SALMON AQUACULTURE DIALOGUE

Draft Indicators for environmentally, socially and economically responsible salmon farming

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Pew Environment Group

This document contains draft indicators, which represent what will be measured in order to determine the extent of the key environmental and social impacts associated with salmon aquaculture. These draft indicators are not final. ***While some indicators reflect a strong consensus of the Steering Committee of the Salmon Aquaculture Dialogue, other proposed indicators are still under discussion. In some places in this document, the Steering Committee has yet to choose between several options for an indicator. Sections of the document where draft indicators are most tentative are highlighted in italics.*** The Steering Committee is making this draft document public as a transparent snapshot of its efforts to develop indicators ahead of the Salmon Aquaculture Dialogue meeting in Bergen, Norway on November 17-18, 2009. The Salmon Aquaculture Dialogue participants will discuss these draft indicators in its public meeting in Bergen. Feedback from the meeting and collected via the web will be used to revise the draft indicators. The document will be open for public comment on the website through November 30, 2009.

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Background and Definitions

The salmon Dialogue 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 environmental and social impacts of salmon farming, while permitting the industry to remain economically viable. The standards can be the basis for an aquaculture certification program. They also can be used to benchmark other standards; incorporated into existing certification programs; adopted for government programs; and, potentially, be the foundation for buyer and investment screens. More information on the Dialogue, including details on the multi-stakeholder Steering Committee that governs the Dialogue, is available at http://www.worldwildlife.org/salmondialogue.

The Dialogue is an iterative, participatory, process that began with identifying the key environmental and social impacts of salmon production. Next, agreement is being reached on principles, criteria, indicators and standards, with each phase building on the previous phase. These terms are defined in the table below.

	Definition	*Non-aquaculture example*	*Aquaculture example*
Impact	The problem we want to minimize	Overweight	Water pollution
Principle	The guiding principle for addressing the impact	Maintain a healthy weight	Conserve and protect water resources
Criteria	The area to focus on to address the impact	Food consumption *	Effluents*
Indicator	What to measure in order to determine the extent of the impact	Calories	Nitrogen concentration in the effluent
Standard	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").*

One example of principle, criteria, indicator and standard that could be considered in the salmon Dialogue is as follows:

Principle: Manage disease and parasites in an environmentally responsible manner (principle 5 below)

Criteria: Survival and health farmed fish (this would be one of several criteria falling under this principle)
Indicator: Percent mortalities annually (this would be one of several indicators falling under this criteria)
Standard: X% mortalities

History of Development of Principles, Criteria, and Draft Indicators

The principles and criteria incorporated below have both been through two public comment periods and presentation and discussion at Dialogue meetings. The draft indicators below were developed by the Steering Committee with support from experts from the Technical Working Groups.

Draft principles were presented and discussed at the Dialogue meeting in January 2008, then edited based on feedback from that meeting and further Steering Committee discussion. The draft principles were posted on the 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 Dialogue meeting in November 2008, and edited based on feedback from that meeting and further Steering Committee 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 meeting of the Dialogue on March 12 – 13, 2009 in Boston. Feedback from the meeting and the public comment period were used by the Steering Committee to develop final draft criteria. The principles and criteria are now closed for comment and revision until the principles, criteria, indicators and standards are drafted and open for comment as a full package.

The potential relevant areas of impact, from the seven key impact areas identified in the salmon Dialogue, are identified for each principle in the draft below. However, as the criteria were revised they were streamlined in order to eliminate redundancies and minimize the number of criteria per principle. The full suite of principles and criteria are intended to address the full suite of potential impacts listed.

At the November 2008 meeting of the Dialogue, animal welfare was raised as an issue of importance to stakeholders at the meeting, both in terms of farmed fish welfare and wildlife interactions including treatment of predators. Wildlife interactions including treatment of and impacts on predators have consistently been agreed to clearly fall under the Dialogue and will be addressed under Principle 2 and the associated criteria, indicators and standards. Early on in the Dialogue process, the Steering Committee had decided to exclude farmed fish welfare from the Dialogue standards. This decision was made based on prior stakeholder input. Meeting participants in November 2008 requested that the Steering Committee revisit its decision. The committee discussed the issue and agreed that farmed fish welfare did not fall under the mandate of the Dialogue and that the Dialogue would not aim to develop a comprehensive fish welfare standard. Farmed fish welfare was not a part of the rationale for establishing the Dialogue, the Steering Committee does not have appropriate expertise on the issue involved, and there already are other fish welfare standards/processes.

Additionally, there is a potential to partner with other certification programs, including fish welfare, down the line. While it is not under the mandate of the process, the Steering Committee expects that some aspects of farmed fish welfare will be indirectly improved under the standards. Environmental and fish health standards developed through the Dialogue will lay the foundation for fish welfare.

The standards are intended to address key impacts associated with smolt and grow-out phases of the farmed salmon life cycle. The seven areas of key potential negative impact that were identified within the salmon Dialogue are: feed, escapes, nutrient loading and carrying capacity, benthic impacts and siting, disease and parasite transfer, chemical inputs and social impacts (including labor and community impacts). Independent, third-party auditing of farms to verify whether they meet the salmon Dialogue standards will also include a traceability and chain-of-custody component that will be developed outside of the salmon Dialogue.

Principles, Criteria, and Draft Indicators

This document contains draft indicators, which represent what will be measured in order to determine the extent of the key environmental and social impacts associated with salmon aquaculture. These draft indicators are not final. ***While some indicators reflect a strong consensus of the Steering Committee of the Salmon Aquaculture Dialogue, other proposed indicators are still under discussion. In some places in this document, the Steering Committee has yet to choose between several options for an indicator. Sections of the document where draft indicators are most tentative are highlighted in italics.*** The Steering Committee is making this draft document public as a transparent snapshot of its efforts to develop indicators ahead of the Salmon Aquaculture Dialogue meeting in Bergen, Norway on November 17-18, 2009. The Salmon Aquaculture Dialogue participants will discuss these draft indicators in its public meeting in Bergen. Feedback from the meeting and collected via the web will be used to revise the draft indicators. The document will be open for public comment on the website through November 30, 2009.

Preamble

The principles serve as a platform to minimize 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 which are in development, are applicable at the farm level. Achieving the suite of principles to standards will entail farms having a high level of transparency and regular monitoring of a number of key indicators. Although the Salmon Aquaculture Dialogue 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 3 years) to ensure that the standards are based on best available scientific knowledge and management practices and to encourage continuous improvement.

Principle 1: Comply with all applicable international and national laws and local regulations

Principle 1 is intended to ensure that all farms meeting the Salmon Aquaculture Dialogue standards meet their legal obligations as a baseline requirement.

CRITERIA

1.1 Compliance with all applicable local, national and international legal requirements and regulations

NOTES ON CRITERIA 1.1: Indicators related to legal compliance have not yet been discussed. For an example of how they have been addressed in other Dialogues, see the draft Bivalve Aquaculture Dialogue standards at http://www.worldwildlife.org/what/globalmarkets/aquaculture/WWFBinaryitem13945.pdf.

Principle 2: Conserve natural habitat, local biodiversity and ecosystem function

Principle 2 is broadly intended to address potential impacts from salmon farms on natural habitat, local biodiversity, and ecosystem function. Specifically, the key impact areas of benthic impacts, effects of chemical inputs, effects of nutrient loading, and siting are addressed within this principle. ***Sections of the document where the Steering Committee is still discussing a proposal for draft indicators are highlighted in italics.***

CRITERIA & DRAFT INDICATORS

2.1 Benthic biodiversity and benthic effects

2.1.1 Chemical indicator: Redox potential and/or Sulphide levels in sediment

2.1.2 Faunal indicator: AZTI Marine Biotic Index (AMBI) in sediment

2.1.3 Maximum levels of therapeutants and antibiotics in the sediment in the Allowable Zone of Effect (AZE).

NOTES ON CRITERIA 2.1: This suite of indicators provides multiple layers of security related to benthic impacts, using a chemical proxy for health, combined with a biodiversity measurement, and measurements of antibiotic and therapeutant residues.

- Technical experts said Redox and Sulphide levels are both good chemical indicators for benthic health, though Redox seems to be more prevalent globally than Sulphide with less risk of "false positives" due to poor electrode maintenance. The Steering Committee may opt to include both indicators in the final document and allow farms to choose one.
- Experts also considered the AMBI indicator for benthic biodiversity best, and though it will initially be difficult to identify to a "species level" all the taxa, once it's done it becomes routine. The AMBI was developed by AZTI Tecnalia. Though the cost is relatively high, it generates very good and credible info on benthic biodiversity. The Steering Committee is still discussing this indicator.

- Experts said it was better to focus on antibiotic and therapeutant residue in the sediment rather than in benthic taxa. All therapeutants that have gone through the regulatory license process have generated information on Environmental Quality Standard levels that can be used to set the standards. This indicator is based on the assumption that this data is available. The critical challenge here is to ensure proper quality control in sampling and in analyzing sample in the lab. The Scottish Environmental Protection Agency has well-established protocols for both on their website that could be referenced as correct procedures to proceed. There is still a discussion on whether to measure for all chemicals used by the farm site or to focus on those with the longest half-life and/or potential to create resistance on targeted species.

2.2 Water quality in and near site of operation

2.2.1 Dissolved oxygen levels on farm during grow-out

2.2.2 Freshwater: Phosphorus concentration

2.2.3 Freshwater: Dissolved oxygen at the water-sediment interface

NOTES ON CRITERIA 2.2:

- Dissolved oxygen is an imperfect measurement of water quality in salt water because of its large natural fluctuations. Nonetheless, it 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. Most farms already measure dissolved oxygen constantly, since salmon are very susceptible to changes in oxygen levels. We believe we can set a meaningful standard that respects the natural fluctuations and makes sure the water quality around farms can support a healthy biodiversity.
- The Benthic indicators in 2.1 will pick up problems from chemicals and antibiotics (which are also addressed by indicators in Criteria 5.3 that requires proper use of therapeutants and antibiotics.)
- For freshwater, P is the limiting factor and the best proxy for water quality. Measurement of dissolved oxygen should be made at the place in the water column where it gives the best information, close to the water-sediment interface in freshwater. The exact location will be defined. There is no need for separate indicators for lake production and flow-through stream (river) production, as the limiting factor (P) is the same in both. The Steering Committee is still discussing how to set a meaningful standard for P. The Freshwater Trout Aquaculture Dialogue is also developing water quality indicators and standards, which may help inform final standards for Salmon.

2.3 Nutrient release from production

2.3.1 % fines in the feed (at the point where it enters the cage assuming technologically possible)

NOTES ON CRITERIA 2.3: Measuring fines in the feed where it enters the cage is the ideal scenario. Since feed is usually under pressure, there may be challenges in taking a measurement there. We can address this during standard-setting discussions. The feed indicators will reduce excess feed, helping to minimize

nutrient release. The nutrient release from fecal matter is covered in the water quality and benthic indicators.

2.4 Interaction with critical or sensitive habitats and species

2.4.1 Clear, substantive documentation on a) proximity to critical, sensitive or protected habitats and species, b) the potential impacts the farm might have on those habitats or species, and c) a program underway to eliminate or minimize any identified impacts the farm might have.

2.4.2 Distance from critical, sensitive, or protected habitats and species

2.4.3 Difference in levels of sensitive species pre-and post use of anti-louse compounds in areas where sensitive species are known to be.

2.4.4 Mortality or morbidity of sentinel species around farm during louse treatment periods

NOTES ON CRITERIA 2.4:

- Indicator 2.4.1 is designed to 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.
- Requiring a minimum distance away from sensitive areas is difficult since the actual risks will vary so greatly depending on the habitat and situation. Further discussion is needed to determine if it is possible to set a distance standard that works globally and helps to ensure salmon farms are not impacting sensitive areas. In addition, indicator 3.1.8 will require a minimum distance from sensitive wild salmon migration routes, breeding areas, and the mouth of wild-salmon rivers.
- The two potential indicators (2.4.3 and 2.4.4) that would measure populations and/or mortality or morbidity of sentinel species after anti-louse treatments may be redundant given the benthic sediment measurements and indicators requiring appropriate use of all chemicals. They also may be difficult for a farm to measure. Further discussion is needed to determine whether the additional layer of security these indicators would provide is worth the difficulty of measuring them.

2.5 Interaction with wildlife including predators

2.5.1 Number of days where acoustic deterrent devices were used

2.5.2 Number of marine mammals and birds killed (number of instances of lethal action taken)

NOTES ON CRITERIA 2.5: If a farm needs to use acoustic devices frequently, it is likely to indicate that the farm is sited inappropriately.

2.6 Cumulative impacts on biodiversity (combined previous Criteria 2.6 and 2.7)

2.6.1 Presence or absence of selected sensitive or sentinel species

NOTES ON CRITERIA 2.6: This criteria combines the biodiversity and cumulative impacts criteria. Biodiversity and cumulative impacts are addressed across the document, either directly through

biodiversity measurements or indirectly through proxy measurements and rules around predator control and use of antibiotics and treatments. The following indicators address biodiversity and cumulative impacts:

- 2.1.2 measures biodiversity in the benthos with the AMBI index.
- 2.1.1 measures Redox as a proxy for benthic health
- 2.1.3 measures antibiotics and therapeutants in the sediment as a proxy for their impact on the ecosystem
- 2.5.1 and 2.5.2 set limits on predator control and use of lethal action
- Indicators under 5.3 require proper use and dosage of antibiotics and therapeutants
- Indicators under 3.1 require participation in an area-wide disease management program that includes measurements in the wild of lice and diseases
- Indicators under 5.4 require participation in an area-wide resistance monitoring program that requires measurements of resistance in target organisms.
- Indicators in 4.6 measure copper in the sediment as a proxy of its impact on the ecosystem, and require copper-treated nets to be cleaned in on-land facilities with effluent treatment.
- 2.2.1 measures dissolved oxygen as a proxy for water quality that is supportive of healthy biodiversity

Indicator 2.6.1 attempts to provide an additional layer of security by identifying a sentinel species that would be a reference point for the overall health of the ecosystem. In principle, there is agreement that it's a good idea. In practice, it could be very difficult to identify an appropriate sentinel species in all salmon-producing regions. In addition, there are concerns that this standard may hold farms accountable for population declines that have nothing to do with the farm. Finally, it would likely require data gathering that would exceed a single farm's ability. It requires further discussion to determine if it's viable.

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. It addresses impacts associated with disease and parasites, escapes, and siting. A proposed 7-point plan to address concerns around wild salmonids emerges across the two principles. In summary, the plan is:

A. Strong escapes indicators to minimize fish getting out (3.4.1.-3.4.5)
B. Good husbandry and disease management on the farm, keeping farmed fish as healthy as possible and ensuring producers are aware of any problems (5.1.1.-5.1.5 plus 3.1.1)
C. A transport indicator that doesn't permit risky transporting of fish in the water by combining testing of fish prior to transport and use of appropriate wellboats (3.1.4)
D. A maximum limit for lice on the farm (3.1.4)
E. Consequences for farms that show non-endemic diseases – either the farm loses certification or farms must conduct tests that show the disease isn't jumping into the environment and/or a strict plan to

contain the disease through culling etc. (3.1.2) . Also, farms that show a reoccurrence of specific diseases (non-endemic or not) in a second generation would face similar consequences (3.1.3).

F. A combination of pressure indicators (3.1.8), either separate or combined into a single index:
    a. Maximum density of fish on farm (kilos of fish/cubic meter)
    b. Maximum density of fish farms in an area (kilos of fish/sq kilometer)
    c. Minimum distance from sensitive migration routes, breeding areas, mouth of wild-salmon rivers
G. Required participation in a region-wide disease management program (3.1.7) that includes:
    a. A maximum on-farm lice limit for all the farms in the region
    b. An environmental indicator that measures lice levels in wild salmon, setting a standard around maximum year-over-year increase, or maximum difference from published ambient levels
    c. An environmental indicator that tests in wild salmon for diseases that are detected on farm, setting a standard around maximum year-over-year increase, or maximum difference from published ambient levels

Below is this seven-point plan, grouped into the original criteria, with clarifying notes. Several indicators also address concerns about impacts on other wild fish. The Steering Committee is still discussing how to best address concerns around non-salmonids. ***Sections of the document where the Steering Committee is still discussing a proposal for draft indicators are highlighted in italics.***

CRITERIA & DRAFT INDICATORS

3.1 Introduced or amplified parasites and pathogens

3.1.1 Presence of clear documentation of disease occurrences/outbreaks on-farm.

3.1.2 If non-endemic diseases and /or parasites are detected on farm, requirement to show through environmental testing that disease hasn't jumped into the wild and/or strong disease management practices through culling etc.

3.1.3 Re-occurrence of a specific disease over more than one generation (yes or no; or requirement to show through environmental testing that disease hasn't jumped into the wild).

3.1.4 Maximum on-farm lice levels (average of X lice per farmed fish)

3.1.5 % of fish tested prior to transport.

3.1.6 Method of transport of farm animals or other materials that reflects risks identified through pre-transport testing (degree of contact with ecosystem through open well-boats, towing cages, etc.).

3.1.7 Participation in an effective area-based disease management scheme (area defined in terms of wild salmon habitats and migration routes), actively monitored and enforced, that includes:
    a. Required components or outcomes of the management scheme (e.g. age class control, fallowing)
    b. Maximum area-level farm lice levels
    c. Measurements of lice levels in wild salmon (setting a standard around either a year-over-year increase, or difference from published ambient lice levels.)
    d. Measurements in the wild of diseases found on farm (setting a standard around either a year-over-year increase, or difference from published ambient lice levels.)

3.1.8 Infection pressure risk indicators, separate or combined into a single index, that includes:

a. Maximum density of fish on farm (kilos of fish/cubic meter)
b. Maximum density of fish farms in an area (kilos of fish/sq kilometer)
c. Minimum distance from sensitive migration routes, breeding areas, mouth of wild-salmon rivers

NOTES ON CRITERIA 3.1: Several of these criteria need further discussion to refine. The Steering Committee is still discussing whether there is sufficient scientific information to set meaningful standards related to disease levels in and effects on wild populations. The Steering Committee agrees it is important to understand the disease and parasite impacts of the farm on wild populations. Overall, indicators around disease should recognize that disease in the wild is the result of many factors, not just farms. Also, disease measurement must be practical. The main intent of most if these indicators is addressing concerns around wild salmon. If the indicators are restricted to wild salmon, an additional indicator needs to be added to address concerns about parasites from farms impacting wild fish in regions without wild salmonids. There are differences of opinion about whether lice level indicators should only apply to regions with wild salmonid populations.

- Indicator 3.1.2 attempts to create serious consequences if non-endemic disease is detected on the farm. However, there's concern that a disease may be "non-endemic" simply because it wasn't detected in the region previously. Given that uncertainly, what is the appropriate consequence for a farm? Lose certification, conduct testing in the wild to prove the disease hasn't jumped into wild fish, or take aggressive disease management steps such as culling nets or the entire farm?
- For the transport indicators (3.1.5 and 3.1.6), while it is agreed that this is an important area to minimize risk, it is under discussion whether the standard should take into account the current availability of closed well-boats. The standard may get split up into an immediate standard and a future standard that takes effect after a few years, giving farms time to update their equipment.
- The indicator that requires a regional disease management scheme contains an assumption that farms-level standards also need to take into account the cumulative impact of several farms on nearby wild salmon. Technical experts have signaled that an area-wide approach to lice management and other diseases is critical.
- For indicator 3.1.8, the density standard must reflect the fact that different locations have different capacities.

3.2 Introduction of non-native species

3.2.1 Will protect against exotic species becoming established by either:

- All*owing certification of non-native species only if the species is already farmed in the area/region/country or*
- *Allowing non-native species to be introduced to new geographies only if they are assessed to pose an acceptable level of risk.*

NOTES ON CRITERIA 3.2: More discussion is needed to select between these two options. This indicator/standard should reflect the FAO guideline that permits non-native species only when they pose an acceptable level of risk to biodiversity. The observed impacts to date from non-native salmon

escapes in Chile, British Columbia and elsewhere have been mixed. The risk tool referred to in option two still needs to be identified.

3.3 Introduction of transgenic species

3.3.1 Prohibit transgenic salmon on farm

NOTES ON CRITERIA 3.3: The Steering Committee will be defining precisely the term "transgenic"

3.4 Escapes

3.4.1 % of fish loss that is unexplained per unit time

3.4.2 Number and % of fish escaped per production cycle (in marine and freshwater)

3.4.3 Number of episodes of escapes per production cycle (with potential look back over several years)

3.4.4 Compliance with a formal plan to assess and mitigate escape risk that includes: # of netpen inspections per year and other elements.

NOTES ON CRITERIA 3.4: These indicators seek to minimize or eliminate escapes from a farm, and do not attempt to measure the consequences of escapes in the wild.

- For 3.4.4, the elements of the plan will need to be developed and may include training or technical requirements.

3.5 Interaction with wild salmonid populations/runs

See indicators 3.1.7 and 3.1.8 above.

Principle 4: Use resources in an environmentally efficient and responsible manner

Principle 4 is broadly intended to address negative impacts that stem from resource use, including feed and non-therapeutic chemical inputs. ***Sections of the document where the Steering Committee is still discussing a proposal for draft indicators are highlighted in italics.***

CRITERIA & DRAFT INDICATORS

4.1 Use of wild fish for feed (dependency on marine protein and lipid sources)

4.1.1 Forage Fish Efficiency Ratio (FFER), calculated separately for meal and oil.

NOTES ON CRITERIA 4.1: The use of an FFER is an ongoing discussion within the Steering Committee.

- If FFER is used, the Steering Committee recommend calculating it using the Tacon & Metian methodology and setting separate standards related to FFER for oil and meal. The Tacon & Metian methodology is used within the Tilapia and Pangasius standards, though their drafts currently set only one maximum FFER (whether meal or oil) as a standard.

4.2 Source of marine raw materials (i.e. origin of fish used in feeds)

4.2.1a: *As of 20XX or upon availability*, the percentage of fisheries product (meal and oil) in feed that is certified under an ISEAL Alliance-accredited scheme.
4.2.1b: Prior to availability of such product as noted in 4.2.1a, the percentage of fisheries products in feed that *meet a minimum sustainability requirement*.

NOTES ON CRITERIA 4.2: This indicator strives to ensure marine-based feed ingredients come from sustainable sources in the short and long-term. The standard could be yes/no or a percentage.

- The Steering Committee does not recommend including specific indicators around by-catch, since by-catch is already covered under fish product sourcing schemes and indicators.
- If 4.2.1 is only applied to forage fish, then an indicator that addresses the sourcing of byproduct/trimmings should be included, prohibiting use of byproduct/trimmings from IUCN red list species or species listed as being overfished by FAO. Current draft feed indicator under Criteria 4.1 encourages the use of byproducts and trimmings, so there is no need to write an additional indicator encouraging their use.
- For 4.2.1a, the date and/or definition of "availability" needs further discussion.
- For 4.2.1b, areas for consideration related to sustainability may include the IUCN red list, the FAO overfished category, and certification under the IFFO Global Standard for Responsible Supply.

4.3 Source of non-marine raw materials in feed

4.3.1 Presence of feed supplier sustainability policy that, at a minimum, includes the ability to trace where their products came from, and complies with internationally recognized moratoriums and local laws.

NOTES ON CRITERIA 4.3: The Steering Committee expects to spend more time discussing indicators for this criteria. As written, this indicator strives to ensure vegetable feed ingredients come from sustainable sources. Further discussion should include a review of whether third-party, ISEAL-accredited certification schemes exist for vegetable ingredients. The Steering Committee is not aware of any that currently exist. If such schemes do exist, it should be discussed whether the Salmon Dialogue should require or encourage sourcing vegetable feed ingredients that meet these schemes.

4.4 Non-biological waste from production

4.4.1 Existence of a functioning recycling policy

4.4.2 % of plastics and other recyclable materials that are recycled or reused

4.4.3 Evidence that all non-biological waste that isn't recycled is disposed of properly (including net pens and beach clean-up)

NOTES ON CRITERIA 4.4: The purpose of these indicators is to ensure that all non-biological waste produced by a farm is recycled, reused or disposed of properly. The standard for the percentage of recycled waste should reflect the fact that some farms are in extremely remote locations with no viable recycling systems nearby. Still, we believe it is important to set a minimum percentage of recycled waste in the standards, knowing that many farms may be able to greatly exceed that minimum.

4.5 Energy consumption and greenhouse gas emissions (on farm)

4.5.1 Records of energy consumption during hatchery, smolt production and grow-out (e.g. volume and type)
4.5.2 Evidence of an energy use assessment for hatchery, smolt production and grow-out (e.g. energy audit, in-house estimates)

NOTES ON CRITERIA 4.5: 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 Salmon Aquaculture Dialogue 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 Salmon Aquaculture Dialogue set a meaningful numerical standard for energy use in the future.

4.6 Non-therapeutic chemical inputs

4.6.1 % of copper-treated nets that are cleaned and treated at sites with effluent treatment
4.6.2 Copper concentrations in the sediment as compared to background levels
4.6.3 Difference between concentrations of copper and zinc in indigenous and/or co-cultured species as compared to reference sites
4.6.4 Difference between concentrations of copper and zinc in indigenous and/or co-cultured species as compared to published data indicating "normal" or background level for that species

NOTES ON CRITERIA 4.6: A significant source of the problems observed from copper stems from cleaning and treating nets in areas that don't treat the effluent. Indicator 4.6.1 gets at the heart of that problem. Although it is not a perfect indicator of effects of copper on organisms, measuring copper in the sediment adds an extra safeguard to ensure copper isn't accumulating around the farm. Additional discussion is needed to determine whether 4.6.3 and 4.6.4 are duplicative of 4.6.2 and whether there is sufficient scientific information to set meaningful standards.

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. ***Sections of the document where the Steering Committee is still discussing a proposal for draft indicators are highlighted in italics.***

CRITERIA & DRAFT INDICATORS

5.1 Survival and health of farmed fish

5.1.1 Frequency of visits by a licensed veterinarian
5.1.2 % of fish that are vaccinated for selected diseases
5.1.3 % of mortality that is cause-specific

5.1.4 % of smolt tested for select diseases prior to entering grow-out phase (on farm)
5.1.5 Survival and/or mortality rate

5.2 Contamination levels and health effects in local non-target organisms

5.2.1 On-farm documentation requirement: Documentation of all chemicals and therapeutants used during the audit period, the amounts used and the dates used.
5.2.2 Concentrations in benthos taxa of one or more chemicals/therapeutants, cross-referenced with the toxicity information made available by the drug manufacturer and/or regulator authorities.

NOTES ON CRITERIA 5.2: Documentation of all chemicals and antibiotics used (including amounts and times) is crucial. It needs to be discussed whether 5.2.2 is redundant if the measurement of chemicals and antibiotics is included under 2.1.3.

5.3 Therapeutic treatments

5.3.1 Proof of proper dosing and/or concentrations for all antibiotics and therapeutants used, whether in feeds and in other treatments such as bath treatments.
5.3.2 % of therapeutic treatments that include antibiotics or chemicals that are banned in any of the primary salmon producing countries.
5.3.3 Grams of active ingredient used per kilo fish produced 5.3.4 % of medication events that are prescribed by a veterinarian
5.3.5 Frequency of tissue residue violations (or duration since last tissue residue violation for the site)
5.3.6 Minimum % of antimicrobial treatments that are applied because of a confirmed bacterial disease

NOTES ON CRITERIA 5.3: These indicators address the use of chemicals and antibiotics and their potential impacts on the receiving environment.

- 5.3.2 requires further conversation to determine whether we include substances that are not permitted, not registered or approved, or banned in certain jurisdictions. The definition of these categories and which countries or jurisdictions are covered will also need to be discussed. Principle 1 (comply with laws and regulations) already prohibits farms from using substances that are not allowed in the country of production.
- Indicator 5.3.3 (grams of active ingredient per kilo of fish produced) may be impractical in some situations. We will need to discuss where this is appropriate and for which chemicals. This should be revisited during the standard-setting conversations.
- For 5.3.4 and 5.3.6, some countries may already require 100%.
- Indicator 5.3.5 about tissue violations is a food safety measurement (not the scope of these standards) but also points to the overuse of chemicals.

5.4 Resistance of parasites, viruses, and bacteria to medicinal treatments

5.4.1 Participation in region-wide resistance monitoring programs (Need to define some of the factors that would be required to be included in the program)

5.4.2 Presence of significantly reduced sensitivity towards relevant therapeutants in target organisms (detected in region-wide monitoring program)
5.4.3 Presences of significantly increased resistance in non-target organisms

NOTES ON CRITERIA 5.4:

- The logic of these indicators is similar to the logic of requiring farms to participate in region-wide lice programs. A farm that wants to be certified needs to bear responsibility for the cumulative resistance effects of all the farms in the region using antibiotics and chemical treatments. The standard will have to define more clearly the responsibility of the individual farm in ensuring that the regional program functions.
- Measuring resistance in non-target organisms requires more discussion, including how it is measured and which organisms are most affected.
- Indicator 2.1.3 under Benthic Impacts will support these indicators by measuring antibiotic residue in the sediment.

5.5 Biosecurity management

5.5.1 % of cages that are single year class
5.5.2 Number of veterinarian visits per year
5.5.3 % of marine-based feed ingredients that are screened for disease
5.5.4 Risk index
5.5.5 Number of smolt suppliers (per site)

NOTES ON CRITERIA 5.5: Generally, indicators related to biosecurity management need significant further discussion and refinement.

- In 5.5.1, the % of cages that are single year class could be measured by farm or region, or as a % of cages in a defined region owned by the same company as the site applying for certification. Alternately, the indicator could be edited to say "implementation of year class/smolt group separation.
- 5.5.2 is duplicative of 5.1.1.
- For 5.5.4, a formula for calculating the risk index would need to be developed and agreed to.

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.

The indicators for Principle 6 and 7 are still under development and are the subject of a technical working group which is drafting indicators in addition to developing a report related to social, community, and labor impacts associated with salmon farming. As part of their terms of reference, the social technical working group will be looking at social standards developed in other Aquaculture Dialogues. For an example of how

they have been addressed in other Dialogues, see the draft Bivalve Aquaculture Dialogue standards at http://www.worldwildlife.org/what/globalmarkets/aquaculture/WWFBinaryitem13945.pdf.

CRITERIA

6.1 Freedom of association and collective bargaining
6.2 Child labor
6.3 Forced, bonded, or compulsory labor
6.4 Discrimination
6.5 Health and safety of workers
6.6 Wages
6.7 Contracts (labor) including subcontracting
6.8 Conflict resolution

Principle 7: Be a good neighbor and conscientious citizen

Principle 7 aims to address any broader (off-farm site) potential negative social impacts associated with a farm, including interactions with local communities.

CRITERIA

7.1 Interaction with local communities and other resource users
7.2 Respect for indigenous and aboriginal cultures and traditional territories