ASC Salmon Standard

Version 1.3

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Version control

Document version history:

Version:	Release date:	Effective date:	Remarks/changes:
V1.3	July 11th, 2019	December 26, 2019	Based on the PTI & Smolt review/revision cycle, the following indicators have been updated/modified: • Criteria 5.2 ('PTI review'): Rationale amended; 5.2.5 & 5.2.6 (reference to PTI removed, WNMT & parasiticide requirements added); 5.2.7 (new indicator, WNMT-related), 5.2.8 (new indicator: Integrated Pest Management /IPM), 5.2.9 (new indicator: IMP measures transparency), 5.2.10 (new indicator: monitoring of parasiticide residue levels outside AZE), 5.2.11 (indicator # changed: was 5.2.7 in v1.2); 5.2.12 (indicator # changed: 5.2.8 in v1.2); 5.2.13 (indicator # changed: 5.2.9 in v1.2); 5.2.14 (indicator # changed: 5.2.10 in v1.2); 5.2.15 (indicator # changed: 5.2.11 in v1.2). • Section 8 ('Smolt review'): "Additional requirements for open (net-pen) production of smolt': 8.24 (indicators deleted), 8.25 (requirement changed), former (in v1.2) indicators [8.26-8.31] deleted and replaced by 8.25. New Rationale for 8.25. Indicators 8.26, 8.27, 8.28 & 8.29 correspond to 'old' (i.e. in v1.2) indicators 8.32, 8.33, 8.34 & 8.35 (requirements unchanged). • Appendix VI (content changed for items #30, 31, 32). • Appendix VII (content changed: 'Parasiticide Treatment Methodology', instead of PTI). • Other updates include layout & UK English-consistent spell-check.
v1.2	March 7th, 2019	March 15th, 2019	Update of the standard to meet ASC style requirements (e.g. inclusion of structure of the standards, formatting and wording). Align the scope, 'about the ASC' and 'overview of the ASC system'. The content of the actual Standard, as defined by criteria/indicators/requirements under Principles [1-7], remains unchanged.

v1.1	April 26th, 2017	October 31st, 2017	Based on the first review/revision cycle: • following has been updated (in v1.1): 2.2.4 (requirement changed); 3.1.5 (updated footnote 43); 3.2.2 (updated footnote 50; requirement change); 4.2.1 (requirement changed); 4.2.2 (requirement changed); 4.3.1 (requirement changed); 4.3.2 (requirement updated); 4.3.4 (indicator expanded); 4.4.2 (requirement updated); 4.6.3 (requirement updated); 5.1.1 (indicator expanded); 5.2.6 (requirement updated); 5.4.4 (updated footnote 119); 6.11.1 (indicator expanded); 8.4 (requirement updated). • following is added (in v1.1): 2.2.6, 4.3.5, footnote 162. • following is removed (from v1.0): 2.5.2.
v1.0	June, 2012	July, 2012	Original version developed and approved by the Salmon Aquaculture Dialogue Steering Committee under the original title "Salmon Aquaculture Dialogue" and handed over to the Aquaculture Stewardship Council.

It is the responsibility of the user of the document to use the latest version as published on the ASC-website.

Available language(s)

The Salmon Standard document is available in the following language(s):

Versions:	Available languages
v1.3 v1.2 v1.1 v1.0	English (official language)
v1.0	Japanese

In case of any inconsistencies and/or discrepancies between available translation(s) and the English version, the online English version (pdf-format) will prevail.

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ABOUT THE AQUACULTURE STEWARDSHIP COUNCIL (ASC)

The Aquaculture Stewardship Council (ASC) is an independent, not-for-profit organisation that operates a voluntary, independent third-party certification and labelling programme based on a scientifically robust set of standards.

The ASC standards define criteria designed to help transform the aquaculture[1] sector[2] towards environmental sustainability and social responsibility, as per the ASC Mission.

ASC Vision

A world where aquaculture plays a major role in supplying food and social benefits for mankind whilst minimising negative impacts on the environment.

ASC Mission

To transform aquaculture towards environmental sustainability and social responsibility using efficient market mechanisms that create value across the chain.

ASC Theory of Change

A Theory of Change (ToC) is an articulation, description and mapping out of the building blocks required to achieve the organisation's vision**.**

ASC has defined a ToC which explains how the ASC certification and labelling programme promotes and rewards responsible fish farming practices through incentivising the choices people make when buying seafood.

ASC's Theory of Change can be found on the ASC website.

[1] **Aquaculture**: Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated (FAO).

[2] **Aquaculture sector**: Represents a group of industries (e.g. feed, farming, processing, etc.) and their markets that share common attributes (i.e. aquaculture products).

THE ASC DOCUMENT AND CERTIFICATION SYSTEM

ASC is a full member of the ISEAL Alliance and implements a voluntary, independent third-party certification system[3] consisting of three independent actors:

I.	Scheme Owner	i.e. Aquaculture Stewardship Council
II.	Accreditation Body	i.e. Assurance Services International (ASI)
III.	Conformity Assessment Body (CAB)	i.e. Accredited CAB's

Scheme Owner

ASC, as scheme owner:

- sets and maintains standards according to the ASC Standard Setting Protocol which is in compliance with the "ISEAL Code of Good Practice - Setting Social and Environmental Standards". The ASC standards are normative documents;

- sets and maintains Implementation Guidance which provides guidance to the Unit of certification (UoC) on how to interpret and best implement the indicators within the Standard;

- sets and maintains the Auditor Guidance which gives guidance to the auditor how to best assess a UoC against the indicators within the Standard;

- sets and maintains the Certification and Accreditation Requirements (CAR) which adheres at a minimum to the "ISEAL Code of Good Practice - Assuring compliance with Social and Environmental Standards". The CAR describes the accreditation requirements, assessment requirements and certification requirements. The CAR is a normative document.

These above listed documents are publicly available on the ASC-website.

Accreditation Body

Accreditation is the assurance process of assessing the Conformity Assessment Body (CAB) against accreditation requirements and is carried out by an Accreditation Body (AB). The appointed AB of ASC is Assurance Services International (ASI, "Accreditation Services International" prior to January 2019) which uses the CAR as normative document for the accreditation process.

Assessment findings of ASI-accreditation audits and an overview of current accredited CABs is publicly available via the ASI-website (http://www.accreditation-services.com).

[3] **Third-party Certification System**: Conformity assessment activity that is performed by a person or body that is independent of the person or organisation that provides the object, and of the user interests in that object (ISO 17000).

Conformity Assessment Body

The UoC contracts the CAB which employs auditor(s) that conduct a conformity assessment (hereafter 'audit') of the UoC against the relevant standard. The management requirements for CABs as well as auditor competency requirements are described in the CAR and assured through ASI accreditation.

ASC Audit and Certification Process

The UoC is audited at Indicator-level.

An ASC audit follows strict process requirements. These requirements are detailed in the CAR. Only ASI-accredited CABs are allowed to audit and certify a UoC against ASC standards. As scheme owner, ASC itself is not - and cannot be - involved in the actual audit and/or certification decision of a UoC. Granted certificates are the property of the CAB. ASC does not manage certificate validity.

Audit findings of all ASC audits, including granted certificates, are made publicly available on the ASC-website. These include the audit findings that result in a negative certification decision.

Note: in addition to the Standard's, there are certification requirements that apply to UoCs seeking certification; these requirements are detailed in the CAR.

ASC Logo use

ASC-certified entities shall only sell their product carrying the ASC Logo if a Logo Licence Agreement (LLA) has been signed. On behalf of the ASC, the Marine Stewardship Council (MSC) Licensing Team will issue logo license agreements and approve logo use on products. For more information see: ASC Logo.

Unauthorised logo display is prohibited and will be treated as a trademark infringement.

STRUCTURE OF ASC STANDARDS

A Standard is "*a document that provides, for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods, with which compliance is not mandatory*".

ASC Standards are as follows designed:

- ASC Standards consist of multiple Principles – a Principle is a set of thematically related Criteria which contribute to the broader outcome defined in the Principle title;

- Each Principle consists of multiple Criteria – each Criterion defines an outcome that contributes to achieving the outcome of the Principle;

- Each Criterion consists of one or several Indicators – each Indicator defines an auditable state that contributes to achieving the Criterion outcome.

Both Principles and Criteria include Rationale statements providing a set of reasons (backed by reference notes if needed) as to why the Principle or Criterion is needed.

SCOPE AND UNIT OF CERTIFICATION

Linked to the ASC Vision, the Scope of the ASC Salmon Standard (hereafter "the Standard") addresses the key negative environmental and social impacts associated with the salmon aquaculture industry. An ASC-certified salmon farm contributes to the ASC Vision by reducing, mitigating or eliminating these negative impacts.

The Scope of the Standard is translated into seven Principles that apply to every UoC:

- Principle 1 – Comply with all applicable national laws and local regulations
- Principle 2 – Conserve natural habitat, local biodiversity and ecosystem function
- Principle 3 – Protect the health and genetic integrity of wild populations
- Principle 4 – Use resources in an environmentally efficient and responsible manner
- Principle 5 – Manage disease and parasites in an environmentally responsible manner
- Principle 6 – Develop and operate farms in a socially responsible manner
- Principle 7 – Be a good neighbour and conscientious citizen
- Section 8 – Requirements for suppliers of smolt

The Criteria within the Principles apply to every UoC.

Unit of Certification (UoC)

The applicable UoC is determined by the CAB/ auditor and adheres to the Standard's Criteria UoC-requirements as outlined in the CAR.

Biological and geographic scope to which the Standard applies

The ASC Salmon Standard v1.3 is applicable to salmonid (i.e. salmon and trout) species belonging to the genus *Salmo* and *Oncorhynchus,* farmed in all marine locations [with the current exclusion/exception of smolt produced or held in net pens and/or [in future/soon] Smolt having to be certified under the FW Trout Standard] and types of aquaculture production systems.

How to read this document?

In the following pages, tables with indicators and their corresponding requirements are included. Within each criterion, requirements tables are followed by a rationale section that provides a brief overview of why the issues are important and how the proposed requirements address them.

Definitions are provided in footnotes.

The ASC Salmon Standard will be supplemented by an auditor guidance document detailing the methodologies used to determine if the ASC Salmon Standard is being met, as well as guidance for producers to achieve compliance to the ASC Salmon Standard.

Metric Performance Levels

Several Indicators in the Standard require a Metric Performance Level (MPL). The applicable MPL is directly listed after the Indicator ("Requirement" section).

PRINCIPLE 1: COMPLY WITH ALL APPLICABLE NATIONAL LAWS AND LOCAL REGULATIONS

Principle 1 is intended to ensure that all farms aiming to be certified against the ASC Salmon Standard standards meet their legal obligations as a baseline requirement. Adhering to the law will ensure that producers meet the basic environmental and social requirements and the minimal structures, such as legitimate land tenure rights, on which the effectiveness of the requirements will stand.

Criterion 1.1 Compliance with all applicable local and national legal requirements and regulations

INDICATOR	REQUIREMENT
1.1.1 Presence of documents demonstrating compliance with local and national regulations and requirements on land and water use	Yes
1.1.2 Presence of documents demonstrating compliance with all tax laws	Yes
1.1.3 Presence of documents demonstrating compliance with all relevant national and local labour laws and regulations	Yes
1.1.4 Presence of documents demonstrating compliance with regulations and permits concerning water quality impacts	Yes

Rationale - Salmon aquaculture operations must, as a baseline, adhere to the national and local laws of the regions where production is taking place. Farm operations that, intentionally or unintentionally, break the law violate a fundamental benchmark of performance for certified farms. It is important that aquaculture operations demonstrate a pattern of legal and responsible behaviour, including the implementation of corrective actions for any legal violations.

PRINCIPLE 2: CONSERVE NATURAL HABITAT, LOCAL BIODIVERSITY AND ECOSYSTEM FUNCTION

Principle 2 is intended to address potential impacts from salmon farms on natural habitat, local biodiversity and ecosystem function. Specifically, the key impact areas of benthic impacts, siting, effects of chemical inputs and effects of nutrient loading are addressed within this principle.

Criterion 2.1 Benthic biodiversity and benthic effects[4]

INDICATOR	REQUIREMENT
2.1.1 Redox potential or[5] sulphide levels in sediment outside of the Allowable Zone of Effect (AZE),[6] following the sampling methodology outlined in Appendix I-1	Redox potential > 0 mV, or, Sulphide ≤ 1,500 µMol /L
2.1.2 Faunal index score indicating good[7] to high ecological quality in sediment outside the AZE, following the sampling methodology outlined in Appendix I-1	AZTI Marine Biotic Index (AMBI[8]) score ≤ 3.3, or, Shannon-Wiener Index score > 3, or, Benthic Quality Index (BQI) score ≥ 15, or, Infaunal Trophic Index (ITI) score ≥ 25
2.1.3 Number of macrofaunal taxa in the sediment within the AZE, following the sampling methodology outlined in Appendix I-1	≥ 2 highly abundant[9] taxa that are not pollution indicator species
2.1.4 Definition of a site-specific AZE based on a robust and credible[10] modelling system[11]	Yes

[4] Closed production systems that can demonstrate that they collect and responsibly dispose of > 75% of solid nutrients from the production system are exempt from standards under Criterion 2.1. See Appendix VI for requirements on transparency for 2.1.1, 2.1.2 and 2.1.3.

[5] Farm sites can choose whether to use redox or sulphide. Farms do not have to demonstrate that they meet both.

[6] **Allowable Zone of Effect** (AZE) is defined under this standard as 30 metres. For farm sites where a site-specific AZE has been defined using a robust and credible modelling system such as the SEPA AUTODEPOMOD and verified through monitoring, the site-specific AZE shall be used.

[7] "***Good***" Ecological Quality Classification: The level of diversity and abundance of invertebrate taxa is slightly outside the range associated with the type-specific conditions. Most of the sensitive taxa of the type-specific communities are present.

[8] http://ambi.azti.es/ambi/.

[9] **Highly abundant**: Greater than 100 organisms per square metre (or equally high to reference site(s) if natural abundance is lower than this level).

Rationale - This suite of indicators provides multiple layers of security related to benthic impacts, using a chemical proxy for health combined with biodiversity measurements both below and a distance from the cages. Technical experts suggest the chemical proxy of redox potential and sulphide levels, which are good chemical indicators for benthic health. Given that both methods are valid, audited farms can choose their preference for one or the other. Requirements have been set for both. Through the consultation of technical experts and review of Hargrave et al.[12] (2008), a level of µMol /L sulphide levels and equivalent redox potential of > 0 mV was set to ensure acceptable and transitory benthic conditions. As a precautionary approach, these requirements are applicable regardless of the depth of the site.

When considering benthic effects, experts recommended measuring effects below the cages and away from the cages, within and outside the AZE. Though an AZE is difficult to identify as a constant, experts discuss this in terms of 25 metres to 125 metres depending on a range of factors, including currents. In an effort to take a precautionary approach to permissible zone of benthic impact, the ASC Salmon Standard defines the AZE as a distance of 30 metres from cages. For sites where a site-specific AZE has been determined using a valid modelling and video surveillance system, farms will use the site-specific AZE and sampling stations based on actual depositional patterns. Within three years of the publication of the ASC Salmon Standard, all certified farms must have undertaken the appropriate analysis to determine the site-specific AZE and depositional patterns. This will help ensure that sampling is taking place in areas most appropriate to protect benthic health around farms.

Potential negative impacts on benthic biodiversity are addressed in the ASC Salmon Standard through the incorporation of an analysis using a benthic faunal index and minimum score at multiple monitoring stations outside the AZE, including a reference site (see Appendix I-1). Farms can use their choice of these four faunal indices to further establish the environmental quality of the soft-bottom benthos. The indices are calculated using the same dataset. Equivalencies for these indices were set using Hargraves et al. (2008) and Zettler et al. (2007)[13] and through consultation with experts. The scores were set to relate to an environmental quality status of good or better according to the definitions of the EU Water Framework Directive.[14] Within the AZE, a demonstration that two or

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[10] **Robust and credible**: The SEPA AUTODEPOMOD modelling system is considered to be an example of a credible and robust system. The model must include a multi-parameter approach. Monitoring must be used to ground-truth the AZE proposed through the model.

[11] The CAB shall confirm that the AZE is correct and then to default to the social principles (P6 and P7) to ensure the farm is responding to stakeholder comments with the intention that the AZE is not arbitrary and meets stakeholder expectations.

[12] Hargrave, B.T., Holmer, M. and Newcombe, C.P. 2008. Towards a classification of organic enrichment in marine sediments based on biogeochemical indicators. Marine Pollution Bulletin 56, 810–824. https://www.researchgate.net/publication/5509807_Towards_a_classification_of_organic_enrichment_in_marine_sediments_based_on_biogeochemical_indicators

[13] Zettler, M.L., Schiedek, D. and Bobertz, B. 2007. Benthic biodiversity indices versus salinity gradient in the southern Baltic Sea. Marine Pollution Bulletin 55, 258–270. https://www.io-warnemuende.de/tl_files/bio/ag-benthische-organismen/pdf/zettler_et_al-2007-mpb.pdf

[14] Additional references for index equivalencies:

- Borja, A., Franco, J. and Perez, V. 2000. A marine biotic index to establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments. Mar. Poll. Bull. 40, 1100–1114. http://www.ecasa.org.uk/Documents/AMBI-MarineBioticIndex.pdf
- Muxika, I., Borja, A. and Bonne, W. 2005. The suitability of the marine biotic index (AMBI) to new impact sources along European coasts. Ecological Indicators 5, 19–31. http://agris.fao.org/agris-search/search.do?recordID=AV20120155174

more benthic macrofaunal species, such as sessile macrophytes and worms, are present in high abundance is required to ensure that impacts fall within an acceptable level.

Criterion 2.2 Water quality in and near the site of operation [15]

INDICATOR	REQUIREMENT
2.2.1 Weekly average percent saturation[16] of dissolved oxygen (DO)[17] on farm, calculated following methodology in Appendix I-4	≥ 70%[18]
2.2.2 Maximum percentage of weekly samples from 2.2.1 that fall under 2 mg/L DO	5%
2.2.3 For jurisdictions that have national or regional coastal water quality targets[19], demonstration through third-party analysis that the farm is in an area recently[20] classified as having "good" or "very good" water quality[21]	Yes[22]

- Muniz, P. et al. 2005. Testing the applicability of a Marine Biotic Index (AMBI) to assessing the ecological quality of soft-bottom benthic communities in the South America Atlantic region. Marine Pollution Bulletin 50, 624–637. http://www.basqueresearch.com/uploads/fitxategiak/2769_1AMBI.pdf

[15] See Appendix VI for transparency requirements for 2.2.1, 2.2.2, 2.2.3 and 2.2.5.

[16] **Percent saturation**: Percent saturation is the amount of oxygen dissolved in the water sample compared to the maximum amount that could be present at the same temperature and salinity.

[17] Averaged weekly from two daily measurements (proposed at 6 am and 3 pm).

[18] An exception to this standard shall be made for farms that can demonstrate consistency with a reference site in the same water body.

[19] Related to nutrients (e.g. N, P, chlorophyll A).

[20] Within the two years prior to the audit.

[21] Classifications of "***good***" and "***very good***" are used in the EU Water Framework Directive. Equivalent classification from other water quality monitoring systems in other jurisdictions are acceptable, it is acceptable to use a benchmark level of water quality from farm monitoring data as defined in Appendix I-5.

[22] Closed production systems that can demonstrate the collection and responsible disposal of > 75% of solid nutrients as well as > 50% of dissolved nutrients (through biofiltration, settling and/or other technologies) are exempt from standards 2.2.3 and 2.2.4.

2.2.4	For jurisdictions without national or regional coastal water quality targets, evidence of monitoring of nitrogen and phosphorous[23] levels on farm and at a reference site, following methodology in Appendix I-5	Consistency with reference site
2.2.5	Demonstration of calculation of biochemical oxygen demand (BOD[24]) of the farm on a production cycle basis	Yes
2.2.6	Appropriate controls are in place that maintains good culture and hygienic conditions on the farm which extends to all chemicals, including veterinary drugs, thereby ensuring that adverse impacts on environmental quality are minimised.	Yes

Rationale - Water quality is essential for the health of farmed salmon and wild species surrounding a farm. One component of water quality, dissolved oxygen (DO), is particularly critical for the survival and good performance of farmed salmon. As a result, most farms regularly measure DO. DO levels (in mg/l) naturally fluctuate in the environment. This is due to a range of factors, including temperature, time of day and upwelling of oxygen-poor waters from deep in the ocean. Low DO levels can also be a sign of excessive nutrient loading. DO provides a useful overall proxy for a water body's ability to support healthy biodiversity and supplements the benthic indicators that will also pick up excessive nutrient loading.

Salmon ideally need a level of dissolved oxygen over 5 mg/L to avoid any possible stress, although they are able to live under lower oxygen concentrations, particularly if only for short periods. Under routine production, the average minimum percent saturation of DO in the water column should be above 70 per cent. Measuring DO as a percent saturation takes into account salinity and temperature at the farm site. Additionally, compliance with the requirement will limit the number of low DO readings in the water column below 2 mg/L to less than 5 per cent incidence rate, which will allow for periodic physical phenomena, such as upwelling. The requirement also addresses natural fluctuations in DO levels and percent saturation through allowing comparison to a reference site as a means to meet requirement 2.2.1. This will ensure that if the percent saturation is lower than ideal, it is the result of natural conditions in the water body and not due to nutrient release from the salmon farm.

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[23] Farms shall monitor total N, NH_4, NO_3, total P and Ortho-P in the water column. Results shall be submitted to the ASC database. Methods such as a Hach kit are acceptable.

[24] **BOD** calculated as: ((total N in feed – total N in fish)*4.57) + ((total C in feed – total C in fish)*2.67). A farm may deduct N or C that is captured, filtered or absorbed through approaches such as IMTA or through direct collection of nutrient wasted. In this equation, "fish" refers to harvested fish. Reference for calculation methodology: Boyd C. 2009. Estimating mechanical aeration requirement in shrimp ponds from the oxygen demand of feed. In: Proceedings of the World Aquaculture Society Meeting; Sept 25-29, 2009; VeraCruz, Mexico. And: Global Aquaculture Performance Index BOD calculation methodology available at http://web.uvic.ca/~gapi/explore-gapi/bod.html.

The requirements also require that farms demonstrate they are located in areas of "good" or "very good" water quality, in jurisdictions such as the European Union that have coastal targets. Not all salmon-producing regions have such targets, however. In these situations, farms must collect data on nutrient levels near the farm and at a reference site and make that data available under Appendix VI. No threshold is placed on this requirement whilst the key factor, as with oxygen in Indicator 2.2.1, is that the requirement should address natural fluctuations in N and P levels through allowing comparison to a reference site as a means to meet requirement 2.2.3.

Lastly, the requirements require farms to calculate the BOD associated with their production cycle in order to better understand the input of nutrients from the farm to the water body. There is no performance threshold associated with this requirement, and the data from this requirement will provide data to better understand nutrient loads, ranges of performance, the degree to which different systems reduce BOD, and the relationship between calculated BOD and the other water quality indicators in the ASC Salmon Standard.

The SAD technical working group on nutrient loading identified the potential link between nutrients around salmon farms and harmful algal blooms as one that had yet to be established but around which there remained some uncertainty and for which there was an intuitive concern around the effect of the cumulative anthropogenic nutrient load into coastal waters. The group noted a shortage of field studies to validate hypotheses from lab-based work. The data collected under this criterion can be used to help better understand potential linkages around salmon farming, ambient nutrient levels and environmental phenomena such as harmful algal blooms. Farm operators may also find this data useful in management decisions, and it can be useful in ensuring that nutrient inputs from salmon farms and other sources fall within the carrying capacity of the water body. Data collected with regard to BOD and nutrient levels shall be reviewed, and the setting of a threshold related to nutrient loads should be seriously considered when the ASC Salmon Standard is updated. The ASC intend to develop a metric for indicator 2.2.6 good culture and hygienic conditions. Until which time the standard will include this best management practice type measure.

Criterion 2.3 Nutrient release from production

INDICATOR	REQUIREMENT
2.3.1 Percentage of fines[25] in the feed at point of entry to the farm[26] (calculated following methodology in Appendix I-2)	< 1% by weight of the feed

[25] **Fines**: Dust and fragments in the feed. Particles that separate from feed with a diameter of 5 mm or less when sieved through a 1 mm sieve, or particles that separate from feed with a diameter greater than 5 mm when sieved through a 2.36 mm sieve. To be measured at farm gate (e.g. from feed bags after they are delivered to farm).

[26] To be measured every quarter or every three months. Samples that are measured shall be chosen randomly. Feed may be sampled immediately prior to delivery to farm for sites with no feed storage where it is not possible to sample on farm. Closed production systems that can demonstrate the collection and responsible disposal of > 75% of solid nutrients and > 50% of dissolved nutrients (through biofiltration, settling and/or other technologies) are exempt.

Rationale - The release of nutrients into the environment from salmon farms was identified by SAD participants as a key impact of production. The impact is addressed throughout the requirements with a range of water quality and benthic performance metrics. Requirement 2.3.1 complements these other requirements by addressing the direct release of uneaten feed in the form of fines into the environment. By setting a maximum percentage of fines in the feed, it addresses the efficient and proper transport, storage and physical delivery of feed pellets to the farm site. Poor performance in any of the above phases of feed handling will result in a higher percentage of fines (fine particles of feed) and potentially increased environmental impacts, due to an increase in suspended organic particles and nutrients released into the environment.

Criterion 2.4 Interaction with critical or sensitive habitats and species

INDICATOR	REQUIREMENT
2.4.1 Evidence of an assessment of the farm's potential impacts on biodiversity and nearby ecosystems that contains at a minimum the components outlined in Appendix I-3	Yes
2.4.2 Allowance for the farm to be sited in a protected area[27] or High Conservation Value Areas[28] (HCVAs)	None[29]

[27] **Protected area**: "A clearly defined geographical space, recognised, dedicated and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." Source: Dudley, N. (Editor) (2008), Guidelines for Applying Protected Area Management Categories, Gland, Switzerland: IUCN. x + 86pp. http://cmsdata.iucn.org/downloads/guidelines_for_applying_protected_area_management_categories.pdf

[28] **High Conservation Value Areas** (HCVA): Natural habitats where conservation values are considered to be of outstanding significance or critical importance. HCVA are designated through a multi-stakeholder approach that provides a systematic basis for identifying critical conservation values—both social and environmental—and for planning ecosystem management in order to ensure that these high conservation values are maintained or enhanced (http://www.hcvnetwork.org/).

[29] The following exceptions shall be made for Standard 2.4.2:

- For protected areas classified by the International Union for the Conservation of Nature (IUCN) as Category V or VI (these are areas preserved primarily for their landscapes or for sustainable resource management).
- For HCVAs if the farm can demonstrate that its environmental impacts are compatible with the conservation objectives of the HCVA designation. The burden of proof would be placed on the farm to demonstrate that it is not negatively impacting the core reason an area has been identified as a HCVA.
- For farms located in a protected area if it was designated as such after the farm was already in operation and provided the farm can demonstrate that its environmental impacts are compatible with the conservation objectives of the protected area and it is in compliance with any relevant conditions or regulations placed on the farm as a result of the formation/designation of the protected area. The burden of proof would be placed on the farm to demonstrate that it is not negatively impacting the core reason an area has been protected.

Rationale - The intent of the requirements under criterion 2.4 is to minimise the effects of a salmon farm on critical or sensitive habitats and species. The habitats and species to consider include marine-protected areas or national parks, established migratory routes for marine mammals, threatened or endangered species, the habitat needed for endangered and threatened species to recover, eelgrass beds and HCVAs, where these have been defined. These requirements are consistent with the Global Reporting Index indicators EN12, EN14 and EN15, which relate to the identification and description of significant impacts of activities on biodiversity, protected habitats and threatened species, and the communication of strategies to manage these impacts and restore sensitive habitats (as defined by the assessment carried out for indicator 2.4.1).[30]

The requirements under Criteria 2.4 ensure that a farm is aware of any nearby critical, sensitive or protected areas, understands the impacts it might have on those areas, and has a functioning plan in place to address those potential impacts. They also ensure that extra care is taken in areas that are recognised for ecological importance either through designation as a protected area or through designation as being an area of high conservation value, by not allowing production in these areas to be eligible for certification, with some exceptions made if extra conditions are met to ensure that the farms are compatible with the conservation goals of the areas.

Criterion 2.5 Interaction with wildlife, including predators[31]

INDICATOR	REQUIREMENT
2.5.1 Number of days in the production cycle when acoustic deterrent devices (ADDs) or acoustic harassment devices (AHDs) were used	0
2.5.2 Number of mortalities[32] of endangered or red-listed[33] marine mammals or birds on the farm	0
2.5.3 Evidence that the following steps were taken prior to lethal action[34] against a predator: 1. All other avenues were pursued prior to using	Yes[35]

[30] Verification at the aquaculture facility shall include whether restoration is necessary, to what degree (evidence could include maps, aerial photos, satellite images, government certification etc.) and whether that the active restoration is suitable (i.e., will it be successful and restore a suitable area of sensitive habitat).

[31] See Appendix VI for transparency requirements for 2.5.2, 2.5.5 and 2.5.6.

[32] **Mortalities**: Includes animals intentionally killed through lethal action as well as accidental deaths through entanglement or other means.

[33] Species listed as endangered or critically endangered by the IUCN or on a national endangered species list.

[34] **Lethal action**: Action taken to deliberately kill an animal, including marine mammals and birds.

[35] Exception to these conditions may be made for a rare situation where human safety is endangered. Should this be required, post-incident approval from a senior manager should be made and relevant authorities must be informed.

	lethal action 2. Approval was given from a senior manager above the farm manager 3. Explicit permission was granted to take lethal action against the specific animal from the relevant regulatory authority	
2.5.4	Evidence that information about any lethal incidents on the farm has been made easily publicly available[36]	Yes
2.5.5	Maximum number of lethal incidents[37] on the farm over the prior two years	< 9 lethal incidents,[38] with no more than two of the incidents being marine mammals
2.5.6	In the event of a lethal incident, evidence that an assessment of the risk of lethal incident(s) has been undertaken and demonstration of concrete steps taken by the farm to reduce the risk of future incidences	Yes

Rationale - The suite of requirements related to mortalities and lethal incidents of predators or other wildlife is intended to ensure that certified farms have minimal impact on populations of wildlife, placing limits on both accidental and intentional mortalities of these species. The requirements ensure that endangered species have not died as a result of interaction with the farm and require transparency of farms on any lethal incidents and wildlife mortalities for non-threatened species. Good management practices with regards to when to take action and how to reduce risk of future incidents are also required.

A large variety of acoustic deterrent (and harassment) devices is used in salmon aquaculture. Based on available research[39] it appears that the effectiveness of these devices in reducing farmed salmon

[36] Posting results on a public website is an example of "easily publicly available." Shall be made available within 30 days of the incident and see Appendix VI for transparency requirements.

[37] **Lethal incident**: Includes all lethal actions as well as entanglements or other accidental mortalities of non-salmonids.

[38] Standard 2.5.6 applicable to incidents related to non-endangered and non-red-listed species. This standard complements, and does not contradict, 2.5.3.

[39] References for the section of the rationale related to ADDs/AHDs:

- Northridge, S.P., Gordon, J.G., Booth, C., Calderan, S., Cargill, A., Coram, A., Gillespie, D., Lonergan, M. and Webb, A. 2010. Assessment of the impacts and utility of acoustic deterrent devices. Final Report to the Scottish Aquaculture Research Forum, Project Code SARF044. 34pp. http://www.sarf.org.uk/cms-assets/documents/28820-18834.sarf044---final-report.pdf
- Morton, A. B., and Symonds, H. K. 2002. Displacement of *Orcinus orca* (L.) by high amplitude sound in British Columbia, Canada. ICES Journal of Marine Science, 59: 71–80. https://oup.silverchair-cdn.com/oup/backfile/Content_public/Journal/icesjms/59/1/10.1006_jmsc.2001.1136/3/59-1-71.pdf?Expires=1499859194&Signature=URpngb2fKVR8B2kFgMguget42wf4uSn3nDVMqD6C-nymcyQlow3frZfVe4l9aLUpkGsJ5H0M4y3h2S6WVJJKOBa0~gFl5fuVjJ2lQhobfCbLu3JkiexGslvDncRW498rq6-06oV8Qsk2Y-Up3QBNujCKBN-

predation by marine mammals can vary widely including by location, marine mammal species, period of use, etc. Available research suggests that noise and high-pitched sounds resulting from currently available acoustic devices can cause pain to dolphins, porpoises and whales. As intended, acoustic devices can cause marine mammals including seals, porpoises and whales to avoid areas that may be important for feeding, breeding and travel/migration. While the devices may be initially effective in deterring marine mammals in certain scenarios, research studies suggest that they lose their effectiveness over several years. Additionally, evidence suggests that alternative measures such as promptly removing dead fish, reducing stocking densities, net tensioning and use of seal blinds are important in reducing depredation on salmon farms.

Given the impacts associated with ADDs/AHDs and the availability of other, potentially less impactful and more effective deterrence practices, the requirements encourage farms not to use ADDs/AHDs, requires that they not be used on a continuous basis and that they are actively used less than 40 percent of the days in the production cycle. The requirement additionally requires that their use be phased out on certified farms within three years of the publication of the ASC Salmon Standard. Starting three years from the date of publication, no farm meeting the requirement shall use ADDs/AHDs. An exception to this requirement for new technologies may be granted by the Technical Advisory Group of the ASC if there is clear scientific evidence that future ADD/AHD technology presents significantly reduced risk to marine mammals and cetaceans.

07SWDpXdX3GvFsJTvxeEecDNojXRgLrYV7z6~iWsFHiVW4CiFO4arHhveN8tpu0yhYte~-byBwFih0BNCPpwQnRbIOCuwcIq6cVIsifQSDbMNSdkYUT72t3KJyocHMvMhvfPYBbAwvoZFYC3Bpvf~3pD4U0NjlkI9YnHQoY6zwShaORjbkq0CfRvc6w__&Key-Pair-Id=APKAIUCZBIA4LVPAVW3Q

- Scottish Association for Marine Science and Napier University (SAMS)2002. Review and synthesis of the environmental impacts of aquaculture. Scottish Executive Research Unit. www.scotland.gov.uk/cru/kd01/green/reia-00.asp.
- Milewski, I. 2001. Impacts of salmon aquaculture on the coastal environment: a review. https://www.iatp.org/sites/default/files/Impacts_of_Salmon_Aquaculture_on_the_Coastal_E.pdf
- Young, S. 2001. Potential adverse effects of aquaculture on marine mammals: in Tlusty, M.F., Bengston, D.A., Halvorson, H.O., Oktay, S.D., Pearce, J.B., Rheault, Jr., R.B. (eds.). Marine Aquaculture and the Environment: A Meeting for Stakeholders in the Northeast. Cape Cod Press, Falmouth, Massachusetts.

PRINCIPLE 3: PROTECT THE HEALTH AND GENETIC INTEGRITY OF WILD POPULATIONS

The primary aim of Principle 3, in combination with Principle 5, is to ensure that salmon farms do not harm the health of wild fish populations. This principle addresses impacts associated with disease and parasites, escapes and siting.

Criterion 3.1 Introduced or amplified parasites and pathogens[40, 41]

INDICATOR	REQUIREMENT
3.1.1 Participation in an Area-Based Management (ABM) scheme for managing disease and resistance to treatments that includes coordination of stocking, fallowing, therapeutic treatments and information sharing. Detailed requirements are in Appendix II-1.	Yes
3.1.2 A demonstrated commitment[42] to collaborate with NGOs, academics and governments on areas of mutually agreed research to measure possible impacts on wild stocks	Yes
3.1.3 Establishment and annual review of a maximum sea lice load for the entire ABM and for the individual farm as outlined in Appendix II-2	Yes

[40] Farm sites for which there is no release of water that may contain pathogens into the natural (freshwater or marine) environment are exempt from the standards under Criterion 3.1.

[41] See Appendix VI for transparency requirements for 3.1.1, 3.1.3, 3.1.4, 3.1.6 and 3.1.7.

[42] **Commitment**: At a minimum, a farm and/or its operating company must demonstrate this commitment through providing farm-level data to researchers, granting researchers access to sites, or other similar non-financial support for research activities.

3.1.4 Frequent[43] on-farm testing for sea lice, with test results made easily publicly available[44] within seven days of testing	Yes
3.1.5 In areas with wild salmonids,[45] evidence of data[46] and the farm's understanding of that data, around salmonid migration routes, migration timing and stock productivity in major waterways within 50 kilometres of the farm	Yes
3.1.6 In areas of wild salmonids, monitoring of sea lice levels on wild out-migrating salmon juveniles or on coastal sea trout or Arctic char, with results made publicly available. See requirements in Appendix III-1	Yes
3.1.7 In areas of wild salmonids, maximum on-farm lice levels during sensitive periods for wild fish.[47] See detailed requirements in Appendix II, subsection 2	0.1 mature female lice per farmed fish

Rationale - Salmon farms interact with wild fish populations that live or migrate near the open net pens. A particular concern is the interaction with wild salmon and sea trout with regard to pathogens and parasites. There is significant debate in the scientific literature about the extent of the interaction and impact. The Disease Report[48] commissioned by the SAD concluded that there is "shared benefit

[43] Testing must be weekly during and immediately prior to sensitive periods for wild salmonids, such as outmigration of wild juvenile salmon. Testing must be at least monthly during the rest of the year, unless water temperature is so cold that it would jeopardise farmed fish health to test for lice (below 4 degrees C). Within closed production systems, alternative methods for monitoring sea lice, such as video monitoring, may be used.

[44] Posting results on a public website is an example of "easily publicly available."

[45] For purposes of these standards, "**areas with wild salmonids**" are defined as areas within 75 kilometres of a wild salmonid migration route or habitat. This definition is expected to encompass all, or nearly all, of salmon-growing areas in the northern hemisphere.

[46] Farms do not need to conduct research on migration routes, timing and the health of wild stocks under this standard if general information is already available. Farms must demonstrate an understanding of this information at the general level for salmonid populations in their region, as such information is needed to make management decisions related to minimizing potential impact on those stocks. Such "evidence" would consist of, for example, peer review studies; publicly available government monitoring and reporting.

[47] Sensitive periods for migrating salmonids is during juvenile outmigration and approximately one month before.

[48] This report and other reports on State of Information of key impacts commissioned by the Salmon Aquaculture Dialogue are available at http://www.worldwildlife.org/pages/creating-standards-for-responsibly-farmed-salmon

to farm productivity and to minimising impacts on wild fish by continually seeking to reduce disease on salmon farms."

Sea lice have emerged as a pressing challenge for the salmon industry and its potential impacts on wild populations. The SAD's Sea Lice Technical Report concluded that the "weight of evidence is that sea lice of farm origin can present, in some locations and for some host species populations, a significant threat." The report called for a "concerted precautionary approach" in managing the issue.

Requirements under Criterion 3.1, in combination with requirements under Criterion 5.4, seek to address these concerns by establishing best practice in managing potential disease and parasite risks to wild populations. The requirements recognise that the cumulative impacts from a group of farms in an area can become harmful even when an individual farm is operating its own production in a responsible way. Farms located in areas of wild salmonids, defined as farms situated within 75 km of a migration route or sea trout habitat, have additional requirements because of the transmission of disease between farms and wild salmonids.

Area-based management (ABM) is a requirement. Some salmon-growing jurisdictions have begun to require ABM or are considering it because neighbouring farms can achieve significantly improved results when coordinating management of diseases and biosecurity measures. Conversely, a lack of coordination can lead to negative outcomes, such as resistance to treatments. Farms that don't have ABM schemes already established in their jurisdiction will need to show leadership in working with neighbouring farms to establish such a scheme, even if the regulatory structure doesn't require it.

The commitment to research required under 3.1.2 intends to ensure that farms are working with researchers and regulators to address the many gaps in understanding around a farm's interaction with wild populations. A demonstrated commitment means that the farm is participating in joint research efforts. Although funding of research is encouraged, transparency around site-level data and/or access to sites is seen as an extremely valuable contribution to scientific research and is, therefore, the requirement.

The requirements address the challenge of sea lice in several ways. Firstly, farms seeking certification must be able to demonstrate that the ABM scheme has set a maximum lice load for the entire area that reflects regulatory requirements. In areas of wild salmonids, the ABM must also show how this maximum load reflects the results of monitoring of wild populations (more below on monitoring).

The requirements also call for an enhanced level of transparency around sea lice monitoring data. Secondly, farms must conduct frequent testing of on-farm lice levels and make those results publicly available. This transparency reflects the goal of building credibility among the interested public around the actual experience of sea lice levels on the farm and in the wild.

Farms located in areas of wild salmonids must participate in monitoring of lice levels on wild out-migrating juvenile salmon or other important salmonids in the area, such as coastal sea trout or arctic char. The requirements assume this monitoring will be conducted in collaboration with researchers and/or regulatory bodies. Area-based management schemes must demonstrate how the scheme has incorporated the results of wild monitoring into maximum lice loads permitted across the area. These requirements require farms to show leadership in managing the interaction with wild populations. This leadership will mean that some farms seeking certification will need to take on roles and responsibilities that they previously didn't view to be inside the scope of responsibility for an individual farm. Enhanced leadership is an essential part of showing best practice in this high-priority issue of farm interaction with wild populations.

Under 3.1.7, the requirements also require farms located in areas of wild salmonids to demonstrate precautionary low lice levels near zero during sensitive periods for wild fish, such as during juvenile out-migration and immediately prior.

The monitoring and disease management presuppose that farmers are aware of salmon migration routes, the timing of out migration and basic information around stock status. This information, along with sea lice monitoring results, should be compiled by ASC in an effort to consolidate data and promote future research.

If national or local regulations prohibit the handling of wild salmonids then it should be clear that wild populations are being monitored and protected in another way. Cooperation from the farm is necessary so it must be able to provide the data, but the farm is not expected to catch the salmon themselves. The farm could, for example, provide existing evidence to the CAB on how control agents are impacting wild populations.

Criterion 3.2 Introduction of non-native species

INDICATOR	REQUIREMENT
3.2.1 If a non-native species is being produced, demonstration that the species was widely commercially produced in the area by the date of publication of the ASC Salmon Standard	Yes[49]
3.2.2 If a non-native species is being produced, evidence of scientific research[50] completed within the past five years that investigates the risk of establishment of the species within the farm's jurisdiction and these results submitted to ASC for review[51]	Yes [52]

[49] Exceptions shall be made for production systems that use 100 percent sterile fish or systems that demonstrate separation from the wild by effective physical barriers that are in place and well-maintained to ensure no escapes of reared specimens or biological material that might survive and subsequently reproduce.

[50] The research must at a minimum include multi-year monitoring for non-native farmed species, use credible methodologies and analysis, and undergo peer review.

[51] If the review demonstrates there is increased risk, the ASC will consider prohibiting the certification of farming of non-native salmon in that jurisdiction under this standard. In the event that the risk tools demonstrate "high" risks, the SAD expects that the ASC will prohibit the certification of farming of non-native salmon in that jurisdiction. The ASC intends to bring this evidence into future revision of the standard and those results taken forward into the revision process.

[52] Farms are exempt from this standard if they are in a jurisdiction where the non-native species became established prior to farming activities in the area and the following three conditions are met: eradication would be impossible or have detrimental environmental effects; the introduction took place prior to 1993 (when the Convention on Biological Diversity (CBD) was ratified); the species is fully self-sustaining.

3.2.3 Use of non-native species for sea lice control or on-farm management purposes	None

Rationale - Accidental or intentional introductions of non-native species are significant global environmental problems.[53] Aquaculture is considered one of the major pathways for introducing non-native aquatic plants and animals that may become harmful invasive species. The ASC believes these standards are in line with FAO guidelines that permit the culture of non-native species only when they pose an acceptable level of risk to biodiversity. This requirement does not permit introductions of non-native salmonids, unless farming of the species already occurs in the area, or a completely closed production system is used, or all cultured fish are sterile.

Research to date, reviewed by the SAD Technical Working Group on Escapes, has not shown that the production of farmed salmon has led to the establishment of viable populations in the wild of non-native species. Given this research and existing analyses of the risks associated with the farming of salmonids as either a native or non-native species, this requirement permits the certification of farming of non-native species in locations where production already exists.

Nonetheless, the requirement also requires that farms producing non-native salmon demonstrate new research every five years that investigates the risks of establishment in that jurisdiction. The requirement is intended to create an incentive for continuing research.

The use of alternatives to chemical treatments for farm management, such as the use of cleaner fish for sea lice control, is permitted and encouraged under the ASC Salmon Standard. However, any wrasse, cleaner fish or other species used for management during production must be native species in order to prevent introduction of new species to an area.

Criterion 3.3 Introduction of transgenic species

INDICATOR	REQUIREMENT
3.3 Use of transgenic[54] salmon by the farm	None

Rationale - Transgenic fish are not permitted under this requirement because of concerns about their unknown impact on wild populations. The culture of genetically enhanced[55] salmon is acceptable

[53] Leung, K.M.Y. and Dudgeon, D. 2008. Ecological risk assessment and management of exotic organisms associated with aquaculture activities. In M.G. Bondad-Reantaso, J.R. Arthur and R.P. Subasinghe (eds.) Understanding and applying risk analysis in aquaculture. FAO Fisheries and Aquaculture Technical Paper. No. 519. Rome, FAO. pp. 67–100. http://www.fao.org/3/a-i0490e/i0490e01e.pdf

[54] **Transgenic**: An organism, with the exception of human beings, in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination. Source EFSA.

[55] **Genetic enhancement:** The process of genetic improvement via selective breeding that can result in better growth performance and domestication but does not involve the insertion of any foreign genes into the genome of the animal.

under the ASC Salmon Standard. This allows for further progress in feed conversion, which should increase the efficient use of local resources. Also allowed under the Standard is the cultivation of triploid or all female fish, as long as those fish are not transgenic.

Criterion 3.4 Escapes[56]

INDICATOR	REQUIREMENT
3.4.1 Maximum number of escapees[57] in the most recent production cycle	300[58]
3.4.2 Accuracy[59] of the counting technology or counting method used for calculating stocking and harvest numbers	≥ 98%
3.4.3 Estimated unexplained loss[60] of farmed salmon is made publicly available	Yes
3.4.4 Evidence of escape prevention planning and related employee training, including: net strength testing; appropriate net mesh size; net traceability; system robustness; predator management; record keeping and reporting of risk events (e.g. holes, infrastructure issues, handling errors, reporting and follow up of escape events); and worker training on escape prevention and counting technologies	Yes

[56] See Appendix VI for transparency requirements for 3.4.1, 3.4.2 and 3.4.3.

[57] Farms shall report all escapes; the total aggregate number of escapees per production cycle must be less than 300 fish. Data on date of escape episode(s), number of fish escaped and cause of escape episode shall be reported as outlined in Appendix VI.

[58] A rare exception to this standard may be made for an escape event that is clearly documented as being outside the farm's control. Only one such exceptional episode is allowed in a 10-year period for the purposes of this standard. The 10-year period starts at the beginning of the production cycle for which the farm is applying for certification. The farmer must demonstrate that there was no reasonable way to predict the events that caused the episode. See auditing guidance for additional details.

[59] Accuracy shall be determined by the spec sheet for counting machines and through common estimates of error for any hand-counts.

[60] Calculated at the end of the production cycle as: Unexplained loss = Stocking count – harvest count – mortalities – other known escapes. Where possible, use of the pre-smolt vaccination count as the stocking count is preferred.

Rationale - Escaped farmed salmon have the potential to disrupt ecosystems and alter the overall pool of genetic diversity through competition with wild fish and interbreeding with local wild stocks of the same population. It has been shown that interbreeding of farmed with wild salmon of the same species can result in reduced lifetime success, lowered individual fitness and decreases in production over at least two generations.[61] The most effective way to address these risks is to reduce the number of escapes of farmed salmon to zero or near zero.

Escapes can occur in large events that are immediately noticeable at a farm, smaller events that are still noticeable, and through slower, lower levels of losses of fish that might go unnoticed. These requirements place a cap on the total amount of escapees. The cap effectively prevents a farm that has had a significant escape event from being certified, except under extremely unusual circumstances in which the farm can demonstrate there was no reasonable way to predict the cause.

The requirements require transparency about unexplained loss of salmon to help the farm and the public understand trends related to the cumulative numbers of losses of fish that go unnoticed during production. The accuracy of these numbers is limited by the margin of error of fish counting machines and other counting techniques. The requirements seek to encourage farmers to use counting devices that are as accurate as possible, requiring a minimum 98 per cent accuracy of the counting method.

A number of other requirements throughout the document complement the requirements on escapes from grow-out sites in terms of minimising impact on wild salmon populations. The ASC Salmon Standard includes requirements related to escapes from smolt production facilities, and a move away from production of smolts in open systems to closed and semi-closed systems with lower risk of escapees. Requirements related to escapees from smolt systems are particularly important in minimising the potential for interbreeding, as some studies show comparatively high reproductive success rates in escaped precocious male parr.[62] The ASC Salmon Standard also includes requirements related to siting in protected or high conservation value areas, including areas that are designated as such in order to protect threatened wild salmonid populations.

[61] Thorstad, E.B., Fleming, I.A., McGinnity, P., Soto, D., Wennevik, V. and Whoriskey, F. 2008. Incidence and impacts of escaped farmed Atlantic salmon *Salmo salar* in nature. NINA Special Report 36. 110 pp. http://www.fao.org/3/a-aj272e.pdf

[62] Garant, D., Fleming I.A., Einum, S. and Bernatchez, L. Alternate male life-history tactics as potential vehicles for speeding introgression of farm salmon traits into wild populations. Ecology Letters 2003;6: 541-549.

PRINCIPLE 4: USE RESOURCES IN AN ENVIRONMENTALLY EFFICIENT AND RESPONSIBLE MANNER

Principle 4 is intended to address negative impacts that stem from resource use, including feed and non-therapeutic chemical inputs.

Criterion 4.1 Traceability of raw materials in feed

INDICATOR	REQUIREMENT
4.1.1 Evidence of traceability, demonstrated by the feed producer, of feed ingredients that make up more than 1% of the feed.[63]	Yes

Rationale - Raw material traceability is fundamental to many of the ASC Salmon Standard and, therefore, is required under this requirement. This requirement will make raw material sourcing more transparent. It must be demonstrated at the feed manufacturer or feed producer level. For some feed ingredients, this will be evidence of traceability with regard to country of origin, while for other feed ingredients that relate specifically to other requirements, this may be a finer level of detail, such as traceability back to the fishery as outlined in the following criteria 4.2 and 4.3.

Criterion 4.2 Use of wild fish for feed[64]

INDICATOR	REQUIREMENT
4.2.1 Fishmeal Forage Fish Dependency Ratio (FFDRm) for grow-out (calculated using formulas in Appendix IV- 1)	< 1.2

[63] Traceability shall be at a level of detail that permits the feed producer to demonstrate compliance with the standards in this document (i.e., marine raw ingredients must be traced back to the fishery, soy to the region grown, etc.). Feed manufacturers will need to supply the farm with third-party documentation of the ingredients covered under this standard.

[64] See Appendix VI for transparency requirements for 4.2.1 and 4.2.2.

4.2.2	Fish Oil Forage Fish Dependency Ratio (FFDRo) for grow-out (calculated using formulas in Appendix IV- 1), or, Maximum amount of EPA and DHA from direct marine sources[65] (calculated according to Appendix IV-2)	FFDRo < 2.52, or, (EPA + DHA) < 30 g/kg feed

Rationale - The salmon aquaculture industry has significantly reduced the inclusion rates of fishmeal and fish oil from forage fish in salmon feeds during the past two decades. The Forage Fish Dependency Ratios (FFDR) contained in these requirements aim to support the trend toward lower inclusion rates and increasingly efficient use of marine resources, which are expected to continue. Fishmeal and fish oil are both finite resources that are shared across a range of users with increasing demands, from direct human consumption to aquaculture to pig and poultry production. The ASC Salmon Standard intends to promote the efficient use of these resources, producing increasing amounts of farmed salmon from a given input of fishmeal and oil.

The ratios, one for fishmeal and another for fish oil, calculate the dependency on forage fisheries through an assessment of the quantity of live fish from small pelagic fisheries required to produce the amount of fishmeal or fish oil needed to produce a unit of farmed salmon. The ASC Salmon Standard offers the calculation of levels of EPA and DHA from wild fish in feeds as an alternate method of measuring dependency on forage fisheries. The requirement encourages producers who want to produce salmon with high levels of omega-3 fatty acids to do so by sourcing the EPA and DHA from sources other than fish oil derived from direct industrial fisheries. The ratios complement the requirements described in criterion 4.3, which will move farms toward using feed with marine ingredients from fisheries certified as responsibly managed. Producers will be able to improve their FFDR by using a greater percentage of fishmeal and fish oil from trimmings and offal, using other sources of meal and oil (e.g. vegetables) and improving their feeding efficiency.

[65] Calculation excludes DHA and EPA derived from fisheries by-products and trimmings. Trimmings are defined as by-products when fish are processed for human consumption or if whole fish is rejected for use of human consumption because the quality at the time of landing does not meet official regulations with regard to fish suitable for human consumption.

Fishmeal and fish oil that are produced from trimmings can be excluded from the calculation as long as the origin of the trimmings is not any species that are classified as critically endangered, endangered or vulnerable in the IUCN Red List of Threatened Species (http://www.iucnredlist.org).

Criterion 4.3 Source of marine raw materials

INDICATOR	REQUIREMENT
4.3.1 Timeframe for all fishmeal and fish oil used in feed to come from fisheries[66] certified under a scheme that is an ISEAL member[67] and has guidelines that specifically promote responsible environmental management of small pelagic fisheries	Not required
4.3.2 Prior to achieving 4.3.1, the FishSource score[65, 68] for the fishery(ies) from which all marine raw material in feed is derived	All individual scores ≥ 6, and biomass score ≥ 6
4.3.3 Prior to achieving 4.3.1, demonstration of third-party verified chain of custody and traceability for the batches of fishmeal and fish oil which are in compliance with 4.3.2.	Yes
4.3.4 Feed containing fishmeal and/or fish oil originating from: by-products[69] or trimmings from IUU[70] catch or from fish species that are categorized as vulnerable, endangered or critically endangered, according to the IUCN Red List of Threatened Species, [71] whole fish and fish meal from the same species and family as the species being	None[72]

[66] This standard and standard 4.3.2 apply to fishmeal and oil from forage fisheries, pelagic fisheries, or fisheries where the catch is directly reduced (including krill) and not to by-products or trimmings used in feed.

[67] Meets ISEAL guidelines as demonstrated through full membership in the ISEAL Alliance, or equivalent as determined by the Technical Advisory Group of the ASC.

[68] Or equivalent score using the same methodology. See Appendix IV-3 for explanation of FishSource scoring.

[69] **Trimmings** are defined as by-products when fish are processed for human consumption or if whole fish is rejected for use of human consumption because the quality at the time of landing does not meet official regulations with regard to fish suitable for human consumption.

[70] **IUU**: Illegal, Unregulated and Unreported.

[71] The International Union for the Conservation of Nature reference can be found at http://www.iucnredlist.org/.

[72] For species listed as "vulnerable" by IUCN, an exception is made if a regional population of the species has been assessed to be *not* vulnerable in a National Red List process that is managed explicitly in the same science-based way as IUCN. In cases where a National Red List doesn't exist or isn't managed in accordance with IUCN guidelines, an exception is allowed when an assessment is conducted using IUCN's methodology and demonstrates that the population is not vulnerable.

farmed.	
4.3.5 Presence and evidence of a responsible sourcing policy for the feed manufacturer for marine ingredients that includes a commitment to continuous improvement of source fisheries.[73]	Yes

Rationale - Wild fish harvested from the ocean and reduced into fishmeal and fish oil are an important component of salmon feeds. Many wild small pelagic fish resources are fished at capacity or overfished.[74] Demand for these resources is increasing as the aquaculture industry expands and as forage fish are increasingly consumed by humans or by other industries including other animal production. There is concern that higher demand could lead to the overfishing—and collapse—of small forage fish stocks. Wild small pelagic fish play a critical role in the ecosystem and the marine food chain. Some conservation groups and scientists are concerned that even fisheries that are not classified as overfished from a population perspective are, or could be, overfished from an ecological perspective.

These indicators strive to ensure that marine-based feed ingredients come from sustainable sources in the short- and long-term. The requirements aim to align industry incentives to support processes that will lead to improved fisheries management and ultimately the certification of forage fisheries as an independent measure of the ecological health of those fisheries.

In the medium term, the requirements will require marine ingredients in feed to be certified by a widely recognised authority. This recognised authority must be a member of the ISEAL Alliance, which promotes transparent, multi-stakeholder processes. The authority must also have a methodology that specifically addresses the ecological role of low trophic-level species. As of the date of publication of this ASC Salmon Standard, the Marine Stewardship Council (MSC) is the only fishery scheme that is a full member of ISEAL, and MSC is in the process of developing specific requirements for small pelagic fisheries. Additional schemes may emerge in the future that meet these requirements. This requirement begins to be applicable five years after the publication of the ASC Salmon Standard because there is a current lack of such certified sources of fishmeal and fish oil and the transformation of the industry will take some time. The ASC Salmon Standard encourages fisheries to begin immediately to make any needed management changes or regulatory reforms needed to achieve certification.

In the short term, the requirements restrict fisheries currently known to have the poorest status from being used for fishmeal and fish oil and places traceability requirements on the fishmeal and fish oil used in the feed. Requirement 4.3.2 requires the fishmeal and fish oil from forage fisheries to originate from fisheries meeting a minimum score using the FishSource scoring methodology, which is outlined in Appendix IV-3.

[73] The policy should be written and include an assessment of source fishery status and identification of improvement needs and work plan to deliver improvements. The policy must include a commitment and timeline to source aquaculture and fishery products from responsible/best practice sources, such as those certified a standard benchmarked at minimum consistent with relevant FAO's eco-labelling guidelines or by identified independent risk assessment.

[74] FAO, The State of World Fisheries and Aquaculture (SOFIA), 2010.

Rigorous traceability requirements are built into requirement 4.3.3. The traceability scheme must also incorporate baseline measures related to sustainability that serve as an additional measure to ensure that fish from unsustainable fisheries are not used in feed. The International Fishmeal and Fish Oil Organization's Global Standard for Responsible Supply[75] or a future equivalent that might emerge can be used to meet this requirement.

Last, requirement 4.3.4 prevents the use of by-products and trimmings that come from species categorized as vulnerable or worse on the IUCN Red List of Threatened Species. Using by-products from fisheries for human consumption in salmon feeds is a valuable use of products that may otherwise be wasted. However, a minimum level of sustainability of these fisheries is still required under the ASC Salmon Standard. For species classified globally as vulnerable by IUCN, the requirement offers the opportunity for feed suppliers to demonstrate through a scientific process that a regional population of a species is not actually vulnerable.

Criterion 4.4 Source of non-marine raw materials in feed

INDICATOR	REQUIREMENT
4.4.1 Presence and evidence of a responsible sourcing policy for the feed manufacturer for feed ingredients that comply with recognised crop moratoriums[76] and local laws[77]	Yes
4.4.2 Percentage of soya or soya-derived ingredients in the feed that are certified by the Roundtable for Responsible Soy (RTRS) or equivalent[78]	100%
4.4.3 Evidence of disclosure to the buyer[79] of the salmon of inclusion of transgenic[80] plant raw	Yes, for each individual raw material containing > 1% transgenic content[81]

[75] http://www.iffo.net/iffo-rs

[76] **Moratorium**: A period of time in which there is a suspension of a specific activity until future events warrant a removal of the suspension or issues regarding the activity have been resolved. In this context, moratoriums may refer to suspension of the growth of defined agricultural crops in defined geographical regions.

[77] Specifically, the policy shall include that vegetable ingredients, or products derived from vegetable ingredients, must not come from areas of the Amazon Biome that were deforested after July 24, 2006, as geographically defined by the Brazilian Soy Moratorium. Should the Brazilian Soy Moratorium be lifted, this specific requirement shall be reconsidered.

[78] Any alternate certification scheme would have to be approved as equivalent by the Technical Advisory Group of the ASC.

[79] The company or entity to which the farm or the producing company is directly selling its product. This standard requires disclosure by the feed company to the farm and by the farm to the buyer of their salmon.

[80] **Transgenic**: An organism, with the exception of human beings, in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination. Source EFSA.

[81] See Appendix VI for transparency requirement for 4.4.3.

material, or raw materials derived from transgenic plants, in the feed	

Rationale - The ASC Salmon Standard aims to promote responsible sourcing of all feed ingredients. Thus, the ASC Salmon Standard requires producers to provide evidence that they are sourcing feed products from feed manufacturers that have a sustainable sourcing policy for feed ingredients.

Feed ingredients sourced from areas where significant ecological damage has occurred was of concern to the ASC. Therefore, the requirement requires producers to source feed from feed producers who comply with any relevant, recognised crop moratoriums that, at the time of the writing of these requirements, includes only the Brazilian Soy Moratorium,[82]. Such moratoriums are temporary measures intended to protect defined geographic regions. Looking to the future, the ASC Salmon Standard incorporates a requirement for feed manufacturers to use soy certified by the RTRS, which the ASC Salmon Standard recognises as the most environmentally meaningful soy certification process today. Because the scheme is recently starting up, the requirements build in a five-year window for this requirement.

Transgenic plants are commonly used in aquaculture and animal feeds throughout the world. Some consumers and retailers want to be able to identify food products, including farmed salmon, that are genetically modified or that have been fed genetically modified ingredients. The ASC Salmon Standard ensure transparency (above one per cent) around any transgenic material used in the feed in order to support informed choices by retailers and consumers. The ASC Salmon Standard require that the producer disclose to the first-order buyer of their salmon the use of any genetically modified ingredients in feed, and publicly disclose whether transgenic ingredients are used under Appendix VI.

Criterion 4.5 Non-biological waste from production

INDICATOR	REQUIREMENT
4.5.1 Presence and evidence of a functioning policy for proper and responsible[83] treatment of non-biological waste from production (e.g. disposal and recycling)	Yes
4.5.2 Evidence that non-biological waste (including net pens) from grow-out site is either disposed of properly or recycled	Yes

[82] See http://www.abiove.org.br/site/index.php?page=soy-moratorium&area=MTEtMy0x for additional information on the soy moratorium.

[83] Proper and responsible disposal will vary based on facilities available in the region and remoteness of farm sites. Disposal of non-biological waste shall be done in a manner consistent with best practice in the area. Dumping of non-biological waste into the ocean does not represent “proper and responsible” disposal.

Rationale - The purpose of these indicators is to ensure that all non-biological waste produced by a farm is recycled, reused or disposed of properly and does not affect neighbouring communities. Proper handling and treatment of wastes may vary across farms depending on the remoteness of the farm site and the disposal and recycling options available in the region.

Initial Auditing Guidance

The ASC Salmon Standard recognises that some farms are located in extremely remote locations with no viable recycling systems nearby and where waste disposal presents challenges. Auditing guidelines will need to clarify what "proper" disposal means and be flexible enough to recognise that what is "proper" on one site is different from what is "proper" on another site. Regardless of the remoteness of a farm, these requirements would, for example, prohibit the dumping of non-biological waste (e.g. feedbags or nets) into the ocean.

Criterion 4.6 Energy consumption and greenhouse gas emissions on farms[84]

INDICATOR	REQUIREMENT
4.6.1 Presence of an energy use assessment verifying the energy consumption on the farm and representing the whole life cycle at sea, as outlined in Appendix V-1	Yes, measured in kilojoule/mt fish produced/production cycle
4.6.2 Records of greenhouse gas (GHG[85]) emissions[86] on farm and evidence of an annual GHG assessment, as outlined in Appendix V-1	Yes
4.6.3 Documentation of GHG emissions of the feed[87] used during the previous production cycle, as outlined in Appendix V, subsection 2	Yes

Rationale - Climate change represents perhaps the biggest environmental challenge facing current and future generations. Because of this, energy consumption used in food production has become a source of major public concern. The ASC Salmon Standard recognises the importance of efficient and sustainable energy use. Therefore, these indicators will require that energy consumption in the production of fish should be monitored on a continual basis and that growers should develop means to improve efficiency and reduce consumption of energy sources, particularly those that are limited or carbon-based. The data collected in this process will help the ASC Salmon Standard set a meaningful numerical requirement for energy use in the future. Energy assessments are a new area for

[84] See Appendix VI for transparency requirements for 4.6.1, 4.6.2 and 4.6.3.

[85] For the purposes of this standard, **GHGs** are defined as the six gases listed in the Kyoto Protocol: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6).

[86] GHG emissions must be recorded using recognised methods, standards and records as outlined in Appendix V.

[87] GHG emissions from feed can be given based on the average raw material composition used to produce the salmon (by weight) and not as documentation linked to each single product used during the production cycle. Feed manufacturer is responsible for calculating GHG emissions per unit feed. Farm site then shall use that information to calculate GHG emissions for the volume of feed they used in the prior production cycle.

producers. Requiring that farms do these assessments will likely raise awareness of the issues related to energy and build support for adding a requirement in the future related to the maximum energy of GHG emissions allowed.

Criterion 4.7 Non-therapeutic chemical inputs[88,89]

INDICATOR		REQUIREMENT
4.7.1	For farms that use copper-treated nets[90], evidence that nets are not cleaned[91] or treated in situ in the marine environment	Yes
4.7.2	For any farm that cleans nets at on-land sites, evidence that net-cleaning sites have effluent treatment[92]	Yes
4.7.3	For farms that use copper nets or copper-treated nets, evidence of testing for copper level in the sediment outside of the AZE, following methodology in Appendix I-1	Yes
4.7.4	Evidence that copper levels[93] are < 34 mg Cu/kg dry sediment weight, or, in instances where the Cu in the sediment exceeds 34 mg Cu/kg dry sediment weight, demonstration that the Cu concentration falls within the range of background concentrations as measured at three reference sites in the water body	Yes

[88] Closed production systems that do not use nets and do not use antifoulants shall be considered exempt from standards under Criterion 4.7.

[89] See Appendix VI for transparency requirements for 4.7.1, 4.7.3 and 4.7.4.

[90] Under the SAD, "**copper-treated net**" is defined as a net that has been treated with any copper-containing substance (such as a copper-based antifoulant) during the previous 18 months, or has not undergone thorough cleaning at a land-based facility since the last treatment. Farms that use nets that have, at some point prior in their lifespan, been treated with copper may still consider nets as untreated so long as sufficient time and cleaning has elapsed as in this definition. This will allow farms to move away from use of copper without immediately having to purchase all new nets.

[91] Light cleaning of nets is allowed. Intent of the standard is that, for example, the high-pressure underwater washers could not be used on copper treated nets under this standard because of the risk of copper flaking off during this type of heavy or more thorough cleaning.

[92] Treatment must have appropriate technologies in place to capture copper if the farm uses copper-treated nets.

[93] According to testing required under 4.7.3. The standards related to testing of copper are only applicable to farms that use copper-based nets or copper-treated nets.

4.7.5 Evidence that the type of biocides used in net antifouling are approved according to legislation in the European Union, or the United States, or Australia	Yes

Rationale - Copper (Cu) is an abundant trace element found in a variety of rocks and minerals. It is an essential micronutrient and is also necessary for a wide range of metabolic processes in animals and plants. At elevated levels, however, Cu becomes toxic. Collectively, the set of requirements related to copper encourage any sites that can do so to not use copper. Simultaneously, they recognise that in some situations phasing out copper usage may not yet be possible if, for example, alternate antifoulants or cleaning methods don't leave nets at a given site clean enough for the use of wrasse to manage sea lice to be feasible. In situations where copper is used, the requirements ensure precautionary healthy levels of copper in the benthos.

In order to minimise release of Cu from salmon farms into the environment, the requirement includes better management practices of not cleaning copper treated nets in the aquatic environment and requires that land-based cleaning facilities have the appropriate effluent treatment.

Additionally, a maximum level of Cu concentration in the sediment outside of the AZE is built into the requirement to ensure that any benthic effect that may occur from the use of copper on the net pens is minimal. The variability in environmental factors makes it very difficult to identify a generic threshold of copper in the environment that can be used to define the environmental risk. However, experts suggest that the threshold of 34mg/kg sediment adequately protects the benthos. The level of 34 mg is also consistent with the level at which Scottish regulation requires some action to ensure benthic health, and with levels recognised by other jurisdictions as the level at which there may be possible environmental effect. Under the ASC Salmon Standard, if Cu levels in the sediment just outside the AZE are higher than the threshold, as may be the case in areas with naturally high levels of Cu, the farm must demonstrate that the level just outside of the AZE is consistent with reference sites and the background levels in the area.

The ASC Salmon Standard is aware that other biocides are commercially applied to netting material. It is difficult to address all biocides used or to be used in the future. To address the high variability of biocides used, the ASC Salmon Standard elected to limit use to those chemicals approved for legal use by the European Union, the United States or Australia. The ASC Salmon Standard encourages the development and review of alternative antifoulants that are protective of the marine environment. The European Union, the United States and Australia were selected as a representation of jurisdictions that were viewed to be undertaking rigorous analyses of biocides.

PRINCIPLE 5: MANAGE DISEASE AND PARASITES IN AN ENVIRONMENTALLY RESPONSIBLE MANNER

Principle 5 aims to address negative impacts of salmon farming associated with disease, parasites and therapeutic chemical inputs. The ASC Salmon Standard recognises the role of proper fish handling and minimised levels of fish stress as an important element in good husbandry and in reducing levels of disease on farms, mortalities and therapeutic treatments. In addition to addressing environmental risks, compliance with requirements under Principle 5 helps ensure farmed fish health and welfare.

Criterion 5.1 Survival and health of farmed fish[94]

INDICATOR	REQUIREMENT
5.1.1. Evidence of a fish health management plan for the identification and monitoring of fish diseases, parasites and environmental conditions relevant for good fish health, including implementing corrective action when required	Yes
5.1.2 Site visits by a designated veterinarian[95] at least four times a year, and by a fish health manager[96] at least once a month	Yes
5.1.3 Percentage of dead fish removed and disposed of in a responsible manner	100%[97]
5.1.4 Percentage of mortalities that are recorded, classified and receive a post-mortem analysis	100%[98]

[94] See Appendix VI for transparency requirements for 5.1.4, 5.1.5 and 5.1.6.

[95] A **designated veterinarian** is the professional responsible for health management on the farm who has the legal authority to diagnose disease and prescribe medication. In some countries such as Norway, a fish health biologist or other professional has equivalent professional qualifications and is equivalent to a veterinarian for purposes of these standards. This definition applies to all references to a veterinarian throughout the standards document.

[96] A **fish health manager** is someone with professional expertise in managing fish health, who may work for a farming company or for a veterinarian, but who does not necessarily have the authority to prescribe medicine.

[97] The SAD recognises that not all mortality events will result in dead fish present for collection and removal. However, such situations are considered the exception rather than the norm.

[98] If on-site diagnosis is inconclusive, this standard requires off-site laboratory diagnosis. A qualified professional must conduct all diagnosis. One hundred percent of mortality events shall receive a post-mortem analysis, not necessarily every fish. A statistically relevant number of fish from the mortality event shall be analysed.

5.1.5 Maximum viral disease-related mortality[99] on farm during the most recent production cycle	≤ 10%
5.1.6 Maximum unexplained mortality rate from each of the previous two production cycles, for farms with total mortality > 6%	≤ 40% of total mortalities
5.1.7 A farm-specific mortalities reduction programme that includes defined annual targets for reductions in mortalities and reductions in unexplained mortalities	Yes

Rationale - Farmed salmon are susceptible to numerous diseases that have the potential to be amplified and transferred, thereby posing a risk to the health of fish and other marine organisms in adjacent ecosystems. One of the best ways to mitigate the risk of disease transfer to wild stocks is to reduce or eliminate the disease from happening initially.

These requirements seek to ensure proactive health management on the farm through a detailed health management plan and frequent visits by the designated veterinarian and other fish health professionals. The requirements under Criterion 5.1 are complemented by requirements related to the health of smolts, as outlined under Section 8 of this document. Requirements related to smolt seek to ensure that farmed salmon have all relevant vaccinations and enter the water as healthy as possible.

Healthy farms also must keep detailed records of all mortalities and cause of death. The post-mortem analysis required in this requirement is essential to provide an early warning against emerging diseases. Repeated high mortality rates, or a high rate of unexplained mortalities, may indicate poor management or poor siting. The mortality requirements in 5.1.5 and 5.1.6 are not intended as a goal, but rather a minimum required. The requirement focuses on mortalities from viral disease and unknown causes, as those categories were highlighted by experts as presenting a greater potential risk to wild fish populations and neighbouring farms. The requirement requires that mortalities from viral disease be kept at or below 10 per cent. Only farms with mortality rates greater than six per cent per production cycle must also then meet the requirement related to percentage of unexplained mortalities. The farm must be able to demonstrate that it is working seriously to reduce its mortalities, including tracking diseases and carrying out a farm-specific plan to reduce diseases and mortalities. The information collected on mortalities will be useful for future revisions of the requirements.

[99] Viral disease-related mortality count shall include unspecified and unexplained mortality as it could be related to viral disease.

Criterion 5.2 Therapeutic treatments[100]

INDICATOR	REQUIREMENT
5.2.1 On-farm documentation that includes, at a minimum, detailed information on all chemicals[101] and therapeutants used during the most recent production cycle, the amounts used (including grams per ton of fish produced), the dates used, which group of fish were treated and against which diseases, proof of proper dosing, and all disease and pathogens detected on the site	Yes
5.2.2 Allowance for use of therapeutic treatments that include antibiotics or chemicals that are banned[102] in any of the primary salmon producing or importing countries[103]	None
5.2.3 Percentage of medication events that are prescribed by a veterinarian	100%
5.2.4 Compliance with all withholding periods after treatments	Yes
5.2.5 The farm shall publicly report (via Appendix VI) the: 1. Weighted Number of Medicinal Treatments (see Appendix VII) for each production cycle 2. The parasiticide load for each agent over the production cycle 3. The benthic parasiticide residue levels	Yes
5.2.6 The Weighted Number of Medicinal Treatments	Yes

[100] See Appendix VI for transparency requirements for 5.2.1, 5.2.5, 5.2.6 and 5.2.10.

[101] Chemicals used for the treatment of fish.

[102] "**Banned**" means proactively prohibited by a government entity because of concerns around the substance. A substance banned in any of the primary salmon-producing or importing countries, as defined here, cannot be used in any salmon farm certified under the SAD, regardless of country of production or destination of the product. The SAD recommends that ASC maintain a list of a banned therapeutants.

[103] For purposes of this standard, those countries are Norway, the UK, Canada, Chile, the United States, Japan and France.

shall be at or below the country Entry Level (see Appendix VII)	
5.2.7 The farm shall reduce the Weighted Number of Medicinal Treatments, after achieving indicator 5.2.6, with 25% per 2 years until the WNMT is at or below the Global Level (see Appendix VII).	Yes
5.2.8 The farm shall implement Integrated Pest Management (IPM) according to the guidance in Appendix VII.	Yes
5.2.9 The farm shall public present (e.g. via company website) the IPM-measures that the company applies which need to be approved by a authorised veterinarian.	Yes
5.2.10 The farm shall monitor parasiticide residue levels annually in the benthic sediment directly outside the AZE.	Yes
5.2.11 Allowance for prophylactic use of antimicrobial treatments[104]	None
5.2.12 Allowance for use of antibiotics listed as critically important for human medicine by the World Health Organization (WHO[105])	None[106]
5.2.13 Number of treatments[107] of antibiotics over the most recent production cycle	≤ 3
5.2.14 If more than one antibiotic treatment is used in the most recent production cycle, demonstration that the antibiotic load[108] is at least 15% less that of the average of the two previous production cycles	Yes[109]

[104] The designated veterinarian must certify that a pathogen or disease is present before prescribing medication.

[105] The fifth edition of the WHO list of "Critically important antimicrobials for human medicine" was released in 2017 and is available at: http://apps.who.int/iris/bitstream/10665/255027/1/9789241512220-eng.pdf?ua=1 .

[106] If the antibiotic treatment is applied to only a portion of the pens on a farm site, fish from pens that did not receive treatment are still eligible for certification.

[107] A **treatment** is a single course medication given to address a specific disease issue and that may last a number of days.

[108] **Antibiotic load** = the sum of the total amount of active ingredient of antibiotics used (kg).

[109] Reduction in load required, regardless of whether production increases on the site. Farms that consolidate production across multiple sites within an ABM can calculate reduction based on the combined antibiotic load of the consolidated sites.

5.2.15 Presence of documents demonstrating that the farm has provided buyers[110] of its salmon a list of all therapeutants used in production	Yes

Rationale - When disease outbreaks occur on salmon farms, farmers often opt to treat using chemical therapeutants as a means of protecting on-farm fish and the health of wild populations near the farm. With any chemical introduction into a wild environment, there is a need to ensure that non-target organisms are not being negatively impacted by the use of that chemical. Accurate and detailed documentation of all treatments is the first step to ensure proper dosing and safe use of therapeutants. The data collected from this requirement will also help the ASC set more measurable requirements in the future.

To minimise the risk of treatments posing a risk to the environment, farms shall not use treatments that have been banned by any of the regulatory bodies in the world's largest salmon-producing or importing countries. The chemical must have been proactively prohibited or banned, versus being not approved. Part of a farm's responsibility to operate within the law involves taking appropriate measures to ensure that its product complies with import laws of the countries where the salmon is eventually sold. Requirement 5.2.11 above ensures that buyers and importers have the information they need to verify that the product complies with import regulations.

Prophylactic use of antimicrobial treatments, and treatments that aren't prescribed by a licensed professional, are unacceptable under the requirement because they open the door to overuse and abuse of therapeutants.

Stakeholders within the SAD shared a common interest and common goal of reducing the use of parasiticides and reducing the risk of needed chemical treatments to the environment. The ultimate goal would be that farms could meet the ASC Salmon Standard without using therapeutants or without the risk of those therapeutants negatively impacting the environment. Simultaneously, the SAD focused on protecting wild stocks of salmonids and thus sets low thresholds (requirement 3.1.7) for allowable lice on farmed fish in areas with wild salmonids. Taking into account current technology and knowledge, and balancing between the objectives of minimising impact on wild stocks and at the same time addressing threats to the environment related to unrestricted use of therapeutants, the SC allowed restricted use of parasiticides to treat sea lice under the requirement.

The purpose of the requirement of 5.2.5 is to place a limit on the number of treatments using parasiticides, while taking into account regional differences in ecosystems and epidemiology, including differences in lice species, wild host reservoirs and susceptibility to lice attack, together with differences in mandatory regulatory requirements in the different countries. The standard seeks to use a progressive indicator which encourages reductions in medicinal product use and the associated risks of resistance from overuse whilst incentivising an increasing shift to non-medicinal means of control through expansion of integrated pest management (IPM) strategies. To promote this, the entry to the process is relatively inclusive in order to promote the progressive changes sought. For this purpose, after the first audit, the farm should show improvement in management against a progress ladder based on the principles of IPM against a time bound plan (Appendix VII) and a shift towards low to zero medicinal product usage (Indicator 5.2.7).

[110] **Buyer**: The company or entity to which the farm or the producing company is directly selling its product.

Indicator 5.2.5 addresses the number of medicinal treatments used on certified farms. The total amount of active ingredient used for medicinal treatments will be provided by the parasiticide load, Indicator 5.2.9. In addition, some more direct assessment of the fate of the various agents in the environment, both in the sediment and the water, is to be encouraged (Indicator 5.2.8) by requiring some monitoring of the concentration of the various agents in water and sediments at the edge and outside the Allowable Zone of Effects (AZE) either by using tools such as direct assay or models that have been scientifically validated (e.g. by peer review and documented testing) and which are approved by national regulatory bodies

In order to monitor effective progress in reduction of medicinal treatments, Indicator 5.2.6 requires that at the end of the second certification cycle following the introduction of the new requirements, that is after 6 years, and of every subsequent cycle, the WMNT can be audited over the preceding 6 years for an overall downward trend indicative of a reduction in medicinal treatment frequency. By this means there should be at least 4 or 5 data points upon which to base judgment. Reductions can be demonstrated at the individual farm or Area Based Management (ABM) level.

These requirements are consistent with industry efforts to reduce both frequency and amount of parasiticide used, as well as with initiatives to develop treatment methods that do not release parasiticides into the environment. To encourage thinking about cumulative use across a broader area, tracking of total use of parasiticides is required under the ABM.

With regards to the use of antibiotics, there is a global effort led by the WHO to ensure that antibiotics important for human medicine are used in a way that doesn't jeopardise their effectiveness in treating human diseases. These requirements seek to be in line with that effort. The requirements set a cap on a maximum allowable number of treatments of antibiotics on certified farms that is intended to set a reasonable limit on what may be needed on a well-managed farm and excludes any farms that fail to follow industry guidelines for prudent use of antibiotics. Through 5.2.10, the ASC Salmon Standard addresses environmental risk from cumulative load of antibiotics entering the environment from certified farms. The requirement requires a reduction, within five years, of the actual load of antibiotics released from farms that use more than one treatment of antibiotics. This is in line with industry goals to reduce total antibiotic use and with trends in industry to use precise pen-by-pen treatments when appropriate.

Additionally, the SAD's technical working group on chemical inputs recommended that antibiotics important for human health only be used with extreme reluctance. These requirements are also intended to further raise awareness within the aquatic veterinary community on the use of medically important antimicrobial drugs in food-animal production, and the public health risks associated with antibiotic resistance. This issue is addressed in requirement 5.2.8 and through a coordination requirement within the ABM related to the use of antibiotics classified by the WHO as "highly important" for human health.

Criterion 5.3 Resistance of parasites, viruses and bacteria to medicinal treatments

INDICATOR	REQUIREMENT
5.3.1 Bio-assay analysis to determine resistance when two applications of a treatment have not produced the expected effect	Yes
5.3.2 When bio-assay tests determine resistance is forming, use of an alternative, permitted treatment, or an immediate harvest of all fish on the site	Yes
5.3.3 Specific rotation, providing that the farm has >1 effective medicinal treatment product available, every third treatment must belong to a different family of drugs.	Yes

Rationale - One of the more serious risks of overusing medicinal treatments is the development of parasite drug resistance, which lowers the overall effectiveness of treatments. In some salmon-growing regions, resistance to a number of drugs has become a growing problem, increasing the challenge for salmon farmers to control sea lice on farmed and wild fish.

Efforts to prevent and monitor resistance are made most effectively through an area-based approach. Timely, accurate sea lice counts on the farm can detect when sea lice treatment is no longer effective. Bioassays are important to confirm if resistance is developing and a limit has been set on the number of repeat treatments of the same family of drugs that can be applied. A single treatment is considered to have taken place when the majority of a site (more than half of all cages) is treated. No more than two such treatments should use the same family of drugs; that is, at least every third treatment should be with a drug of a different class.

Criterion 5.4 Biosecurity management[111]

INDICATOR	REQUIREMENT
5.4.1 Evidence that all salmon on the site are a single year class[112]	100%[113]
5.4.2 Evidence that if the farm suspects an unidentifiable transmissible agent, or if the farm experiences unexplained increased mortality,[114] the farm has: 1. Reported the issue to the ABM and to the appropriate regulatory authority 2. Increased monitoring and surveillance[115] on the farm and within the ABM 3. Promptly[116] made findings publicly available	Yes
5.4.3 Evidence of compliance[117] with the OIE *Aquatic Animal Health Code*[118]	Yes
5.4.4 If an OIE-notifiable disease[119] is confirmed on the farm, evidence that:	Yes

[111] See Appendix VI for transparency requirements for 5.4.2 and 5.4.4.

[112] Gaps of up to six months between inputs of smolts derived from the same stripping are acceptable as long as there remains a period of time when the site is fully fallow after harvest.

[113] Exception is allowed for: 1) farm sites that have closed, contained production units where there is complete separation of water between units and no sharing of filtration systems or other systems that could spread disease, or, 2) farm sites that have ≥95% water recirculation, a pre-entry disease screening protocol, dedicated quarantine capability and biosecurity measures for waste to ensure there is no discharge of live biological material to the natural environment (e.g. UV or other effective treatment of effluent) .

[114] **Increased mortality**: A statistically significant increase over background rate on a monthly basis.

[115] Primary aim of monitoring and surveillance is to investigate whether a new or adapted disease is present in the area.

[116] Within one month.

[117] Compliance is defined as farm practices consistent with the intentions of the Code, to be further outlined in auditing guidance. For purposes of this standard, this includes an aggressive response to detection of an exotic OIE-notifiable disease on the farm, which includes depopulating the infected site and implementation of quarantine zones in accordance with guidelines from OIE for the specific pathogen. Quarantine zones will likely incorporate mandatory depopulation of sites close to the infected site and affect some, though not necessarily all, of the ABM. Exotic signifies not previously found in the area or had been fully eradicated (area declared free of the pathogen).

[118] OIE 2017. Aquatic Animal Health Code. http://www.oie.int/en/international-standard-setting/aquatic-code/access-online/

[119] **OIE-notifiable diseases** relevant to salmon aquaculture were: Epizootic haematopoietic necrosis, Infectious haematopoietic necrosis (IHN), Infectious salmon anemia (ISA), Viral hemorrhagic septicemia (VHS) and Gyrodactylosis

1. the farm at a minimum, immediately culled the pen(s) in which the disease was detected 2. the farm immediately notified the other farms in the ABM[120] 3. the farm and the ABM enhanced monitoring and conducted rigorous testing for the disease 4. the farm promptly[121] made findings publicly available	

Rationale - Biosecurity measures reduce the risk of disease transmission to the wild and between farms. These requirements aim to ensure that farms don't harm the health of wild populations by amplifying or spreading disease. It is recognised that disease flow is bidirectional between farmed and wild fish, and these requirements aim to minimise effect of disease transmission and retransmission. The ASC recognises that broad-level response to disease, in particular aggressive response to OIE-notifiable disease, must be led by regulators in the jurisdiction. This is important both because of legal implications of actions and because a mandatory response required by government has greatest potential to be effective.

(Gyrodactylus salaris). The actions required are applicable to exotic OIE notifiable diseases. Actions taken need to comply with national regulations.

[120] This is in addition to any notifications to regulatory bodies required under law and the OIE Aquatic Animal Health Code.

[121] Within one month.

PRINCIPLE 6: DEVELOP AND OPERATE FARMS IN A SOCIALLY RESPONSIBLE MANNER

Principle 6 aims to address potential negative social impacts related to farm development and operation, including labour concerns.

Criterion 6.1 Freedom of association and collective bargaining[122]

INDICATOR		REQUIREMENT
6.1.1	Evidence that workers have access to trade unions (if they exist) and union representative(s) chosen by themselves without managerial interference	Yes
6.1.2	Evidence that workers are free to form organizations, including unions, to advocate for and protect their rights	Yes
6.1.3	Evidence that workers are free and able to bargain collectively for their rights	Yes

Rationale - Having the freedom to associate and bargain collectively is a critical right of workers because it enables them to engage in collective bargaining over issues such as wages and other working conditions. Freedom of Association and the effective recognition of the right to collective bargaining is one of the core principles of the International Labor Organization's (ILO) "Declaration on Fundamental Principles and Rights at Work." The declaration was adopted in 1998 by the 86th International Labor Conference and has since been ratified by the overwhelming majority of ILO's 183 member nation-states.

[122] **Bargain collectively**: A voluntary negotiation between employers and organizations of workers in order to establish the terms and conditions of employment by means of collective (written) agreements.

Criterion 6.2 Child labour

INDICATOR		REQUIREMENT
6.2.1	Number of incidences of child[123] labour[124]	None
6.2.2	Percentage of young workers[125] that are protected[126]	100%

Rationale - The effective abolition of child labour is one of the core principles of the ILO "Declaration on Fundamental Principles and Rights at Work." Adherence to the child labour codes and definitions included in this section indicates compliance with what the ILO and international conventions generally recognise as the key areas for the protection of child and young workers. Children are particularly vulnerable to economic exploitation, due to their inherent age-related limitations in physical development, knowledge and experience. Children and youth need adequate time for education, development and play. Therefore, they should not have to work or be exposed to working hours and conditions that are hazardous[127,128] to their physical or mental well-being. To this end, the requirements related to what constitutes child labour will protect the interests of children and young workers at salmon farms certified to these requirements.

[123] **Child**: Any person under 15 years of age. A higher age would apply if the minimum age law of an area stipulates a higher age for work or mandatory schooling. Minimum age may be 14 if the country allows it under the developing country exceptions in ILO convention 138.

[124] **Child Labour**: Any work by a child younger than the age specified in the definition of a child.

[125] **Young Worker**: Any worker between the age of a child, as defined above, and under the age of 18.

[126] **Protected**: Workers between 15 and 18 years of age will not be exposed to hazardous health and safety conditions; working hours shall not interfere with their education and the combined daily transportation time and school time, and work time shall not exceed 10 hours.

[127] **Hazard**: The inherent potential to cause injury or damage to a person's health (e.g. unequipped to handle heavy machinery safely, and unprotected exposure to harmful chemicals).

[128] **Hazardous work**: Work that, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of workers (e.g. heavy lifting disproportionate to a person's body size, operating heavy machinery, exposure to toxic chemicals).

Criterion 6.3 Forced, bonded or compulsory labour

INDICATOR	REQUIREMENT
6.3.1 Number of incidences of forced,[129] bonded[130] or compulsory labour	None

Rationale - Forced labour - such as slavery, debt bondage and human trafficking - is a serious concern in many industries and regions of the world. The elimination of all forms of forced or compulsory labour is one of the core principles of the ILO "Declaration on Fundamental Principles and Rights at Work." Ensuring that contracts are clearly articulated and understood by workers is critical to determining that labour is not forced. The inability of a worker to freely leave the workplace and/or an employer withholding original identity documents of workers are indicators that employment may not be at-will. Adherence to these policies shall indicate that an aquaculture operation is not using forced, bonded or compulsory labour forces.

Criterion 6.4 Discrimination[131]

INDICATOR	REQUIREMENT
6.4.1 Evidence of comprehensive[132] and proactive anti-discrimination policies, procedures and practices	Yes
6.4.2 Number of incidences of discrimination	None

[129] **Forced (Compulsory) labour**: All work or service that is extracted from any person under the menace of any penalty for which a person has not offered himself/herself voluntarily or for which such work or service is demanded as a repayment of debt. "Penalty" can imply monetary sanctions, physical punishment, or the loss of rights and privileges or restriction of movement (e.g. withholding of identity documents).

[130] **Bonded labour**: When a person is forced by the employer or creditor to work to repay a financial debt to the crediting agency.

[131] **Discrimination**: Any distinction, exclusion or preference that has the effect of nullifying or impairing equality of opportunity or treatment. Not every distinction, exclusion or preference constitutes discrimination. For instance, a merit- or performance-based pay increase or bonus is not by itself discriminatory. Positive discrimination in favour of people from certain underrepresented groups may be legal in some countries.

[132] Employers shall have **written anti-discrimination policies** stating that the company does not engage in or support discrimination in hiring, remuneration, access to training, promotion, termination or retirement based on race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation, age or any other condition that may give rise to discrimination.

Rationale - The elimination of discrimination in respect of employment and occupation is one of the core principles of the ILO "Declaration on Fundamental Principles and Rights at Work." Unequal treatment of workers based on certain characteristics (such as sex or race), is a violation of a workers' human rights. Additionally, widespread discrimination in the working environment can negatively affect overall poverty and economic development rates. Discrimination occurs in many work environments and takes many forms. A common form is discrimination against women workers.

In order to ensure that discrimination does not occur at salmon farms certified to this requirement, employers must demonstrate their commitment to equality with an official anti-discrimination policy, a policy of equal pay for equal work, and clearly outlined procedures to raise, file and respond to a discrimination complaint in an effective manner. Evidence, including worker testimony, of adherence to these policies and procedures will indicate minimisation of discrimination. "Positive" discrimination (i.e., special treatment to protect the rights and health of particular groups of workers, or to provide opportunities for groups which have historically been disadvantaged) is allowed, and often required by laws related to such issues as maternity and affirmative action.

Criterion 6.5 Work environment health and safety

INDICATOR		REQUIREMENT
6.5.1	Percentage of workers trained in health and safety practices, procedures[133] and policies on a yearly basis	100%
6.5.2	Evidence that workers use Personal Protective Equipment (PPE) effectively	Yes
6.5.3	Presence of a health and safety risk assessment and evidence of preventive actions taken	Yes
6.5.4	Evidence that all health- and safety-related accidents and violations are recorded and corrective actions are taken when necessary	Yes
6.5.5	Evidence of employer responsibility and/or proof of insurance (accident or injury) for 100% of worker costs in a job-related accident or injury when not covered under national law	Yes
6.5.6	Evidence that all diving operations are conducted by divers who are certified	Yes

[133] **Health and safety training** shall include emergency response procedures and practices.

Rationale - A safe and healthy working environment is essential for protecting workers from harm. It is critical for a responsible aquaculture operation to minimise these risks. One of the key risks to workers is hazards resulting from accidents and injuries. Consistent, effective and regular worker training in health and safety practices is an important preventative measure. When an accident, injury or violation occurs, the company must record it and take corrective action to identify the root causes of the incident, remediate, and take steps to prevent future occurrences of similar incidents. This addresses violations and the long-term health and safety risks. Finally, while many national laws require that employers assume responsibility for job-related accidents and injuries, not all countries require this and not all workers (in some cases migrant and other workers) will be covered under such laws. When not covered under national law, employers must prove they are insured to cover 100 per cent of worker costs when a job-related accident or injury occurs.

Criterion 6.6 Wages

INDICATOR		REQUIREMENT
6.6.1	The percentage of workers whose basic wage[134] (before overtime and bonuses) is below the minimum wage[135]	0 (None)
6.6.2	Evidence that the employer is working toward the payment of basic needs wage[136]	Yes
6.6.3	Evidence of transparency in wage-setting and rendering[137]	Yes

Rationale - Wages and the process for setting wages are important components of the ILO core principles. For this reason, it is important to highlight under these requirements the importance of workers' basic wages meeting the legal minimum wage and being rendered to workers in a convenient manner. Unfortunately, minimum wage in many countries does not always cover the basic needs of workers. Unfairly and insufficiently compensated workers can be subject to a life of sustained poverty. Therefore, it is important for socially responsible employers to pay or be working toward paying a basic needs wage. The calculation of a basic needs wage can be complex, and it is important for employers to consult with workers, their representatives and other credible sources when assessing what a basic needs wage would be.

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[134] **Basic wage**: The wages paid for a standard working week (no more than 48 hours).

[135] If there is no legal minimum wage in a country, basic wages must meet the industry-standard minimum wage.

[136] **Basic needs wage**: A wage that covers the basic needs of an individual or family, including housing, food and transport. This concept differs from a minimum wage, which is set by law and may or may not cover the basic needs of workers.

[137] Payments shall be rendered to workers in a convenient manner.

Certified salmon farms shall also demonstrate their commitment to fair and equitable wages by having and sharing a clear and transparent mechanism for wage-setting and a labour conflict resolution policy[138] that tracks wage-related complaints and responses. Having these policies outlined in a clear and transparent manner will empower the workers to negotiate effectively for fair and equitable wages that shall, at a minimum, satisfy basic needs.

Criterion 6.7 Contracts (labour) including subcontracting

INDICATOR		REQUIREMENT
6.7.1	Percentage of workers who have contracts[139]	100%
6.7.2	Evidence of a policy to ensure social compliance of its suppliers and contractors	Yes

Rationale - Fair contracting is important to ensure transparency between the employer and employee and fairness in the employment relation. Short-term and temporary contracts are acceptable but cannot be used to avoid paying benefits or to deny other rights. The company shall also have policies and mechanisms to ensure that workers contracted from other companies for specific services (e.g. divers, cleaning or maintenance) and the companies providing them with primary inputs or supplies have socially responsible practices and policies.

Criterion 6.8 Conflict resolution

INDICATOR		REQUIREMENT
6.8.1	Evidence of worker access to effective, fair and confidential grievance procedures	Yes
6.8.2	Percentage of grievances handled that are addressed[140] within a 90-day timeframe	100%

[138] See Criterion 6.8.

[139] **Labor-only contracting relationships** or **false apprenticeship** schemes are not acceptable. This includes revolving/consecutive labor contracts to deny benefit accrual or equitable remuneration. False Apprenticeship Scheme: The practice of hiring workers under apprenticeship terms without stipulating terms of the apprenticeship or wages under contract. It is a "false" apprenticeship if its purpose is to underpay people, avoid legal obligations or employ underage workers. Labor-only contracting arrangement: The practice of hiring workers without establishing a formal employment relationship for the purpose of avoiding payment of regular wages or the provision of legally required benefits, such as health and safety protections.

[140] **Addressed**: Acknowledged and received, moving through the company's process for grievances, corrective action taken when necessary.

Rationale - Companies must have a clear labour conflict resolution policy in place for the presentation, treatment and resolution of worker grievances in a confidential manner. Workers shall be familiar with the policy and its effective use. Such a policy is necessary to track conflicts and complaints raised, and responses to conflicts and complaints.

Criterion 6.9 Disciplinary practices

INDICATOR		REQUIREMENT
6.9.1	Incidences of excessive or abusive disciplinary actions	None
6.9.2	Evidence of a functioning disciplinary action policy whose aim is to improve the worker[141]	Yes

Rationale - The rationale for discipline in the workplace is to correct improper actions and maintain effective levels of worker conduct and performance. However, abusive disciplinary actions can violate workers' human rights. The focus of disciplinary practices shall always be on the improvement of the worker. Fines or basic wage deductions shall not be acceptable as methods for disciplining workforce. A certified salmon farm shall never employ threatening, humiliating or punishing disciplinary practices that negatively impact a worker's physical and mental[142] health or dignity.

Criterion 6.10 Working hours and overtime

INDICATOR		REQUIREMENT
6.10.1	Incidences, violations or abuse of working hours[143] and overtime laws	None

[141] If disciplinary action is required, progressive verbal and written warnings shall be engaged. The aim shall always be to improve the worker; dismissal shall be the last resort. Policies for bonuses, incentives, access to training and promotions are clearly stated and understood, and not used arbitrarily. Fines or basic wage deductions shall not be acceptable disciplinary practices.

[142] **Mental Abuse**: Characterised by the intentional use of power, including verbal abuse, isolation, sexual or racial harassment, intimidation or threat of physical force.

[143] In cases where local legislation on working hours and overtime exceed internationally accepted recommendations (48 regular hours, 12 hours overtime), the international standards will apply.

6.10.2 Overtime is limited, voluntary,[144] paid at a premium rate and restricted to exceptional circumstances	Yes

Rationale - Abuse of overtime working hours is a widespread issue in many industries and regions. Workers subject to extensive overtime can suffer consequences in their work-life balance and are subject to higher fatigue-related accident rates. In accordance with better practices, workers in certified salmon farms are permitted to work—within defined guidelines—beyond normal work week hours but must be compensated at premium rates.[145] Requirements for time off, working hours and compensation rates as described should reduce the impacts of overtime.

Criterion 6.11 Education and training

INDICATOR	REQUIREMENT
6.11.1 Evidence that the company regularly performs training of staff in fish husbandry, general farm and fish escape management and health and safety procedures	Yes

Rationale - Education and training can be beneficial to companies and enable workers to improve their incomes. Such human capital development should be encouraged where it is in the interest of the company. Incentives, such as subsidies for tuition or textbooks and time off prior to exams, should be offered. The offer of training may be contingent on workers committing to stay with the company for a pre-arranged time. This should be made clear to participants before they start the training.

Workers employed in husbandry activities require specific and adequate training and are aware of their responsibilities in aquatic animal health management practices.

[144] Compulsory overtime is permitted if previously agreed to under a collective bargaining agreement.

[145] **Premium rate**: A rate of pay higher than the regular work week rate. Must comply with national laws/regulations and/or industry standards.

6.12 Corporate policies for social responsibility

INDICATOR		REQUIREMENT
6.12.1	Demonstration of company-level[146] policies in line with the requirements under 6.1 to 6.11 above	Yes

Rationale - Companies must be able to demonstrate that not only are the specific farm sites applying for certification able to meet this robust set of social and labour requirements, but that they also have company-wide policies related to these key issue areas that are in line with the ASC Salmon Standard requirements. Such policies must relate to all of the company's salmon operations in the region, whether they be smolt production facilities, grow-out facilities or processing plants.

[146] Applies to the headquarters of the company in a region or country where the site applying for certification is located. The policy shall relate to all of the company's operations in the region or country, including grow-out, smolt production and processing facilities.

PRINCIPLE 7: BE A GOOD NEIGHBOUR AND CONSCIENTIOUS CITIZEN

Principle 7 aims to address any broader off-site potential social impacts associated with salmon production, including interactions with local communities.

Criterion 7.1 Community engagement

INDICATOR	REQUIREMENT
7.1.1 Evidence of regular and meaningful[147] consultation and engagement with community representatives and organizations	Yes
7.1.2 Presence and evidence of an effective[148] policy and mechanism for the presentation, treatment and resolution of complaints by community stakeholders and organizations	Yes
7.1.3 Evidence that the farm has posted visible notice[149] at the farm during times of therapeutic treatments and has, as part of consultation with communities under 7.1.1, communicated about potential health risks from treatments	Yes

Rationale - A salmon farm must respond to human concerns that arise in communities located near the farm and to concerns related to the farm's overall operations. In particular, appropriate consultation must be undertaken within local communities so that risks, impacts and potential conflicts are properly identified, avoided, minimised and/or mitigated through open and transparent negotiations. Communities shall have the opportunity to be part of the assessment process (e.g. by including them in the discussion of any social investments and contributions by companies to neighbouring communities).

Channels of communication with community stakeholders are important. Regular consultation with community representatives and a transparent procedure for handling complaints are key components of this communication. Negative impacts may not always be avoidable. However, the process for addressing them must be open, fair and transparent and demonstrate due diligence. A company shall

[147] **Regular and meaningful**: Meetings shall be held at least bi-annually with elected representatives of affected communities. The agenda for the meetings should in part be set by the community representatives. Participatory Social Impact Assessment methods may be one option to consider here.

[148] **Effective**: In order to demonstrate that the mechanism is effective, evidence of resolutions of complaints can be given.

[149] Signage shall be visible to mariners and, for example, to fishermen passing by the farm.

share with neighbouring communities' information about any potential human health risks that may be associated with the use of therapeutic treatments and communicate about typical treatment patterns. They shall also post notices around the farm during times of treatment.

Criterion 7.2 Respect for indigenous and aboriginal cultures and traditional territories

INDICATOR		REQUIREMENT
7.2.1	Evidence that indigenous groups were consulted as required by relevant local and/or national laws and regulations	Yes
7.2.2	Evidence that the farm has undertaken proactive consultation with indigenous communities	Yes[150]
7.2.3	Evidence of a protocol agreement, or an active process[151] to establish a protocol agreement, with indigenous communities	Yes

Rationale - Interactions with and evidence of due diligence to prevent and mitigate negative impacts on communities is important globally, and takes on an additional dimension in regions where indigenous or aboriginal people or traditional territories are involved. In some jurisdictions, aboriginal groups have legal rights related to their territories. These shall be respected, as in Principle 1. It is also expected that operations seeking to meet the ASC Salmon Standard have directly consulted with bodies functioning as territorial governments and have come to agreement with indigenous governments, or are working towards an agreement, for farms that are operating in indigenous territories. The requirements are designed to be consistent with the United Nations Declaration on the Rights of Indigenous Peoples.

[150] All standards related to indigenous rights only apply where relevant, based on proximity of indigenous territories.

[151] To demonstrate an **active process**, a farm must show ongoing efforts to communicate with indigenous communities, an understanding of key community concerns and responsiveness to key community concerns through adaptive farm management and other actions.

Criterion 7.3 Access to resources

INDICATOR		REQUIREMENT
7.3.1	Changes undertaken restricting access to vital community resources[152] without community approval	None
7.3.2	Evidence of assessments of company's impact on access to resources	Yes

Rationale - Companies should make a maximum effort to not affect the surrounding community's access to vital resources as a result of its presence and activities. Some change in access is expected. What is to be prevented is an unacceptable degree of change.

[152] Vital community resources can include freshwater, land or other natural resources that communities rely on for their livelihood. If a farm site were to block, for example, a community's sole access point to a needed freshwater resource, this would be unacceptable under the ASC Salmon Standard.

INDICATORS AND REQUIREMENTS FOR SMOLT PRODUCTION

This section of the document contains the full suite of principles, criteria, indicators and requirements for responsible salmon farming at freshwater smolt sites.

SECTION 8: REQUIREMENTS FOR SUPPLIERS OF SMOLT

A farm seeking certification must have documentation from all of its smolt suppliers to demonstrate compliance with the following requirements.[153] The requirements are, in general, a subset of the requirements in Principles 1 through 7, focusing on the impacts that are most relevant for smolt facilities. In addition, specific requirements are applied to open systems (net pens), and to closed and semi-closed systems (recirculation and flow-through).

Requirements related to Principle 1

INDICATOR	REQUIREMENT
8.1 Compliance with local and national regulations on water use and discharge, specifically providing permits related to water quality	Yes
8.2 Compliance with labour laws and regulations	Yes

Rationale - Please see the relevant Rationale in Principle 1. The requirements do not require the smolt producer to provide confidential business documents such as tax documentation.

Requirements related to Principle 2

INDICATOR	REQUIREMENT
8.3 Evidence of an assessment of the farm's potential impacts on biodiversity and nearby ecosystems that contains the same components as the assessment for grow-out facilities under 2.4.1	Yes

[153] The SAD SC proposed this approach to addressing environmental and social performance during the smolt phase of production. In the medium term, the SC anticipates a system to audit smolt production facilities on site. In the meantime, farms will need to work with their smolt suppliers to generate the necessary documentation to demonstrate compliance with the standards. The documentation will be reviewed as part of the audit at the grow-out facility.

8.4 Maximum total amount of phosphorus released into the environment per metric ton (mt) of fish produced over a 12-month period (see Appendix VIII-1)	4 kg /mt of fish produced over a 12-month period

Rationale - Please see the relevant Rationale in Principle 2. See also the relevant Rationale related to Additional Requirements for both open net-pen smolt production and closed and semi-closed smolt production.

Requirements related to Principle 3

INDICATOR	REQUIREMENT
8.5 If a non-native species is being produced, the species shall have been widely commercially produced in the area prior to the publication[154] of the ASC Salmon Standard	Yes[155]
8.6 Maximum number of escapees[156] in the most recent production cycle	300[157] fish
8.7 Accuracy[158] of the counting technology or counting method used for calculating the number of fish	≥98%

Rationale - Please see the relevant Rationale in Principle 3.

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[154] **Publication**: Refers to the date when the final standards and accompanying guidelines are completed and made publicly available. This definition of publication applies throughout this document.

[155] Exceptions shall be made for production systems that use 100 percent sterile fish or systems that demonstrate separation from the wild by effective physical barriers that are in place and well-maintained to ensure no escapes of reared specimens or biological material that might survive and subsequently reproduce.

[156] Farms shall report all escapes; the total aggregated number of escapees per production cycle must be less than 300 fish.

[157] A rare exception to this standard may be made for an escape event that is clearly documented as being outside of the farm's control. Only one such exceptional episode is allowed in a 10-year period for the purposes of this standard. The 10-year period starts at the beginning of the production cycle for which the farm is applying for certification. The farmer must demonstrate that there was no reasonable way to predict the events that caused the episode. Extreme weather (e.g. 100-year storms) or accidents caused by farms located near high-traffic waterways are not intended to be covered under this exception.

[158] **Accuracy** shall be determined by the spec sheet for counting machines and through common estimates of error for any hand counts.

Requirements related to Principle 4

INDICATOR	REQUIREMENT
8.8 Evidence of a functioning policy for proper and responsible treatment of non-biological waste from production (e.g. disposal and recycling)	Yes
8.9 Presence of an energy-use assessment verifying the energy consumption at the smolt production facility (see Appendix V subsection 1 for guidance and required components of the records and assessment)	Yes, measured in kilojoule / t fish produced /production cycle
8.10 Records of greenhouse gas (GHG[159]) emissions[160] at the smolt production facility and evidence of an annual GHG assessment (See Appendix V, subsection 1)	Yes

Rationale - Please see the relevant Rationale in Principle 4.

Requirements related to Principle 5

INDICATOR	REQUIREMENT
8.11 Evidence of a fish health management plan, approved by the designated veterinarian, for the identification and monitoring of fish diseases and parasites	Yes
8.12 Percentage of fish that are vaccinated for selected diseases that are known to present a significant	100%

[159] For the purposes of this standard, **GHGs** are defined as the six gases listed in the Kyoto Protocol: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6).

[160] GHG emissions must be recorded using recognised methods, standards and records as outlined in Appendix V.

risk in the region and for which an effective vaccine exists[161]	
8.13 Percentage of smolt groups[162] tested for select diseases of regional concern prior to entering the grow-out phase on farm[163]	100%
8.14 Detailed information, provided by the designated veterinarian, of all chemicals and therapeutants used during the smolt production cycle, the amounts used (including grams per ton of fish produced), the dates used, which group of fish were treated and against which diseases, proof of proper dosing and all disease and pathogens detected on the site	Yes
8.15 Allowance for use of therapeutic treatments that include antibiotics or chemicals that are banned[164] in any of the primary salmon producing or importing countries[165]	None
8.16 Number of treatments of antibiotics over the most recent production cycle	≤ 3

[161] The farm's designated veterinarian is responsible for undertaking and providing written documentation of the analysis of the diseases that pose a risk in the region and the vaccines that are effective. The veterinarian shall determine which vaccinations to use and demonstrate to the auditor that this decision is consistent with the analysis.

[162] A **smolt group** is any population that shares disease risk, including environment, husbandry and host factors that might contribute to sharing disease agents for each group. Only diseases that are proven, or suspected, as occurring in seawater (and for which seawater fish-to-fish transmission is a concern) but originating in freshwater should be on the list of diseases tested. The designated veterinarian to the smolt farm is required to evaluate, based on scientific criteria and publicly available information, which diseases should be tested for. This analysis shall include an evaluation of whether clinical disease or a pathogen carrier state in fresh water is deemed to have a negative impact on the grow-out phase, thereby disqualifying a smolt group from being transferred. A written analysis must be available to the certifier on demand.

[163] Suitable measures must be in place to ensure that hatchery-raised seed are free from relevant/important pathogens before stocking for grow-out. This includes addressing on farm disease and parasite transfer (such as the ability to quarantine diseased stocks, separating equipment) as well as between the facility and natural fauna (such as disinfection of effluents for diseased stocks, fallowing). The approach should be relevant to the species, production system, scale of production, and legal requirements. Appropriate procedures or systems should include specific requirements or actions defined by the aquaculture facility through a suitable risk assessment or other evidence such as local or national regulations. Appropriate management measures in these cases could include treatment trigger levels of parasite numbers on the farm-facility or siting requirements that require that the aquaculture facility is located at suitable distances from wild populations. The CAB should verify that the management measures are suitable and employed.

[164] "**Banned**" means proactively prohibited by a government entity because of concerns around the substance.

[165] For purposes of this standard, those countries are Norway, the UK, Canada, Chile, the United States, Japan and France.

8.17 Allowance for use of antibiotics listed as critically important for human medicine by the WHO[166]	None[167]
8.18 Evidence of compliance[168] with the OIE *Aquatic Animal Health Code*[169]	Yes

Rationale - Please see the relevant Rationale in Principle 5.

Requirements related to Principle 6

INDICATOR	REQUIREMENT
8.19 Evidence of company-level policies and procedures in line with the labour standards under 6.1 to 6.11	Yes

Rationale - Please see the relevant Rationale in Principle 6.

Requirements related to Principle 7

INDICATOR	REQUIREMENT
8.20 Evidence of regular consultation and engagement with community representatives and organizations	Yes
8.21 Evidence of a policy for the presentation, treatment and resolution of complaints by community stakeholders and organizations	Yes

[166] The fifth edition of the WHO list of "Critically important antimicrobials for human medicine" was released in 2017 and is available at: http://apps.who.int/iris/bitstream/10665/255027/1/9789241512220-eng.pdf?ua=1 .

[167] If the antibiotic treatment is applied to only a portion of the pens on a farm site, fish from pens that did not receive treatment are still eligible for certification.

[168] **Compliance** is defined as farm practices consistent with the intentions of the Code, to be further outlined in auditing guidance. For purposes of this standard, this includes an aggressive response to detection of an exotic OIE-notifiable disease on the farm, which includes depopulating the infected site and implementation of quarantine zones in accordance with guidelines from OIE for the specific pathogen. Exotic signifies not previously found in the area or had been fully eradicated (area declared free of the pathogen).

[169] OIE 2017. Aquatic Animal Health Code. http://www.oie.int/en/international-standard-setting/aquatic-code/access-online/

8.22	Where relevant, evidence that indigenous groups were consulted as required by relevant local and/or national laws and regulations	Yes
8.23	Where relevant, evidence that the farm has undertaken proactive consultation with indigenous communities	Yes

Rationale - Please see the relevant Rationale in Principle 7.

Additional requirements for open (net-pen) production of smolt

In addition to the requirements above, if the smolt is produced in an open system, evidence shall be provided that the following is met:

INDICATOR		REQUIREMENT
8.25	Allowance for stocking smolts produced in cage-culture	Permitted only if supplying farms are 1) operated in a region where indigenous salmonids are present of the same species being cultivated and 2) the farm is certified to the ASC Freshwater trout Standard

Rationale - Due to the broader range of impacts associated with cage-culture smolt production in non-native regions, the ASC Salmon Standard prohibits the use of smolts produced in cage-culture in regions without indigenous salmonid species.

Using smolts produced from cage-culture is only allowed if they are produced in regions where indigenous salmonids are present of the same species being cultivated, and, if the farm is certified to the ASC Freshwater Trout Standard.

Additional requirements for semi-closed and closed production of smolts

Additionally, if the smolt is produced in a closed or semi-closed system (flow through or recirculation) that discharges into freshwater, evidence shall be provided that the following are met:[170]

INDICATOR		REQUIREMENT
8.26	Water quality monitoring matrix completed and submitted to ASC (see Appendix VIII-2)	Yes[171]
8.27	Minimum oxygen saturation in the outflow (methodology in Appendix VIII-2)	60%[172,173]
8.28	Macro-invertebrate surveys downstream from the farm's effluent discharge demonstrate benthic health that is similar or better than surveys upstream from the discharge (methodology in Appendix VIII-3)	Yes
8.29	Evidence of implementation of biosolids (sludge) Best Management Practices (BMPs) (Appendix VIII-4)	Yes

Rationale - Effluent from semi-closed and closed smolt facilities can have an environmental effect on rivers, streams and other bodies of water that receive the discharge. Phosphorus is the key limiting nutrient in most temperate and cool freshwater systems. It is a stable nutrient in that it does not volatilize like nitrogen compounds. It is also added to feeds in proportions that can allow estimations of other waste constituents (organic matter and nitrogen). Thus, phosphorus is an ideal variable to set load limits for freshwater aquaculture. The SAD developed the phosphorus load requirement (8.4) based on a unit of production, making it an indicator of how well a farm is minimising nutrient discharges per ton of fish produced. From an environmental standpoint, farms should aim for as low an annual load of phosphorus per ton of fish as possible. Farms can lower their phosphorus load on the environment by using a better feeding strategy (ratio and feed distribution), improving feed conversion efficiency through the improvement of the environmental conditions in the farm, utilizing feed that is more digestible and has lower phosphorus content, and by employing cleaning technologies such as settling ponds and filters. Smolt production facilities are encouraged to develop

[170] Production systems that don't discharge into fresh water are exempt from these standards.

[171] See Appendix VI for transparency requirements for 8.32.

[172] A single oxygen reading below 60 per cent would require daily continuous monitoring with an electronic probe and recorder for at least a week demonstrating a minimum 60 per cent saturation at all times.

[173] See Appendix VI for transparency requirements for 8.33.

methodologies to reduce their phosphorus burdens over time, while ensuring farmed fish are getting the appropriate nutrients to protect the health of the smolt.

In an attempt to limit the oxygen burden on natural water bodies from the release of nutrients, these requirements include a minimum saturation level of dissolved oxygen at discharge. Benthic biodiversity is often a measure of aquatic ecosystem health. These requirements use faunal surveys as a reference for a farm's actual impact on the environment. By comparing surveys downstream and upstream from the farm's effluent discharge, the requirement aims to isolate the impact of the production facility and ensure that no significant impact is occurring.

Biosolids are a mixture of organic waste and sediment produced or accumulated through the farming activity. Biosolids discharged into natural water bodies are of concern because solids can restrict light penetration in water bodies, accumulate downstream, cover plants and habitat, and cause general shallowing of water bodies. Additionally, the organic component of biosolids will exert an oxygen demand as the organic matter decays. The simplest and best way to minimise these impacts is to remove sediments from the water column and allow organic matter to decay prior to discharge. Functionally, this infers the use of settling basins or ponds to let solids settle out of the water column, and for bacterial decomposition and oxygen depletion to occur at the same time prior to disposal of biosolids. To provide assurance of appropriate disposal of biosolids, these requirements include a small number of BMPs. These requirements do not require a specific effluent monitoring regime beyond the dissolved oxygen requirement and benthic analyses. However, the requirements do require farms to submit to the ASC the results of the effluent monitoring they conduct as part of their regulatory requirements. In particular, the requirement requires data on any sampling of phosphorus, nitrogen, total suspended solids (TSS) and biological oxygen demand (BOD). This data will help to distinguish the performance of farms certified by this requirement over time and assist in revisions to the requirement.

Appendix I: Methodologies Related to Principle 2 and Benthic Testing

Subsections

1. Sampling methodology for calculation of faunal index, macrofaunal taxa, sulphide and redox, and copper
2. Calculation methodology for the percent fines in feed
3. Biodiversity-focused impact assessment
4. Methodology for sampling dissolved oxygen
5. Methodology for sampling nitrogen and phosphorous

Appendix I-1. Sampling methodology for calculation of faunal index, macrofaunal taxa, sulphide and redox, and copper[174]

Grab sampling for the faunal index, macrofaunal taxa measurements, and sulphide and redox should be conducted at nine stations in duplicate during peak cage biomass for the production cycle.

1. Two stations should be from the cage edge, one at each end of the long axis of the farm.
2. Three should be from within the Allowable Zone of Effect (AZE), 25 metres from the edge of the array of cages at slack tide measured with a marked line and recorded using GPS. Of these three, one should be upstream and one downstream with respect to the direction of the residual current, and the other should be to one side of the farm in a direction orthogonal to the residual current.
3. Three should be 25 metres outside the AZE, or 55 metres from the edge of the array of cages measured with a marked line and recorded using GPS. Of these, one should be upstream and one downstream with respect to the direction of the residual current, and the other should be to one side of the farm in a direction orthogonal to the residual current.
4. One from a reference site 500-1000 metres from the farm (edge of the array of cages), in similar water depth and substratum type (where this exists), and recorded using GPS.
5. For farm sites using a site-specific AZE, sampling locations shall be determined based on that AZE, at distances consistent from the boundary of the AZE as for other farms (e.g. five metres inside of AZE and 25 metres outside of the AZE, recorded using GPS, and in multiple directions as determined appropriate through the modelling.
6. Values for requirements in Criterion 2.1 must be calculated using the results of samples from the edge of the AZE and the reference point. The CAB shall confirm that the AZE is correct and then to default to the social principles (P6 and P7) to ensure the farm is responding to stakeholder comments with the intention that the AZE is not arbitrary and meets stakeholder expectations.

[174] When biomass is estimated at ≥75% until harvest the audit can take place according to this guidance.

For farms using copper-based nets or copper-treated nets, copper sampling shall be conducted at the same locations outside the AZE as the other benthic sampling, at three stations outside the AZE, in duplicate. The reference site used shall also be the same, and two additional reference sites are needed. Timing shall also be the same, sampling at peak cage biomass during the production cycle.

Although the site visit should coincide with harvest period, it may be undertaken before end of harvest (at >75% peak biomass) and estimates of indicators requiring data from peak biomass / end of cycle provided in the draft report. The CAB shall review actual figures before the certification decision is made and include these figures in the final report.

Methodology for auditing indicators relating to peak biomass and end of cycle:

1) CABs shall carry out site visit audit at >75% peak biomass.

2) At the time of the audit the farm shall provide the CAB with estimates of values at that date for indicators that rely on information only available with the farm reaches peak biomass / end of cycle. The Farm shall provide the CAB with values of samples taken at peak biomass and end of cycle when they become available.

3) CAB shall raise a non-conformity for indicators where estimated values are used instead of actual values and note the estimated value in the draft audit report. It shall be explained in the draft audit report where figures are estimated and explain that these are to be updated in the final audit report.

4) CAB shall review the actual values and supporting evidence when they come back at peak biomass / end of cycle in order to make a certification decision.

5) CAB shall not make a certification decision and issue final report until actual values are provided for all indicators except biotic indicators 2.1.2 and 2.1.3.

6) In the case that biotic values are not available at the time of drafting the final report the CAB shall carry out a risk assessment to evaluate whether the biotic values are likely to meet the ASC standard. If the CAB finds evidence that the results of the biotic analyses are likely to meet the ASC standard then certification can be granted.

7) The CAB shall review biotic findings at the surveillance audit and raise non-conformities as appropriate when results have been found not meet the ASC standard.

Appendix I-2. Calculation methodology for the percentage of fines in feed

Introduction

This method determines the fines (dust and small fragments) in finished fish feed product, which has a diameter of 3 mm or more.

The amount of dust and fragments shall be determined when the feed is delivered to the farming site.[175]

Procedure

The test can be performed either by use of a sieving machine or by a manual test.

The sample of feed shall be put through a sieve with a maximum sieve opening of:

1. 1 mm when the particle diameter is equal to 5 mm or less
2. 2.36 mm when the particle diameter is more than 5 mm

Manual test

1. Put the accumulation box and the sieves on top of each other, with the accumulation box on the lowest part, then the smallest sieve and the biggest on top
2. Place the sieves on the balance and tare it
3. Weigh at least 300 g of the feed on the upper sieve, note the weight (**m0**)
4. Put on the lid
5. Sieve the feed smoothly and carefully for about 30 seconds
6. Remove the lid and weigh what is left in the accumulation box
7. Use a brush to remove all the particles from the sieves
8. The feed particles that have passed through all sieves are called dust (**md**)
9. If the feed is fatty, or if dust is unevenly distributed, two replicates must be taken

Sifting machine

1. Put the accumulation box and the sieves on top of each other, with the accumulation box at the bottom and the biggest sieve on top
2. Place the sieves on the balance and tare it
3. Weigh at least 300 g of feed on the upper sieve, note the weight (**m0**)
4. Place the sieves on the sifting machine and then close the cover properly

[175] Feed can be sampled prior to delivery to farm site for sites where there is no feed storage.

5. Press the "START" button by holding it for 2-3 seconds, and then run the machine twice (2 x 1 min)
6. Remove the sieves and weigh what is left in the accumulation box
7. The feed particles that have passed through all sieves are called dust (md)

Calculations

1. Weight of feed before sieving = **m0**
2. Weight of feed that has passed through all sieves = **md**

   Dust % = (md / m0) x 100

Feed Sampling Protocol

Sampling of feed lots—delivered as material in bulk, big bags or small bags—shall, at a minimum, be sampled as follows:

1. Cut a minimum of six increment samples from the lot, evenly distributed throughout the lot
2. Each increment sample should have a mass of approximately 500 grams
3. Make a pooled sample from all the increment samples and be sure to use all sampled material (i.e., around 6 kg)
4. Reduce the pooled sample to one analysis sample (for testing), each of approximately 500 grams

Appendix I-3. Biodiversity-focused impact assessment

Requirement 2.4.1 requires the farm to demonstrate that a biodiversity-focused environmental impact assessment has been undertaken for the farm.

The assessment shall include habitats and species that could reasonably be impacted by the farm. For example, cold-water corals near the farm could be impacted by nutrients, or whale populations in the region could be impacted by acoustic deterrent devices.

The assessment shall incorporate:

1. Identification of proximity to critical, sensitive or protected habitats and species:
   a. This includes key wild species within the marine environment around the farm
   b. Particular attention to be paid to species listed on International Union for the Conservation of Nature (IUCN) or national threatened/endangered lists and on any areas that have been identified as HCVAs, areas important for conservation/biodiversity or the equivalent
   c. Sensitive species may include non-threatened species of high economic value in the area that may be affected by the salmon farm (e.g. lobsters)
2. Identification and description of the potential impacts the farm might have on biodiversity, with a focus on those habitats or species

3. Description of strategies and current and future program(s) underway on the farm to eliminate or minimise any identified impacts the farm may have, and for the monitoring of outcomes of said programs and strategies
4. Where damage of sensitive habitats has been caused by the farm (as defined in the impact assessment) previously and where restoration is possible and effective; restoration efforts will or have resulted in a meaningful amount of restored habitat; either through direct on-farm restoration or by an off-farm offsetting approach. Grandfathering of historical losses is allowed.

Appendix I-4. Methodology for sampling dissolved oxygen

Requirements 2.2.1 and 2.2.2 require the sampling of dissolved oxygen on the farm site and the calculation of the percent saturation for those samples.

- DO, salinity and temperature shall be measured twice daily (proposed at 6 am and 3 pm, but with recognition that this will vary depending on region and operational practices). Percent saturation shall be calculated for each sample from the data and a weekly average percent saturation shall result.
    - A minimal amount of missed samples due to extreme weather conditions will be considered acceptable.
    - Sampling once daily shall also be considered acceptable, though not preferred.
- DO shall be measured at a depth of five metres at a location where the conditions of the water will be similar to those the fish experience. For example, measurements can be taken at the edge of the net-pen array, in the downstream direction of the current, or off a feed shed or housing structure on the site. Measurements shall be taken at the same location, recorded with GPS, at the same time to allow for comparison between days.
- Weekly averages shall be calculated and remain at or above 70 per cent saturation.
- Should a farm not meet the minimum 70 per cent weekly average saturation requirement, the farm must demonstrate the consistency of percent saturation with a reference site. The reference site shall be at least 500 metres from the edge of the net pen array, in a location that is understood to follow similar patterns in upwelling to the farm site and is not influenced by nutrient inputs from anthropogenic causes including aquaculture, agricultural runoff or nutrient releases from coastal communities.

Appendix I-5. Methodology for sampling nitrogen and phosphorous

Under requirement 2.2.4, some farms are required to monitor nitrogen and phosphorous levels on the farm and at reference sites. Farms shall monitor total N, NH4NO3, total P and Ortho-P in the water column. Monitoring of nitrogen and phosphorous shall follow the following methodology or an equivalent:

- This sampling regime should be carried out monthly for the first year to create the baseline against which long term changes can be assessed.

- The N and P sampling shall then be conducted four times a year (quarterly), once during each of the seasons, with three replicate samples at the edge of the AZE and three at the reference site 500m downstream on each occasion.
- Samples should be taken using a VanDorn or Kemmerer type water sampler. 500 ml samples should be placed in clear plastic bottles, placed on ice and in a cooler, and analysed within 48 hours. Ideally, analyses shall be done by a private (third-party) laboratory following standard methods. However, Hach field kits can be used. Clear and detailed records or the sampling frequency and analytical results must be kept. For best practice, the samples from Hach kits should be sent periodically (e.g. once a quarter and at minimum once a year) to an independent laboratory for analysis to ensure consistency of results and ensure/establish quality control.

Appendix II: Area-Based Management (ABM) Scheme

Subsections

1. Attributes and Required Components of the ABM

2. Setting and Revising ABM Lice Loads and On-farm Lice Levels

Appendix II-1. Attributes and required components of the ABM

Participation in an area-based scheme[176] for managing disease and parasites and resistance to treatments is required under the ASC Salmon Standard. This appendix outlines the main components of the area-based management scheme that the ASC Salmon Standard requires under Criteria 3.1 and 5.4.

The purpose of the area-based management scheme is to improve health and biosecurity management on the farm, with the ultimate goal of minimising potential negative impacts on wild populations.

II-1. A Definition of "area"

If area-based management is already a regulatory requirement of the farm's jurisdiction, then farms will use this definition of "area" for the purposes of these requirements. In jurisdictions where ABM is not a regulatory requirement, the area covered under the ABM must reflect a logical geographic scope such as a fjord or a collection of fjords that are ecologically connected. The boundaries of an area should be defined, taking into account the zone in which key cumulative impacts on wild populations may occur, water movement and other relevant aspects of ecosystem structure and function.

II-1. B Requirements related to participation in the scheme

Within the defined area, at least 80 per cent of farmed production (by weight) must participate in the area-based management scheme, even if not all farms are seeking certification under this requirement. Without the vast majority of farms participation, the scheme will likely be ineffective. All farms owned by the company applying for certification in the area must participate in the ABM, though not all must be applying for certification.

II-1. C ABM components and guidance

In order to be considered as applicable under the ASC Salmon Standard, the ABM scheme used by a farm must ensure that there is:

1. Clear documentation of the farms/companies included in the ABM, contact people (including contact information) and mechanisms for communication
2. Development and documentation of shared disease management goals and objectives for the ABM. Goals shall include components related to understanding and minimising risk of on-farm disease to wild fish. Objectives shall be updated regularly based on new information, including

[176] For more information on the principles of place-based or area-based management, see Young et al., 2007. Solving the Crisis in Ocean Governance: Place-Based Management of Marine Ecosystems. Environment: Volume 49, Number 4, pages 20–32.

concerns raised to the farms in the ABM from communities and wild fish interests are part of company engagement with stakeholders as outlined under 7.1.1.

3. Information and data-sharing among farms of any data needed to ensure coordination, including plans for stocking and fallowing; on-farm disease and parasite monitoring results including sea lice numbers; suspicion of an unidentifiable transmissible agent, information on therapeutic treatments; and data on resistance including information related to treatments not being as effective as expected.

The ABM scheme must include coordination among farms as relates to:

1. Application and rotation of treatments:
    a. Farmers must be able to demonstrate a coordinated treatment plan and evidence that the schedule and rotation of treatments are being implemented.
    b. Consideration of the cumulative use, and potential risks[177] of this use, of antibiotics classified as "highly important" by the WHO[178] is a required component of coordination and information-sharing about treatments.
    c. Where applicable, treatments and/or strategic harvesting of salmon is coordinated prior to outmigration of wild salmonids to ensure minimal on-farm lice levels at this sensitive time period for those species (as has been determined under 3.1.5).
    d. Tracking of cumulative use of parasiticides (by chemical, annually and by production cycle) within the ABM.
2. Stocking: Records must demonstrate that all stocked fish within the ABM are of the same year class and that stocking dates were coordinated with other farms.
3. Fallowing: Coordination of fallowing between each production cycle to help break disease cycles, with a clear period of time when there are no farmed salmon in the area in the water.
4. Monitoring schemes:
    a. On-farm disease and pathogen monitoring and information sharing among farms
    b. On-farm resistance monitoring and information sharing among farms
    c. For farms located in areas where there are wild salmonids, monitoring of wild salmonid populations that is relevant for the area must occur as specified under 3.1.6, either under the auspices of the ABM or under some other auspices
5. Setting and revising a maximum ABM lice load:
    a. The entire ABM scheme will set a maximum lice load, expressed as total mature female lice on all farms in the area. In areas of wild salmonids, the ABM scheme must demonstrate how the scheme incorporates the results of wild monitoring into revisions of this total lice load over time (see Section 2 below for additional details on this feedback loop).

[177] Assessment of risk shall take into account the cumulative use of these antibiotics from salmon production within the area in order to assess the potential risk to human health from the development of resistance in the environment. Prescribing antibiotics highly important for human health shall be considered as a last resort.

[178] The fifth edition of the WHO list of "Critically important antimicrobials for human medicine" was released in 2017 and is available at: http://apps.who.int/iris/bitstream/10665/255027/1/9789241512220-eng.pdf?ua=1 .

Appendix II-2. Setting and revising ABM lice loads and on-farm lice levels

Requirement 3.1.3 requires that the ABM scheme set a maximum lice load. A core purpose of this requirement is to be able to see the potential cumulative infection pressure from on-farm lice, expressed as the number of mature female lice on all farms in the scheme. This "total load" figure is a better reflection of the potential risks to wild populations than on-farm lice levels, measured as lice per farmed fish.

An ABM scheme shall initially set this total load figure based on the regulatory obligations of the jurisdiction in which it operates and the results of any wild monitoring done to date. In practice, this would mean that farms in most ABM schemes would take the on-farm lice levels they are required to achieve by regulators, and multiply them times the number of farmed fish in the area. This would be a starting place.

For farms located in areas of wild salmonids, the ABM scheme shall demonstrate how the scheme is using the results of wild monitoring to review and potentially revise the maximum lice load for the area each year and/or production cycle. Adjustments to the area's lice load would lead to corresponding limits on lice levels on individual farms. This feedback loop must be transparent and document how the ABM scheme is being protective of wild fish through the interpretation of wild monitoring data. Given the time lag in collecting and analysing data from wild monitoring, it is expected that the ABM scheme will look at data from previous periods, particularly sensitive periods such as outmigration of wild salmon juveniles.

Requirement 3.1.7 requires farms seeking certification to maintain on-farm lice levels at 0.1 mature female lice (leps) during and immediately prior to sensitive periods, particularly outmigration of wild juvenile salmon. The results of wild monitoring must inform this level over time, with a similar type of feedback loop as described for the ABM total lice level. If wild monitoring reveals that 0.1 mature female lice are not being protective of wild populations, the farm must set a lower level in subsequent sensitive periods. Conversely, data from wild monitoring that consistently demonstrates healthy wild populations would allow a farm to make the case for a level higher than 0.1. This case would need to be made for the ABM as a whole to the Technical Advisory Group of the ASC.

Appendix III: Methodologies and Thresholds Related to Monitoring Wild Salmonids

Appendix III-1. Methodologies for monitoring wild salmonids

The ASC Salmon Standard requires all farms located in areas of wild salmonids to participate in monitoring of sea lice on wild salmonids. The purpose of this monitoring is to assist in clarifying the link between the health of wild and farmed fish through objective information. These requirements do not demand a specific methodology for this monitoring. Nonetheless, the monitoring must comply with the following requirements:

- The methodology, the results and the analysis are made publicly available and demonstrate scientific rigor in the sampling size, location and method.
- Monitoring must be geographically relevant to the area where the farm/ABM is located, so it provides meaningful information for ABM management practices.
- The process must involve third parties beyond the farm, such as independent scientists. Government programs, in which the company may be contributing little or nothing are acceptable, given the programme is geographically relevant.
- Numbers of lice per wild fish, and prevalence of lice are both meaningful metrics that could be considered in the research.
- Species should be chosen based on importance to area (i.e., sea trout vs. salmon vs. arctic char).

Appendix IV: Feed Resource Calculations and Methodologies

Subsections

1. Forage Fish Dependency Ratio calculation
2. Calculation of EPA and DHA in feed
3. Explanation of FishSource scoring

Appendix IV-1. Forage Fish Dependency Ratio calculation

Feed Fish Dependency Ratio (FFDR) is the quantity of wild fish used per quantity of cultured fish produced. It is expected that the CABs raise major NCRs when FFDRs do not meet ASC requirements. This measure can be calculated based on fishmeal (FM) and/or fish oil (FO). In the case of salmon currently, in most cases the FFDR for fish oil will be higher than that for fishmeal. The dependency on wild forage fish resources shall be calculated for both FM and FO using the formulas noted below. This formula calculates the dependency of a single site on wild forage fish resources, independent of any other farm.

$$FFDR_m = \frac{(\%\ fishmeal\ in\ feed\ from\ forage\ fisheries) \times (eFCR)}{24}$$

$$FFDR_o = \frac{(\%\ Fish\ oil\ in\ feed\ from\ forage\ fisheries) \times (eFCR)}{5.0\ or\ 7.0, depending\ on\ source\ of\ fish}$$

Where:

1. Economic Feed Conversion Ratio (eFCR) is the quantity of feed used to produce the quantity of fish harvested (net production is the live weight).

$$eFCR = \frac{Feed, kg\ or\ mt}{Net\ aquacultural\ production, kg\ or\ mt\ (wet\ weight)}$$

i.

2. The percentage of fishmeal and fish oil excludes fishmeal and fish oil derived from fisheries' by-products.[179] Only fishmeal and fish oil that is derived directly from a pelagic fishery (e.g. anchoveta) or fisheries where the catch is directly reduced (such as krill or blue whiting) is to be included in the calculation of FFDR. Fishmeal and fish oil derived from fisheries' by-products (e.g. trimmings and offal) should not be included because the FFDR is intended to be a calculation of direct dependency on wild fisheries.

[179] Trimmings are defined as by-products when fish are processed for human consumption or if whole fish is rejected for use of human consumption because the quality at the time of landing do not meet official regulations with regard to fish suitable for human consumption. Restrictions on what trimmings are allowed for use under the standard are under 4.3.4.

3. The amount of fishmeal in the diet is calculated back to live fish weight by using a yield of 24%.[180] This is an assumed average yield.
4. The amount of fish oil in the diet is calculated back to live fish weight by using an average yield in accordance with this procedure:
    a. Group a - Fish oil originating from Peru and Chile and Gulf of Mexico, five per cent yield of fish oil
    b. Group b - Fish oil originating from the North Atlantic (Denmark, Norway, Iceland and the UK) seven per cent yield of fish oil
    c. If fish oil is used from other areas than mentioned above, they should be classified as belonging to group a if documentation shows a yield less than six per cent, and into group b if documentation shows a yield more than six per cent.
5. FFDR is calculated for the grow-out period in the sea as long as the smolt phase does not go past 200 grams per smolt. If the smolt phase goes past 200g then FFDR is calculated based on all feed used from 200 grams and onwards. If needed, the grow-out site shall collect this data from the smolt supplier.

Appendix IV-2. Calculation of EPA and DHA in feed

In order to demonstrate compliance with the requirement related to the maximum amount EPA and DHA from direct forage fisheries in the feed, the calculations shall be done according to the following formula:

$$\text{Grams of EPA and DHA in feed} = \frac{((\text{grams of fish oil per kg feed}) \times (\%\text{ of EPA and DHA in fish oil}))}{100}$$

Where:

1. If the fish oil content varies in different feeds used during the production cycle, a weighted average can be used. The grams of fish oil relate to fish oil originating from forage fisheries for industrial purposes.
2. The content of EPA and DHA of the fish oil shall be calculated using the average figures:
    a. group a - Fish oil originating from Peru and Chile and Gulf of Mexico, 30 per cent EPA and DHA in fish oil
    b. group b - Fish oil originating from the North Atlantic (Denmark, Norway, Iceland and UK) 20 per cent EPA and DHA in fish oil

[180] Reference for FM and FO yields: Péron, G., et al. 2010. Where do fishmeal and fish oil products come from? An analysis of the conversion ratios in the global fishmeal industry. Marine Policy, doi:10.1016/j.marpol.2010.01.027.

c. If fish oil is used from other areas than mentioned above, they should be classified as belonging to group a if analyses of EPA and DHA is above 25 per cent, and into group b if analyses of EPA and DHA is below 25 per cent.

Analyses of EPA and DHA are the percentage of fatty acids in the oil that are EPA and DHA. In the calculation above, we make the simplification that 100 per cent of the oil consists of fatty acids. EPA and DHA originating from fish oil originating from by-products and trimmings are not included in the calculation above. The feed producer can justify and demonstrate the amount of fish oil coming from trimmings and by-products by using a percentage of fish oil originating from trimmings based on information from purchases in an annual year, either using information related to the current year when the feed is produced or the previous year.

Appendix IV-3. Explanation of FishSource scoring

FishSource scores provide a rough guide to how a fishery stacks up against existing definitions and measures of sustainability. The FishSource scores currently only cover five criteria of sustainability, whereas a full assessment—such as that by the Marine Stewardship Council (MSC)—will typically cover more than 60. As such, the FishSource scores are not a firm guide to how a fishery will perform overall. Nonetheless, the FishSource scores do capture the main outcome-based measures of sustainability.

FishSource scores are based on common measures of sustainability, as used by the International Council for the Exploration of the Seas, the National Marine Fisheries Service and the MSC, among others (e.g. current fishing mortality relative to the fishing mortality target reference point, or current adult fish biomass relative to its maximum sustainable yield (B_{msy})).

Components of the FishSource score

Issue	Measure	Underlying Ratio
Is the management strategy precautionary?	Determine whether harvest rates are reduced at low stock levels	$F_{advised}/F_{target\ reference\ point}$ or $F_{actual}/F_{target\ reference\ point}$
Do managers follow scientific advice?	Determine whether the catch limits set by managers are in line with the advice in the stock assessment	Set TAC / Advised TAC
Do fishers comply?	Determine whether the actual catches are in line with the catch limits set by managers	Actual Catch / Set TAC
Is the fish stock healthy?	Determine if current biomass is at long-term target levels	SSB/B_{40} (or equivalent)
Will the fish stock be healthy in future?	Determine if current fishing mortality is at the long-term target level	$F/F_{target\ reference\ point}$

If existing measures of sustainability consider a fishery to be relatively well-managed, then it will typically score eight or more out of 10 on FishSource. If the fishery is judged to be doing okay, but

requires improvement, then it will typically score between six and eight on FishSource. A fishery falling short of minimum requirements of existing measures of sustainability is scored six or below, with the score declining as the condition of the fishery deteriorates.

The key relation between the MSC scoring system and FishSource scores is “80 <-> 8”. For example, a FishSource score of eight or above would mean an unconditioned passing for that particular aspect on the MSC system. Sustainable Fisheries Partnership devised scores in a way that, departing from eight, a score of six relates to a score of 60, and below six, an MSC “below 60”, “no-pass” condition. Please note, however, that the MSC criteria have been interpreted through time with a substantial degree of variability among fisheries.

More information on FishSource is available at www.fishsource.com, and an overview of the FishSource indices is available at http://www.fishsource.org/indices_overview.pdf.

About scoring and availability of product meeting a minimum score

A typical full assessment of a fishery through the MSC will include significantly more areas/criteria assessed than through FishSource, typically including more than 60 sustainability criteria. A fishery is deemed sustainable by the MSC if it scores 60 or more in every performance indicator, and an average of 80 or more at the principle level. The MSC requires certified fisheries to take corrective actions to improve any areas of the fishery that scored between 60 and 80, with the intention of achieving a score of 80 or above in every area of the fishery.

As of May 2011, FishSource released updated information on the ratings of the 25 principal forage fisheries around the Atlantic and South America in their “Reduction Fisheries League Table 2011.” Ten of the 25 fisheries met a minimum FishSource score of six in all categories with a minimum score of eight in the biomass category. These ten fisheries had a total combined 2009 catch of 9157 thousand mt, accounting for just over 66 per cent of the total catch of those 25 forage fisheries.

The ratings of fisheries under the FishSource methodology will change over time based on the performance of those fisheries. Farms undergoing certification and feed companies should be attuned to updates of the “Reduction Fisheries League Table” and use the latest version publicly available. Auditing guidelines will be developed around the timing of purchasing of fishmeal and fish oil and the updates of the ratings to ensure reasonable interpretation of the requirement and timing of shifts in purchasing if a fishery’s performance declines to a point where it fails to meet the minimum score needed under the requirement.

Appendix V: Energy Records and Assessment

Subsections

1. Energy use assessment and greenhouse gas (GHG) accounting for farms
2. GHG accounting for feed

Appendix V-1. Energy use assessment and GHG accounting for farms

The ASC encourages companies to integrate energy use assessments and GHG accounting into their policies and procedures across the board in the company. However, this requirement only requires that operational energy use and GHG assessments have been done for the farm sites that are applying for certification.

Assessments shall follow either the GHG Protocol Corporate Standard or ISO 14064-1 (references below). These are the commonly accepted international requirements, and they are largely consistent with one another. Both are also high level enough not to be prescriptive and they allow companies some flexibility in determining the best approach for calculating emissions for their operations.

If a company wants to go beyond the requirement of the ASC Salmon Standard and conduct this assessment for their entire company, then the full protocols are applicable. If the assessment is being done only on sites that are being certified, the farms shall follow the GHG Protocol Corporate Standard and/or ISO 14064-1 requirements pertaining to:

- Accounting principles of relevance, completeness, transparency, consistency and accuracy
- Setting operational boundaries
- Tracking emissions over time
- Reporting GHG emissions

Regarding the operational boundaries, farm sites shall include in the assessment:

- Scope 1 emissions, which are emissions that come directly from a source that is either owned or controlled by the farm/facility.
    - For example, if the farm has a diesel generator, this will generate Scope 1 emissions. So will a farm-owned/-operated truck.
- Scope 2 emissions, which are emissions resulting from the generation of purchased electricity, heating, or cooling.

Quantification of emissions is done by multiplying activity data (e.g. quantity of fuel or kwh consumed) by an emission factor (e.g. CO2/kwh). For non-CO2 gases, you then need to multiply by a Global Warming Potential (GWP) to convert non-CO2 gases into the CO2-equivalent. Neither the GHG Protocol nor the ISO require specific approaches to quantifying emissions, so the ASC Salmon Standard provides the following additional information on the quantification of emissions:

- Farms shall clearly document the emission factors they use and the source of the emission factors. Recommended sources include the Intergovernmental Panel on Climate Change (IPCC) or factors provided by national government agencies such as the United States Environmental Protection Agency (USEPA). Companies shall survey available emission factors and select the one that is most accurate for their situation, and transparently report their selection.

- Farms shall clearly document the GWPs that they use and the source of those GWPs. Recommended sources include the IPCC 2nd Assessment Report, on which the Kyoto Protocol and related policies are based, or more recent Assessment Reports.

References:

- GHG Protocol Corporate Standard Website: http://www.ghgprotocol.org/standards/corporate-standard
- ISO 14064-1 available for download (with fee) at http://www.iso.org/iso/catalogue_detail?csnumber=38381
- Some information on ISO 14064-1 is at http://www.iso.org/iso/pressrelease.htm?refid=Ref994
- IPCC 2nd Assessment Report: http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf
- All IPCC Assessment Reports: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

Appendix V-2. GHG accounting for feed

The requirement requires the calculation of the GHG emissions for the feed used during the prior production cycle at the grow-out site undergoing certification. This calculation requires farms to multiply the GHG emissions per unit of feed, provided to them by the feed manufacturer, by the amount of feed used on the farm during the production cycle.

The feed manufacturer is responsible for calculating GHG emissions per unit feed. GHG emissions from feed can be calculated based on the average raw material composition used to produce the salmon (by weight) and not as documentation linked to each single product used during the production cycle.

The scope of the study to determine GHG emissions should include the growing, harvesting, processing and transportation of raw materials (vegetable and marine raw materials) to the feed mill and processing at feed mill. Vitamins and trace elements can be excluded from the analysis. The method of allocation of GHG emissions linked to by-products must be specified.

The study to determine GHG emissions can follow one of the following methodological approaches:

1. A cradle-to-gate assessment, taking into account upstream inputs and the feed manufacturing process, according to the GHG Product Standard
2. A Life Cycle Analysis following the ISO 14040 and 14044 requirements for life cycle assessments

Should the feed manufacturer choose to do a cradle-to-gate assessment:

1. It shall incorporate the first three phases from the methodology, covering materials acquisition and processing, production, and product distribution and storage (everything upstream and the feed manufacturing process itself).

Should the manufacturer follow the ISO 14040 and 14044 requirements for Life Cycle Assessment:

1. Feed manufacturers may follow either an ISO-compliant life cycle assessment methodology or the GHG Protocol product standard.

Regardless of which methodology is chosen, feed manufacturers shall include in the assessment:

- Scope 1 emissions, which are emissions that come directly from a source that is either owned or controlled by the farm/facility.
- Scope 2 emissions, which are emissions resulting from the generation of purchased electricity, heating or cooling.
- Scope 3 emissions, which are emissions resulting from upstream inputs and other indirect emissions, such as the extraction and production of purchased materials, following the Scope 3 standard.

Quantification of emissions is done by multiplying activity data (e.g. quantity of fuel or kwh consumed) by an emission factor (e.g. CO2/kwh). For non-CO2 gases, you then need to multiply by a Global Warming Potential (GWP) to convert non-CO2 gases into CO2-equivalent. The ASC Salmon Standard provides the following additional information on the quantification of emissions:

- Farms shall clearly document the emission factors they use and the source of the emission factors. Recommended sources include the IPCC or factors provided by national government agencies, such as the USEPA. Companies shall survey available emission factors and select the one that is most accurate for their situation, and transparently report their selection.
- Farms shall clearly document the GWPs that they use and the source of those GWPs. Recommended sources include the IPCC 2nd Assessment Report, on which the Kyoto Protocol and related policies are based, or more recent Assessment Reports.

References:

- GHG Product Standard: http://www.ghgprotocol.org/product-standard
- ISO 14044 available for download (with fee) at: http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=38498
- Some information on ISO 14064-1 is at: http://www.iso.org/iso/pressrelease.htm?refid=Ref994
- IPCC 2nd Assessment Report: http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf
- All IPCC Assessment Reports: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

Appendix VI: Transparency of Farm-Level Performance Data

The farm must provide evidence that it has submitted to ASC in the requested format the following information about its environmental and social performance.

Information pertaining to biomass and or stocking from which production volumes, timing and financial information can be extracted or inferred should be considered confidential in order to not put certified companies at a competitive disadvantage. Information related to production volumes or harvest timing may be made public with a time delay (e.g. if released post-harvest and sale).

Item	Option	Relevant Requirement	Measurement	Units	Measurement Frequency	Calculations and Sampling Methodologies, Additional Notes
1			Species in production	species		
2	a	2.1.1	Redox potential	mV	production cycle	Appendix I-1
	b		Sulfide levels	µMol/L	production cycle	Appendix I-1
3	a	2.1.2	AZTI Marine Biotic Index (AMBI)	AMBI score	production cycle	Appendix I-1
	b		Shannon-Wiener Index	S-WI score	production cycle	Appendix I-1
	c		Benthic Quality Index (BQI)	BQI score	production cycle	Appendix I-1
	d		Infaunal Trophic Index (ITI)	ITI score	production cycle	Appendix I-1
4		2.1.3	# of microfaunal taxa	#	production cycle	Appendix I-1
5		2.2.1	Average % DO saturation	%	weekly	Appendix I-4
6		2.2.2	Max % samples under 1.85 mg/L DO	%	weekly	Appendix I-4
7		2.2.4	Nitrogen monitoring	mg N/L	quarterly	Appendix I-5
8		2.2.4	Phosphorous monitoring	mg P/L	quarterly	Appendix I-5
9		2.2.5	Calculated BOD		production cycle	Footnote in 2.2.5
10		2.5.2	# days ADDs/AHDs	#	ongoing[181],	

[181] Ongoing: Logged as needed or as occurs. Data shall be logged such that it can be analysed on both an annual and a production cycle basis. This definition of "ongoing" applies throughout Appendix VI.

Item	Option	Relevant Requirement	Measurement	Units	Measurement Frequency	Calculations and Sampling Methodologies, Additional Notes
11		2.5.5 and 2.5.6	Lethal incidents of marine mammals and birds	#, species and cause per episode	ongoing	To be made publicly available (e.g. on web) by farming company shortly after incident
12		3.1.1	Fallowing period	dates		
13		3.1.3	Maximum sea lice load set for the ABM	number	annual	Appendix II and III
14		3.1.4 and 3.1.7	Weekly, on-farm sea lice levels		weekly	To be made directly publicly available by farming company within a week
15		3.1.6	In areas of wild salmonids, monitoring of sea lice on out-migrating salmon juveniles or costal sea trout			Appendix III, to be made publicly available within eight weeks of completion of monitoring
16		3.4.1-3.4.2	Escapes data	# episodes	production cycle	
				date of episode	ongoing	
				cause of episode	ongoing	
				# escapees per episode	ongoing	
				# total escapees	production cycle	
17		3.4.2	Counting technology accuracy	%	production cycle	Footnote 58
		3.4.3	Estimated unexplained loss	#	production cycle	Footnote 59
18		4.2.1	FFDR fishmeal (during grow-out)	FFDRm	production cycle	Appendix IV

Item	Option	Relevant Requirement	Measurement	Units	Measurement Frequency	Calculations and Sampling Methodologies, Additional Notes
19	a	4.2.2	FFDR fish oil (during grow-out)	FFDRo	production cycle	Appendix IV
	b		Max amount EPA and DHA	g/kg feed	production cycle	Appendix IV
20		4.4.3	Transgenic feed ingredients	Y/N	production cycle	
21		4.6.1	Energy use	kJ/mt fish	production cycle	Appendix V-1
22		4.6.2	GHG emissions on farm		annual	Appendix V-1
23		4.6.3	GHG emissions of feed		production cycle (not immediately applicable)	Appendix V-2
24		4.7.1	Copper-based antifoulants	Y/N	production cycle	
25		4.7.3 and 4.7.4	Results of copper sampling (outside AZE and at reference sites), if required	mg Cu/kg sediment	production cycle	Appendix I-1
26		5.1.5	Total mortality of farmed fish	%	ongoing	
27		5.1.4	Cause of mortalities (post-mortem analysis)	# mortalities per cause or disease	ongoing	
28		5.1.6	Maximum unexplained mortalities	% of total mortality	production cycle	
29		5.2.1	Amount of each chemical/therapeutant used for each (antibiotics, parasiticides, etc.)	product name	ongoing	Also 5.2.9
				active component name	ongoing	
				reason for use	ongoing	
				date	ongoing	
				kg	ongoing	
				t fish treated	ongoing	
				dosage	ongoing	

Item	Option	Relevant Requirement	Measurement	Units	Measurement Frequency	Calculations and Sampling Methodologies, Additional Notes
				# of treatments	ongoing	
				WHO classification (antibiotics only)	ongoing	
30		5.2.7	Reduction in WNMT	%	per 2 year after first audit after effective date	
			Amount of each parasiticide used	product name	ongoing	
				Active component name	ongoing	
				date	ongoing	
				kg	ongoing	
				t fish treated	ongoing	
				dosage	ongoing	
				Application method	ongoing	
				# of treatments	ongoing	
31		5.2.6	Weighted Number of Medicinal Treatments (WNMT)	No.	WNMT	Appendix VII
32		5.2.8	Results of environmental monitoring of benthic parasiticide levels	Name of active ingredient and/or residue found		Public disclosure of results within 30 days of findings
33		5.2.10	Antibiotic load compared to two previous production cycles, if required	kg	production cycle	Starting June 2017
34		5.4.2	Unidentifiable transmissible agent	Date(s) concern raised; disease detected from monitoring (if applicable)	ongoing	Public disclosure of results of surveillance within 30 days of findings

Item	Option	Relevant Requirement	Measurement	Units	Measurement Frequency	Calculations and Sampling Methodologies, Additional Notes
35		5.4.4	OIE-notifiable disease detected on farm	Disease(s), exotic or endemic, and detection date(s)	ongoing	Public disclosure of detection and results of surveillance within 30 days of findings
36		Section 8	Type of smolt production system	Open, semi or closed	production cycle	
37		8.32 and 8.33	Monitoring results from water quality analyses	See Appendix VIII-2		

Appendix VII: Parasiticide Treatment Methodology

Continuous reduction of applying medicinal parasiticide treatments

The ASC Salmon Standard requires farms to continuously reduce the number of medicinal treatments applied in treating sealice, a persistent marine ectoparasite. The ultimate vision is to no longer having to treat sealice with medicinal treatments. However, at the same time it is also recognised that this scenario is not yet achievable for the far majority of the industry at this moment in time.

In order to incentivise the development and implementation of non-medicinal measures (e.g. biological and mechanical control), the relevant indicators under Criteria 5.2 require farms to meet an Entry Level (EL) that expresses the Weighted Number of Medicinal Treatments (WNMT), after which a fixed rate of reduction needs to be achieved until the WNMT meets the defined Global Level (GL).

Parallel to the improvement process as described above, the Standard requires that farms apply Integrated Pest Management (IPM) in order to mitigate in an effective manner.

This Appendix gives more detail on the various concepts referenced above, as well as providing metric levels that relate to the EL, GL and rate of reduction.

Weighted Number of Medicinal Treatments (WNMT)[182]

The Weighted Number of Medicinal Treatment frequency is the total number medicinal parasiticide treatments applied over the production cycle, within the UoC. Partial treatments should be counted as a proportion of the cages treated.

Some examples are given on how to count the WNMT, e.g.

- treating an entire farm (all cages) once, counts as WNMT = 1;
- treating 1 cage, out of 10, once, will count as WNMT = 0.1;
- treating 1 cage, out of 10, twice (i.e. two unique treatments), will count as WNMT = 0.2;
- treating 5 cages, out of 20, once, will count as WNMT = 0.25.

Additional considerations:

1. Hydrogen peroxide (H_2O_2) must be considered as medicinal parasiticide treatment and thus be included in the WNMT-count;
2. If a *single* bath-treatment is prescribed to be applied as “coupled-treatment” (i.e. one treatment at t_1 and a follow-up treatment at t_2), then each treatment (t_1 and t_2) must be included in the WNMT-count.

Some more examples are given on how to count the WNMT, e.g.

- treating 1 cage, out of 10, once with hydrogen peroxide (H_2O_2), will count as WNMT = 0.1;

[182] Medicinal parasiticide includes hydrogen peroxide.

- treating 1 cage, out of 10, once with hydrogen peroxide (H_2O_2) as a coupled-treatment, will count as WNMT = 0.2;

Defining Entry Level (EL) and Global Level (GL)

A detailed statistical study was conducted and reviewed by a Technical Working Group in order to understand the regional characteristics of the number of sealice treatments applied per production cycle within the various production regions. The study, including the used data (in Excel) is publicly available on the ASC-website.

In summary, the study used 4 datasets, resulting in N = 896 data points. The data sets covered the following production regions: West Canada (BC), Chile, Faroe Islands, Ireland, Norway and Scotland. Subsequently, the study established distribution curves of the number of medicinal treatments applied per region and one global curve on the basis of N = 896.

On the basis of the 50th percentile for each of the regional curves, regional WNMT-numbers are set that form an Entry Level for farms in that region. Farms must be below, or at, EL for compliance. The results are presented in the table below:

Region	Entry Level (WNMT)	Global Level (WNMT)
Canada (BC)	1	3*
Chile	9	
Faeroes	6	
Ireland	3	
Norway	5	
Scotland	9	

Table: Regional Entry Level and Global Level (both in WNMT)

* GL is set at 3 WNMT, unless twice a "coupled-treatment" is applied (counted as 2*2 = 4 WNMT), then GL = 4 WNMT applies. In case of this exception, additional medicinal treatments applied will result in exceedance of GL=4

In addition to the defined regional Entry Levels, a Global Level (GL) was determined as well. It is required that farms progress from EL to GL according to a fixed timeframe. The GL is based on the 20-25th percentile of the used overall dataset. This resulted into GL = 3 WNMT. However, some bath-treatments are given as "coupled-treatment" (as per above), which with a GL = 3, could result into having a part of the treatment falling beyond GL = 3. In order to reflect the realities of applying these coupled-treatments, an exception is defined in case two times a coupled-treatment is applied. For this specific situation, GL = 4 WNMT applies. Situations that do not meet this exception, shall apply GL = 3 WNMT.

Reducing from EL to GL

It is required for farms to reduce from ≤EL to GL by means of a fixed rate of reduction. This rate is determined at 25% WNMT per 2-year.

Integrated Pest Management (IPM)

Integrated Pest Management (IPM) has long been recognised as being critical to effective and robust sea lice management. IPM is based upon the implementation of a number of proven techniques and approaches developed for pest management in terrestrial agriculture systems, often with the central aim of slowing the development of drug resistance in pest species.

The strategy of IPM generally involves coordinated application and integrated use of all available management practices, with surveillance, communication and cooperation between operators within a defined area. IPM seeks in particular to reduce reliance upon medicinal treatments, thus reducing scope for development of drug resistance and is therefore a process that ASC intends to promote.

The ASC Salmon Standard already contains several aspects of IPM through its current Criteria and Indicators, namely:

- Adherence to relevant thresholds/limits on sea lice levels and required action (Ind. 3.1.4)
- Regular counting and reported of sea lice levels (Ind. 3.1.7)
- Maintenance of treatment records (Appendix VI)
- Single year-class stocking (Ind. 5.4.1)
- Fallowing between cycles (Ind. 3.1.1)
- Health management / veterinary health plan (Ind. 5.1.1)
- Cleaning of nets to increase water flow
- Routine removal of moribund fish (Ind. 5.1.3)
- Monitoring of fish state (*e.g*. behaviour – 5.1.1)
- Monitoring and control of other fish diseases (Ind. 5.1.1)
- Strategic use of medicines *i.e.* the appropriate medicine used for the targeted stage/s of lice (Ind. 5.1.1)
- Medicine rotation, where possible (Crit. 5.3)
- Medicine resistance surveillance (site or area) (Crit. 5.3)
- Monitoring of treatment efficacy (Crit. 5.3)
- Area coordinated planning and management (Ind. 3.1.3)

In addition to the list above, the use of non-medicinal, mechanical and biological controls should be applied in order to reduce sea lice load and risk for resistance built-up. Some examples are given here: https://globalsalmoninitiative.org/en/what-is-the-gsi-working-on/biosecurity/non-medicinal-approaches-to-sea-lice-management/.

As applying these measures depends on various factors – including state of technological development, unintended health side-effects on fish, site-specific situations like strong currents – the standard requires farms to prepare a strategic plan that outlines which non-medicinal measures are (to be) applied at the farms. The plan must be made public and signed-off by an authorized veterinarian. It is required that the plan is reviewed and updated on a production cycle basis to reflect the effectiveness of applied methods and determine next approaches.

Appendix VIII: Methodologies Related to Water Quality and Smolt Systems

Appendix VIII-1. Calculation of Total Phosphorous discharged per tonne of smolt produced

Requirement 8.4 looks at how much phosphorus is discharged from the farm per unit of smolt produced. The requirement is set at 5 kg/mt for the first three years from date of publication of the ASC Salmon Standard, dropping to 4 kg/mt thereafter. Smolt facilities would calculate their discharge using a "mass balance" approach that calculates the discharge from the phosphorus in the feed and the phosphorus in the fish biomass. Farms would be able to subtract P that is physically removed in sludge (documented sludge removal with P levels tested).

To calculate P released to the environment, one must calculate the P used to produce one unit of fish and subtract the P taken up by the fish and P removed in sludge. The basic formula per time period, to be calculated for a maximum period of 12 months, is:

P released to the water body per unit of smolt produced = (P in – P out)/biomass produced

Where:

P in = Total P in feed

P out= (Total P in biomass produced) + (Total P in sludge removed)

Where the following definitions of the parameters apply in the basic formula:

1. *Total P in feed*
    a. ∑(Total amount of feed type (product) multiplied by content of phosphorus) $_{1.....X}$), where 1…….X represents the number of different feed types (products) used.
        i. The phosphorus content per feed type can be determined either by chemical analyses of the feed type, or based on declaration by the feed producer of phosphorus content in the feed type in jurisdictions where national legislation order phosphorus content of feed to be declared.
2. *Biomass produced*
    a. Biomass of fish produced over the specific time period is calculated as: (biomass harvested + biomass of mortalities + remaining standing biomass) – biomass at start of time period.
3. *P content in biomass produced*
    a. P content in biomass produced = (biomass produced)*(% of P in fish)
        i. For purposes of calculating this requirement, the following phosphorus percentages will be used for harvested fish or mortalities:
            1. Less than 1 kg: 0.43%
            2. More than 1 kg: 0.4%
4. *Total P in removed sludge*
    a. P content in sludge removed = (sludge removed) * (% of P in sludge)
        i. Phosphorus in sludge removed per unit shall be determined based on analytical values that are representative of the batch of sludge removed from the farm.
        ii. The smolt farm must demonstrate the sludge was physically removed from the farm site and that the sludge was deposed of according to the principles in requirement 8.35.

Appendix VIII-2: Water quality sampling methodology and data sharing for land-based systems

Land-based farms (flow-through and recirculation systems) must measure dissolved oxygen in the effluent. They also must submit to ASC the results from the effluent monitoring they conduct to comply with their local regulatory requirements. In particular, the requirement requires data on any sampling of phosphorus, nitrogen, TSS and BOD. This data will help to distinguish the performance of farms certified by this requirement over time, and assist in revisions to the ASC Salmon Standard.

Oxygen saturation must be measured at least monthly in the early morning and late afternoon. A single oxygen reading below 60 per cent would require daily continuous monitoring with an electronic probe and recorder for at least a week demonstrating a minimum 60 per cent saturation at all times.

Farms shall use the following table to submit the results of effluent monitoring to ASC. Please list each analysis separately over the previous 12-month period.

Date	**Analysis** (*TP, TN, BOD, TSS, etc.*)	**Location** (*Effluent, Inlet, etc.*)	**Method** (*Single grab, 24-hour bulk, etc.*)	**Sampling by Third Party?** (*Yes/No*)	**Analysis by Third Party?** (*Yes/No*)	**Result** (*including units*)

Appendix VIII-3: Sampling methodology for benthic macro-invertebrate surveys

Land-based smolt production systems must conduct sampling of the benthic macro-invertebrate habitats in the receiving body of water downstream and upstream of the effluent discharge point. The requirement requires that the downstream benthic status be similar or better than the upstream benthic status. To demonstrate this, the survey must demonstrate that the downstream location has the same or better benthic health classification as the upstream location.

Below are required components of the sampling methodology and classification scheme that a farm shall use. It is expected that a farm will use the faunal sampling regime in its own jurisdiction, as long as the regime includes the following minimum requirements.

This appendix also includes additional suggested ideas on conducting the surveys. The suggestions are intended as a guide only. The entity conducting the faunal survey should use its own discretion based on local knowledge, national fauna index systems, and expertise as to what specific sub-element or parameter will provide the best representation to document the status of the benthic macro invertebrates and the impact that the fish farm may have on this environment in the receiving water body.

Minimum requirements for faunal surveys:

Classification System

- The benthic health classification system must have at least five categories of benthic status.

Focus of the survey

- The survey must detect the composition, abundance diversity and presence of benthic invertebrate fauna in the receiving water body (upstream and downstream from farm outlet). The survey must focus on key sensitive indicator species for the region.

When and how often

- The samples must be collected once every year upstream and downstream from the farm outlet. In case the downstream survey drops a category according to the faunal index, two consecutive faunal surveys must be conducted during the following 12 months, using the same faunal index system, that demonstrate compliance with the requirement.
- After three years of demonstrating consistent results, a farm may reduce sampling to once every two years.

Where to sample

- The samples must be taken from both midstream and near the bank and must also include marginal areas with slacker water flow.
- All efforts must be made to isolate the impact of the farm, for example by seeking similar conditions, such as type of bottom, water flow and/or substrate types present along the bank, in the upstream and downstream locations.
- The location of sampling sites downstream from the farm must reflect a scientific assessment of the most likely area of potential impact from the farm, with consideration to the mixing of water and the minimum and maximum distance from the farm outlet.

Number of samples

- The survey must collect samples in at least three transects (10 metres apart), with at least four samples in each transect across the river. This must be conducted both upstream and downstream from the farm outlet.

Analysis of the samples and how to samples

- All collected samples must be analysed by an accredited laboratory and the sampling methodology must be approved by the laboratory conducting the analysis.

Further recommendations to sampling:

When and how

When collecting macro-invertebrates, consideration should be given to the seasonality of the presence of the macro-invertebrate species, namely insects in their larval stage of the life cycle. It is generally recommended that samples are conducted during summer and/or winter. In geographical regions like Scandinavia, spring and autumn are recommended as the best times for sampling.

Sampling gear

The sampling should be undertaken using standard equipment such as surber sampler, handnet and grab. More detailed sampling guidelines can also be found in ISO standards ISO 8265, 7828 and 9391.

References:

- Common Implementation Strategy for the Water Framework Directive (2000/60/EC) *Guidance document no. 7.* Monitoring under the Water Framework Directive.
- Biological assessment of running waters in Denmark: introduction to the Danish Stream Fauna Index (DSFI) Skriver et al.; 2000.
- The performance of a new biological water quality score system based on macro-invertebrates over a wide range of unpolluted running-water sites. Amitage, P.D. et al., 1982.
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC) *Guidance document no. 13.* Overall approach to the classification of ecological status and ecological potential.
- UN/ECE Task Force on Monitoring & Assessment under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992) Volume 3:Biological Assessment Methods for Watercourses.

Appendix VIII-4: Sludge BMPs for closed and semi-closed smolt systems

Methods to mitigate the impacts from fish metabolic wastes on water can range from the employment of simple settling ponds to the use of advanced technology filters and biological process. Dealing responsibly with the waste (sludge, liquid slurry, biosolids) from these processes is a critical element to responsible smolt facility management. The ASC acknowledges that BMPs related to other principles such as correct feed composition and texture as well as good feed management practices—such as not storing feed for too long—can also influence the effectiveness of biosolids capture, however this section deals with practices for cleaning, storage and disposal that will minimise the potential impacts of sludge/biosolids being released into the environment.

All closed and semi-closed smolt systems shall employ/undertake the following in relation to sludge/biosolids:

1. A process flow drawing that tracks/maps the water and waste flow of a farm including treatment of waste, transfer of wastes, waste storage and final waste utilisation options. Flow diagram should demonstrate the farm is dealing with biosolids responsibly.
2. Farm shall have a management plan for sludge/biosolids that details cleaning and maintenance procedures of the water treatment system. The plan must also identify and address the farm's specific risks such as—but not limited to—loss of power, fire and drought. The management can be evaluated in relation to maintenance records.
3. Farm must keep detailed records/log of sludge/bio-solid cleaning and maintenance including how sludge is discarded after being dug out of settlement ponds/basins.
4. Biosolids accumulated in settling ponds/basins shall not be discharged into natural water bodies.

Appendix VIII-5: Assimilative capacity assessment for cage (net-pen) smolt systems

Under 8.26, all open smolt farms in lake or reservoir settings must demonstrate that an assimilative capacity assessment has been conducted to determine if there is sufficient capacity from a water quality perspective to allow for the level of additional loading to the system.

Many suitable models exist that can help determine assimilative capacity, such as Dillon and Rigler (1975), Kirchener and Dillon (1975), Reckhow (1977), and Dillon and Molot (1996). The requirement does not favour one existing model over another but it is important to outline key elements of a credible assimilative capacity study.

At a minimum, the study must do the following:

- Undertake assessment as to allocation of capacity for the whole water body
- Undertake assessment as to land use, slope, sewage, other discharges, stream input
- Account for retention in lake and mixing
- Predict total phosphorus concentration
- Classify trophic status
- Undertake impact assessment of fish farm

The study must pay particular attention to the nature and morphology of the lake basin where the farm will be established. The study must analyse at a minimum:

1. Mixing of the surface and bottom waters
2. Whether bottom waters are isolated within the water body
3. The naturally occurring oxygen levels in the surface and bottom waters
4. Whether the water forms part of an enclosed basin, or an area with isolated bottom waters

Appendix VIII-6: Receiving water monitoring for open (net-pen) smolt systems

Sampling Regime for Receiving Water Quality Monitoring

Location of sampling stations: Stations will be established at the limit of the cage farm management zone on each side of the farm, roughly 50 metres from the edge of the cages and at reference stations located approximately 1-2 kilometres (km). All sampling locations will be identified with GPS coordinates on a schematic outline of the farm operations and on available satellite imagery.

Sampling methods: All water samples testing for total phosphorus shall be taken from a representative composite sample through the water column to a depth of the bottom of the cages. Samples will be submitted to an accredited laboratory for analysis of TP to a method detection limit of $\leq$ 0.002 mg/L. Dissolved oxygen measurements will be taken at 50 centimetres from the bottom sediment.

Frequency: At least once every three months during periods without ice, including at peak biomass.

**NOTE: Some flexibility on the exact location and method of sampling is allowed to avoid farms needing to duplicate similar sampling for their local regulatory regime.

	Boundary Stations (Note: if the farm is attached to land via a walkway, only three stations would be used)				**Reference Stations**	
	North	South	East	West	Upcurrent	Downcurrent
TP (mg/L)	X	X	X	X	X	X
DO profile (mg/L)	X	X	X	X	X	X

Appendix VIII-7: Trophic status classification and determining baseline trophic status

Requirement 8.30 requires a farm to determine a baseline trophic status for the water body and demonstrate through monitoring that the status is maintained. The ASC Salmon Standard use a modified version of the trophic status system developed by the Organization for Economic Cooperation Development (OECD) (Vollenweider and Kerekes, 1982). Trophic status is determined by the concentration of total phosphorus.

Trophic Status	Range of Total Phosphorus Concentration (≤ 20 μg/l)
Ultra-oligotrophic	< 4
Oligotrophic	4-10
Mesotrophic	10-20
Meso-eutrophic	20-35
Eutrophic	35-100
Hyper-eutrophic	> 100

(Note: these ranges are identical to ones described in an Environment Canada report titled “Canadian Guidance Framework for the Management of Phosphorus in Freshwater Systems, Science-based Solutions Report 1-8, February 2004”)

Determining Baseline

Basic approach: Use the concentration in the most pristine area of the water body as possible, i.e., far from point sources of nutrients such as stream inflows, wastewater runoff, the farm or other fish farms. If the regulatory body has determined a historical baseline for the water body, that baseline shall be used.