



Naturland Standards for Organic  
Aquaculture (Version 05/2011)  
*Tropical Freshwater Fishes*



Benchmarking equivalency results assessed against the Seafood  
Watch Aquaculture Criteria

May 2013

## Final Seafood Recommendation

### Naturland Standards for Organic Aquaculture – Freshwater Fishes

Criterion	Score (0-10)	Rank	Critical?
C1 Data	8.61	GREEN	
C2 Effluent	6.00	YELLOW	NO
C3 Habitat	6.53	YELLOW	NO
C4 Chemicals	10.00	GREEN	NO
C5 Feed	7.40	GREEN	NO
C6 Escapes	2.00	RED	NO
C7 Disease	4.00	YELLOW	NO
C8 Source	10.00	GREEN	
3.3X Wildlife mortalities	-2.00	GREEN	NO
6.2X Introduced species escape	0.00	GREEN	
<b>Total</b>	<b>52.54</b>		
<b>Final score</b>	<b>6.57</b>		

Final Score	6.57
Initial rank	YELLOW
Red criteria	1
Final rank	YELLOW
Critical Criteria?	NO

FINAL RANK
<b>YELLOW</b>

*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 Naturland Standards for Organic Aquaculture, assessed for tropical freshwater fishes, have a final numerical score of 6.57 out of 10, and with one red criterion (escapes) the final result 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” ranking.

The assessment was conducted for tilapia in cages as a worst-case scenario for the species and production systems covered within the scope of the standards. The final result of the equivalence assessment for Naturland Standards for Organic Aquaculture for tropical freshwater fish 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 Naturland Freshwater Fishes certification as an assurance that certified products meet at least a yellow “Good Alternative” recommendation.

In general, the Naturland Standards for Organic Aquaculture for freshwater fish:

- contain overview requirements for all species and production systems certified under the standards (under Part A and Part B- Section I)
- contain species-specific and production-specific standards (under Part B- Sections II through VII)
- frequently use terms such as “prefer” or “minimize” which have no value in certification
- have few specific requirements for tilapia in cages
- like all farm-level certification standards do not robustly control cumulative impacts for multiple neighboring, local, or regional farms

Specifically for each criterion, the Naturland Organic Aquaculture Standards for tropical freshwater fishes:

- necessitate considerable data collection to demonstrate compliance with the standards, and when combined with the farm-level certification process (ie. audit) result in a high data score,
- prohibit effluents from impacting surrounding habitats or ecosystem functionality, yet do not set discrete effluent limits,
- restrict chemical use and prohibit impacts on non-target organisms,
- specify a limit on fishmeal inclusion well above current industry norms
- have no specific escape requirements or limits,
- certify open production systems that allow the exchange of pathogens and parasites,
- prohibit the use of wild-caught broodstock,
- only recommend (i.e. do not require) passive, non-lethal predator deterrents

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## **Introduction**

### ***Scope of the analysis and ensuing recommendation***

The Naturland Organic Aquaculture Standards consist of general regulations for organic aquaculture (and other forms of organic agriculture) and contain supplemental sections for specific species groups. This assessment is specific to relevant general standards (Part B – Section I) as well as Part B – Section VI supplementary regulations for the culture of freshwater tropical fishes (ie. milkfish *Chanos chanos*, tilapia *Oreochromis sp.*, Siamese catfish *Pangasius sp.*)

### **Species**

The assessment focuses on tilapia (*Oreochromis sp.*) in cages where the species is non-native as a realistic worst-case scenario.

### **Geographic coverage**

Global

### **Production Methods**

Ponds and net cages

## **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](#)<sup>1</sup>:**
- **The full data values and scoring calculations are available in Appendix 1**

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<sup>1</sup> [http://www.montereybayaquarium.org/cr/cr\\_seafoodwatch/sfw\\_aboutsfw.aspx](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 Naturland Tropical Freshwater Fishes**

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

<b>Data Category</b>	<b>Relevance (Y/N)</b>	<b>Data Quality</b>	<b>Score (0-10)</b>
Industry or production statistics	yes	10	10
Effluent	yes	7.5	7.5
Locations/habitats	yes	10	10
Predators and wildlife	yes	10	10
Chemical use	yes	10	10
Feed	yes	7.5	7.5
Escapes, animal movements	yes	7.5	7.5
Disease	yes	7.5	7.5
Source of stock	Yes	7.5	7.5
Other – (e.g. GHG emissions)	No	n/a	n/a
<b>Total</b>			<b>77.5</b>

<b>C1 Data Final Score</b>	<b>8.61</b>	<b>GREEN</b>
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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 Criterion 1 (Data) score is 8.61 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 Naurland Tropical Freshwater Fishes**

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

<b>Effluent parameters</b>	<b>Value</b>	<b>Score</b>	
F2.1a Biological waste (nitrogen) production per of fish (kg N ton-1)	59.2		
F2.1b Waste discharged from farm (%)	80		
F2 .1 Waste discharge score (0-10)		5	
F2.2a Content of regulations (0-5)	3		
F2.2b Enforcement of regulations (0-5)	5		
F2.2 Regulatory or management effectiveness score (0-10)		6	
<b>C2 Effluent Final Score</b>		<b>6.00</b>	<b>YELLOW</b>
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

Naurland standard Section VI 2.1 states: "The water quality of source water bodies (in the case of pond farms) or the surrounding lake or sea regions (in the case of net cages) should not

become significantly deteriorated (standard value < 10% of the parameters determined, see footnote) due to the farming operation. This shall be secured by sedimentation ponds and/or filtering plants dimensioned adequately. Settled particulate organic matter (products of metabolism, feed residues) shall be removed and brought to adequate re-usage (e.g. as fertilizer in agriculture).”

The footnote referred to states: Monitoring and evaluation of macro-zoobenthos (e.g. in accordance with the index of saprobiontic succession) or measurement of single parameters (ammonia, nitrate, nitrite, phosphate) at the outlet resp. in the immediate vicinity of the net cages, compared with values from reference points above the effluent resp. outside the vicinity of the net cages.

For this assessment, the interpretation of the <10% language and how it is applied in reality is ambiguous. The remedial measures do not appear to apply to cage farms. Additionally the Naturland Standards for Organic Aquaculture do not have any specific effluent water quality requirements. Therefore the full Seafood Watch assessment was used to calculate typical effluent characteristics for tilapia farms.

#### **Factor 2.1. Waste discharged from the farm**

The Naturland Standards for Organic Aquaculture do not have any specific effluent water quality requirements. Therefore the full Seafood Watch assessment was used to calculate waste production.

<b>Relevant Content of Standards</b>	<b>How we applied it</b>
Protein content of feed <b>Not addressed by initiative</b>	30.0% for tilapia from FAO (2010)
Feed conversion ratio <b>Not addressed by initiative</b>	1.7 for tilapia from Tacon et al (2011)
Fertilizer input	Assumed zero for all benchmarking assessments
Protein content of whole harvested fish <b>Not addressed by initiative</b>	14% for tilapia from Boyd et al (2007)

These values result in a nitrogen waste production of 59.2 kg per ton of farmed tilapia (see Criteria – Factor 2.1a for calculations).

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

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

Waste discharge per ton of farmed tilapia (available for impact beyond an allowable zone of effect [AZE]) is 47.36 kg. This results in an initial waste score of 5 out of 10 for the 40-50 kg category.

Factor 2.1 score is 5 out of 10.

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

Factor 2.2a assesses the content of the management measures.

Relevant Content of Standards	How we applied it
Section I 1.1. By selection of site and the method of management of the farm, the surrounding ecosystems shall not be adversely affected. In particular, negative impact caused by effluents as well as by escape of animals shall be prevented by adopting suitable preventive measures.	Score of 1 out of 1 for F2.2a Question 1 because the standard has set specific regulations and control measures that are designed for aquaculture.
Are the control measures applied according to site-specific conditions and/or do they lead to site-specific effluent, biomass or other discharge limits? <b>Not addressed by initiative</b>	Score of 0 out of 1 for F2.2a Question 2 because the standards can be universally applied and as such no site-specific limits or requirements are included
Do the control measures address or relate to the cumulative impacts of multiple farms? <b>Not addressed by initiative</b>	Score of 0 out of 1 for F2.2a Question 3 because the farm-level certification has no control over the cumulative impacts of neighboring or multiple farms.
Section I 1.1. By selection of site and the method of management of the farm, the surrounding ecosystems shall not be adversely affected. In particular, negative impact caused by effluents as well as by escape of animals shall be prevented by adopting suitable preventive measures.  Section I 1.3 Through appropriate design and management of the farm areas it shall be ensured that the water bodies inside the operation retain their ecological functions depending on the respective geographical conditions (e.g. breeding ground for amphibians and water insects, resting place for	Score of 1 out of 1 for F2.2 Question 4 because the standards require that the ecosystem functionality not be adversely affected by the farming operation.

migratory birds, migration routes for fish).	
Section VI 2.1 The bottom of the ponds below the net cages should be regularly inspected for organic deposits caused by excrements and feed residues.	Score of 1 out of 1 for F2.2a Question 5 because the standards require regular monitoring throughout the production cycle.

Factor 2.2a score is 3 out of 5.

Factor 2.2b assesses the enforcement of the above measures.

Relevant Content of Standards	How we applied it
<p>Previously announced (at least once a year) and unannounced visits and inspections by personnel authorized by Naturland shall monitor adherence to the standards. They shall be provided with unrestricted access and scrutinizing opportunities into all the relevant areas of the farm. Upon request, all the documents relating to the managing of the farming operation as well as any other relevant information shall be made available.</p> <p>Naturland mandates inspection bodies to perform regular inspections of farmers and processors at least once every year. In addition to the annual tours of inspection, unannounced spot checks are also made. Inspection is performed by external, expert, state-approved inspection bodies. Naturland co-operates primarily with the following respected inspection bodies:</p> <p>BCS-Öko-Garantie GmbH IMO Institute of Marketecologie Lacon GmbH and Ökop-Zertifizierungsgesellschaft mbH</p>	<p>Score of 1 out of 1 for F2.2b Question 1 because Naturland identifies which inspection bodies they work with and that farms are inspected on a yearly basis</p>
<p>The basis for the decision of the certification committee is the results determined by and facts presented in the inspection report. In cases of non-conformity with the standards, any of a list of penalties ranging from a warning to withdrawal of the right to use the logo and disqualification of the farm may be imposed.</p> <p>Every year the farms receive a new notice of certification and a certificate from Naturland's certification committee. These confirm that the farm is managed in conformity with Naturland's standards.</p> <p>Processing enterprises which process raw goods certified by Naturland and require their suppliers to produce corresponding proof of Naturland quality may receive corresponding confirmation that they do so from Naturland, on request.</p>	<p>Score of 1 out of 1 for F2.2b Question 2 because if Naturland standards are not being met then there are number of potential penalties including disqualification of the farm</p>

<p>6. Documentation and inspection</p> <p>The currently valid details (i.e. type and size of the stock, large-scale transport of stock, e.g. to net cages located some distance away) shall be reported to Naturland. Regarding product flow (e.g. additional purchases of feed as well as the sale of farm products), likewise, records shall be kept in accordance with Naturland's standards. Furthermore, a farm diary shall be kept (e.g. on the incidence of diseases, mortality rates, implementation of special hygienic measures such as dewatering, liming etc.). An obligation for an immediate reporting shall exist in respect of all such factors that can negatively affect the quality of the products (e.g. contamination of water sources, occurrence of toxic algae blooms or „red tides“). Previously announced (at least once a year) and unannounced visits and inspections by personnel authorized by Naturland shall monitor adherence to the standards. They shall be provided with unrestricted access and scrutinizing opportunities into all the relevant areas of the farm. Upon request, all the documents relating to the managing of the farming operation as well as any other relevant information shall be made available.</p> <p>All stages of the value chain have to be recorded when the farm is inspected, although, in the case of co- operatives, for example, individual areas can be organized to conform with the internal control system (ICS).</p>	<p>Score of 1 out of 1 for F2.2b Question 3 because enforcement covers the entire production cycle.</p>
<p>The basis for the decision of the certification committee is the results determined by and facts presented in the inspection report. In cases of non-conformity with the standards, any of a list of penalties ranging from a warning to withdrawal of the right to use the logo and disqualification of the farm may be imposed.</p> <p>Every year the farms receive a new notice of certification and a certificate from Naturland's certification committee. These confirm that the farm is managed in conformity with Naturland's standards.</p> <p>Processing enterprises which process raw goods certified by Naturland and require their suppliers to produce corresponding proof of Naturland quality may receive corresponding confirmation that they do so from Naturland, on request.</p>	<p>Score of 1 out of 1 for F2.2b Question 4 because if Naturland standards are not being met then there are number of potential penalties including disqualification of the farm.</p>
<p>The basis for the decision of the certification committee is the results determined by and facts presented in the inspection report. In cases of non-conformity with the standards, any of a list of penalties ranging from a warning to withdrawal of the</p>	<p>Score of 1 out of 1 for F2.2b Question 5 because if Naturland standards are not being met then there are</p>

<p>right to use the logo and disqualification of the farm may be imposed.</p> <p>Every year the farms receive a new notice of certification and a certificate from Naturland’s certification committee. These confirm that the farm is managed in conformity with Naturland’s standards.</p> <p>Processing enterprises which process raw goods certified by Naturland and require their suppliers to produce corresponding proof of Naturland quality may receive corresponding confirmation that they do so from Naturland, on request.</p>	<p>number of potential penalties including disqualification of the farm.</p>
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Factor 2.2b score is 5 out of 5.

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 Seafood Watch assessment 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 of scores for Naturland Tropical Freshwater Fishes**

Explanatory score 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	3.50		
F3.2b Enforcement of habitat regulations	4.00		
F3.2 Regulatory or management effectiveness score		5.60	
<b>C3 Habitat Final Score</b>		<b>6.53</b>	<b>YELLOW</b>
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
<p>Part B Section I 2.1 The inflowing water shall reveal none or only slight contamination of anthropogenic origin. The pH- value shall be between pH 6.0 and 9.0.</p> <p>Part B Section I 1.1. By selection of site and the method of management of the farm, the surrounding ecosystems shall not be adversely affected. In particular, negative impact caused by effluents as well as by escape of animals shall be prevented by adopting suitable preventive measures. In the case of installation of new farms or amplification of already existing, natural vegetation shall not be damaged in a lasting way. This has to be respected, in particular, if the type of vegetation has to be classified, at regional or international level, as rare or endangered (e.g. marsh areas in Middle Europe; rain forest, mangroves).</p> <p>Part B I 1.3. Through appropriate design and management of the farm areas it shall be ensured that the water bodies inside the operation retain their ecological functions depending on the respective geographical conditions (e.g. breeding ground for amphibians and water insects, resting place for migratory birds, migration routes for fish). For this purpose, in particular, adequately large areas showing natural vegetation (e.g. water reeds, tall aquatic plants) shall be protected or re-planted by the enterprise.</p>	<p>Score of 7 due to worst-case moderate impacts while retaining all ecological functions.</p>

**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
Section I 1.1 and 1.3 as above	Score of 0.75 out of 1 for F3.2a Question 1 because an EIA is not required by this initiative, however siting standards require farming operations to maintain full ecosystem function.
Is the industry's total size and concentration based on its cumulative impacts and the maintenance of ecosystem function? <b>Not addressed by initiative</b>	Score of 0 out of 1 for F3.2a Question 2 because the standards are farm-specific and therefore have no control over the cumulative impacts of neighboring or regional farms.
Section I 1.1 and 1.3 as above	Score of 0.75 out of 1 for F3.2a Question 3 because although ongoing and future expansion are not significantly spoken to directly within the initiatives, it is expected that any growth of a farm would comply with all previously set standards.
Section I 1.1 and 1.3 as above	Score of 1 out of 1 for F3.2a Question 4 because habitats with high levels of ecosystem functionality must be avoided.
Do control measures include requirements for the restoration of important or critical habitats or ecosystem services? <b>Not addressed by initiative</b>	Score of 1 out of 1 for F3.2a Question 5 because although the standards do not speak to restoration, F3.2a Question 4 indicates that important or critical habitats are avoided and as such no restoration is necessary.

Factor 3.2a score is 3.5 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
Naturland mandates inspection bodies to perform regular inspections of farmers and processors at least once every year. In addition to the annual tours of	Score of 1 out of 1 for F3.2b Question 1 because farm inspections occur at least once

<p>inspection, unannounced spot checks are also made. Inspection is performed by external, expert, state-approved inspection bodies. Naturland co-operates primarily with the following respected inspection bodies:</p> <p>BCS-Öko-Garantie GmbH IMO Institute of Marketecologie Lacon GmbH and Ökop-Zertifizierungsgesellschaft mbH</p> <p>Naturland provides inspection bodies with inspection documents and develops specific guidelines for complex areas like inspection of grower groups or the Naturland standards on social responsibility.</p>	<p>every year. Inspection Bodies are listed on the Naturland website.</p>
<p>Section I 1.1 as above</p>	<p>Score of 1 out of 1 for F3.2b Question 2 because if siting does not function based on the ecosystem-based management plans included in the standards then farm are ineligible for certification.</p>
<p>Does the farm siting or permitting process take account of other farms and their cumulative impacts? <b>Not addressed by initiative</b></p>	<p>Score of 0 out of 1 for F3.2b Question 3 because the standards are farm-specific and therefore have no control over the cumulative impacts of neighboring or regional farms.</p>
<p>Naturland Association, along with Naturland’s marketing organisation, FiBL Research Institute of Organic Agriculture and the trading firm tegut...“ are offering buyers of organic produce a new service. By means of a reliable tracing system, the customer can refer to the internet to find out where, by whom and how the organic product he or she has purchased was cultivated and processed.</p> <p>This is how “Bio mit Gesicht” works: each article purchased bears a number. This enables the customer to “visit” the producer on the internet, where he or she is presented under Bio mit Gesicht (<a href="http://www.bio-mit-gesicht.de">www.bio-mit-gesicht.de</a>): Where is the farm/manufacturer? Who works there? What standards do they have to comply with? What else is there of interest?</p>	<p>Score of 1 out of 1 for F3.2b Question 4 because Naturland has an extensive system that allows full traceability of any product throughout its lifecycle.</p>
<ul style="list-style-type: none"> <li>• The development of standards and their implementation are the core mission of any certified association for organic agriculture. Standards have to be</li> </ul>	<p>Score of 1 out of 1 for F3.2b Question 5 because farms must comply with the standards in order</p>

<p>proven to be workable. They have to adapt to changing conditions and extended to cover new areas.</p> <ul style="list-style-type: none"> <li>• These standards are regularly revised and updated, taking into account new technical or political insights. On numerous occasions, we present the standards to international audiences, and we are in a permanent communication about the content with technical experts, NGOs, scientific institutions, and consumers.</li> <li>• Naturland is one of the major global certification organizations for organic agricultural produce. Just as Naturland’s farmers and processors are subject to annual inspection, Naturland too is inspected once a year by neutral, qualified organizations, thereby proving that Naturland’s certification system fulfills the most stringent internationally recognized standards.</li> </ul>	<p>to achieve certification.</p>
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Factor 3.2b score is 4 out of 5.

When combined with the Factor 3.2a score, the score for Factor 3.2 is 5.6 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 6.53 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 Naturland Tropical Freshwater Fishes

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.

Relevant Content of Standards	How we applied it
1.4. While protecting the farm areas from predatory birds and other animal species, measures not harming the animals physically shall be preferred (e.g. nets, dummy raptors).	Score of -4 out of -10 based on the above assumption because the standards do not specifically prohibit lethal predator control.

The final score for Criterion 3.3X is a deduction of -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 Naturland Tropical Freshwater Fishes**

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	10.00	
<b>C4 Chemical Use Final Score</b>	<b>10.00</b>	<b>GREEN</b>
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).

Relevant Content of Standards	How we applied it
<p>5.1 The fishes' health has primarily to be ensured by prophylactic methods (e.g. the best management conditions, breeding, feeding). Nature healing methods are to be preferred where diseases do occur. Conventional medicines may only be applied if prescribed after diagnosis by a veterinary surgeon. In the case of tropical fish species, treatment with conventional veterinary medicines (e.g. antibiotics etc.) leads to the revocation of Naturland's certification for the affected stock.</p> <p>5.2. For the protection of net cages against growth of algae and colonization by invertebrates, environment-friendly methods shall be employed. Use of chemical "anti-fouling" agents is prohibited. 5.4 For disinfection the pond bottom can be limed. Nevertheless, the maximum amount of lime applied to the pond may not exceed 1000 kg/ha. In addition the liming can have a positive effect on the productivity of the ponds.</p>	<p>Score of 10 for C4 because the use of conventional veterinary medicines is not permitted under Naturland's freshwater fish standards. Antifouling agents are not permitted. Only agricultural lime is allowed at a designated level.</p>

The final score of Criterion 4 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 of scores for Naturland Tropical Freshwater Fishes**

Explanatory score tables and calculations can be found on pages 21-26 of the Seafood Watch assessment criteria. Breakdown of calculations and data points can be found in Appendix 1 of this report.

Feed parameters	Value	Score	
F5.1a Fish In: Fish Out ratio (FIFO)	0.23	9.43	
F5.1b Source fishery sustainability score		-6.00	
F5.1: Wild Fish Use		9.30	
F5.2a Protein IN	36.71		
F5.2b Protein OUT	9.59		
F5.2: Net Protein Gain or Loss (%)	-73.87	2	
F5.3: Feed Footprint (hectares)	1.95	9	
<b>C5 Feed Final Score</b>		<b>7.40</b>	<b>GREEN</b>
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.

Explanatory score tables and calculations can be found on pages 22-26 of the assessment criteria. Breakdown of calculations and data points can be found in Appendix 1 of this report.

### Factor 5.1. Wild Fish Use

Factor 5.1 combines a 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 Content of Standards	How we applied it
<p>Fishmeal inclusion level</p> <p><b>6. Feed</b> - The provision upper limit for the fish meal resp. fish oil content in feed has been determined at 20% for <i>Pangasius</i> and <i>Oreochromis</i></p>	20% fishmeal is extremely high for any freshwater fish. For this assessment of tilapia, 3% from Tacon et al (2011) based on China was used.
<p>Fishmeal from by-products</p> <p>Appendix 1</p> <p>Principally, fishmeal/-oil shall originate from the same geographical region as the aquaculture operation is located in. The following sources are permitted: Fishmeal/-oil from fisheries certified independently as sustainable, taking into account as well impact on target species as on by-catch species and the ecosystem</p> <p>Fishmeal/-oil from trimmings of fish processed for human consumption (not from conventional aquaculture)</p> <p>Fishmeal/-oil from by-catches of captures for human consumption.</p> <p>The use of fishmeal/-oil from other sources may be applied for the solely purposes of safeguarding quality and only up to a limited amount (maximum 30% of total fishmeal/-oil, referring to total life-span of fish).</p>	Assumed zero
<p>Fish oil inclusion level</p> <p><b>6. Feed</b> - The provision upper limit for the fish meal resp. fish oil content in feed has been determined at 20% for <i>Pangasius</i> and <i>Oreochromis</i></p>	Used 0% from Tacon et al (2011) based on China
<p>Fish oil from by-products</p> <p><b>As Appendix 1 listed above</b></p>	Assumed zero
<p>FCR</p> <p><b>Not addressed by initiative</b></p>	1.7 for tilapia from Tacon et al (2011)

Using these values in the criteria calculations generates a FIFO value of 0.23 which equates to a score of 9.43 out of 10 for F5.1a.

#### Factor 5.1b Fishery source sustainability

Relevant Content of Standards	How we applied it
<p>Appendix 1: Requirements regarding fishmeal/-oil used as feed</p> <p>All feed originating from wild marine fauna has to be harvested in compliance with internationally established sustainability standards (e. g. FAO Code of Conduct<sup>28</sup>, ICES<sup>29</sup>). Wherever possible, this should be confirmed by</p>	Score of -6 out of -10 for F5.1b because fish meal and fish oil must be from fishery certified by FAO code of conduct or ICES.

<p>producing proof of independent certification. Principally, fishmeal/-oil shall originate from the same geographical region as the aquaculture operation is located in. The following sources are permitted:</p> <p>Fishmeal/-oil from fisheries certified independently as sustainable, taking into account as well impact on target species as on by-catch species and the ecosystem</p> <p>Fishmeal/-oil from trimmings of fish processed for human consumption (not from conventional aquaculture)</p> <p>Fishmeal/-oil from by-catches of captures for human consumption. The use of fishmeal/-oil from other sources may be applied for the solely purposes of safeguarding quality and only up to a limited amount (maximum 30% of total fishmeal/-oil, referring to total life-span of fish).</p>	
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The source sustainability score (F5.1b) is -6 out of -10.

Factor 5.1b adjusts the score from 5.1a according to the Seafood Watch criteria calculations to give a final wild fish score (Factor 5.1) of 9.30 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 Content of Standards	How we applied it
Protein content of feed <b>Not addressed by initiative</b>	Used 30% from FAO (2010)
Percentage of feed protein from non-edible sources <b>Not addressed by initiative</b>	Assumed zero for all benchmarking
Percentage of feed protein from edible crop sources <b>Not addressed by initiative</b>	Assumed to be all except protein from fishmeal. 98% based on 66.5% protein in fishmeal.
FCR <b>Not addressed by initiative</b>	1.7 for tilapia from Tacon et al (2011)

Protein content of harvested fish <b>Not addressed by initiative</b>	Used 14% from Boyd et al (2007)
Edible yield of harvested fish <b>Not addressed by initiative</b>	Used 37% from FAO website <sup>2</sup>
Percentage of non-edible byproducts from harvested fish utilized <b>Not addressed by initiative</b>	Used 50% across all standards for consistency as not addressed in standards.

Protein input in feeds is 36.7

Protein output in harvested fish is 9.59

Net edible protein loss is 73.9 % which equates to a score of 2 out of 10 for the 70-80% category.

### Factor 5.3. Feed Footprint

Relevant Content of Standards	How we applied it
Inclusion of aquatic ingredients <b>Not addressed by initiative</b>	3%
Inclusion level of crop ingredients <b>Not addressed by initiative</b>	97% (assumed all non-marine ingredients)
Inclusion level of land animal ingredients <b>Not addressed by initiative</b>	Assumed zero as not addressed in standards.

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

Final feed footprint is 1.95 hectares per ton which equates to a score of 9 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 7.40 out of 10.

## Criterion 6: Escapes

### **Impact, unit of sustainability and principle**

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

### **Criterion 6 Summary of scores for Naturland Tropical Freshwater Fishes**

<sup>2</sup> Yield and nutritional value of the commercially more important fish species. Accessed 20 April 2012 from <http://www.fao.org/DOCREP/003/T0219E/T0219E05.htm>

Escape parameters	Value	Score	
F6.1 Escape Risk		2.00	
F6.1a Recapture and mortality (%)	0		
F6.1b Invasiveness		3.5	
<b>C6 Escape Final Score</b>		<b>2.00</b>	<b>RED</b>
Critical?	NO		

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

### Justification of Ranking

#### Assumptions

- Assume high exchange ponds and cages are high escape risk unless the standards require realistically effective prevention measures above industry norms.
- Assume worst case scenario species/location (e.g. non-native or heavily domesticated native)

### Factor 6.1a. Escape risk

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

Open net cages, even with best management practices, are deemed “high risk” production methods with respect to escapes. No evidence exists to support significant recapture or mortality of escapees, resulting in a score of 2 out of 10 for Factor 6.1.

Relevant Content of Standards	How we applied it
<b>Part B III 2.5.</b> Inlet and outlet of the farm shall be protected from invasion by wild fishes as well as from stock escaping. Net cages shall be secured by means of firm anchoring, strong net walls and a type of construction taking into account the prevailing conditions against damage and related escaping of stocks. <b>Part B I 1.1.</b> By selection of site and the method of management of the farm, the surrounding ecosystems shall not be adversely affected. In particular, negative impact caused by effluents as well as by escape of animals shall be prevented by adopting suitable preventive measures.	Score of 2 out of 10 because the initiative standards for the species in this assessment are specific to marine net cage farming which is considered a 'high risk' system. The initiative implies some best management practices to minimize escapes, however there is uncertainty as to how effective the management of escapes is.

### Recaptures and mortality

Relevant Content of Standards	How we applied it
No relevant standards	Scored zero

The recaptures and mortality score can improve the escape risk score. The final escape risk score (Factor 6.1) remains 2 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 used for non-native species

Relevant Content of Standards	How we applied it
2.1. As stock, species naturally occurring in the region shall be preferred. In particular, possibility for cooperation with regional breeding/conservation programs should be examined (e.g. autochthonous strains of Atlantic salmon, Adriatic trout species). The risk of escaping or introduction of species not naturally occurring in the region in open waters (e.g. by marketing as livestock) must be prevented.	Score of 2.5 because the standards suggest that all currently certified species must be native to the region of culture or fully established non-native species. Score of 2.5 is based on a fully established non-native species as a realistic worst case scenario.

Part B score is 2.5 out of 2.5.

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 1 out of 5 based on basic species life history (see scores in Appendix 1)

Part C score is 1 out of 5.

Final invasiveness (Factor 6.1b) score combines Part A or B, and Part C and is 3.5 out of 10.

The final score for Criterion 6 (Escapes) is 2 out of 10 (an explanatory score matrix can be found on page 30 of the assessment criteria).

## 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 Naturland Tropical Freshwater Fishes

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 (%)	0.00	
F6.2Xb Biosecurity of source/destination	10.00	
<b>C6 Escape of unintentionally introduced species Final Score</b>	<b>0.00</b>	<b>GREEN</b>

### 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 Content of Standards	How we applied it
International or transwaterbody movements of live fish or ova <b>Not addressed by initiative</b>	Assumed zero reliance on shipments of international or transwaterbody movements of live fish or ova

### Factor 6.2Xb Biosecurity of source/destination

Not relevant with zero shipment assumption

The final score for Factor 6.2X is a deduction of 0 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 Naturland Tropical Freshwater Fishes

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	
<b>C7 Disease; pathogen and parasite Final Score</b>	<b>4.00</b>	<b>YELLOW</b>
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”*

Relevant Content of Standards	How we applied it
<p>5. Health and hygiene</p> <p>5.1 The fishes' health has primarily to be ensured by prophylactic methods (e.g. the best management conditions, breeding, feeding). Nature healing methods are to be preferred where diseases do occur. Conventional medicines may only be applied if prescribed after diagnosis by a veterinary surgeon. In the case of tropical fish species, treatment with conventional veterinary medicines (e.g. antibiotics etc.) leads to the revocation of Naturland's certification for the affected stock.</p> <p>5.2. For the protection of net cages against growth of algae and colonization by invertebrates, environment-friendly methods shall be employed. Use of chemical "anti-fouling" agents is prohibited.</p>	<p>Score of 4 as a production system with biosecurity protocols in place but that it still open to introduction to local pathogens and parasites.</p>

The final score for Criterion 7 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 Naturland Tropical Freshwater Fishes**

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

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

### 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.

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

As all commercial tilapia production originates from hatcheries, 100% of the industry is said to be independent from wild stocks. The above assumption is realistic for tilapia and the score is 10 out of 10 because certified farms are considered to be independent of wild fisheries for juveniles or broodstock.

## 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  $\geq 6.6$  AND no individual criteria are Red (i.e.  $< 3.3$ )
- **Good Alternative** = Final score  $\geq 3.3$  AND  $< 6.6$ , OR Final score  $\geq 6.6$  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.

### Naturland Standards for Organic Aquaculture – Freshwater Fishes

Criterion	Score (0-10)	Rank	Critical?
C1 Data	8.61	GREEN	
C2 Effluent	6.00	YELLOW	NO
C3 Habitat	6.53	YELLOW	NO
C4 Chemicals	10.00	GREEN	NO
C5 Feed	7.40	GREEN	NO
C6 Escapes	2.00	RED	NO
C7 Disease	4.00	YELLOW	NO
C8 Source	10.00	GREEN	
3.3X Wildlife mortalities	-2.00	GREEN	NO
6.2X Introduced species escape	0.00	GREEN	
<b>Total</b>	<b>52.54</b>		
<b>Final score</b>	<b>6.57</b>		

#### OVERALL RANKING

Final Score	6.57
Initial rank	YELLOW
Red criteria	1
Final rank	YELLOW
Critical Criteria?	NO

FINAL RANK
<b>YELLOW</b>

## **Guiding Principles**

Seafood Watch™ defines sustainable seafood as originating from sources, whether fished<sup>3</sup> 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

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<sup>3</sup> “Fish” is used throughout this document to refer to finfish, shellfish and other invertebrates.

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

Food and Agriculture Organization. 1989. Yield and nutritional value of the commercially more important fish species. [Internet] Accessed 7 June 2012 from <http://www.fao.org/DOCREP/003/T0219E/T0219E00.HTM>

Food and Agriculture Organization of the United Nations. 2010. Aquaculture Feed and Fertilizer Resources Information System - Nile Tilapia Nutritional Requirements. Accessed 20 April 2012 from <http://affris.org/tilapia/nutri.php>

Tacon, A.G.J., and Metian, M. 2008. Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: Trends and future prospects. *Aquaculture* 285: 146-158

## 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	10	10
Predators and wildlife	yes	10	10
Chemical use	yes	10	10
Feed	yes	5	5
Escapes, animal movements	yes	5	5
Disease	yes	7.5	7.5
Source of stock	yes	7.5	7.5
Other – (e.g. GHG emissions)	No	n/a	n/a
<b>Total</b>			<b>77.5</b>

<b>C1 Data Final Score</b>	8.61	<b>GREEN</b>
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## Criterion 2: Effluents

### Factor 2.1a - Biological waste production score

Protein content of feed (%)	30
eFCR	1.7
Fertilizer N input (kg N/ton fish)	0
Protein content of harvested fish (%)	14
N content factor (fixed)	0.16
N input per ton of fish produced (kg)	81.6
N in each ton of fish harvested (kg)	22.4
<b>Waste N produced per ton of fish (kg)</b>	<b>59.2</b>

### Factor 2.1b - Production System discharge score

Basic production system score	0.8
Adjustment 1 (if applicable)	0
Adjustment 2 (if applicable)	0
Adjustment 3 (if applicable)	0
<b>Discharge (Factor 2.1b) score</b>	<b>0.8</b>

8

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?	No	0
3 - Do the control measures address or relate to the cumulative impacts of multiple farms?	No	0
4 - Are the limits considered scientifically robust and set according to the ecological status of the receiving water body?	Yes	1
5 - Do the control measures cover or prescribe including peak biomass, harvest, sludge disposal, cleaning etc?	Yes	1
		<b>3</b>

### 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

<b>F2.2 Score (2.2a*2.2b/2.5)</b>	<b>6</b>
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<b>C2 Effluent Final Score</b>	<b>6.00</b>	<b>YELLOW</b>
	Critical?	NO

## Criterion 3: Habitat

### 3.1. Habitat conversion and function

<b>F3.1 Score</b>	<b>7</b>
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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?	mostly	0.75
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?	mostly	0.75
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?	Yes	1
		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?	No	0
4 - Is the enforcement process transparent - e.g. public availability of farm locations and sizes, EIA reports, zoning plans, etc?	Yes	1
5 - Is there evidence that the restrictions or limits defined in the control measures are being achieved?	Yes	1
		4

<b>F3.2 Score (2.2a*2.2b/2.5)</b>	<b>5.60</b>
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<b>C3 Habitat Final Score</b>	<b>6.53</b>	<b>YELLOW</b>
Critical?		NO

### Exceptional Factor 3.3X: Wildlife and predator mortalities

<b>Wildlife and predator mortality parameters</b>	<b>Score</b>	
<b>F3.3X Wildlife and Predator Final Score</b>	<b>-2.00</b>	<b>GREEN</b>
Critical?	NO	

### Criterion 4: Evidence or Risk of Chemical Use

<b>Chemical Use parameters</b>	<b>Score</b>	
C4 Chemical Use Score	<b>10.00</b>	
<b>C4 Chemical Use Final Score</b>	<b>10.00</b>	<b>GREEN</b>
Critical?	NO	

### Criterion 5: Feed

#### 5.1. Wild Fish Use

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

Fishmeal inclusion level (%)	3
Fishmeal from by-products (%)	0
% FM	3
Fish oil inclusion level (%)	0
Fish oil from by-products (%)	0
% FO	0
Fishmeal yield (%)	22.5

Fish oil yield (%)	5
eFCR	1.7
FIFO fishmeal	0.23
FIFO fish oil	0.00
Greater of the 2 FIFO scores	0.23
<b>FIFO Score</b>	<b>9.43</b>

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

SSWF	-6
SSWF Factor	-0.136

<b>F5.1 Wild Fish Use Score</b>	<b>9.30</b>
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**5.2. Net protein Gain or Loss**

Protein INPUTS		
Protein content of feed	30	
eFCR	1.7	
Feed protein from NON-EDIBLE sources (%)	0	
Feed protein from EDIBLE CROP sources (%)	98	
Protein OUTPUTS		
Protein content of whole harvested fish (%)	14	
Edible yield of harvested fish (%)	37	
Non-edible by-products from harvested fish used for other food production	50	
Protein IN	36.71	
Protein OUT	9.59	
<b>Net protein gain or loss (%)</b>	<b>-73.8733</b>	
	Critical?	NO
<b>F5.2 Net protein Score</b>	<b>2.00</b>	

**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 (%)	3
eFCR	1.7
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
<b>Ocean area appropriated (ha/ton fish)</b>	<b>1.33</b>

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

Inclusion level of crop feed ingredients (%)	97
Inclusion level of land animal products (%)	0
Conversion ratio of crop ingredients to land animal products	2.88
eFCR	1.7
Average yield of major feed ingredient crops (t/ha)	2.64
<b>Land area appropriated (ha per ton of fish)</b>	<b>0.62</b>

<b>Value (Ocean + Land Area)</b>	<b>1.95</b>
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<b>F5.3 Feed Footprint Score</b>	<b>9.00</b>
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<b>C5 Feed Final Score</b>	<b>7.40</b>	<b>GREEN</b>
	Critical?	<b>NO</b>

**Criterion 6: Escapes****6.1a. Escape Risk**

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

**6.1b. Invasiveness****Part A – Native species**

<b>Score</b>	<b>0</b>
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**Part B – Non-Native species**

<b>Score</b>	<b>2.5</b>
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**Part C – Native and Non-native species**

<b>Question</b>	<b>Score</b>
Do escapees compete with wild native populations for food or habitat?	yes
Do escapees act as additional predation pressure on wild native populations?	yes

Do escapees compete with wild native populations for breeding partners or disturb breeding behavior of the same or other species?	yes
Do escapees modify habitats to the detriment of other species (e.g. by feeding, foraging, settlement or other)?	yes
Do escapees have some other impact on other native species or habitats?	no
	1

<b>F 6.1b Score</b>	<b>3.5</b>
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<b>Final C6 Score</b>	<b>2.00</b>	<b>RED</b>
	<b>Critical?</b>	<b>NO</b>

## Exceptional Factor 6.2X: Escape of unintentionally introduced species

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

## Criterion 7: Diseases

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

## Criterion 8: Source of Stock

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