Monterey Bay Aquarium
Seafood Watch®

Aquaculture Stewardship Council

SHRIMP (final draft standards)

Aquaculture Stewardship Council

Benchmarking equivalency results assessed against the Seafood Watch Aquaculture Criteria

May 2013

Final Seafood Recommendation

ASC Shrimp

Criterion	Score (0-10)	Rank	Critical?
C1 Data	9.44	GREEN	
C2 Effluent	6.00	YELLOW	NO
C3 Habitat	4.04	YELLOW	NO
C4 Chemicals	10.00	GREEN	NO
C5 Feed	5.96	YELLOW	NO
C6 Escapes	4.00	YELLOW	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	0.00	GREEN	
Total	**49.73**		
Final score	**6.22**		

OVERALL RANKING

Final Score	6.22
Initial rank	YELLOW
Red criteria	0
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.

Scoring Summary

ASC Shrimp has a final numerical score of 6.22 with no red criteria. The final recommendation is a yellow "Good Alternative".

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 ASC shrimp equivalence assessment is a yellow "Good Alternative". We do 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 we can defer to ASC Shrimp certification as an assurance that certified products meet at least a yellow "Good Alternative" recommendation.

The (draft) ASC shrimp standards were assessed for white shrimp (*L. vannamei*) in a non-native region. The standards:

- score moderately or good on all criteria and therefore do not have substantial weaknesses (compared to the Seafood Watch criteria) that would result in a red criterion.
- like all farm-level standards do not robustly address cumulative impacts of multiple neighboring, local or regional farms.

Specifically for each criterion, the ASC shrimp standards:

- require considerable data collection, and when combined with the farm-level certification process (i.e. audit) result in a high data score,
- specify a limit of total nitrogen (and phosphorous) discharge and include measures intended to address cumulative impacts in shared receiving water bodies,
- allow farms to be located in high value habitats if constructed prior to 1999, but the standards require a comprehensive biological environmental impact assessment.
- chemical use is restricted and no active products can be discharged,
- allow a lower feed performance than the global average, but shrimp have a relatively low requirement (on a per ton basis of production) for fishmeal and oil. Shrimp farming leads to a large net loss in edible protein, but overall the score remains moderate,
- have good escape measures for the farm construction and production cycle, but are limited with respect to harvest,
- are limited with respect to the transmission of diseases and is scored based on assumption that disease and water exchanges still occur,
- allow the use of wild broodstock, but the assessment for *L. vannamei* assumes domesticated broodstock from hatcheries,
- allow some lethal predator control, but not of protected species,

- require disease free status for international shipping, but the benchmarking assumes no shipping for consistency across standards.

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Introduction

Scope of the analysis and ensuing recommendation

Species
The ASC standards cover all species of farmed shrimp. The assessment has been conducted for a species farmed where it is non-native species such as *L. vannamei* (unless the standards specify otherwise)

Geographic coverage
The ASC standards have global scope

Production Methods
Ponds with high water exchange rate

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.
- "Worst-case scenario" – we need to know that the worst farm capable of being certified is equivalent

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 similarly non-specific 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

Data Category	Relevance (Y/N)	Data Quality	Score (0-10)
Industry or production statistics	Yes	7.5	7.5
Effluent	Yes	10	10
Locations/habitats	Yes	10	10
Predators and wildlife	Yes	10	10
Chemical use	Yes	10	10
Feed	Yes	10	10
Escapes, animal movements	Yes	10	10
Disease	Yes	10	10
Source of stock	Yes	10	10
Other – (e.g. GHG emissions)	No	n/a	n/a
Total			**87.5**

C1 Data Final Score	9.7	GREEN

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 the standards have few specific date collection requirements, certification to the standards necessitates monitoring and data collection on all aspects relevant to the SFW criteria. The “industry or production statistics” category is scored 7.5 because some of this data is likely to be considered confidential or proprietary. The final score (average of relevant category scores) is 9.7 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

Effluent parameters	Value	Score	
F2.1a Biological waste (nitrogen) production per of fish (kg N ton-1)	25.2		
F2.1b Waste discharged from farm (%)	100		
F2 .1 Waste discharge score (0-10)		7	
F2.2a Content of regulations (0-5)	2.5		
F2.2b Enforcement of regulations (0-5)	5		
F2.2 Regulatory or management effectiveness score (0-10)		5	
C2 Effluent Final Score		**6.00**	**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
- 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
- In the case of ASC, the nutrient limitations in the standards negate the need to define an exchange rate.

Explanatory tables and scoring calculations can be found on page 8 of the assessment criteria.

Factor 2.1 Waste discharge from the farm

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

Bold text indicates the requirement of the standard.

Relevant ASC Shrimp Standards	How we applied it
7.5.1 Nitrogen effluent load per ton of shrimp produced over a 12- month period**.** **Less than 25.2 kg N per ton of shrimp for L. vannamei.** **Less than 32.4 kg N per ton of shrimp for P. monodon.**	Used 25.2 kg N per ton as the waste discharged from farm (for *L. vannamei*)

The Seafood Watch criteria calculate the amount of waste produced by the shrimp and then how much of that waste is discharged from the farm. The ASC standards specify a limit of 25.2 kg N per ton of shrimp (for vannamei) which has been used.

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

Relevant ASC Shrimp Standards	How we applied it
As above for ASC standard 7.5.1	25.2 kg N is per ton is used as the limit of discharge, so the Seafood Watch Factor 2.1b is not needed (i.e. it is effectively 100% of 25.2 kg)

Waste discharged per ton of shrimp is 25.2kg N

Factor 2.2. Effluent management effectiveness (appropriate to the scale of production)
Factor 2.2 assesses the effectiveness of management measure or regulations etc to control the total waste produced from the total tonnage of the farm and the cumulative impact of multiple neighboring farms. See criteria document page p11 for scoring tables.

Factor 2.2a assesses the content of the management measures

Relevant ASC Shrimp Standards	How we applied it
7.5 Rationale This criterion addresses the issues regarding the emissions of contaminants from shrimp farms and their effects on receiving water bodies.	Score of 1 in F2.2a Question 1 because the standards are specific to shrimp farming
Standards are global and universally applied to all certified farms, i.e. they do not lead to site specific requirements.	Score of 0 in F2.2a Question 2 because the standards are not specific to the site
Within the B-EIA requirements (d) Spatial and temporal scale of influence, identifying effects on connectivity between ecosystems, and potential cumulative effects. 7.5.5 Percentage change in diurnal dissolved oxygen (DO) relative to DO at saturation in receiving water body for the water's specific salinity and temperature.	Score of 0.5 in F2.2a Question 3 because the standards moderately address or relate to the cumulative impacts of multiple farms
The standards are considered scientifically robust, but are not set according to characteristic of the receiving body of water.	Score of 0.5 in F2.2a Question 4 because the standards are scientifically robust, and have an option for oligotrophic water bodies
Nitrogen and phosphorous measurements are done through calculation from feed (and thus are averaged over a 12 month production cycle), but dissolved oxygen measurements must be taken at least twice a month	Score of 0.5 in F2.2a Question 5 because the standards do not cover all aspects of the production cycle (for example oxygen measurements are not required during harvest)

The total for Factor 2.2a is 2.5 (out of 5)

Factor 2.2b assesses the enforcement of the above measures.

Relevant ASC Shrimp Standards	How we applied it
Certified farms must reach 100% compliance with standards	Score of 1 for F2.2b Questions 1 to 5 because the relevant standards are considered to be enforced by audit.

The total for Factor 2.2b is 5 (out of 5)

The Factor 2.2 score for the effectiveness of the management is 5 (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 12 of the criteria document shows how this score is calculated, producing a final C2 score of 6 out of 10.

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

Habitat parameters	Value	Score	
F3.1 Habitat conversion and function		4.00	
F3.2a Content of habitat regulations	2.75		
F3.2b Enforcement of habitat regulations	3.75		
F3.2 Regulatory or management effectiveness score		4.13	
C3 Habitat Final Score		**4.04**	**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

Explanatory tables and calculations can be found on page 14 of the assessment criteria.

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.

Relevant ASC Shrimp Standards	How we applied it
2.1.1 Farm owners shall commission a participatory B-EIA and disseminate results and outcomes openly in locally appropriate language. The BEIA process and document must follow the outline in Appendix I. – **Completed**	ASC standards prevent siting in high value habitats from 1999 on, but therefore allow farms if constructed prior to that date. Score Factor 3.1 as "4" for Historic, >10 yrs loss of habitat functionality of high value habitat

The final score for Factor 3.1 is 4 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 relating to site-specific and cumulative habitat impacts. See Appendix 1 for scoring questions.

Relevant ASC Shrimp Standards	How we applied it
2.1.1 Farm owners shall commission a participatory B-EIA and disseminate results and outcomes openly in locally appropriate language. The BEIA process and document must follow the outline in Appendix I. -	Score of 1 in F3.2a Question 1 because the B-EIA should ensure siting is based on ecological principles
Within the B-EIA requirements (d) Spatial and temporal scale of influence, identifying effects on connectivity between ecosystems, and potential cumulative effects.	Score of 0.25 in F3.2a Question 2 because the certification has little control over the rest of the industry Score of 1 in F3.2a Question 3 because standards prevent further loss of ecosystem services on certified farms
2.2.1 Allowance for siting in Protected Areas (PAs) [….] **None, except within PAs with IUCN category V if the farming system is regarded as traditional land use14, or category VI if the farm was built legally prior to the designation of the PA and in both cases is in compliance with the management objectives and plan of the PA, and shrimp farming is no more than 25% of the total PA area.15** 2.2.2 Allowance for siting in mangrove ecosystems and other natural wetlands, or areas of ecological importance as determined by the B-EIA or national/state/local authority plans/list […] **None for farms built (with or without permits) after May 1999, except for pumping stations and inlet/outlet canals provided they have been permitted by authorities and an equivalent area is rehabilitated as compensation. For farms built or permitted before May 1999, farmers are required to compensate/offset impacts via rehabilitation as determined by the B-EIA, or the national/state/local authority plans/list, or 50% of the affected ecosystem (whichever is greater).**	Score of 0.25 in F3.2a Question 4 because farms can be in high-value habitats if constructed prior to 1999. Rehabilitation is not considered to be a reliable compensation for lost ecosystem services.
Mitigation and offsetting – The BEIA must define appropriate mitigation and offsetting requirements given previous impacts [….]	Score of 0.25 in F3.2a Question 5 because Restoration is limited to within the B-EIA requirements and the requirements are not defined under the initiative.

The final score for Factor 3.2a is 2.75 out of 5

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

Relevant ASC Shrimp Standards	How we applied it
Certified farms must reach 100% compliance with standards	Certification and audit of B-EIA requirements mean a score of 1 for F3.2b Questions 1, 2 and 5. Question 3 is scored 0.25 because certification is farm-specific and does not address cumulative habitat impacts. Question 4 is scored 0.5 because audit information transparency is not yet known for ASC.

The final score for Factor 3.2b is 3.75 out of 5

The final score for criterion 3 combines factors 3.1. and 3.2 (Explanatory tables and calculations can be found on page 16 of the assessment criteria) to give a score of 4.04 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

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 ASC Shrimp Standards	How we applied it
5.2.1 Allowance for intentional lethal predator control of any protected, threatened or endangered species as defined by the International Union for Conservation of Nature (IUCN) Red List national listing processes, or other official lists. **- None.** 5.2.2 Allowance for use of lead shot and select chemicals for predator control. **- None.** 5.2.3 In case lethal predator control is used, a basic monitoring program must be in place for documenting the frequency of visits, variety of species and number of animals interacting with the farm. **- Yes.**	F3.3X score as "-4" Low-moderate - 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.

Final score for 3.3X 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

Chemical Use parameters	Score	
C4 Chemical Use Score	**10.0**	
C4 Chemical Use Final Score	**10.0**	**GREEN**
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 page 20 of the assessment criteria.

Relevant ASC Shrimp Standards	How we applied it
5.3.1 Allowance for use of antibiotic and medicated feed on ASC labeled products (farm can be certified but specific product receiving medicated feed will not be authorized to carry ASC label). **- None.** 5.3.2 Allowance for the use of antibiotics categorized as essential or critically important by the World Health Organization (WHO), even if authorized by the pertinent national authorities. **- None.** 5.3.3 Information on chemical storage and usage. - **Records of stocks and usage are available for all products.** 5.3.5 Allowance for treating water with pesticides banned or restricted by the Rotterdam Convention on Prior Informed Consent (PIC), the Stockholm Convention on Persistent Organic Pollutants (POPs) or the World Health Organization (WHO). - **None.** 5.3.6 Allowance for discharge of any hazardous chemicals without previous neutralization. **- None.** 5.3.7 Use of probiotic bacterial strains excluding the use of fermented product to seed further batches. - **Only probiotic products approved by the appropriate competent authorities can be used.**	Certain chemicals are prohibited (antibiotic/medicated feeds), and the remainder must be neutralized (through holding for the appropriate length of time) before releasing. C4 scored as "10" - the method of treatment does not allow active chemicals or by-products to be discharged.

Criterion 4 final score is 10 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

Feed parameters	Value	Score	
F5.1a Fish In: Fish Out ratio (FIFO)	1.14	7.16	
F5.1b Source fishery sustainability score		-2.00	
F5.1: Wild Fish Use		6.93	
F5.2a Protein IN	44.85		
F5.2b Protein OUT	13.97		
F5.2: Net Protein Gain or Loss (%)	-68.85	3	
F5.3: Feed Footprint (hectares)	7.99	7	
C5 Feed Final Score		**5.96**	**YELLOW**
Critical?	NO		

Justification of Ranking

Assumptions

- If un-specified in the standards, assume the 2011 species-average FCR, fishmeal and oil levels from FAO (Tacon et al, 2011).
- 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 50% of by-products from harvested fish are utilized unless otherwise specified in the standards. This aspect is not expected to be addressed in farm-level standard.

Factor 5.1 combines a Fish In:Fish Out ratio (F5.1a) with a source sustainability factor (F5.1b) to give a "wild fish use" score. Explanatory tables and calculations can be found on page 22 of the assessment criteria.

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

Relevant ASC Shrimp Standards	How we applied it
7.4.1 - Feed Fish Equivalence Ratio (FFER) **L. vannamei 1.35:1** **P. monodon 1.9: 1**	Using a global average values from FAO (2011) (fishmeal inclusion level = 16%, and FCR = 1.6) gives a FIFO (FFER) of 1.14. The ASC standards therefore allow a lower performance than the global average, but the 1.14 value has been used for consistency across all the standards assessed in order to avoid penalizing a standard such as this that sets a limit compared to a standard that has no limit set of FIFO (FFER).
7.4.2a Economic Feed Conversion Ratio (eFCR) - **Records are available**	

The FIFO value of 1.14 equates to a score of 7.16 out of 10

Factor 5.1b Fishery source sustainability

Relevant Content of Standards	How we applied it
FishSource score for the fishery(ies) from which a minimum of 80% of the fishmeal and fish oil by volume. is derived [….] a. for Fishsource Criteria 4 (spawning biomass assessment) b. for Fishsource Criteria 1, 2, 3 and 5 **a. 8; b. 6 or compliance with alternative interim proposal**	Factor 5.1b Sustainability of the source of wild fish scored as -2 as all Fishsource scores are >6 with one or more >8.

The source sustainability score (F5.1b) is -2 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 6.93 out of 10.

Factor 5.2. Net Protein Gain or Loss
Explanatory tables and calculations can be found on page 24 of the assessment criteria.

Relevant ASC Shrimp Standards	How we applied it
7.4.2b Protein Retention Efficiency – **Records are available**	Calculations based on average global data from FAO (2011) or other as specified.
Protein content of feed – **not addressed by initiative, but 35-38% indicated in Table 1**	Used 35% based on ASC standards Table 1 and value from Seafood Watch Thailand farmed

	shrimp report.
7.4.2a Economic Feed Conversion Ratio (eFCR) **- Records are available**	Used 1.6 from Tacon et al (2011)
Protein content of harvested shrimp – **not addressed by initiative**	Used 17.8% from Boyd et al (2007)
Edible yield of harvested shrimp - **not addressed by initiative**	Used 57% from Briggs et al (2004)
Percentage of non-edible byproducts from harvested shrimp utilized – **not addressed by initiative**	Used 50% across all standards for consistency in the face of a lack of data.

Protein input in feeds is 44.85
Protein output in harvested fish/shrimp is 13.97
Net edible protein loss is 68.9% which equates to a score of 3 out of 10.

Factor 5.3. Feed Footprint

Relevant ASC Shrimp Standards	How we applied it
Inclusion of aquatic ingredients **Not addressed by initiative**	16% fishmeal + 2% fish oil = 18%
Inclusion of crop ingredients – **Not addressed by initiative**	Factor 5.3a Assumed all non-aquatic ingredients are edible crops – i.e. 82%
Inclusion of land animal ingredients – **Not addressed by initiative**	Factor 5.3b assumed zero for all standards unless specified

Inclusion levels are translated to footprint areas using scoring calculations explained on page 25 of the criteria document.

Final feed footprint is 7.99 hectares per ton which equates to a score of 7 out of 10.

The final feed criterion (C5) score is a combination of the three feed factors with a double weighting on FIFO. The final score is 5.96 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

Escape parameters	Value	Score	
F6.1 Escape Risk		4.00	
F6.1a Recapture and mortality (%)	0		
F6.1b Invasiveness		4.5	
C6 Escape Final Score		**4.00**	**Yellow**
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.

Factor 6.1a. Escape risk

Explanatory score table can be found on page 28 of the assessment criteria

Relevant ASC Shrimp Standards	How we applied it
6.1.2 Prevention measures in place to prevent escapes at harvest and during grow-out include: A. Effective screens or barriers of appropriate mesh size for the smallest animals present; double screened when nonindigenous species. **– Yes** B. Perimeter pond banks or dykes are of adequate height and construction to prevent breaching in exceptional flood events **– Yes** C. Regular, timely inspections are performed and recorded in a permanent register **- Yes** D. Timely repairs to the system are recorded **- Yes** E. Installation and management of trapping devices to sample for the existence of escapes; data is recorded **- Yes** F. Escape recovery protocols in place **- Yes** 6.1.3 Escapes and actions taken to prevent reoccurrence. - **Records are available for inspection**.	The measures in place for the production cycle improve an initial basic escape score (Factor 6.1a)) of 2 for exchanging systems to 4 according to the Seafood Watch criteria for "Ponds that drain at harvest". ASC standards do not clearly address this key escape risk (i.e. escape when draining ponds at harvest).

Initial escape risk score is 4 out of 10

Recaptures and mortality

Relevant ASC Shrimp Standards	How we applied it
6.1.2 E. Installation and management of trapping devices to sample for the existence of escapes; data is recorded **- Yes** 6.1.2 F. Escape recovery protocols in place **- Yes** 6.1.3 Escapes and actions taken to prevent reoccurrence. - **Records are available for inspection**.	Standards do not demonstrably lead to reduced escapes for which a score can be applied, but this aspect has been taken into consideration in the improved escape score (6.1a) above. Zero percent recapture used for scoring.

The recaptures and mortality score can improve the escape risk score, but is taken account in the initial score of 4 final escape risk score is 4 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

Part B

Relevant Content of Standards	How we applied it
6.1.1 Use of non-indigenous shrimp species. – **Allowed, provided it is in commercial production locally AND there is no evidence of establishment or impact on adjacent ecosystems by that species AND there is documentation (hatchery permits, import licenses, etc.) that demonstrates compliance with introduction procedures as identified by regional, national and international importation guidelines (e.g., OIE and ICES).**	Factor 6.1b PART B scored as 0.5 for non-native species: "Not present, but establishment is possible, or similar species have established elsewhere".

Part A (or B) score is 0.5 out of 5

Part C

Relevant Content of Standards	How we applied it
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)	Factor 6.1b PART C scored on basic species life history (see scores in Appendix 1). Total score is 4 out of 5.

Part C score is 4 out of 5

Final invasiveness score combines Part B and Part C (for non-native species) and is 4.5 out of 10

The final escapes score combines the escape risk score with the invasiveness score (see criteria document p30 for scoring matrix) and is 4 for ASC shrimp.

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

Escape of unintentionally introduced species parameters	Score	
F6.2Xa International or trans-waterbody live animal shipments (%)	0.00	
F6.2Xb Biosecurity of source/destination	n/a	
F6.2X 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 6.2Xa International or trans-waterbody live animal shipments

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

Relevant ASC Shrimp Standards	How we applied it
6.2.1 PL and broodstock have appropriate disease-free status and sources meet regional, national and international importation guidelines (e.g., OIE and ICES) Documentation provided demonstrating compliance within two years of standards publication date for wild monodon broodstock sourced locally; applicable immediately in all other cases.	Assumed zero reliance on shipments. Score is 0 out of -10

The score for Factor 6.2X is 0 out of -10.

Factor 6.2Xb Biosecurity of source/destination

Not relevant with zero shipment assumption

Final score for Factor 6.2X is a zero deduction

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

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*"

Explanatory score table can be found on page 34 of the assessment criteria

Relevant ASC Shrimp Standards	How we applied it
5.1.1 Develop and maintain an operational health plan addressing: 1)Pathogens that can come from the surrounding environment into the farm (e.g., predator and vector control), 2) Pathogens that can spread from the farm to the surrounding environment (e.g., effluent filtration/sterilization, and waste such as dead-shrimp management) 3) Spreading of pathogens within the farm. Critical to avoid cross contamination, detect and prevent emerging pathogen(s), and monitor external signs of pathologies **Demonstration that the operational health plan is functional.**	Scored as "4" Moderate according to the criteria because disease-related mortalities occur and farms discharge water on multiple occasions during the production cycle without relevant treatment. The health plan has no verifiable outcomes and does not improve the score.

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

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

- Assume 100% is source from hatcheries except shrimp standards that do not specifically prohibit capture of wild postlarvae.

Explanatory score table can be found on page 35 of the assessment criteria

The standards allow the use of wild broodstock, but this assessment has been done overall for *L. vannamei* which are assumed to come from domesticated broodstock in hatcheries. The final source of stock score (C8) is 10 out of 10.

Overall Recommendation

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.

- ASC Shrimp

Criterion	Score (0-10)	Rank	Critical?
C1 Data	9.72	GREEN	
C2 Effluent	6.00	YELLOW	NO
C3 Habitat	4.04	YELLOW	NO
C4 Chemicals	10.00	GREEN	NO
C5 Feed	5.96	YELLOW	NO
C6 Escapes	4.00	YELLOW	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	0.00	GREEN	
Total	**49.73**		
Final score	**6.22**		

Final Score	6.22
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 fished 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 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.

References

Boyd, CE, C Tucker, A McNevin, K Bostick, J Clay (2007) Indicators of Resource Use Efficiency and Environmental Performance in Fish and Crustacean Aquaculture. Reviews in Fisheries Science 15: 327-360.

Tacon, A., Hasan, M. R., & Metian, M. (2011). Demand and supply of feed ingredients for farmed fish and crustaceansTrends 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 1: Data quality and availability

Data Category	Relevance (Y/N)	Data Quality	Score (0-10)
Industry or production statistics	*Yes*	7.5	7.5
Effluent	Yes	10	10
Locations/habitats	Yes	10	10
Predators and wildlife	Yes	10	10
Chemical use	Yes	10	10
Feed	Yes	10	10
Escapes, animal movements	Yes	10	10
Disease	Yes	10	10
Source of stock	Yes	10	10
Other – (e.g. GHG emissions)	No	10	n/a
Total			**87.5**

C1 Data Final Score	9.7	GREEN

Criterion 2: Effluents

Factor 2.1a - Biological waste production score

Protein content of feed (%)	Used 25.2kg N from standard
eFCR	Used 25.2kg N from standard
Fertilizer N input (kg N/ton fish)	Used 25.2kg N from standard
Protein content of harvested fish (%)	Used 25.2kg N from standard
N content factor (fixed)	*0.16*
N input per ton of fish produced (kg)	Used 25.2kg N from standard
N in each ton of fish harvested (kg)	Used 25.2kg N from standard
Waste N produced per ton of fish (kg)	**25.2**

Factor 2.1b - Production System discharge score

Basic production system score	1
Adjustment 1 (if applicable)	0
Adjustment 2 (if applicable)	0

Adjustment 3 (if applicable)	0
Discharge (Factor 2.1b) score	**1**

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?	Yes	0
3 - Do the control measures address or relate to the cumulative impacts of multiple farms?	Moderately	0.5
4 - Are the limits considered scientifically robust and set according to the ecological status of the receiving water body?	Moderately	0.5
5 - Do the control measures cover or prescribe including peak biomass, harvest, sludge disposal, cleaning etc?	Moderately	0.5
		2.5

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?	Yes	1
3 - Does enforcement cover the entire production cycle (i.e. are peak discharges such as peak biomass, harvest, sludge disposal, cleaning included)?	Yes	1
4 - Does enforcement demonstrably result in compliance with set limits?	Yes	1
5 - Is there evidence of robust penalties for infringements?	Yes	1
		5

F2.2 Score (2.2a*2.2b/2.5)	**5**

C2 Effluent Final Score	**6.00**	**GREEN**
	Critical?	NO

Criterion 3: Habitat

3.1. Habitat conversion and function

F3.1 Score	4

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?	Yes	1
2 - Is the industry's total size and concentration based on its cumulative impacts and the maintenance of ecosystem function?	Partly	0.25
3 – Is the industry's ongoing and future expansion appropriate locations, and thereby preventing the future loss of ecosystem services?	Yes	1
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	0.25
5 - Do control measures include requirements for the restoration of important or critical habitats or ecosystem services?	Partly	0.25
		3.5

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?	Yes	1
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?	Moderately	0.5
5 - Is there evidence that the restrictions or limits defined in the control measures are being achieved?	Yes	1
		3.75

F3.2 Score (2.2a*2.2b/2.5)	4.13

C3 Habitat Final Score	4.04	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	6.00	
C4 Chemical Use Final Score	6.00	YELLOW
Critical?	NO	

Criterion 5: Feed

5.1. Wild Fish Use

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

Fishmeal inclusion level (%)	16
Fishmeal from by-products (%)	0
% FM	16
Fish oil inclusion level (%)	2
Fish oil from by-products (%)	0
% FO	2
Fishmeal yield (%)	22.5
Fish oil yield (%)	5
eFCR	1.6
FIFO fishmeal	1.14
FIFO fish oil	0.64
Greater of the 2 FIFO scores	1.14
FIFO Score	**7.16**

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

SSWF	-2
SSWF Factor	-0.23

F5.1 Wild Fish Use Score	**6.93**

5.2. Net protein Gain or Loss

Protein INPUTS	
Protein content of feed	35
eFCR	1.6

Feed protein from NON-EDIBLE sources (%)		0
Feed protein from EDIBLE CROP soruces (%)		69.6
Protein OUTPUTS		
Protein content of whole harvested fish (%)		17.8
Edible yield of harvested fish (%)		57
Non-edible by-products from harvested fish used for other food production		50
Protein IN		44.85
Protein OUT		13.973
Net protein gain or loss (%)		-68.84
	Critical?	NO
F5.2 Net protein Score	**3.00**	

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 (%)	18
eFCR	1.6
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)	7.49

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

Inclusion level of crop feed ingredients (%)	82
Inclusion level of land animal products (%)	0
Conversion ratio of crop ingedients to land animal products	*2.88*
eFCR	1.6
Average yield of major feed ingredient crops (t/ha)	*2.64*
Land area appropriated (ha per ton of fish)	0.50

Value (Ocean + Land Area)	**7.99**

F5.3 Feed Footprint Score	**7.00**

C5 Feed Final Score	**5.96**	**YELLOW**
	Critical?	**NO**

Criterion 6: Escapes

6.1a. Escape Risk

Escape Risk	4

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	**4**

6.1b. Invasiveness

Part A – Native species

Score	0

Part B – Non-Native species

Score	**0.5**

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	**4.5**

Final C6 Score	**4.00**	**YELLOW**
	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	n/a	
F6.2X Escape of unintentionally introduced species Final Score	**0.00**	**GREEN**

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**