



MONTEREY BAY AQUARIUM®

Seafood WATCH

Canadian Organic Aquaculture Standards (CAN/CGSB-32.312-2012 April 2012) *Shellfish*

Benchmarking equivalency results assessed against the Seafood
Watch Aquaculture Criteria

May 2013

Final Seafood Recommendation

Canadian Organic Aquaculture Standards - Shellfish

Criterion	Score (0-10)	Rank	Critical?
C1 Data	7.50	GREEN	
C2 Effluent	10.00	GREEN	NO
C3 Habitat	5.22	YELLOW	NO
C4 Chemicals	8.00	GREEN	NO
C5 Feed	10.00	GREEN	NO
C6 Escapes	2.00	RED	NO
C7 Disease	4.00	YELLOW	NO
C8 Source	10.00	GREEN	
3.3X Wildlife mortalities	-4.00	YELLOW	NO
6.2X Introduced species escape	-4.00	YELLOW	
Total	48.72		
Final score	6.09		

OVERALL RANKING

Final Score	6.09
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, except for the two exceptional “X” criteria for which a score of -10 is very poor and zero is good.

Summary

The Canadian Organic Aquaculture standards assessed for shellfish farming have a final numerical score in the yellow category, but with only one red criterion (escapes) and no critical factors the final result is a yellow “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” ranking.

The final result of the equivalence assessment for Canadian Organic Aquaculture standards for shellfish is a yellow “Good Alternative” recommendation. Seafood Watch does not consider all certified farms to be at that level, but the standards could allow a farm equivalent to a yellow Seafood Watch recommendation to be certified. This means Seafood Watch can defer to Canadian Organic Shellfish certification as an assurance that certified products meet at least a yellow “Good Alternative” recommendation.

In general, the Canadian Organic Aquaculture standards:

- Cover many species and production systems (under Section 6 Animal Aquaculture) and therefore have few specific requirements for any one species
- Frequently use terms such as “prefer” or “minimize” which have no value in certification
- Have few robust requirements above industry norms
- like all certification standards, are not able to robustly manage the cumulative impacts of multiple neighboring, local or regional farms

Specifically for each criterion, and with respect to shellfish farming, the Canadian Organic Aquaculture 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
- certify production that is extractive in nature and does not produce significant effluents,
- receive a high score for chemical use because industry norms dictate no chemical use in shellfish culture,
- receive a high score for feed because industry norms dictate that no external feed is provided,
- certify open production systems that by their very nature allow escapes and the potential introduction of local pathogens and parasites,
- prohibit the use of wild-caught broodstock,
- do not prohibit lethal predator control,
- do not directly address the introduction of non-native species as a result of international shipping, however the benchmarking assumes 50% shipping of non-secure stock for shellfish standards for consistency across standards.

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Introduction

Scope of the analysis and ensuing recommendation

Species

The Canadian Organic Aquaculture Standards can be applied to “seaweeds and aquatic plant products, aquaculture animals and aquaculture animal products”. This assessment was conducted for all species of cultured shellfish, with a worst case scenario of a non-native species where there is the potential for further expansion of the species range.

Geographic coverage

Canada

Production Methods

All currently-utilized shellfish culture methods

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 factors (3.3x and 6.2X), 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 two exceptional factors result in negative scores from zero to minus ten, and in these cases zero indicates no negative impact.

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

¹ http://www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_aboutsfw.aspx

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 Canadian Organic Shellfish

Explanatory tables for C1 can be found on pages 3-4 of the Seafood Watch assessment criteria.

Data Category	Relevance (Y/N)	Data Quality	Score (0-10)
Industry or production statistics	Yes	10	10
Effluent	Yes	7.5	7.5
Locations/habitats	Yes	7.5	7.5
Predators and wildlife	Yes	7.5	7.5
Chemical use	Yes	7.5	7.5
Feed	No	n/a	n/a
Escapes, animal movements	Yes	7.5	7.5
Disease	Yes	5	5
Source of stock	Yes	7.5	7.5
Other – (e.g. GHG emissions)	No	n/a	n/a
Total			60

C1 Data Final Score	7.50	GREEN
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Justification of Ranking

Assumptions:

- The “Source of stock” and “Energy use” categories were 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 lack of specific requirements in many standards means that the data score is only 7.5 rather than 10 in many categories. The language regarding disease data collection was not as comprehensive as for the other factors, resulting in a score of 5 out of 10 for this criterion.

The final score for Criterion 1 (Data) is 7.50 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 Canadian Organic Shellfish

Explanatory tables for C2 can be found on pages 8-12 of the Seafood Watch assessment criteria.

Effluent Rapid Assessment

C2 Effluent Final Score	10.00	GREEN
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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
- No fertilizer use was considered unless specified in the standards
- Tilapia, salmon and cod effluent was assessed for cages, other species were assessed for high-exchange ponds as a worst-case scenario unless otherwise specified

As shellfish aquaculture is extractive, no effluent is released from the farm site. The potential for benthic impacts (ex. from pseudofeces) beyond the farm site or allowable zone of effect (AZE) is very low. Without the addition of external feed, the score is 10 out of 10 for this criterion.

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 Canadian Organic Shellfish

Explanatory tables for C3 can be found on pages 13-16 of the Seafood Watch assessment criteria.

Habitat parameters	Value	Score	
F3.1 Habitat conversion and function		7.00	
F3.2a Content of habitat regulations	1.50		
F3.2b Enforcement of habitat regulations	2.75		
F3.2 Regulatory or management effectiveness score		1.65	
C3 Habitat Final Score		5.22	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

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 (AZE). Explanatory tables and calculations can be found on page 14 of the Seafood Watch assessment criteria.

Relevant Content of Standards	How we applied it
6.1.1 Operations shall be sited in locations where the water is not subject to contamination by products or substances not authorized for organic production, or pollutants that would compromise the organic nature of the products.	Score of 7 for F3.1 because the standard prohibits the disturbance and destruction of critical animal habitat. Most shellfish farming takes place in shallow coastal water with a sandy or silty bottom with species that are well-adapted to periodic disturbances. Score as "7" Maintaining functionality w/ moderate impacts.
6.1.2 The operator shall detail the environmental effects of the operation and the environmental monitoring to be undertaken, and list measures to be taken to minimize negative impacts on the surrounding aquatic and terrestrial environments, including limiting waste accumulation and minimizing impact to the migratory	

<p>and reproductive patterns of local wild fish populations, other local species like predators, birds and any other fauna and flora.</p> <p>6.1.3 Open water units shall be sited and managed in such a way that sediment build-up underneath the unit does not exceed the assimilation capacity of the local environment. The operator shall develop a dissolved and particulate nutrient management plan clearly illustrating how assimilation capacity will be evaluated and how assimilation capacity will be maintained.</p> <p>6.1.4 Nutrient cycling through practices such as Integrated Multi-Trophic Aquaculture is encouraged.</p> <p>6.9.7.4.6 Disturbance of endangered aquatic organisms or critical animal habitat is prohibited.</p> <p>6.9.7.4.7 Unnecessary destruction of aquatic organisms or aquatic habitat is prohibited.</p>	
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The final score for 3.1a 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>6.1.2 The operator shall detail the environmental effects of the operation and the environmental monitoring to be undertaken, and list measures to be taken to minimize negative impacts on the surrounding aquatic and terrestrial environments, including limiting waste accumulation and minimizing impact to the migratory and reproductive patterns of local wild fish populations, other local species like predators, birds and any other fauna and flora.</p> <p>6.1.3 Open water units shall be sited and managed in such a way that sediment build-up underneath the unit does not exceed the assimilation capacity of the local environment. The operator shall develop a dissolved and particulate nutrient management plan clearly illustrating how assimilation capacity will be evaluated and how</p>	<p>Score of 0.5 out of 1 for F3.2a Question 1 because no EIA is specifically required, but an environmental monitoring program must be maintained.</p>

assimilation capacity will be maintained.	
Is the industry's total size and concentration based on its cumulative impacts and the maintenance of ecosystem function? Not addressed by initiative	Score of 0 out of 1 for F3.2a Question 2 because the standards do not address the cumulative impact of the industry's total size.
Is the industry's ongoing and future expansion limited to an appropriate scale and/or to appropriate locations, and thereby preventing the future loss of ecosystem services? Not addressed by initiative	Score of 0 out of 1 for F3.2a Question 3 because the standards do not address the industry's future expansion with respect to habitat impacts
6.9.7.4.6 Disturbance of endangered aquatic organisms or critical animal habitat is prohibited. 6.9.7.4.7 Unnecessary destruction of aquatic organisms or aquatic habitat is prohibited.	Score of 1 out of 1 for F3.2a Question 4 because the standards require that high-value habitats must be avoided
Do control measures include requirements for the restoration of important or critical habitats or ecosystem services? Not addressed by initiative	Score of 0 out of 1 for F3.2a Question 5 because the standards do not require the restoration of habitat loss as a result of farming operations.

Factor 3.2a score is 1.5 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
	Score of 1 out of 1 for F3.2b Question 1 because the enforcement organizations and/or resources are identifiable and contactable, and appropriate to the scale of the industry
6.1.2 The operator shall detail the environmental effects of the operation and the environmental monitoring to be undertaken, and list measures to be taken to minimize negative impacts on the surrounding aquatic and terrestrial environments, including limiting waste accumulation and minimizing impact to the migratory and reproductive patterns of local wild fish populations, other local species like predators, birds and any other fauna and flora. 6.1.3 Open water units shall be sited and managed in such a way that sediment build-up underneath the unit does not exceed the assimilation capacity of the local environment. The operator shall develop a dissolved and	Score of 0.5 out of 1 for F3.2b Question 2 because while no EIA is specifically required, an environmental monitoring program must be maintained.

particulate nutrient management plan clearly illustrating how assimilation capacity will be evaluated and how assimilation capacity will be maintained.	
4.6.2 In open water systems, organic aquaculture facilities shall provide buffer zones from potential contamination sources, including pesticide drift and other possible contaminants from external sources. The minimum separation distance between organic and non-organic production shall be based on the natural situation, separate water distribution systems, distances, tidal flow, and the upstream and downstream location of the organic production unit.	Score of 0.25 out of 1 for F3.2b Question 3 because farm siting takes into account the locations of other farms and their cumulative impacts.
Is the enforcement process transparent - e.g. public availability of farm locations and sizes, EIA reports, zoning plans, etc? Not addressed by initiative	Score of 0 out of 1 for F3.2b Question 4 because the transparency of the audit and certification process is unknown.
1.1 Foods and other aquaculture products shall refer to organic production methods only if they comply with this standard and local regulations.	Score of 1 out of 1 for F3.2b Question 5 because farms must comply with the standards in order to achieve certification.

Factor 3.2b score is 2.75 out of 5.

When combined with the Factor 3.2a score, the score for Factor 3.2 is 1.65 out of 10. The final score for Criterion 3 (C3) combines Factors 3.1 and 3.2 (see Seafood Watch assessment criteria document page 16 for calculation) to give a final score of 5.22 out of 10.

Factor 3.3X: 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.

Factor 3.3X Summary of scores for Canadian Organic Shellfish

Explanatory score tables for F3.3X can be found on pages 17-18 of the Seafood Watch assessment criteria.

Wildlife and predator mortality parameters	Score	
F3.3X 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.
- F3.3X Wildlife and predator score. Explanatory tables can be found on page 18 of the assessment criteria.

Relevant Content of Standards	How we applied it
<p>6.6.7.1 An Integrated Predator Deterrence Plan shall be developed. The plan shall identify potential predators, appropriate deterrence methods, how predator behavior will be modified by application of deterrence methods, documentation of control methods and effects, contingencies for failure to achieve objectives, and how plan implementation conserves biodiversity in the ecosystem adjacent to and including the aquaculture facility. Examples of such control measures include, but are not limited to, site selection, physical barriers, repellents, and legal predator deterrence methods.</p> <p>6.6.7.2 Non-lethal deterrents shall be used as a first course of action.</p> <p>6.6.7.3 Lethal measures may be taken only when predators threaten human safety or are necessary for predator welfare and shall include appropriate documentation. Lethal measures shall be in compliance with local regulations.</p>	<p>Score of -4 for F3.3X because lethal predator control is not prohibited, but mortalities are not considered likely to affect predator populations.</p>

Factor 3.3X score is -4 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 Canadian Organic Shellfish

Explanatory score tables for C4 can be found on pages 19-20 of the Seafood Watch assessment criteria.

Chemical Use parameters	Score	
C4 Chemical Use Score	8.00	
C4 Chemical Use Final Score	8.00	GREEN
Critical?	NO	

Justification of Ranking

Assumptions:

- 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 can be found on page 20 of the Seafood Watch assessment criteria.

Relevant Content of Standards	How we applied it
<p>1.4.1 b. [Prohibited substances] Synthetic pesticides (e.g. defoliants and desiccants, fungicides, insecticides and rodenticides), wood preservatives (e.g. arsenate) or other pesticides, except as specified in this standard</p> <p>f. Synthetic veterinary drugs, including antibiotics and parasiticides, except as specified in this standard</p> <p>6.5.7 Vaccinations are permitted. Prophylactic treatment with other synthetic veterinary drugs is prohibited.</p> <p>6.5.12 a. If no alternative treatment or management practice exists, the use of veterinary biologics, including vaccines, the use of parasiticides or the therapeutic use of synthetic medications may be administered provided that such medications are permitted, in accordance with this standard, or are required by law.</p> <p>6.5.12 c. If the use of the products in par. 6.5.12 a. and b. is unlikely to be effective in combating illness or injury, chemical allopathic drugs (not listed on the Permitted Substances Lists) may be administered under veterinary supervision. Some restrictions apply when aquaculture animals are treated (see par. 6.5.13, 6.5.14 d. and 6.5.15). In addition to the treatments allowed for combating illness or injury, anaesthetics may be administered no more than twice a year when handling individual fish (e.g. vaccination, weight counts, parasite counting, fin clipping, tagging, or surgery).</p>	<p>Score of 8 for C4 because chemical use in shellfish culture is of low concern due to infrequent use in typical industry practice - pesticides are permitted if necessary.</p>

<p>6.5.14 The operator of an organic aquaculture animal operation shall not administer:</p> <p>a. synthetic compounds to stimulate or retard growth or production, including hormones for growth promotion;</p> <p>b. synthetic parasiticides to slaughter aquaculture animals, except as provided in par. 6.5.15; 12 CAN/CGSB-32.312-2012</p> <p>c. antibiotics to slaughter aquaculture animals;</p> <p>d. chemical allopathic veterinary drugs (e.g. pharmaceuticals, antibiotics, hormones and steroids) for preventive treatments.</p> <p>6.5.15 b. By way of derogation, when preventive measures fail (because of aquatic climatic conditions or other uncontrollable factors), and in the case where the operator uses direct treatment measures such as feeding, topical application or external application in a confined static bath, the use of synthetic parasiticides is permitted, provided that iv. there shall be only one treatment for slaughter aquaculture animals under a year old and a maximum of two treatments for older slaughter aquaculture animals. Slaughter aquaculture animals that require further treatment will lose organic status.</p>	
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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 Canadian Organic Shellfish

Explanatory score tables and calculations can be found on pages 21-26 of the Seafood Watch assessment criteria.

Feed parameters	Value	Score	
No supplemental feed added	0.00	10	GREEN

Justification of Ranking

Shellfish aquaculture is extractive with the stock filtering natural plankton populations for nutrition. As external feed is not provided, a score of 10 out of 10 is assigned to this criterion.

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 Canadian Organic Shellfish

Explanatory score tables for C6 can be found on pages 27-30 of the Seafood Watch assessment criteria.

Escape parameters	Value	Score	
F6.1 Escape Risk		0	
F6.1a Recapture and mortality (%)	0		
F6.1b Invasiveness		5	
C6 Escape Final Score		2.00	RED
Critical?	NO		

Justification of Ranking

Factor 6.1a. Escape risk

The “escape” risk for shellfish is primarily due to broadcast spawning of the stock for which there are no practical prevention measures. For the purposes of this assessment, the “escape risk” is considered to be very high, but the nature of the species in Factor 6.1b below ensures that the final score reflects the minimal risk for the “escape” of shellfish.

The initial escape score is 0 out of 10 for Factor 6.1a due to broadcast spawning.

Recaptures and mortality

Relevant Content of Standards	How we applied it
Not addressed by initiative. Likely to be high mortality of larval dispersal, yet very high initial potential “escape” numbers.	No score (zero)

The recaptures and mortality score can improve the escape risk score. The final escape risk score (Factor 6.1) remains 0 out of 10.

Factor 6.1b. Invasiveness

See criteria document page 29 for explanation of the factors and scoring questions for native and non-native species.

The culture of shellfish in Canada is highly likely to occur within the species natural range, but it is possible (within the scope of the standards) for juveniles to be relocated to culture areas where local populations are not present. The broadcast and subsequent settlement of juvenile spat could therefore result in some substrate modification and competition for food.

The invasiveness score is 5 out of 10.

The final score for Criterion 6 (Escapes) combines the escape risk with the invasiveness score and is 2 out of 10.

Factor 6.2X: 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.

Factor 6.2X Summary of scores for Canadian Organic Shellfish

Explanatory score tables for F6.2X can be found on pages 31-32 of the Seafood Watch assessment criteria.

Escape of unintentionally introduced species parameters	Score	
F6.2Xa International or trans-waterbody live animal shipments (%)	5.00	
F6.2Xb Biosecurity of source/destination	4.00	
C6 Escape of unintentionally introduced species Final Score	-4.00	YELLOW

Justification of Ranking

Assumptions

- Assume 50% shipping of non-secure stock for shellfish or mussel standards (due to common movement of seed in shellfish production).

Factor 6.2Xa International or trans-waterbody live animal shipments

Explanatory score table can be found on page 31 of the assessment criteria.

Relevant Content of Standards	How we applied it
International or transwaterbody movements of live fish/ shellfish or ova/ seed Not addressed by initiative	The standards do not prohibit the transwaterbody movements of shellfish seed, and historic requirements are no guarantee of future compliance. Assumed 50% movement for all shellfish standards.

Factor 6.2Xb Biosecurity of source/destination

Biosecurity score for the source and destination of any shellfish (seed/spat/juvenile etc.) movements is 2 out of 10 for open locations with best management practices to prevent the introduction or loss of unintended transported organisms. Score 4 out of 10.

The final score for Factor 6.2X combines 6.2Xa and 6.2Xb giving a deduction of -4 out of -10

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 Canadian Organic Shellfish

Explanatory score tables for C7 can be found on pages 33-34 of the Seafood Watch assessment criteria.

Pathogen and parasite parameters	Score	
C7 Biosecurity	4.00	
C7 Disease; pathogen and parasite Final Score	4.00	YELLOW
Critical?	NO	

Justification of Ranking

Assumptions

- Unless standards robustly specify otherwise, assume a score of 4 for species other than salmon based on the Seafood Watch criteria definition: *“Amplification of pathogens or parasites on the farm results in increased infection of wild fish, shellfish or other populations in the farming locality or region”*

Shellfish production systems are open to the environment and subsequent introductions of local pathogens and parasites, resulting in a score of 4 out of 10 for this criterion.

Relevant Content of Standards	How we applied it
<p>6.5.1 Aquaculture facilities shall be designed, operated and managed in a manner that seeks to maximize the welfare and minimize the stress on aquaculture animals, and minimizes the spread of disease within the facility, and to all adjoining ecosystems and native fish species.</p> <p>6.5.1.1 When net pen systems are used, producers shall implement measures to minimize transmission of diseases and parasites between cultured and wild aquatic animals. Net pens shall be sited in such a manner as to minimize contamination and disease from conventional fish pens or native fish populations, taking into account factors like currents and seasonal changes.</p> <p>6.5.4 If necessary to prevent disease, an appropriate fallowing period shall be applied after each production cycle. During fallowing, the cage or other structure used for aquaculture animal production is emptied, cleaned and left empty before being used again.</p> <p>6.5.15 Organic aquaculture operations shall have a comprehensive plan to minimize parasite problems in aquaculture animals.</p>	<p>Score of 4 for C7 because the initiative requires a fish/ shellfish health management plan and biosecurity measures, however the production system is still open to introductions of local pathogens and parasites.</p>

The final disease criterion (C7) score is 4 out of 10.

Criterion 8. 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*

Criterion 8 Summary of scores for Canadian Organic Shellfish

An explanatory score table for C8 can be found on page 35 of the Seafood Watch assessment criteria.

Source of stock parameters	Score	
C8 % of production from hatchery-raised broodstock or natural (passive) settlement	100	
C8 Source of stock Final Score	10.00	GREEN

Justification of Ranking

Assumptions

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

Shellfish culture either relies on hatchery- born stock or natural passive settlement. As such a score of 10 out of 10 is assigned to this criterion.

Relevant Content of Standards	How we applied it
<p>6.2.1 Aquaculture animals intended for organic production shall be taken from indigenous species or adapted to rearing conditions.</p> <p>6.2.3 For breeding purposes or for improving genetic stock, and when organic aquaculture animals are not commercially available, wild-caught or non-organic aquaculture animals may be brought into a production unit and shall be kept under organic management. Collection of wild-caught species shall be in compliance with all local regulations, and shall be done in collaboration with government agencies, to ensure that natural populations and the collected individuals are protected, and that biodiversity in the ecosystem is supported.</p> <p>6.2.4 Broodstock that has not been under continuous organic management shall never be organic for slaughter purposes. However, the offspring may be organic if they have been raised according to this standard.</p> <p>6.2.5 For finfish, if organic animals are not commercially available, stock from non-organic hatcheries may be used, provided that at</p>	<p>Score of 10 for C8 – while this is not directly addressed by the initiative, passive natural settlement is the industry standard.</p>

least the final 90% of biomass gain occurs while the animals are under continuous organic management.

6.9.2.3 The use of seed from non-organic sources is permitted if organic material is not commercially available. If seed originates from non-organic sources, then the product may be considered as organic provided that at least the final 95% of biomass gain occurs while the animals are under continuous organic management.

6.9.2.4 The collection of wild seed shall

- a. be done according to local regulations;
- b. not compromise the ecological integrity of the aquatic ecosystem;
- c. ensure sustainable wild populations; and
- d. minimize overset of wild seed, when possible.

The final source of stock score (C8) is 10 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	7.50	GREEN	
C2 Effluent	10.00	GREEN	NO
C3 Habitat	5.22	YELLOW	NO
C4 Chemicals	8.00	GREEN	NO
C5 Feed	10.00	GREEN	NO
C6 Escapes	2.00	RED	NO
C7 Disease	4.00	YELLOW	NO
C8 Source	10.00	GREEN	
3.3X Wildlife mortalities	-4.00	YELLOW	NO
6.2X Introduced species escape	-4.00	YELLOW	
Total	48.72		
Final score	6.09		

Final Score	6.09
Initial rank	YELLOW
Red criteria	1
Final rank	YELLOW
Critical Criteria?	NO

FINAL RANK
YELLOW

Guiding Principles

Seafood Watch™ defines sustainable seafood as originating from sources, whether fished² or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following **guiding principles** illustrate the qualities that aquaculture must possess to be considered sustainable by the Seafood Watch program:

Seafood Watch will:

- Support data transparency and therefore aquaculture producers or industries that make information and data on production practices and their impacts available to relevant stakeholders.
- Promote aquaculture production that minimizes or avoids the 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.
- Promote aquaculture production at locations, scales and intensities that cumulatively maintain the functionality of ecologically valuable habitats without unreasonably penalizing historic habitat damage.
- Promote aquaculture production that by design, management or regulation avoids the use and discharge of chemicals toxic to aquatic life, and/or effectively controls the frequency, risk of environmental impact and risk to human health of their use
- Within the typically limited data availability, use understandable quantitative and relative indicators to recognize the global impacts of feed production and the efficiency of conversion of feed ingredients to farmed seafood.
- Promote aquaculture operations that pose no substantial risk of deleterious effects to wild fish or shellfish populations through competition, habitat damage, genetic introgression, hybridization, spawning disruption, changes in trophic structure or other impacts associated with the escape of farmed fish or other unintentionally introduced species.
- Promote aquaculture operations that pose no substantial risk of deleterious effects to wild populations through the amplification and retransmission of pathogens or parasites.
- promote the use of eggs, larvae, or juvenile fish produced in hatcheries using domesticated broodstocks thereby avoiding the need for wild capture
- recognize that energy use varies greatly among different production systems and can be a major impact category for some aquaculture operations, and also recognize that improving

² “Fish” is used throughout this document to refer to finfish, shellfish and other invertebrates.

practices for some criteria may lead to more energy intensive production systems (e.g. promoting more energy-intensive closed recirculation systems)

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.

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 1: Data quality and availability

Data Category	Relevance (Y/N)	Data Quality	Score (0-10)
Industry or production statistics	Yes	10	10
Effluent	Yes	7.5	7.5
Locations/habitats	Yes	7.5	7.5
Predators and wildlife	Yes	7.5	7.5
Chemical use	Yes	7.5	7.5
Feed	No	Not relevant	n/a
Escapes, animal movements	Yes	7.5	7.5
Disease	Yes	5	5
Source of stock	Yes	7.5	7.5
Other – (e.g. GHG emissions)	No	Not relevant	n/a
Total			60

C1 Data Final Score	7.5	GREEN
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Criterion 2: Effluents

Factor 2.1a - Biological waste production score

Protein content of feed (%)	0
eFCR	0
Fertilizer N input (kg N/ton fish)	0
Protein content of harvested fish (%)	0
N content factor (fixed)	0.16
N input per ton of fish produced (kg)	0
N in each ton of fish harvested (kg)	0
Waste N produced per ton of fish (kg)	0

Factor 2.1b - Production System discharge score

Basic production system score	0
Adjustment 1 (if applicable)	0

Adjustment 2 (if applicable)	0
Adjustment 3 (if applicable)	0
Discharge (Factor 2.1b) score	0

0 % of the waste produced by the fish is discharged from the farm

2.2 – Management of farm-level and cumulative impacts and appropriateness to the scale of the industry

Factor 2.2a - Regulatory or management effectiveness

Question	Scoring	Score
1 - Are effluent regulations or control measures present that are designed for, or are applicable to aquaculture?	Yes	1
2 - Are the control measures applied according to site-specific conditions and/or do they lead to site-specific effluent, biomass or other discharge limits?	Moderately	0.5
3 - Do the control measures address or relate to the cumulative impacts of multiple farms?	Partly	0.25
4 - Are the limits considered scientifically robust and set according to the ecological status of the receiving water body?	Partly	0.25
5 - Do the control measures cover or prescribe including peak biomass, harvest, sludge disposal, cleaning etc?	No	0
		2

Factor 2.2b - Enforcement level of effluent regulations or management

Question	Scoring	Score
1 - Are the enforcement organizations and/or resources identifiable and contactable, and appropriate to the scale of the industry?	Yes	1
2 - Does monitoring data or other available information demonstrate active enforcement of the control measures?	Partly	0.25
3 - Does enforcement cover the entire production cycle (i.e. are peak discharges such as peak biomass, harvest, sludge disposal, cleaning included)?	No	0
4 - Does enforcement demonstrably result in compliance with set limits?	No	0
5 - Is there evidence of robust penalties for infringements?	Partly	0.25
		1.5

F2.2 Score (2.2a*2.2b/2.5)	1.2
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C2 Effluent Final Score	10.00	GREEN
	Critical?	NO

Criterion 3: Habitat

3.1. Habitat conversion and function

F3.1 Score	7
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3.2 Habitat and farm siting management effectiveness (appropriate to the scale of the industry)

Factor 3.2a - Regulatory or management effectiveness

Question	Scoring	Score
1 - Is the farm location, siting and/or licensing process based on ecological principles, including an EIAs requirement for new sites?	Moderately	0.5
2 - Is the industry's total size and concentration based on its cumulative impacts and the maintenance of ecosystem function?	No	0
3 - Is the industry's ongoing and future expansion appropriate locations, and thereby preventing the future loss of ecosystem services?	No	0
4 - Are high-value habitats being avoided for aquaculture siting? (i.e. avoidance of areas critical to vulnerable wild populations; effective zoning, or compliance with international agreements such as the Ramsar treaty)	Yes	1
5 - Do control measures include requirements for the restoration of important or critical habitats or ecosystem services?	No	0
		1.5

Factor 3.2b - Siting regulatory or management enforcement

Question	Scoring	Score
1 - Are enforcement organizations or individuals identifiable and contactable, and are they appropriate to the scale of the industry?	Yes	1
2 - Does the farm siting or permitting process function according to the zoning or other ecosystem-based management plans articulated in the control measures?	Moderately	0.5
3 - Does the farm siting or permitting process take account of other farms and their cumulative impacts?	Partly	0.25
4 - Is the enforcement process transparent - e.g. public availability of farm locations and sizes, EIA reports, zoning plans, etc?	No	0
5 - Is there evidence that the restrictions or limits defined in the control measures are being achieved?	Yes	1
		2.75

F3.2 Score (2.2a*2.2b/2.5)	1.65
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C3 Habitat Final Score	5.22	YELLOW
	Critical?	NO

Exceptional Factor 3.3X: Wildlife and predator mortalities

Wildlife and predator mortality parameters	Score	
F3.3X Wildlife and Predator Final Score	-4.00	YELLOW
Critical?	NO	

Criterion 4: Evidence or Risk of Chemical Use

Chemical Use parameters	Score	
C4 Chemical Use Score	8.00	
C4 Chemical Use Final Score	8.00	GREEN
Critical?	NO	

Criterion 5: Feed

5.1. Wild Fish Use

Factor 5.1a - Fish In: Fish Out (FIFO)

Fishmeal inclusion level (%)	0
Fishmeal from by-products (%)	0
% FM	0
Fish oil inclusion level (%)	0
Fish oil from by-products (%)	0
% FO	0
Fishmeal yield (%)	22.5
Fish oil yield (%)	5
eFCR	0
FIFO fishmeal	0.00
FIFO fish oil	0.00
Greater of the 2 FIFO scores	0.00
FIFO Score	10.00

Factor 5.1b - Sustainability of the Source of Wild Fish (SSWF)

SSWF	-6
SSWF Factor	0

F5.1 Wild Fish Use Score	10.00
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5.2. Net protein Gain or Loss

Protein INPUTS		
Protein content of feed		0
eFCR		0
Feed protein from NON-EDIBLE sources (%)		0
Feed protein from EDIBLE CROP sources (%)		0
Protein OUTPUTS		
Protein content of whole harvested fish (%)		0
Edible yield of harvested fish (%)		0
Non-edible by-products from harvested fish used for other food production		0
Protein IN		0.00
Protein OUT		0
Net protein gain or loss (%)		0
	Critical?	NO
F5.2 Net protein Score	10.00	

5.3. Feed Footprint

5.3a Ocean area of primary productivity appropriated by feed ingredients per ton of farmed seafood

Inclusion level of aquatic feed ingredients (%)		0
eFCR		0
Average Primary Productivity (C) required for aquatic feed ingredients (ton C/ton fish)		69.7
Average ocean productivity for continental shelf areas (ton C/ha)		2.68
Ocean area appropriated (ha/ton fish)		0.00

5.3b Land area appropriated by feed ingredients per ton of production

Inclusion level of crop feed ingredients (%)		0
Inclusion level of land animal products (%)		0
Conversion ratio of crop ingredients to land animal products		2.88
eFCR		0
Average yield of major feed ingredient crops (t/ha)		2.64
Land area appropriated (ha per ton of fish)		0.00

Value (Ocean + Land Area)	0.00
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F5.3 Feed Footprint Score	10.00
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C5 Feed Final Score	10.00	GREEN
	Critical?	NO

Criterion 6: Escapes

6.1a. Escape Risk

Escape Risk	2
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Recapture & Mortality Score (RMS)	
Estimated % recapture rate or direct mortality at the escape site	0
Recapture & Mortality Score	0
Factor 6.1a Escape Risk Score	2

6.1b. Invasiveness

Part A – Native species

Score	0
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Part B – Non-Native species

Score	1
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Part C – Native and Non-native species

Question	Score
Do escapees compete with wild native populations for food or habitat?	To some extent
Do escapees act as additional predation pressure on wild native populations?	No
Do escapees compete with wild native populations for breeding partners or disturb breeding behavior of the same or other species?	To some extent
Do escapees modify habitats to the detriment of other species (e.g. by feeding, foraging, settlement or other)?	No
Do escapees have some other impact on other native species or habitats?	No
	4

F 6.1b Score	5
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Final C6 Score	2.00	RED
	Critical?	NO

Exceptional Factor 6.2X: Escape of unintentionally introduced

species

Escape of unintentionally introduced species parameters	Score	
F6.2Xa International or trans-waterbody live animal shipments (%)	0.00	
F6.2Xb Biosecurity of source/destination	10.00	
F6.2X Escape of unintentionally introduced species Final Score	-4.00	YELLOW

Criterion 7: Diseases

Pathogen and parasite parameters	Score	
C7 Biosecurity	4.00	
C7 Disease; pathogen and parasite Final Score	4.00	YELLOW
Critical?	NO	

Criterion 8: Source of Stock

Source of stock parameters	Score	
C8 % of production from hatchery-raised broodstock or natural (passive) settlement	100	
C8 Source of stock Final Score	10	GREEN