ASC Tropical Marine Finfish Standard

2nd Draft for Public Consultation

August 2017

About The ASC

ASC is the acronym for Aquaculture Stewardship Council, an independent not for profit organisation. The ASC was founded in 2010 by the WWF (World Wildlife Fund) and IDH (The Sustainable Trade Initiative) to manage the global Standards for responsible aquaculture. ASC's Standards were first developed by the Aquaculture Dialogues, a series of roundtables initiated and coordinated by the WWF.

What the ASC is

The ASC's aquaculture certification programme and logo recognise and reward responsible aquaculture. The ASC is a global organisation working internationally with aquaculture producers, seafood processors, retail and foodservice companies, scientists, conservation groups, social NGO's and the public to promote the best environmental and social choice practices in aquaculture.

What the ASC does

Working with partners, the ASC runs a programme to transform the world's aquaculture markets by promoting the best environmental and social aquaculture performance. The ASC seeks to increase the availability of aquaculture products certified as sustainable and responsibly produced. The ASC's credible consumer logo provides third party assurance of conformity with production and chain of custody standards and makes it easy for everyone to choose ASC certified-products.

What the ASC will achieve

The ASC is transforming aquaculture practices globally through:

Credibility: Standards developed according to ISEAL guidelines, multi-stakeholder, open and transparent, science-based performance metrics.

Effectiveness: Minimising the environmental and social footprint of commercial aquaculture by addressing key impacts.

Added value: Connecting the farm to the marketplace by promoting responsible practices through a consumer logo.

OVERVIEW OF THE ASC SYSTEM

The ASC system is made up of 3 components:

1. Aquaculture Farm Standards

The ASC works with independent third-party certification organizations that provide certification services for aquaculture operations that grow one or more of the species for which the Standards have been developed by the Aquaculture Dialogues.

The species groups were chosen because of their potential impact on the environment and society, their market value and the extent to which they are traded internationally or their potential for such trade. The species covered include: abalone, bivalves (clams, oysters, mussels and scallops), cobia, freshwater trout, pangasius, salmon, Seriola, shrimp, and tilapia.

Through the Aquaculture Dialogues more than 2,200 people have participated in the development of the ASC Standards including fish farmers, seafood processors, retailers, foodservice operators, NGOs, government agencies and research institutes. Universal, open and transparent, the Aquaculture Dialogues focused on minimising the key environmental and social impacts of aquaculture. Each Dialogue produced standards for one or a range of major aquaculture species groups. The Standard creation process followed guidelines of the ISEAL Alliance the *ISEAL Code of Good Practices for Setting Social and Environmental Standards*. This code of good practice complies with the ISO/IEC Guide 59 *Code of good practice for standardization*, and the WTO Technical Barriers to Trade (TBT) Agreement Annex 3 *Code of good practice for the preparation, adoption and application of standards*. The Standards are science-based, performance-based and metrics-based and will apply globally to aquaculture production systems, covering many types, locations and scales of aquaculture operations.

2. Independent 3rd Party Audits Conducted by accredited Conformity Assessment Bodies (CAB)

Farms that seek ASC certification hire a CAB (conformity assessment body) that has been accredited by Accreditation Services International GmbH. (ASI). Only farms that are certified by a CAB accredited by ASI are eligible to sell certified product into a recognized chain of custody and have that product eligible to carry the ASC logo.

Accreditation is the process by which CABs are evaluated to determine their competency to provide certification to the ASC Standards. The accreditation process includes annual evaluations of each accredited CAB and the ASC audits they perform. ASC has exclusively appointed ASI to provide accreditation services for ASC. ASI is fully independent of ASC. ASI is based in Bonn, Germany and also provides accreditation services to several standard-holding organisations, like Forest Stewardship Council (FSC) and Marine Stewardship Council (MSC). Despite similar sounding names, all of these organizations are independent of ASC.

ASI is responsible for evaluations of CABs against the requirements in this document. All accreditation decisions are taken independently by ASI. The independence of ASC, ASI and

the CAB ensures that high quality; objective audits and certification decisions are performed without bias for all clients around the world.

3. MSC Chain of Custody Certification and the ASC logo

The ASC logo has been developed for use by certified and licensed farms, processors and distributors so that all parts of the value chain and especially consumers can easily identify ASC certified product(s). The use of the ASC logo can be applied only to products that are sold through a consecutive, certified chain of custody that ensures traceability of certified products from production to final point of sale. For ASC, chain of custody is certified through application of the MSC chain of custody system, to which ASC CoC requirements have been added as a scope, to ASC certified aquaculture products. Only products that originate in ASC certified farms and are sold through an MSC certified chain of custody (with ASC CoC scope) are eligible to carry the ASC logo.

Just as with the ASC Standards, the ASC logo is owned by ASC which regulates all aspects of its use.

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INTRODUCTION

Seafood is one of the most popular sources of protein worldwide. By volume, more than half of the seafood we eat is from aquaculture, the fastest-growing animal protein production sector in the world.

As with many rapidly growing industries, the growth in aquaculture production has raised concerns about negative social and environmental impacts related to farming, such as impacts on water quality, fish health and labor practices at farms. Although some businesses are addressing these issues well, many others are not.

One tool to help encourage more responsible aquaculture is the development of global standards—performance levels that must be reached to help minimize or eliminate a set of key impacts. Once established, standards can serve as the basis for new certification programs or can be incorporated into existing programs. New standards can also be used to benchmark existing standards, adopted by government programs, and inform purchase and investment decision making.

Preamble

The principles contained in this document serve as a platform to minimize or eliminate the social and environmental impacts of tropical marine finfish aquaculture while permitting the industry to maintain economically viability. These principles—along with the corresponding criteria, indicators and requirements—are applicable at the farm level. Farms must meet 100 percent of the requirements in this document to achieve certification.

Although these standards represent farm-level requirements, they are intended to help protect and maintain ecosystem function and ecosystem services in tropical marine finfish producing areas, with the recognition that aquaculture operations are not solely responsible for total ecosystem health. The ASC Tropical Marine Finfish Standard is intended to be revisited and updated periodically (e.g., every three to five years) to ensure that the requirements are based on the best available scientific knowledge and management practices and to encourage continuous improvement.

How to read this document

In the following pages, tables with indicators and their corresponding requirements are included. Within each criterion, requirements tables are followed by a rationale section that provides a brief overview of why the issues are important and how the proposed standards address them.

Definitions are provided in footnotes.

PURPOSE AND SCOPE OF THE TROPICAL MARINE FINFISH STANDARD

Purpose of the Standard

The goal of the Tropical Marine Finfish Standard is to credibly set out comprehensive and measurable performance-based requirements that minimize or eliminate the key negative environmental and social impacts of fish farming, while permitting the industry to remain economically viable.

The increasing global demand for readily available sources of animal protein relies more and more on aquaculture. In 2014, human consumption of farmed fish overtook that of wild fish for the first time[1].

This trend in farmed fish consumption underlines the ASC's mission to transform aquaculture to become more environmentally sustainable and socially responsible.

Being a market-based program, an important consideration in creating standards for new species is the market demand for them. Since the launch of the ASC, many requests for the development of new standards have been received; particularly for tropical marine finfish species.

Scope of the Standard

Issue areas of tropical marine finfish aquaculture to which the standards apply

This standard establishes principles, criteria, indicators and measurable performance levels for responsible tropical marine finfish aquaculture with regard to social and environmental issues. The areas of key potential negative impact that have been identified are: impacts on biodiversity, feed use, benthic impacts and siting, disease and parasite transfer, chemical inputs and social impacts (i.e., labor and community impacts). It is recognized that there is overlap within the impact areas and the principles. The full suite of requirements is intended to address the range of potential negative impacts, focusing on key potential impacts of the hatchery and grow-out stages of production.

Range of activities within aquaculture to which the standards apply

Aquaculture is the production of aquatic organisms. It involves the planning, development and operation of facilities, which in turn affect the inputs, production, processing and chain-of-custody components. The ASC Tropical Marine Finfish Standard applies to the planning, development and operation of hatcheries and grow-out systems. The focus of the requirements in this standard is on production and the immediate inputs to production.

Biological and geographic scope to which the standards apply

[1] Food Outlook, FAO 2015

The ASC Tropical Marine Finfish Standard is applicable to all species in the genera *Epinephelus, Mycteroperca, Lutjanus, Trachinotus, and Lates* (Grouper, Snapper, Barramundi, and Pompano) and in all regions globally where these fish are cultured.

Unit of certification to which the standards apply

The unit of certification is a farming site, which in practice means a cluster of cages located together in an operational unit or a land based system using a common facility. A farm must comply with all the requirements in this document to be certified, including providing required documentation from their feed suppliers. The standard does not focus on other areas of the supply chain, for instance transport, processing or distribution.

PROCESS FOR CREATING THE STANDARD

General Considerations

The process of setting requirements is critical, as it significantly affects the credibility, viability, practicality and acceptance of the ASC Tropical Marine Finfish Standard. The process of creating the ASC Tropical Marine Finfish Standard aimed to be multi-stakeholder, open to anybody to participate, and transparent. This is in line with the International Social and Environmental Accreditation and Labelling (ISEAL) Alliance's "Code of Good Practice for Setting Social and Environmental Standards". This has allowed the process to remain transparent, open to public participation, and engage multiple key stakeholders.

Standard Setting Process

Almost 100 stakeholders including producers, civil society organizations (CSOs), seafood buyers, scientists and academics and government representatives have participated in the creation of the Tropical Marine Finfish Standard (TMFF) to this point though a regionally focused Aquaculture Dialogue (A`D) process. The TMFF AD is a science-based forum initiated by World Wildlife Fund (WWF) in 2013. The "regional" nature of this AD process recognizes the geographic extent of the farming of these species, which does not require a more extensive global dialogue as was the case with several other species. In 2016, an 'interim' Technical Advisory Group (TAG) was formed to manage the TMFF Standards development process. The TAG included representatives from grouper and barramundi farming operations, CSOs, scientists and feed manufacturers.

It is envisaged that the TMFF AD will continue to be iterative, participatory process designed to identify key negative environmental and social impacts of production of tropical marine finfish and build agreement on principles, criteria, indicators and requirements that address the impacts.

The steps in the process are described below:

- In early-2013, WWF approached the ASC with a request for their endorsement to develop a regionally applicable Standard for Grouper and Snapper. That endorsement was forthcoming.

- In October 2013, under the leadership of WWF the inaugural meeting of the Grouper, Snapper & Barramundi[2] Aquaculture Dialogue (GSBAD) was held in Penang, Malaysia (October 8-10, 2013) to discuss the development of standards for responsible farming of these species. For a list of meeting participants see Appendix 3.

- Draft principles were presented and discussed at this meeting, with GSBAD participants initially approved eight (8) Principles before agreeing to reduce this to seven (7) key environmental and social impacts associated with aquaculture of these species[3]. Limited agreement was reached at this meeting on the main Criteria, Indicators and Requirements associated with each Principle.

- Although an early draft of the Standard was compiled in January of 2014, there were significant challenges with regards funding and administrative capacity for the GSBAD; with the result being the GSB Draft Standard remained in abeyance for more than eighteen (18) months.

- A joint decision by WWF and the ASC was made to further delay advancing this GSBAD during 2015 due to the ASC's Standards 'harmonization' program and ongoing capacity constraints

- In mid-2016, it was agreed between WWF and the ASC that the ASC would take lead technical responsibility for advancing the GSB Standard with WWF managing the stakeholder engagement process.

- Between August and October, 2016, an 'interim' Technical Advisory Group (TAG) was formed with the objective of updating the early draft and to ready that draft Standard for release for public comment. (For a list of TAG participants see Appendix 4).

- In December of 2016, the TAG convened in Bali, Indonesia for a 3-day meeting (December 12-15, 2016) producing draft Criteria, Indicators and Requirements for each Principle for the Tropical Marine Fin-Fish Standard[4]. Draft Indicators and Requirements

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[2] Following discussions on Day 1 it was proposed and agreed by the meeting attendees to expand the scope of the dialogue to also include Asian Sea Bass or Barramundi (*Lates Calcarifer*).

[3]Original eighth principle "Develop Corporate Initiatives To Be A Good Neighbour And Conscientious Citizen" removed.

[4] At this meeting it was proposed and agreed by the meeting attendees to rename the Grouper Snapper Barramundi Standard the Tropical Marine Fin Fish Standard. It was further agreed to increase the scope of the TMFF aquaculture dialogue to also include Pompano (*Trachinotus spp.)*

have been further refined via phone and email communication with the TAG during the period February through May, 2017

- On May 31st, 2017, a first draft of the standard will be posted for a 30 day public comment period. Feedback and comment received during the comment period will be used by the TAG to revise the standard document. The document will then be posted for a second public consultation period as required by the ISEAL Code of Good Practice for Setting Social and Environmental Standards.

PRINCIPLES, CRITERIA, INDICATORS AND REQUIREMENTS

This section of the document contains the full suite of principles, criteria, indicators and requirements for responsible tropical marine finfish farming at saltwater/brackish grow-out sites (both ponds and sea-cages).

PRINCIPLE 1: COMPLY WITH ALL APPLICABLE NATIONAL LAWS AND LOCAL REGULATIONS

Principle 1 is intended to ensure that all farms aiming to be certified against the ASC Tropical Marine Finfish Standard meet their legal obligations as a baseline requirement. Adhering to the law will ensure that producers meet the basic environmental and social requirements and the minimal basis, such as legitimate land tenure rights, on which the effectiveness of the requirements will stand.

Criterion 1.1 Compliance with all applicable local and national legal requirements and regulations

INDICATOR	REQUIREMENT
1.1.1 Documents demonstrating compliance with all relevant local and national laws and regulations	Yes
1.1.2 Documents demonstrating compliance with all tax laws	Yes
1.1.3 Documents demonstrating compliance with all labor laws and regulations	Yes
1.1.4 Documents demonstrating compliance with regulations and permits concerning water quality impacts	Yes

Rationale- Aquaculture operations must, as a baseline, adhere to the national and local laws of the regions where production is taking place. Farm operations that, intentionally or unintentionally, break the law violate a fundamental benchmark of performance for certified

farms. It is important that aquaculture operations demonstrate a pattern of legal and responsible behavior, including the implementation of corrective actions for any legal violations.

PRINCIPLE 2: CONSERVE NATURAL HABITAT, LOCAL BIODIVERSITY AND ECOSYSTEM STRUCTURE AND FUNCTION

Principle 2 is intended to address potential impacts from tropical marine finfish farms on natural habitat, local biodiversity and ecosystem function. Specifically, the key impact areas of benthic impacts, siting, effects of chemical inputs and effects of nutrient loading are addressed within this principle.

Criterion 2.1 Benthic biodiversity and benthic effects[5]

INDICATOR	REQUIREMENT
2.1.1 Redox potential or total 'free' sulphide levels in sediment immediately outside of the Allowable Zone of Effect (AZE)[6] attributed to farm operations	Redox potential > 0 millivolts (mV) OR Sulphide ≤ 1,500 microMoles / l OR No significant change[7] in redox potential or total 'free' sulphide levels in sediment at the edge of the AZE in comparison to control sites

[5] Three benthic samples shall be taken at the edge of the AZE downstream from the predominant current and three samples shall be collected at control sites 100-1000m from the edge of the cage array with similar water depth and substratum as found on the farm.

[6] Allowable Zone of Effect (AZE) is defined under this standard as 25 meters. For farm sites where a site-specific AZE has been defined using a robust and credible modeling system such as the SEPA AUTODEPOMOD and verified through monitoring, the site-specific AZE shall be used.

[7] Significance measured at a 95% confidence interval.

2.1.2 Benthic faunal index score (Choosing a suitable benthic index to the composition of the benthos being sampled)	AZTI Marine Biotic Index (AMBI[8]) score ≤ 3.3, or Shannon-Wiener Index score > 3, or Benthic Quality Index (BQI) score ≥ 15, or Infaunal Trophic Index (ITI) score ≥ 25 OR No significant change in benthic faunal index scores at the edge of the AZE in comparison to control sites

Rationale- Technical experts agree that the chemical proxy of redox potential and sulphide levels are good chemical indicators for benthic health. Given that both methods are valid, audited farms can choose their preference for one or the other. When considering benthic effects, experts recommended measuring effects at the edge of the AZE and away from the cages, at control sites of similar depth, sediment, and environmental parameters. Though an AZE is difficult to identify as a constant, experts discuss this in terms of 25 meters to 125 meters depending on a range of factors, including currents. In an effort to take a precautionary approach to permissible zone of benthic impact, the ASC Tropical Marine Finfish Standard defines the AZE as a distance of 25 meters from the cage array. For sites where a site-specific AZE has been determined using a valid modeling and video surveillance system, farms will use the site-specific AZE and sampling stations based on actual depositional patterns. Potential negative impacts on benthic biodiversity are also addressed in the ASC Tropical Marine Finfish Standard through the incorporation of an analysis of benthic faunal index at the edge of the AZE in comparison to control sites.

Criterion 2.2 Water quality

INDICATOR	REQUIREMENT
2.2.2 Weekly average percent saturation[9] of dissolved oxygen (DO)[10] on farm	≥ 50%

[8] http://www.azti.es/en/ambi-azti-marine-biotic-index.html.

[9] Percent saturation: Percent saturation is the amount of oxygen dissolved in the water sample compared to the maximum amount that could be present at the same temperature and salinity.

[10] Averaged weekly from two daily measurements (proposed at 6 am and 3 pm).

2.2.3 Maximum percentage of weekly samples from 2.2.2 that fall under 2 mg/liter DO	5%

Rationale- Water quality is essential for the health of farmed fish and wild species surrounding a farm. One component of water quality, dissolved oxygen (DO), is particularly critical for the survival and good performance of farmed finfish. As a result, most farms regularly measure DO. DO levels (in mg/l) naturally fluctuate in the environment. This is due to a range of factors, including temperature, time of day and upwelling of oxygen-poor waters from deep in the ocean. Low DO levels can also be a sign of excessive nutrient loading. DO provides a useful overall proxy for a water body's ability to support healthy biodiversity and supplements the benthic indicators that will also pick up excessive nutrient loading. Measuring DO as a percent saturation takes into account salinity and temperature at the farm site. Additionally, compliance with the requirement will limit the number of low DO readings in the water column below 2 mg/lt to less than a 5 percent incidence rate, which will allow for periodic physical phenomena, such as upwelling.

Criterion 2.3 Interaction with critical or sensitive habitats and species

INDICATOR	REQUIREMENT
2.3.1 Evidence of an assessment of the farm's potential impacts on biodiversity and nearby ecosystems undertaken by an independent 3rd party that contains at a minimum: a) identification of proximity to critical, sensitive or protected habitats[11] and species, b) description of the potential impacts the farm might have on biodiversity, with a focus on affected habitats or species, and c) a description of strategies and current and future programs underway to eliminate or minimize any identified impacts the farm might have	Yes

[11] Specific geographic areas that contain features essential to the conservation of an endangered or threatened species and that may require special management and protection

2.3.2 Allowance for the farm to be sited in a protected area[12] or High Conservation Value Areas[13] (HCVAs)	None[14]

[12] Protected area: "A clearly defined geographical space, recognized, dedicated and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." Source: Dudley, N. (Editor) (2008), Guidelines for Applying Protected Area Management Categories, Gland, Switzerland: IUCN. x + 86pp.

[13] High Conservation Value Areas (HCVA): Natural habitats where conservation values are considered to be of outstanding significance or critical importance. HCVA are designated through a multi-stakeholder approach that provides a systematic basis for identifying critical conservation values—both social and environmental—and for planning ecosystem management in order to ensure that these high conservation values are maintained or enhanced (http://www.hcvnetwork.org/).

[14] The following exceptions shall be made for Standard 2.3.2:

- For protected areas classified by the International Union for the Conservation of Nature (IUCN) as Category V or VI (these are areas preserved primarily for their landscapes or for sustainable resource management).
- For HCVAs if the farm can demonstrate that its environmental impacts are compatible with the conservation objectives of the HCVA designation. The burden of proof would be placed on the farm to demonstrate that it is not negatively impacting the core reason an area has been identified as a HCVA.
- For farms located in a protected area if it was designated as such after the farm was already in operation and provided the farm can demonstrate that its environmental impacts are compatible with the conservation objectives of the protected area and it is in compliance with any relevant conditions or regulations placed on the farm as a result of the formation/designation of the protected area. The burden of proof would be placed on the farm to demonstrate that it is not negatively impacting the core reason an area has been protected.

2.3.3 Allowance for siting in mangrove ecosystems[15] and other natural wetlands[16]	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 of at least 50% of the affected ecosystem.[17]

Rationale-The intent of the requirements under criterion 2.3 is to minimize the effects of fish farms on critical or sensitive habitats and species. The habitats and species to consider include marine protected areas or national parks, established migratory routes for marine mammals, threatened or endangered species, the habitat needed for endangered and threatened species to recover, eelgrass beds and High Conservation Value Areas (HCVAs) (as defined by a credible, multi-stakeholder internationally recognized process). These requirements are consistent with normal environmental assessment requirements in most jurisdictions.

The requirements under criterion 2.3 ensure a farm is aware of any nearby critical, sensitive or protected areas, understands the impacts it might have on those areas, and has a functioning

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[15] **Mangrove Ecosystems:** Mangrove forests are among the world's most productive ecosystems. These are often called 'tidal forests', 'coastal woodlands' or 'oceanic rainforests'. Mangroves are woody plants that grow in tropical and subtropical latitudes along the land-sea interface, bays, estuaries, lagoons, backwaters, and in the rivers, reaching upstream up to the point where the water still remains saline (Qasim, l998). These plants and their associated organisms (microbes, fungi, other plants and animals), constitute the 'mangrove forest community' or 'mangal' (See Tomlinson PB (1986) The Botany of Mangroves. Cambridge, UK: Cambridge University Press. 413 p. for full list of true and associate mangrove plant species) The mangal and its associated abiotic factors constitute the mangrove ecosystem (Kathiresan and Bingham, 2001).

[16] **Natural Wetland:** For the purpose of this standard, natural wetlands are non-artificial (i.e. not human made) areas of marsh, fen, peatland or water, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres. They may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands'. Ramsar Wetland Definition (Ramsar, Iran, 1971), Classification and Criteria for Internationally Important Wetlands. Under the Convention on Wetlands, 'wetlands' are defined by Articles 1.1 and 2.1).

[17] Consideration of local government programs for restoration and their effectiveness is advised. Mangrove areas preserved within the farm can be considered as part of the compensation (e.g. if a farm has 2ha, but they kept 1ha with mangroves inside the farm, they can be considered in compliance).

plan in place to mitigate those potential impacts. They also ensure that extra care is taken in areas that are recognized for ecological importance through designation as a protected area. It would not allow production in these areas to be eligible for certification, unless compatible with the conservation goals of the area.

Criterion 2.4 Interaction with wildlife, including predators

INDICATOR	REQUIREMENT
2.4.1 Submerged acoustic deterrent devices	Not allowed
2.4.2 Number of mortalities[18] of endangered or red-listed[19] animals in the farm lease area and adjacent areas due to farm operations, personnel or associates over the previous 2 years	0
2.4.3 Allowance for intentional lethal action against predators/wildlife on the farm site	None, unless human safety is immediately threatened
2.4.4 All lethal incidents are recorded and categorized	Yes
2.4.5 In the event of any lethal incident, evidence that an assessment of the probability of lethal incident(s) has been undertaken and demonstration of concrete steps taken by the farm to reduce the risk of future incidences	Yes

[18] Mortalities: includes animals intentionally killed through lethal action as well as accidental deaths through entanglement or other means.

[19] Species listed as endangered or critically endangered by the IUCN or on a national endangered species list.

Rationale-Scientific literature[20] about the use of acoustic deterrent devices (ADDs), also known as acoustic harassment devices, to deter predators from marine aquaculture facilities show three main conclusions. First, ADDs have been demonstrated to damage the hearing capability of marine mammals (target and non-target species). Second, they have been demonstrated to force a change in the natural feeding or breeding behavior of some marine mammals. And, third, over time and with regular use, ADDs begin to act as an incentive that actually attracts rather than deters the target species (e.g., seals) from the aquaculture facilities. Therefore, submerged ADD use is not allowed under these requirements.

While every effort should be made to avoid lethal action and to take appropriate measures prior to any lethal action, the safety of workers should not be compromised. In an instance where worker safety is at immediate risk, lethal actions are allowed under this standard. However, 2.4.5 mandates that adaptive management fully investigate the reasons for lethal incidents, and therefore the farm should fully analyze the reasons why human safety was compromised, and put in place measures to prevent such risks recurring.

Criterion 2.5 Pond Effluents[21]

INDICATOR	REQUIREMENT
2.5.1 Biological oxygen demand (BOD)	≤ 30 mg/l average and no higher than 50
2.5.2 Total suspended solids	≤ 30 mg/l average and no higher than 50

[20] Fjalling, A, Wahlberg, M and Westerberg H, 2006 Acoustic harassment devices reduce seal interaction in the Baltic Salmon-trap, net fishery, ICES Journal of Marine Science: Volume 63, Number 9 pp. 1751-1758.

B.C. Government, 1997, The environmental risks of salmon aquaculture, pp. 35-37 and Cox, TM, Read A.J., Solow, A, Tregenza, N, 2001, Will harbor porpoises (Phocoena, phocoena) habituate to pingers, J. Cetacean Res. Manage 3(1) 81-86.

[21] Applicable to pond culture systems only. Samples should be taken at the point source 2 hours after feeding, at least once per month. Farm must accumulate 6 months of data before initial site visit/farm audit

2.5.3 Total Ammonia Nitrogen	≤ 1 mg/l average and no higher than 1.5
2.5.4 Evidence that all non-dietary chemicals used on the farm that are discharged to effluent are recorded and quantified	Yes

Rationale- There are a number of pollutants associated with discharges from aquaculture facilities. Fish farms can have high concentrations of suspended solids and nutrients, high BOD and low dissolved oxygen levels. Organic matter is discharged primarily from feces and uneaten feed. Metals, present in feed additives or from the deterioration of production equipment, may also be present in aquaculture wastewater. Effluents with high levels of suspended solids, when discharged into receiving waters, can have a detrimental effect on the environment. Suspended solids can degrade aquatic ecosystems by increasing turbidity and reducing the depth to which sunlight can penetrate, thus reducing photosynthetic activity. Suspended particles can damage fish gills, increasing the risk of infection and disease. Nutrients are discharged mainly in the form of nitrate, ammonia and organic nitrogen. Ammonia causes two main problems in water. First, it is toxic to aquatic life. Second, it is easily converted to nitrate which may increase plant and algae growth.

Some substances, like drugs and pesticides, that may be present in the wastewater may be introduced directly as part of the production process. An important source of the pollutants potentially present in aquaculture wastewater is the feed used on fish farms. Feed used at aquaculture facilities contributes to pollutant discharges in a number of ways: by-product feces, ammonia excretions and, most directly, as uneaten feed (in dissolved and particulate forms). Moreover, the feed may be the vehicle for introducing other substances into the wastewater, like drugs. For example, medicated feed may introduce antibiotics into the wastewater.

Criterion 2.6 Sludge Disposal and Salinization of Freshwater and Soil Resources

INDICATOR	REQUIREMENT

2.6.1 Evidence that sludge is not discharged directly into receiving waters or natural ecosystems[22]	Yes
2.6.2 Specific conductance or chloride concentration of sludge prior to disposal outside the farm	The specific conductance or chloride concentration values must not exceed those of the soil in the disposal area.
2.6.3 Allowance for discharging saline water to natural freshwater bodies.[23]	None
2.6.4 Water-specific conductance or chloride concentration in freshwater wells used by the farm or located on adjacent properties.[24]	For all freshwater wells (identified prior to full assessment), specific conductance may not exceed 1,500 mhos per centimeter and/or chloride concentration may not exceed 300 milligrams per liter[25]

[22] Proper disposal includes delivery to a regulated or dedicated landfill or farmers may re-use the sludge. Evidence of the re-use needs to be available for the audit process. Examples of re-use methods allowed by the standards are, as fertilizer or soil conditioner for the production of agriculture crops as landfill and other construction-related uses.

[23] Surface freshwater bodies adjacent to farm property or receiving waters discharged from the farm. Freshwater is characterized by a specific conductance of less than 1,500 µmhos per centimeter and a chloride concentration of less than 300 milligrams per liter. These values correspond to salinity inferior to 1 ppt. Farms that can demonstrate that surrounding waters and soils have a salinity of 2 and above using a hand-held refractometer will not be required to provide measurements of conductance or chloride concentration. Water bodies displaying freshwater conditions only during the peak rainy season are considered as brackish water bodies under these standards.

[24] Exceptions are made if it can be demonstrated that seawater intrusion or other phenomenon outside the control of the farmer is responsible for the increase.

[25] Specific conductance or chloride concentration must be monitored at a frequency adapted to possible fluctuations because of natural factors such as rain regime, and comparisons with first-year values.

2.6.5 Soil-specific conductance or chloride concentration in adjacent land ecosystems and agricultural fields. [26]	No net increase when compared to the first year of monitoring.

Rationale- Aquaculture ponds can contain saline water and, if located above freshwater aquifers, infiltration through bottom soil may cause groundwater salinization (Boyd et al. 2006). Lateral seepage beneath or through pond embankments can also cause soil and surface water salinization near farms. All ponds seep to a certain extent; however, some seep worse than others. A literature review found that normal seepage from aquaculture ponds did not exceed 20 centimeters per month (Boyd 2009).

Farms must not extract freshwater from underground sources to dilute salinity in ponds due to the important volumes of freshwater that would be used for such activities. In coastal areas, pumping fresh groundwater can depress the water table, allowing saltwater to intrude into aquifers (Anonymous 1993). Salinization of freshwater aquifers can interfere with water supplies and, in the case of shallow aquifers, cause crop root damage. In addition, land subsidence can result from excessive pumping of groundwater (Chen 1990).

The release of effluents can cause salinization in surface freshwater bodies and non-saline soils near farms. Saline water should not be released in natural freshwater bodies. Many farms, especially those using intensive culture methods, accumulate sediments in ponds and canals, which are mechanically removed at times. Sediment disposal sites can cause salinization of surface water if rainfall leaches salts from them and runoff enters freshwater bodies (Boyd et al. 1994). Saline runoff can also flow onto non-saline soil areas causing salinization of surface soil. Water from sediment disposal areas can infiltrate and lead to the salinization of freshwater aquifers. Dry sediments can be used for landfill or disposed of by being spread in agricultural areas, provided the salt content of sediment is not higher than in the soil of the disposal site.

This standard requires monitoring of chloride concentration or specific conductance levels in soil (including sediment disposal sites), surface water and groundwater near fish farms, as an increase will indicate salinization has taken place. Historical data on either will often not be available; thus, the first values taken at the onset of the certification program will serve as the reference point for each site.

[26] Soil salinity must be measured 25 meters within adjacent land ecosystems and agricultural fields every six months. If salt contamination is detected at the 25-meter station, the monitoring could be extended further out as necessary. No progressive increase of specific conductance or chloride concentration should be observed over the years when compared to the first year of monitoring.

PRINCIPLE 3: PROTECT THE HEALTH AND GENETIC INTEGRITY OF WILD POPULATIONS

The intention of Principle 3 is to ensure that farms do not harm the health, genetic make-up and biodiversity of wild aquatic populations. This principle addresses impacts associated with escapes, introduction and cultivation of exotic and transgenic species and the collection of wild fingerlings. When species are introduced into an area they may cause increased predation and competition, disease, habitat destruction, genetic stock alterations and in some cases, extinction. A proper assessment of the potential risks is therefore desirable.

Criterion 3.1 Culture of non-native species

INDICATOR	REQUIREMENT
3.1.1 Culture of a non-native species (excluding inter-species hybrids)	None, unless commercial[27] farming of the species already occurs in the region at time of the first publication of the ASC Tropical Marine Finfish Standard, or a closed land-based production[28] system with *de minimis*[29] risk of escapes and/or pest and pathogen transfer to wild populations is used

Rationale- Accidental or intentional introductions of non-native species is a significant global environmental problem. Aquaculture is considered one of the major pathways for introducing non-native aquatic plants and animals that may become harmful invasive species. These requirements are in line with the FAO guidelines that permit the culture of non-native species only when they pose an acceptable level of risk to biodiversity. This Standard does not permit introductions of non-native species, unless farming of the species already occurs in the area at the time of the adoption of the Standard by the ASC, or a closed production system is used.

The use of alternatives to chemical treatments for farm management, such as the use of cleaner fish for sea lice control in salmon, is permitted and encouraged. However, any wrasse, cleaner fish or other species used for management during production must be native species in order to prevent introduction of new species area.

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[27] Commercial: if a species is cultured as part of a permitted research trial, it will not be considered an existing commercial operation. Generally, research trials will contain no more than one pen of an experimental species.

[28] Land-based systems must not directly discharge into the receiving water body.

[29] The cultured fish must not become established as a result of escapes.

Criterion 3.2 Introduction of transgenic species

INDICATOR	REQUIREMENT
3.2.1 Culture of transgenic fish	Not permitted

Rationale-Transgenic fish are not permitted under this standard because of concerns about their unknown impact on wild populations.

Criterion 3.3 Escapes

INDICATOR	REQUIREMENT
3.3.1 Evidence of escape prevention planning and related employee training, including: net strength testing; appropriate net mesh size; net traceability; system robustness; predator management; record keeping and reporting of risk events (e.g., holes, infrastructure issues, handling errors, reporting and follow up of escape events); and worker training on escape prevention and counting technologies	Yes
3.3.2 Accuracy of the counting technology or counting method used for calculating stocking and harvest numbers[30]	≥ 98%
3.3.3 Allowance for more than three (3) escape events of 30% or more (cumulative total fish not recovered) within any 10-year period	None
3.3.4 Number of known escapes is documented and made publically available upon request	Yes

[30] Accuracy shall be validated and documented (e.g. frequency of hand counts)

Rationale- A conservative approach demands that conscientious fish farmers strive to minimize the number of escapes of farmed cultured fish. Escapes can occur in large events that are immediately noticeable at a farm, smaller events that are still noticeable, and through slower, lower levels of losses of fish that might go unnoticed. The standard mandates strict requirements for net pen maintenance and escape procedures while also requiring farms to collect data on stocking and recovery. The standard also sets mass escape requirements, in order to prevent the certification of farms that allow mass escapes more than three times over a ten year period. The requirements require transparency about unexplained losses to help the farm and the regulators understand trends related to the cumulative numbers of lost fish that go unnoticed during production.

Criterion 3.4 Source of fingerlings/seed-stock[31]

INDICATOR	REQUIREMENT
3.4.1 Evidence that purchased or collected wild fingerlings are harvested from a source fishery with a public fishery assessment, for example FishSource or is in a credible fishery improvement process (FIP) moving towards an ISEAL compliant fisheries sustainability certification scheme	Yes
3.4.2 Traceability of wild or hatchery purchased or collected fingerlings to their source	Yes
3.4.3 The seed supplier has a documented fish health and bio-security protocol or a comparable 3rd party certificate	Yes

[31] This standard defines seed/fingerling as entering an ASC certified farm to be ≤ 50g unless they come from and ASC certified farm/facility. A farm seeking certification would need to demonstrate through documentation that its fingerling or seed suppliers have met ASC requirements.

3.4.4 The receiving facility[32] has a documented bio-security protocol, including quarantining, with respect to purchased or collected fry/fingerlings	Yes
3.4.5 All trans-national imported seed must be accompanied by documentation required by importing countries (e.g. health certificate)	Yes
3.4.6 Responsible disposal of deformities (e.g. scoliosis, lordosis, dropjaw)	Yes

Rationale-The use of wild fingerlings for culture is acceptable, however they need to be from a well-managed sustainable source. Currently there is only one ISEAL compliant credible fisheries certification scheme (MSC). However, in the future there may be others. Because some of these source fisheries may not have all the data available immediately or there may not be appropriate conditions to drive certification of a seed fishery, the standard also accepts source fisheries with a public assessment such as 'FishSource' or fisheries in a credible fishery improvement process (FIP) moving towards an ISEAL compliant sustainability certification scheme. Farmers also need to be able to prove the traceability of their wild caught or hatchery reared fingerlings from the source fishery or hatchery.

Biosecurity measures reduce the risk of disease transmission to the wild and between farms. These requirements aim to ensure that farms don't harm the health of wild populations by amplifying or spreading disease. It is recognized that disease flow is bidirectional between farmed and wild fish, and these requirements aim to minimize effect of disease transmission and retransmission.

Criterion 3.5 Broodstock Management

INDICATOR	REQUIREMENT
3.5.1 Allowance for wild harvest of broodstock of IUCN red-listed species	None

[32] The receiving facility includes private and/or government-run quarantine facility

3.5.2 Documented procedures are in place to limit non-controlled spawning of broodstock and evidence that these procedures are being followed	Yes

Rationale- Genetic diversity is an important conservation issue, as farmed fish have the potential to negatively impact the genetic diversity of wild populations through interbreeding. Genetic changes in captive bred or hatchery populations are likely in any stock of fish that is bred in captivity over several generations. Captive breeding may result in the mixing of genetically distinct stocks which may lower overall genetic diversity and reduce survival. Introducing a different strain of the same species (i.e., a population which is genetically different but still belonging to the same species) would therefore pose the risk of the different strain having an impact on the ecosystem. Hatcheries should therefore take all precautions necessary to limit uncontrolled spawning of their captive broodstock.

There is concern that the use of wild-caught seed or wild collections of juveniles can lead to adverse impacts (e.g., decline) on wild fish populations. Therefore the harvest of wild-caught broodstock of threatened or endangered species is not allowed.

PRINCIPLE 4: USE RESOURCES IN AN ENVIRONMENTALLY EFFICIENT AND RESPONSIBLE MANNER

The culture of marine fish requires the use of resources including feed inputs (e.g., wild-forage fisheries, terrestrial plant and animal protein), non-therapeutic chemical inputs and consumables (e.g., building supplies and fuel), etc. Extraction, production and/or consumption of these resources have the potential to negatively impact marine and terrestrial ecosystems. For marine finfish farming, the most important parameter is unquestionably the use of fishmeal and fish oil, and the impacts that such use has on forage fish resources and marine food webs.

Criterion 4.1 Traceability and transparency of marine raw materials in feed

INDICATOR	REQUIREMENT

4.1.1 Evidence of traceability, demonstrated by the feed producer, of fishmeal and fish oil ingredients[33]	Yes

Rationale-Traceability of forage fish resources and edible seafood processing by-products is required to ensure their authentic origin. Traceability is a necessary prerequisite to comply with the primary feed requirement under this principle. The farmer must have full knowledge of the source of the fishmeal (FM) and fish oil (FO) ingredients used in the feed.

Criterion 4.2 Efficient and optimized diets

INDICATOR	REQUIREMENT
4.2.1 (a) FFDRm Barramundi (b) FFDRm Grouper and Snapper (c) FFDRm Pompano	(a) ≤2.5 (now), 2 (3 years), 1.5 (6 years) (b) ≤5 (now), 3.5 (3 years), 2.5 (6 years) (c) ≤3.5 (now), 2.5 (3 years), 2.2 (6 years)
4.2.2 (a) FFDRo Barramundi (b) FFDRo Grouper and Snapper (c) FFDRo Pompano	(a) ≤3.0 (now), 2.5 (3 years), 2.0 (6 years) (b) ≤2.0 (c) ≤2.0

[33] Traceability should be at a level of detail that permits the feed producer to demonstrate compliance with the standards in this document. This standard also assumes that the feed producer will make available to the farm a list of the FMFO ingredients, the inclusion rates of FMFO, and the sources of each component of the FMFO.

4.2.3 Use of wet feed and moist pellets produced from unprocessed fish[34]	Sourcing permitted from within same country or within 300km of the farm site

Rationale- Most wild small pelagic fish resources are either fished at capacity or are overfished. These fish, sometimes referred to as "forage fish," are eaten by humans but are primarily reduced into fish meal and fish oil for use in animal and aquaculture feed. Demand for these resources is growing and will continue to increase as the aquaculture industry expands and as the fish are increasingly directly consumed by humans or by other industries. There is concern that increased demand could lead to the overfishing—and collapse—of small forage fish stocks.

Wild small pelagic fish play a critical role in the ecosystem and the marine food chain. Some conservation groups and scientists are concerned that even fisheries that are not classified as overfished from a population perspective are, or could be, overfished from an ecological perspective. Good fisheries management is crucial to ensuring that these fisheries are sustainable. The source of fish product used in feeds is also addressed in this Standard under Criterion 4.3.

As the aquaculture industry expands, the demand for fish meal and fish oil from wild pelagic fisheries will expand if dependency on these resources continues to increase on a per-unit production basis, as has been the case historically. Inclusion of an indicator and requirements related to efficiency of use and/or dependency of aquaculture producers on forage fisheries is important to encourage future decreases in dependency on these fisheries and is an important extra layer of security to reduce pressure on wild fisheries.

In thinking about the long-term sustainability of fishery resource use within the fish farming sector, it is useful to transform fish meal- and fish oil-use levels in the feed back to live fish weight equivalents. In doing so, one has a more accurate assessment of the quantity of live fish from capture fisheries required to produce either the amount of fish meal, or the amount of fish oil, required to produce a unit of farmed fish.

The use of the Forage Fish Dependency Ratio (FFDR) encourages producers to decrease reliance on forage fish resources by reducing the inclusion rate of fishmeal (FM) and fish-oil (FO) from such sources in their feed, and optimizing their feed conversion ratio on the farm. FFDR is the primary metric for assessing the use of limited natural resources in the most straightforward manner. It is designed to optimize the transfer of resources from wild forage fish to feed constituents (FM and FO), and then into the cultured fish that is eaten by the consumer. It is recognized that the quality and marketability of forage fish (such as anchoveta and

[34] Farms are required to have plan in place to phase out the use of wet feed and moist pellets within 5 years of the publication of the standard or verify that the feed fish is sourced from an ISEAL compliant certification scheme or show evidence that the fishery is engaged in a credible and time bound fisheries improvement project (FIP)

menhaden) is considerably less than that of the cultured end products, but does not seek to make any value judgments in end use of these resources. The standard seeks to establish criteria that reward better performing farms for their efforts, and to encourage the rest of the industry to improve their FFDR performance.

For certain species, the standard lays out a timeline for increasingly strict requirements over a period of 3 years and then again 6 years from the publication of the standard to drive improvement. The proposed reduction of FFDRm and FFDRo from the date of the publication of the standards will encourage producers to work towards better performance on an aggressive timeframe.

After careful review of data from producers and feed companies, FFDRs for each species were established that will incentivize producers to make meaningful improvements in their farm practices. The ASC standards seek to push best practice within each species sector. Although these FFDR numbers might be higher than those of some of the other ASC species, they are set at the right level to encourage producers to further improve their practices in order to achieve ASC certification.

Auditing guidance

The feed supplier must document inclusion rates for fishmeal and fish oil for the actual diet. The producer must show records of feed purchases and fish sales. See Appendix 1 for detailed information on FFDR calculation methodology.

Criterion 4.3 Responsible origin of marine raw materials

[Note: In November 2016 ASC published an Interim Solution for ASC Marine Feed Ingredients, which will replace indicators 4.3.1 and 4.3.2 of this standard. This solution applies to all ASC's standards, which have indicators for marine raw material origin, including this ASC Tropical Marine Finfish Standard. This interim solution will apply until the ASC Feed Standard will be available or until further official and public notice by ASC.]

INDICATOR		REQUIREMENT
4.3.1	Timeframe for at least 90% fishmeal or fish oil used in feed to come from fisheries[35] certified under an ISEAL member's accredited certification whose primary goal is to promote ecological sustainability	Within 5 years following the date of the publication of the ASC Tropical Marine Finfish Standard ***[see note above]***

[35] This requirement applies to fishmeal and fish oil from forage fisheries and not to by-products or trimmings used in feed.

4.3.2	Prior to achieving 4.3.1 the fishmeal or fish oil used in feed must have a FishSource score of 6.0 or higher, and an 8 in the biomass category or show evidence of being engaged in a credible and time bound fisheries improvement project (FIP)	At least 90% of the fish meal and fish oil used in feed (excluding fishmeal and oil from byproducts) must meet this criteria ***[see note above]***
4.3.3	Feed containing fishmeal and/or fish oil originating from by-products[36] or trimmings from fish species which are categorized as vulnerable, endangered or critically endangered, according to the IUCN Red List of Threatened Species[37]	None
4.3.4	Feed ingredients which come from other fish from the same genus	None

Rationale-These indicators strive to ensure that marine-based feed ingredients come from responsible sources. A main concept of the proposed requirements is to align industry incentives to support processes that will lead to improved fisheries management, and then certification, of forage fisheries.

Ultimately, the requirements will use marine ingredients certified by a widely recognized authority, such as the Marine Stewardship Council (MSC) or another standard, as the best option available to promote responsible catch. In addition to the MSC standard, other standards developed by an ISEAL member that promote the ecological sustainability of pelagic fisheries as a primary focus could qualify.

Given the current modest supply of MSC certified sources of fishmeal and fish oil, the ASC proposes to restrict fisheries currently known to have the poorest status from being used for fishmeal and fish oil used in the feed. This will be achieved by requiring the vast majority of marine ingredients to come from a fishery that receives a minimum score of 6 using the FishSource methodology. The standard requires 80% of the fishmeal and fish oil to meet the FishSource score because the products are sold as blends, where the origin of fisheries can come from multiple fisheries (for further information see the scheme website: www.FishSource.com).

[36] Trimmings are defined as by-products when fish are processed for human consumption or if whole fish is rejected for use of human consumption because the quality at the time of landing does not meet official regulations with regard to fish suitable for human consumption.

[37] International Union for the Conservation of Nature (IUCN) reference at http://www.iucnredlist.org/static/introduction.

These standards support the use of marine trimmings and by-products, as long as they don't originate from fisheries targeting endangered or vulnerable species. The ASC seeks to encourage the use of fishmeal and fish oil derived from by-products from phylogenetically distinct species. These represent sustainable, underutilized resources.

Even in the presence of an ISEAL member certification scheme for forage fisheries, many stakeholders believe that growth in marine fish production must be accompanied by reduced reliance on globally finite wild forage species. This reduction is already happening due to market realities of supply and demand for fishmeal and fish oil. However, the rate of growth is offsetting these per capita improvements, resulting in greater aggregate reliance on forage fish (Naylor et al. 2010).

Forage fisheries serve multiple purposes, being both ingredients for fish feeds as well as direct food items for humans. Most forage fisheries are reasonably biologically resilient (i.e., rapid life cycles, early age at maturity, highly fecund and can be harvested by low impact gears) and important sources of EPA/DHA that are important for human health and cognitive development. Particularly in developing countries and within local economies, forage fish such as anchovies, sardines and mackerel can be important parts of a healthy diet including sources of protein and essential fatty acids. Conversion of wild fish, used for subsistence, into farmed fish represents a meaningful issue of equity and food security. By minimizing forage fish inclusion rates, these requirements acknowledge this issue and will strive to optimize use of resources allocated to aquaculture.

Some stakeholders in other Dialogues have argued against including FFDR requirements. For these stakeholders, once a feed source becomes a certified responsible fishery, farms should feel free to use it. Also, limiting aquaculture from using fishmeal and fish oil from responsible sources may be globally inefficient, given that other users (such as livestock farmers) who are less efficient than fish farmers at producing protein, would likely use it instead. Limiting amounts of marine ingredients also has implications for feed retention, digestibility and a farmed fish's nutritional value.

Criterion 4.4 Responsible origin of non-marine raw materials in feed

INDICATOR		REQUIREMENT
4.4.1	Presence and evidence of traceability and a responsible sourcing policy for the feed manufacturer for feed ingredients which comply	Yes

	with internationally recognized moratoriums and local laws[38]	
4.4.2	Documentation of the use of transgenic[39] plant raw materials, or raw materials derived from genetically modified plants, in the feed	Yes
4.4.3	Percent of non-marine ingredients from sources certified by an ISEAL Member's certification scheme that addresses environmental and social sustainability	80% for soy and palm oil within 5 years following the date of the publication of the ASC Tropical Marine Finfish Standard

Rationale-The ASC encourages the use of non-marine protein and lipid sources as a key method to reduce the dependence upon fishmeal and fish oil in the culture of marine fish. However, the sourcing of non-marine raw materials must take into account their culture areas and production methods—these must be sustainably secure and respect the environment within which they are raised. Products from conservation and biodiversity hotspots (for example the Amazon rainforest) must not be allowed under the standard.

While the use of genetically modified organisms (GMOs) in feed is allowed, it must be acknowledged. Transgenic plants are commonly used in aquaculture and animal feeds throughout the world, yet some consumers and retailers want to be able to identify food products, including farmed fish, that are genetically modified or that have been fed genetically modified ingredients. Documentation of the use of GMOs (such as Roundup Ready soybeans) can be obtained from the feed manufacturer. This is not an onerous or unrealistic demand for a fish producer to make to their feed producer since the purchase, use and manufacture of a non-GMO sourced complete feed (i.e., organically certified feed) would require much more stringent documentation and disclosure by the feed manufacturer to meet that particular certification. The requirements ensure transparency (above one percent volume) around any transgenic material used in the feed in order to support informed choices by retailers and consumers.

Feed ingredients sourced from areas where significant ecological damage has occurred is a concern. Therefore, the standard requires producers to source feed from feed producers who comply with any relevant, recognized crop moratoriums that, at the time of the writing of these requirements, includes only the Brazilian Soy Moratorium. Such moratoriums are temporary

[38] Specifically, the policy shall include that vegetable ingredients, or products derived from vegetable ingredients, must not come from the Amazon Biome as geographically defined by the Brazilian Soya Moratorium.

[39] Transgenic: containing genes altered by insertion of DNA from an unrelated species. Taking genes from one species and inserting them into another species to get that trait expressed in the offspring.

measures intended to protect defined geographic regions. Looking to the future, the standard intends to incorporate a requirement for feed manufacturers to use soy or palm oil certified to an ISEAL member scheme. Because these schemes have just recently been launched, the requirement builds in a five-year window for this requirement to be met.

Criterion 4.5 Waste Management/Pollution Control

INDICATOR	REQUIREMENT
4.5.1 Evidence of waste reduction (e.g., reuse and recycling) programs	Yes
4.5.2 Evidence of appropriate storage and/or disposal of biological waste	Yes
4.5.3 Evidence of appropriate storage and/or disposal of chemical and hydrocarbon wastes	Yes
4.5.4 Spill prevention and response plan for chemicals/hydrocarbons originating from farming operations	Yes

Rationale - Fish farmers should be responsible for waste disposal and protect against harmful chemical and hydrocarbon spills. Farming operations should have sufficient prevention and response plans in place and farm employees should have the training necessary to properly dispose of waste, and prevent and manage chemical and hydrocarbon spills.

The purpose of these indicators is to ensure that all biological and non-biological waste produced by a farm is recycled, reused or disposed of properly and does not affect neighboring communities. Proper handling and treatment of wastes may vary across farms depending on the remoteness of the farm site and the disposal and recycling options available in the region.

Criterion 4.6 Energy consumption and greenhouse gas emissions on farms

INDICATOR	REQUIREMENT

4.6.1 Presence of an energy use assessment verifying the energy consumption on the farm and representing the whole life cycle at sea, as outlined in Appendix 2	Within two years of the initial audit (measured in kilojoule/mt fish/production cycle)
4.6.2 Records of greenhouse gas (GHG[40]) emissions[41] on farm and evidence of an annual GHG assessment, as outlined in Appendix 2	Yes, within two years of the initial audit
4.6.3 Documentation of GHG emissions of the feed[42] used during the previous production cycle, as outlined in Appendix 2	Yes, within two years of the initial audit
4.6.4 Evidence of a documented strategy to reduce GHG per unit of production (measured in kilojoule/mt of change in fish biomass)	Yes, within two years of the initial audit

Rationale- Climate change represents perhaps the biggest environmental challenge facing current and future generations. Because of this, energy consumption used in food production has become a source of major public concern. The ASC recognizes the importance of efficient and sustainable energy use. Therefore, these indicators will require that energy consumption in the production of fish should be monitored on a continual basis and that growers should develop means to improve efficiency and reduce consumption of energy sources, particularly those that are limited or carbon- based. The data collected in this process will help the ASC set a meaningful numerical requirement for energy use in the future. Energy assessments are a new area for producers. Requiring that farms do these assessments will likely raise awareness of the issues related to energy and build support for adding a requirement in the future related to the maximum energy of GHG emissions allowed.

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[40] For the purposes of this standard, GHGs are defined as the six gases listed in the Kyoto Protocol: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6).

[41] GHG emissions must be recorded using recognized methods, standards and records as outlined in Appendix 2.

[42] GHG emissions from feed can be given based on the average raw material composition used to produce the fish (by weight) and not as documentation linked to each single product used during the production cycle. Feed manufacturer is responsible for calculating GHG emissions per unit feed. Farm site then shall use that information to calculate GHG emissions for the volume of feed they used in the prior production cycle.

PRINCIPLE 5: Manage Disease and Parasites in an Environmentally Responsible Manner

There are three primary mechanisms by which fish health management on marine fish farms may negatively impact the environment: proliferation of pests and parasites on the farm may create a vehicle for increased prevalence of diseases among wild fish; use of prophylactic antibiotics or improper use of other therapeutants may result in development of resistance to the treatment; and use of some therapeutants may lead to contamination of farm effluents.

Criterion 5.1 Fish Health Management

INDICATOR		REQUIREMENT
5.1.1.	Evidence of a fish health management plan for the identification, monitoring and control diseases and parasites	Yes
5.1.2	Farm maintains a fish health management record keeping system	Yes

Rationale- Farming of fish can lead to an increased risk of aquatic diseases in the environment. Marine fish producers should naturally want to optimize fish health on the farm site, due to the dramatic impacts this has on economic viability. It is not necessary to restrict how marine fish producers innovate around the challenge of optimizing fish health on the farm site, so long as there is negligible risk to wild stocks.

Farmed fish are susceptible to numerous diseases that have the potential to be amplified and transferred, thereby posing a risk to the health of fish and other marine organisms in adjacent ecosystems. One of the best ways to mitigate the risk of disease transfer to wild stocks is to reduce or eliminate the disease from happening initially. These requirements seek to ensure proactive health management on the farm through comprehensive health management plans and up to date record keeping systems.

Criterion 5.2 Chemicals and treatments

INDICATOR	REQUIREMENT
5.2.1 Use of therapeutic treatments that are banned by law under the local jurisdiction or listed as critically important for human medicine by the World Health Organization[43]	Not permitted
5.2.2 Prophylactic use of chemical antimicrobial treatments	Not permitted
5.2.3 On-farm documentation that includes, at a minimum, detailed information on all chemicals[44] and therapeutants used during the most recent production cycle, the amounts used (including grams per kg of fish produced), the dates used, which group of fish were treated and against which diseases, proof of proper dosing, and all disease and pathogens detected on the site	Yes
5.2.4 Allowable farm level anti-parasiticide treatment (bath), not including freshwater, formaldehyde[45] or hydrogen peroxide	None
5.2.5 Number of treatments[46]of antibiotics over the most recent production cycle	≤ 3

[43] refer to http://www.who.int/foodsafety/publications/antimicrobials-fourth/en/.

[44] Chemicals used for the treatment of fish

[45] In countries where formaldehyde is banned, its use would not be permitted under Principle 1, obeying all laws takes precedence.

[46] A treatment is a single course medication given to address a specific disease issue and that may last a number of days.

Rationale- The use of certain therapeutic treatments may impact the sustainable use of antimicrobials that are critical to human health or may have a damaging effect on the aquatic environment, both in terms of water quality and direct impact on flora and fauna. It is appropriate that a comprehensive fish health management plan is in place that tracks and investigates mortalities and includes either vaccination procedures or alternative methods approved by the farm's veterinarian or fish health expert. In the interest of environmental monitoring and product traceability, all chemical treatments must be recorded and made available to auditors.

With regards to the use of antibiotics, there is a global effort led by the WHO to ensure that antibiotics important for human medicine are used in a way that doesn't jeopardize their effectiveness in treating human diseases. These requirements seek to be in line with that effort. The requirements set a cap on a maximum allowable number of treatments of antibiotics on certified farms and sets a reasonable limit on what may be needed on a well-managed farm and excludes any farms that fail to follow industry guidelines for prudent use of antibiotics. Additionally, the ASC holds the position that anti-microbial treatments that are critical to human health should not be allowed. These requirements have been adopted with the intent to further raise awareness within the aquatic veterinary community on the use of medically important antimicrobial drugs in food-animal production, and the public health risks associated with antibiotic resistance.

Criterion 5.3 Survival of Farmed Fish

INDICATOR	REQUIREMENT
5.3.1 Removal and disposal of dead fish	All dead fish are removed and disposed of in a responsible manner
5.3.2 Classification of mortalities	All mortalities are recorded and classified
5.3.3 When unexplained mortalities exceed ≥0.5% / per day samples are submitted for analysis by a veterinarian or designated fish health expert	Yes
5.3.4 Evidence of a farm specific mortalities reduction program that includes defined annual targets for reductions in mortalities and reductions in unexplained mortalities	Yes

Rationale- Farms must keep detailed records of all mortalities and cause of death. The post-mortem analysis required in the standard is essential to provide an early warning against emerging diseases. Repeated high mortality rates, or a high rate of unexplained mortalities, may indicate poor management or poor siting. The requirements focus on mortalities from viral disease and unknown causes, as they present a greater potential risk to wild fish populations and neighboring farms. The farm must be able to demonstrate that it is working seriously to reduce its mortalities, including tracking diseases and carrying out a farm-specific plan to reduce diseases and mortalities.

PRINCIPLE 6: DEVELOP AND OPERATE FARMS IN A SOCIALLY RESPONSIBLE MANNER

Principle 6 aims to address potential negative social impacts related to farm development and operation, including labor concerns.

Criterion 6.1 Freedom of association and collective bargaining[47]

INDICATOR		REQUIREMENT
6.1.1	Evidence that workers have access to trade unions (if they exist) and union representative(s) chosen by themselves without managerial interference	Yes
6.1.2	Evidence that workers are free to form organizations, including unions, to advocate for and protect their rights	Yes
6.1.3	Evidence that workers are free and able to bargain collectively for their rights	Yes

Rationale-Having the freedom to associate and bargain collectively is a critical right of workers because it enables them to engage in collective bargaining over issues such as wages and other working conditions. Freedom of Association and the effective recognition of the right to collective bargaining is one of the core principles of the International Labor Organization's (ILO)

[47] Bargain collectively: A voluntary negotiation between employers and organizations of workers in order to establish the terms and conditions of employment by means of collective (written) agreements.

"Declaration on Fundamental Principles and Rights at Work." The declaration was adopted in 1998 by the 86th International Labor Conference and has since been ratified by the overwhelming majority of ILO's 183 member nation-states.

Criterion 6.2 Child labor

INDICATOR		REQUIREMENT
6.2.1	Number of incidences of child[48] labor[49]	None
6.2.2	Percentage of young workers[50] that are protected[51]	100%

Rationale-The effective abolition of child labor is one of the core principles of the ILO "Declaration on Fundamental Principles and Rights at Work." Adherence to the child labor codes and definitions included in this section indicates compliance with what the ILO and international conventions generally recognize as the key areas for the protection of child and young workers. Children are particularly vulnerable to economic exploitation, due to their inherent age-related limitations in physical development, knowledge and experience. Children and youth need adequate time for education, development and play. Therefore, they should not have to work or be exposed to working hours and conditions that are hazardous[52,53] to their physical or mental well-being. To this end, the requirements related to what constitutes child

[48] Child: Any person under 15 years of age. A higher age would apply if the minimum age law of an area stipulates a higher age for work or mandatory schooling. Minimum age may be 14 if the country allows it under the developing country exceptions in ILO convention 138.

[49] Child Labor: Any work by a child younger than the age specified in the definition of a child.

[50] Young Worker: Any worker between the age of a child, as defined above, and under the age of 18.

[51] Protected: Workers between 15 and 18 years of age will not be exposed to hazardous health and safety conditions; working hours shall not interfere with their education and the combined daily transportation time and school time, and work time shall not exceed 10 hours.

[52] Hazard: The inherent potential to cause injury or damage to a person's health (e.g., unequipped to handle heavy machinery safely, and unprotected exposure to harmful chemicals).

[53] Hazardous work: Work that, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of workers (e.g., heavy lifting disproportionate to a person's body size, operating heavy machinery, exposure to toxic chemicals).

labor will protect the interests of children and young workers at fish farms certified to these requirements.

Criterion 6.3 Forced, bonded or compulsory labor

INDICATOR		REQUIREMENT
6.3.1	Number of incidences of forced,[54] bonded[55] or compulsory labor	None

Rationale- Forced labor—such as slavery, debt bondage and human trafficking—is a serious concern in many industries and regions of the world. The elimination of all forms of forced or compulsory labor is one of the core principles of the ILO "Declaration on Fundamental Principles and Rights at Work." Ensuring that contracts are clearly articulated and understood by workers is critical to determining that labor is not forced. The inability of a worker to freely leave the workplace and/or an employer withholding original identity documents of workers are indicators that employment may not be at-will. Adherence to these policies shall indicate that an aquaculture operation is not using forced, bonded or compulsory labor forces.

Criterion 6.4 Discrimination[56]

INDICATOR	REQUIREMENT

[54] Forced (Compulsory) labor: All work or service that is extracted from any person under the menace of any penalty for which a person has not offered himself/herself voluntarily or for which such work or service is demanded as a repayment of debt. "Penalty" can imply monetary sanctions, physical punishment, or the loss of rights and privileges or restriction of movement (e.g., withholding of identity documents).

[55] Bonded labor: When a person is forced by the employer or creditor to work to repay a financial debt to the crediting agency.

[56] Discrimination: Any distinction, exclusion or preference that has the effect of nullifying or impairing equality of opportunity or treatment. Not every distinction, exclusion or preference constitutes discrimination. For instance, a merit- or performance-based pay increase or bonus is not by itself discriminatory. Positive discrimination in favor of people from certain underrepresented groups may be legal in some countries.

6.4.1	Evidence of comprehensive[57] and proactive anti-discrimination policies, procedures and practices	Yes
6.4.2	Number of incidences of discrimination	None

Rationale-The elimination of discrimination in respect of employment and occupation is one of the core principles of the ILO "Declaration on Fundamental Principles and Rights at Work." Unequal treatment of workers based on certain characteristics (such as sex or race), is a violation of a workers' human rights. Additionally, widespread discrimination in the working environment can negatively affect overall poverty and economic development rates. Discrimination occurs in many work environments and takes many forms. A common form is discrimination against women workers.

In order to ensure that discrimination does not occur at fish farms certified to this requirement, employers must demonstrate their commitment to equality with an official anti-discrimination policy, a policy of equal pay for equal work, and clearly outlined procedures to raise, file and respond to a discrimination complaint in an effective manner. Evidence, including worker testimony, of adherence to these policies and procedures will indicate minimization of discrimination. "Positive" discrimination (i.e., special treatment to protect the rights and health of particular groups of workers, or to provide opportunities for groups which have historically been disadvantaged) is allowed, and often required by laws related to such issues as maternity and affirmative action.

Criterion 6.5 Work Environment Health and Safety

INDICATOR		REQUIREMENT
6.5.1	Percentage of workers trained in health and safety practices, procedures[58] and policies on a yearly basis	100%

[57] Employers shall have written anti-discrimination policies stating that the company does not engage in or support discrimination in hiring, remuneration, access to training, promotion, termination or retirement based on race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation, age or any other condition that may give rise to discrimination.

[58] Health and safety training shall include emergency response procedures and practices.

6.5.2	Evidence that workers use Personal Protective Equipment (PPE) effectively	Yes
6.5.3	Presence of a health and safety risk assessment and evidence of preventive actions taken	Yes
6.5.4	Evidence that all health- and safety-related accidents and violations are recorded and corrective actions are taken when necessary	Yes
6.5.5	Evidence of employer responsibility and/or proof of insurance (accident or injury) for 100% of worker costs in a job-related accident or injury when not covered under national law	Yes
6.5.6	Evidence that all diving operations are conducted by divers who are certified	Yes

Rationale-A safe and healthy working environment is essential for protecting workers from harm. It is critical for a responsible aquaculture operation to minimize these risks. One of the key risks to workers is hazards resulting from accidents and injuries. Consistent, effective and regular worker training in health and safety practices is an important preventative measure. When an accident, injury or violation occurs, the company must record it and take corrective action to identify the root causes of the incident, remediate, and take steps to prevent future occurrences of similar incidents. This addresses violations and the long-term health and safety risks. Finally, while many national laws require that employers assume responsibility for job-related accidents and injuries, not all countries require this and not all workers (in some cases migrant and other workers) will be covered under such laws. When not covered under national law, employers must prove they are insured to cover 100 percent of worker costs when a job-related accident or injury occurs.

Criterion 6.6 Wages

INDICATOR	REQUIREMENT

6.6.1	The percentage of workers whose basic wage[59] (before overtime and bonuses) is below the minimum wage[60]	0 (None)
6.6.2	Evidence that the employer is working toward the payment of basic needs wage[61]	Yes
6.6.3	Evidence of transparency in wage-setting and rendering[62]	Yes

Rationale- Wages and the process for setting wages are important components of the ILO core principles. For this reason, it is important to highlight under these requirements the importance of workers' basic wages meeting the legal minimum wage and being rendered to workers in a convenient manner. Unfortunately, minimum wage in many countries does not always cover the basic needs of workers. Unfairly and insufficiently compensated workers can be subject to a life of sustained poverty. Therefore, it is important for socially responsible employers to pay or be working toward paying a basic needs wage. The calculation of a basic needs wage can be complex, and it is important for employers to consult with workers, their representatives and other credible sources when assessing what a basic needs wage would be.

Certified farms shall also demonstrate their commitment to fair and equitable wages by having and sharing a clear and transparent mechanism for wage-setting and a labor conflict resolution policy[63] that tracks wage-related complaints and responses. Having these policies outlined in a clear and transparent manner will empower the workers to negotiate effectively for fair and equitable wages that shall, at a minimum, satisfy basic needs.

[59] Basic wage: The wages paid for a standard working week (no more than 48 hours).

[60] If there is no legal minimum wage in a country, basic wages must meet the industry-standard minimum wage.

[61] Basic needs wage: A wage that covers the basic needs of an individual or family, including housing, food and transport. This concept differs from a minimum wage, which is set by law and may or may not cover the basic needs of workers.

[62] Payments shall be rendered to workers in a convenient manner.

[63] See Criterion 6.8.

Criterion 6.7 Contracts (labor) including subcontracting

INDICATOR	REQUIREMENT
6.7.1 Percentage of workers who have contracts[64]	100%
6.7.2 Evidence of a policy to ensure social compliance of its suppliers and contractors	Yes

Rationale- Fair contracting is important to ensure transparency between the employer and employee and fairness in the employment relation. Short-term and temporary contracts are acceptable but cannot be used to avoid paying benefits or to deny other rights. The company shall also have policies and mechanisms to ensure that workers contracted from other companies for specific services (e.g., divers, cleaning or maintenance) and the companies providing them with primary inputs or supplies have socially responsible practices and policies.

Criterion 6.8 Conflict resolution

INDICATOR	REQUIREMENT
6.8.1 Evidence of worker access to effective, fair and confidential grievance procedures	Yes
6.8.2 Percentage of grievances handled that are addressed[65] within a 90-day timeframe	100%

[64] Labor-only contracting relationships or false apprenticeship schemes are not acceptable. This includes revolving/consecutive labor contracts to deny benefit accrual or equitable remuneration. False Apprenticeship Scheme: The practice of hiring workers under apprenticeship terms without stipulating terms of the apprenticeship or wages under contract. It is a "false" apprenticeship if its purpose is to underpay people, avoid legal obligations or employ underage workers. Labor-only contracting arrangement: The practice of hiring workers without establishing a formal employment relationship for the purpose of avoiding payment of regular wages or the provision of legally required benefits, such as health and safety protections.

[65] Addressed: Acknowledged and received, moving through the company's process for grievances, corrective action taken when necessary.

Rationale- Companies must have a clear labor conflict resolution policy in place for the presentation, treatment and resolution of worker grievances in a confidential manner. Workers shall be familiar with the policy and its effective use. Such a policy is necessary to track conflicts and complaints raised, and responses to conflicts and complaints.

Criterion 6.9 Disciplinary practices

INDICATOR		REQUIREMENT
6.9.1	Incidences of excessive or abusive disciplinary actions	None
6.9.2	Evidence of a functioning disciplinary action policy whose aim is to improve the worker[66]	Yes

Rationale- The rationale for discipline in the workplace is to correct improper actions and maintain effective levels of worker conduct and performance. However, abusive disciplinary actions can violate workers' human rights. The focus of disciplinary practices shall always be on the improvement of the worker. Fines or basic wage deductions shall not be acceptable as methods for disciplining workforce. A certified farm shall never employ threatening, humiliating or punishing disciplinary practices that negatively impact a worker's physical and mental[67] health or dignity.

[66] If disciplinary action is required, progressive verbal and written warnings shall be engaged. The aim shall always be to improve the worker; dismissal shall be the last resort. Policies for bonuses, incentives, access to training and promotions are clearly stated and understood, and not used arbitrarily. Fines or basic wage deductions shall not be acceptable disciplinary practices.

[67] Mental Abuse: Characterized by the intentional use of power, including verbal abuse, isolation, sexual or racial harassment, intimidation or threat of physical force.

Criterion 6.10 Working hours and overtime

INDICATOR	REQUIREMENT
6.10.1 Incidences, violations or abuse of working hours[68] and overtime laws	None
6.10.2 Overtime is limited, voluntary,[69] paid at a premium rate and restricted to exceptional circumstances	Yes

Rationale- Abuse of overtime working hours is a widespread issue in many industries and regions. Workers subject to extensive overtime can suffer consequences in their work-life balance and are subject to higher fatigue-related accident rates. In accordance with better practices, workers in certified farms are permitted to work—within defined guidelines—beyond normal work week hours but must be compensated at premium rates.[70] Requirements for time off, working hours and compensation rates as described should reduce the impacts of overtime.

Criterion 6.11 Living conditions for employees accommodated on the farm

INDICATOR	REQUIREMENT
6.11.1 Farm employees accommodated on the farm have access to clean, sanitary, safe and suitable living conditions	Yes

[68] In cases where local legislation on working hours and overtime exceed internationally accepted recommendations (48 regular hours, 12 hours overtime), the international standards will apply.

[69] Compulsory overtime is permitted if previously agreed to under a collective bargaining agreement.

[70] Premium rate: A rate of pay higher than the regular work week rate. Must comply with national laws/regulations and/or industry standards.

6.11.2	Existence of separate sanitary and toilet facilities for men and women; with the exception of work sites with fewer than 10 employees or where married couples are working and accommodated together	Yes

Rationale-The protection of the workers that reside or live on the farm's property is an integral part of the employer's responsibility. Farms must provide clean, safe and sanitary living quarters with access to clean water and nutritious meals. Accommodation facilities must provide for the needs of those (presumably, but not exclusively, women) who can be considered at risk of sexual or privacy harassments.

PRINCIPLE 7: BE A GOOD NEIGHBOR AND CONSCIENTIOUS CITIZEN

Principle 7 aims to address any broader off-site potential social impacts associated with tropical marine finfish production, including interactions with local communities.

Criterion 7.1 Community engagement and effective conflict resolution

INDICATOR		REQUIREMENT
7.1.1	Evidence of regular and meaningful[71] consultation and engagement with community representatives and organizations	Yes
7.1.2	Presence and evidence of an effective[72] policy and mechanism for the presentation, treatment and resolution of complaints by community	Yes

[71] Regular and meaningful: meetings shall be held at least bi-annually with elected representatives of affected communities. The agenda for the meetings should in part be set by the community representatives. Participatory Social Impact Assessment methods may be one option to consider here.

[72] Effective: in order to demonstrate that the mechanism is effective, evidence of resolutions of complaints can be given.

	stakeholders and organizations	
7.1.3	For new farms[73], evidence of engagement and consultation with surrounding communities about potential social impacts from the farm.	Yes

Rationale- Fish farms must respond to human concerns that arise in communities located near the farm, and to concerns related to the farm's overall operations. In particular, appropriate consultation must be undertaken within local communities so that risks, impacts and potential conflicts are properly identified, avoided, minimized and/or mitigated through open and transparent negotiations. Communities shall have the opportunity to be part of the assessment process (e.g., by including them in the discussion of any social investments and contributions by companies to neighboring communities).

Channels of communication with community stakeholders are important. Regular consultation with community representatives and a transparent procedure for handling complaints are key components of this communication. Negative impacts may not always be avoidable. However, the process for addressing them must be open, fair and transparent, and must demonstrate due diligence. A company shall share with neighboring communities any pertinent information about any potential health and safety risks or changes in access to resources.

[73] A 'new farm' is defined as an aquaculture operation where construction was completed after the publication date of the ASC Tropical Marine Finfish Standard or a farm that underwent a significant expansion after said publication date.

Appendix 1. Forage Fish Dependency Ratio calculation

Forage Fish Dependency Ratio (FFDR) is the quantity of wild fish used per quantity of cultured fish produced. This measure can be calculated based on fishmeal (FM) and/or fish oil (FO). The dependency on wild forage fish resources shall be calculated for both FM and FO using the formulas noted below, and then the higher of the two values shall be applied to the Standard. This formula calculates the dependency of a single site on wild forage fish resources, independent of any other farm.

$$\textbf{FFDR FM} = \frac{\textbf{\% fishmeal in feed from forage fisheries (e FCR)}}{\textbf{24}}$$

$$\textbf{FFDR FO} = \frac{\textbf{\% fish oil in feed from forage fisheries (e FCR)}}{\textbf{5.0 or 7.0, depending on source of fish}}$$

Where:

1. Economic Feed Conversion Ratio (eFCR) is the quantity of feed used to produce the quantity of fish harvested.

$$\textbf{eFCR} = \frac{\textbf{Feed, kg or mt}}{\textbf{Net aquaculture production, kg or mt (wet weight)}}$$

2. The percentage of fishmeal and fish oil excludes fishmeal and fish oil derived from fisheries' by-products.[74] Only fishmeal and fish oil that is derived directly from a pelagic fishery (e.g., anchoveta) or fisheries where the catch is directly reduced (such as krill or blue whiting) is to be included in the calculation of FFDR. Fishmeal and fish oil derived from fisheries' by-products (e.g., trimmings and offal) should not be included because the FFDR is intended to be a calculation of direct dependency on wild fisheries.
3. The amount of fishmeal in the diet is calculated back to live fish weight by using a yield of 24%.[75] This is an assumed average yield.

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[74] Trimmings are defined as by-products when fish are processed for human consumption or if whole fish is rejected for use of human consumption because the quality at the time of landing do not meet official regulations with regard to fish suitable for human consumption. Restrictions on what trimmings are allowed for use under the standard are under 4.3.3.

[75] Reference for FM and FO yields: Péron, G., et al. 2010. Where do fishmeal and fish oil products come from? An analysis of the conversion ratios in the global fishmeal industry. Marine Policy, doi:10.1016/j.marpol.2010.01.027.

4. The amount of fish oil in the diet is calculated back to live fish weight by using an average yield in accordance with this procedure:
    a. Group A: Fish oil originating from Peru and Chile and Gulf of Mexico, five percent yield of fish oil.
    b. Group –B: Fish oil originating from the North Atlantic (Denmark, Norway, Iceland and the UK) seven percent yield of fish oil.
    c. If fish oil is used from other areas than mentioned above, they should be classified as belonging to group A if documentation shows a yield less than or equal to six percent, and into group B if documentation shows a yield more than six percent.
5. FFDR is calculated for the grow-out period in the sea as long as the fingerling phase does not go past 50 grams per fingerling. If the fingerling phase goes past 50g then FFDR is calculated based on all feed used from 50 grams and onwards. If needed, the grow-out site shall collect this data from the fingerling supplier.

Appendix 2: Energy Records and Assessment

Subsections

A. Energy use assessment and greenhouse gas (GHG) accounting for farms
B. GHG accounting for feed

Appendix 2A. Energy use assessment and GHG accounting for farms

The ASC encourages companies to integrate energy use assessments and GHG accounting into their policies and procedures across the board in the company. However, this requirement only requires that operational energy use and GHG assessments have been done for the farm sites that are applying for certification.

Assessments shall follow either the GHG Protocol Corporate Standard or ISO 14064-1 (references below). These are the commonly accepted international requirements, and they are largely consistent with one another. Both are also high level enough not to be prescriptive and they allow companies some flexibility in determining the best approach for calculating emissions for their operations.

If a company wants to go beyond the requirement and conduct this assessment for their entire company, then the full protocols are applicable. If the assessment is being done only on sites that are being certified, the farms shall follow the GHG Protocol Corporate Standard and/or ISO 14064-1 requirements pertaining to:

- Accounting principles of relevance, completeness, transparency, consistency and accuracy
- Setting operational boundaries
- Tracking emissions over time
- Reporting GHG emissions

In regard to the operational boundaries, farm sites shall include in the assessment:

- Scope 1 emissions, which are emissions that come directly from a source that is either owned or controlled by the farm/facility.
    - For example, if the farm has a diesel generator, this will generate Scope 1 emissions. So will a farm-owned/-operated truck.
- Scope 2 emissions, which are emissions resulting from the generation of purchased electricity, heating, or cooling.

Quantification of emissions is done by multiplying activity data (e.g., quantity of fuel or kwh consumed) by an emission factor (e.g., CO2/kwh). For non-CO2 gases, you then need to multiply by a Global Warming Potential (GWP) to convert non-CO2 gases into the CO2-equivalent. Neither the GHG Protocol nor the ISO require specific approaches to quantifying emissions, so the ASC provides the following additional information on the quantification of emissions:

- Farms shall clearly document the emission factors they use and the source of the emission factors. Recommended sources include the Intergovernmental Panel on Climate Change (IPCC) or factors provided by national government agencies such as

the United States Environmental Protection Agency (USEPA). Companies shall survey available emission factors and select the one that is most accurate for their situation, and transparently report their selection.

- Farms shall clearly document the GWPs that they use and the source of those GWPs. Recommended sources include the IPCC 2nd Assessment Report, on which the Kyoto Protocol and related policies are based, or more recent Assessment Reports.

References (relevant at time of publication of standard):

- GHG Protocol Corporate Standard Website: http://www.ghgprotocol.org/standards/corporate-standard
- GHG Protocol Corporate Standard Document: http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf
- ISO 14064-1 available for download (with fee) at http://www.iso.org/iso/catalogue_detail?csnumber=38381
- Some information on ISO 14064-1 is at http://www.iso.org/iso/pressrelease.htm?refid=Ref994
- IPCC 2nd Assessment Report: http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf
- All IPCC Assessment Reports: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

Appendix 2B. GHG accounting for feed

The requirement requires the calculation of the GHG emissions for the feed used during the prior production cycle at the grow-out site undergoing certification. This calculation requires farms to multiply the GHG emissions per unit of feed, provided to them by the feed manufacturer, by the amount of feed used on the farm during the production cycle.

The feed manufacturer is responsible for calculating GHG emissions per unit feed. GHG emissions from feed can be calculated based on the average raw material composition used to produce the fish (by weight) and not as documentation linked to each single product used during the production cycle.

The scope of the study to determine GHG emissions should include the growing, harvesting, processing and transportation of raw materials (vegetable and marine raw materials) to the feed mill and processing at feed mill. Vitamins and trace elements can be excluded from the analysis. The method of allocation of GHG emissions linked to by-products must be specified.

The study to determine GHG emissions can follow one of the following methodological approaches:

1. A cradle-to-gate assessment, taking into account upstream inputs and the feed manufacturing process, according to the GHG Product Standard
2. A Life Cycle Analysis following the ISO 14040 and 14044 requirements for life cycle assessments

Should the feed manufacturer choose to do a cradle-to-gate assessment:

1. It shall incorporate the first three phases from the methodology, covering materials acquisition and processing, production, and product distribution and storage (everything upstream and the feed manufacturing process itself).

Should the manufacturer follow the ISO 14040 and 14044 requirements for Life Cycle Assessment:

1. Feed manufacturers may follow either an ISO-compliant life cycle assessment methodology or the GHG Protocol product standard.

Regardless of which methodology is chosen, feed manufacturers shall include in the assessment:

- Scope 1 emissions, which are emissions that come directly from a source that is either owned or controlled by the farm/facility.
- Scope 2 emissions, which are emissions resulting from the generation of purchased electricity, heating or cooling.
- Scope 3 emissions, which are emissions resulting from upstream inputs and other indirect emissions, such as the extraction and production of purchased materials, following the Scope 3 standard.

Quantification of emissions is done by multiplying activity data (e.g., quantity of fuel or kwh consumed) by an emission factor (e.g. CO2/kwh). For non-CO2 gases, you then need to multiply by a Global Warming Potential (GWP) to convert non-CO2 gases into CO2-equivalent. The ASC provides the following additional information on the quantification of emissions:

- Farms shall clearly document the emission factors they use and the source of the emission factors. Recommended sources include the IPCC or factors provided by national government agencies, such as the USEPA. Companies shall survey available emission factors and select the one that is most accurate for their situation, and transparently report their selection.
- Farms shall clearly document the GWPs that they use and the source of those GWPs. Recommended sources include the IPCC 2nd Assessment Report, on which the Kyoto Protocol and related policies are based, or more recent Assessment Reports.

References:

- GHG Product Standard: http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-product-standard-draft-november-20101.pdf
- Scope 3 Standard: http://www.ghgprotocol.org/files/ghgp/GHG%20Protocol%20-%20Scope%203%20Standard%20-%20Stakeholder%20Comments%20-%20November%202010.xlsx
- ISO 14044 available for download (with fee) at: http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=38498
- Some information on ISO 14064-1 is at: http://www.iso.org/iso/pressrelease.htm?refid=Ref994
- IPCC 2nd Assessment Report: http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf

- All IPCC Assessment Reports: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

Appendix 3: Participant List – Inaugural meeting of the Grouper, Snapper, and Barramundi Diaolgue

Grouper, Snapper & Barramundi Dialogue 9-10 October 2013 The Northam All Suite Penang, Malaysia		
Name	**Company/Organization**	**Country**
YB. Dr. Afif b. Bahardin	**State Exco for Agriculture & Agro-based Industries, Rural Development & Health**	Malaysia
Carol Phua	WWF-Malaysia	Malaysia
Geoffrey Muldoon	WWF Coral Triangle Global Initiative	Australia
Merrielle Macleod	WWF-US	USA
Peter Scott	Independent Consultant	Philippines
Tang Twen Poh	Stanton Emms	Malaysia
Olav Jamtøy	GenoMar AS / Trapia Malaysia Sdn Bhd	Malaysia
Mohamed Razali Mohamed	Aquagrow Corporation Sdn Bhd	Malaysia
Gangaram Pursumal	WWF-Malaysia	Malaysia
Ernest Chiam	WWF-Malaysia	Malaysia
Alistair Yong	WWF-Malaysia	Malaysia
Nadiah Rosli	WWF-Malaysia	Malaysia
Liew Hui Ling	WWF-Malaysia	Malaysia
Christina Yung Tze Moi	Better Prospects Sdn Bhd	Malaysia
Mylene Mace	Aquagrow Corporation Sdn Bhd	Malaysia
Dato' Goh Cheng Liang	Marine Fish Farmers Association Msia (MFFAM) / GST Fine Foods Sdn Bhd	Malaysia
Kamaruddin bin Harun	MFFAM	Malaysia
Mohd Addin Aarif	MFFAM	Malaysia
Noraisyah Abu Bakar	Department of Fisheries Penang	Malaysia
Che Zulkifli bin Che Ismail	Department of Fisheries-FRI Pulau Sayak	Malaysia
Suffian Mustafa	Department of Fisheries	Malaysia
Cheah Guan Seng	BE-BIOMS/B / Penang Aquaculture Association	Malaysia
Kimberly Lim	Palawan Aquaculture Corporation	Philippines
Elsie Tech	Palawan Aquaculture Corporation	Philippines
Badrudin	Ex-DG Aquaculture	Indonesia
Effendy Wong	UD Sondoro	Indonesia
I Wayan Sudja	Indonesian Mariculture Association (ABILINDO)	Indonesia
Dedy Yaniharto	Masyarakat Aquaculture Indonesia (MAI)	Indonesia
Imam Musthofa	WWF-ID	Indonesia
Candhika Yusuf	WWF-ID	Indonesia
Nur Ahyani	WWF-ID	Indonesia
Indah Sukmayanti	DG Aquaculture	Indonesia
Dwi Murtono	PT Pura Baruna Lestari	Indonesia
Arfiana Budiati Jindan	DG Aquaculture	Indonesia
Felix G. Ayson, DSc	SEAFDEC Aquaculture Department	Philippines
Renato B. Bocaya	Finfish Hatcheries Inc. / Alsons Aquaculture Corp.	Philippines
Troy Keast	Director of Aquaculture and Sustainability, Phillips Foods Asia	Indonesia
Ngo Tien Chuong	WWF-Vietnam	Vietnam
Thuong	Vinh Hoan	Vietnam
Nguyen Huu Dung	Nha Trang Unversity	Vietnam
Dr Roger Chan Eng Nai	Aqua Ceria Group	Vietnam
Alissala Thian	Press Buletin Motions	Malaysia
Arafat Esah	Press Buletin Motions	Malaysia

Appendix 4: Participant List – Technical Advisory Group Meeting

Tropical Marine Fin Fish Dialogue 12 – 14 December 2016 Sudamala Hotel, Sanur, Bali, Indonesia		
Name	**Company / Organization**	**Country**
Dan Fisk	Australis	Vietnam
Josh Goldman	Australis	United States
Felix Wai	Aquaculture Technologies Asia Ltd	Hong Kong SAR
Steven Chan	Aquaculture Technologies Asia Ltd	China
Troy Keast	Philipps Seafood	Indonesia
Joep Kleine Staarman	Barramundi Asia	Singapore
Timothy Hromatka	Fin Fisher Pte	Singapore
Santhana Krishnan	Maritech	India
Ravi Fotedar	Curtain University	Australia
Trevor Anderson	Australian Barramundi Farmers Association	Australia
Tatam Sutarmat	TBA	Indonesia
Cut Desayna	WWF	Indonesia
Ernest Chiam	Consultant	Malaysia
Chee Kiat Ng	Marine Fish Farmers Association of Malaysia	Malaysia
Colin Brannen	ASC	United States
Geoffrey Muldoon	WWF	Australia

Absent members

Richard Knuckey	Finfish Eneterprises P/L	Australia
Steve Davies	Marine Products Australia	Australia
David Cahill	National Aquaculture Group	Saudi Arabia