every month: the number of adult female salmon lice, the number of male and adolescent salmon lice, the number of treatments carried out, the sea temperature and the use of ‘cleaner fish’ as biological controls.</p>	<p>At any time there should be fewer than 0.5 grown females on average per fish in an aquaculture facility.</p> <p>If lice numbers are above the thresholds for a longer period of time, and farmers are unable to lower the numbers, the Food Safety Authority (responsible for welfare of the farmed fish) is allowed to reduce the allowed biomass at the site.</p>

²⁵ [Fish Health Inspectorate: sea lice information - gov.scot \(www.gov.scot\)](http://www.gov.scot)

²⁶ [Fisheries and Aquaculture - National Aquaculture Legislation Overview - Norway \(fao.org\)](http://www.fao.org)

²⁷ [Decree No. 70 of 2000 relative to fighting of Lepeophtheirus salmonis. | FAOLEX](#)

<p>British Columbia, Canada²⁸</p>	<p>To protect vulnerable juvenile wild salmon, sea lice monitoring and mitigation at aquaculture facilities is increased from March to June when wild salmon smolts are out-migrating from freshwater systems.</p>	<p>Fisheries and Oceans Canada (DFO) manages sea lice numbers through mandatory monitoring, mitigation, treatment, and reporting; as well as audits to ensure compliance.</p>	<p>Licence holders must report to DFO within 48 hours if average number of motile <i>Lepeophtheirus salmonis</i> (a species of sea lice found primarily on salmon) exceeds 3 sea lice / fish.</p> <p>Mitigation actions must be taken to reduce lice levels, and pre- and post-treatment counts to assess treatment efficacy. These actions can include in-feed medication, medicinal or non-medicinal bath treatments, mechanical removal, or harvest.</p>
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²⁸ [Regulating and monitoring British Columbia's marine finfish aquaculture facilities - 2020 \(dfo-mpo.gc.ca\)](https://dfo-mpo.gc.ca)