

Monterey Bay Aquarium Seafood Watch®

Aquaculture Stewardship Council

Salmon Standard (Version 1.1 June 2017)



Benchmarking equivalency results assessed against the Seafood
Watch Aquaculture Standard

June 2017

Final Seafood Recommendation

ASC Salmon

Criterion	Score (0-10)	Rank	Critical?
C1 Data	9.77	GREEN	
C2 Effluent	5.00	YELLOW	NO
C3 Habitat	6.27	YELLOW	NO
C4 Chemicals	4.00	YELLOW	NO
C5 Feed	3.36	YELLOW	NO
C6 Escapes	2.00	RED	NO
C7 Disease	5.00	YELLOW	NO
C8X Source	0.00	GREEN	NO
C9X Wildlife mortalities	-4.00	YELLOW	NO
C10X Introduced species escape	0.00	GREEN	
Total	31.40		
Final score	4.49		

Final Score	4.49
Initial rank	YELLOW
Red criteria	1
Final rank	YELLOW
Critical Criteria?	NO

FINAL RANK
YELLOW

Scoring note – scores range from zero to ten where zero indicates very poor performance and ten indicates the aquaculture operations have no significant impact. Color ranks: Red = 0 to 3.33, Yellow = 3.34 to 6.66, Green = 6.66 to 10. Criteria 8X, 9X, and 10X are exceptional criteria, where 0 indicates no impact and a deduction of -10 reflects very poor performance. Two or more Red criteria trigger a Red final result.

Scoring summary

The final numerical score for the ASC Salmon Standard benchmarked against the Seafood Watch Aquaculture Standard is 4.49 out of 10. With only one Red-ranked criterion (Escapes), the final result is a “Good Alternative” recommendation.

Executive Summary

The benchmarking equivalence assessment was undertaken on the basis of a positive application of a realistic worst-case scenario

- “Positive” – Seafood Watch wants to be able to defer to equivalent certification schemes
- “Realistic” – we are not actively pursuing the theoretical worst case score. It has to represent reality and realistic aquaculture production.
- “Worst-case scenario” – we need to know that the worst-performing farm capable of being certified to any one standard is equivalent to a minimum of a Seafood Watch “Good alternative” or “Yellow” rank.

The final result of the equivalence assessment for ASC Salmon is a yellow “Good Alternative” recommendation. This means we can confidently defer to ASC Salmon as an assurance that all certified products meet at least a yellow “Good Alternative” recommendation.

The ASC Salmon standard was assessed against the Seafood Watch standard using the realistic worst case scenario of multi-generational domesticated Atlantic salmon in a region where there is documented evidence of negative genetic impacts on wild salmon and negative parasite impacts on wild salmon or sea trout.

In general the ASC standard scores moderate to good on most criteria and only have substantial weakness (compared to the Seafood Watch criteria) for escapes. This results in one red criterion, and an overall yellow ranking.

Specifically for each criterion, the ASC salmon standards:

- necessitate considerable data collection to demonstrate compliance with the standards, and when combined with the farm-level certification process (i.e. audit) result in a high data score
- have specific requirements for benthic impacts within and outside an allowable zone of effect (AZE), but only require monitoring of soluble effluents. Despite area based management requirements, the standards do not robustly deal with cumulative effluent or habitat impacts of sites located in close proximity.
- prohibit critically important antibiotics and other treatments are limited to some extent, but standards still permit significant use of antibiotics and pesticides in a high exchange production system (open exchange net pens/cages).
- set a limit on the “Feed Fish Efficiency Ratio” of 2.52 for fish oil meaning that from first principles, 2.52 tons of wild fish would need to be caught to produce one ton of ASC certified salmon.
- set a strict limit on escapes numbers, but allow a large counting error which in reality would allow escapes of thousands of fish.
- have substantial requirements for parasite monitoring and control, but are unclear regarding the actions to be taken as a result of the monitoring results.
- limit mortality of marine mammals to two in the previous two years,
- do not limit the international movement of eggs or smolts, but are not penalized in the benchmarking assessment for this aspect.

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Introduction

Scope of the analysis and ensuing recommendation

The ASC 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”.

The worst case scenario used in this assessment is Atlantic salmon farmed in net pens where there is the potential for escape and where there is documented evidence of negative genetic impacts on wild salmon and negative parasite impacts on wild salmon or sea trout.

Analysis

Benchmarking principles

The benchmarking equivalence assessment was undertaken on the basis of a positive application of a realistic worst-case scenario

- “Positive” – Seafood Watch wants to be able to defer to equivalent certification schemes
- “Realistic” – we are not actively pursuing the theoretical worst case score. It has to represent reality and realistic aquaculture production.
- “Worst-case scenario” – we need to know that the worst farm capable of being certified to any one standard is equivalent to a minimum of a Seafood Watch “Good alternative” or “Yellow” rank.

Benchmarking assumptions

A number of assumptions were made to enable an equivalence assessment to be made either in the face of differing language or units etc., or in the case of missing information or gaps in the standards. The assumptions enable consistency across all the standards being assessed.

Specific assumptions have been noted where relevant in the individual criteria sections below, but the following were applied to all standards:

- Anything referred to as “should”, “recommend”, “prefer”, “minimize”, “minor must” or any similarly non-specific language was ignored
- Any deferral to local or national regulations in a standard of global scope was ignored.
- Any aspirational intent not supported by robust standards was ignored (for example “You must prevent escapes” was ignored if there were not effective supporting standards to actually prevent escapes).
- Any standards based on a future timeframe were ignored.
- Assume standards are applicable globally unless the standards or the scheme’s label specify or differentiate production regions. Assume the worst-case farm is in the worst country or region.

- Only “complete” production systems were assessed across all criteria – for example all criteria for tilapia are assessed for cages because this gives the lowest overall final score and rank, even though ponds would have a lower habitat criterion score.
- Requirements for animal health plans, veterinary supervision, or veterinary prescription of medications were ignored without further robust requirements in the standards

Scoring guide

- With the exception of the exceptional criteria (C8X, C9X and C10X), all scores result in a zero to ten final score for the criterion and the overall final rank. A zero score indicates poor performance, while a score of ten indicates high performance. In contrast, the three exceptional criteria result in negative scores from zero to minus ten, and in these cases zero indicates no negative impact.

- **The full Seafood Watch Aquaculture Criteria that the following scores relate to are available [here](#)¹.**
- **The full data values and scoring calculations are available in Appendix 1**

¹ http://www.seafoodwatch.org/-/m/sfw/pdf/criteria/mba_seafood%20watch_aquaculture%20standard_version%20a3.2.pdf?la=en

Criterion 1: Data quality and availability

Impact, unit of sustainability and principle

- *Impact: poor data quality and availability limits the ability to assess and understand the impacts of aquaculture production. It also does not enable informed choices for seafood purchasers, nor enable businesses to be held accountable for their impacts.*
- *Sustainability unit: the ability to make a robust sustainability assessment*
- *Principle: robust and up-to-date information on production practices and their impacts is available to relevant stakeholders.*

Criterion 1 Summary of scores for ASC Salmon

Data Category	Relevance (Y/N)	Data Quality	Score (0-10)
Industry or production statistics	Yes	10	10
Management	Yes	10	10
Effluent	Yes	10	10
Habitats	Yes	10	10
Chemical use	Yes	10	10
Feed	Yes	10	10
Escapes	Yes	7.5	7.5
Disease	Yes	10	10
Source of Stock	Yes	10	10
Wildlife interactions	Yes	10	10
Introduced species	Yes	10	10
Total			107.5

C1 Data Final Score	9.75	GREEN
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Justification of Ranking

Assumptions:

- The “Source of stock” category was considered “non-relevant” unless the scheme specifically required data collection on these aspects. Schemes could improve their score by requirements in this respect, but would not be penalized for not providing information on what would be considered universal practice.

While there are few specific data collection requirements, certification to the standards necessitates monitoring and data collection on all aspects relevant to the Seafood Watch criteria. The escapes category is scored 7.5 because of the inherent uncertainty in counting implied in the standards.

Relevant Content of Standards	How we applied it
Production	Assumed farm will have production statistics and industry information. Score 10 of 10
Management	For benchmarking, the standard holder and the audit are considered effective management. Score 10 of 10
<p>Effluent</p> <p>1.1.1 Presence of documents demonstrating compliance with local and national regulations and requirements on land and water use - Yes</p> <p>1.1.4 Presence of documents demonstrating compliance with regulations and permits concerning water quality impacts - Yes</p> <p>4.7.1 For farms that use copper treated nets, evidence that nets are not cleaned or treated in situ in the marine environment - Yes</p> <p>4.7.2 For any farm that cleans nets at on land sites evidence that net cleaning sites have effluent treatment – Yes</p> <p>4.7.3 For farms that use copper nets or copper treated nets evidence of testing for copper level in the sediment outside of the AZE, following methodology in Appendix I-1 – Yes</p>	<p>Data collected on legality of farm operations.</p> <p>Assumed data is collected on water quality as part of monitoring plans. Score 10 of 10</p>
<p>Habitat</p> <p>1.1.1 Presence of documents demonstrating compliance with local and national regulations and requirements on land and water use - Yes</p> <p>2.4.1 Evidence of an assessment on a farm’s potential impacts on biodiversity and nearby ecosystems that contains at a minimum the components outlined in Appendix I-3 – Yes</p> <p>3.1.5 In areas with wild salmonids, evidence of data and the farm’s understanding of that data, around salmonid migration routes, migration timing and stock</p>	<p>Data collected regarding legality of farm siting.</p> <p>Data collected on farm’s impact to biodiversity. Appendix I-3 requires assessments of proximity to high-value habitats, and critical, sensitive, or protected species Score 10 of 10</p>

<p>productivity in major waterways within 50 kilometers of the farm - Yes</p>	
<p>Chemical Use 5.2.1 On-farm documentation that includes, at a minimum, detailed information on all chemicals 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</p>	<p>Data on chemical type, frequency of use, and dose collected. Score 10 of 10</p>
<p>Feed 4.1.1 Evidence of traceability, demonstrated by the feed producer, of feed ingredients that make up more than 1% of the feed. – Yes</p> <p>4.3.3 Prior to achieving 4.3.1, demonstration of third-party verified chain of custody and traceability for the batches of fishmeal and fish oil which are in compliance with 4.3.2 – Yes</p> <p>4.3.5 Presence and evidence of a responsible sourcing policy for the feed manufacturer for marine ingredients that includes a commitment to continuous improvement of source fisheries – Yes</p>	<p>Data on source of wild fish in feeds collected. Score 10 of 10</p>
<p>Escapes 3.1.5 In areas with wild salmonids, evidence of data 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 – Yes</p> <p>3.2.1 If a non-native species is being produced, demonstration that the species was widely commercially produced in the area by the date of publication of the ASC Salmon standard Yes</p> <p>3.2.2 If a non-native species is being produced, evidence of scientific research completed within the past five years that investigates the risk of</p>	<p>Data on numbers of escapes collected, but inherent uncertainty in counting implied in the standard. Impacts of escaped fish on ecosystems unknown. Score 7.5 of 10</p>

<p>establishment of the species within the farm's jurisdiction and these results submitted to ASC for review Yes, by June 2017</p> <p>3.4.3 Estimated unexplained loss of farmed salmon is made publicly available - Yes</p> <p>3.4.4 Evidence of escape prevention planning and related employee training, including: net strength testing; appropriate net mesh size; net traceability; system robustness; predator management; record keeping and reporting of risk events (e.g., holes, infrastructure issues, handling errors, reporting and follow up of escape events); and worker training on escape prevention and counting technologies – Yes</p>	
<p>Disease</p> <p>3.1.2 A demonstrated commitment to collaborate with NGOs, academics and governments on areas of mutually agreed research to measure possible impacts on wild stocks - Yes</p> <p>3.1.4 Frequent on-farm testing for sea lice, with test results made easily publicly available within seven days of testing - Yes</p> <p>3.1.5 In areas with wild salmonids, evidence of data 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 - 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 or Arctic char, with results made publicly available. See requirements in Appendix III-1. – Yes</p> <p>3.4.3 Estimated unexplained loss of farmed salmon is made publicly available - Yes</p> <p>5.1.1 Evidence of a fish health management plan for the identification and monitoring of fish diseases,</p>	<p>Data on pathogen and parasite levels collected and shared with other farms in the management area.</p> <p>Data on sea lice levels on wild salmonids during migration periods made publicly available</p> <p>Score 10 of 10</p>

<p>parasites and environmental conditions relevant for good fish health, including implementing corrective action when required. - Yes</p> <p>5.1.4 Percentage of mortalities that are recorded, classified, and receive a post-mortem analysis – 100%</p> <p>5.1.7 Farm specific mortalities reduction program that includes defined annual targets for reductions in mortalities and reductions in unexplained mortalities – Yes</p> <p>5.2.1 On-farm documentation that includes, at a minimum, detailed information on all chemicals 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</p> <p>5.4.2 Evidence that if the farm suspects an unidentifiable transmissible agent, or if the farm experiences unexplained increased mortality, the farm has 1. Reported the issue to the ABM and to the appropriate regulatory authority 2. Increased monitoring and surveillance on the farm and within the ABM 3. Promptly made findings publicly available – Yes</p> <p>5.4.3 Evidence of compliance with the OIE <i>Aquatic Animal Health Code</i> – Yes</p> <p>5.4.4 If an OIE-notifiable disease is confirmed on the farm, evidence that: 1. the farm has, at a minimum, immediately culled the pen(s) in which the disease was detected 2. the farm immediately notified the other farms in the ABM 3. the farm and the ABM enhanced monitoring and conducted rigorous testing for the disease 4. the farm promptly made findings publicly available</p>	
Source of Stock	Considered “non-relevant” for salmon benchmark.
Wildlife interactions	Data on lethal incidents collected. Score 10 of 10

<p>2.4.1 Evidence of an assessment on a farm’s potential impacts on biodiversity and nearby ecosystems that contains at a minimum the components outlined in Appendix I-3 – Yes</p> <p>2.5.4 Evidence that the following steps were taken prior to lethal action against a predator: 1. All other avenues were pursued prior to using lethal action 2. Approval was given from a senior manager above the farm manager 3. Explicit permission was granted to take lethal action against the specific animal from the relevant regulatory authority - Yes</p> <p>2.5.5 Evidence that information about any lethal incidents on the farm has been made easily publicly available - Yes</p> <p>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</p>	
<p>Introduced species</p> <p>5.4.2 Evidence that if the farm suspects an unidentifiable transmissible agent, or if the farm experiences unexplained increased mortality, the farm has 1. Reported the issue to the ABM and to the appropriate regulatory authority 2. Increased monitoring and surveillance on the farm and within the ABM 3. Promptly made findings publicly available – Yes</p> <p>5.4.3 Evidence of compliance with the OIE <i>Aquatic Animal Health Code</i> – Yes</p> <p>5.4.4 If an OIE-notifiable disease is confirmed on the farm, evidence that: 1. the farm has, at a minimum, immediately culled the pen(s) in which the disease was detected 2. the farm immediately notified the other farms in the ABM 3. the farm and the ABM enhanced monitoring and conducted rigorous testing for the disease 4. the farm promptly made findings publicly available</p>	<p>Data on movements of animals collected Score 10 of 10</p>

The final score (average of relevant category scores) is 9.8 out of 10

Criterion 2: Effluents

Impact, unit of sustainability and principle

- *Impact: aquaculture species, production systems and management methods vary in the amount of waste produced and discharged per unit of production. The combined discharge of farms, groups of farms or industries contributes to local and regional nutrient loads.*
- *Sustainability unit: the carrying or assimilative capacity of the local and regional receiving waters beyond the farm or its allowable zone of effect.*
- *Principle: aquaculture operations minimize or avoid the production and discharge of wastes at the farm level in combination with an effective management or regulatory system to control the location, scale and cumulative impacts of the industry's waste discharges beyond the immediate vicinity of the farm.*

Criterion 2 Summary of scores for ASC salmon

Effluent parameters	Value	Score	
F2.1a Biological waste (nitrogen) production per ton of fish (kg N ton-1)	46		
F2.1b Waste discharged from farm (%)	80		
F2 .1 Waste discharge score (0-10)		6	
F2.2a Content of regulations (0-5)	2		
F2.2b Enforcement of regulations (0-5)	4		
F2.2 Regulatory or management effectiveness score (0-10)		3.2	
C2 Effluent Final Score		5.00	YELLOW
Critical?	NO		

Justification of Ranking

Assumptions

- For consistency, the full assessment was used across all species
- The cumulative impacts questions on regulations and enforcement were assessed according to the standards requirements in this respect

The effluent criterion assesses the impacts of waste beyond the farm site or an Allowable Zone of Effect.

Factor 2.1. Waste discharged from the farm

Factor 2.1a calculates the amount of (nitrogen) waste produced per ton of production

The ASC standards have benthic requirements for settling wastes beyond the AZE, but only require monitoring of soluble nitrogen and phosphorous beyond the AZE (i.e. no limits set in the standards).

Note the full list of data points and intermediate calculations are provided in Appendix 1. Bold text in tables indicates the requirement of the standard

Relevant Content of Standards	How we applied it
Protein content of feed Not addressed by initiative	37.8% average value from Scotland, Norway, British Columbia and Chile SFW assessments
Feed conversion ratio Not addressed by initiative	1.25 average value from Scotland, Norway, British Columbia and Chile SFW assessments
Fertilizer input	Assumed zero for all benchmarking assessments
Protein content of whole harvested salmon Not addressed by initiative	18.5% from Boyd et al (2007)

These values result in a nitrogen waste production of 46 kg per ton of salmon (see Criteria - Factor 2.1a for calculations).

Factor 2.1b calculates the proportion of the waste produced that is discharged from the farm.

Relevant Content of Standards	How we applied it
Basic discharge score or percentage of waste discharged Not addressed by initiative	From the Seafood Watch criteria, 80% of waste produced by fish in net pens has the potential to impact beyond the farm AZE.

Waste discharged per ton of salmon (available for impact beyond an allowable zone of effect) is 36.8 kg N.

Using global norms for salmon, 36.8kg nitrogen is discharged from the farm and its AZE per ton of salmon produced. This gives an initial waste discharge score of 6 out of 10 (for the 30-40kg N category).

Factor 2.2 then addresses the management measures in the standards to control the potential impact of the total farm tonnage and the cumulative impacts of neighboring farms.

Factor 2.2. Effluent management effectiveness (appropriate to the scale of production)

Factor 2.2 assesses the effectiveness of management measure or regulations to control the total waste produced from the total tonnage of the farm and the cumulative impact of multiple neighboring farms. See criteria document pages 18-19 for scoring tables.

Relevant Content of Standards	How we applied it
<p>ASC standards have been developed specifically for salmon</p> <p>1.1.4 Presence of documents demonstrating compliance with regulations and permits concerning water quality impacts - Yes</p> <p>2.1.1 Redox potential or sulphide levels in sediment outside of the Allowable Zone of Effect (AZE), following the sampling methodology outlined in Appendix I-1 Redox potential > 0 millivolts (mV) OR Sulphide ≤ 1,500 microMoles / l</p> <p>2.1.2 Faunal index score indicating good to high ecological quality in sediment outside the AZE, following the sampling methodology outlined in Appendix I-1 AZTI Marine Biotic Index (AMBI6) score ≤ 3.3, or Shannon-Wiener Index score > 3, or Benthic Quality Index (BQI) score ≥ 15, or Infaunal Trophic Index (ITI) score ≥ 25</p> <p>4.7.1 For farms that use copper treated nets, evidence that nets are not cleaned or treated in situ in the marine environment - Yes</p> <p>4.7.2 For any farm that cleans nets at on land sites evidence that net cleaning sites have effluent treatment – Yes</p> <p>4.7.3 For farms that use copper nets or copper treated nets evidence of testing for copper level in the sediment outside of the AZE, following methodology in Appendix I-1 – Yes</p> <p>This suite of indicators set by technical experts provide 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.</p>	<p>Factor 2.2a Impact limits are in place, but are not site-specific.</p> <p>Participation in area-based management systems required, but not for effluent impacts.</p> <p>Monitoring for full production cycle is required for some impacts, but not all.</p> <p>Factor 2.2a Score 2 of 5</p>

Factor 2.2a score is 2 out of 5

Factor 2.2b assesses the enforcement of the above measures.

Relevant Content of Standards	How we applied it
The requirements for audit and full compliance for all ASC standards mean that enforcement is considered to be effective.	
Management is not at the area-based scale.	

Factor 2.2b score is 4 out of 5

The Factor 2.2 score for the effectiveness of the management is 3.2 out of 10. The final effluent score is a combination of the waste discharged and the effectiveness of the management to control the total and cumulative impacts. The table on page 19 of the criteria document shows how this score is calculated, producing a final C2 score of 5 out of 10.

For comparison, had the Evidence-based assessment been completed based on the requirements of the ASC standards (assuming the standards were met), the result would have been the same as the Risk-based assessment; that is an intermediate score of 5 in between “Data shows no evidence of impacts beyond the AZE...” (score 6) and “Data show only occasional, temporary or minor impacts beyond the AZE...” (Score 4).

Criterion 3: Habitat

Impact, unit of sustainability and principle

- *Impact: Aquaculture farms can be located in a wide variety of aquatic and terrestrial habitat types and have greatly varying levels of impact to both pristine and previously modified habitats and to the critical “ecosystem services” they provide.*
- *Sustainability unit: The ability to maintain the critical ecosystem services relevant to the habitat type.*
- *Principle: aquaculture operations are located at sites, scales and intensities that cumulatively maintain the functionality of ecologically valuable habitats.*

Criterion 3 Summary of scores for ASC Salmon

Habitat parameters	Value	Score	
F3.1 Habitat conversion and function		7.00	
F3.2a Content of habitat regulations	3.00		
F3.2b Enforcement of habitat regulations	4.00		
F3.2 Regulatory or management effectiveness score		4.80	
C3 Habitat Final Score		6.27	YELLOW
Critical?	NO		

Justification of Ranking

Assumptions:

- Assume farm is in high-value (or former high-value) habitat unless standards specify otherwise
- The cumulative impacts questions on regulations and enforcement were assessed according to the standards requirements in this respect

The Habitat criterion assesses the impacts within the farm boundary or Allowable Zone of Effect.

Factor 3.1. Habitat conversion and function

Factor 3.1 assesses the impact on ecosystem services at the farm site, or within an allowable zone of effect. Explanatory tables and calculations can be found on page 25 of the assessment criteria.

Relevant Content of Standards	How we applied it
<p>1.1.1 Presence of documents demonstrating compliance with local and national regulations and requirements on land and water use - Yes</p> <p>2.1.2 Faunal index score indicating good to high ecological quality in sediment outside the AZE, following the sampling methodology outlined in Appendix I-1 AZTI Marine Biotic Index (AMBI5) score ≤ 3.3, or Shannon-Wiener Index score > 3, or Benthic Quality Index (BQI) score ≥ 15, or Infaunal Trophic Index (ITI) score ≥ 25</p> <p>2.1.3 Number of macrofaunal taxa in the sediment within the AZE, following the sampling methodology outlined in Appendix I-1 ≥ 2 highly abundant taxa that are not pollution indicator species</p> <p>2.2.1 Weekly average percent saturation of dissolved oxygen (DO) on farm, calculated following methodology in Appendix I-4 $\geq 70\%$</p> <p>2.2.2 Maximum percentage of weekly samples from 2.2.1 that fall under 2mg/liter DO 5%</p> <p>2.4.2 Allowance for the farm to be sited in a protected area or High Conservation Value Areas (HCVAs) – None</p> <p>4.7.4 Evidence that copper levels are <34 mg Cu/kg dry sediment weight OR in instances where the Cu in the sediment exceeds 34 mg Cu/kg dry sediment weight, demonstration that the Cu concentration falls within the range of background concentrations as measured at three reference sites in the water body – Yes</p>	<p>AZTI Marine Biotic Index (AMBI5) score ≤ 3.3 falls within the "Minimal impacts", but is beyond the AZE. Impacts are considered to be relatively rapidly reversible, and considering standard 2.1.3 are scored 7 of 10 as the lowest score for maintaining ecosystem function.</p>

The final score for factor 3.1 is 7 out of 10

Factor 3.2. Habitat and farm siting management effectiveness (appropriate to the scale of the industry)

Factor 3.2a assesses the content of the management measures to manage site-specific and cumulative habitat impacts. See Appendix 1 for scoring questions.

Relevant Content of Standards	How we applied it
<p>1.1.1 Presence of documents demonstrating compliance with local and national regulations and requirements on land and water use - Yes</p> <p>2.1.3 Number of macrofaunal taxa in the sediment within the AZE, following the sampling methodology outlined in Appendix I-1 ≥ 2 highly abundant taxa that are not pollution indicator species</p> <p>2.2.1 Weekly average percent saturation of dissolved oxygen (DO) on farm, calculated following methodology in Appendix I-4 ≥70%</p> <p>2.2.2 Maximum percentage of weekly samples from 2.2.1 that fall under 2mg/liter DO 5%</p> <p>2.4.1 Evidence of an assessment on a farm’s potential impacts on biodiversity and nearby ecosystems that contains at a minimum the components outlined in Appendix I-3 – Yes</p> <p>2.4.2 Allowance for the farm to be sited in a protected area or High Conservation Value Areas (HCVAs) - None</p> <p>3.1.5 In areas with wild salmonids, evidence of data 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 - Yes</p> <p>4.7.4 Evidence that copper levels are <34 mg Cu/kg dry sediment weight OR in instances where the Cu in the sediment exceeds 34 mg Cu/kg dry sediment weight, demonstration that the Cu concentration falls within</p>	<p>Assessment of habitat impacts on biodiversity and nearby habitats required, but not at the cumulative scale.</p> <p>Farms may not be sited in High Value habitats.</p> <p>Score 3 of 5</p>

<p>the range of background concentrations as measured at three reference sites in the water body - Yes</p>	
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The final score for Factor 3.2a is 3 out of 5

Factor 3.2b assesses the enforcement of the above measures. See Appendix 1 for scoring questions.

Relevant Content of Standards	How we applied it
<p>1.1.1 Presence of documents demonstrating compliance with local and national regulations and requirements on land and water use - Yes</p>	<p>Enforcement organization is considered to be the standard holder, and is therefore considered identifiable and contactable with resources appropriate for certification.</p> <p>Enforcement is not active at an area-based or habitat scale and therefore may not address cumulative habitat impacts.</p> <p>Score 4 of 5</p>

The final score for Factor 3.2b is 4 out of 5

The final score for Factor 3.2 is 4.8 out of 10.

The final score for criterion 3 (C3) combines factors 3.1. and 3.2 (see criteria document for calculation) to give a score of 6.27 out of 10.

Criterion 4: Evidence or Risk of Chemical Use

Impact, unit of sustainability and principle

- *Impact: Improper use of chemical treatments impacts non-target organisms and leads to production losses and human health concerns due to the development of chemical-resistant organisms.*
- *Sustainability unit: non-target organisms in the local or regional environment, presence of pathogens or parasites resistant to important treatments*
- *Principle: aquaculture operations by design, management or regulation avoid the discharge of chemicals toxic to aquatic life, and/or effectively control the frequency, risk of environmental impact and risk to human health of their use*

Criterion 4 Summary of scores for ASC Salmon

Chemical Use parameters	Score	
C4 Chemical Use Score	4.00	
C4 Chemical Use Final Score	4.00	YELLOW
Critical?	NO	

Justification of Ranking

Assumptions:

- Assume un-restricted use of critically important antibiotics unless specifically prohibited in the standards
- If antibiotics are prohibited but other chemicals are permitted, the score was based on any further standards limitations, or the typical use for the species and production system (whichever was lower).

Explanatory tables and calculations can be found on pages 27-28 of the assessment criteria.

Relevant Content of Standards	How we applied it
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. - Yes	Critically important antibiotics are prohibited Other antibiotic treatments (including chemicals Highly important for human health) are limited.
5.2.1 On-farm documentation that includes, at a minimum, detailed information on all chemicals and therapeutants used during the most recent production cycle, the amounts used (including grams per ton of	Requirement that if parasiticide use is high (PTI ≥ 6) parasiticides load must be at least 15% less than the

<p>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</p> <p>5.2.2 Allowance for use of therapeutic treatments that include antibiotics or chemicals that are banned in any of the primary salmon producing or importing countries - None</p> <p>5.2.3 Percentage of medication events that are prescribed by a veterinarian - 100%</p> <p>5.2.5 Maximum farm level cumulative parasiticide treatment index (PTI) score as calculated according to the formula in Appendix VII – PTI score ≤ 13</p> <p>5.2.6 For farms with a cumulative PTI ≥ 6 in the most recent production cycle, demonstration that parasiticide load is at least 15% less that of the average of the two previous production cycles - Yes, by June 2017</p> <p>5.2.7 Allowance for prophylactic use of antimicrobial treatments - None</p> <p>5.2.8 Allowance for use of antibiotics listed as critically important for human medicine by the World Health Organization (WHO) – None</p> <p>5.2.9 Number of treatments of antibiotics over the most recent production cycle - ≤ 3</p> <p>5.2.10 If more than one antibiotic treatment is used in the most recent production cycle, demonstration that the antibiotic load is at least 15% less that of the average of the two previous production cycles - Yes, by June 2017</p> <p>5.3.1 Bio-assay analysis to determine resistance when two applications of a treatment have not produced the expected effect – Yes</p>	<p>average of the last two production cycles by 2017 (implies a downward trend in sites with high parasiticide use).</p> <p>Score 4 of 10</p>
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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	
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The final Chemical use (C4) score is 4 out of 10.

Criterion 5: Feed

Impact, unit of sustainability and principle

- *Impact: feed consumption, feed type, ingredients used and the net nutritional gains or losses vary dramatically between farmed species and production systems. Producing feeds and their ingredients has complex global ecological impacts, and their efficiency of conversion can result in net food gains, or dramatic net losses of nutrients. Feed use is considered to be one of the defining factors of aquaculture sustainability.*
- *Sustainability unit: the amount and sustainability of wild fish caught for feeding to farmed fish, the global impacts of harvesting or cultivating feed ingredients, and the net nutritional gains or losses from the farming operation.*
- *Principle: aquaculture operations source only sustainable feed ingredients, convert them efficiently and responsibly, and minimize and utilize the non-edible portion of farmed fish.*

Criterion 5 Summary of scores for ASC Salmon

Feed parameters	Value	Score	
F5.1a Feed Fish Efficiency Ratio (FFER)	2.52	3.73	
F5.1b Source fishery sustainability score		-4.00	
F5.1: Wild Fish Use		1.72	
F5.2a Protein IN	47.25		
F5.2b Protein OUT	21.46		
F5.2: Net Protein Gain or Loss (%)	-54.59	4	
F5.3: Feed Footprint (hectares)	10.73	6	
C5 Feed Final Score		3.36	YELLOW
Critical?	NO		

Justification of Ranking

Assumptions

- If un-specified in the standards, assume the current industry average FCR
- If un-specified in the standards, assume fishmeal and oil levels averaged from Seafood Watch assessments of Atlantic salmon Chile, Scotland, British Columbia and Norway.
- Assume all non-aquatic feed ingredients are from edible crops (this generates the overall worst-case scenario score for feed in the criteria).
- If standards have some requirements for fishery sustainability but insufficient to deserve a better score, the sustainability score is -6 which assumes the very worst fisheries will be avoided. If there are no fishery sustainability standards then the score is -10.
- Assume a fishmeal protein content of 66.5% from FAO Technical paper 540 (2009). Assume remaining non-fishmeal protein comes from edible crops.

- Assume by-product ingredients in feed is zero unless specified in the standards
- For all species, assume 100% of by-products from harvested fish are utilized unless otherwise specified in the standards.

Explanatory score tables and calculations can be found on pages 37-44 of the assessment criteria. Breakdown of calculations and data points can be found in Appendix 1 of this report.

Factor 5.1. Wild Fish Use

Factor 5.1 combines a Feed Fish Efficiency Ratio (FFER) (F5.1a) with a source sustainability factor (F5.1b) to give a “wild fish use” score. Explanatory tables and calculations can be found on pages 38-39 of the assessment criteria.

Factor 5.1a Feed Fish Efficiency Ratio (FFER)

Relevant Content of Standards	How we applied it
4.2.1 Fishmeal Forage Fish Dependency Ratio (FFDR _m) for grow-out (calculated using formulas in Appendix IV-1) - < 1.2	The Seafood Watch FFER calculation is the same as FFDR _m or FFDR _o . The higher FFER value of 2.52 for all was used, which gives a FFER score of 3.73 out of 10.
4.2.2 Fish Oil Forage Fish Dependency Ratio (FFDR _o) for grow-out (calculated using formulas in Appendix IV-1), OR Maximum amount of EPA and DHA from direct marine sources (calculated according to Appendix IV-2) - FFDR _o < 2.52 or (EPA + DHA) < 30 g/kg feed	

Factor 5.1b Fishery source sustainability

Relevant Content of Standards	How we applied it
4.1.1 Evidence of traceability, demonstrated by the feed producer, of feed ingredients that make up more than 1% of the feed. - Yes	Scored as "-4" - All Fishsource scores ≥ 6 , OR source fishery must be considered 'responsible,' have guidelines specific to promotion of responsible environmental management of small pelagic fisheries, be ISEAL compliant, and be committed to continuous improvement
4.3.1 Timeframe for all fishmeal and fish oil used in feed to come from fisheries certified under a scheme that is an ISEAL member and has guidelines that specifically promote responsible environmental management of small pelagic fisheries - Not required	
4.3.2 Prior to achieving 4.3.1, the FishSource score for the fishery(ies) from which all marine raw material in feed is derived - All individual scores ≥ 6 , and biomass score ≥ 6	

<p>4.3.3 Prior to achieving 4.3.1, demonstration of third-party verified chain of custody and traceability for the batches of fishmeal and fish oil which are in compliance with 4.3.2 – Yes</p> <p>4.3.4 Feed containing fishmeal and/or fish oil originating from by-products or trimmings from IUU catch or from fish species that are categorized as vulnerable, endangered or critically endangered, according to the IUCN Red List of Threatened Species, whole fish, and fish meal from the same species and family as the species being farmed – None</p> <p>4.3.5 Presence and evidence of a responsible sourcing policy for the feed manufacturer for marine ingredients that includes a commitment to continuous improvement of source fisheries – Yes</p>	
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The source sustainability score (F5.1b) is -4 out of 10

Factor 5.1b adjusts the score from 5.1a according to the criteria calculations to give a final wild fish score (Factor 5.1) of 1.72 out of 10.

Factor 5.2. Net Protein Gain or Loss

Explanatory tables and calculations can be found on pages 39-43 of the assessment criteria, and specific values in Appendix 1.

Relevant Content of Standards	How we applied it
Protein content of feed Not addressed by initiative	Used 37.8% average value from Scotland, Norway, British Columbia and Chile SFW assessments
eFCR Not addressed by initiative	Used 1.25 average value from Scotland, Norway, British Columbia and Chile SFW assessments
Protein content of harvested salmon Not addressed by initiative	Used 18.5% from Boyd et al (2007)
Edible yield of harvested salmon Not addressed by initiative	Used 62% from Gjedrem et al (2009)
Percentage of non-edible byproducts from harvested salmon utilized Not addressed by initiative	Used 100% across all re-benchmarked standards for consistency as not addressed in standards.

Calculations using these values:

Protein input in feeds is 47.25 kg protein/100kg fish

Protein output in harvested salmon is 21.46 kg protein/100kg fish

Net edible protein loss is 54.59 % which equates to a score of 4 out of 10.

Factor 5.3. Feed Footprint

Explanatory tables and calculations can be found on page 44 of the assessment criteria.

Relevant Content of Standards	How we applied it
Inclusion of aquatic ingredients Not addressed by initiative	Calculations for fishmeal and fish oil inclusion rates from the FFDR (FFER) values in the standards and an FCR of 1.25 give 19.73% fishmeal and 12.29% fish oil. Total = 32.02%
Inclusion level of crop ingredients Not addressed by initiative	Assumed all non-marine ingredients are from crops as not addressed in standards, i.e. 67.98%
Inclusion level of land animal ingredients Not addressed by initiative	Assumed zero as not addressed in standards.

Inclusion levels are translated to footprint areas using scoring calculations explained on page 44 of the criteria document. Final feed footprint is 10.73 hectares per ton which equates to a score of 6 out of 10.

The final feed criterion (C5) score is a combination of the three feed factors with a double weighting on FFER. The final score is 3.36 out of 10.

Criterion 6: Escapes

Impact, unit of sustainability and principle

- *Impact: competition, genetic loss, predation, habitat damage, spawning disruption, and other impacts on wild fish and ecosystems resulting from the escape of native, non-native and/or genetically distinct fish or other unintended species from aquaculture operations*
- *Sustainability unit: affected ecosystems and/or associated wild populations.*
- *Principle: aquaculture operations pose no substantial risk of deleterious effects to wild populations associated with the escape of farmed fish or other unintentionally introduced species.*

Criterion 6 Summary of scores for ASC salmon

Escape parameters	Value	Score	
F6.1 Escape Risk		2.00	
F6.1a Recapture and mortality (%)	0		
F6.1b Invasiveness		2.00	
C6 Escape Final Score		2.00	RED
Critical?	NO		

Justification of Ranking

Assumptions

- Assume high exchange ponds and cages are high escape risk unless the standards require realistically effective prevention measures above industry norms
- Assume worst case scenario species/location (e.g. non-native or heavily domesticated native)
- For salmon, the worst case scenario is for the escape of multi-generation domesticated native salmon where there is evidence of genetic interactions with wild salmon.

Factor 6.1 Escape risk

Explanatory score table can be found on pages 48-50 of the assessment criteria

Relevant Content of Standards	How we applied it
3.4.1 Maximum number of escapees in the most recent production cycle 300	A 98% counting accuracy (i.e. 2% error) on a single cage of 100,000 fish would be 2,000 fish. Therefore the 300 fish limit is unrealistic.
3.4.2 Accuracy of the counting technology or counting method used for calculating stocking and harvest numbers ≥ 98%	
3.4.4 Evidence of escape prevention planning and related employee training, including: net strength testing; appropriate net	Net pens considered a 'High risk' system.

<p>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</p> <p>Yes</p> <p>Footnote 58 - A rare exception to this standard may be made for an escape event that is clearly documented as being outside the farm's control. Only one such exceptional episode is allowed in a 10-year period for the purposes of this standard.</p>	<p>Standard requires effective Best Management Practices for design, construction, and management of escape prevention (biosecurity).</p> <p>Score 2 of 10</p>
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The initial escape risk score is 2 out of 10

Recaptures

Relevant Content of Standards	How we applied it
Recapture standards are not addressed by the initiative	Zero % recapture

The recapture score can improve the escape risk score, but in this case the escape risk remains high and scored 2 out of 10.

Factor 6.2 Invasiveness

Relevant Content of Standards	How we applied it
<p>3.1.5 In areas with wild salmonids, evidence of data 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 - Yes</p> <p>3.2.1 If a non-native species is being produced, demonstration that the species was widely commercially produced in the area by the date of publication of the ASC Salmon standard</p> <p>Yes</p> <p>3.2.2 If a non-native species is being produced, evidence of scientific research completed within the past five years that investigates the risk of establishment of the species within the farm's jurisdiction and these results submitted to ASC for review</p> <p>Yes, by June 2017</p>	<p>Standards only relate to non-native species and do not address risk of genetic introgression from domesticated native species.</p> <p>Evidence of genetic introgression, but not unknown population level impact.</p> <p>Basic life history for farmed Atlantic salmon show a lack of ability to survive and establish in the wild once escaped.</p> <p>Some competition for breeding partners may occur.</p> <p>Score 2 of 10</p>

There are no standards to limit the direct impact of escapees (e.g. competition for food, predation on wild species, disturbance of breeding sites or other habitat modification)	
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Final invasiveness score is 2 out of 10

The final escapes score combines the escape risk score with the invasiveness score (explanatory score matrix can be found on page 53 of the assessment criteria) and is 2 out of 10 for the high risk of escape of multi-generational domesticated fish where there is evidence of genetic introgression in wild populations.

Criterion 7. Disease; pathogen and parasite interactions

Impact, unit of sustainability and principle

- *Impact: amplification of local pathogens and parasites on fish farms and their retransmission to local wild species that share the same water body*
- *Sustainability unit: wild populations susceptible to elevated levels of pathogens and parasites.*
- *Principle: aquaculture operations pose no substantial risk of deleterious effects to wild populations through the amplification and retransmission of pathogens or parasites.*

Criterion 7 Summary of scores for ASC Salmon

Risk-based assessment

Pathogen and parasite parameters	Score	
C7 Biosecurity	5.00	
C7 Disease; pathogen and parasite Final Score	5.00	YELLOW
Critical?	NO	

Justification of Ranking

Explanatory score table can be found on pages 56-57 of the assessment criteria

Relevant Content of Standards	How we applied it
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. - Yes	Between: “Low-moderate risk” score (6 of 10) for “Independently audited, scientifically robust limits are in place, and data show that

<p>3.1.3 Establishment and annual review of a maximum sea lice load for the entire ABM and for the individual farm as outlined in Appendix II-2 -Yes</p> <p>3.1.4 Frequent on-farm testing for sea lice, with test results made easily publicly available within seven days of testing - Yes</p> <p>3.1.5 In areas with wild salmonids, evidence of data 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 - 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 or Arctic char, with results made publicly available. See requirements in Appendix III-1. - Yes</p> <p>3.1.7 In areas of wild salmonids, maximum on-farm lice levels during sensitive periods for wild fish. (See detailed requirements in Appendix II, subsection 2.) - 0.1 mature female lice per farmed fish – Yes</p> <p>5.1.1 Evidence of a fish health management plan for the identification and monitoring of fish diseases, parasites and environmental conditions relevant for good fish health, including implementing corrective action when required. - Yes</p> <p>5.1.3 Percentage of dead fish removed and disposed of in a responsible manner – 100%</p> <p>5.1.4 Percentage of mortalities that are recorded, classified, and receive a post-mortem analysis – 100%</p> <p>5.1.5: Maximum viral disease-related mortality on the farm during the most recent production cycle - ≤ 10%</p> <p>5.1.6: Maximum unexplained mortality rate from each of the previous two production cycles, for farms with total mortality > 6% - ≤ 40% of total mortalities</p>	<p>pathogen or parasite levels are consistently below the limits over multiple production cycles”</p> <p>and “Moderate risk” score (4 of 10)</p> <p>“The production system has some biosecurity regulations or protocols in place, yet is still open to introductions of local pathogens and parasites (e.g., from water, broodstock, eggs, fry, feed, local wildlife, etc.) and is also open to the discharge of pathogens.”</p> <p>Farms sited in areas with management knowledge of native species migration patterns, with limits for sea lice loads allowed during migration periods, and during non-migration periods.</p> <p>Score 5 of 10</p>
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<p>5.2.1 On-farm documentation that includes, at a minimum, detailed information on all chemicals 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</p> <p>5.3.1 Bio-assay analysis to determine resistance when two applications of a treatment have not produced the expected effect – Yes</p> <p>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</p> <p>5.4.2 Evidence that if the farm suspects an unidentifiable transmissible agent, or if the farm experiences unexplained increased mortality, the farm has 1. Reported the issue to the ABM and to the appropriate regulatory authority 2. Increased monitoring and surveillance on the farm and within the ABM 3. Promptly made findings publicly available – Yes</p> <p>5.4.3 Evidence of compliance with the OIE <i>Aquatic Animal Health Code</i> – Yes</p> <p>5.4.4 If an OIE-notifiable disease is confirmed on the farm, evidence that: 1. the farm has, at a minimum, immediately culled the pen(s) in which the disease was detected 2. the farm immediately notified the other farms in the ABM 3. the farm and the ABM enhanced monitoring and conducted rigorous testing for the disease 4. the farm promptly made findings publicly available</p>	
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The final disease criterion (C7) score is 5 out of 10

Criterion 8X. Source of Stock – independence from wild fisheries

Impact, unit of sustainability and principle

- *Impact: the removal of fish from wild populations for on-growing to harvest size in farms*
- *Sustainability unit: wild fish populations*
- *Principle: aquaculture operations use eggs, larvae, or juvenile fish produced from farm-raised broodstocks thereby avoiding the need for wild capture*

This is an “exceptional” factor that may not apply in many circumstances. It generates a negative score that is deducted from the overall final score. A score of zero means there is no impact.

Criterion 8X Summary of scores for ASC Salmon

Source of stock parameters	Score
C8X % of production from hatchery-raised broodstock or natural (passive) settlement	100
C8X Source of stock Final Score	0.00
	GREEN

Justification of Ranking

Assumptions

- For the species covered by the standards in this assessment, assume 100% is sourced from hatcheries (because almost all are) except shrimp standards that do not specifically prohibit capture of wild postlarvae.

Explanatory score table can be found on page 59 of the assessment criteria

Relevant Content of Standards	How we applied it
Section 8 relates to smolt production, but the above assumption is realistic for salmon and the score is 10 out of 10 because certified farms are considered independent of wild fisheries for juveniles or broodstock.	

The final source of stock score (C8X) is 10 out of 10.

Criterion 9X: Wildlife and predator mortalities

A measure of the effects of deliberate or accidental mortality on the populations of affected species of predators or other wildlife.

This is an “exceptional” factor that may not apply in many circumstances. It generates a negative score that is deducted from the overall final score. A score of zero means there is no impact.

Criterion 9X Summary of scores for ASC Salmon

Wildlife and predator mortality parameters	Score	
F9X Wildlife and predator mortality Final Score	-4.00	YELLOW
Critical?	NO	

Justification of Ranking

Assumptions:

- Assume score of -4 unless standards specify otherwise. This is based on an assumption that wildlife mortalities will occur if the standards do not specifically require non-lethal controls, but that in the large majority of cases, the mortality numbers will not significantly impact the predator populations.

C9X Wildlife and predator score. Explanatory tables can be found on page 61 of the assessment criteria.

Relevant Content of Standards	How we applied it
2.4.1 Evidence of an assessment on a farm’s potential impacts on biodiversity and nearby ecosystems that contains at a minimum the components outlined in Appendix I-3 – Yes	Score as "-4" according to the criteria: Wildlife mortalities occur (beyond exceptional cases), but due to high population size and/or high productivity and/or low mortality numbers, they do not significantly impact the affected species' population sizes.
2.5.1 Number of days in the production cycle when acoustic deterrent devices (ADDs) or acoustic harassment devices (AHDs) were used Zero	
2.5.2 Prior to the achievement of 2.5.1, if ADDs or AHDs are used, maximum percentage of days in the production cycle that the devices are operational - ≤40%	
2.5.3 Number of mortalities of endangered or red-listed marine mammals or birds on the farm - Zero	

<p>2.5.4 Evidence that the following steps were taken prior to lethal action against a predator: 1. All other avenues were pursued prior to using lethal action 2. Approval was given from a senior manager above the farm manager 3. Explicit permission was granted to take lethal action against the specific animal from the relevant regulatory authority - Yes</p> <p>2.5.6 Maximum number of lethal incidents on the farm over the prior two years - < 9 lethal incidents, with no more than two of the incidents being marine mammals</p> <p>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</p>	
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Final score for Criterion 9X is -4 out of -10

Criterion 10X: Escape of unintentionally introduced species

A measure of the escape risk (introduction to the wild) of alien species other than the principle farmed species unintentionally transported during live animal shipments.

This is an “exceptional criterion that may not apply in many circumstances. It generates a negative score that is deducted from the overall final score.

Criterion 10X Summary of scores for ASC Salmon

Escape of unintentionally introduced species parameters	Score	
F10Xa International or trans-waterbody live animal shipments (%)	10.00	
F10Xb Biosecurity of source/destination	10	
C6 Escape of unintentionally introduced species Final Score	0.00	GREEN

Justification of Ranking

Assumptions

- Assume zero international shipping of livestock for finfish and shrimp

Factor 10Xa International or trans-waterbody live animal shipments

Explanatory score table can be found on page 63 of the assessment criteria.

Relevant Content of Standards	How we applied it
International or trans-waterbody movements of live fish or ova Not addressed by initiative	Assumed zero reliance on shipments as 100% is unrealistic, and it was not possible to set a consistent alternative arbitrary percentage across all standards.

Factor 10Xb Biosecurity of source/destination

Not relevant with zero shipment assumption

The final score for Criterion 10X is a deduction of 0 out of -10

Overall Recommendation

The overall recommendation is as follows:

The overall final score is the average of the individual criterion scores (after the two exceptional scores have been deducted from the total). The overall ranking is decided according to the final score, the number of red criteria, and the number of critical scores as follows:

- **Best Choice** = Final score ≥ 6.6 AND no individual criteria are Red (i.e. < 3.3)
- **Good Alternative** = Final score ≥ 3.3 AND < 6.6 , OR Final score ≥ 6.6 and there is one individual “Red” criterion.
- **Red** = Final score < 3.3 , OR there is more than one individual Red criterion, OR there is one or more Critical score.

Criterion	Score (0-10)	Rank	Critical?
C1 Data	9.77	GREEN	
C2 Effluent	5.00	YELLOW	NO
C3 Habitat	6.27	YELLOW	NO
C4 Chemicals	4.00	YELLOW	NO
C5 Feed	3.36	YELLOW	NO
C6 Escapes	2.00	RED	NO
C7 Disease	5.00	YELLOW	NO
C8X Source	0.00	GREEN	NO
C9X Wildlife mortalities	-4.00	YELLOW	NO
C10X Introduced species escape	0.00	GREEN	
Total	31.40		
Final score	4.49		

OVERALL RANKING

Final Score	4.49
Initial rank	YELLOW
Red criteria	1
Interim rank	YELLOW
Critical Criteria?	NO

FINAL RANK
YELLOW

Guiding Principles

Seafood Watch® defines “sustainable seafood” as seafood from sources, whether fished or farmed, that can maintain or increase production without jeopardizing the structure and function of affected ecosystems.

Sustainable aquaculture farms and collective industries, by design, management and/or regulation, address the impacts of individual farms and the cumulative impacts of multiple farms at the local or regional scale by:

- 1. Having robust and up-to-date information on production practices and their impacts publically available;**
 Poor data quality or availability limits the ability to understand and assess the environmental impacts of aquaculture production and subsequently for seafood purchasers to make informed choices. Robust and up-to-date information on production practices and their impacts should be publically available.
- 2. Not allowing effluent discharges to exceed, or contribute to exceeding, the carrying capacity of receiving waters at the local or regional level;**
 Aquaculture farms minimize or avoid the production and discharge of wastes at the farm level in combination with an effective management or regulatory system to control the location, scale and cumulative impacts of the industry’s waste discharges.
- 3. Being located at sites, scales and intensities that maintain the functionality of ecologically valuable habitats;**
 The siting of aquaculture farms does not result in the loss of critical ecosystem services at the local, regional, or ecosystem level.
- 4. Limiting the type, frequency of use, total use, or discharge of chemicals to levels representing a low risk of impact to non-target organisms;**
 Aquaculture farms avoid the discharge of chemicals toxic to aquatic life or limit the type, frequency or total volume of use to ensure a low risk of impact to non-target organisms.
- 5. Sourcing sustainable feed ingredients and converting them efficiently with net edible nutrition gains;**
 Producing feeds and their constituent ingredients has complex global ecological impacts, and the efficiency of conversion can result in net food gains or dramatic net losses of nutrients. Aquaculture operations source only sustainable feed ingredients or those of low value for human consumption (e.g. by-products of other food production), and convert them efficiently and responsibly.
- 6. Preventing population-level impacts to wild species or other ecosystem-level impacts from farm escapes;**
 Aquaculture farms, by limiting escapes or the nature of escapees, prevent competition, reductions in genetic fitness, predation, habitat damage, spawning disruption, and other impacts on wild fish and ecosystems that may result from the escape of native, non-native and/or genetically distinct farmed species.

7. Preventing population-level impacts to wild species through the amplification and retransmission, or increased virulence of pathogens or parasites;

Aquaculture farms pose no substantial risk of deleterious effects to wild populations through the amplification and retransmission of pathogens or parasites, or the increased virulence of naturally occurring pathogens.

8. Using eggs, larvae, or juvenile fish produced from farm-raised broodstocks thereby avoiding the need for wild capture;

Aquaculture farms use eggs, larvae, or juvenile fish produced from farm-raised broodstocks thereby avoiding the need for wild capture, or where farm-raised broodstocks are not yet available, ensure that the harvest of wild broodstock does not have population-level impacts on affected species. Wild-caught juveniles may be used from passive inflow, or natural settlement.

9. Preventing population-level impacts to predators or other species of wildlife attracted to farm sites.

Aquaculture operations use non-lethal exclusion devices or deterrents, prevent accidental mortality of wildlife, and use lethal control only as a last resort, thereby ensuring any mortalities do not have population-level impacts on affected species.

10. Avoiding the potential for the accidental introduction of non-native species or pathogens during the shipment of live animals;

Aquaculture farms avoid the international or trans-waterbody movements of live animals, or ensure that either the source or destination of movements is biosecure in order to avoid the introduction of unintended pathogens, parasites and invasive species to the natural environment.

Once a score and rank has been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

Best Choices/Green: Are well managed and caught or farmed in environmentally friendly ways.

Good Alternatives/Yellow: Buy, but be aware there are concerns with how they're caught or farmed.

Avoid/Red: Take a pass on these. These items are overfished or caught or farmed in ways that harm other marine life or the environment

References

Bridson, Pete. (2014). Monterey Bay Aquarium Seafood Watch Assessment of Atlantic Salmon farmed in British Columbia, Canada. Accessed 4 December 2015 from http://www.seafoodwatch.org/-/m/sfw/pdf/reports/mba_seafoodwatch_farmedbcsalmon_report.pdf

Bridson, Pete. (2014). Monterey Bay Aquarium Seafood Watch Assessment of Atlantic and Coho Salmon farmed in Chile. Accessed 4 December 2015 from http://www.seafoodwatch.org/-/m/sfw/pdf/reports/mba_seafoodwatch_farmedchilesalmon_report.pdf

Bridson, Pete. (2014). Monterey Bay Aquarium Seafood Watch Assessment of Atlantic Salmon farmed in Norway. Accessed 4 December 2015 from http://www.seafoodwatch.org/-/m/sfw/pdf/reports/mba_seafoodwatch_farmednorwaysalmon_report.pdf

Bridson, Pete. (2014). Monterey Bay Aquarium Seafood Watch Assessment of Atlantic Salmon farmed in Scotland. Accessed 4 December 2015 from http://www.seafoodwatch.org/-/m/sfw/pdf/reports/mba_seafoodwatch_farmedscotlandsalmon_report.pdf

Food and Agriculture Organization of the United Nations. 2010. Aquaculture Feed and Fertilizer Resources Information System - *Salmo salar* Nutritional Requirements. Accessed 14 March 2012 from http://affris.org/atlantic_salmon/nutri.php

Gjedrem, T. and Baranski, M. 2009. Reviews in Methods and Technologies in Fish Biology and Fisheries. Selective Breeding in Aquaculture: An Introduction. DOI 10.1007/978-90-481-2773-3. p.76

Tacon, A., Hasan, M. R., & Metian, M. (2011). Demand and supply of feed ingredients for farmed fish and crustaceans Trends and prospects. FAO Fisheries and Aquaculture Technical Paper, 564.

Appendix 1 - Data points and all scoring calculations

This is a condensed version of the criteria and scoring sheet to provide access to all data points and calculations. See the Seafood Watch Aquaculture Criteria document for a full explanation of the criteria, calculations and scores. Yellow cells represent data entry points.

Criterion	Score	Rank	Critical?
C1 Data	9.77	GREEN	
C2 Effluent	5.00	YELLOW	NO
C3 Habitat	6.27	YELLOW	NO
C4 Chemicals	4.00	YELLOW	NO
C5 Feed	3.36	YELLOW	NO
C6 Escapes	2.00	RED	NO
C7 Disease	5.00	YELLOW	NO
C8X Source	0.00	GREEN	NO
C9X Wildlife mortalities	-4.00	YELLOW	NO
C10X Secondary species escape	0.00	GREEN	
Total	31.40		
Final score (0-10)	4.49		

OVERALL RANKING

Final Score	4.49
Initial rank	YELLOW
Red criteria	1
Interim rank	YELLOW
Critical Criteria?	NO

FINAL RANK
YELLOW

Criterion 1: Data quality and availability

Data Category	Data Quality	Score (0-10)
Industry or production statistics	10	10
Management	10	10
Effluent	10	10
Habitat	10	10
Chemical use	10	10
Feed	10	10
Escapes	7.5	7.5

Disease	10	10
Source of stock	10	10
Predators and wildlife	10	10
Introduced species	10	10
Other – (e.g. GHG emissions)	Not Applicable	n/a
Total		107.5

C1 Data Final Score (0-10)	9.772727273	GREEN
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Criterion 2: Effluents

Effluent Risk-Based Assessment

Effluent parameters	Value	Score
F2.1a Waste (nitrogen) production per of fish (kg N ton-1)	46	
F2.1b Waste discharged from farm (%)	80	
F2 .1 Waste discharge score (0-10)		6
F2.2a Content of regulations (0-5)	2	
F2.2b Enforcement of regulations (0-5)	4	
F2.2 Regulatory or management effectiveness score (0-10)		3.2
C2 Effluent Final Score (0-10)		5.00
Critical?	NO	YELLOW

Criterion 3: Habitat

Habitat parameters	Value	Score
F3.1 Habitat conversion and function		7
F3.2a Content of habitat regulations	3	
F3.2b Enforcement of habitat regulations	4	
F3.2 Regulatory or management effectiveness score		5
C3 Habitat Final Score (0-10)		6
Critical?	NO	YELLOW

Criterion 4: Chemical use

Chemical Use parameters	Score
C4 Chemical Use Score (0-10)	4
Critical?	NO
	YELLOW

Criterion 5: Feed

Feed parameters	Value	Score
F5.1a Fish In: Fish Out ratio (FIFO)	2.51	3.73
F5.1b Source fishery sustainability score	-4.00	
F5.1: Wild fish use score		1.72
F5.2a Protein IN (kg/100kg fish harvested)	47.25	
F5.2b Protein OUT (kg/100kg fish harvested)	21.46	
F5.2: Net Protein Gain or Loss (%)	-54.59	4
F5.3: Feed Footprint (hectares)	10.73	6
C5 Feed Final Score (0-10)		3.36
Critical?	NO	YELLOW

Criterion 6: Escapes

Escape parameters	Value	Score
F6.1 System escape risk	2	
F6.1 Recapture adjustment	0	
F6.1 Final escape risk score		2
F6.2 Competitive and genetic interactions		2
C6 Escape Final Score (0-10)		2
Critical?	NO	RED

Criterion 7: Disease

Disease Risk-based assessment

Pathogen and parasite parameters	Score
C7 Disease Score (0-10)	5
Critical?	NO
	YELLOW

Criterion 8X: Source of stock

Source of stock parameters	Score
C8 Independence from unsustainable wild fisheries (0-10)	0
Critical?	NO
	GREEN

Criterion 9X: Wildlife interactions

Wildlife and predator mortality parameters		Score	
C9X Wildlife and predator mortality Final Score (0-10)		-4	
	Critical?	NO	YELLOW

Criterion 10X: Escape of secondary species

Escape of secondary species parameters		Score	
F10Xa International or trans-waterbody live animal shipments (%)		10	
F10Xb Biosecurity of source/destination		10	
C10X Escape of secondary species Final Score		0.00	GREEN