

# **SALMON AQUACULTURE DIALOGUE**

## **Second draft standards for responsible salmon aquaculture**

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These draft standards are released for public comment by the Steering Committee of the Salmon Aquaculture Dialogue. The Steering Committee is composed of a representative from each of the following organizations:

Coastal Alliance for Aquaculture Reform  
Canadian Aquaculture Industry Alliance  
Marine Harvest Group  
Norwegian Seafood Federation (FHL)  
Pew Environment Group  
SalmonChile  
Skretting  
Fundación Terram  
World Wildlife Fund

This document contains draft standards that seek to minimize or eliminate the key negative environmental and social impacts of salmon farming, while permitting the industry to remain economically viable. In order to improve the industry's overall performance, the standards focus on today's best performers and are intended to be at a level where enough producers strive to achieve them, bringing about actual change on the ground. Once completed, the standards are intended to be revisited and updated periodically (e.g., every three to five years) to ensure that the standards are based on best available scientific knowledge and management practices and to encourage continuous improvement.

These draft standards have been significantly revised from the first draft that was open for comment in 2010, based on public feedback and the deliberations of the Salmon Aquaculture Dialogue Steering Committee. On any given standard, individual Steering Committee members may have a range of views. As a package, the Steering Committee believes the standards represent an important step forward in defining environmentally and socially responsible production of farmed salmon.

The standards are open for public comment from May 16, 2011 through June 14, 2011. Comments can be submitted via the website at [www.worldwildlife.org/salmondialogue](http://www.worldwildlife.org/salmondialogue). Feedback received during the public comment period will be posted online and used to revise and finalize the standards.

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## INTRODUCTION

Seafood is one of the most popular sources of protein worldwide. By volume, approximately half of the seafood we eat is wild caught. But the other half is from aquaculture, the fastest growing food production system in the world.

As with many rapidly growing industries, the growth in aquaculture production has raised concerns about negative social and environmental impacts related to farming, such as water pollution, the spread of diseases and unfair labor practices at farms. Although there are some businesses addressing these issues well, others are not doing so at all or are doing so poorly.

One tool to help encourage more responsible aquaculture is global standards – performance levels that must be reached to help minimize or eliminate a set of key impacts. Standards can serve as the basis for a certification program. They also can be used to benchmark other standards, incorporated into existing certification programs, adopted for government programs, and be the foundation for buyer and investment screens. Through the Salmon Aquaculture Dialogue (SAD) roundtable, global performance-based standards are being created for salmon farming.

### PURPOSE AND SCOPE OF THE SALMON AQUACULTURE DIALOGUE STANDARDS

The SAD is a science-based forum initiated by World Wildlife Fund (WWF) in 2004. The goal of the Dialogue is to credibly develop measurable, performance-based standards that minimize or eliminate the key negative environmental and social impacts of salmon farming, while permitting the industry to remain economically viable.

More than 500 stakeholders, including producers, environmental and social non-governmental organizations (NGOs), seafood buyers, scientists, and government representatives have participated in the Dialogue. A nine-person Steering Committee (SC) is responsible for managing the SAD process and making all final decisions related to the salmon standards document. This group of volunteers includes representatives from salmon producer associations and companies, feed manufacturers, and environmental and social NGOs. More information on the Dialogue, including meeting summaries and reports on key issues that were commissioned by the Dialogue, is available at <http://www.worldwildlife.org/salmondialogue>.

#### Definition of Standards

The Dialogue is an iterative, participatory process that began with identifying the key environmental and social impacts of salmon production. Using a step-wise process, the Dialogue is building agreement on principles, criteria, indicators and standards that address the impacts. These terms are defined in the table below.

	<i>Definition</i>	<i>Non-aquaculture example</i>	<i>Aquaculture example</i>
<i>Impact</i>	The problem we want to minimize	Overweight	Water pollution
<i>Principle</i>	The guiding principle for addressing the impact	Maintain a healthy weight	Conserve and protect water resources
<i>Criteria</i>	The area to focus on to	Food consumption *	Effluents*

	address the impact		
<i>Indicator</i>	What to measure in order to determine the extent of the impact	Calories	Nitrogen concentration in the effluent
<i>Standard</i>	The number and/or performance level that must be reached to determine if the impact is being minimized **	< 10 calories/pound of body weight/day	4 mg/L total nitrogen in effluent

*\*For this example, only one criteria is listed, even though there often are several criteria for each principle, as well as several indicators for each criteria.*

*\*\*A number is not necessary when an indicator cannot be measured (e.g., the indicator for the principle “obey the law,” which might be “documentation of compliance with national and local regulations”).*

### **Issue Areas of Salmon Aquaculture to Which the Standards Apply**

The SAD establishes principles, criteria, indicators and measurable performance levels for responsible salmon aquaculture with regard to social and environmental issues. The seven areas of key potential negative impact that were identified within the Dialogue are: feed, escapes, nutrient loading and carrying capacity, benthic impacts and siting, disease and parasite transfer, chemical inputs and social impacts (i.e., labor and community impacts). It is recognized that there is overlap within the impact areas and the principles. The full suite of standards is intended to address the suite of potential negative impacts.

Animal welfare (i.e., farmed fish welfare and wildlife interactions, including treatment of and impacts on predators) has been raised by some stakeholders as an issue for the SAD to address. Wildlife interactions will be addressed under Principle 2. The SC has decided, however, not to comprehensively address farmed fish welfare in the standards document, as the SC believes that 1.) farmed fish welfare does not fall under the mandate of the SAD and was not part of the rationale for creating the SAD, 2.) the SC does not have appropriate expertise on the issue, 3.) other fish welfare standards and processes already exist, and 4.) there is potential to partner in the future with other certification programs that address farmed fish welfare. The SC expects that some aspects of farmed fish welfare will be addressed, indirectly, under the standards (e.g., through several environmental and fish health standards).

### **Range of Activities within Aquaculture to Which the Standards Apply**

Aquaculture is the production of aquatic organisms. It involves the planning, development and operation of facilities, which in turn affect the inputs, production, processing and chain-of-custody components.

The SAD standards apply to the planning, development and operation of salmon aquaculture production systems. The focus of the standards is on production and the immediate inputs to production.

### **Biological and Geographic Scope to Which the Standards Apply**

The salmon standards are applicable to species belonging to the genus *Salmo* and *Oncorhynchus*, and can be applied to all locations and scales of salmon aquaculture production systems.

### **Unit of Certification to Which the Standards Apply**

The unit of certification is a farming site. In undergoing assessment for certification, a company that owns multiple grow-out sites will be subject to compliance only at the particular site(s) for which they choose to undergo certification. A farm must comply with all the standards in this document to be certified, including providing required documentation from their feed and smolt suppliers.

## Implementation of the Standards

When finalized, the SAD standards will be handed off to a new organization, the Aquaculture Stewardship Council (ASC), which will be responsible for working with independent, accredited, third-party entities to certify farms that are in compliance with the standards. Farms will be certified on an annual basis. The ASC will also offer a Chain of Custody (CoC) assurance that tracks fish from a certified farm to the consumer. More information on the ASC and their certification and accreditation processes is available on their website, [www.ascworldwide.org](http://www.ascworldwide.org).

In addition to their use by the ASC, the standards could potentially be incorporated into existing certification programs, government regulations and buyer and investment screens.

## PROCESS FOR CREATING THE STANDARDS

### General Considerations

The process of setting standards is critical, as it significantly affects the credibility, viability, practicality and acceptance of the standards. The process of creating the SAD standards has been – and will continue to be – multi-stakeholder, open to anybody to participate in and transparent. This is in line with the International Social and Environmental Accreditation and Labeling (ISEAL) Alliance’s “Code of Good Practice for Setting Social and Environmental Standards.” A goal of the SAD is to follow the ISEAL code.

### Standards Setting Process

- In February 2004, under the leadership of WWF, the inaugural meeting of the SAD was held in Washington, DC. The primary goal of the meeting was to begin identifying which impacts to address through the standards. Several additional meetings were held in 2004 and 2005 to finalize the list of impacts.
- The process and format for the SAD was discussed at the June 2004 SAD meeting and formalized in a process document that was finalized in July 2008 (available at <http://www.worldwildlife.org/what/globalmarkets/aquaculture/WWFBinaryitem9675.pdf>).
- The scope and purpose of the Dialogue was discussed and finalized at the October 2004 SAD meeting. Roles, structure and governance were refined and then finalized at the November 2005 meeting.
- Technical Working Groups (TWGs) were created, starting in 2005, to help research issues related to salmon aquaculture. Members of the Dialogue were actively involved in choosing experts and developing a scope of work for the TWGs. Each of the seven TWGs was tasked with producing a "State of Information Report" that reviews the status of existing research related to the impact, identifies gaps or areas of disagreement in the research and suggests a process for addressing the gaps. The reports were presented at SAD meetings, beginning in December 2007.
- The SAD SC was created over the course of 2004 and 2005. The SC now includes the following people:

Name	Organization	Sector	Country
Petter Arnesen	Marine Harvest	Producer	Norway
Hernan Frigolett	Fundacion Terram	NGO	Chile
Rachel Hopkins	Pew Environment Group	NGO	United States
Rodrigo Infante	SalmonChile	Producer	Chile

		association	
Trygve Berg Lea	Skretting	Feed manufacturer	Norway
Kjell Maroni	Norwegian Seafood Federation	Producer association	Norway
Jay Ritchlin	Coastal Alliance for Aquaculture Reform	NGO	Canada
Jose Villalon	World Wildlife Fund	NGO	United States
Mary Ellen Walling	Canadian Aquaculture Industry Alliance	Producer association	Canada

- Draft principles were presented and discussed at the January 2008 SAD meeting, then edited based on feedback from that meeting and further SC discussion. The draft principles were posted on the SAD website for public comment for a 60-day period which ended October 15, 2008, then discussed at the November 2008 Dialogue meeting. Principles were revised a second time based on feedback from the comment period and November meeting.
- Draft criteria were presented and discussed at the November 2008 SAD meeting, then edited based on feedback from that meeting and further SC discussion. Revised draft criteria were open for public comment via the website for a 30-day comment period that ended March 6, 2009. They were presented and discussed at the March 2009 SAD meeting. Feedback from the meeting and the public comment period were used by the SC to develop final draft criteria.
- From December 2009 to July 2010, the SC met regularly via phone, several times in person, and consulted with various experts from the TWGs in order to develop draft indicators and standards.
- Draft principles, criteria, indicators and standards were posted for a 60-day public comment period on August 3, 2010. This revised draft has been posted for a second, 30-day comment period. Feedback received during both comment periods will be used by the SC to revise and finalize the standards document. All comments received, as well as the SC's overarching responses to the feedback, will be posted on the SAD website. Comments and responses will be sorted according to key issues, themes and frequency.
- Final standards will be given to a new entity, the Aquaculture Stewardship Council (ASC), which will be responsible for working with independent, third party entities to certify farms that are in compliance with the standards being created by participants of the Aquaculture Dialogues. The ASC is expected to be in operation in mid-2011.
- Throughout the process, WWF has, on behalf of the SC, written and disseminated press releases, and developed and updated the SAD website, to keep people informed of upcoming meetings and progress within the SAD.
- Throughout the process, the SC and SAD coordinator also have held outreach meetings (in person, or via phone or e-mail) with stakeholder groups identified in the outreach strategy. Additional outreach meetings will be held with key stakeholders during the two comment periods.

### **Continuous Improvement of the Salmon Aquaculture Dialogue Standards**

As stated in the ISEAL "Code of Good Practices for Setting Social and Environmental Standards," ". . . standards shall be reviewed on a periodic basis for continued relevance and effectiveness in meeting their stated

objectives and, if necessary, revised in a timely manner.” It is implicit in the development of the SAD standards that the numerical values, or tolerance levels, will be raised or lowered over time to reflect new data, improved practices and new technology.

### **INFORMATION FOR THE READER**

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

The “Additional Information” sections contain more detailed information on the process for arriving at the particular proposed indicators and standards. This information will not be included in the final standards document, or will be moved to an appendix, since it is included primarily to help inform the reader who wants to provide constructive comments on the draft standards. This section may contain, for example, explanations of indicators and standards that were considered but ultimately not included, as well as the rationale behind their exclusion.

When provided, the “Auditing Guidance” sections begin to explain how each standard should be interpreted by auditors or implemented at the farm level. A detailed auditing guidance document and auditor checklist will be developed after the standards are finalized. The information in these sections will be leveraged into those two documents and will be removed from the final standards document.

Definitions are provided in footnotes.

The documentation that a farm must provide around its smolt supplier(s) is outlined in a separate section of the document.

These draft standards have been significantly revised from the first draft that was open for comment in 2010, based on public feedback and the deliberations of the Salmon Aquaculture Dialogue Steering Committee. On any given standard, individual Steering Committee members may have a range of views. As a package, the Steering Committee believes the standards represent an important step forward in defining environmentally and socially responsible production of farmed salmon. These standards are intended to reduce key impacts from the status quo while also being economically viable and within the range of achievability for the industry.

The standards are open for public comment from May 16, 2011 through June 14, 2011. Comments can be submitted via the website at [www.worldwildlife.org/salmondialogue](http://www.worldwildlife.org/salmondialogue). Feedback received during the public comment period will be posted online and used to revise and finalize the standards.

## **PRINCIPLES, CRITERIA, INDICATORS AND STANDARDS FOR GROW-OUT**

This section of the document contains the first draft of the full suite of principles, criteria, indicators and standards for responsible salmon farming at saltwater grow-out sites.

### **PREAMBLE**

The principles serve as a platform to minimize or eliminate the social and environmental impacts of salmon aquaculture while permitting the salmon farming industry to remain economically viable. These principles—along with the corresponding criteria, indicators and standards—are applicable at the farm level.

Farms must meet 100% of the standards in this document to achieve certification. Meeting the full suite of standards will require farms to have a high level of transparency and regular monitoring of a number of key indicators. The standards require the farm to make some performance data publicly available and other performance data available to the ASC<sup>1</sup>.

Although the SAD is creating farm-level standards, they are intended to help protect and maintain ecosystem function and ecosystem services in salmon producing areas, with the recognition that aquaculture operations are not solely responsible for total ecosystem health. The standards are intended to be revisited and updated periodically (e.g., every three to five years) to ensure that the standards are based on the best available scientific knowledge and management practices and to encourage continuous improvement.

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<sup>1</sup> See Appendix VI for details on proposed data transparency.

**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 SAD 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 standards will stand.*

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

INDICATOR	STANDARD
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 labor laws and regulations	Yes
1.1.4 Presence of documents demonstrating compliance with regulations and permits concerning water quality impacts	Yes
1.1.5 Presence of documents demonstrating that the farm has provided the buyer <sup>2</sup> of its salmon a list of all therapeutants used in production.	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 behavior, including the implementation of corrective actions for any legal violations.

**Additional information**

Part of a farm’s responsibility to operate within the law involves taking appropriate measures to ensure its product complies with import laws of the countries where the salmon is eventually sold. The standard 1.1.5 above ensures that buyers and importers have the information they need to verify that the product complies with import regulations.

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<sup>2</sup> **Buyer:** the company or entity to which the farm or the producing company is directly selling its product.

The primary focus of this principle is national and local laws and regulations. Although international legal requirements are agreed to be important, the practicality of including international conventions in these standards is limited because of ratification and other issues. Some specific international legal issues are addressed in other sections of the standard, such as Principle 6, which refers to International Labor Organization conventions.

Despite concerns about equivalent status being granted to products grown in countries with varying levels of legal requirements, it is outside the scope of the SAD to address differences in national legislation, providing that legislation is complied with.

The SAD standards go beyond those required by law in many circumstances. They are not, however, intended to contradict them. Laws that compel a farmer to take certain action take precedence over voluntary standards. The standards under Principle 1 are a means to reinforce and complement the legal framework.

### **Auditing guidance**

In order to ensure compliance with these standards, auditors will need to review a range of documentation and relevant correspondence related to farm siting and operation. It is probable that some of the information will need to be generated by the headquarters of the company owning the operation, while other information will relate specifically to the site. The final standards document and associated auditing guidelines should include a list of the required documentation. This documentation and auditing activities may include and are not restricted to:

- For 1.1.1: copies of the applicable land and water use laws, original lease agreements or land titles, permits from government agencies, inspection for compliance with national and local laws and regulations, and documents outlining allowable activities in or near national preservation areas (e.g., parks, limited use protected areas)
- For 1.1.2: proof of compliance with tax payments to appropriate authorities and copies of tax laws for the jurisdiction(s) in which the company is operating
- For 1.1.3: national labor codes and laws applicable to the farm and inspection of the facility for compliance
- For 1.1.4: discharge laws and applicable permits for operation, as well as records of monitoring and compliance with discharge regulations
- Review of any violations and associated corrective actions taken over the five-year period prior to certification to demonstrate a pattern of legal and responsible behavior. This may include review of lists developed by relevant regulatory authorities of companies and operations with infringements or violations or official communications by the company with government.
- Review to ensure that if legislation is more demanding than the Dialogue standards, relevant legislation is met

## 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

INDICATOR	STANDARD
2.1.1 Redox potential or <sup>3</sup> sulphide levels in sediment outside of the Allowable Zone of Effect (AZE) <sup>4</sup> , following the sampling methodology outlined in Appendix I subsection 1	Redox potential > 0 millivolts (mV) or Sulphide ≤ 1,500 microMoles / l
2.1.2 Faunal index score indicating good <sup>5</sup> to high ecological quality in sediment outside of the AZE, following the sampling methodology outlined in Appendix I subsection 1	AZTI Marine Biotic Index (AMBI <sup>6</sup> ) 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 subsection 1	≥ 2 highly abundant <sup>7</sup> taxa that are not pollution indicator species
2.1.4 Definition of a site-specific AZE based on a robust and credible <sup>8</sup> modeling system	Yes, within 3 years of the publication <sup>9</sup> of the SAD standard

### Rationale

<sup>3</sup> Farm sites can choose whether to use redox or sulphide. Farms do not have to demonstrate that they meet both.

<sup>4</sup> Allowable Zone of Effect (AZE) is defined under this standard as 30 meters. For farms sites where a site-specific AZE has been defined using a robust and credible modeling system such as the SEPA AUTODEPOMOD and verified through monitoring, the site specific AZE should be used.

<sup>5</sup> “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.

<sup>6</sup> <http://www.azti.es/en/ambi-azti-marine-biotic-index.html>

<sup>7</sup> **Highly abundant:** Greater than 100 organisms per square meter (or equally high to reference site(s) if natural abundance is lower than this level).

<sup>8</sup> **Robust and credible:** The SC will provide further guidance on this moving forward, however, the SEPA AUTODEPOMOD modeling 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.

<sup>9</sup> **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.

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. Standards have been set for both. As a precautionary approach, these standards 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 of the AZE. Though an AZE is difficult to identify as a constant, experts discuss this in terms of 25 meters to 125 meters depending on a range of factors, including currents. In an effort to take a precautionary approach to permissible zone of benthic impact, the SAD standards define the AZE as a distance of 30 meters from cages. For sites where a site-specific AZE has been determined using a valid modeling and video surveillance system, farms will use the site-specific AZE and sampling stations based on actual depositional patterns. Within 3 years of the publication of the SAD standards, 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 standard through the incorporation of an annual analysis using a benthic faunal index and minimum score at multiple monitoring stations outside of the AZE, including a reference site (see Appendix I subsection 1). Within the AZE, a demonstration that two or more benthic macrofaunal species, such as sessile macrophytes and worms, are present in high abundance is required to ensure impacts fall within an acceptable level.

#### **Additional information**

The SC recognizes that standards 2.1.1 to 2.1.3 are only relevant to sites with soft bottoms. There appears to be no clear and effective methodology for measuring impacts on hard benthos. The SC notes that this is an area for continuous improvement of the standard over time as new methods for measuring benthic effects on hard bottom sites are developed. In order to not have to meet 2.1.1 to 2.1.3, the farm will have to clearly demonstrate beyond doubt that the site is entirely hard bottom and that these measurements cannot be taken.

Redox seems to be more prevalent globally than sulphide and some experts have advised that it has less risk of false positives, which can occur for sulphide due to poor electrode maintenance. Producers may wish to consider this possibility when considering which measurement to use. Through the consultation of technical experts and review of Hargrave et al.<sup>10</sup> (2008), a proposal of 1,500 mM sulphide levels and equivalent redox potential of >0 mV was proposed as ensuring acceptable and transitory benthic conditions.

Under expert guidance, the SC selected the AZTI Marine Biotic Index (AMBI), the Shannon-Wiener Index, the Benthic Quality Index (BQI), and the Infaunal Trophic Index (ITI) to be included under the standard. Farms can use their choice of these four faunal indices to further establish the environmental quality of the soft-bottom benthos. Equivalencies for these indices were set using Hargraves et al 2008 and Zettler et al 2007<sup>11</sup> and through consultation with experts. The scores were set to relate to an environmental quality status of good or better

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<sup>10</sup> 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.

<sup>11</sup> 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.

according to the definitions of the EU Water Framework Directive. For example, AMBI scores range from 0, or undisturbed, to 7, which correlates to extremely disturbed or azoic. Experts recommended setting the AMBI score to be less than or equal to 3.3. An AMBI score less than or equal to 3.3 is equivalent to good to high environmental status, while scores greater than 3.3 relate to moderate or worse environmental status and a benthic quality of transitional to pollution, polluted or worse<sup>12</sup>. The indices are calculated using the same dataset.

**Criterion 2.2 Water quality in and near the site of operation**

INDICATOR	STANDARD
2.2.1 Weekly average percent saturation <sup>13</sup> of dissolved oxygen (DO) <sup>14</sup> on farm	≥60%
2.2.2 Maximum percentage of weekly samples from 2.2.1 that fall under 1.85 mg/liter DO	5%
2.2.3 Evidence of weekly monitoring of nitrogen and phosphorous <sup>15</sup> levels on farm and at a reference site	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.

<sup>12</sup> Borja, A., Franco, J., Perez, V., 2000. A marine biotic index to establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments. *Mar. Poll. Bull.* 40, 1100–1114.

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.

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.

<sup>13</sup> 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

<sup>14</sup> Averaged weekly from two daily measurements (proposed at 6 am and 3 pm)

<sup>15</sup> Farms shall use a Hach kit or similar method to monitor total N, NH4, NO3, total P, and Ortho-P in the water column. Results shall be submitted to the ASC database.

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 of time. Under routine production, the average minimum percent saturation of DO in the water column should be above 60%. Measuring DO as a percent saturation takes into account salinity and temperature at the farm site. Compliance with the proposed draft SAD standards will limit the number of low DO readings in the water column below 1.85 mg/l to less than 5% incidence rate, which will allow for periodic physical phenomena, such as upwelling.

The standards also incorporate a requirement to monitor nitrogen and phosphorous levels on farm and at a reference site. No threshold is placed on this standard. The data collected can be used to help better understand potential linkages around salmon farming, ambient nutrient levels, and environmental phenomena such as harmful algal blooms (HABS). Farm operators may also find this data useful in management decisions.

**Additional information**

The SC is still in the process of reviewing comments related to DO levels and sampling protocols and will be reaching out to experts to further refine these standards. Suggestions of water quality experts who may be able to advise on the revisions of these standards would be appreciated.

The monitoring of N and P should be inexpensive and relatively easily done, except perhaps in times of bad weather. The SAD technical working group on nutrient loading identified the potential link between nutrients around salmon farms and HABS 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.

**Criterion 2.3: Nutrient release from production**

INDICATOR	STANDARD
2.3.1 Percentage of fines <sup>16</sup> in the feed at point of entry to the farm <sup>17</sup> (measured according to methodology in Appendix I subsection 2)	<1% by weight of the feed

**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 standards with a range of water quality and benthic performance metrics. Standard 2.3.1 complements these other standards 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 net

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<sup>16</sup> **Fines:** Dust and fragments in the feed. Particles that separate from feed with diameter of 5mm or less when sieved through a 1mm sieve, or particles that separate from feed with a diameter greater than 5mm 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).

<sup>17</sup> 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.

pens. 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	STANDARD
<p>2.4.1 Evidence of an assessment of the farm’s potential impacts on biodiversity and nearby ecosystems that contains at a minimum: a) identification of proximity to critical, sensitive or protected habitats and species, b) description of the potential impacts the farm might have on biodiversity, with focus on those habitats or species, and c) a description of strategies and current and future programs underway to eliminate or minimize any identified impacts the farm might have and to monitor outcomes of these programs and strategies (See Appendix I subsection 3 for details)</p>	<p>Yes</p>
<p>2.4.2 Allowance for the farm to be sited in a protected area<sup>18</sup> or areas determined to be of High Conservation Value<sup>19</sup> (HCV)</p>	<p>None<sup>20</sup></p>

<sup>18</sup> Protected area: a clearly defined geographical space, recognized, 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.

<sup>19</sup> High Conservation Value Areas: Natural habitats where conservation values are considered to be of outstanding significance or critical importance. HCVAs 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/>)

<sup>20</sup> 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.
- 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 HCV.
- 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

## Rationale

The intent of the standard(s) under criterion 2.4 is to minimize 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 High Conservation Value Areas (HCVAs), where these have been defined. These standards are consistent with the Global Reporting Index indicators EN12, EN14, and EN15 which related to identification and description of significant impacts of activities on biodiversity, protected habitats, and threatened species and the communication of strategies to manage these impacts.

The standards under Criteria 2.4 ensure 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 recognized 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.

## Additional information

For Standard 2.4.2, an exception is made for protected areas that are classified by the International Union for Conservation of Nature (IUCN), as Category V or VI. These are areas preserved primarily for their landscapes, or areas that include sustainable resource management. Details can be found here: [http://www.iucn.org/about/work/programmes/pa/pa\\_products/wcpa\\_categories/](http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/).

In developing these standards, the SC recognizes that there is an important role for governments in identifying appropriate areas for protection of biodiversity along with appropriate areas for aquaculture and other economic activities. Additionally, the SC believes that salmon farming companies should be active participants in encouraging adaptive and effective coastal zone management that protects areas of high conservation value with a long-term vision of a coastal zone that is both ecologically and economically productive.

## Auditing guidance

- Farms cannot be located in any protected area that does not allow economic activities—this falls under the concepts of Principle 1 related to obeying the law.
- Compatibility with the goals of a protected area or HCVA shall be guided by the outcomes of the assessment conducted for 2.4.1.
- Components of the biodiversity impact assessment may have already been undertaken by farms are part of the regulatory permitting process. In these cases, such documents may be used to demonstrate compliance with this standard.

## Criterion 2.5: Interaction with wildlife, including predators

### INDICATOR

### STANDARD

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.

2.5.1	Number of days where acoustic deterrent devices (ADDs) or acoustic harassment devices (AHDs) were used	0, within two years of the date of publication of the SAD standard
2.5.2	Prior to the achievement of 2.5.1, evidence that if ADDs or AHDs are in use, the farm is developing and implementing a plan to phase out their use	Yes
2.5.3	Number of mortalities <sup>21</sup> of endangered or red-listed <sup>22</sup> marine mammals or birds on the farm	0
2.5.4	Evidence that the following steps were taken prior to lethal action <sup>23</sup> against a predator: <ol style="list-style-type: none"> <li>1. All other avenues were pursued prior to using lethal action</li> <li>2. Approval was given from a senior manager above the farm manager</li> <li>3. Explicit permission was granted to take lethal action against the specific animal from the relevant regulatory authority</li> </ol>	Yes
2.5.5	Evidence that information about any lethal incidents on the farm has been made easily publicly accessible	Yes
2.5.6	Maximum number of lethal incidents <sup>24</sup> on the farm over the prior two years	<9 lethal incidents, with no more than 2 of the incidents being marine mammals
2.5.7	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 standards 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 standards 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.

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<sup>21</sup> Mortalities: includes animals intentionally killed through lethal action as well as accidental deaths through entanglement or other means.

<sup>22</sup> Species listed as endangered or critically endangered by the IUCN or on a national endangered species list

<sup>23</sup> **Lethal action:** Action taken to deliberately kill an animal, including marine mammals and birds.

<sup>24</sup> **Lethal incident:** includes all lethal actions as well as entanglements or other accidental mortalities of non-salmonids.

A large variety of acoustic deterrent (and harassment) devices are used in salmon aquaculture. Based on available research<sup>25</sup>, it appears that the effectiveness of these devices in reducing farmed salmon predation by marine mammals can vary widely including by location, marine mammal species, time period of use, etc. Available research suggests that noise and high pitched sounds resulting from acoustic devices may 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 standards encourage farms not to use ADDs/AHDs, and requires that their use be phased out on certified farms within two years of the publication of the SAD standard. Starting two years from the date of publication, no farm meeting the standard shall use ADDs/AHDs.

#### **Additional information**

The SC encourages continued research into development of new devices or improved practices that effectively deter marine mammal depredation without harming marine mammals. The SC is aware of ongoing research related to the development of new ADDs/AHDs that aim to make the unintended consequences on marine mammals negligible. However, the SC has not found any such devices already on the market. The SC believes that this is an area where, should a newer technology become available that has scientific evidence of significantly reduced unintended effects, the Technical Advisory Group of the ASC should be asked to review evidence provided to them to determine whether the technology should be allowed under the standard. This request could be made prior to the formal, complete review of the standards or could be done as part of a broader update of the standards.

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<sup>25</sup> References for the section of the rationale related to ADDs/AHDs:

- Milewski, I. 2001. Impacts of salmon aquaculture on the coastal environment: a review.
- 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.
- 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](http://www.scotland.gov.uk/cru/kd01/green/reia-00.asp).
- 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.
- 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.

**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 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**

INDICATOR	STANDARD
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	Yes
3.1.2 A demonstrated commitment <sup>26</sup> 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 of a maximum sea lice load for the entire ABM and for the individual farm that is based on regulatory requirements. In areas of wild salmonids, loads shall also be based on wild fish monitoring (see Standard 3.1.6) and incorporate a precautionary low maximum lice level just before and during outmigration	Yes
3.1.4 Weekly <sup>27</sup> on-farm testing for sea lice, with test results made easily publicly available <sup>28</sup> within 7 days of testing.	Yes

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<sup>26</sup> 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.

<sup>27</sup> The SC recognizes that weekly testing may be unnecessarily frequent in some situations and during times of the year when wild salmonids are not present. The SC would welcome comments on how to refine this standard.

<sup>28</sup> Posting results on a public website is an example of “easily publicly available.”

<p>3.1.5 In areas with wild salmonids<sup>29</sup>, evidence of data<sup>30</sup>, and the farm’s understanding of that data, around salmonid migration routes, migration timing, and stock productivity in major waterways within 50 kilometers of the farm</p>	<p>Yes</p>
<p>3.1.6 In areas of wild salmonids, monitoring of sea lice levels on wild out-migrating salmon juveniles or on coastal sea trout (details in Appendix III subsection 1). Monitoring results must be made easily publicly available within 8 weeks of testing</p>	<p>Yes</p>
<p>3.1.7 In areas of wild salmonids, maximum on-farm lice levels during sensitive periods for wild fish<sup>31</sup></p>	<p>[The SC puts forward two options for review during the public comment period. Please see the Addition Information section]</p> <p>Option A: 0.1 mature female lice per farmed fish</p> <p>Option B: 0.1 mature female lice per farmed fish if monitoring reveals lice levels in wild populations has exceed the thresholds described in Appendix III, subsection 2.</p>
<p>3.1.8 In areas of wild salmonids, evidence that the farm has submitted sea lice testing results and other data points to ASC in the template requested by ASC<sup>32</sup></p>	<p>Yes</p>

**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. There is significant debate in scientific literature about the extent of the interaction and impact. The Disease Report commissioned by the SAD

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<sup>29</sup> For purposes of these standards, “areas with wild salmonids” are defined as areas within 75 kilometers 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.

<sup>30</sup> Farms do not need to conduct research on migration routes, timing, and the health of wild stocks under this standard. 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.

<sup>31</sup> Sensitive periods for migrating salmonids is during juvenile outmigration and approximately one month before. The SC welcomes input on how to define the most sensitive moments for coastal sea trout.

<sup>32</sup> The SAD SC has not yet developed this format. The intent of this standard is to consolidate key data points, such as on-farm lice levels, lice levels on wild stocks, and stock productivity data, into a useful datasets for researchers.

concluded that there is “shared benefit to farm productivity and to minimizing impacts on wild fish by continually seeking to reduce disease on salmon farms.”

Sea lice has 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.

These standards seek to address these concerns by establishing best practice in managing potential disease risks to wild populations. The standards recognize 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 under this standard because of the transmission of disease between farms and wild salmonids.

Area-based management (ABM) is a requirement under this standard. Most salmon-growing jurisdictions have begun to require ABM or are considering it because neighboring 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.

The commitment to research required under 3.1.2 intends to ensure 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 under this standard.

The standards address the challenge of sea lice in several ways. First, 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).

Second, farms must conduct frequent testing of on-farm lice levels, and make those results publicly available.

Farms located in areas of wild salmonids must participate in monitoring of lice levels on wild out-migrating juvenile salmon or on coastal sea trout. The standards assume that 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.

The standards 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 presupposes 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, will be compiled by ASC in an effort to consolidate data and promote future research.

### **Additional information**

The SC received an enormous amount of feedback on the first draft of these standards. The feedback included a very diverse range of views and opinions.

These revised standards reflect many of the ideas in the feedback, as well as the deliberations of the SC.

These standards 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. The SAD SC believes this enhanced leadership is an essential part of showing best practice in this high-priority issue of farm interaction with wild populations.

Specifically, this standard requires monitoring of sea lice levels in wild salmonid populations. Some farms do this today. Many farms will need to work with researchers, government entities and neighboring farms to establish monitoring systems. The SAD SC recognizes that at least one jurisdiction faces impediments to wild fish monitoring because of extremely low population levels and associated challenges related to obtaining permits and sampling wild populations. During the public comment period, the SC is eager to talk representatives from such jurisdictions and welcomes feedback on how to address these situations.

Similarly, many farms today work inside an area-based management scheme. Farms that don't have ABM already established in their jurisdiction will need to show leadership in working with neighboring farms to establish such a scheme, even if the regulatory structure doesn't require it.

The standards also call for an enhanced level of transparency around sea lice monitoring data. 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.

The SC is still considering two options around how to set a standard that requires producers to demonstrate very precautionary low on-farm lice levels during sensitive periods for wild populations, such as juvenile outmigration (3.1.7). The SC welcomes input on how to choose between these options for the final standards.

Under Option A, all certified farms would need to demonstrate lice levels below 0.1 mature female lice per farmed fish during these sensitive periods. Under Option B, that specific level (0.1 mature female lice) would only be required when wild monitoring reveals sea lice levels on wild populations have exceeded a certain threshold. Still, all farms under Option B would need to incorporate an unspecified "precautionary low maximum lice level just before and during outmigration," as part of the ABM as required under 3.1.3.

The SC is reviewing trade-offs as it considers the two options. Option A has the benefit of being a clear, measurable level that would be very precautionary for wild populations. The level reflects a level that Norway has sought to achieve during sensitive periods. The standard and associated monitoring are designed so that the level will be adapted over time to reflect better understanding of interactions between farmed and wild fish, and that regional data collected through monitoring of wild salmonids and the ABM would be used to adapt the level on a regional basis.

At the same time, the SC received many concerns during the previous public comment period about setting global standards around on-farm sea lice levels because of regional variations and these concerns are not immediately addressed in Option A. Also, the SC is aware of that demanding an extremely low level could, in some situations, result in additional sea lice treatments that may not be needed to protect wild fish and could increase risks from resistance.

Option B has the benefit of requiring a specific on-farm maximum lice level only in situations when wild populations are experiencing lice levels above a threshold that is considered safe. This option is initially more tailored to local conditions and addresses, partially, the concerns around setting a global numerical standard for all farms. This option, similar to option A, is designed to use regional, science-based information to adjust the required on-farm lice levels over time.

However, determining the thresholds for lice on wild populations has proved to be challenging, particularly for Pacific wild salmon. Several experts advising the SC have suggested that it may not be possible to set a credible threshold for Pacific species at this time. See Appendix III subsection II for details on work completed to date on these thresholds. In addition, option B relies on a specific lice level on wild fish, while some researchers suggest that overall infection prevalence, intensity and duration of exposure to elevated lice levels are the factors that are most correlated to negative impacts on wild fish, so the approach in Option B risks using an overly simplistic measure to try and make real time decisions for on-farm management.

In addition, under Option B, the feedback from wild monitoring may come too late for a farm to adapt its management quickly enough to be protective, particularly for out-migrating juveniles.

### Auditing Guidance

For 3.1.5, which requires evidence of data around wild salmonid health and migration:

- The farms are not responsible for conducting this research. Farms must demonstrate that they are aware of this basic information in their area. The data is likely to come from government sources or from research institutions.
- This is intended to be basic data for major watersheds within approximately 50 km of the farm. Detailed auditing guidance will need to be developed to reflect this intent. A farm does not need to demonstrate that there is data for every small river or tributary or subpopulation.
- Note: It is the understanding of the SC that this data is publicly available in the vast majority of, if not all, jurisdictions with wild salmonids.

### Criterion 3.2 Introduction of non-native species

INDICATOR	STANDARD
3.2.1 If a non-native species is being produced, demonstration that the species was widely commercially produced in the area by the standards release date	Yes <sup>33</sup>
3.2.2 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.<sup>34</sup> Aquaculture is considered to be one of the major pathways for introducing non-native aquatic plants and

<sup>33</sup> Exceptions shall be made for production systems that demonstrate separation from the wild through closed containment and production systems that use 100% sterile fish.

<sup>34</sup> 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.

animals that may become harmful invasive species. This standard 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.

To date, research 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 standard permits the farming of non-native species in locations where production already exists. The SAD encourages researchers to continue studying risks from non-native salmon farming. New studies that demonstrate any increased risks should prompt a revision of this standard.

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

**Additional information**

The SC is still considering how to precisely define “widely commercially produced in the area” in this standard, and welcomes suggestions.

The SC requests that the ASC conducts a review to ensure that there is still no evidence of establishment of non-native salmon in producing regions that are eligible for certification and that the risk of establishment in these regions remains low. This can be done every 3-5 years when the standards are updated. This reflects the FAO guideline that permits the culture of non-native species only when they pose an acceptable level of risk to biodiversity. It will not be the responsibility or role of the auditor to review the issue of establishment.

**Criterion 3.3 Introduction of transgenic species**

INDICATOR	STANDARD
3.3 Use of transgenic <sup>35</sup> salmon by the farm	None

**Rationale**

Transgenic fish are not permitted under this standard because of concerns about their unknown impact on wild populations. The culture of genetically enhanced<sup>36</sup> salmon is acceptable under the SAD. This allows for further progress in feed conversion, which should increase the efficient use of local resources. Also allowed under the SAD standard is the cultivation of triploid or all female fish as long as those fish are not transgenic.

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<sup>35</sup> Transgenic: Containing genes altered by insertion of DNA from an unrelated organism. Taking genes from one species and inserting them into another species to get that trait expressed in the offspring. ([http://www.csrees.usda.gov/nea/biotech/res/biotechnology\\_res\\_glossary.html](http://www.csrees.usda.gov/nea/biotech/res/biotechnology_res_glossary.html)).

<sup>36</sup> 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

**Criterion 3.4 Escapes**

INDICATOR	STANDARD
3.4.1 Maximum number of escapes episodes (defined as 200 or more fish), with the exception of escape episodes that are clearly documented as being out of the farm’s control <sup>37</sup>	0, in the most recent production cycle
3.4.2 Maximum number of escapees <sup>38</sup> in the most recent production cycle	300
3.4.3 Accuracy <sup>39</sup> of the counting technology or counting method used for calculating stocking and harvest numbers	≥98%
3.4.4 Estimated unexplained loss <sup>40</sup> of farmed salmon is made publicly available	Yes
3.4.5 Evidence of compliance with relevant regulations and technical standards aimed at reducing the risk of escapees	Yes

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<sup>37</sup> 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.

<sup>38</sup> Farms shall report all escapes, the total aggregated number of escapees per production cycle must be less than 300 fish.

<sup>39</sup> Accuracy shall be determined by the spec sheet for counting machines and through common estimates of error for any hand-counts.

<sup>40</sup> Calculated as: Unexplained loss = Stocking count – harvest count – mortalities – other known escapes. Where possible, use of the presmolt vaccination count as the stocking count is preferred.

3.4.6 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

### 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 farm 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<sup>41</sup>. 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 standards do not permit a certified farm to have a significant escapes event of 200 fish or more, except under extremely unusual circumstances in which the farm can demonstrate there was no reasonable way to predict the cause. The standards also place a cap on the total amount of fish that are allowed to escape through small events of less than 200 fish.

The standards 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 standards seek to encourage farmers to use counting devices that are as accurate as possible, requiring a minimum 98% accuracy of the counting method.

In addition, the standards require farms to observe local norms around escapes management, as well as best management practices to prevent escapes and to ensure accurate counts.

### Additional information

Data on escapes suggests that the vast majority of escaped fish are released in events involving 200 or more fish. Therefore, the SC decided to define an escape event as one where 200 or more fish escape.

The calculation of unexplained loss requires, where possible, the use of counts from the two moments when farms have the most accurate counts: pre-smolt vaccines and harvest. It must be recognized, however, that counting the number of escapes is a challenge on farms, due to the margin-of-error of fish counting machines and techniques. The standard related to transparency of unexplained losses can be used to cross-check and confirm that any reported escapes from the farm are within the error-range of accuracy, i.e. if farms are

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<sup>41</sup> 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.

demonstrating unexplained losses that are significantly larger than could be explained by counting error then that is an indication that there were higher mortalities or higher escapes.

The Steering Committee recognizes that some companies consider stocking and harvest data to be confidential business information. These standards require at a minimum public disclosure around the amount of unexplained loss as a percentage of fish put in the water.

A number of other standards throughout the document complement the standards on escapes from grow-out sites in terms of minimizing impact on wild salmon populations. The SAD includes standards 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. Standards related to escapees from smolt systems are particularly important in minimizing the potential for interbreeding, as some studies show comparatively high reproductive success rates in escaped precocious male parr<sup>42</sup>. The SAD also includes standards 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.

### **Auditing guidance**

Related to the exceptional episode allowed up to once every 10 years:

- When a farm is first applying for certification, the auditor should look back to the beginning of the production cycle for which the farm is applying for certification and effectively start the 10-year period at that stocking date.
- The farmer must demonstrate that there was no reasonable way to predict the events that caused the episode. Events that should be considered “exceptional” under this standard includes vandalization of the farm. Events that should not be considered “exceptional” under the standard include failures in mooring due to a bad storm.

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<sup>42</sup> Garant D., Fleming I.A., Einum S., 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.*

**Note on auditing the suite of standards related to feed**

These feed standards require a salmon producer to work with its feed supplier to demonstrate compliance. The feed producer will need to provide the farm with documentation demonstrating compliance with the standards. Detailed auditing guidelines will be developed after the standards are finalized. The SAD permits two methods for demonstrating compliance with the standards. The first method requires the farm to buy feed that contains the ingredients as specified in these standards, and provide an auditor with third-party documentation that the manufacturing process did, indeed, produce this special feed for the farmer.

Farmers also have a second option, commonly referred to as the “mass-balance approach.” Under this option, the farm’s feed manufacturer must demonstrate, using a third-party audit, that it purchased the appropriate amount and kind of ingredients to supply feed to all of its customers requesting specific ingredients through schemes such as the SAD. These ingredients, however, would get mixed into the general silos and production lines of the manufacturer, greatly reducing costs associated with special storage capacity and production lines. This mass-balance approach is commonly used in other certification schemes and in situations such as purchasing “green” energy off an electricity grid.

**Criterion 4.1 Traceability of raw materials in feed**

INDICATOR	STANDARD
4.1.1 Presence and evidence of traceability of all raw feed ingredients with regard to country of origin and of a certified chain of custody to the level of detail needed to meet the standards under Principle 4	Yes

**Rationale**

Raw material traceability is fundamental to many of the SAD standards and, therefore, is required under this standard. This standard 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 regards to country of origin, while for other feed ingredients that relate specifically to other SAD standards, this may be a finer level of detail, such as traceability back to the fishery.

**Criterion 4.2 Use of wild fish for feed**

INDICATOR	STANDARD
4.2.1 Fishmeal Forage Fish Dependency Ratio (FFDRm) for grow-out (calculated using formulas in Appendix IV,	<1.35

subsection 1)	
<p>4.2.2 Fish oil Forage Fish Dependency Ratio (FFDRo) for grow-out (calculated using formulas in Appendix IV, subsection 1),</p> <p>OR</p> <p>Maximum amount of EPA and DHA from direct marine sources<sup>43</sup> (calculated according to Appendix IV, subsection 2)</p>	<p>FFDRo &lt;2.95 or (EPA + DHA) &lt; 30 g/kg feed</p>
<p>4.2.3 Protein Retention Efficiency (PRE) for grow-out (calculated using formulas in Appendix IV, subsection 3)</p>	<p>≥35%</p>

### 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 standards 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 must be shared across a range of users with increasing demands, from direct human consumption to aquaculture to pig and poultry production. The SAD 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 SAD 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 standard 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 standards 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. The standard was set at a level that is achievable today according to available nutritional knowledge, backed by scientific results<sup>44</sup>.

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<sup>43</sup> 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 do not come from any species that are classified as critically endangered, endangered, or vulnerable in the IUCN Red List of Threatened Species (<http://www.iucnredlist.org/static/introduction>).

<sup>44</sup> <http://www.aquamaxip.eu/content/view/53/71/>

Protein Retention Efficiency (PRE) is a measure of the net protein retention in the aquaculture system and unlike FFDR gives an indication of the conversion efficiency of all protein ingredients—it includes terrestrial plant and animal proteins in addition to protein from fish and marine sources. PRE gives a direct measure of the feed efficiency. As this is a relatively undocumented parameter in the field, the low initial standard level is intended to allow broad compliance, but data will be collected to set a more rigorous standard in future revisions if it proves to be a useful indicator of responsible salmon production. The SC views this as a starting point on a critical issue and expects the standard to change as more information is collected.

**Additional information**

The FFDR and PRE are proposed to be calculated during the grow-out phase of salmon production. Salmon is normally transferred to sea at a size of 50 – 200 grams. A normal slaughter-weight, live fish, will weigh approximately 5,000 grams. This means that the freshwater period represents only about 1 to 4% of the total life cycle. In order to do a correct calculation of FFDR, one needs a detailed inventory of the feed used and an accurate calculation of economic feed conversion ratio (eFCR). This information is readily available at the grow-out (sea water) site. If one also has to provide information from the freshwater site, it makes it more complicated to gather necessary information. This information adds little value in terms of ecological gain, as it only represents 1 to 4% of the life cycle. As a result, only a fraction of the total feed is used during the freshwater production phase. Some farmers, especially small-scale farmers, will buy smolt from a third party producer. This can also make it more complicated to get access to the information needed.

For most of the standards, the SAD has tried to identify best practices in the industry and incorporate these best practices into the standards. When identifying the present standards linked to FFDR of fishmeal and fish oil, the SAD did a survey of the variables that go into the calculation and established the current variation in the industry. Using recognized statistical methods the SAD then identified the variation of FFDR for fishmeal and fish oil in the industry. Using this data, it was also possible to determine an FFDR that was consistent with a level currently met by approximately 20-30% of the industry (i.e., the better performers on this issue).

The SC decided to offer the calculation of levels of EPA and DHA from wild fish in feeds as an alternate method of measuring dependency on forage fisheries. The threshold for the standard was set to be equivalent to the FFDR for oil of 2.95, meaning that the effect of meeting either is equivalent. This alternative was suggested as a way that may be easier for some feed manufacturers to calculate based on their current systems and calculations.

**Criterion 4.3 Source of marine raw materials**

INDICATOR	STANDARD
4.3.1 Timeframe for all fishmeal and fish oil used in feed to come from fisheries <sup>45</sup> certified under a scheme that is ISEAL accredited and has guidelines that specifically promote responsible environmental management of small pelagic fisheries	<5 years after the date of publication of the SAD standards

<sup>45</sup> This standard applies to fishmeal and oil from forage fisheries (including krill) and not to by-products or trimmings used in feed

<p>4.3.2 Prior to achieving 4.3.1, the FishSource score<sup>46</sup> for the fishery(ies) from which all marine raw material in feed is derived. (See Appendix IV, subsection 4 for explanation of FishSource scoring)</p>	<p>All individual scores ≥6, and biomass score ≥8</p>
<p>4.3.3 Prior to achieving 4.3.1, demonstration of chain of custody and traceability for fisheries products in feed through an ISEAL accredited or ISO 65 compliant certification scheme that also incorporates the FAO<sup>47</sup> Code of Conduct for Responsible Fisheries</p>	<p>Yes</p>
<p>4.3.4 Feed containing fishmeal and/or fish oil originating from by-products<sup>48</sup> or trimmings from IUU<sup>49</sup> catch or from fish species which are categorized as vulnerable, endangered or critically endangered, according to the IUCN Red List of Threatened Species<sup>50</sup></p>	<p>None</p>

### 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<sup>51</sup>. 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 proposed standards 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.

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<sup>46</sup> Or equivalent score using the same methodology

<sup>47</sup> Food and Agricultural Organization of the United Nations (FAO)

<sup>48</sup> 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

<sup>49</sup> IUU: Illegal, Unregulated and Unreported

<sup>50</sup> The International Union for the Conservation of Nature reference can be found at <http://www.iucnredlist.org/static/introduction>

<sup>51</sup> FAO, The State of World Fisheries and Aquaculture (SOFIA), 2010.

In the medium term, the standards will require marine ingredients in feed to be certified by a widely recognized authority. This recognized authority must be accredited by 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. Currently the Marine Stewardship Council (MSC) is the only scheme that is ISEAL accredited, and MSC is in the process of developing specific standards for small pelagic fisheries. Additional schemes may emerge in the future that meet these requirements. This standard begins to be applicable 5 years after the publication of the SAD standards 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.

In the short term, the standards 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. Standard 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.

Rigorous traceability requirements are built into 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<sup>52</sup> or a future equivalent that might emerge can be used to meet this standard.

Last, standard 4.3.4 incorporates a component that relates to the source of fisheries by-products and trimmings and prohibits the use of those 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 SAD standards.

#### **Additional information**

The SAD standards require that the fisheries be certified by a member of the ISEAL Alliance. ISEAL membership was selected as a requirement because of ISEAL's stringent requirements related to governance structures, ensuring independent third-party certification, multi-stakeholder advisory councils, and processes for responding to objections to certifications. Currently, the only fisheries certification scheme under ISEAL is the MSC. The fisheries must also be certified under guidelines that are developed specifically to take into account the crucial ecological role of low-trophic level species. It is the understanding of the SAD SC that the MSC is currently in the process of developing such guidelines. In order to achieve certification, it is probable that many fisheries will need to enact management changes and even regulatory changes in some jurisdictions. Such changes take time, and the SC encourages fisheries to immediately begin to make any needed reforms.

#### **Auditing guidance**

The International Fishmeal and Fish Oil Organization's Global Standard for Responsible Supply is one option for demonstrating compliance with standards related to traceability of fishmeal and fish oil, as well as the exclusion of by-products from IUU catch and vulnerable, endangered, and critically endangered fisheries.

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<sup>52</sup> <http://www.iffo.net/default.asp?contentID=636>

#### Criterion 4.4 Source of non-marine raw materials in feed

INDICATOR	STANDARD
4.4.1 Presence and evidence of a responsible sourcing policy for the feed manufacturer for feed ingredients which comply with recognized crop moratoriums <sup>53</sup> and local laws <sup>54</sup>	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 <sup>55</sup>	100%, within 5 years of the publication of the SAD standards
4.4.3 Evidence of disclosure to the buyer <sup>56</sup> of the salmon of inclusion of transgenic <sup>57</sup> plant raw material, or raw materials derived from transgenic plants, in the feed	Yes, for each individual raw material containing > 1% transgenics

#### Rationale

The SAD standards aim to promote responsible sourcing of all feed ingredients. Thus, the SAD 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 SAD. Therefore, the standard requires producers to source feed from feed producers who comply with any relevant recognized crop moratoriums, which, at the time of the writing of these draft standards, includes only the Brazilian Soy Moratorium,<sup>58</sup> as far as the SC understands. Such moratoriums are temporary measures intended to protect defined geographic regions. Looking to the future, the SAD incorporates a requirement for feed manufacturers to use soy certified by the RTRS, which the SAD recognizes as the most environmentally meaningful soy certification process today. Because the scheme is recently starting up, the standards build in a 5-year window for this requirement.

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<sup>53</sup> 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.

<sup>54</sup> 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 Soya Moratorium. Should the Brazilian Soy Moratorium be lifted, this specific requirement shall be reconsidered.

<sup>55</sup> Equivalent: Any alternate certification scheme would have to be approved as equivalent by the technical governance structure of the Aquaculture Stewardship Council.

<sup>56</sup> 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.

<sup>57</sup> Transgenic: Containing genes altered by insertion of DNA from an unrelated organism. Taking genes from one species and inserting them into another species to get that trait expressed in the offspring.

<sup>58</sup> See [http://www.abiove.com.br/english/ss\\_moratoria\\_us.html](http://www.abiove.com.br/english/ss_moratoria_us.html) for additional information on the soy moratorium.

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 feed genetically modified ingredients. The SAD standards ensure transparency around any transgenic material used in the feed in order to support informed choices by retailers and consumers.

**Additional information**

The SAD standards require that the producer disclose to the first-order buyer of their salmon the use of any genetically modified ingredients in feed. For any single raw material such as soy, where there is production of a genetically modified version of the material, there is a possibility of contamination of non-GM with GM materials throughout the production and processing chain. To be consistent with European Union policy, the standard incorporates a 1% threshold for allowed contamination of GM ingredients without triggering the requirement for disclosure. The feed producer can provide evidence that genetically modified raw materials are not present in the feed through analytical results and identity preservation programs.

Although a responsible sourcing policy cannot be validated for all aspects of feed production by salmon producers, it provides a layer of accountability for salmon producers and enables them to use their purchasing preferences to improve, where necessary, the practices of their feed suppliers. When the SAD standards are updated and revised, the addition of a requirement for the certification of key vegetable ingredients, beyond soy, by independent, third-party sustainability schemes should be considered. Specifically, the SAD will encourage the ASC to review of whether the standard should demand that vegetable ingredients originate from an ISEAL-accredited certification scheme.

**Criterion 4.5 Non-biological waste from production**

INDICATOR	STANDARD
4.5.1 Presence and evidence of a functioning policy for proper and responsible 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

**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 neighboring communities.

**Additional information**

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. The SAD recognizes 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 recognize that what is “proper” on one site is different from what is “proper” on another site. Regardless of the remoteness of a farm, these standards would, for example, prohibit the dumping of non-biological waste (e.g.,

feedbags or nets) into the ocean. The presence of this type of trash in the ocean and on beaches near farms in some regions was highlighted as an issue of concern by some stakeholders.

#### Criterion 4.6 Energy consumption and greenhouse gas emissions on farm

INDICATOR	STANDARD
4.6.1 Presence of an energy use assessment verifying the energy consumption on the farm and representing the whole life cycle at sea (see Appendix V subsection 1 for guidance and required components of the records & assessment)	Yes, measured in kilojoule/mt fish/production cycle
4.6.2 Records of greenhouse gas (GHG <sup>59</sup> ) emissions <sup>60</sup> on farm and evidence of an annual GHG assessment (See Appendix V subsection 1)	Yes
4.6.3 Documentation of GHG emissions of the feed <sup>61</sup> used during the previous production cycle (See Appendix V subsection 2 for guidance and requirement components of the assessment)	Yes, within 3 years of the publication of the SAD standards

#### 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 SAD recognizes 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 SAD set a meaningful numerical standard for energy use in the future. Energy assessments are a new area for producers. Requiring that farms do these assessments will, likely, raise awareness of the issues related to energy and build support for adding a standard in the future related to the maximum energy of GHG emissions allowed.

#### Criterion 4.7 Non-therapeutic chemical inputs

INDICATOR	STANDARD
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<sup>59</sup> For the purposes of this standard, GHGs are defined as the six gases listed in the Kyoto Protocol: carbon dioxide (CO<sub>2</sub>); methane (CH<sub>4</sub>); nitrous oxide (N<sub>2</sub>O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF<sub>6</sub>)

<sup>60</sup> GHG emissions must be recorded using recognized methods, standards and records as outlined in Appendix V

<sup>61</sup> 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.

4.7.1	For farms that use copper-treated nets, evidence that nets are not cleaned <sup>62</sup> 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 <sup>63</sup>	Yes
4.7.3	For farms that use copper nets or copper-treated nets, evidence of annual testing for copper level in the sediment outside of the AZE (According to methodology in Appendix 1, subsection 1)	Yes
4.7.4	In instances where the Cu concentration <sup>64</sup> in the sediment exceeds 34 mg Cu/kg dry sediment weight, demonstration that the Cu concentration is consistent with reference sites and backgrounds levels	Yes
4.7.5	Evidence that the type of biocides used in net antifouling are approved according to legislation in the European Union, or 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. 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. In order to minimize release of Cu from salmon farms into the environment, the draft standard 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 standard. The AZE used shall be the same as for other standards, using a precautionary AZE until a credible modeling method is used to determine an actual zone of effect. Experts suggest that the threshold stated (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. Under the SAD 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.

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<sup>62</sup> 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.

<sup>63</sup> Treatment must have appropriate technologies in place to capture copper if the farm uses copper treated nets.

<sup>64</sup> 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.

The SAD 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 SAD elected to limit use to those chemicals approved for legal use by the European Union, United States, or Australia. The SC encourages the development and review of alternative anti-foulants that are protective of the marine environment.

**Additional information**

To be available to biological systems, Cu must be present in a readily soluble form. The form taken by the copper (i.e., ionic, complexed and precipitated), and hence its bioavailability, depends on environmental factors such as pH, redox potential (Eh), soil and sediment type, water hardness and organic content. These factors vary in the environment, making it hard to make global predictions related to Cu toxicity. This is part of the rationale behind the SC's decision to set the Cu threshold as one that triggers further analysis rather than failure of the standard.

The EU, US, and Australia were selected as a representation of jurisdictions that were viewed to be undertaking rigorous analyses of biocides. In the EU, biocides are currently being reviewed under the Biocidal Product Directive, and the SC was advised that Australia is currently in the process of reviewing several biocides for net coatings.

## 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.*

### Criterion 5.1 Survival and health of farmed fish

5.1.1. Evidence of a fish health management plan for the identification and monitoring of fish diseases and parasites	Yes
5.1.2 Site visits by a designated veterinarian <sup>65</sup> at least four times a year, and by a fish health manager <sup>66</sup> at least once a month	Yes
5.1.3 Percentage of dead fish removed and disposed of	100%
5.1.4 Percentage of mortalities that are recorded, classified, and receive a post-mortem analysis	100% <sup>67</sup>
5.1.5 Maximum mortality <sup>68</sup> rate of farmed fish	≤20%, during at least two of the previous three production cycles <sup>69</sup>
5.1.6 Maximum unexplained mortality rate from the previous two production cycles, for farms with mortality rates >6%	≤40% of total mortalities
5.1.7 A farm-specific mortalities reduction program that includes defined annual targets for reductions in	Yes

<sup>65</sup> 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.

<sup>66</sup> 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.

<sup>67</sup> If on-site diagnosis is inconclusive, this standard requires off-site laboratory diagnosis. A qualified professional must conduct all diagnosis. 100% 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 analyzed.

<sup>68</sup> Culled fish may be excluded from mortality counts. The SC understands that culling at grow-out facilities is not a regular activity. Total number of culled fish shall also be reported.

<sup>69</sup> Farms applying for certification for the first time have to demonstrate mortality ≤20% for one production cycle prior to certification. This cycle then counts as the first of the three consecutive production cycles for this they will be evaluated under the standard going forward.

**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 standards 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 standards 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 standard 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 standards in 5.1.5 and 5.1.6 are not intended as a goal, but rather a bare minimum required. The standard requires that the mortalities be kept at or below 20% for at least two of every three production cycles. This allows for the farms to occasionally have an exceptional mortality event. Only farms with mortality rates greater than 6% per production cycle must also then meet the standard 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 standards.

**Criterion 5.2 Therapeutic treatments**

INDICATOR	STANDARD
5.2.1 On-farm documentation that includes, at a minimum, detailed information on all chemicals <sup>70</sup> 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 <sup>71</sup> in any of the primary salmon producing or importing countries <sup>72</sup>	None

<sup>70</sup> Chemicals used for the treatment of fish.

<sup>71</sup> “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. The SAD SC recommends that ASC maintain a list of a banned therapeutants.

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	Maximum cumulative parasiticide treatment index (PTI) score <sup>73</sup> calculated according to the formula <sup>74</sup> : $\sum(\text{Average live weight of salmon at treatment in kg})$	PTI score < 6.8 <sup>75</sup>
5.2.6	Allowance for prophylactic use of antimicrobial treatments <sup>76</sup>	None
5.2.7	For any use of antibiotics listed as highly important for human medicine by the World Health Organization (WHO <sup>77</sup> ), demonstration that a risk assessment <sup>78</sup> was conducted by the veterinarian prior to prescription and application	Yes
5.2.8	Allowance for use of antibiotics listed as critically important for human medicine by the WHO	None <sup>79</sup>

### 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

<sup>72</sup> For purposes of this standard, those countries are Norway, UK, Canada, Chile, US, Japan, and France.

<sup>73</sup> The index shall be calculated for all parasiticides with the exception of hydrogen peroxide, which is viewed as sufficiently less toxic and persistent than other parasiticides used in salmon production.

<sup>74</sup> PTI is calculated as the sum of the average live weight of the salmon being treated at each treatment, in kg, over the course of the production cycle. See additional information section for 5.2 for more details on the PTI.

<sup>75</sup> The threshold for this standard remains a topic of discussion. The SC welcomes feedback on this. See additional information section for 5.2 for more details on the PTI and thresholds under discussion.

<sup>76</sup> The designated veterinarian must certify that pathogen or disease is present before prescribing medication

<sup>77</sup> The 3<sup>rd</sup> edition of the WHO list of critically and highly important antimicrobials was released in 2009 and is available at [http://www.who.int/foodborne\\_disease/resistance/CIA\\_3.pdf](http://www.who.int/foodborne_disease/resistance/CIA_3.pdf)

<sup>78</sup> The risk assessment 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. The assessment shall consider all alternative treatment options. Prescribing antibiotics highly important for human health shall be considered as a last resort.

<sup>79</sup> 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.

first step to ensure proper dosing and safe use of therapeutants. The data collected from this standard will also help the SAD set more measurable standards in the future.

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

Standard 5.2.5 sets a maximum index score that a farm must achieve related to parasiticide use given the significant environmental concerns and effects on non-target organisms that may arise with excessive parasiticide use, especially of those parasiticides that are either more toxic or more persistent in the environment. The parasiticide treatment index (PTI) is intended as a proxy for the total amount of toxic parasiticide released into the marine environment. The PTI takes into account the sum of the average size of the salmon at treatment as a means to restrict the total quantity of parasiticide used per unit of fish produced. The standards allow for the use of toxic parasiticides due to a desire to keep lice levels low, in particular at times when wild fish may be most sensitive to high levels of lice in the marine environment.

There is a global effort led by the World Health Organization to ensure that antibiotics important for human medicine are used in a way that doesn't jeopardize their effectiveness in treating human diseases. These standards seek to be in line with that effort. The Salmon Dialogue's technical working group on chemical inputs recommended that antibiotics important for human health only be used with extreme reluctance. These standards 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 standards 5.2.7 and 5.2.8.

#### **Additional information**

The parasiticide treatment index (PTI) is calculated according to the formula:  $\sum(\text{Average live weight in kg of salmon at treatment})$ . The index shall be calculated for all parasiticides with the exception of hydrogen peroxide, which is viewed as sufficiently less toxic and persistent than other parasiticides used in salmon production. The amount of parasiticide released into the environment will be proportionate to the total amount of biomass treated. Therefore, setting a cap on the amount of biomass treated per fish produced will put a cap on the amount of therapeutant that can be used. This allows for greater flexibility by the producer in terms of treatments while capping the environmental load.

As an example, two farms that use a different number of treatments may have the same PTI. A farm treating their fish four times in a production cycle, at average sizes of 0.5kg, 1.5kg, 2 kg, and 3 kg would have a total PTI of 7. Similarly, a farm treating larger fish fewer times could also have a PTI of 7 if the fish were treated at average sizes of 1kg, 2.5kg, and 3.5 kg.

The proposed standard of 6.8 was set based on the average sum of weight of fish based on a regime of three treatments over the course of a production cycle. Treatments were assumed to take place at in the first autumn after stocking, in early spring prior to wild smolt outmigration, and a treatment during the second summer at sea.

The SC would like to build a reduction in PTI, or in total parasiticide use, over time into the standard but has not yet done so in this version and welcomes feedback on how to integrate continuous improvement into the

standard. The SC is also considering whether to put restrictions on treatment during times when lobster populations, if present, are known to be particularly sensitive.

The SC initially hoped to develop an index that took into account toxicity and persistence of parasiticides as a means to differentiate which were of greater environmental concern. However, data related to toxicity (by LC50) in particular had a degree of uncertainty and inconsistency that made including these factors uncomfortable for the SC. Should more information become available to better compare parasiticides in terms of their toxicity and persistence, the index can easily be modified to take into account the degree of environmental concern of each individual therapeutic. The SC welcomes feedback on how best to structure and revise this standard to ensure that it is an effective proxy for risk from the use of toxic parasiticides.

With regards to standard 5.2.2, it is the understanding of the SC that, as of the writing of the second draft of the SAD standards, the use of fluoroquinolones is prohibited in fish production in the United States under a prohibition of the extra-label use of fluoroquinolones in food-producing animals. Although Australia is not listed as a primary producer or importer under the SAD standard, the Australian government has prohibited the use of fluoroquinolones in food-producing animals. The only fluoroquinolone that the SC knows to be approved in any jurisdiction for salmon production is flumequine in Chile. This standard would prohibit certified farms from using flumequine in production. Should the status of that prohibition in the U.S. change, or should any additional antibiotics or therapeutants become proactively banned or prohibited in any of the primary salmon producing or importing countries, that would be taken into account under this standard. Standard 5.2.2 would also, for example, prohibit the use of malachite green in salmon produced under the SAD standard, regardless of whether malachite green was legal in the country of production. For ease of auditing, the SAD SC recommends that the ASC maintain a list of banned substances, as this standard is also used in other Dialogue standards.

The WHO ranks classes of antimicrobial compounds used on humans as being critically important, highly important, or important for human health. The WHO developed the critically important antimicrobial list as a means of identifying and prioritizing antibiotics that should not be used for non-human use and to provide information on the human health consequences of antimicrobial resistance for use in the management of risk due to non-human use of antimicrobials. The SAD SC proposes that this list be used to determine which antibiotics should be considered as presenting an acceptable level of risk for use under this standard. The SC recognizes that treatment of salmon is sometimes necessary for production and animal welfare reasons, and that the use of antibiotics listed by the WHO as critically important for human health may be necessary on rare occasions. However, salmon treated with these specific antibiotics cannot be sold or labeled as compliant with the SAD. As of the writing of the second draft of the SAD standards, it is the SC’s understanding that the antibiotics that are legally allowed for use in any of the four leading producing jurisdictions include five antibiotics that are listed as being critically important for human health by the WHO. These are, with the countries where the SC understands them to be approved: flumequine (Chile), oxolinic acid (Chile, Norway), amoxicillin (Chile, UK), erythromycin (Chile, Canada under EDR), and oxytetracycline (Norway, UK, Canada, Chile). These compounds, and any other antibiotics on the WHO list of critically important antimicrobials, cannot be used on salmon that are certified under the SAD.

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

INDICATOR	STANDARD
5.3.1 Bio-assay analysis to determine resistance when two applications of a treatment have not produced the	Yes

expected effect <sup>80</sup>	
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

**Rationale**

One of the more serious risks of overusing chemical therapeutants is the development of resistance, which lowers the overall effectiveness. In some salmon-growing regions, resistance to SLICE 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 done 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. Bio-assays are important to confirm if resistance is developing. If a farm doesn't have alternative treatments that are authorized in its jurisdiction and under this standard, immediate harvest of the fish is necessary to halt the outbreak and prevent further development of resistance.

**Criterion 5.4 Biosecurity management**

INDICATOR	STANDARD
5.4.1 Evidence that all salmon on the site are a single-year class <sup>81</sup>	100%
5.4.2 Percentage of fish transferred live from one sea-based farm site to another, unless explicitly accepted by the designated veterinarian not to increase disease spreading risk <sup>82</sup>	0%

<sup>80</sup> For purposes of this standard, treatments are expected to produce at least a 90% reduction in prevalence of lice on the farmed fish. Compliance with this standard requires that a farm conducts timely, accurate lice counts to ensure it understands the impact of treatments.

<sup>81</sup> Gaps of up to 6 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.

<sup>82</sup> For example, to move fish from one site to another inside an ABM area when planned in the ABM-production plan should be OK if the fish is shown to be free of diseases of regional concern (ref 5.1.4). Where multiple sites in an ABM area have the same yearclass of smolt input and the same disease situation, a veterinarian shall be allowed to give green light to move fish from one site to another if veterinarian has analyzed and accepted risk and if needed, for example where one site is split into two sites when the biomass reach a certain level.

5.4.3 Percentage of fish transported in a closed wellboat <sup>83</sup> , a wellboat with sea lice filtration, or a wellboat with discharge treatment and disinfection	100% , where such transport involves moving fish across management areas
5.4.4 If exotic diseases and /or parasites are detected on the farm or in the hatchery, evidence of increased <sup>84</sup> biosecurity measures that include restrictions on movement and evidence of strong disease management practices, including culling	Required

**Rationale**

Biosecurity measures reduce the risk of disease transmission to the wild and between farms. These standards aim to ensure farms don't harm the health of wild populations by amplifying or spreading disease. It is recognized that disease flow is bidirectional between farmed and wild fish, and these standards aim to minimize effect of disease transmission and retransmission.

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<sup>83</sup> Or another closed system

<sup>84</sup> Increased biosecurity measures compared to prior practice on the farm. Guidelines will be developed to detail minimum biosecurity measures, such as footbaths, separate dive equipment.

## 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 labor concerns.

### Criterion 6.1 Freedom of association and collective bargaining<sup>85</sup>

INDICATOR	STANDARD
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 Labour Organization's (ILO) "Declaration on Fundamental Principles and Rights at Work." The declaration was adopted in 1998 by the 86th International Labour Conference and has since been ratified by the overwhelming majority of ILO's 183 member nation-states.

#### Auditing guidance

The information below is intended to clarify the intent of the standard related to freedom of association and collective bargaining in order to develop appropriate auditing guidelines that will accompany the final version of the standards.

- Workers have the freedom to form and join any trade union, free of any form of interference from employers or competing organizations set up or backed by the employer. ILO specifically prohibits "acts which are designated to promote the establishment of worker organizations or to support worker organizations by financial or other means, with the object of placing such organizations under the control of employers or employers' organizations." For verification, auditors could review policies on Freedom of Association, collective bargaining agreements, meeting minutes, complaints resolutions or worker interviews.
- Workers can choose their own representatives, without employer interference. Workers are allowed access to worker organizations and their representatives. Employers cannot discriminate against workers who are organized, including unions. Workers have the right to bargain collectively with employers regarding rights and working conditions. For verification, auditors could review policies on

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<sup>85</sup> 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.

Freedom of Association, collective bargaining agreements, meeting minutes, complaints resolutions or worker interviews.

- These standards do not mean all workers of a certified aquaculture operation must be in a trade union or similar organization. The standards mean that workers must not be prohibited from accessing or joining such organizations. If they do not exist or are illegal, companies must make it clear that they are willing to engage in a collective dialogue through a representative structure freely elected by the workers.

## Criterion 6.2 Child labor

INDICATOR	STANDARD
6.2.1 Number of incidences of child <sup>86</sup> labor <sup>87</sup>	None
6.2.2 Percentage of young workers <sup>88</sup> that are protected <sup>89</sup>	100%

### Rationale

The effective abolition of child labor is one of the core principles of the ILO “Declaration on Fundamental Principles and Rights at Work.” Adherence to the child labor codes and definitions included in this section indicates compliance with what the ILO and international conventions generally recognize 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<sup>90, 91</sup> to their physical or mental well-being. To this end, the standards related to what constitutes child labor will protect the interests of children and young workers at salmon farms certified to these standards.

### Auditing guidance

1. Minimum age of permanent workers is 15 years old (or 14, if the country allows it under the developing country exceptions in ILO convention 138). If the legal minimum age allowed in the country is higher than 15 years, the legal minimum age of the country is followed. (Note: Employer is accountable for worker age documentation. In most countries, the law states that the general minimum age for employment is 15 years.)

<sup>86</sup> **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.

<sup>87</sup> **Child Labor:** Any work by a child younger than the age specified in the definition of a child.

<sup>88</sup> **Young Worker:** Any worker between the age of child, as defined above, and under the age of 18.

<sup>89</sup> **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, school time and work time shall not exceed 10 hours.

<sup>90</sup> **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).

<sup>91</sup> **Hazardous work:** Work that, by its nature or 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)

2. For workers aged 15-18 (i.e., young workers), work shall not conflict with schooling and the combined daily transportation time, school time and work time shall not exceed 10 hours. This standard is compatible with the allowance of internships, technical training or after-school jobs for young workers. Hazardous work (e.g., heavy lifting disproportionate to a person’s body size, operating heavy machinery, working night shifts and exposure to any toxic chemicals) is not performed by those below age 18.
3. Auditors may want to review company policies on young workers, training programs, Personal Protective Equipment and timesheets. They also may want to conduct worker interviews.

**Criterion 6.3 Forced, bonded or compulsory labor**

INDICATOR	STANDARD
6.3.1 Number of incidences of forced <sup>92</sup> , bonded <sup>93</sup> or compulsory labor	None

**Rationale**

Forced labor - 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 labor 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 labor 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. Employers are never permitted to withhold original worker identity documents. Adherence to these policies shall indicate an aquaculture operation is not using forced, bonded or compulsory labor forces.

**Auditing guidance**

1. Contracts shall be clearly stated and understood by workers and never lead to a worker being indebted (e.g., workers paying for essential job training programs).
2. Employer shall never be permitted to withhold a worker’s original identity documents. (Note: Extra care shall be given to migrants and contractor/ subcontractor situations because they can be particularly vulnerable without their identity documents).
3. Auditors may wish to choose to review company policy on forced labor, payroll records and worker interviews

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<sup>92</sup> **Forced (Compulsory) labor:** All work or service that is extracted from any person under the menace of any penalty for which a person has not offered him/ 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).

<sup>93</sup> **Bonded labor:** When a person is forced by the employer or creditor to work to repay a financial debt to the crediting agency.

## Criterion 6.4 Discrimination<sup>94</sup>

INDICATOR	STANDARD
6.4.1 Evidence of comprehensive <sup>95</sup> and proactive anti-discrimination policies and practices	Yes
6.4.2 Number of incidences of discrimination	None

### 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 standard, employers must demonstrate their commitment to equality with an official anti-discrimination policy, a policy of equal pay for equal work, as well as 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 minimization 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.

### Auditing guidance

1. Employers shall have written anti-discrimination policies stating the company does not engage 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
2. Clear and transparent company procedures are outlined to raise, file and respond to discrimination complaints
3. Employers shall respect the principle of equal pay for equal work and equal access to job opportunities, promotions, raises, etc.
4. Worker testimony shall be able to support that the company does not interfere with the rights of personnel to observe tenets or practices, or to meet needs related to race, caste, national origin, religion, disability,

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<sup>94</sup> **Discrimination:** Any distinction, exclusion, or preferences, which has the effect of nullifying or impairing equality of opportunity or treatment. Not all 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 favor of people from certain underrepresented groups may be legal in some countries.

<sup>95</sup> Employers shall have written anti-discrimination policies stating the company does not engage 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

gender, sexual orientation, union membership, political affiliation, or any other condition that may give rise to discrimination

### Criterion 6.5 Work environment health and safety

INDICATOR	STANDARD
6.5.1 Percentage of workers trained in health and safety practices, procedures 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 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

#### Rationale

A safe and healthy working environment is essential for protecting workers from harm. It is critical for a responsible aquaculture operation to minimize 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% of worker costs when a job-related accident or injury occurs.

#### Auditing guidance

*Guidance for percentage of workers trained in health and safety practices, procedures and policies*

1. Emergency response procedures shall exist and be known by workers
2. Offer regular health and safety training for workers (once a year and for all new workers), including training on potential hazards and risk minimization, Occupational Safety and Health (OSH) and effective use of PPE.

*Guidance for presence of a health and safety risk assessment and evidence of preventive actions taken*

1. Minimization of hazards and risks in the working environment, including documented systemic procedures and policies to prevent workplace hazards and their risks (e.g., risk assessments), shall exist and all workers shall be trained in how to identify and prevent those hazards and risks  
Policies, procedures and instructions that are adapted according to the results of risk assessments shall be in place to help prevent accidents from taking place

*Guidance for evidence that all health and safety related accidents and violations are recorded and corrective actions are taken when necessary*

1. Accidents shall be recorded.
2. Documentation shall be generated with regard to occupational health and safety violations.
3. Corrective action plan shall be implemented in response to accidents that have occurred. This should analyze the root causes, address the root causes, and remediate and prevent future accidents of a similar nature.

*Guidance for proof of accident insurance*

1. There shall be sufficient insurance to cover workers who suffer accident or injury in the work environment. Special consideration must be given to migrant or foreign workers who may fall outside of the law.

*Guidance for certification of divers:*

1. Divers shall be certified through an accredited national or international organization for diver certification.

**Criterion 6.6 Wages**

INDICATOR	STANDARD
6.6.1 The percentage of workers whose basic wage <sup>96</sup> (before overtime and bonuses) is below the minimum wage <sup>97</sup>	0 (None)
6.6.2 Evidence that the employer is working towards the payment of basic needs wage <sup>98</sup>	Yes
6.6.3 Evidence of transparency in wage-setting	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 standards the importance of workers' basic wages meeting the legal

<sup>96</sup> **Basic wage:** the wages paid for a standard working week (no more than 48 hours)

<sup>97</sup> If there is no legal minimum wage in a country, basic wages must meet the industry-standard minimum wage.

<sup>98</sup> **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.

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 towards 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.

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 labor conflict resolution policy<sup>99</sup> 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.

**Auditing guidance**

1. Employers shall ensure that wages paid for a standard working week (no more than 48 hours) always, at a minimum, meet legal/ industry minimum standards. Piece-rate and pay-per-production are reasonable and attainable within regular working hours.
2. Employers shall demonstrate assessment of workers’ basic needs and the corresponding wage.
3. Employers shall demonstrate that they have taken steps towards achieving a basic needs wage for their workers.
4. Wage and benefits are clearly articulated to workers and are rendered to workers in a convenient manner. Workers don’t need to travel to collect benefits, and promissory notes, coupons or merchandise never replace cash/ electronic/ check payment methods.
5. Clear and transparent mechanism for wage setting shall be known to workers
6. Auditors may review payroll, timesheets, punch cards, production records, utility records, and worker interviews.

**Criterion 6.7 Contracts (labor) including subcontracting**

INDICATOR	STANDARD
6.7.1 Percentage of workers who have contracts <sup>100</sup>	100%
6.7.2 Evidence of a policy to ensure social compliance of its suppliers and contractors	Yes

<sup>99</sup> See Criterion 6.8.

<sup>100</sup> 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

**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.

**Auditing guidance**

Auditor may review contracts and worker interviews to determine compliance with 6.7.1.

Auditor may review contracts and communications with suppliers and subcontractors to determine compliance with 6.7.2. The producing company should have a map of suppliers and subcontractors as well as evaluation criteria for suppliers and subcontractors.

**Criterion 6.8 Conflict resolution**

INDICATOR	STANDARD
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 <sup>101</sup> within a 90 day timeframe	100%

**Rationale**

Companies must have a clear labor 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, as well responses to conflicts and complaints.

**Auditing guidance**

Auditors shall review grievance procedures, meeting minutes, evidence of resolution, and conduct worker interviews. Labor conflict resolution policy shall be in place to track conflicts and complaints raised, as well as responses to conflicts and complaints

**Criterion 6.9 Disciplinary practices**

INDICATOR	STANDARD
6.9.1 Incidences of excessive or abusive disciplinary actions	None

<sup>101</sup> **Addressed:** acknowledged and received, moving through the company’s process for grievances, corrective action taken when necessary.

6.9.2 Evidence of a functioning disciplinary action policy whose aim is to improve the worker <sup>102</sup>	Yes
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**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<sup>103</sup> health or dignity.

**Auditing guidance**

Auditors shall investigate any allegations of corporeal punishment, mental or physical coercion, or verbal abuse. Verification shall be done through interviews and evidence that disciplinary policies and practices are transparent, fair and effective. Auditors may wish to review disciplinary procedures, worker evaluation criteria and reports, and worker interviews.

**Criterion 6.10 Working hours and overtime**

INDICATOR	STANDARD
6.10.1 Incidences, violations or abuse of working hours <sup>104</sup> and overtime laws	None
6.10.2 Overtime is limited, voluntary <sup>105</sup> , 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<sup>106</sup>.

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<sup>102</sup> If disciplinary action is required, progressive verbal and written warnings shall be engaged. 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.

<sup>103</sup> **Mental Abuse:** Characterized by the intentional use of power, including verbal abuse, isolation, sexual or racial harassment, intimidation, or threat of physical force

<sup>104</sup> 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.

<sup>105</sup> Compulsory overtime is permitted if previously agreed to under a collective bargaining agreement.

<sup>106</sup> **Premium rate:** A rate of pay higher than the regular work week rate. Must comply with national laws/ regulations and/or industry standards.

Requirements for time-off, working hours and compensation rates as described should reduce the impacts of overtime.

**Auditing Guidance**

Auditors shall be aware of working hours and overtime requirements in local legislation. They can check time sheets and payroll and verify through worker interviews that workers are working the number of hours allowed under the law. If the nature of the work reasonably requires employees work shifts (e.g. 10 days on, 6 days off), this is acceptable as long as employees receive equivalent time off in the calendar month and employees have agreed to this schedule (which may be highlighted in hiring contract). Pay slips and pay records can confirm whether overtime hours are being paid at a premium. To verify that overtime is not the norm, interviews can be conducted and production records, time sheets and other records of working hours from at least one year before can be checked. Worker interviews to determine whether overtime is voluntary are important. Some exceptions can be made for overtime not being voluntary, if there is a collective bargaining agreement in place that allows for such overtime.

**Criterion 6.11 Education and training**

INDICATOR	STANDARD
6.11.1 Evidence that the company encourages and sometimes supports education initiatives for all workers (e.g., courses, certificates and degrees)	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.

**Auditing guidance**

Auditors can check for evidence of courses taken, review curriculum for relevance and interview workers for effectiveness and satisfaction.

**Criterion 6.12 Corporate policies for social responsibility**

INDICATOR	STANDARD
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6.12.1 Demonstration of company-level<sup>107</sup> policies in line with the standards 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 labor standards, but that they also have company-wide policies related to these key issue areas that are in line with the Salmon Dialogue standards. Such policies must relate to all of the company’s salmon operations in the region, whether those be smolt production facilities, grow-out facilities, or processing plants.

**Auditing Guidance**

Auditors can review the company policies and procedures, which should be available either at the regional headquarters or at the farm site that is applying for certification. Only the site applying for certification will be audited against the detailed standards incorporated under 6.1 to 6.11.

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<sup>107</sup> 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, including grow-out, smolt production, and processing facilities.

## PRINCIPLE 7: BE A GOOD NEIGHBOR 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	STANDARD
7.1.1 Evidence of regular and meaningful <sup>108</sup> consultation and engagement with community representatives and organizations	Yes
7.1.2 Presence and evidence of an effective <sup>109</sup> 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 at the farm during times of therapeutic treatments <sup>110</sup> and has, as part of consultation with communities under 7.1.1, communicated about potential negative health impacts from treatments	Yes

#### Rationale

A salmon farm must respond to human concerns that arise in communities located near the farm, as well as 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, minimized 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 neighboring 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 share with neighboring 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 notice around the farm during times of treatment.

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<sup>108</sup> **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.

<sup>109</sup> **Effective:** In order to demonstrate that the mechanism is effective, evidence of resolutions of complaints can be given.

<sup>110</sup> Signage shall be visible to mariners and, for example, to fishermen passing by the farm.

### Additional information

For standard 7.1.3, the SC is discussing whether it is reasonable to include a requirement related to broader public notice at times of treatment. This would be a step beyond posting notice at the farm site.

### Auditing guidance

Auditors may wish to review meeting reports, minutes and interviews with community representatives for 7.1.1. For 7.1.2, auditors may wish to review complaints procedures and policies, documentation of communications with stakeholders, documentation of corrective actions taken by the company, and reports to stakeholders on actions taken and solutions.

## Criterion 7.2 Respect for indigenous and aboriginal cultures and traditional territories

INDICATOR	STANDARD
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 <sup>111</sup> with indigenous communities	Yes
7.2.3 Evidence of a protocol agreement, or an active process <sup>112</sup> 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 SAD standards 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 standards are designed to be consistent with the United Nations Declaration on the Rights of Indigenous Peoples.

### Additional information

The SC recognized that standard 7.2.1 falls under the principle of “obey the law”, and at the same time this issue is important enough that the SC wanted to highlight here. The SC wants to ensure that farms and governments have performed the legal consultation requirements with indigenous and aboriginal groups.

## Criterion 7.3 Access to resources

<sup>111</sup> All standards related to indigenous rights only apply where relevant, based on proximity of indigenous territories.

<sup>112</sup> 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.

INDICATOR	STANDARD
7.3.1 Changes undertaken restricting access to vital community resources <sup>113</sup> 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.

**Auditing guidance**

Auditors may choose to look at assessments, meeting reports and minutes, interview with community representatives to verify compliance. Auditing guidance on these issues must be further developed to clarify intent of the standard.

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<sup>113</sup> 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 Dialogue standard.

## SECTION 8: STANDARDS FOR SUPPLIERS OF SMOLT

A farm seeking certification must have documentation from all of its smolt suppliers to demonstrate compliance with the following standards.<sup>114</sup> The requirements are, in general, a subset of the standards in Principles 1 through 7, focusing on the impacts that are most relevant for smolt facilities. In addition, specific standards are applied to open systems (net pens), and to closed and semi-closed systems (recirculation and flow-through).

### Standards related to Principle 1

INDICATOR	STANDARD
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 labor laws and regulations	Yes

#### Rationale

Please see the relevant Rationale, Additional Information and Auditing Guidance text in Principle 1. The standards do not require the smolt producer to provide confidential business documents such as tax documentation.

### Standards related to Principle 2

INDICATOR	STANDARD
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

#### Rationale

Please see the relevant Rationale, Additional Information and Auditing Guidance text in Principle 2.

### Standards related to Principle 3

INDICATOR	STANDARD
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<sup>114</sup> The SAD SC proposes 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 reviewed as part of the audit at the grow-out facility.

8.4	If a non-native species is being produced, the species shall have been widely commercially produced in the area prior to the publication of the SAD standards. Exceptions are made for smolt production under closed systems <sup>115</sup>	Yes
8.5	Maximum number of escapes episodes (defined as 200 or more fish), with the exception of escape episodes that are clearly documented as being out of the farm's control <sup>116</sup>	0, in the most recent production cycle
8.6	Maximum number of escapees <sup>117</sup> in the most recent production cycle	300 fish
8.7	Accuracy <sup>118</sup> of the counting technology or counting method used for calculating the number of fish	≥98%

#### Rationale

Please see the relevant Rationale, Additional Information and Auditing Guidance text in Principle 3.

#### Standards related to Principle 4

INDICATOR	STANDARD	
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 & assessment)	Yes, measured in kilojoule/mt fish/production cycle

<sup>115</sup> Systems that re-circulate ≥ 95% of water or that do not discharge into a natural waterway (e.g. discharge into a municipal sewage treatment system)

<sup>116</sup> 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.

<sup>117</sup> Farms shall report all escapes, the total aggregated number of escapees per production cycle must be less than 300 fish.

<sup>118</sup> Accuracy shall be determined by the spec sheet for counting machines and through common estimates of error for any hand-counts.

8.10 Records of greenhouse gas (GHG <sup>119</sup> ) emissions <sup>120</sup> at the smolt production facility and evidence of an annual GHG assessment (See Appendix V subsection 1)	Yes
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### Rationale

Please see the relevant Rationale, Additional Information and Auditing Guidance text in Principle 4.

### Standards related to Principle 5

INDICATOR	STANDARD
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 risk in the region and for which an effective vaccine exists <sup>121</sup>	100%
8.13 Percentage of smolt groups <sup>122</sup> tested for select diseases of regional concern prior to entering the grow-out phase on farm	100%
8.14 Detailed information, provided by the designated veterinarian, of all chemicals and therapeutants used during the smolt production cycle, the	Yes

<sup>119</sup> For the purposes of this standard, GHGs are defined as the six gases listed in the Kyoto Protocol: carbon dioxide (CO<sub>2</sub>); methane (CH<sub>4</sub>); nitrous oxide (N<sub>2</sub>O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF<sub>6</sub>)

<sup>120</sup> GHG emissions must be recorded using recognized methods, standards and records as outlined in Appendix V

<sup>121</sup> 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.

<sup>122</sup> 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.

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	
8.15 Allowance for use of therapeutic treatments that include antibiotics or chemicals that are banned <sup>123</sup> in any of the primary salmon producing or importing countries <sup>124</sup>	None
8.16 For any use of antibiotics listed as highly important for human medicine by the World Health Organization (WHO <sup>125</sup> ), demonstration that a risk assessment <sup>126</sup> was conducted by the veterinarian prior to prescription and application	Yes
8.17 Allowance for use of antibiotics listed as critically important for human medicine by the WHO	None <sup>127</sup>
8.18 If exotic diseases and /or parasites are detected in the hatchery, evidence of additional biosecurity measures that include restrictions on movement and evidence of strong disease management practices, including culling	Required

**Rationale**

Please see the relevant Rationale, Additional Information and Auditing Guidance text in Principle 5.

**Standards related to Principle 6**

INDICATOR	STANDARD
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<sup>123</sup> “Banned” means proactively prohibited by a government entity because of concerns around the substance

<sup>124</sup> For purposes of this standard, those countries are Norway, UK, Canada, Chile, US, Japan, and France.

<sup>125</sup> The 3<sup>rd</sup> edition of the WHO list of critically and highly important antimicrobials was released in 2009 and is available at [http://www.who.int/foodborne\\_disease/resistance/CIA\\_3.pdf](http://www.who.int/foodborne_disease/resistance/CIA_3.pdf)

<sup>126</sup> The risk assessment 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. The assessment shall consider all alternative treatment options. Prescribing antibiotics highly important for human health shall be considered as a last resort.

<sup>127</sup> 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.

8.19 Evidence of company-level policies and procedures in line with the labor standards under 6.1 to 6.11	Yes
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**Rationale**

Please see the relevant Rationale, Additional Information and Auditing Guidance text in Principle 6.

**Standards related to Principle 7**

INDICATOR	STANDARD
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
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, Additional Information and Auditing Guidance text in Principle 7.

**ADDITIONAL REQUIREMENTS FOR OPEN (NET-PEN) PRODUCTION:**

***IN ADDITION TO THE REQUIREMENTS ABOVE, IF THE SMOLT IS PRODUCED IN AN OPEN SYSTEM, EVIDENCE SHALL BE PROVIDED THAT THE FOLLOWING ARE MET:***

INDICATOR	STANDARD
8.24 Allowance for producing or holding smolt in net pens in water bodies with native salmonids	None
8.25 Allowance for producing or holding smolt in net pens in any water body	Permitted only for 5 years from publication of the SAD standards

8.26	Demonstration that benthic sediments under the cages have not reached hypoxic or anoxic conditions	Yes
8.27	Evidence that carrying capacity (assimilative capacity) of the freshwater body has been established by a reliable entity <sup>128</sup> within the past five years <sup>129</sup> , and total biomass in the water body is within the limits established by that study	Yes
8.28	Allowance for use of aeration systems or other technological means of increasing oxygen levels in the water body	None

### Rationale

Globally, the majority of salmon smolt are produced in closed (e.g. recirculating) or semi-closed (e.g. flow-through) systems and there is a trend towards moving out of open smolt production systems for both environmental and economic reasons. Simultaneously, significant concerns have been raised about the effects of smolt production in open systems (i.e., net pens and cages).

Impacts of concern include the effect of escapees on wild fish populations, nutrient loading, disease transmission, and antibiotics and chemicals entering the freshwater environment. The vast majority of salmon smolt production takes place in closed or semi-closed systems where these impacts can be significantly reduced in a way that is not possible in fully open systems, such as net pens.

The introduction and amplification of parasites and pathogens, as well as the potential genetic effects of escapees, have been raised as particularly concerning in areas where native salmonids exist. For this reason, the draft SAD standards allow only closed or semi-closed smolt systems to be certified in areas of wild salmonids.

Additionally, due to the broader range of impacts associated with open net pen smolt production in all regions, and the particular ecological importance of freshwater lakes in Chile<sup>130</sup> (which is the largest salmon producer in the non-native range), the SAD standards require a phase out of all net pen smolt production under the standard within five years. Many smolt in Chile are already currently being produced in re-circulating or semi-closed systems and this trend is expected to increase. Through these standards, the SAD encourages the continuous movement globally towards producing smolt in closed systems.

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<sup>128</sup> Could be done in the form of an Environmental Impact Statement (EIS) and must be undertaken by an independent body. Criteria to be considered in the analysis should include but not be limited to water transparency, total phosphorous levels, total suspended solids and total ammonia-nitrogen levels. The same independent EIS can be used to demonstrate that all salmon smolt production facilities (either certified or not) operating in the lake are within the carrying capacity levels established.

<sup>129</sup> If the study is older than 2 years old, and there has been a significant increase in nutrient input to the water body since the completion of the study, a more recent assessment is required.

<sup>130</sup> Various sources as summarized in: León-Muñoz, Jorge; Tecklin, David; Farías, Aldo and Díaz, Susan. 2007. Salmon Farming in the Lakes of Southern Chile - Valdivian Ecoregion. History, tendencies and environmental impacts. Valdivia, Chile: WWF. Full report at: [http://assets.panda.org/downloads/informe\\_salmones\\_lagos\\_sur\\_de\\_chile\\_restriccion.pdf](http://assets.panda.org/downloads/informe_salmones_lagos_sur_de_chile_restriccion.pdf)

During the next five years, open net pen smolt producers must demonstrate that a rigorous carry capacity study has been conducted of the fresh water body in which their pens are located. The total biomass of aquaculture production in that water body must be within the limit established by the study.

**Additional information**

These standards reflect particular concerns over escapes directly into freshwater salmonid systems, in part due to growing knowledge of the very large contribution to successful spawning from precocious male parr<sup>131</sup>. Records demonstrate that the escape rate from open smolt production systems is significantly higher than that from closed or semi-closed systems.

The SC has created a five-year phase-out period for production in lakes in order to provide producers sufficient time to invest in closed technologies, which require several years to develop and build. This five-year period only applies in areas where there are no wild salmonids. During this period, smolt producers using open systems must be able to demonstrate the existence of a rigorous carrying capacity study, and the total load on the water body from aquaculture must be within that capacity. The five-year period begins upon publication of the final SAD standards.

**ADDITIONAL REQUIREMENTS FOR SEMI-CLOSED AND CLOSED PRODUCTION :  
 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<sup>132</sup>:**

INDICATOR	STANDARD
8.29 Regular monitoring of water quality parameters as outlined in Appendix VII	Yes
8.30 Maximum Total Phosphorus released into the environment per ton of production per year according to methodology in Appendix VII, subsection 2	To be determined <sup>133</sup>

<sup>131</sup> Salmon Aquaculture Dialogue report on escapes and also Garant D., Fleming I.A., Einum S., 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.

<sup>132</sup> Production systems that don't discharge into fresh water are exempt from these standards.

<sup>133</sup> The SC intends to align this standard with the phosphorous standards in the Freshwater Trout Aquaculture Dialogue (FTAD), adjusting them as needed for them to relate specifically to salmon smolts. The SC understands that the FTAD is considering setting the standard at 6.5 kg P/mt of fish produced over a 12-month period, with a reduction of this number over time.

8.31 Minimum oxygen saturation in the outflow	70% <sup>134</sup>
8.32 Biosolids (sludge) Best Management Practices (BMPs) are employed (see Appendix VII, subsection 3)	Yes

**Rationale**

Smolt production facilities can impact fresh water by adding nutrients and other discharges such as suspended solids and ammonia. Phosphorus is a particular concern, due to its role in causing eutrophication in fresh water.

Regular monitoring of discharges is the first step in ensuring a smolt producer is aware of and minimizing potential impacts on receiving waters. These standards also set a maximum allowed discharge of phosphorus per ton of smolt produced, to promote best practices in feed use and water cleaning methods. To meet this standard, farms will measure phosphorus concentrations in the inflow and outflow each month, along with the water flow. With this data, farms can calculate kilograms of phosphorus released into the environment per ton of production on the farm. Farms can lower their phosphorus load on the environment by using feed that is more digestible and has lower phosphorus content, by improving their feeding regime, and by employing cleaning technologies such as settling ponds and filters.

The standards also ensure a farm’s discharge has a minimum oxygen saturation level. Finally, the standards require basic management practices around disposal of sludge.

**Additional information**

The SAD recognizes that different jurisdictions employ a variety of regulations around water quality and freshwater discharges. Some regulations will resemble these draft standards, while other jurisdictions use different approaches. These draft standards represent the SAD’s effort to write standards that will function globally with a range of receiving waters. The SAD SC welcomes public comments about how to preserve the intent of these standards while minimizing the costs for smolt producers that need to demonstrate water quality performance with different metrics and monitoring schemes.

The monitoring scheme required under this draft standard seeks to provide smolt producers with the essential information needed to gauge their impact on receiving waters. The frequency of measurements and proposed methodology reflects an effort to maximize the usefulness of the information, while attempting to reduce the cost of testing. The SC is considering ways to reduce the frequency for smolt producers that consistently perform well inside the parameters.

The SAD SC is determining a limit for total phosphorus per ton of production (8.30) as well oxygen saturation in effluent water (8.31) and welcomes feedback on these standards. The SC is considering using values agreed upon within the Freshwater Trout Aquaculture Dialogue (FTAD). However, the FTAD standard is also a working draft and the proposal was developed based on data from trout operations. The SAD recognizes that nutrient loads coming from salmon smolt facilities may differ from grow-out trout operations and welcomes suggestions for revisions based on salmon-specific data.

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<sup>134</sup> A single oxygen reading below 70% would require daily continuous monitoring with an electronic probe and recorder for at least a week demonstrating a minimum 70% saturation at all times.

## Appendix I: Methodologies related to Principle 2 and benthic testing

### 1. Sampling methodology for calculation of faunal index, macrofaunal taxa, and sulphide and redox, and copper

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.

- Two stations should be from the cage edge, one at each end of the long axis of the farm
- Three should be from within the AZE, 25 m 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
- Three should be 25m outside the AZE, or 55 m 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
- One from a reference site 500-1000m from the farm (edge of the array of cages), in similar water depth and substratum type (where this exists), and recorded using GPS
- 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. 5 m inside of AZE and 25 m outside of AZE, recorded using GPS, and in multiple directions as determined appropriate through the modeling.

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. Timing shall also be the same, sampling at peak cage biomass.

### 2. Calculation methodology for the percent fines in feed

#### Introduction

This method determines dust in finished product of fish feed 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<sup>135</sup>.

#### Procedure

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

The sample of feed should 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

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<sup>135</sup> Feed can be sampled prior to delivery to farm site for sites where there is no feed storage.

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 which 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
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 which have passed through all sieves are called dust (md)

#### **Calculations**

- Weight of feed before sieving = **m0**
- Weight of feed that has passed through all sieves = **md**

$$\text{Dust \%} = (\text{md} / \text{m0}) \times 100$$

#### **Sampling**

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

1. Cut minimum 6 increment samples from the lot, evenly distributed throughout the lot
2. Each increment sample should have a mass of ca. 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 ca. 500 grams

### **3. Biodiversity-focused impact assessment**

Standard 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, coldwater corals near the farm could be impacted by nutrients, or threatened 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 IUCN or national threatened/endangered lists and on any areas that have been identified as High Conservation Value Areas, areas important for conservation/biodiversity, or 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 focus on those habitats or species
3. Description of strategies and current and future program(s) underway on the farm to eliminate or minimize any identified impacts the farm may have, and for the monitoring of outcomes of said programs and strategies.

## Appendix II: Area-based management scheme

Participation in an area-based scheme<sup>136</sup> for managing disease and parasites and resistance to treatments is required under the SAD standards. This appendix outlines the main components of the area-based management scheme that the SAD standards require under Criterion 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 minimizing potential negative impacts on wild populations.

### 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 standards. 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, as well as water movement and other relevant aspects of ecosystem structure and function.

### Requirements related to participation in the scheme

Within the defined area, at least 80% of farmed production (by weight) must participate in the area based management scheme, even if not all farms are seeking certification under this standard. 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.

### ABM components and guidance

In order to be considered as applicable under the SAD standard, the ABM scheme used by a farm must ensure that there is

- Clear documentation of the farms/companies included in the ABM, contact people (including contact information) and mechanisms for communication
- 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; 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

- Application and rotation of treatments: farmers must be able to demonstrate a coordinated treatment plan and evidence that the schedule and rotation of treatments are being implemented (e.g., records, and empty containers). 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).
- Stocking: records must demonstrate that all stocked fish are of the same year class and stocking dates were coordinated with other farms.
- Fallowing: Coordination of fallowing to help break disease cycles, with a clear period of time when there

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<sup>136</sup> 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

are no farmed salmon in the area in the water.

- Monitoring schemes:
  - On-farm disease and pathogen monitoring and information sharing among farms
  - On-farm resistance monitoring and information sharing among farms
  - For farms located in areas where there are wild salmonids, the results of monitoring of wild salmonid populations, as specified under 3.1.6, must be incorporated into the decision-making around treatments and health management of the ABM.

## Appendix III: Methodologies and thresholds related to monitoring wild salmonids

### 1. Methodologies for monitoring wild salmonids

The SAD standards require all farms located in areas of wild salmonids to participate in monitoring of sea lice on wild salmonids.

The SAD is still developing guidance on monitoring methodologies and welcomes feedback during the public comment period on how to balance the desire for standardized information with the benefits of localized methods.

### 2. Thresholds for sea lice on wild salmonids

NOTE: This subsection of Appendix III is only relevant if the concept of a threshold on wild salmonids is included under standard 3.1.7. Under Option B of standard 3.1.7, farms would need to demonstrate that on-farm lice levels drop to near zero if more than 10% of the wild salmonids sampled surpass the thresholds below in the ABM where the ASC certified site is located

The following thresholds represent the best available research on maximum lice loads that different species of wild outmigrating wild juveniles, or coastal sea trout, can sustain and remain healthy. The thresholds relate to *Lepeophtheirus salmonis*.

Species	Threshold	Reference
Atlantic salmon, arctic charr, sea trout	0.1 lice/g fish	<ul style="list-style-type: none"> <li>• Risikovurdering – miljøvirkninger av norsk fiskeoppdrett, Fisken og havet særnummer 3 – 2010 (Risk evaluation— environmental effects from Norwegian fish farming)</li> <li>• Holst J.C., Jakobsen P., Nilsen F. et al (2003): Mortality of seaward migrating post-smolts of Atlantic salmon due to salmon lice infection in Norwegian salmon stocks. In: Salmon at the edge (ed. D. Mills) pp 136 – 137. Oxford: Blackwell Publishing Ltd</li> <li>• Tveiten H., Bjørn P.A., Johnsen H.K. et al (2010): Effects of the sea louse <i>Lepeophtheirus salmonis</i> on temporal changes in cortisol, sex steroids, growth and reproductive investment in Arctic Charr <i>Salvelinus alpinus</i>. Journal of Fish Biology 76, 2318 – 2341.</li> <li>• Finstad B., Todd C.T., Whoriskey F., Gargan P.G., Forde G. &amp; Revie C.W. (2011): The effect of sea lice on Atlantic Salmon and other Salmonid Species. In: Atlantic Salmon Ecology (ed Aas Ø., Einum S., Klemetsen A. &amp; Skurdal J. pp 253 – 276. Oxford: Blackwell Publishing Ltd.)</li> </ul>
Pink salmon ( <i>Oncorhynchus gorbuscha</i> )	<b>To Be Determined:</b> <i>References listed here suggest that a</i>	<ul style="list-style-type: none"> <li>• Jones S., and Hargreaves, NB. 2009. Infection threshold to estimate <i>Lepeophtheirus salmonis</i>-associated mortality among juvenile pink salmon. Diseases of Aquatic Organisms. Vol. 84: 131–137, 2009</li> <li>• Morton A &amp; Routledge RD. 2005. Mortality rates for juvenile</li> </ul>

	<i>threshold between 1 and 7.5 lice/g fish may be an appropriate number, with a high degree of uncertainty</i>	<p>pink <i>Oncorhynchus gorbuscha</i> and chum <i>O. keta</i> salmon infested with sea lice <i>Lepeophtheirus salmonis</i> in the Broughton Archipelago. Alaska Fishery Research Bulletin 11, 146-152.</p> <ul style="list-style-type: none"> <li>• Morton A, Routledge, RD and Williams, R. 2005. Temporal Patterns of Sea Louse Infestation on Wild Pacific Salmon in Relation to the Fallowing of Atlantic Salmon Farms <i>North American Journal of Fisheries Management</i> 25:811–821.</li> </ul>
Other Pacific salmon species	To be determined	Data on mortality thresholds of Pacific salmon species other than pinks was not found. The threshold is proposed to be the same level as for pinks as a precautionary approach, since pinks are believed to be more vulnerable than other species.

**Additional information**

The SC requests feedback on the threshold levels, in particular those that have yet to be determined for Pacific salmonids. The SC does not feel that they currently have enough references to determine a threshold for lice on pink salmon for the purposes of this standard. Some experts advising the SC have suggesting that determining a credible threshold for Pacific salmon at this time may not be possible.

## Appendix IV: Feed resource calculations and methodologies

### 1. Forage Fish Dependency Ratio calculation

Feed Fish Dependency Ratio (FFDR) is the quantity of wild fish used per quantity of cultured fish produced. This measure can be weighted for fishmeal (FM) or fish oil (FO), whichever component creates a larger burden of wild fish in feed. In the case of salmon currently, the fish oil will be the determining factor for the FFDR in most cases. The dependency on wild forage fish resources should 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.

$$FFDR_m = \frac{(\% \text{ fishmeal in feed from forage fisheries}) \times (\text{eFCR})}{22.2}$$

$$FFDR_o = \frac{(\% \text{ Fish oil in feed from forage fisheries}) \times (\text{eFCR})}{5.0}$$

Where:

- Economic Feed Conversion Ratio (eFCR) is the quantity of feed used to produce the quantity of fish harvested.

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

- The percentage of fishmeal and fish oil excludes fishmeal and fish oil derived from fisheries' by-products.<sup>137</sup> 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.
- The amount of fishmeal in the diet is calculated back to live fish weight by using a yield of 24%<sup>138</sup>. This is an assumed average yield.
- 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:

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<sup>137</sup> 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.

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

<sup>138</sup> 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

- Fish oil originating from Peru and Chile and Gulf of Mexico, 5% yield of fish oil
- Fish oil originating from the North Atlantic (Denmark, Norway, Iceland and UK) 7 % yield of fish oil
- 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 6%, and into b a if documentation shows a yield more than 6%
- FFDR is calculated for the grow-out period in the sea as long as the smolt phase does not go past 200 grams. If the smolt phase goes past 200g then FFDR is calculated based on FFDR is calculated based on all feed used from 200 grams and onwards.

## 2. Calculation of EPA and DHA in feed

In order to demonstrate compliance with the standard 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:

Grams of EPA and DHA in feed = (grams of fish oil per kg feed)\* (% 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. Fish oil originating from Peru and Chile and Gulf of Mexico, 30% EPA and DHA in fish oil
  - b. Fish oil originating from the North Atlantic (Denmark, Norway, Iceland and UK) 20% EPA & DHA in fish oil
  - 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%, and into group b if analyses of EPA and DHA is below 25%

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% 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.

## 3. Protein Retention Efficiency calculation

Protein Retention Efficiency (PRE) is a measure of the amount of protein provided in the feed that is retained in the harvested salmon. It is used in the standard as an additional indicator of the efficiency of use of feed resources.

$$\text{PRE} = \frac{\text{Percentage of protein in salmon}}{(\text{eFCR} * (\% \text{ protein in feed}))} \times 100\%$$

Where:

- Percentage of protein in salmon (whole fish) is 18%. The protein content in salmon is considered to be fixed in this calculation.

- The protein in feed should be calculated as a weighted average when the protein content varies over different fish size intervals.
- eFCR is the economic FCR related to the site of production (defined in the same way as for the FFDR calculation).

**Example calculation:**

$$PRE = \frac{\text{Percentage of protein in salmon}}{(\text{eFCR} * (\% \text{ protein in feed}))} \times 100\%$$

If one were to assume a eFCR of 1.4, and a weighted average crude protein content in feed of 36.5%:  
 PRE = [18% / (1.4 \* 36.5)] \* 100 = 35.2%

**4. 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 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  $B_{msy}$ ).

**Components of the FishSource score**

Issue	Measure	Underlying Ratio
Is the management strategy precautionary?	Determine whether harvest rates are reduced at low stock levels	$F_{\text{advised}}/F_{\text{target reference point}}$ or $F_{\text{actual}}/F_{\text{target reference point}}$
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	$F/F_{\text{target reference point}}$

If existing measures of sustainability consider a fishery to be relatively well-managed, then it will typically score 8 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 6 and 8 on FishSource. A fishery falling short of minimum requirements of existing measures of sustainability is scored 6 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 8 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 8, a score of 6 relates to a score of 60, and below 6, 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.org](http://www.fishsource.org) and an overview of the FishSource indices is available at [http://www.fishsource.org/indices\\_overview.pdf](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 6 in all categories with a minimum score of 8 in the biomass category. These ten fisheries had a total combined 2009 catch of 9157 thousand mt, accounting for just over 66% 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 standard 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 standard.

## Appendix V: Energy records and assessment

### 1. Energy use assessment and GHG accounting for farms

The SAD SC encourages companies to integrate energy use assessments and GHG accounting into their policies and procedures across the board in the company. However, this standard 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 standards, and they are largely consistent with one another. Both are also high level enough to not 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 SAD 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, and
- Reporting GHG emissions

In regards to 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. CO<sub>2</sub>/kwh). For non-CO<sub>2</sub> gases, you then need to multiply by a Global Warming Potential (GWP) to convert non-CO<sub>2</sub> gases into CO<sub>2</sub>-equivalent. Neither the GHG Protocol nor ISO require specific approaches to quantifying emissions, so the SAD 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, which is what the Kyoto Protocol and related policies are based on, or more recent Assessment Reports.

References:

- GHG Protocol Corporate Standard Website: <http://www.ghgprotocol.org/standards/corporate-standard>

- GHG Protocol Corporate Standard Document: <http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf>
- ISO 14064-1 available for download (with fee) at [http://www.iso.org/iso/catalogue\\_detail?csnumber=38381](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 2<sup>nd</sup> 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](http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1)

## 2. GHG accounting for feed

The standard 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 three 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 standard for life cycle assessments
3. A GHG assessment following the GHG Protocol Corporate Standard or ISO 14064-1

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

1. They 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). Define which of the 5 phases to use. There is a chapter on allocation that we should recommend.

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

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

Should the feed manufacturer decide to follow the GHG Protocol Corporate Standard and/or ISO 14064-1:

1. They shall follow requirements pertaining to:
  - a. Accounting principles of relevance, completeness, transparency, consistency, and accuracy
  - b. Setting operational boundaries
  - c. Tracking emissions over time, and
  - d. Reporting GHG emissions.
2. They should note that GHG corporate method may not be appropriate for facilities that are making feeds for multiple species because the methodology does not clearly separate out emissions by product.

Regardless of which methodology 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. CO<sub>2</sub>/kwh). For non-CO<sub>2</sub> gases, you then need to multiply by a Global Warming Potential (GWP) to convert non-CO<sub>2</sub> gases into CO<sub>2</sub>-equivalent. The SAD 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, which is what the Kyoto Protocol and related policies are based on, or more recent Assessment Reports.

#### References:

- GHG Product Standard: <http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-product-standard-draft-november-20101.pdf>
- Scope 3 Standard: <http://www.ghgprotocol.org/files/ghgp/GHG%20Protocol%20-%20Scope%203%20Standard%20-%20Stakeholder%20Comments%20-%20November%202010.xlsx>
- GHG Protocol Corporate Standard Website: <http://www.ghgprotocol.org/standards/corporate-standard>
- GHG Protocol Corporate Standard Document: <http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf>
- ISO 14044 available for download (with fee) at [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=38498](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 2<sup>nd</sup> 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](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. The SAD SC is aware that the ASC is currently discussing their policies around transparency of data collected during audits, and the SC recommends that the ASC makes public in a database the following information about certified farms. The SC recommends that the following farm-level data be released on an annual basis, except for any data that cannot be calculated prior to the end of a production cycle, or for exceptions noted in the table below. This high degree of transparency can be used by stakeholder and scientists to better understand actual performance of certified farms in a given area and to study interactions of farms with the environment. The data will also help the ASC track performance over time and will inform the revisions to the standard in the future.

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 release post-harvest and sale).

Item	Option	Relevant Standard	Measurement	Units	Measurement Frequency	Calculations & Sampling Methodologies, Additional Notes
1			Species in production	species		
2	a	2.1.1	Redox potential	mV	production cycle	Appendix I
	b		Sulfide levels	microMoles/l	production cycle	Appendix I
3	a	2.1.2	AZTI Marine Biotic Index (AMBI)	AMBI score	production cycle	Appendix I
	b		Shannon-Wiener Index	S-WI score	production cycle	Appendix I
	c		Benthic Quality Index (BQI)	BQI score	production cycle	Appendix I
	d		Infaunal Trophic Index (ITI)	ITI score	production cycle	Appendix I
4		2.1.3	# of microfaunal taxa	#	production cycle	Appendix I
5		2.2.1	Average % DO saturation	%	weekly	TBD
6		2.2.2	Max % samples under 1.85 mg/l DO	%	weekly	TBD
7		2.2.3	Nitrogen monitoring		weekly	
8		2.2.3	Phosphorous monitoring		weekly	
9		2.5.2	# days ADDs/ADHDs	#	annual	
10		2.5.5	Lethal incidents of marine mammals & birds	#, species & cause per episode	Ongoing (logged as needed)	To be made publicly available (e.g., on web) by farming company shortly after incident

11		3.1.3	Maximum sea lice load set for the ABM	number	annual	Appendix II & III
12		3.1.4	Weekly, on-farm sea lice levels		weekly	To be made directly publicly available by farming company within a week.
13		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 8 weeks of completion of monitoring
14		3.1.1	Fallowing period	dates		
15		3.4.1-3.4.2	Escapes data	# episodes	production cycle	
				date of episode	production cycle	
				cause of episode	production cycle	
				# escapees per episode	production cycle	
				# total escapees	production cycle	
16		3.4.3	Estimated unexplained loss	#	production cycle	Footnote 16
17		3.4.2	Counting technology accuracy	%	production cycle	
18		4.2.1	FFDR fishmeal (during grow-out)	FFDRm	production cycle	P3, Appendix IV
19	a	4.2.2	FFDR fish oil (during grow-out)	FFDRo	production cycle	P3, Appendix IV
	b		Max amount EPA and DHA	g/kg feed	production cycle	P3, Appendix IV
20		4.2.3	Protein Retention Efficiency (PRE)	%	production cycle	P3, Appendix IV
21		4.4.3	Transgenic feed ingredients	Y/N	production cycle	
22		4.6.2	Greenhouse gas (GHG) emissions on farm		annual	Appendix V
23		4.6.3	Greenhouse gas (GHG) emissions of feed		Production cycle (not immediately applicable)	Appendix V
24		4.6.1	Energy use assessment	kJ/mT fish	production cycle	
25		4.7.1	Copper-based antifoulants	Y/N	production cycle	Appendix 1
26		4.7.3	Results of copper sampling (outside AZE), if copper used on nets	mg Cu/kg sediment	annual	Appendix 1
27		5.1.5	Mortality rate of farmed fish	%	ongoing (logged as needed)	
28		5.1.4	Cause of mortalities (post-mortem analysis)	# morts per disease	ongoing (logged as needed)	
29		5.1.6	Maximum unexplained morts	%	production cycle	

30	5.2.1	Amount of each chemical/therapeutant used, for each (antibiotics, parasitcides, etc.)	product name	ongoing (logged as needed)	
			chemical name	ongoing	
			reason for use	ongoing	
			date	ongoing	
			kg	ongoing	
			mT fish treated	ongoing	
			Dosage	ongoing	
			# of treatments	ongoing	
			WHO classification (antibiotics only)	ongoing	
31	5.2.5	Parasiticide Treatment Index (PTI)	PTI	production cycle	Criterion 5.2
32	Section 8	Type of smolt production system	Open, semi, or closed	production cycle	

## Appendix VII: Water monitoring for land based systems

The appendix below originated with the Freshwater Trout Aquaculture Dialogue. It will be further reviewed and refined to ensure methodologies are suited to salmon smolt production facilities.

### 1. Sampling Regime for Water Quality Monitoring

Phosphorus and nitrogen must be sampled using a 24-hour bulk sample, while total suspended solids (TSS), biochemical oxygen demand (BOD<sub>5</sub>), ammonia and nitrites must be sampled in the early afternoon. Oxygen saturation will be measured in the early morning and late afternoon.

	Effluent discharge at farm <sup>1</sup>	Inlet	Frequency
Dissolved oxygen (mg/L or % sat.)	X		Monthly
TP (ug/L)	X	X	Monthly
TN (ug/L)	X	X	Semi-annually
TSS (mg/L)	X	X	Quarterly
BOD <sub>5</sub> (mg/L)	X	X	Quarterly
N-NO <sub>2</sub> (mg/L)	X		Semi-annually
N-NH <sub>3</sub> (mg/L)	X		Semi-annually
Flow (L/sec)	X		Monthly

<sup>1</sup>This refers to the effluent pipe discharge. In systems with multiple discharge points, each point will be sampled, or where all systems form one effluent stream, one sampling station is sufficient.

### 2. Monitoring and Calculation Methodology for Total Phosphorous

Standard 3.2.2 seeks to promote farm efficiency in managing feed resources and managing nutrient releases. To do this, a monthly 24-hour water bulk sample will be collected in the intake and outlet of the farm and analyzed for total phosphorus concentration (g/m<sup>3</sup>). Total water volume discharged during this period will be quantified. Intake water flow will also be determined. The difference in phosphorus concentration between the inlet and outlet, multiplied by the water flow, will provide the total phosphorus released from the farm over a 24-h period.

The twelve monthly samples will be averaged and multiplied by 365 days to calculate annual net discharge. In order to correctly relate this data with the whole trout production biomass, accurate recording of fish biomass produced during those 12 months must be provided, including detailed records of any fish transfers.

$$\text{kg P/mt fish}_{12 \text{ months}} = \frac{\text{Water discharge (m}^3\text{/day)} \times 365 \text{ (days/yr)} \times \Delta\text{TP (g/m}^3\text{)} \times 10^{-3} \text{ (kg/g)}}{(\text{CSS (mt)} + \text{TH(mt)} - \text{ISS (mt)}) - \text{SF from offsite(mt)}}$$

Where:

Q = Water discharge

$\Delta$ TP = Total phosphorus (Net of outlet minus inlet)

CSS = Current standing stock

TH = Salmon harvested

ISS = Initial standing stock

SF = Stocked fish (additional fish stocked during the 12 months)

NOTE: standing stock, salmon harvested, initial standing stock and fingerlings stocked are for the prior 12-month period.

### 3. Sludge BMPs for Land-based systems (RAS/ Re-circulation and Flow-through)

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, bio-solids) from these processes is a critical element to responsible trout farm management. The SAD acknowledges that BMP's 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 bio-solids capture, however this section deals with practices for cleaning, storage and disposal that will minimize the potential impacts of sludge/ bio-solids being released into the environment

All land based systems shall employ/ undertake the following in relation to sludge/ bio-solids:

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 utilization options. Flow diagram should indicate the farm is dealing with bio-solids responsibly. (Auditing guidance for evaluating whether the plan indicates responsible use: The system design shall allow for simple cleaning routines of pipes, sumps, channels, units.)
2. Farm shall have a management plan for sludge/ bio-solids 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, 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 what is done with sludge dug out of settlement ponds.
4. Biosolids accumulated in settling basins shall not be discharged into natural water bodies.