DRAFT STANDARDS FOR
RESPONSIBLE SHRIMP AQUACULTURE

Created by the Shrimp Aquaculture Dialogue

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Version 1.0 for Public Comment

Note: This document does not reflect final agreement by the Shrimp Aquaculture Dialogue Global Steering Committee. Rather, during the public comment periods for this document, committee members retain the right to debate outstanding issues and develop alternatives based on public input, proactive outreach and further research.

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Introduction

Seafood is one of the most popular sources of protein worldwide. By volume, almost half of the seafood we eat is wild caught, while the other half is from aquaculture—the fastest growing food production system in the world. Aquaculture's contribution is expected to continue to rise while the wild caught supply of seafood is expected to diminish as fisheries reach their natural production limits.

As with any rapidly growing activity, the growth in aquaculture production has raised concerns about negative social and environmental impacts related to farming, such as water pollution, the enhancement and spread of disease, escapes, habitat impacts, and social impacts to surrounding communities. As in any industry, there are some businesses that are better than others in terms of how their production mitigates environmental and social impacts. It is important that we face the challenge of identifying the key areas where production can be improved, and ultimately, reduce or eliminate negative impacts.

One solution to this challenge is creating standards for responsible aquaculture products, as well as a process for certifying producers who adopt the standards. Standards, when adopted and compliance appropriately verified can help reassure retailers and consumers that the impacts related to aquaculture are minimized. Standards also can provide aquaculture industry stakeholders, as well as consumers, with the confidence that compliance with social and environmental performance has been achieved.

Through the Shrimp Aquaculture Dialogue (ShAD), performance-based standards for shrimp farming are being developed. With minor exceptions, the final standards will be numbers and/or performance levels that must be reached to determine if an impact is being addressed.[1] The final standards will be different than Best Management Practices in that they will define acceptable impacts rather than prescribe a production method. The core philosophy, in practice, is that the producers are the production experts and should be given the freedom to innovate around a collectively-defined environmental or social benchmark.

Each standard will be based on an impact, principle, criteria and indicator, as defined below:

- Impact: The problem to be addressed
- Principle: The high-level goal for addressing the impact
- Criteria: The area to focus on to address the impact
- Indicator: What to measure in order to determine the extent of the impact

The Dialogue seeks to set performance standards at the farm-level that are ambitious, yet practical for approximately the top 20 percent of farms – whether those farms are large or small. At the same time, the standards are intended to help protect and maintain large-scale ecosystem function and ecosystem services in shrimp producing areas, with the recognition that aquaculture operations are not solely responsible for total ecosystem health (see page 7 for further details on scope of application).

Created in 2007 by World Wildlife Fund (WWF), the ShAD includes more than 400 shrimp producers, environmental and social non-governmental organizations (NGOs), development organizations, retailers, wholesalers, aquaculture associations, academics, researchers, government representatives and independent consultants.

[1] A numerical result is not necessary when an indicator cannot be quantified. For example, the indicator for the principle "Obey the law," is "Documentation of compliance with national and local regulations." Thus, evidence of the necessary documentation satisfies the requirement.

The ShAD's 14-person Global Steering Committee (GSC) is a voluntary group responsible for managing the ShAD process, drafting standards and finalizing them based on public input. This group includes shrimp aquaculture producers, representatives from environmental and social NGOs, academics and certifiers that seek to represent constituent groups larger than themselves. GSC members were self-selected with the aim of developing a diverse and balanced decision-making body.

The ShAD process and full suite of draft standards (including principles, criteria, indicators and standards) are described in this document, along with the underlying rationales for how a particular standard is intended to address a key impact. This document also provides initial guidance on how to audit against the standards. [2]

Auditor checklists and guidance documents, which will be developed after the shrimp standards are finalized, will explain the methodologies used to determine if the standards are being met. A Better Management Practices (BMP) manual for shrimp aquaculture also will be created. The manual, geared toward producers, will explain specific steps that can be taken to meet the standards. The BMP manual will be particularly useful to those producers who do not have the capability to test new and innovative techniques that could be used to meet or exceed the standards.

The draft standards document will be posted for two 60-day public comment periods before being finalized. The first comment period will be from March 1 to April 30, 2010. All input received during the comment periods will be used to revise the standards document. Final standards are expected by the end of 2010.

This document does not reflect final agreement by the ShAD's GSC. Rather, during the public comment periods, GSC members retain the right to debate outstanding issues and develop alternatives based on public input, proactive outreach, and further research.

For complete information about the ShAD, including meeting summaries and presentations, go to www.worldwildlife.org/shrimpdialogue

This flag icon and textbox is used throughout the document to indicate a specific issue where public feedback would be particularly helpful in formulating an effective standard although public comment is encouraged on any part of the document.

[2] The ShAD recognizes that there may challenges with auditing some of these standards. However, it is expected that stakeholders will work to further develop auditing guidelines that will better ensure that the social and environmental impacts are mitigated in a practical and efficient way. The ShAD welcomes comments on auditing guidance for challenging standards.

Understanding standard-setting, certification and accreditation

Understanding the link between certification, standard-setting, and accreditation is important to comprehending the ShAD process.

Certification is the validation that standards have been achieved by producers. Certification may also refer to the labeling of companies, practices, operations or products that conform to the standards.

Certification schemes encompass the processes, systems, procedures and activities related to three primary functions: standard-setting, accreditation and certification (i.e., verification of compliance, also known as "conformity assessment"). Aquaculture certification schemes must be consistent with rigorous procedures for standard-setting, accreditation and certification to ensure that certification schemes are credible. With this in mind, a goal of the ShAD is to follow the International Social and Environmental Accreditation and Labelling (ISEAL) Alliance's "Code of Good Practice for Setting Social and Environmental Standards" when creating the standards.

For *standard-setting* (i.e., the process of creating the acceptable tolerance levels or limits of impacts), it is essential that the process is not dominated by one, or a few, stakeholder groups. The standards will be more credible and effective if they are based on the expertise and experiences of a broad and diverse group of people who are interested in aquaculture (e.g., producers who use different management practices, conservationists from international and local organizations, and scientists who specialize in different fields related to aquaculture).

For *accreditation* (i.e., the process of authorizing entities to verify compliance with the standards), it is important that there is no conflict of interest between the entities that participated in the standard-setting process, the entity that manages the standards, the entity that accredits third party certification bodies, and the entity that undertakes the third party certification. Firewalls are required between these various entities to assure that independence and credibility are maintained.

For *certification* (i.e., the process of verifying compliance with the standards), it is critical that there is no conflict of interest between the entity that conducts this function, the entities that participated in the standard-setting process, the entity that manages the standards, and the entity that accredits the certifiers. The organization that generates revenue from the labeling of products and distribution of certificates must not have any connections with the standard-setting body, as this could create an incentive to increase revenues by weakening standards. For the same reasons, the auditors determining compliance of a farm should not have a conflict of interest with the standards development body. The auditors also should not be housed in the certification body, given that the revenue generated from the certificates could influence the nature by which the audit is conducted. For this reason, third party certification is the most robust and credible process.

Purpose and scope of the Shrimp Aquaculture Dialogue standards

Purpose of the Standards

The purpose of the ShAD standards is to provide a means to measurably improve the environmental and social performance of shrimp aquaculture operations.

Scope of the Standards

Issue areas of shrimp aquaculture to which the standards apply

The shrimp standards establish principles, criteria, indicators and performance levels for responsible shrimp aquaculture with regard to social and environmental issues.

Supply or value-added chain of shrimp aquaculture to which the standards apply
The shrimp standards address the most significant environmental and social impacts of shrimp aquaculture, which primarily originate from the production systems and the immediate inputs to production, such as feed, seed, chemicals and water. Additionally, social impacts related to on-farm labor and community relations are addressed.

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 ShAD standards apply to the planning, development and operation of shrimp aquaculture production systems. Planning includes farm siting; resource use or extraction; and assessment of environmental, social and cumulative impacts. Development includes construction, habitat alteration and access to public areas by other resource users. Operation includes effluent discharge, working conditions, use of antibiotics and other chemicals, as well as feed composition and use.

Geographic scope to which the standards apply
The shrimp standards apply to all locations and scales of shrimp farm-based aquaculture production systems in the world. The shrimp standards are intended for internationally traded shrimp. Although there has been an increased level of consumption of shrimp in wealthier countries during recent years, it is expected that shrimp production in less-developed countries will continue to be promoted. The shrimp standards do not seek to impede or restrict the general development of shrimp operations, but rather to address the production of shrimp that is traded internationally. Every action that has an impact on natural resources could be perceived as limiting the resilience of the resources. Conversely, every action that human beings take could be perceived as necessary for survival. The shrimp standards attempt to reduce the ambiguity between these extremes and clarify what is an acceptable level of impact.

Unit of certification to which the standards apply
The unit of certification is the system within the production chain sought to be examined. In the case of the ShAD standards, the unit of production is the farming operation. The size of the production operation can vary considerably. Given that the focus of the shrimp standards is on production and the immediate inputs to production, the unit of certification will typically consist of a single farm or some other type of collective grouping. Specific data collection protocols will be described in the ShAD standards guidance document.

The unit of certification could be a group or cluster of facilities or operations that should, for a number of reasons, be considered collectively as the aquaculture operation under consideration. For example, they may share resources or infrastructure (e.g., water sources or an effluent discharge system), share a landscape unit (e.g., a watershed), have the same production system, and/or involve the same species and have a common market outlet. This group or cluster must be a legal entity that shares a common management structure so that the shrimp standards are binding for each individual producer. Regardless of the specific situation, farms and other users often can have cumulative effects on the environment and society. As a result, some of the ShAD standards are independent of what a producer can achieve at the farm level and rely on the efforts of the producer to act as an advocate and steward of their environment.

Under the compliance assessment of the ShAD standards, part of the unit of certification determination will include the geographic and/or receiving water body delineations in which the farm cultures in or discharges. In this context, a company that owns multiple grow-out sites will be

subject to compliance at the particular site they chose to undergo certification. Certifications will not be transferable to other farms or production systems that do not undergo auditing.

Each farm will be evaluated based on its activity. For example, if the farm operates a hatchery, the farm and hatchery will need to comply with the standard related to the amount of phosphorus used to produce a metric ton of shrimp. If the farm does not operate a hatchery, the farm will not be held accountable for the phosphorus loads that are produced at the hatchery where they source their seed.

Process for creating the standards

General Considerations

The process of setting standards is critical, as it largely determines the standards' credibility, viability, practicality and acceptance. The process of creating the ShAD standards has been – and will continue to be – multi-stakeholder, open to anybody to participate and transparent. Following are some of the fundamental components and steps of the ShAD process:

Process for Creating the Shrimp Aquaculture Dialogue Standards

- The Consortium on Shrimp Farming and the Environment was created in 1999. The consortium included representatives from WWF, Food and Agriculture Organization of the United Nations (FAO), World Bank, Network of Aquaculture Centres of Asia-Pacific and the United Nations Environment Program. Members of the consortium identified the key negative environmental and social impacts associated with shrimp aquaculture and developed principles that address the impacts. The consortium's work was based on discussions at 140 meetings with more than 8,000 people and the publication of 40 case studies by 120 researchers.
- The final principles produced by the consortium were adopted in 2006 by FAO.
    - Under the leadership of WWF, the ShAD was created in 2007. The impacts and principles identified by the consortium were the foundation for the ShAD's future work in creating criteria, indicators and standards.
- In 2007, ShAD participants agreed on the goals and objectives for the ShAD.
- In 2007, WWF notified ISEAL of the intent to apply the "Code of Good Practice for Setting Social and Environmental Standards" to the ShAD. ISEAL accepted WWF as an associate member on behalf of all of the Aquaculture Dialogues.
- In 2007 and 2008, three regional steering committees for the ShAD were formed, representing people from Asia, the Americas and East Africa.
- In 2009, the GSC – made up mainly of members of the regional committees – was formed. Nobody was prevented from participating on the GSC. The GSC includes the following people:

Name	Organization	Sector	Country
Laurent Galloux	Bureau VERITAS	Certification	France
Mathias Ismail	OSO	Producer & Distributor	Madagascar, EU
Marc Le Groumellec	Groupe UNIMA	Producer	Madagascar
Dominique Gautier	Aqua star	Distribution	UK
S.Jahangir Hasan Masum	Coastal Development Partnership (CDP)	NGO	Bangladesh
Mathew Parr	IUCN NL	NGO	Netherlands
Sian Morgan	Fishwise	NGO	USA
Pete Bridson	Monterey Bay Aquarium	NGO	USA

Name	Organization	Sector	Country
Ernesto Jack Morales	Sustainable Fisheries Partnerships	NGO	Philippines
Teresa Ish	Fish Choice	NGO	USA
Hector Corrales	Independent	Producer	Honduras
Michael Bowen	Belize Aquaculture Ltd	Producer	Belize
Leo van Mulekom	OXFAM Novib	NGO	Netherlands
Eric Bernard	World Wildlife Fund	NGO	France

- In 2009, the GSC created a process document for the ShAD that, among other things, includes steps for decision-making.
- From April 2007 to November 2008, five ShAD full Dialogue meetings (summarized below) were held to discuss potential criteria, indicators and standards. A sixth full Dialogue meeting was planned for Jakarta, Indonesia March 9-10, 2010.

Date	Location	Participants
April 2007	Antananarivo, Madagascar	65
April 1 - 2, 2008	Belize City, Belize	54
June 3 - 4, 2008	Antananarivo, Madagascar	62
October 9–10, 2008	Guayaquil, Ecuador	55
November 17-18 2008	Bangkok, Thailand	158

- From April 2009 to February 2010, the GSC held five multi-day meetings to develop and refine the ShAD's agreement building approach; develop draft criteria, indicators and standards; and develop and refine the ShAD's outreach strategy. Additional GSC meetings will be held prior to the completion of the ShAD process.
- The ShAD began outreach with key stakeholders and regions in April 2009. Additional outreach meetings will be held with key stakeholders during the two comment periods. Outreach to date includes:

Date	Location	Event
April 2009	Brussels SeaFood	Industry outreach
November 2009	Expo AQUA, Ecuador	Industry Outreach
November 2009	Qingdao, China	Industry Outreach
November 2009	Philippines	Multi-stakeholder Outreach
November 2009	Bangladesh	Multi-stakeholder Outreach

- Throughout the process, WWF wrote and disseminated press releases, and developed/updated the ShAD website, to keep people informed of upcoming meetings and progress within the ShAD.
- Draft principles, criteria, indicators and standards were posted for the first of two 60-day public comment periods on March 1, 2010. Feedback received during both comment periods will be used by the GSC to revise and finalize the standards document by the end of 2010. All general and specific comments received, as well as the GSC's responses to the feedback, will be posted on the ShAD website. Comments/responses will be sorted according to key issues, themes and frequency.
- Final standards will be given to a new entity, the Aquaculture Stewardship Council (ASC), which will be responsible for working with independent, third party entities to certify farms that are in compliance with the standards for responsible aquaculture being created by participants of the Aquaculture Dialogues. The ASC is expected to be in operation in 2011.

Continuous improvement of the Shrimp Aquaculture Dialogue standards

As stated in the ISEAL "Code of Good Practices for Setting Social and Environmental Standards," standards shall be reviewed on a periodic basis for continued relevance and effectiveness in meeting their stated objectives and, if necessary, revised in a timely manner." It is implicit in the development of the ShAD standards that the numerical values, or tolerance levels, will be raised or lowered over time to reflect new data, improved practices and new technology. These changes will correspond to a lessening of impacts rather than an increase in impacts. Changes to other components of the ShAD standards are also recognized as a way to reward better performance. It is the expectation of the GSC that the ASC will set the proper mechanism to review the standards.

Information for reader

In the following pages, tables present indicators and then corresponding standards. Within each criterion, standards tables are followed by a rationale section which explains to readers the conceptual framing behind the inclusion of given content and perceived key impacts.

The Guidance section explains how each standard should be interpreted by auditors or implemented at the farm level.

When provided, continuous improvement section explains how the members of the dialogue and standards setting body would like to see the standards improved through time – as necessary infrastructure, information or science - become available.
Definitions are provided in footnotes.

Principle 1: Comply with all applicable national laws and local regulations

Impact: Farm operations that, intentionally or unintentionally, break the law and violate a fundamental benchmark of performance for certified farms.

Criterion 1.1: Legal Requirements

	Indicator	Standards
1.1.1	Documents proving compliance with local and national authorities are available (e.g., permits, evidence of lease, concessions and rights to land and/or water use)	Yes
1.1.2	Documents proving compliance with all tax requirements	Yes
1.1.3	Documents proving compliance with all labor laws and regulations	Yes
1.1.4	Documents proving compliance with discharge regulations or permits	Yes
1.1.5	Only theraputants and chemical (e.g. chemicals, drugs, pesticides and probiotics etc.) authorized by national authorities and used in accordance to this standard are used	Yes

Rationale

Principle 1 reinforces the need for the shrimp aquaculture industry to follow the national and local laws of the region where shrimp aquaculture is taking place. A goal of the ShAD is to go beyond the law and produce more rigorous standards than that which the law requires, as long as the legal structure of the producing country is respected. Conversely, the ShAD standards do not contradict the laws where shrimp aquaculture is practiced. Thus, this principle is a means to reinforce and complement the legal framework in shrimp producing countries.

Principle 2: Site farms in environmentally suitable locations while conserving biodiversity and important natural habitats.

Impact: Inappropriate and unplanned siting of shrimp farms often results in production failures, environmental degradation, land use conflicts and social injustice. Thus, it is imperative that, when shrimp farms are created, due consideration is given to the environment, ecologically sensitive habitats, other land use in the vicinity, and the sustainability of the shrimp farming operations.[3] *Principle 2 covers the impacts associated with the initial siting as well as the construction and expansion of shrimp farms.*

Criterion 2.1: Ecological and biotic siting considerations

	Indicator	Standards (Existing Farms[4])	Standards (New/Expanding Farms[5])
**[6]2.1.1	Allowance for siting in National Protected Areas [7](PAs)	None, except for those with IUCN PA category V or VI	None, except for those with IUCN PA category V or VI
**2.1.2	Allowance for siting in mangrove ecosystems	None, except in areas needed for pumping stations and canals with appropriate offsetting via restoration of 100% of equivalent area.	None, except in areas needed for pumping stations and canals with appropriate offsetting via restoration of 100% of equivalent area.
**2.1.3	Allowance for siting in natural wetlands.[8]	None, except in areas needed for pumping stations and canals with appropriate offsetting via restoration of 100% of equivalent wetlands area and characteristics	None, except in areas needed for pumping stations and canals with appropriate offsetting via restoration of 100% of equivalent wetlands area and characteristics
**2.1.4	Allowance for siting in habitats of species listed by the IUCN Red List.	BEIA (2.1.9-2.1.11) must identify critical habitat for all species present on farms listed as threatened, vulnerable, endangered or critically endangered. Farms protect areas of critical habitat for such species.	BEIA (2.1.9-2.1.11) must identify critical habitat for all species present on farms listed as threatened, vulnerable, endangered or critically endangered. Farms protect areas of critical habitat for such species.

[3] As noted in the International Principles for Shrimp farming (FAO 2006), advantage should be taken of improved techniques that take into account not only the requirements of the cultured shrimp and the management of the farm, but also integrate the farm into the local environment whilst causing the minimum possible disturbance other surrounding ecosystem.
[4] **Existing Farm**: Encompasses any of pond, farm site or related facilities established prior to publication of this document.
[5] **New Farm**: Encompasses all forms of expansion, new ponds, new farm sites or related facilities done after publication of this document.
[6] **Asterix** indicate standards that may be replaced or complimented by HCVA and quantitative conservation planning outputs, as they become available.
[7] **Protected Areas** : A protected area is "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.
[8] **Wetland (Ramsar Convention):**Wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, 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 meters.

	Indicator	Standards (Existing Farms[4])	Standards (New/Expanding Farms[5])
**2.1.5	Allowance for siting in critical habitats ofspecies at risk[9] as defined by national listing processes.[10]	None	None
2.1.6	Minimum width and density of buffer zone between farm boundary and closest (exposed coast) maximum high tide line	>/=100m, with tree density >/=30 trees *100 m^{-2}	>/=100m, with tree density >/=30 trees *100 m^{-2}
2.1.7	Minimum width and characteristics of riparian buffers between farms and natural waterways	100 m each side for adjacent natural water bodies, 25 m each side for confined watercourses.	100 m each side for adjacent natural water bodies, 25 m each side for confined watercourses.
2.1.8.	Size of corridors on farms	Size determined by EIA and must traverse the farm in a minimum of 2 perpendicular directions	Size determined by EIA and must traverse the farm in a minimum of 2 perpendicular directions
2.1.9	Presence and content of a BEIA statement.	BEIA statement in accordance with guidance document framework	BEIA statement in accordance with guidance document framework
2.1.10	Accreditation of the BEIA assessment team	BEIA carried out by accredited national body in accordance with national legislation	BEIA carried out by accredited national body in accordance with national legislation
2.1.11	Public availability and transparency of BEIA.	BEIA statement and associated management plan published and accessible on company website, local government offices, and with local community representatives in appropriate language	BEIA statement and associated management plan published and accessible on company website, local government offices, and with local community representatives in appropriate language
2.1.12	Allowance for siting in High Conservation Value Areas (HCVA)	HCVAs maintained	HCVAs maintained

[9] **Species at risk:** Also known as an endangered species is a population of organisms which is at risk of becoming extinct because it is either few in numbers, or threatened by changing environmental or predation parameters.

[10] **National listing process**: Any process that occurs at the national, provincial, state, or other level within-country that evaluates species conservation status against a set of defined criteria recognized by relevant governance. Such listing processes may legally binding (e.g. Endangered Species Act in the U.S.A. or the Species at Risk Act in Canada), or may not be legally binding. (e.g. species listings created by COSEWIC in Canada (Committee on the Status of Endangered Wildlife), or the Red Data Book in Vietnam).

	Indicator	Standards (Existing Farms[4])	Standards (New/Expanding Farms[5])
2.1.13 	Scientific conservation planning	Farms provide relevant information (see guidance), at the scale of ≥10 km to the ASC over 3 years following certification.	Mandated use starting five years after release of the ISFRSF, at the scale of ≥10km. Farms sited only in zones identified as having appropriate characteristics for shrimp culture.

2.1.6 – 2.1.8: There is a clear ecological rationale for maintaining or including coastal and riparian buffer zones and wildlife movement corridors in human impacted landscapes. How can we implement this rationale in practice on shrimp farms?

2.1.9 – 2.1.11: At what scale should EIAs be mandatory – with all farms, all ponds, with farms above a certain size, or with farms operating at certain intensities.

What is the status of legislation in differing producing countries? What would the differing national Impact Assessment authorities recommend? Do the three indicators (2.1.6-2.1.8) adequately address 'quality' of impact process? How can the standards most efficiently deal with recognized impact assessment procedures such as EIA and SIA, and emerging assessment procedures such as HCVs? Should they all be considered under one heading, and one assessment, or kept separate?

2.1.12 – 2.1.13: How do we implement incentives to undertake landscape level and integrated coastal planning processes and deal with the issues of 'carrying capacity' and cumulative impacts? Are EIAs, HCV assessments and Quantitative Conservation Planning on their own sufficient to deal with these issues? What else would be recommended? Are data collection layers feasible expectations for farmers both in terms of costs and/or capacity?

2.1.12 – 2.1.13: Is the scale of 10 km and time scale for 2.1.10 appropriate?

Rationale

Conceptually, there is clear recognition that ecological and social considerations are both key to siting. Principle 2 focuses on ecological considerations, although some standards under this principle simultaneously invoke planning related to human use or values (e.g. standard 2.1.9, HCVA planning). As the standards are currently designed, most social considerations related to siting are housed under Principles 3 and 4.

Standards 2.1.1 - 2.1.3 focus specifically on habitats that have protected status, or that have historically received inadequate protection when land has been converted into shrimp farms.

Standards 2.1.4 and 2.1.5 address additional habitat considerations, recognizing that certain habitat serves essential functional uses for key life stages of species (2.1.4), or that species may be themselves at risk, but not within a protected area, a wetland, or a mangrove system (2.1.5).

Standards 2.1.6-2.1.8 relate to siting or retaining biological features in relation to abiotic or landscape features. These siting issues comprise buffer and corridor considerations.

Standards 2.1.9 – 2.1.11 govern environmental impact assessments that will be mandated to precede farm construction or expansion.

Standards 2.1.12 and 2.1.13 serve to improve data gathering and to support governance mechanisms responsible for assuring responsible regional land/coastal zone use. Furthermore, standards 2.1.12 and 2.1.13 acknowledge that while the ShAD standards will be evaluated at the farm level, cumulative impacts can only be addressed at the landscape level. Furthermore, the proportion of shrimp farms sited inland away from the coastal zone is increasing. These landscapes vary in different parts of the world, making it difficult to identify *a priori* all areas/ habitat types that may be unsuitable for conversion. The intent here is that such areas would be identified as rare or otherwise important to protect, relative to the surrounding landscape matrix, via standards 2.1.12 and 2.1.13. Standards 2.1.12 and 2.1.13 are anticipated to take time to implement in relevant regions, but will drive the use of appropriate consultative processes and best science. Together, these should result in non-prescriptive conservation planning that is ecologically sound and supported by regional stakeholders.

Biological diversity - or biodiversity - is the term given to the variety of life on Earth and the natural patterns it forms. Biodiversity is often understood in terms of the wide variety between and within species - the plants, animals, microorganisms and their associated genes. Another aspect of biodiversity is the variety of ecosystems where living creatures, including humans, form a community, interacting with one another and with the air, water, and soil around them. It is the combination of life forms and their interactions with each other that provides the foundation for the goods and services that sustain humans.

At the 1992 Earth Summit in Rio de Janeiro, world leaders agreed on a comprehensive strategy for "sustainable development" -- meeting our needs while ensuring that we leave a healthy and viable world for future generations. One of the key agreements adopted at Rio was the Convention on Biological Diversity (CBD). This pact among the vast majority of the world's governments sets out commitments for maintaining the world's ecological underpinnings as we go about the business of economic development.

The standards under Principle 2 of the ShAD standards draw heavily on international conventions such as the CBD and their approach and philosophy. In particular there is a focus on conserving biodiversity at the ecosystem, habitat and species level, conserving ecosystem functions, and attempting to reward siting and shrimp farm planning based on an ecosystem approach, one with siting assessments that identify biodiversity and social impacts, and local governance that integrate coastal management. Principle 2 also tries to deal with the complexity and 'data deficiency' realities of biodiversity and ecosystems in tropical countries by focusing on single issues such as mangroves and wetlands, as well as trying to direct the industry and relevant local governments towards a broader appreciation and valuation of biodiversity and ecosystems, and planning that reflects that valuation.

2.1.1: Protected Areas: Protected areas are internationally recognised as a major tool in conserving species and ecosystems. They also provide a range of goods and services essential to sustainable use of natural resources. A protect area is defined as “An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means” (IUCN, 1994, Guidelines for Protected Areas Management Categories. IUCN, Cambridge, UK and Gland, Switzerland.261pp.).

2.1.2: Mangroves and Wetlands: Coastal wetlands are very rich in biodiversity and highly productive in nature. They are the grazing and breeding ground for many marine species and also provide habitat for a wide variety of resident and migratory waterfowls. They are as such considered critical habitats and high conservation value areas.

One of the most critical impacts of shrimp farming has been the deforestation and impact of farm siting on mangroves and other critical habitats. These habitats have been compromised by a variety of coastal development activities, including aquaculture. It is estimated that 10% of mangroves have been lost to shrimp aquaculture, with global losses on the order of 40-50% (Boyd, 2002[11]), although these figures are extremely difficult to verify. Mangroves serve critical ecosystem functions including: stabilizing soil erosion, reducing wave energy and storm surges, diminishing the effect of high winds, filtering runoff entering coastal waters from rivers (sedimentation and biofiltering), maintaining water quality for inland aquaculture, being the most productive ecosystems on tropical and subtropical shorelines, providing habitat for many birds and marine organisms, performing a nursery function for marine and estuarine species, and being used by humans for food gathering (fish, reptiles, shrimp, crabs and other uses (construction materials, fuelwood, employment), and C sequestration (Boyd, 2002, Twilley et al., 1992[12]). No net loss of biodiversity and ecosystems, via offsetting, is now a common principle in conservation.

Guidance 2.1.2 – 2.1.3: Restoration

The ShAD accepts that shrimp farms will require saline water to be pumped or brought into the farm via canals through coastal habitats such as mangroves. It is now accepted practice to allow for such impacts as long as they are compensated for. Should the ShAD adopt a 'no net loss' policy, or something more stringent? What type of restoration should be recommended, and how should a farmer demonstrate compliance to this restoration?

Guidance 2.1.2 – 2.1.3: Existing Farms

For existing farms, how can an auditor best identify and assess previous habitats? Are aerial photography, satellite imagery, GIS, historical data or records, community and farmer testaments a valid and sufficient set of criteria to check previous habitat? Can farms comply to this? What other methods could auditors use to confirm siting has not occurred in mangroves or wetlands? Should the ShAD impose 'retroactive' standards on shrimp farms, i.e. prevent access to certification to those built after 1999 within mangroves and wetlands (Ramsar declaration date), but permit access to those built before 1999 within these habitats?

Guidance 2.1.2 – 2.1.3: Silvofishery

How can the ShAD set specific guidance criteria for silvofishery? What is accepted/recommended tree cover and design? Is the guidance on this, focusing on the Indonesian context, sufficient and clear?

2.1.3: Wetlands: The Convention on Wetlands of International Importance, called the Ramsar Convention, the intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Wetlands provide fundamental ecological services and are regulators of water regimes and sources of biodiversity at all levels - species, genetic and ecosystem. Wetlands constitute a resource of great economic, scientific, cultural, and recreational value for the community. Wetlands play a vital role in climate change adaptation and mitigation. Progressive encroachment on, and loss of, wetlands causes serious and sometimes irreparable environmental damage to the provision of ecosystem services. Wetlands should be restored and rehabilitated, whenever possible and should be conserved by ensuring their wise use.

[11] Boyd, C.E. 2002. Mangrove and coastal aquaculture. Pp: 145-157. R.R. Stickney & J. P. McVey. Responsible Marine Aquaculture. Pp. 391.
[12] Twilley, R.R., Chen, R. H. &Hargis, T. 1992. Carbon sinks in mangroves and their implications to carbon budget of tropical coastal ecosystems. *Water, Air &Soil Pollution*. 64 (1-2) : 265-288

2.1.4: Species at risk: "IUCN Red List of Threatened Species" is a global inventory of the conservation status of plant and animal species. A series of "Regional Red Lists" are produced by countries or organizations, which assess the risk of extinction to species within a political management unit. The IUCN Red List uses criteria that evaluate extinction risk. Criteria are relevant to all species and all regions of the world. ISRSP Standards refer to the three categories that confer the greatest risk (near threatened, vulnerable, endangered, and critically endangered).

2.1.5: Critical habitat: The ShAD standards seek to identify and protect critical habitats for species at risk, in areas where shrimp farms can be located. While mangroves and wetlands are acknowledged as habitats that provide valuable human and ecological services, and that regularly overlap with shrimp farming regions, other habitats at risk that are distinct from mangrove forests[13] and wetlands also occur in regions where farms may be sited. Such areas may be considered critical for a variety of reasons which are broadly defined by the fact that species use such areas as necessary space, for the resources that they provide, for cover, for reproduction (see guidance for further description).

We acknowledge that critical habitat is ideally defined using life history information and population viability analyses to ascertain which life stages most influence population trajectories (as defined by the elasticity of population growth rates) (Mangel *et al.,* 2006[14]). Such information shows which life stages most influence population growth and therefore identifies which functional habitats with their corresponding behaviours deserve particular protection. For example, if a juvenile life stage is limiting, protecting foraging grounds for juveniles may be more important that protecting breeding grounds for adult life stages.

However, the real costs of intensive science to ascertain such information is prohibitive in the context of certification, particularly for small-scale farmers. Recognizing its limitations, we here adopt a proxy-based approach that aims to protect the main component of critical habitat for species that are listed in national listing process (see glossary for definition).

2.1.6 – 2.1.8: Buffer zones: Consideration was given to the siting of buffers between/within farms and the surrounding landscape matrix. Five types of buffers were considered: 1) riparian buffers between farms and aquatic ecosystems (rivers, surface waters), 2) coastal buffers between farms and coastlines, 3) between farms and terrestrial ecosystems (wild, agricultural, or developed land), 4) between adjacent farms, and 5) between ponds within farms.

Of the five types of buffers outlined, only buffers between farms and rivers and farms and coastlines have been included as siting considerations, while the needs addressed by other forms of buffers are covered under standards in other Principles. In keeping with the performance-based/impact-oriented aims of the standards, we note here where the other impacts that necessitate consideration of buffers are addressed by standards housed under other Principles.

Between Farms and terrestrial systems
It is generally recommended that farms have buffer zones around them to protect surrounding field, agricultural land or surface waters, from salinization (Perez Osuna, 2001). Criteria 2.3 includes standards that prevent salinization impacts outside of farms via soil and "closest well" tests.

[13] **Mangrove Forest**: A mangrove forest is an association of halophytic trees, shrubs, palms, ferns and other plants growing in brackish to saline tidal waters on mudflats, riverbanks and coastlines in tropical and subtropical regions. This vegetation has the common characteristic of living in the zone inundated by the highest tides and exposed by the lowest tides. All mangrove species also share a common characteristic of salt tolerance. (Mitsch & Gosselink, 1993).
[14] Mangel, M. Levin, P. &Patil, A. 2006. Using life history and persistence criteria to prioritize habitats for management and conservation. *Ecological Applications*. 16(2): 797-806

Between Farms
Buffers between farms grouped in a landscape are relevant because they have impacts on water use/re-use, which in turn affects the quality of effluent and habitat impacts. Standards under Principle 7 address these concerns. In particular, the standard 7.6.4 aims to account for cumulative effluent loads from sets of farms in landscapes.

Between Ponds within Farms
Such a standard is relevant to disease transfer within farms. Therefore it was considered to be covered under Principle 5.

2.1.6: Coastal buffers: Coastal vegetation, and particularly mangroves, serve an important protection function for coastal communities, where these ecosystems break onshore waves and winds at the land/sea interface, particularly during storm surges. Mangroves also stabilize soil against erosion and filter runoff entering coastal water from rivers (Boyd, 2002). The magnitude of energy absorption strongly depends on tree forest/soil attributes, which include, among others, tree density, tree size/age (stem and root diameter) species of trees, shore slope, bathymetry and the amount of undergrowth, the spectral characteristics of incident waves and tidal stage upon entering forests stem and root diameter, shore slope, bathymetry, spectral characteristics of incident waves, and tidal stage upon entering the forest (Alongi 2008[15], Forbes &Broadhead, 2007). Mangrove forests in particular, are among the most important types of vegetation in coastal buffers. Analytical models show that 30 trees per 100 m^2 in a 100m wide belt may reduce the maximum tsunami flow pressure by more than 90% (Hiraishi & Harada, 2003[16]). Coastal mangrove buffers are regularly 100m - 2 km in width (Haylor, G. & Bland, S. 2001[17]) and may be much wider.

Here we are including standards that set a minimum of 100m of coastal buffer between farms and shorelines. This value errs on the side of small relative to what currently exists in many areas (e.g. 2-10km). The reasoning behind this standard acknowledges the need for coastal buffers, while also being realistic that farms have little control over the land practices between their own holdings and shorelines unless this is a relatively narrow strip where they have immediate influence. Including a minimum buffer strip between farms and oceans has two further benefits. First, it assures that ponds cannot occupy the sea-water interface. This is a high risk farming area where, relative to inland areas, it is more difficult to control environmental events that are directly linked to escapement and disease transfer. The second benefit of coastal buffers is that they assure that communities have an area from which to access to marine resources.

2.1.7: Riparian buffers: FAO International Principles for Responsible Shrimp Farming propose to: incorporate or retain buffer zones and habitat corridors between farms and other users and habitats. Landscape connectivity is critical in tropical agricultural countryside (Sekercioglu, 2009[18]). Riparian habitats are considered particularly important in this respect, but unfortunately there is no "one-size-fits-all" description of an ideal riparian buffer strip (Fischer and Fischernitch, 2000[19]). While other ShAD standards address water quality and salinization, recommended widths for ecological concerns in buffer strips typically are much wider than those recommended for water quality concerns (Fischer

[15] Alongi, D.M. Mangrove forests: resilience, protection from tsunamis, and responses to global climate change. *Estuarine Coastal and Shelf Science*. 76(1): 1-13
[16] Hiraishi T. and Harada K. 2003:Greenbelt Tsunami Prevention in South-Pacific Region, Report of the Port and Harbour Research Institute, Vol.42
[17] Haylor, G. & Bland, S. 2001. Integrating aquaculture into rural development in coastal and inland areas, In R.P. Subasinghe, P. Bueno, M.J. Phillips, C. Hough, S.E. McGladdery& J.R. Arthur, eds. Aquaculture in the Third Millennium. Technical Proceedings of the Conference on Aquaculture in the Third Millennium, Bangkok, Thailand, 20-25 February 2000. pp.73.81. NACA, Bangkok and FAO, Rome.
[18] Sekercioglu, C., H. 2009. Riparian Corridors Connect Fragmented Forest Bird Populations. *Current Biology*. 19(5) : R210-R213
[19] Fischer, R. A., and Fischenich, J.C. (2000). "Design recommendations for riparian corridors and vegetated buffer strips," EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-24), U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/emrrp

et al. 1999; Fischer 2000[20]). Lees and Peres (2008)[21] recommend buffer zones of >400m (>200m each side of the watercourse), but acknowledge that compliance with some countries legal requirements for even a 100m buffer is currently minimal. Recognizing the difficulty of implementing a 400m wide buffer, the ShAD standards initially aim to achieve full compliance with a 200m zone, represented by 100m buffers on either side of waterways.

2.1.8: Corridors: Corridors are essential ecological features that allow the movement and dispersal of organisms between suitable patches within a landscape (http://en.wikipedia.org/wiki/Habitat_corridor). Maintaining the potential for organisms to move freely and within the safety of appropriate habitat is essential for the maintenance of essential functions such as foraging and breeding.

2.1.9 – 2.1.11: Biodiversity inclusive environmental Impact Assessments (BEIA): Environmental impact assessment (EIA) "is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse."(International Association for Impact Assessment, IAIA, http://www.iaia.org/). It also acts as a decision making process for reducing these impacts. EIA also provides opportunities to ensure that biodiversity values are recognized and taken into account in decision-making. Importantly, this involves a participatory approach with people who might be affected by a proposal (those living in or around site), which is also a key indicator as to the quality and credibility of the assessment. Decision VI/7-A of the CBD endorsed guidelines for incorporating biodiversity issues in environmental impact assessment legislation and/or processes – so called biodiversity inclusive environmental impact assessments. See guidance for further info. The process of participatory-Social Impact Assessment (SPIA) is currently covered under 3.1.1 at Principle 3.

Given the potential impact of shrimp farming on the environment and biodiversity, and the complexities of defining specific critical habitats and local environmental conditions, the ShAD proposes that Biodiversity inclusive EIAs are mandatory and implemented prior to the siting of any new or expansion of any existing shrimp farms.

Although legislation and practice vary around the world, the fundamental components of a quality EIA are the same, ranging from screening through to monitoring and compliance. See guidance for key documents.

One of the most effective ways to ensure that an EIA process is fair and credible is through full and public stakeholder engagement, with all affected and interested parties, and public disclosure of Environmental Impacts Statements.

2.1.12 – 2.1.13: Cumulative impacts: Farm siting should be done in a relative sense, acknowledging the multiple uses and ecological realities of the surrounding landscape matrix. This approach is consistent with both ecosystem based management and the precautionary principle. Without landscape-level assessment, it is challenging, and sometimes not possible, to optimally identify best areas for siting of shrimp farms. The ISRSF include two standards that aim to allow farms to be best sited given social/human value considerations (HCVA) and given ecological considerations (quantitative conservation planning). Such standards were included on the premise that farms in

[20] Fischer, R. A., Martin, C. O., Barry, D. Q., Hoffman, K., Dickson, K. L., Zimmerman, E. G., and Elrod, D. A. (1999). "Corridors and vegetated buffer zones: A preliminary assessment and study design," Technical Report EL-99-3, U.S. Army Engineer Water ways Experiment Station, Vicksburg, MS., Fischer, R. A. (2000). "Widths of riparian zones for birds," EMRRP Technical Note Series, TN-EMRRP-SI-09, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

[21] Lees, A.C., and Peres, C.A. (2008). Conservation value of remnant riparian forest Corridors of varying quality for Amazonian birds and mammals, *Conservation Biology*. 22, 439–449.

areas that use some form of integrated (coastal zone) management are better able to account for their cumulative siting impacts relative to the distribution of biodiversity - and services provided - by a landscape.

2.1.12: High Conservation Value Areas (HCVAs): The High Conservation Value Areas methodology is one approach that enables habitats and areas to be defined and delineated as High Conservation Value Areas (HCVAs). High Conservation Value Areas (HCVA) are defined as natural habitats where values are considered to be of **outstanding significance** or **critical importance.** Six main values, common to most stakeholders are considered during an HCVA evaluation[22]. Examples of areas identified as HCVAs include habitat with rare or endemic species, sacred sites, or resources harvested by local residents. Mapping these areas will, in turn, make it possible to site farms most-appropriately from both an ecological and human perspective. HCVA methods have currently been developed and are being implemented for siting other industrial uses of land resources, focused mainly on forestry, and mining to a lesser degree **(**http://hcvnetwork.org/**)**.

HCVA methods have received limited use in the context of marine and particularly coastal (land/water interface) situations. The ShAD GSC is committed to exploring the development of these democratic, multi-stakeholder processes in the context of siting for shrimp farms under the ASC (see continuous improvement section below). In the interim, cumulative impacts are being addressed through standards 2.1.1 - , coupled with standards that mandate data collection, that will later be coupled with or supplanted by standards developed directly from HCVA consultation via standard 2.1.7. Standards that currently function as proxies for standards that will be addressed through HCVA consultation in the future are marked by **.

2.1.13: Systematic, quantitative conservation planning: Visualizing the distribution of rare or threatened species or habitats with high conservation value is necessary for effective conservation initiatives. Systematic quantitative conservation planning tools also allow multiple layers of spatial information to be combined when defining patches with optimal characteristics, within landscapes. Normally the objectives of such a process are pre-defined by the end user. Here objectives are envisioned to be consistent with at least the ecological conservation objectives of relevant agencies tasked to retain ecosystem patterns and processes in relevant jurisdictions. Social or expert considerations from HCVA can also be explicitly included in analysis. There are many tools that can be used in systematic, quantitative conservation planning (Sarkar*et al.,* 2006). Examples include Marxan, MarZone, C-Plan and others.

Standards currently mandate the collection of landscape-level ecological data for existing farms within three years of certification, acknowledging that such data may be missing or incomplete in many developing countries, but promoting data monitoring/collection for informed decision-making. Existing farms will require the *a priori* completion of quantitative conservation planning in the future, giving prospective certified farms time to begin collecting such information. A five year time horizon is consistent with prospective data collection proposed by other ShAD standards and other ASC standards (e.g. traceability of feed inputs etc.).

Ten km of spatial information was chosen because it provided a level of information that exceeded the farm scale in a reasonable manner, but did not place an unfair burden of documentation on

[22] **The six values evaluated by HCVA include: HCV 1: a**reas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia). **HCV 2:** Globally, regionally or nationally significant large landscape-level areas where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance. **HCV 3:** Areas that are in or contain rare, threatened or endangered ecosystems. **HCV 4**: Areas that provide basic ecosystem services in critical situations (e.g. watershed protection, erosion control). **HCV 5:** Areas fundamental to meeting basic needs of local communities (e.g. subsistence, health). **HCV 6:** Areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

producers. Furthermore, this scale was felt to be reasonable to generate a series of overlapping 20 km mapped circles, that could collectively map a regional landscape. Mapping at the scale of 1km would be likely to leave unmapped patches in the landscape when information is consolidated by the ASC, while mapping at scales beyond 10 km could represent wasted effort and repetitive mapping of the same spaces.

Guidance for implementation

2.1.1: Protected Areas :Although all protected areas meet the general purposes contained in this definition, in practice the precise purposes for which protected areas are managed differ greatly. Human activities like shrimp farms may occur within a Protected Area but in fact also be contributing to the purpose of that Protected Area. The IUCN Protected Area category, the Protected Area authority itself, combined with the standards contained within this document, will ultimately determine if the farm can be certified. Tools to be utilized for ensuring compliance include National Protected Area maps, Integrated Biodiversity Assessment Tool, and Protected Area management consent. Protected Areas with IUCN categories Ia through to IV: if within PA IUCN category V or VI, farm must be operating in accordance with protected areas management plan and consent of protected areas management is required.

The location of a farm relative to protected areas will be determined via the farms geographical coordinates. These coordinates will be provided to the auditor (degrees and minutes latitude and longitude) with an accuracy of two decimals in the geographical minutes (e.g. 15º 22,65' N ; 22º 43,78' E) and shall refer to the centre of the production site (smaller sites; <1 ha.) or the corners of the contours of the larger production sites (> 1 ha.) All farms must give their designation relative to IUCN PA status in their operations manual.

2.1.2 and 2.1.3 – Mangroves and Wetlands: Cutting Mangroves or altering natural wetlands is ONLY acceptable in relation to shrimp farms for building pumping stations and canals. Mangroves must be compensated by allowing natural regrowth or reforesting an equivalent area, using indigenous species adapted to the specific hydrological conditions. When reforesting, plantings should be done to create forests with similar relative composition and must include 80% of tree species that were in the original communities. Natural wetland must be compensated by creating areas with similar ecological characteristics[23] and such that areas used do not contain HCVAs and are not of critical functional use by species at risk or local people. These issues should be covered within the EIA and/or SPIA. 100% of farms sited after 1999 are required to prove through aerial photography, satellite imagery, GIS, historical data or records, community and farmer testaments that the current farm did not cause mangrove deforestation or natural wetland alteration. Farms sited prior to 1999 are required to reforest 50% of the average area present on the farm site. Farms shall monitor neighbouring mangrove areas to ascertain that negative impacts are not occurring. Factors to consider in mangrove assessments are changes in the area of mangroves, changes in species diversity, presence of dead or dying trees, freshwater impoundment, saline water intrusion, sedimentation, hydrological changes and use of mangroves by local people (Boyd, 2002).

[23] **Similar ecological characteristics**: environments with the same (not statistically significantly different at the p=0.05 level, based on at least three randomly sampled transects) density of the top five community-dominant species, species richness within 10% of the original and composition showing the same ordering of dominants. This will be determined through initial baseline monitoring during audits for established farms, or via EIAs, for new or expanding farms.

Silvofishery

Silvofishery/culture is socially important in some Asian countries, and is an exception to the siting in mangrove standard. The term silvofishery is derived from the two words sylvo (meaning tree/forest) and fishery. Silvofishery is technically a good approach, comprising a framework of activities integrating fish cultivation with the planting, care, management and conservation of mangrove forest. This system requires only simple technology, can be applied without harming the mangrove trees or the construction of existing ponds, and can be carried out as an activity in its own right, not just as part of efforts to reforest the green belt along critical coastal areas.

In its development, the silvofishery model has been substantially modified, but generally three models can be distinguished (examples taken from Indonesia). These are the empangparit, komplangan, and jalur. In the empangparit model, the land for mangrove forest and ponds is one large expanse regulated by one sluicegate. In the komplangan model, the land for mangrove forest is separate from that for the ponds, forming two large expanses regulated by a water channel with two sluice gates: one for the mangrove forest area and the other for the ponds (Bengen, 2003). The silvofishery jalur model is a modification of the empatparit, having additional channels in the centre that function as ponds. The silvofishery model commonly developed in the community is the tanggul model.

2.1.3: Wetlands: The Ramsar Convention takes a broad approach in determining the wetlands which come under its aegis. Under the text of the Convention (Article 1.1), wetlands are defined as: “areas of marsh, fen, peatland or water, whether natural or artificial, 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”.

Ponds can be built in wetland areas previously modified for other human activity and now considered as artificial wetlands. Ponds can be built in flood plains provided the hydrology of the area is maintained and a percentage of the natural land is not developed. No construction of new ponds in natural wetlands is permitted.

2.1.4: Species at Risk: Guidance interpreting application of the Red List Categories and criteria can be found here: http://www.iucnredlist.org/apps/redlist/static/categories_criteria_3_1

2.1.5: Critical habitat: All criteria are taken verbatim from the 1984 US Fish and Wildlife Service criteria for designation of critical habitat under the Endangered Species Act. These criteria were updated in 2001 to include the National Marine Fisheries Service criteria. Critical habitat is defined as:

1. Space for individual and population growth and for normal behaviour “Space”.
2. Food water, air, light, minerals, or other nutritional or physiological requirements. “Resources”.
3. Cover or shelter “Cover”.
4. Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal “Reproduction”.
5. Habitats that are protected from disturbance or are representative of the historic geographical and ecological distribution of a species. “Distribution”

For further interpretation see: http://www.epa.gov/lawsregs/laws/esa.html

2.1.6: Coastal buffers: Vegetation must be undisturbed and permanent, and must be dominated by tree/forest cover. For open coastlines and adjacent natural water bodies, the zone of undisturbed vegetation must be 100m wide.

2.1.7: Riparian buffers: Vegetation must be undisturbed and permanent, and must be dominated by tree/forest cover. For open coastlines and adjacent natural water bodies, the zone of undisturbed vegetation must be 100m wide. For confined watercourses such as rivers or streams that cross the farm area, or man-made canals in forested habitats, the zone must be at least 25m wide on both sides.

2.1.8: Corridors: BEIAs shall determine, both through national agency records and direct monitoring, the organisms present on farms including the largest organisms known to have occurred within 10 years within 50km of a farm. Corridors shall be designed to allow free passage of such organisms across at least two perpendicular farm axes. Corridors need to retain the historical habitat which should be of at least theoretical passability to species of concern.

2.1.9: BEIA Statement: The EIA should follow best practices as outlined by the IAIA and the Institute for Environmental Assessment (http://www.iaia.org/publicdocuments/special-publications/Principles%20of%20IA_web.pdf). The Espoo Convention, signed in 1991, lays down the minimum content of an EIA in its Appendix II (http://www.unece.org/env/eia/documents/legaltexts/conventiontextenglish.pdf). The Convention on Biodiversity has outlined the main content and process of a Biodiversity inclusive EIAs - Guidelines on biodiversity-inclusive Environmental Impact Assessment (BEIA) (http://www.cbd.int/doc/reviews/impact/EIA-guidelines.pdf). The EIA should be consistent with the criteria outlined in the full ShAD standard, and carried out in conjunction with the Social Impact Assessment outlined in 3.1.

2.1.10: BEIA team: The BEIA should be carried out by a nationally accredited body. Where no accredited body exists, companies should ensure that the BEIA team consists of competent and qualified environmental scientists, biologists and ecologists.

2.1.11: BEIA transparency: Engagement with all affected and interested parties should be carried out from the beginning of the process, to the point of producing the Impact Statement, and ongoing as part of the Environmental Management plan. All of these documents should be published in local languages and in local forum – at local government offices, with local community heads, with local NGOs who have close relationships with the communities, or on the company website.

2.1.12: HCVA: HCVA methodologies are being developed rapidly in differing production contexts around the world. At present the best resource for further information about HCV assessments can be found at the HCV Network website: hcvnetwork.org.

The HCV process comprises three key steps, each with an associated output:

1. Identify the HCVs which are present: the presence or absence of each HCV is determined based on an analysis of existing information and the collection of additional information where necessary to fill gaps. Pre-existing areas of importance have been identified here: http://www.zeroextinction.org/sitemap.htm.
2. Identify the HCV area and how it must be managed: the High Conservation Value area is the area of habitat which must be appropriately managed in order to maintain or enhance the identified values. Identifying an HCV area and its management regime involves:
    a) Investigating the existing and potential future threats to the high conservation values identified. These may be threats from proposed management activities, such as logging operations or plantation establishment, or from external activities such as hunting of wildlife, illegal logging or encroachment for agriculture.
    b) Establishing both the location and the management requirements for the HCV area with the aim of ensuring that the HCVs identified are maintained or enhanced. This can

include delineating areas which need total protection and identifying areas which can be used for production provided that management is undertaken in a way consistent with maintaining or enhancing HCVs.

3. Establish an appropriate monitoring regime to ensure that the management practices are effective in their aim of maintaining or enhancing the HCVs. The monitoring regime needs to translate the strategic objectives of the management regime into operational objectives. Appropriate indicators must be chosen to assess the status of the HCVs, and thresholds for action must be established to ensure that the HCVs are maintained or enhanced.

2.1.13: Systematic, quantitative conservation planning:

Existing Farms: Farms are required to provide the following minimal information to certifiers:

- All spatial land/water use data must be provided in a digital format for areas surrounding the farm at a scale of at least 10km in all radial directions, for an area centred on the geographical centre of the farm, comprising at least a circle of 20 km diameter, not including the farm area. Free resources including information that can be obtained or generated through Google Earth or Google Maps are acceptable. All maps should be provided at a scale of 30 m resolution (LandSat7[24] resolution), where possible, and 100m if not.
- Land use zoning and/or industrial activities in the region (e.g. mining, forestry, hydro, etc. – possibly including fisheries)
- Existing protected areas (see: http://www.wdpa.org/)
- Vegetation cover types (for mangroves, see: http://dwms.fao.org/mangroves/index_en.asp)
- Primary productivity maps
- Primary, secondary and tertiary road data layers
- River and water ways
- Soil type

New Farms: Systematic conservation planning can be separated into six stages, and some examples of tasks and decisions in each are presented below. Note that the process is not unidirectional; there will be many feedbacks and reasons for altering decisions (see text for examples)(from Margules&Pressey, 2000[25]).

1. Compile data on the biodiversity of the planning region

- Review existing data and decide on which data sets are sufficiently consistent to serve as surrogates for biodiversity across the planning region.
- If time allows, collect new data to augment or replace some existing data sets.
- Collect information on the localities of species considered to be rare and/or threatened in the region (these are likely to be missed or under-represented in conservation areas selected only on the basis of land classes such as vegetation types).

2. Identify conservation goals for the planning region

- Set quantitative conservation targets for species, vegetation types or other features (for example, at least three occurrences of each species, 1,500 ha of each vegetation type, or specific targets tailored to the conservation needs of individual features). Despite inevitable subjectivity in their formulation, the value of such goals is their explicitness.
- Set quantitative targets for minimum size, connectivity or other design criteria.
- Identify qualitative targets or preferences (for example, as far as possible, new conservation areas should have minimal previous disturbance from grazing or logging).

[24] **LandSat**: The Landsat program is the longest running enterprise for acquisition of imagery of Earth from space. The satellites acquire images of the Earth's surface which have important applications for agriculture, cartography, geology, forestry, regional planning, surveillance, education and national security. Images are currently captured at resolutions ranging from 15-60 m.

[25] Margules, C.R. &Presey, R.L. 2000. Systematic conservation planning. *Nature*. 405: 243-253.doi:10.1038/35012251

3. Review existing conservation areas

- Measure the extent to which quantitative targets for representation and design have been achieved by existing conservation areas.
- Identify the imminence of threat to under-represented features such as species or vegetation types, and the threats posed to areas that will be important in securing satisfactory design targets.

4. Select additional conservation areas

- Regard established conservation areas as 'constraints' or focal points for the design of an expanded system.
- Identify preliminary sets of new conservation areas for consideration as additions to established areas. Options for doing this include reserve selection algorithms or decision-support software to allow stakeholders to design expanded systems that achieve regional conservation goals subject to constraints such as existing reserves, acquisition budgets, or limits on feasible opportunity costs for other land uses.

5. Implement conservation actions

- Decide on the most appropriate or feasible form of management to be applied to individual areas (some management approaches will be fallbacks from the preferred option).
- If one or more selected areas prove to be unexpectedly degraded or difficult to protect, return to stage 4 and look for alternatives.
- Decide on the relative timing of conservation management when resources are insufficient to implement the whole system in the short term (usually).

6. Maintain the required values of conservation areas

- Set conservation goals at the level of individual conservation areas (for example, maintain serial habitats for one or more species for which the area is important). Ideally, these goals will acknowledge the particular values of the area in the context of the whole system.
- Implement management actions and zonings in and around each area to achieve the goals.
- Monitor key indicators that will reflect the success of management actions or zonings in achieving goals. Modify management as required.

Inappropriate soil conditions (low potential for seepage), no/minimal overlap with protected areas, mangroves, wetlands or other habitat patches identified for preservation should serve as minimum requirements for excluding areas suitable for shrimp culture.

Continuous improvement

2.1.6. – Coastal buffer

Instead of using a discrete and generic coastal buffer recommendation, countries should be strongly encouraged to use the most current numerical models available (e.g. Koh et al. 2009[26]) to examine how coastal buffers should vary along different sections of coastline. Such efforts are outside the scope of auditing or BEIAs for the ISRSF, but are acknowledged as best practice and would make use of the best available science. Collaborative efforts by national agencies and local municipalities should make such recommendations public, then work to attain such buffers, potentially buying back developed land in areas that would be best used for coastal protection[27].

[26] Koh, H.L., Teh, S.Y., Llu, P.L., Ismail, A.I.M., Lee, H.L. 2009; Simulations of Andaman 2004 tsunami for assessing impact on Malaysia. *Journal of Asian Earth Science*.;36(1): 74-83

2.1.12

The HCVA criterion in the draft standard of the ShAD faces a number of challenges (see also section 1.1). The four main challenges for a successful implementation are:

1. Lack of data on where HCVAs can be found in different countries and at different scale, in particular in coastal settings;
2. A lack of understanding of the concept, capacity to implement, and how it can be incorporated in the monitoring of adherence to certification standards;
3. A proliferation of different approaches in applying the HCV concept in different certification schemes and;
4. The costs of assessment.

The ShAD will have to answer these and other challenges in the coming months if the criteria and methodology is to be adopted by the ShAD GSC and broadly accepted by the industry. It is also expected, given the relatively new nature of this concept and methodology that the ASC will have to continue this work in the first few years of existence in order further address these challenges.

In initially the GSC proposes the following approach to address these:

- Engage the HCV Network (the organisation set up to promote cooperation, collaboration and consistency in the use of the HCV concept, to enable local-level approaches to implementation, and to support activities to develop and improve the HCV approach)
- Obtain feedback from key coastal HCV practitioners in shrimp producing countries
- Develop a number of HCV pilots in broad coastal settings where shrimp farming is prevalent
- Facilitate HCV assessments in a number of pilot farms
- Feedback and refine the criteria, standards and indicators to the GSC/ASC

At present the GSC will incorporate both an HCV criteria and traditional critical habitat criteria (such as mangroves, Protected Area etc.) where they are known.

Data availability (comprehensive maps of ecologically sensitive habitats such as mangroves and other coastal ecosystems, and other land use in the vicinity important for local livelihoods) is currently one of the major information challenges facing standards implementation (pattern/process mention).

HCVA assessments can be done as part of a BEIA and SPIA (see 3.1), and the ShAD will provide ongoing improvements around implementation of this standard in the coming years. The ShAD is committed to furthering the ability of HCV assessments to be carried out by farmers to achieve these standards.

Other Outstanding Issues:

Do any of existing standards overlap within P3 and P4 – how should this be addressed? Do we need to include either/or options (particularly with reference to EAI/SPIA, conservation planning/HCVA)?

Hydrology: Hydrological conditions are very important for the maintenance of many organisms and local ecosystem functions. Does the ShAD sufficiently deal with water issues, in particular as they relate to siting and ecosystem function? How can the ShAD deal with hydrology at the indicator and standard level, and direct auditors and farmers in the right direction to deal with this complex issue?

[28] Additional References: Hagen, A. N., and K. E. Hodges. 2006. Resolving critical habitat designation failures: reconciling law, policy and biology. *Conservation Biology* 20:399-407.

Criterion 2.2: Prevention of salinization of adjacent freshwater and soil resources

	Indicator	Standards
2.2.1	Soil texture required for ponds and canals not covered with a plastic liner or other waterproof material	Clay content >10% and sand content <70%.
2.2.2	Allowable water loss[29] in ponds	< 1 cm/day
2.2.3	Allowance for the use of fresh groundwater for diluting salinity in pond	None
2.2.4	Water-specific conductance or chloride concentration in adjacent freshwater wells[30] and surface freshwater bodies[31]	Specific conductance <1,500 µmhos/cm or chloride concentration <300 mg/L
2.2.5	Soil-specific conductance or chloride concentration in adjacent land ecosystems and agricultural fields[32]	Specific conductance <1,500 µmhos/cm or chloride concentration <300 mg/L
2.2.6	Dimensions of sediment containment area	0.75m-high embankments and at least 0.375m-high of storage volume available for rainfall
2.2.7	Specific conductance or chloride concentration of sediment used as fertilizer	If sediment is to be disposed of in a freshwater zone, specific conductance <1,500 µmhos/cm or chloride concentration <300 mg/L. If sediment is to be disposed of in a saline soil area, the specific conductance or chloride concentration values could equal those of the soil in the disposal area.

Rationale

Shrimp ponds contain saline water and -- if located above freshwater aquifers -- infiltration may cause groundwater salinization (Boyd et al. 2006) by means of lateral seepage beneath or through pond embankments. Seepage can also cause soil and surface water salinization near farms. The main practice for avoiding salinization is to construct ponds on sites where soils are impermeable -- effectively slowing the percolation rate. The ShAD requires ponds to be constructed in soils that have

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Stoner, A. W. 2003. What constitutes essential nursery habitat for a marine species? A case study of habitat form and function for queen conch. *Marine Ecology Progress Series*. 257:275-289.

[29] Cumulated water loss through seepage and evaporation

[30] "Adjacent freshwater wells" are defined as wells located on the farm property or adjacent properties. If salt is detected in the nearest well it would suggest a problem that should be corrected for continuance of certification compliance. In the absence, the nearest freshwater well would be considered although It is impossible to say how far the salt could move through the soil to reach aquifers and how far it would move in aquifers.

[31] Surface freshwater bodies adjacent to farm property or receiving waters discharged from the farm should be sampled to track their salinity over time and assure that water seepage or draining effluents are not causing salinization. The distance that salt could infiltrate through soil to reach more distant surface water bodies will depend upon time, soil properties, ground water depth and movement, and slope (Boyd, personal communication).

[32] Soil salinity in adjacent land ecosystems and agricultural fields should be sampled 100 m from ponds or canals. If salt contamination is detected at the 100-m station, then the monitoring could be extended further out as necessary.

a good range of particle sizes (but not rocks and gravel) and contain more than 10% clay. However, having a clay content of 20 to 30% is recommended for pond site soils (Yoo and Boyd 1994).

All ponds seep to a certain extent, however, some seep worse than others. A recent literature review found that normal seepage from aquaculture ponds did not exceed 20 cm/month (Boyd 2009). The seepage rate from ponds can be determined as the water level changes minus evaporation over a period of a few days without rainfall and during which water is not added or discharged from ponds. Producers normally will not have access to evaporation data. However, in a properly constructed pond on suitable soils, evaporation usually will be about twice seepage (Boyd 2009). Therefore, it was determined that cumulated losses from seepage and evaporation should not exceed 1cm per day.

The ShAD determined shrimp farms cannot extract freshwater from subsurface 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. Also, 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. Many shrimp 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 could also flow onto non-saline soil areas causing salinization of surface soil. Water from sediment disposal areas could infiltrate and lead to salinization of freshwater aquifers. The best way to dispose of saline sediment removed from ponds is to place it back on the insides and tops of pond embankments from which most of it eroded. However, sediment from sedimentation basins, water supply canals, and ponds not protected from external sediment input must be disposed outside of ponds. The best sites are in saline soil areas and especially in areas without surface or underground freshwater bodies. Sediment disposal sites should be surrounded by embankments to avoid runoff and, if they are in areas with highly permeable soil or in freshwater zone, they should be lined with clay or plastic to avoid infiltration. If embankments are 0.75 meters high and twice as large as the area in which sediment will be stored, at least 0.375 meters of storage volume for rainfall would be available. This amount of storage volume would capture the rainfall from the 100-year rainfall event in most areas and prevent runoff from the stockpiled sediment. After two or three years, salt will leach from sediment that can be used for landfill or disposed of by spreading it in agricultural areas, provided the salt content of sediment is not higher than in the soil of the disposal site.

The ShAD requires monitoring of chloride concentration or specific conductance levels in soil (including sediment disposal sites), surface water and groundwater near shrimp farms, as an increase will indicate salinization has taken place. Historical data on either will not be available, thus the first tests taken at the onset of the certification program will serve as the reference point for each site. The ShAD has set freshwater limits to 1,500 µmhos/cm specific conductance and 300 mg/L chloride. These levels are based on data presented by Boyd (2000) indicating that freshwater waters have <1,000 mg/L total dissolved solids (TDS), and a TDS-specific conductance ratio of 0.65, while the chloride: TDS ratio is around 0.30, also aligning with Benoit's (1988) position that effluents discharged into freshwater streams should not increase chloride concentration above 230 mg/L.

Guidance for implementation

2.2.1: Sand and clay soil contents must be determined by a soil laboratory. Sand content is determined using a sieve No. 270 with an opening of 0.053 mm (Boyd 1995). Clay content is determined using a hydrometer model 152H of the American Society of Testing Materials (Boyd 1995). A simpler test is to determine if wet soil can be molded into a ball or "snake." This technique can be used by auditors for rough field verification.

2.2.2: A water level decline of 1.0 cm/day can be measured during a 24-hour period without rainfall, but if there is no overflow during the period of measurement, an adjustment can be made for rainfall. The equation for estimating water loss is:

$$WL = \frac{(H_{t=1} + P) - H_{t=2}}{t_2 - t_1/24} \qquad (4)$$

where WL = water loss (cm/day);
H = water surface elevation in pond (cm);
P = precipitation during period of measurement (cm);
t_2-t_1 = time (hour) between the beginning (t_1) and the end of measurement (t_2).

There is a simple way to measure water level (H) in ponds (Fig. 1). A length of 5- to 10-cm diameter plastic pipe with a 0.5-cm diameter hole drilled in its midsection can be installed vertically in a pond by pounding one end of the pipe into the sediment. The small hole will allow the water level in the pond to stand at the same level in the pipe as outside the pipe. The purpose of the pipe is to allow a still surface for measuring water level. A wooden or plastic measuring stick can be fitted with a horizontal cross piece that will prevent it from being inserted further into the pipe once the cross piece contacts the top of the pipe. The difference in the water mark readings on the measuring stick between t = 1 and t = 2 will indicate how much the water level changed during the period of measurement. Note: A small rain gauge may be installed near the pond whose catch during the period of measurement used to adjust for rain falling into the ponds. Also, it will be necessary to install an extra dam board in the discharge structure during the period of water level change measurement to provide storage volume and avoid overflow after rain events.

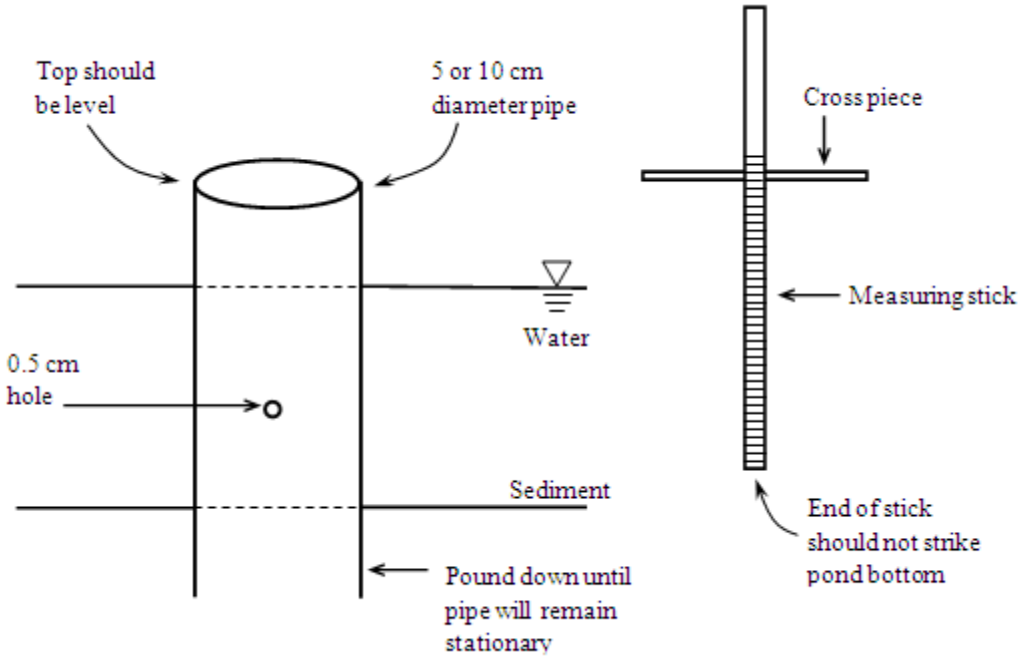

Fig. 1: Illustration of apparatus for measuring water level changes in an aquaculture pond.

2.2.3: Measurements must be made at six-month intervals during the dry and rainy seasons for considering possible seasonal variations as a result of the precipitation regime. Hand-held salinometers are used widely to measure salinity in shrimp ponds. These devices are fine for salinities of approximately 2 or 3 ppt, but they are not sensitive enough for use in ascertaining if shrimp farms are causing salinization of freshwater bodies. Two alternative methods are proposed. The quickest and easiest method for evaluating the salinity status of water is to measure specific conductance with a conductivity meter. This instrument costs about USD 1,000, and small-scale farmers may not be able to afford it. An alternative is a chloride test kit. Several companies sell these kits for less than USD 100. Note: When purchasing kits, chloride kits must not be confused with chlorine kits.

2.2.4 and 2.2.7: The standard procedure for measuring chloride or specific conductance in soil (Jackson 1958) is too complicated for use in shrimp aquaculture certification efforts. An alternative for specific conductance measurement (Boyd et al. 2006) involves taking a 20-g soil sample and placing it in a 250 mL Erlenmeyer flask with 20 mL of distilled water and mixing for 2 hr on an oscillating platform shaker at 180 rpm. The mixtures were filtered by vacuum through a Whatman Number 41 paper in a Buchner funnel. Specific conductance of filtrates was measured with a YSI salinity conductivity temperature meter. This method is also too complicated for use by small-scale shrimp farmers. Therefore, a possible alternative is to place 20 g of soil in a glass container, add 40 mL of distilled water, and shake by hand for five minutes. The specific conductance could be measured directly in the solution or the solution could be filtered and the chloride concentration measured. Multiply specific conductance values by 2 to adjust for the extra dilution (40 mL versus 20 mL) for the modified procedure. Specific conductance values over 1,500 µmhos/cm or chloride concentrations above 300 mg/L would indicate soil is slightly saline. The greater the specific conductance or chloride concentration values, the more saline the soil.

Criterion 2.3: Prevention of soil erosion

2.3: Is soil erosion a farm priority impact that needs to be addressed?

Rationale for possible exclusion: Erosion of embankments and canals can affect the operation of the farm, restricting water storage capacity and water movement. However, it is unlikely to affect directly the surrounding environment. Canals and ponds act as settling basins for soil particles. The main consequence of erosion would be the accumulation of sediments in the farm. These sediments would have to be periodically removed for restoring the volume capacity of canals and ponds. Therefore, the main environmental risk would be associated with disposal of these sediments. The handling and disposal of sediments is already addressed through indicators 3.1.4 and 3.1.5 under the salinization criterion.

	Indicators	Standards
2.3.1	Side slope[33] of open canals	>3:1 for a loose clay or sandy loam, >1.5:1 for stiff clay. 0.5:1 to 1:1 is acceptable with lining.
2.3.2	Bottom slope, total depth, width at the bottom, width of the water surface and top width of open canals	Calculated such as the flow velocity in the canal is not higher than maximum permissible velocity
2.3.3	Presence of a freeboard[34] on open canals	Yes
2.3.4	Presence of lining in vulnerable reaches, such as bends, steep slopes, changes in width, reaches with unstable soil, and junctions to control erosion and scouring in open canals	Yes
2.3.5	Side slope of pond banks	>3:1 for clayey soils, 2:1 or even 1:1 is acceptable for well-graded soils, especially on the dry side
2.3.6	Freeboard of pond banks after settlement	>30cm
2.3.7	Top width of pond banks	>2m
2.3.8	Siting of farms in relation to natural waterways in the immediate farm area.	Construction of shrimp farm must not alter hydrological conditions of the area.

Rationale

Erosion of embankments results in an accumulation of soil particles on the bottom of canals and ponds, and consequently in a loss of water storage capacity and alterations of water movement. In this case, farms need to periodically remove accumulated sediments for restoring the depth and slope of canals and ponds. The disposal of these sediments must not have detrimental ecological impacts on the surrounding environment. The best option is to use sediments on site for repairing embankments. Alternatively, sediments must be stored in a controlled area prior to responsible disposal (refer to indicators 3.1.4 and 3.1.5 on salinization).

Bank erosion can be prevented by respecting key rules when designing and constructing ponds and canals (Yoo and Boyd 1994). This is the focus of this criterion. Existing farms that do not comply with these construction rules must implement effective measures for controlling erosion and a plan of progressive reconditioning of banks to achieve these standards.

[33] horizontal: vertical

[34] Vertical distance from normal water level to the top of the bank.

Shrimp farms are usually located near natural watercourses, including freshwater streams and rivers, estuaries and natural coastal canals. The hydrological features of an area condition the type of vegetation and related wildlife, and major changes in hydrological conditions can have detrimental impacts on the ecosystem. Therefore, the ShAD promotes the conservation of natural hydrological conditions when siting and designing a shrimp farm.

Guidance for Implementation

2.3.1: Farmers need to demonstrate that slopes were determined, based on the nature of construction materials used.

2.3.2: Where the natural terrain does not allow for the adequate bottom slope, drop structures must be installed as to reduce water velocity. The maximum permissible velocity is a function of normal flow depth and erosion coefficient for different construction materials, and is determined at 0.75 to 1.8 m/s for common flow depth of less than 90 cm.

2.3.3: The adequate height of the freeboard must be determined, based on the normal depth of flow and the flow rate.

2.3.4: A number of alternative materials – such as plastic liner, wooden boards, concrete and rocks – can be used.

2.3.5: Lining materials can be used to maintain stability below the normal water line. Grass cover can be used above the normal water line on the wet side and on the dry side to protect embankment from damage by erosion.

2.3.6 : Embankments must have a freeboard extending above the anticipated maximum high water level in the pond as a safety factor to protect embankments from waves or overflow due to higher than expected storm events.

2.3.7: This standard is defined for banks as high as 3 meters, which would be the case in most farms. For embankments higher than 3 meters, the top needs to be wider in relation to the height. If the top of the embankment is to be used for a roadway, provide for a shoulder on each side of the roadway to prevent raveling.

Principle 3: Develop and operate farms with consideration for surrounding communities[35]

Impact: Although often the economic backbone of local communities, shrimp farms can also have a negative impact on local communities, such as reducing public access to land and water resources and jeopardizing livelihoods.[36]

Criterion 3.1: All impacts on surrounding communities, ecosystem users, and land owners are accounted for and are, or will be, negotiated in an open and accountable manner

	Indicator	Standards
3.1.1	Farm owners shall commission or undertake a participatory Social Impact Assessment (p-SIA)[37] and disseminate results and outcome openly in locally appropriate language. Local government and at least one civil society organization chosen by community shall have a copy of this document.	Full compliance. The p-SIA process and document comply to guidelines given below. The participatory element (community input) is an integral part of the report.

Rationale

Credible social sustainability standards must be able to respond to real human concerns that arise in communities located near the farm, as well as its overall operations. In particular, appropriate consultation must be undertaken within local communities so that potential conflicts are properly identified, avoided, minimized, and/or mitigated through open and transparent negotiations on the basis of an assessment toward risks and current impacts on the surrounding communities. Communities will have the opportunity to be part of the assessment process. The impacts of aquaculture operations on minorities and those prone to discrimination will be accounted for, and opportunities for these groups of people should be identified, evaluated and addressed. Negative impacts may not always be avoidable. However, the process for addressing them must be open, fair, and transparent. Therefore, these community standards focus on due diligence through dialogue and

[35] **Community:** A group of people with possibly diverse characteristics who are linked by social ties, share common perspectives, and are joined by collective engagements within a geographically confined area. Four indicators:

- a state of organized society in small form (town, village, hamlet) that recognizes a single representative (leader, formal or informal)
- The people inside a confined geographical area; small enough to allow face-to-face interaction as the main form of contact between the individuals within the group
- having a common good or a common interest and recognizing that, and been recognized as having that.
- A sense of common identity and characteristics ('we' versus 'them' feeling) on either/or social, cultural, economic, ethnic grounds.

[36] This principle area seeks to minimize injustice or unrest in affected communities that may result for Shrimp farming activities. The standards recognize that it is only possible to be socially equitable to the point that legal frameworks and negotiated outcomes allow. Nonetheless, the GSC believes this standard represents a significant improvement from past and current social realities, and will seek to continuously strengthen them. Specifically, the GSC has benchmarked ShAD social sustainability standards against widely accepted international public covenants and agreements, such as UN declarations on Human Rights, the Right to Development, the UN Declaration on the Rights of Indigenous Peoples, the Millennium Development Goals, and the ILO core conventions. Examples of convenants with the private sector include: OECD Guidelines for multinational corporations and the UN Global Compact on Corporate Social Responsibility. A more detailed benchmark is set by existing and developing protocols in Multi-Stakeholder Initiatives such as the Roundtable on Sustainable Palmoil, Ethical Tea Partnership, Forest Stewardship Council and in standards such as SA8000, ETI, and the GlobalGAP Social Annex (specific to shrimp aquaculture).

[37] **Participatory Social Impact Assessment (p-SIA)**: An assessment of positive and negative consequences and risks of a planned or ongoing project (here: a farm or farm development) undertaken in such a manner that all stakeholder groups have input in process, results, and outcome of such an assessment, and that steps taken and information gathered is openly accessible to all.

negotiation with surrounding communities. The p-SIA report forms the basis for assessing compliance to criterion 3.2 and 3.4.

Criterion 3.2: Complaints by affected stakeholders are being resolved

	Indicator	Standards
3.2.1	Farm owners shall draft and apply a verifiable conflict resolution policy for local communities. The policy shall state how conflicts and complaints will be tracked transparently and explain how to respond to all received complaints. Complaint boxes, complaint registers, and complaint acknowledgement receipts (in local language(s)) are used.	Areas of conflict or dispute are listed on paper and shared among farm, local government, and surrounding community representatives. At least 50 percent of the conflicts shall be resolved within six months from the date of being filed, and an additional 50% six months later (75% total within one year).

Mutually fair and open negotiations will help resolve conflicts. The farm must, therefore, have a conflict resolution policy in place that describes how to make complaints as well as how the farm intends to address them. The contents of this policy must be known publicly (in surrounding communities) and the farm must allow verification as to the progress it makes in resolving outstanding concerns. The standard makes allowance for the eventuality that not all conflicts can be resolved easily and quickly. It must also be mentioned that conflicts may not necessarily be caused by farm development and/or operation. But the farm shall exercise due diligence (i.e. actively seek to determine and solve) with regard to complaints, provide the utmost effort to avoid doing harm to the interests of surrounding communities, and provide evidence for this according to the standard.

Criterion 3.3: Providing employment within local communities

	Indicator	Standards
3.3.1 	Farms shall purposely seek to employ people from surrounding villages before turning to migrant and/or distant workers	Farm owners shall document evidence of advertising positions within local communities before hiring migrant workers

3.3.1 : Will this standard help mitigate the associated negative impacts of migrant labor? Are there better alternatives?

Rationale

Unskilled manual labor is common on many shrimp farms and, therefore, shrimp aquaculture can be very beneficial to rural village economies as a major source of employment. However, shrimp farmers often resort to hiring migratory workers asking them to stay on, or close to, the farm. In doing so the potential value shrimp farming has to local rural economies is lessened. The criterion is formulated to ensure the local workforce is duly considered for jobs on the farm, and migratory workers are only hired when the local workforce does not meet requirements.

Criterion 3.4: Contract farming[38] arrangements (if practiced) are fair and transparent and are beneficial to the contract farmer

	Indicator	Standards
3.4.1	The contracts are on paper in appropriate language and co-signed copies are in the hands of both parties	100% compliance
3.4.2	The contracts include basic provisions (see guidance section for information about basic provisions) that ensure the full implication of the agreement is mutually understood	100% compliance
3.4.3	There are recorded meetings between the purchaser and the contract farmers to discuss and/or negotiate in open and transparent fashion	Meetings are held at least twice/year. Meetings with farm-groups or cooperatives have been attended by at least 50% of the membership.

Rationale

Contract farming arrangements are increasingly part of the business practices in the aquaculture sector. However, these arrangements do differ from labor contract arrangements in that the contract does not revolve around labor in exchange for wages, but is an arrangement between two independent parties that both carry risks in committing to and implementing the contact. The concern that the standard is seeking to address is that contract farming arrangements are open to skewed, in-equal, and in-transparent arrangements. In short, often the less powerful party is not fully made aware of what he/she is committing to, and often compliance to mutual obligations can only be enforced by one party. This should, evidently, not be the case. Three specific indicators are set to ensure the contracting itself is open, fair and transparent.

Guidance for implementation

3.1 Participatory Social Impact Assessments (p-SIAs)

1. Documents can be checked and verified through confidential conversations with participating stakeholders, local government, and/or the civil society organization. Minimally a one-page summary with main outcomes is translated in the local language(s) that apply.
2. The focus of the criterion is on risks and impacts between (surrounding) communities and the farm. Information as to technical operations on the farm that have no bearing on risks and impacts outside the farm need not be documented nor disclosed in the participatory processes.
3. The extent to which the steps in the p-SIA are done by outside professionals, or with outside professional consultants, or (almost fully) localized, with or without the use of high-end technical tools, can be appropriate to the scale of the farm. Therein are area-size (ponds and additional grounds dedicated to the farm), farm-technology (intensive to extensive), and capital lay-out are good indicators to make judgments on the appropriateness of the methods and tools used in the p-SIA. Small farmers can do these steps in locally organized processes and use hand-written documentation that gets posted on village public signboards. Industrial estates of large size and investment will need to hire professional experts to assist in this process and are expected to adhere to methodological descriptions provided by UNDP

[38] **Contract farming:** Contract farming can be defined as an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices. The arrangement also invariably involves the purchaser in providing a degree of production support through, for example, the supply of inputs and the provision of technical advice. The basis of such arrangements is a commitment on the part of the farmer to provide a specific commodity in quantities and at quality standards determined by the purchaser and a commitment on the part of the company to support the farmer's production and to purchase the commodity" (FAO)

or World Bank. The only addition to existing generic descriptions of the p-SIA methodology is that here also a 'closure and reclamation plan' is requested.

4. For new farms the focus of this criterion lies in assessing future risks and impacts. It will be done before a physical start is made with farm establishment. For existing farms the focus lies in assessing actual risks and impacts. In both cases, the outcome is oriented towards identifying how to responsibly deal with these risks and impacts in negotiated processes with those who are affected.
5. In group certification approaches (cooperatives or an area of individual farms of which products are not individually traceable in trade), the whole group is the unit of interest.

Guidance on applying a p-SIA

Commonly used prescribed methodologies exist for p-SIAs. See:

- http://unpan1.un.org/intradoc/groups/public/documents/cgg/unpan026197.pdf for an example of a more comprehensive description of the methodology, and http://www.unep.ch/etu/publications/EIA_2ed/EIA_E_top13_hd1.PDF for a short concise set of tools adapted to developing country rural context.

What audits can check for – independent of country or place or context the farm is in – is that the following nine steps have appropriately been followed or commissioned by the farm owner or operator:

1. Look for stakeholders (possibly affected people, groups, communities) and develop a two-way communication.
2. Make a description of the current or intended farm and at least two alternatives (one of these is the 'no farm or no expansion' scenario). Focus therein should be on siting, the size it occupies (including buffers, fences, safety zones, roads or harbors associated with the farm), habitat (conversion), inflows of natural resources (e.g. water and groundwater), interruption of natural processes (e.g. fishery/nursery), interruption of socio-economic and socio-cultural processes (fishery/walkways/ancestral heritage lands, etc.), and effluents coming from the farm (water, pollution, noise, light, etc.). Processes on the farm need only be described if risks outside the farm are associated (e.g. pesticides, antibiotics) and need not include operational details that are not relevant to a risk/impact discussion.
3. Describe anticipated changes and impacts as well as how much they will impact whom. Pay attention to: socio-economics, socio-cultural, labour, livelihood options, access to & control of natural resources, governance (participatory, transparent) parameters. Include changes to and impact on use rights[39] and customary rights[40].
4. Research probable impacts that are likely to be most important. In doing this, it is important to arrange meetings with stakeholders to let them prioritize as well as include data reports on interviews with stakeholders to let them express how they assess/view/feel about risk and impact; identify both positive and negative risks and impacts, as this paves the way for handling trade-offs.
5. Do deeper investigations into priority impacts with focus on the question: "what changes will lead to if indeed come about?" Include:
    a. physical effects
    b. likely adaptations and the social and economic effects of making such adaptations
    c. how these effects and indirect effects would compare to having no intervention
    d. how effects may or might be cumulative

[39] **Use rights**: Rights for the use of land and resources that can be defined by local custom, mutual agreements, or prescribed by other entities holding access rights. These rights may include customary or legal restrictions on use of resources to specific levels of consumption or harvesting techniques

[40] **Customary rights:** Patterns of long standing community land and resource usage in accordance with indigenous or local community customary laws, values, customs, and traditions.

6. Make recommendations to maximize the positive, minimize the negative, compensate, mitigate, or avoid the intended farm of farm development
7. Propose a mitigation plan assuming the farm development will take place or continue (in adapted form if that seems appropriate); include a 'closure and reclamation plan' (see criterion 3.4)
8. Develop and approve with all stakeholders a monitoring plan and indicators on both positive and negative risks and impacts (make use of PRA methodologies in this step)
9. Make recommendations and conclusions (accessible to all and not just the owner/manager of the farm)

3.2 Conflict resolution

Conflicts, for the purpose of this standard, are situations wherein one party perceives hindrance in legitimate interest as caused by the other party's actions or absence of actions. One party is the farm owner or manager. The other party is either a surrounding community, or group of stakeholders in the community. Conflicts, for the purpose of this standard, do exclude complaints made by single individuals unless verified by a community leader or community organization. The farm may not necessarily be at fault if conflicts arise. But the farm shall exercise due diligence to avoid any harm done on legitimate interests of people around the farm. "Due diligence" is the effort made by an ordinarily prudent or reasonable party to avoid harm to another party.

The process of resolution is documented and meeting minutes are kept. Minutes include an agenda, the list of concerns raised, resolutions or agreements reached, who shall take what action by when, and a list of participants. Local government and, if available, at least one civil society or customary organization chosen by the community, shall have access to the conflict resolution process and the documentation. A conflict is deemed resolved if both parties in the negotiation process have agreed to take it off the agenda.

3.3 Providing employment within local communities

Farms must be able to demonstrate that vacancies are first communicated to the surrounding community. The standard does not pre-determine local hiring, but seeks to exclude the possibility that farms avoid hiring people locally if and where suitable workers are available.

3.4 Contract farming arrangements

1. The contract should include, at a minimum, the following contents and clarifications:
    - Date of entry, both signatures, date of signing
    - The assurance that credit or input provisions are at a price not above prevailing market rates
    - Changes in credit/input arrangement and prices thereof are communicated on paper and amount to the right of the contractee to terminate the contract
    - Payments for harvests are calculated on paper; these calculations are mutually signed and copies are available to both parties
    - Provisions on price-quality parameters are described on paper in the contract or to the contract belonging annex
    - The contract provides clear arrangements on exit, termination, buy-out options, handing over of deeds of assets (if applicable) and compensation measures in case of bankruptcy of the purchaser
    - The contract includes mutual rights and obligations as to ensuring quality of inputs, production system, product, and a list of 'dos and don'ts' as to preventing diseases and/or damages to neighboring ponds
2. Sometimes the "purchase" is referred to as the "mother company," but in this document they are one in the same.

3. Copies of signed contracts are available with both parties and can be inspected.
4. Meeting minutes between contractor and contractees are documented. Minutes include an agenda (the list of concerns), resolutions or agreements reached, who shall take what action by when.

Principle 3

- Which indicator and standards are appropriate for farm closure and reclamation arrangements?
- Would such an indicator be relevant for private standard system?

Principle 4: Operate farms with responsible labor practices

Impact: Aquaculture, as any agricultural production system, often requires intensive labor. Particularly in developing countries, workers often live on or near the farm in a rural environment lacking good infrastructure and living conditions.[41]

Criterion 4.1: Child labor[42]

	Indicator	Standards
4.1.1	Number of incidences of child labor in violation of ILO Convention 138 and/or ILO Convention 182, with the additional exception that any child working on the farm must be 15 years of age or older	None

Rationale

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[43] and young workers[44]. Children are particularly vulnerable to economic exploitation, due to their inherent age-related limitations in physical development, knowledge and experience. Children need adequate time for education, development and play and, therefore, shall never be exposed to work or working hours that are hazardous to their physical or mental well-being. To this end, the standards related to what constitutes child labor will protect the interests of children and young workers in certified aquaculture operations.

Criterion 4.2: Forced, bonded compulsory labor[45]

	Indicator	Standards
4.2.1	Number of incidences of forced, bonded or compulsory labor	None

Rationale

Forced labor[46]—such as slavery, debt bondage and human trafficking – is a serious concern in many industries and regions of the world. Ensuring that contracts are clearly articulated and understood by employees[47] is critical to determining that labor is not forced. The inability of a worker to freely leave

[41] Please note that many countries have national laws that address labor issues rigorously and intensively, however this is not consistent in a global context. Addressing these key issues in aquaculture is critical, given the important human rights implications and proven societal benefits of labor standards related to poverty, sustainable economic growth, good governance and political stability. The labor standards in this document help ensure that all aquaculture operations certified against the ShAD standards have reduced or eliminated the potential impacts of key labor issues associated with production. Moreover, the ShAD labor standards are based on the core principles of the International Labor Organization (ILO): freedom of association, the right to collective bargaining, prohibition on forced labor, prohibition on child labor, and freedom from discrimination, as well as the other elements that are considered to be the fundamental rights at work: fair wages and working hours, decent health and safety conditions and non-abusive disciplinary practices. Social Accountability International (SAI), an international and renowned social standards/labor NGO, worked with the Dialogues to recommend ways to best align the standards with best practice labor standards, including ILO conventions.

[42] **Child Labor:** refers to any work by a child younger than the age specified in definition of a child, except for light work as provided for by ILO Convention 138, article 7. The conventions permit children between 15 and 18 to work on farms, provided that time for school and play is guaranteed and children are excluded from hazardous, abusive and physically hard work

[43] **Child:** any person less than 15 years of age, unless local minimum age law stipulates a higher age for work or mandatory schooling, in which case the higher age would apply. If however, local minimum age law is set at 14 years of age in accordance with developing country exceptions under ILO Convention 138, the lower age will apply

[44] **Worker (Young worker):** Any worker between the age of child as defined and under the age of 18

[45] **Bonded Labor:** when a person is forced by the employer or creditor to work to repay a financial debt to the crediting agency

[46] **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 him/ 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 (withholding of identity documents)

[47] **Employee:** An employee is a person who enters an agreement, which may be formal or informal, with an enterprise to work for the enterprise in return for remuneration in cash or in kind.

the workplace and/ or an employer[48] withholding original identity documents of workers are indicators that employment may not be at-will. Employees shall always be permitted to leave the workplace and manage their own time. Employers are never permitted to withhold original worker identity documents. Adherence to these policies shall indicate an aquaculture operation is not using forced, bonded or compulsory labor forces.

Criterion 4.3: Discrimination[49] in the work environment

	Indicator	Standards
4.3.1	Evidence of proactive anti-discrimination policy	Yes
4.3.2	Number of incidences of discrimination	None
4.3.3	Women and men receive equal pay for equal work. Different ethnic groups receive equal pay for equal work	100% compliance[50]

Rationale

Unequal treatment of employees, based on certain characteristics (such as sex or race), is a violation of 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. In order to ensure that discrimination does not occur at certified aquaculture farms, employers must prove their commitment to equality with an official anti-discrimination policy, a policy of equal pay for equal work, as well as 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.

Criterion 4.4: Work environment health and safety

	Indicator	Standards
4.4.1	Percentage of workers trained in health and safety practices, procedures and policies. Safety equipment provided and in use. Evidence that all farm employees have been trained and fully understand the training.	100% in operations above five employees[51] and safety equipment in use by workers.
4.4.2	Occurrences of health- and safety- related accidents and violations recorded and corrective actions taken. No persons under 18 involved in accidents.	100%
4.4.3	Employer responsibility and proof of insurance (accident/ injury) for employee costs in a job-related accident or injury when not covered under national law	100%

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. Some of the key risks to employees include hazards[52] resulting from accidents and injury. Consistent and effective employee training in

[48] **Employer:** Employers are those workers who, working on their own account or with one or a few partners, hold the type of job defined as a self-employed job, and in this capacity, on a continuous basis (including the reference period) have engaged one or more persons to work for them in their business as employees.

[49] **Discrimination:** any distinction, exclusion, or preferences, which has the effect of nullifying or impairing equality of opportunity or treatment. Not all 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

[50] Evidence in records (payslips and contracts that both parties hold)

[51] Certificate issued by the relevant competent national authority.

[52] **Hazard:** The inherent potential to cause injury or damage to people's health—for instance unequipped to handle heavy machinery safely/ unprotected exposure to harmful chemicals

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 also the long-term health and safety risks. Finally, while many national laws require that employers assume responsibility for job-related accidents/ injuries, not all countries require this and not all employees (e.g., 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% of employee costs in a job-related accident or injury.

Criterion 4.5: Basic needs and living wages[53]

	Indicator	Standards
4.5.1	The percentage of employees who are paid basic needs / living wages or legal minimum wage (whichever is highest)	100%

Rationale

Workers shall be paid fair and equitable wages that, at a minimum, meet the legal minimum wage and industry-standards, but also meet the minimum basic needs of workers and provide some discretionary income. Unfairly compensated workers can be subject to a life of sustained poverty. Certified aquaculture operations 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 that tracks wage-related complaints and responses. Company policies and practice shall also prohibit deductions in pay for disciplinary actions, and payments shall be made in a manner convenient to workers. Having these policies outlined in a clear and transparent manner will empower the workers to negotiate effectively for fair and equitable wages that will, at a minimum, satisfy basic needs. Revolving labor contract schemes designed to deny long-time workers full access to fair and equitable remuneration and other benefits are prohibited.

Criterion 4.6: Access to freedom of association and the right to collective bargaining

	Indicator	Standards
4.6.1	The percentage of employees with access to trade unions, self-organization, and ability to bargain collectively or worker access to representative(s) chosen by workers without management interference.	100%

Rationale

Having the freedom to associate and bargain collectively[54] is a critical right of workers because it allows workers to have a more balanced power relationship with employers when doing such things as negotiating fair compensation. Although this does not mean all workers of a certified aquaculture operation must be in a trade union or similar organization, workers must not be prohibited from accessing such organizations when they exist. If they do not exist or are illegal, companies must make it clear that they are willing to engage in a collective dialogue through a representative structure freely elected by the workers.

[53] **Basic needs wage (living wage):** enables workers to support the average sized family above the poverty line, based on local prices near the workplace. Basic needs include essential expenses such as food, clean water, clothes, shelter, transport, education, obligatory taxes, plus a discretionary income, as well as legally mandated social benefits (which may include health care medical insurance, unemployment insurance, retirement, etc).

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

Criterion 4.7: Disciplinary practices in the working environment causing temporary or permanent physical and/or mental harm

	Indicator	Standards
4.7.1	Incidences of physically or mentally abusive[55] disciplinary actions	None
4.7.2	Evidence of abusive disciplinary policies and procedures	None

Rationale

The rationale for discipline in the workplace is to correct improper actions and maintain effective levels of employee 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. A certified aquaculture operation shall never employ threatening, humiliating or punishing disciplinary practices that negatively impact a worker's physical and mental health or dignity. Employers that support non-abusive disciplinary practices as described in the accompanying guidance, as well as evidence from worker testimony, shall indicate that a certified aquaculture operation is not employing abusive disciplinary practices.

Criterion 4.8: Overtime compensation and working hours

	Indicator	Standards
4.8.1	Incidences, violations, abuse of working hours, and overtime laws/ expectations	None[56]

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, employees in certified aquaculture operations are permitted to work—within defined guidelines—beyond normal work week hours but must be compensated at premium rates.[57] Requirements for time off, working hours and compensation rates as described should reduce the impacts of overtime.

Criterion 4.9: Employee and worker contracts fair and transparent

	Indicator	Standards
4.9.1	Paper contracts: A complete set of contracts is filed in office, mutually signed, and copies are available with employee. Verbal contracts: Employer and employee cite consistent contract conditions in independent interviews.	100% compliance. Based on paper evidence for farms with five workers or more. Workers cite verbal contract conditions in independent interviews for farms below five workers.

Rationale

The key to a fair and transparent exchange (work for income) is an agreement that is clear to both parties and can be verified during the contract period. Signed documents that both parties have access to at will are imported for verification to take place. This will also ensure conflicts around misunderstandings can be avoided and, if they occur, discussed in a mutually transparent manner.

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

[56] None expressed in interviews

[57] **Premium rate:** a rate of pay higher than the regular workweek rate. Must comply with national laws/ regulations and / or industry standards. Must be 125% of normal rate or higher.

[57] **Light Work**: (ILO convention 138, article 7.1) Light work is work that is 1) not likely to be harmful to a child's

Where verbal contracts are practiced (e.g. remote rural locations, cases of illiteracy and small family farms), extra care needs to be taken that the contents of the agreement are fully agreed to and well-understood.

Criterion 4.10: Fair and transparent mechanism to resolve conflicts

	Indicator	Standards
4.10.1	Management and the full workforce meet at least twice per year on the basis of written agendas and written minutes of the meetings	Evidence of these meetings taking place

Rationale

Besides a bilateral relationship between employer and employee, there is also a collective relationship between farm management and the group of workers. Collective meetings should take place regularly to create a venue and moment to discuss collectively-felt concerns. Such concerns can come from management to workers, but also from workers to management. Prepared meetings on the basis of a prepared and communicated agenda, and with minutes as an outcome on paper, will allow a structured process of negotiation and group cohesion building. Regular collective meetings will improve effectiveness and efficiency of the work done on the farm, and will also ensure greater job satisfaction.

Guidance for implementation

1. Minimum age of permanent workers is 15 years old. If the legal minimum age allowed in the country is higher than 15, the legal minimum age of the country is followed. (Note: Employer is accountable for employee age documentation. In most countries, the law states that the general minimum age for employment is 15 years.)
2. Child workers under the age of 15 perform only light work.[58] According to the ILO convention 138, article 7.1, light work is work that is 1) not likely to be harmful to a child's health or development and 2) not likely to prejudice their attendance at school, participation in vocational orientation or training programs, or diminish their capacity to benefit from instruction received), as long as it does not exceed 2 hours per day on school days or holidays. Also, the total number of hours spent on light work and on school shall not exceed 7 hours/ day. (Note: Per ILO C 138, Article 7.4: Some developing countries may apply for an exception to the minimum age, thereby defining 12 as the minimum age for light work by children and 14 for the minimum age for young workers; few if any countries still invoke this clause.)
3. For employees aged 15-18 (young workers, work shall not conflict with schooling and the combined daily transportation time, school time and work time shall not exceed 10 hours. Hazardous work[59] (e.g., heavy lifting disproportionate to a person's body size, operating heavy machinery, working night shifts, and exposure to any toxic chemicals) is not performed by those below age 18.
4. Company shall ensure young workers can meet costs of their education if they are concurrently working and in school. There is evidence of this happening.

4.2 Forced, bonded or compulsory labor

1. Contracts shall be clearly stated and understood by employees and never lead to an employee being indebted, such as employees paying for essential job training programs
2. Employees shall be free to leave the workplace and manage their own time

[58] **Light Work**: (ILO convention 138, article 7.1) Light work is work that is 1) not likely to be harmful to a child's health or development and 2) not likely to prejudice their attendance at school, participation in vocational orientation or training programs, or diminish their capacity to benefit from instruction received

[59] **Hazardous work**: work which, by its nature or circumstances in which it is carried out, is likely to harm the health, safety or morals of workers

3. Employer shall never be permitted to withhold an employee's original identity documents. (Note: Extra care shall be given to migrants and contractor/ subcontractor situations because they can be particularly vulnerable without their identity documents.)

4.3 Discrimination in the work environment

Guidance for evidence of proactive anti-discrimination policies/practices

1. Employers shall have written anti-discrimination policies stating the company does not engage 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
2. Clear and transparent company procedures are outlined to raise/file/respond to discrimination complaints
3. Employers shall respect the principle of equal pay for equal work

Guidance for evidence of incidence of discrimination

Worker testimony shall be able to support that the company does not interfere with the rights of personnel to observe tenets or practices, or to meet needs related to race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation, or any other condition that may give rise to discrimination

4.4 Work environment health and safety

Guidance for percentage of workers trained in health and safety practices, procedures and policies

1. Minimization of hazards/risks in the working environment, including documented systemic procedures and policies to prevent workplace hazards and their risks, shall exist and the information shall be available to employees
2. Emergency response procedures shall exist and be known by employees
3. Offer regular health and safety training for employees (once a year and for all new employees), including training on potential hazards and risk minimization
4. Offer regular health and safety training for employees (once a year and for all new employees), including training on potential hazards and risk minimization

Guidance for determining occurrences of health and safety related accidents and violations recorded and corrective actions taken

5. Documentation shall be generated with regards to occupational health and safety violations
6. Corrective action plan shall be implemented in response to accidents that have occurred. This should analyze the root causes, address the root causes, remediate and prevent future accidents of a similar nature.

Guidance for proof of accident insurance

There shall be sufficient insurance, to cover employees who suffer from accidents or injuries in the work environment. Special consideration must be given to migrant or foreign workers who may fall outside of the law. The documents pertaining to worker insurance can be verified with the indicated insurance company.

4.5 Basic needs / living wages

Guidance for the percentage of employees who are paid basic needs / living wages

1. Employers shall ensure that wages paid for a standard working week (no more than 48 hours) always, at a minimum, meet legal/industry minimum standards and basic needs of personnel. They also must provide income to employees to make sure their basic needs are met.
2. No deductions in pay for disciplinary actions.
3. Wage and benefits are clearly articulated to employees and are rendered to employees in a convenient manner. Employees do not need to travel to collect benefits, promissory notes,

coupons or merchandise never replace cash/electronic/check payment methods. They are given wage payment slips on paper, indicating the actual amounts paid and listing any deductions or advances.

4. Labor-only contracting relationships[60] or false apprenticeship schemes[61] are not acceptable. This includes revolving/consecutive labor contracts to deny benefit accrual.
   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 children.
   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
5. Clear and transparent mechanism for wage setting shall be known to employees
6. Labor conflict resolution policy shall be in place to track conflicts and complaints raised, as well as responses to conflicts and complaints

Guidance for the calculation of basic needs/living wages

1. Basic needs are determined by calculating the cost of the basic shopping basket needed for an adequate diet, the percentage of an average household's budget that goes to food and other necessary expenses, and the average size of a household in a given country. Recognized representative shopping baskets surveys include those undertaken by national authorities and multi-lateral developmental agencies.
2. A basic or living wage should be capable of sustaining 50% of an average-sized family with food, clean water, clothing, housing, transportation, schooling, obligatory tax payments, health care and an additional 10% discretionary income (SA8000). An employer shall minimally pay a full-time worker the basic needs wage (without financial deductions) or national legal minimum wage; whichever is higher.
3. The basic needs wage/living wage refers to 'take home payment'. Any obligatory expenses at the side of the employee/worker (e.g. uniform, tools, lunches) will not bring 'take home' pay below a basic needs standard.

4.6 Freedom of association and collective bargaining

Guidance for determining the percentage of employees with access to trade unions, the and ability to bargain collectively, and or worker access to the appropriate representative(s) chosen by workers without management interference.

1) Companies should ensure workers interested in collective bargaining or joining a union or worker organization of their choice are not the subject of discrimination. When rights are restricted the company should make clear to workers that they are willing to engage workers in collective dialogue through representative structure and that they will allow workers to freely elect their own representatives.
2) Workers have the freedom to form and join any trade union or worker organization, free of any form of interference from employers or competing organizations set up or backed by the employer. ILO specifically prohibits "acts which are designated to promote the establishment of worker organizations or to support worker organizations by financial or other means, with the object of placing such organizations under the control of employers or employers' organizations.
3) Evidence provided will be cross-checked with the indicated union or worker organization.

[60] **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 protection

[61] **False Apprenticeship Scheme:** the practice of hiring workers under apprentice-ship terms without stipulating terms of the apprenticeship/ wages under contract. It is a "false" apprenticeship if its purpose is to underpay people, avoid legal obligations, or employ children

4.7 Disciplinary actions in the work environment

Guidance for determining incidences of abusive disciplinary actions

There shall be absolutely no engagement in or support of corporal punishment, mental or physical coercion, or verbal abuse. Fines or wage deductions shall not be acceptable as a method for disciplining workforce, as indicated by policy statements and evidence from worker testimony.

Guidance for evidence of non-abusive disciplinary policies and procedures

If disciplinary action is required, progressive verbal and written warnings shall be engaged. Aim should always be to improve the worker before letting him/her go, as indicated by policy statements and evidence from worker testimony.

4.8 Overtime and working hours

Guidance for determining incidences, violations and abuse of working hours and overtime

1. Hours actually worked includes time spent at the workplace on productive activities and on other activities which are part of the tasks and duties of the jobs concerned (for example, cleaning and preparing working tools). It also includes time spent at the place of work when the person is inactive for reasons linked to the production process or work organization (for example, standby time), as during these periods paid workers remain at the disposal of their employer. Hours actually worked also includes short rest periods spent at the place of work because they are difficult to distinguish separately, even if workers are not "at the disposal" of their employer during those periods. Explicitly excluded are lunch breaks, as they normally are sufficiently long to be easily distinguished from work periods.

2. Employer shall comply with applicable laws and industry standards related to working hours. "Normal workweek" can be defined by law but shall not on a regular basis (constantly or majority of the time) exceed 48 hours. Variations based on seasonality may apply. Farms are encouraged to keep work-time records.

3. Personnel shall be provided with at least one day off in every seven day period.

4. Workers will not be discouraged from keeping work-time records (in cases when the farm does not do so itself).

5. All overtime shall not exceed 12 hours per week, for more than two consecutive weeks, and total work time (including overtime) shall not exceed 48 hours per week on average over a 17-week period. All overtime shall be paid at a premium of +25% over regular wage. Overtime work shall be voluntary. Exceptions to this last requirement can be made in cases where it is legal and in which there is a collective bargaining agreement in place that addresses this, in order to meet short-term business demands.

4.9 Employees and worker contracts fair and transparent

1. Contracts include provisions on: date of entry, notice period, probation period, salary + salary policy, expected working hours, policies on overtime, farm safety protocols, terms of insurance, policies on disciplinary measures, list of obligatory expenses at the side of the employee, other specific right and obligations of both parties, both signatures, and date of signing. The general or collective provisions may be annexed to the signed contract, but the worker shall have a full printed copy of those.

2. Farms with five or more workers (the size to which the possibility of "family labor" might theoretically apply) are deemed to be able to follow formalized paper-based contract and policy procedures.

3. On smaller farms, confidential interviews with farm owner, worker(s), and surrounding community (e.g., local school teacher, in case of children working on the farm) may be necessary to validate whether fair and transparent (i.e., verbal) contracting is taking place.

4. Cooperatives (groups of farms) amounting to in total more than 5 workers are expected to comply with the paperwork that is implied in the indicators.

4.10 Fair and transparent mechanism to resolve collective conflicts

Records of the meetings can be inspected and verified with management, workers, and union or another organization of which a worker is a member. The minutes include the agenda, the resolution or action points agreed on, and a list of participants to the meeting.

Principle 5: Manage shrimp health in a responsible manner

Impact: The culture of shrimp under stressful conditions can lead to the transfer of diseases or the amplification of diseases in the receiving waters. Additionally, heavy reliance on the use of therapeutic chemicals at shrimp aquaculture facilities not only can cause pollution but also can stimulate and/or introduce antibiotic resistant bacteria in the receiving waters, which can potentially have a negative effect on the local ecosystem.

Criterion 5.1: Disease prevention

	Indicator	Standards
5.1.1	Demonstration of functional and documented preventive tools to prevent: 1) Diseases from the surrounding environment entering the farm (predator and vector control), 2) Diseases from the farm spreading to the surrounding environment (water filtration/sterilization), 3) the spreading of disease within the farm [avoid cross contamination, detect and prevent emerging pathogen(s), and monitor external signs of pathologies and moribund animal]	Yes
5.1.2	Presence of net mesh, grills, screens, or barriers on inlets of farm that are appropriately sized to minimize entry of disease vector Or Mesh size for mechanical filtration of supply water	Yes ≤ 250 μm
5.1.3	Three-day average minimum daily dissolved oxygen concentration in pond bottom with measurement recorded one hour before sunrise	>3ppm
5.1.4	Daily minimum pond water pH	>7
5.1.5	Annual average farm survival rate (SR)[62] and relative standard deviation (RSD)[63] in : 1) Unfed and non-aerated ponds 2) Fed but non-aerated ponds 3) Fed and permanently aerated[64] ponds	 SR >50% and RSD <15% SR >60% and RSD <15% SR >80% and RSD <15%

[62] Survival Rate (SR) Calculation

Step 1 - Individual Pond Survival Rate Calculation

The estimated number of shrimp harvested is calculated by dividing the harvested biomass by the harvest average body weight and can be estimated for each pond using the following formula:

% Pond Survival rate = (Stocked PL Count / (Harvested Biomass/ Average Body Weight)) X 100

Farmers are responsible for all counts, including the Stocked PL count and hatchery counts. The stocked PL count needs to take place when PLs are transferred from the hatchery to the farm, whether they are stocked directly in grow-out ponds or in some intermediate, nursery raceway or pond.

Step 2: Annual average Farm Survival Rate (SR) Calculation

The Annual Average Survival Rate is the mean value for all ponds harvested during the last 12 months:

Average farm survival rate (SR) in %= (% Pond1 survival rate +% Pond2 survival rate +% Pond3 survival rate +etc)./ number of ponds harvested

The standard deviation (SD) is calculated as follows:

$SD = [(\%\ Pond1\ survival\ rate - SR)^2 + (\%\ Pond2\ survival\ rate - SR)^2 + (\%\ Pond3\ survival\ rate - SR)^2 + etc)./\ (number\ of\ ponds\ harvested-1)]^{1/2}$

[63] The relative standard deviation (RSD) (also called coefficient of variation) is calculated as follows:

Relative standard deviation (RSD) in % = (SD/SR) x 100

[64] Permanent aeration refers to aeration capacity installed during the whole grow-out period for sustaining a high biomass that exceeds the natural carrying capacity of the culture system and for feeding at the corresponding rate to ensure the best possible growth rate. Emergency aeration is not considered as permanent aeration.

	Indicator	Standards
5.1.6	% of stocked post larvae (PL) that are SPF[65] or SPR[66]	100%

5.1.2: Water supply disease suppression: The ShAD has proposed two alternative indicators with regard to mesh size and is seeking feedback on which approach would be more appropriate. Is requiring "Presence of net mesh, grills, screens, or barriers on inlets of farm that are appropriately sized to minimize entry of disease vector" sufficient? Or should the standard explicitly specify ≤ 250 μm or some other number as the "Mesh size for mechanical filtration of supply water?"

Rationale

Prevention of disease is the absolute priority for this principle and the ShAD is pointing out the importance of implementing biosecurity measures to reduce the risk of disease at the farm, regional, national and international levels. At the farm level, those biosecurity measures include controlling the inputs (e.g., water, feed and PL) and disease vectors (e.g., birds and crabs), as well as taking action to reduce the stress (e.g. good pond condition, adequate feed).

To reduce the use of antibiotics and pesticides, the ShAD is promoting the use of mechanical filtration in order to eliminate pathogen carriers and competitors. Mechanical filtration can take place at different levels in the farm (pumping station, canal or pond), depending on the farm design, and with different means (e.g., drum filters and inlet filters).

The ShAD considers the dissolved oxygen (DO) level on the pond bottom to be a key indicator. DO ensures a hospitable environment for animals and allows for the oxidization of organic matter, which further improves the pond bottom conditions. DO must be measured with a calibrated DO meter by a trained technician. The measure must take place near the outlet (if any) just above the pond bottom. The measure needs to be done one hour before sunrise.

Another important parameter to measure is pH, as shrimp farms have often been built on acidic soils. Ponds built on potential acid-sulfate soils[67] could exhibit problems of water acidity when soil is disturbed. Although it has been documented that ponds with acidic soils generally have low production output (Boyd 1995) and it can be observed that many shrimp ponds built on acid-sulfate soils have been abandoned over time worldwide, it is technically possible to prevent and remediate soil acidity and even reclaim acid-sulfate ponds[68]. Therefore, although standards recognize that acid-sulfate soils are best avoided when siting a farm, the ShAD also recognizes that there are management tools available for preventing acidity issues when farms have already been located in such areas. Also, intensive farming techniques result in the consumption of water alkalinity, leading to the acidification of pond water over time. In all cases, the acidification of pond water needs to be compensated by the addition of liming materials in order to maintain water alkalinity to a level that will ensure that water pH remains above seven, which is reported as adequate for shrimp culture.[69]

Pond water pH can be measured with pH paper, a test kit, or with a calibrated probe on a water sample taken just above the pond bottom. DO and pH should be measured at the same time.

[65] **Specific Pathogen Free**: a term used for animals that are guaranteed free of particular pathogens. The claim It is accompanied by a list of the absent pathogens

[66] **Specific Pathogen Resistant** describes a genetic trait of a shrimp that confers some resistance against one specific pathogen. SPR shrimp usually result from a specific breeding program designed to increase resistance to a particular virus

[67] **Potential acid-sulfate soils:** soils containing pyrite (sulfur compound). When exposed to air (disturbed soil), pyrite oxidizes to yield acidity (Boyd 1995).

[68] Boyd 1995; Boyd and Tucker 1998

[69] Brock and Main 1994

The survival rates proposed not only serve well as a performance-based indicator for successful disease prevention, but as survival depends upon different factors (e.g., water quality, feeding and pond size), these indicators also indirectly address management practices. Thus, the use of good management practices should result in a fairly consistent survival rate among ponds. The proposed standard provides room for isolated pond mortalities, but farmers would have to react quickly to prevent disease from spreading to other ponds and farms.

The level of control over pond conditions, which partly determines the ability of preventing diseases, varies greatly depending on the culture system, especially the use of feeding and aeration. Therefore, the ShAD is proposing three different standards for the survival rate depending on whether ponds are fed and aerated or not. Unfed and non-aerated ponds are normally low–density, very large (>50ha) ponds where farmers have limited means of controlling conditions and preventing mortalities. Fed but non-aerated ponds allow for a higher level of control, but are still susceptible to oxygen crises. Farmers that use continuous aeration usually operate small ponds (<5ha) and are able to ensure optimum conditions for preventing mortalities.

One of the main biosecurity measures is to make sure that animals stocked in ponds are free of disease. The ShAD supports the use of Specific Pathogen Free and Local Pathogen Resistant Post Larvae to achieve this goal.

Criterion 5.2: Predator[70] control

	Indicator	Standard
5.2.1	Allowance for intentional lethal predator control of any protected, threatened or endangered species as defined by the International Union for Conservation of Nature (IUCN) Red List,[71] or state, local or national governments	None
5.2.2	Allowance for use of lead shot for predator control of non-protected, threatened or endangered species	None
5.2.3 	Establishment of a scientifically substantiated predator monitoring program that documents the frequency of visits, species, and number of animals interacting with the farm	Yes

Rationale

The predation of cultured shrimp by fish, birds, amphibians, reptiles and other crustaceans can cause significant economic impacts to farmers via loss of stock or the introduction of disease. Methods to control predator populations include strings across the culture pond and fences to keep out the crabs. In some cases, farmers employ lethal control to deter or remove predators from their farms. The killing of predators can negatively impact predator populations and effect local biodiversity, especially when local predators (e.g. herons and egrets) become dependent on the reliable food source that shrimp farms provide. Although a consistent food supply is likely to enhance population numbers, it is also likely to change behavior and local dispersal patterns of affected species that may ultimately affect the health of the predator populations. The ShAD determined that the intentional killing or harassment of animals that prey on cultured shrimp is inappropriate for farms certified under these standards. The ShAD plans to allow for limited lethal control of predators in exceptional situations that are appropriately documented by the farmer and made available for the auditor to a maximum of a yet undetermined number of occurrences per year.

[70] **Predator:** Any animal that lives by preying on other animals
[71] IUCN red lists can be accessed via (www.iucnredlist.org).

5.2.3. -- **Setting the maximum allowable annual occurrences of lethal control**:
Besides a predator monitoring program, What would be an appropriate maximum number of lethal control activities that can be undertaken by a farm annually?

Any lethal control must be exercised without the use of lead shots, as this has been found to have environmental impacts. Furthermore, farmers are not permitted to kill any species that are deemed as protected, threatened, or endangered as defined by the (IUCN Red List or state, local, or national governments.

Farms must demonstrate they have exhausted non-lethal options before lethal control is employed. Also, documentation must be provided to the auditor on the exceptional circumstances that led to the lethal control. This information must include the date, time, method of control, species and method of disposal.

The ShAD also mandates that a predator monitoring program be implemented in order to help researchers better understand the interaction between farms and local predator populations in ways that will allow for more conclusive scientific information that can be used to continuously improve the standards. To assure the information is useful and credible, the monitoring program must be developed with the support of qualified biological scientists or ecologists.

Criterion 5.3: Disease management and treatment

	Indicator	Standards
5.3.1	Allowance for use of antibiotic and medicated feed on labeled products	None
5.3.2	Presence of records listing all product stocked and used on the farm	Yes
5.3.3	Evidence proving all chemical product instructions are on the farm and are available to farm workers	Yes
5.3.4	Allowance for treating water with pesticides,[72] with the exception of Tea-seed-cake and Rotenone in the absence of shrimp Or Allowance for the use and storage on site of pesticides that are banned, restricted or identified as extremely to moderately hazardous by the Rotterdam Convention on Prior Informed Consent (PIC), the Stockholm Convention on Persistent Organic Pollutants (POPs), the World Health Organization (WHO) or the European Commission.	None None
5.3.5	Allowance for discharge of all chemicals[73] without previous neutralization[74]	None
5.3.6	Pesticide and chlorine residues in pond water when shrimp are present	Not detectable

[72] Any substance, or mixture of substances, or micro-organisms including viruses, intended for repelling, destroying or controlling any pest, including vectors of human or animal disease, nuisance pests, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feeding stuffs, or which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. [ ]; Pesticide Specifications, Manual on Development and Use of FAO and WHO Specifications for Pesticides, 2002

[73] Hazardous chemicals need to be identified through a risk analysis. Common hazardous products used in shrimp farming are lime, disinfectants, sodium metabisulfite, pesticides, including natural piscicides such as tea seed and rotenone (refer to Boyd and Massaut 1999 and Gräslund and Bengtsson 2001 for a review of risks with chemicals).

[74] This does not mean that the discharge must be pH neutral; but need to ensure that chemicals are broken down.

	Indicator	Standards
5.3.7	Allowance of probiotic bacterial strains deemed not harmful by the appropriate competent authorities	Yes

5.3.2. -- records listing all products stocked and used on the farm:
The ShAD is proposing to consider a ***"white-list" of approved products*** used by the EU and the US; a "***'black-list" of banned products*** (with reference to the Rotterdam Convention on Prior Informed Consent (PIC, POPs, WHO,); the Stockholm Convention on Persistent Organic Pollutants (POPs); the World health Organization (WHO); or the European Commission for pesticides, and the GCFA for antibiotics); and to develop a ***"grey-list" of products*** through the auditing process. Grey listed products would be reviewed for authorization or banning after three years. Only white listed products would be authorized to be compliant against the ShAD standards.

5.3.4 -- Acceptable pesticide use on shrimp farms: Shrimp farms use pesticides for eliminating pathogen carriers and competitors. Some pesticides are known for their negative effects on animal and human health. The ShAD recognizes that such hazardous products should not be used in shrimp culture.

Two opposing options are put forward for public consideration. One is a complete ban on pesticides, except for those naturally occurring. The other option is tolerance for a prescribed group of products.

Feedback is sought on the effectiveness and practicality of these options

Option 1): Naturally Occurring Pesticides Only
"Use of pesticides has had serious environmental consequences. Pesticides contaminate soil and water. There are many examples of entire communities suffering from chronic pesticide poisoning. Even when used properly, some pesticide chemicals remain in the environment for years, evaporating into the atmosphere and, in effect, polluting the entire planet" (FAO). This option would allow only the use of rotenone and tea seed cake in the absence of the animal.

Option 2): Restricted List
The ShAD standards could impose a requirement that shrimp farms use less chemicals and dispose of chemicals responsibly.

If this option is selected, the ShAD standards would refer to existing conventions regarding hazardous pesticides (e.g., from extremely to moderately hazardous) to strictly exclude the use of those pesticides. The farmer would keep a list available of all chemicals stocked and used on the farm and annual analyses for the pesticide used would be done. The farmers would also be obliged to monitor residues. Farmers using chemicals would need to strictly follow supplier guidance and have documentation explaining how chemicals are stored and used by workers. Farmers would also need to provide safety and disposal procedure information to all farm workers.

Rationale
It is the responsibility of the farmer to reduce the risk of spreading pathogens by taking adequate measures to contain diseased shrimp and dispose of dead shrimp in a sanitary way. It is also the farmer's responsibility to avoid environmental side effects (feed application needs to be adjusted in case of pond mortality or dead shrimp need to be discarded properly). Therefore, the farmer shall develop internal skill to address disease management.

Use of antibiotics

The shrimp industry has made progress to prevent disease outbreaks, especially with the development of selected stocks free of pathogens, such as SPF. Recent experience in many countries has shown that the use of veterinary medicines, especially antibiotics, is not effective for treating most diseases, in particular viral diseases, and is not justified when effective biosecurity measures are implemented. By excluding the possibility of labeling products treated with veterinary medicines, the ShAD promotes the use of disease prevention measures.

In the event that veterinary medicines and chemicals[75] are used, they must be prescribed by an aquatic animal health specialist,[76] based on a diagnostic test, and all labeled instructions must be followed. The specialist shall also indicate how to apply, handle and store veterinary medicines and chemicals.

Use of probiotics

Probiotics, which are natural and beneficial bacteria, are increasingly used in shrimp farming in different forms and for different purposes. Probiotics are used to modify the microbial communities in the digestive tract of shrimp (as a feed additive) and in their aquatic environment (applied directly to the pond) with the objective of competing with and displacing pathogens and, as a result, improving shrimp growth and survival.[77] Probiotics are also used for improving pond water and soil quality.[78] There are concerns that some bacterial species or strains contained in commercial products or resulting from uncontrolled fermentation conducted on site may be inappropriate or even hazardous for shrimp and humans[79]. On this basis, the ShAD considers that the use of probiotics in shrimp culture needs to be restricted to safe microorganisms and those deemed safe by the appropriate authority.

[75] All veterinary medicines and chemicals must

- Be approved for aquaculture by national authorities and by FDA list of drugs approved for aquaculture. and by the Council regulation EEC n°2377/90 Annex 1 and not listed on Annex 4
- Respect the withdrawal period or apply a period of 750 degree-days for those without documented withdrawal period times[47];
- Never be used as growth promoters[48] or for preventive (prophylactic) treatment. This product will not be eligible for certification

[76] An aquatic animal health specialist

- follows government regulations, if such regulations exist in the producing country
- If the government does not regulate on this, the following people can be considered as specialists:
  - Veterinarians with at least three months of training on fish pathology
  - Aquaculturists (with university or vocational degree) who have completed at least three months of training on fish pathology. This training maybe included with the university or vocational degree.

[77] Moriarty and Decamp 2009

[78] Boyd and Gross 1998; Gatesoupe 1999

[79] Moriarty and Decamp 2009

Principle 6: Manage broodstock origin, stock selection and effects of stock management

Impact: Shrimp farming has been shown to have negative impacts on wild shrimp populations and on the environment due to the collection of wild post-larvae and broodstock; the introduction of non-native species and/or the escape of genetically-distinct native shrimp.

Criterion 6.1: Presence of natural or established shrimp species

	Indicator	Standards
6.1.1	Allowance for non-indigenous shrimp species unless those species are already widely used in commercial production locally by the date of the publication of the ShAD standards; there is no evidence of establishment or impact on adjacent ecosystems; and the species have been approved for aquaculture use by a process based on ICES code of practice on the introductions and transfers of marine organisms or comparable protocol.	None
6.1.2	For native species, post-larvae must be sourced in order to prevent genetic contamination of their population	Yes

Rationale

These standards were written to be applicable for the production of *Litopenaeus vannemei* and *Penaeus monodon*. The focus of the ShAD standards was initially on *L. vannemei* and *P. monodon* because of the proportionally large export volume of these species to major global markets and a greater understanding of the potential impacts from their harvesting. The ShAD recognizes the importance of other shrimp species (e.g. *P. indicus*). However, more information about breeding programs is needed for the inclusion of other species in future versions of the standards.

The ShAD GSC focused on developing standards that can be audited through farm records and traceability through the supply chain. The GSC recognizes the auditing challenge associated with some proposed standards, particularly in non-vertically integrated operations, and welcomes feedback on these difficulties. The GSC recognizes the need for hatchery standards if the sourcing requirements are to be more comprehensive and suggests that an aquaculture hatchery dialogue be considered for the future.

According to the FAO (FAO, 2005), introduced species may have environmental as well as social and economic impacts. Aquaculture is considered one of the major pathways for introducing non-native aquatic plants and animals that may become harmful invasive species[80] and accidental or intentional introductions of non-native species have become an alarming global environmental problem.[81] The ShAD defines "exotic species" as non-native animals living in areas outside their native boundaries and "established species" as an introduced population that is currently reproducing and sustaining in the wild without further introductions of any kind. The SHAD does not allow the farming of non-indigenous shrimp species unless those species are already widely used ("widely used" is defined as 30% of country or province's production or 30% of farms in the country farming the species in question) in commercial production locally by the date the ShAD standards are published; there is no

[80] **Invasive species:** organisms (usually transported by humans) which successfully establish themselves in, and then overcome, otherwise intact, pre-existing native ecosystems (http://www.issg.org/about_is.htm). Weigle, S.M., Smith, L.D., Carlton, J.T. & Pederson, J. 2005. Assessing the risk of introducing exotic species via the live marine species trade. Cons. Biol., 19: 213–223. Casal, C.M.V. 2006. Global documentation of fish introductions: the growing crisis and recommendations for action. Biol. Invasions, 8: 3–11.

[81] Leung, K.M.Y. and Dudgeon, D. 2008. Ecological risk assessment and management of exotic organisms associated with aquaculture activities. In M.G. Bondad-Reantaso, J.R. Arthur and R.P. Subasinghe (eds). Understanding and applying risk analysis in aquaculture. FAO Fisheries and Aquaculture Technical Paper. No. 519. Rome, FAO. pp. 67–100.

evidence[82] of establishment or impact on adjacent ecosystems; and if the species has been approved for aquaculture use by a process based on ICES code of practice on the introductions and transfers of marine organisms or comparable protocol after the release of the ShAD standards.

The principle aim of the ShAD with regard to introductions of non-native species is to discourage introductions of shrimp into waterways where shrimp species are not native or previously established. Worldwide transfers and introductions of *P.monodon*, and *L. vannamei* were widespread in the early history of shrimp culture (Rönnbäck 2002). Introductions occurred from Asia to Latin America in the form of *P. monodon* and vice versa in the form of *L. vannamei* (Phillips, Kwei Lin and Beveridge 1993; Shrimp News International 2009). The International Council for the Exploration of the Sea's Code of Practice on the Introduction and Transfer of Marine Organisms is one of the most comprehensive instruments to help in the responsible use of introduced species but is only voluntary. *L. vannamei* is thought to have been illegally imported to several Asian countries (Bondad-Reantaso 2004), despite efforts to outlaw introductions of non-native species. First introductions of *L. vannamei* to Asian countries are as follows: Mainland China, 1988; Taiwan, 1995; Viet Nam, 2000; Indonesia, 2001; Thailand, 1998; Malaysia, 2001; India, 2001, Philippines, 1997; and Pacific Islands, 1972.

Such introductions and transfers have led to concerns about individuals escaping and competing with local fauna (Briggs et al, 2005; Naylor et al, 1997; Phillips, Kwei Lin and Beveridge 1993; Qing-Yin and Cong-Hai 2005). However, although there appears to be some specific examples of escapes occurring, there are little or no hard data on their ecological impact[83] (Briggs et al, 2005). However, *L. vannemei* represents the vast majority of global farmed shrimp production and is an exotic species in most of the areas where it is grown. Although exotic species have been deemed a critical conservation concern globally as they have the ability to significantly disrupt ecosystem function and species interaction, in the case of *L. vannemei,* there is currently no evidence[84] to suggest that the use of this species poses a significant risk to adjacent ecosystems in areas where it is exotic. Therefore, the current version of the ShAD standards allows for the culture of *L. vannemei* in areas outside its native range but does not allow it to be introduced into a new area without following proper protocols, as stated above. Future revisions of the standards will respond to new research developments and the ShAD will change its position if the evidence suggests that there is a significant risk of impact to ecosystems due to the culture of *L. vannemei* in areas outside its native range.

[82] Evidence: defined as peer review science published in the primary scientific literature that demonstrates environmental impacts

[83] Despite documented escapes and concern about the impacts, there is no evidence of established populations in the wild. The last *L. vannamei* found in wild U.S. continental[83] waters was in 1998, and most records occurred in the early 1990s (Perry 2009); perhaps related to the transition between open flow through and largely contained systems in coastal ponds in the mid-1990s (Treece 2002). In South Carolina, two exotic occurrences of *L. vannamei* have been recorded for the North Edisto River mouth (Charleston County) and from coastal waters (Wenner and Knott 1992). In Texas, six individual non-native *L. vannamei* have been collected from the Gulf of Mexico off Brownsville (Cameron County), Matagorda Bay, Laguna Madre (north of Arroyo Colorado), Port Mansfield (Willacy County) and at Palacios (Matagorda County) (Balboa et al. 1991, Howells 2001). The last and only time an escape was identified in Hawaiian waters was 1994, and one escape was noted in a canal connecting commercial aquaculture operations to La Plata River in Puerto Rico (Perry 2009).

[84] Literature reviews conducted on *L. vannamei* escapes found no evidence of *L. vannamei* becoming established outside of its range, but a precautionary approach still should be taken when farming *L. vannamei* (Briggs et al. 2005). Anecdotal evidence indicates *L. vannamei* has been caught in fishing nets in Thailand and *P. monodon* in the U.S., though the numbers reported are not large and may have been soon after a large number of shrimp escaped. *P monodon, L. vannamei, P. stylirostris* and *P. japonicus* are all known to have escaped from U.S. culture operations (Briggs et al. 2005). Farmed P. japonicus and P. merguiensis have escaped facilities in the Pacific Islands, with the latter now known to be established off Fiji (Briggs et al. 2005). There is a P. monodon fishery off of the Western Coast of Africa that is attributed to farmed escapements (failures) and there are established populations off the northern Coast of Brazil, Guyana, and the coast of North Carolina (S. Newman pers. comm, March 17, 2008; from Seafood Watch Mexico farmed shrimp report)

L. vannamei has been farmed in Thailand for over 15 years, and now dominates production in Southeast Asia. While *P. vannamei* has been found in natural water bodies, like Briggs et al (2005) Senanan et al (2007) were unable to find evidence that the shrimp they found in the wild were a reproducing population. None of the shrimp sampled in the Gulf of Thailand or Bangkapong estuary had achieved the sizes needed to reproduce.

For *P. monodon,* enough evidence[85] exists to suggest that there is a risk of impact when it is cultured outside of its native habitat, as there are reports from several regions of the world that demonstrate its ability to colonize foreign habitats. Therefore, the ShAD standards are unlikely to allow for certification of *P. monodon* in areas outside its native range.

Risk assessment is a key approach to determining whether shrimp in existing or proposed facilities are likely to escape and become established. However, risk assessment is controversial and some of the assessments are based on observation rather than in situ measurements of population structures. There are also knowledge gaps on the effects of escapes, as limited research has been conducted for both *L. vannemei* and *P. monodon*. This situation poses a significant challenge for the ShAD and we welcome suggestions for improvement.

Guidance for Implementation

6.1.1 – More information on ICES code of practice on the introductions and transfers of marine organisms can be found at (www.**ices**.dk/reports/general/2004/**ices**cop2004.pdf). The introduction of new/exotic/non-indigenous species must also be in compliance with national law as specified in Principle 1.

Criterion 6.2: Origin of post larvae

	Indicator	Standards
6.2.1	Documentation provided demonstrating compliance with regional, national and international importation guidelines (e.g. OIE and ICES) for the prevention of disease introduction and the introduction of invasive species	Yes
6.2.2	Shrimp PL certified SPF against OIE disease official list and country specific disease not specifically listed under OIE	Yes
6.2.3	% of total post-larvae from closed loop hatchery (i.e. farm-raised broodstock)	*P. Vannamei* 100% *P. Monodon* must be improved over time (100% within 6 years after the publication of the standards)
6.2.4	Wild-caught broodstock must be sourced from fisheries with an established fishery management plan or certified fisheries[86]	Yes
6.2.5	Allowance for wild-caught PL	None

[85] *P. monodon*, has been officially recorded 27 times in at least six US states including Alabama, (n=2), Hawaii (n=1), Florida (n=4), Louisiana (n=1), South Carolina (n=7), North Carolina (n=10) and Georgia (n=2) (Fuller 2009). However, at present, no *P. monodon* are reared on U.S. farms or in U.S. research facilities, and there are no known established populations in U.S. waters. Anecdotal evidence indicates that *P. monodon* may be spawning off the coast of Brazil in the Caribbean, based on the continued capture in the region with no active farms to continually supply individuals to the population.[85] In areas of West Africa, particularly in Cameroon and Nigeria, populations of escaped *P. monodon* have become sufficiently established to support a commercial fishery. Penaeid shrimp make up about 2% of Cameroon capture fisheries, and black tiger shrimp is a notable portion of this catch[85]. In Nigeria, tiger shrimp comprises as much as 10% of trawler catches since its arrival approximately 4 years ago. Interestingly, while Cameroon holds aquaculture in Nigeria responsible for the release, Nigeria has indicated that Gambia, Senegal or Cameroon may be responsible.[85] Recommendations to USAID have been to support aquaculture for *P. monodon* over white shrimp because of the availability of broodstock from the fishery and because it "it forestalls the question of introduction of an exotic farm species to an existing economically important shrimp ecosystem - obviously, P monodon is already in Nigerian waters."

[86] Certified Fishery: a fishery that is certified and audited by a third party according to standards that were developed using ISEAL's codes for standards development.

Rationale
Disease problems within the shrimp aquaculture industry have been catastrophic, resulting primarily from poor biosecurity and, in particular, the transboundary movements of non-indigenous species. The movement of shrimp across borders brought new threats of disease transmission and reduced biodiversity to shrimp farming areas around the globe. The ShAD standards mandate compliance with international importation guidelines for the prevention of disease and the use of SPF and PL.

The wild collection of PL added to the disease problems that the shrimp aquaculture industry experienced in addition to causing high by-catch of untargeted marine species and impacts to the health of wild shrimp populations. The ShAD does not allow the collection of wild PL, employs strict indicators and standards for what species and stocks can be collected for broodstock, and limits the amount of shrimp broodstock that can be collected overall. Wild stock monitoring systems must be enforced via government methods, stock assessments or quota systems.

Recently, the shrimp aquaculture industry has increased its capacity to produce *L. vannemei* via farm-raised broodstock and hatchery production, which has nearly eliminated the industry's reliance on wild stocks as a PL source. While hatchery production still necessitates the occasional collection of some wild-caught broodstock for genetic enhancement, the potential impact of this activity is far less than using wild-caught PL. The ShAD standards require that 100% of *L. vannemei* PL are from a closed loop hatchery, which is defined as a hatchery relying predominately on hatchery-raised broodstock to produce PL.

For *P. monodon,* hatchery production is less developed and the standards currently allow for the wild capture of broodstock. A reduction in the use of wild-caught broodstock must be demonstrated over time and the ShAD standards will require 100% to be hatchery sourced within six years after the publication of the standards. It is expected that this will allow enough time for commercial hatchery and domestication[87] technology for *P. monodon* to become established. Wild-caught broodstock will still be permitted for genetic enhancement purposes without time limitation (for occasional collection only) for both *P.monodon* and *L vannamei*. The only exception to this is for extensive culture where producers are allowed to grow the shrimp that are trapped in ponds after having entered into the culture area with natural water flows.

In future versions of the standards, the use of certified broodstock fisheries as the source will also be required. Defining sustainability of wild fisheries is very challenging and there is a strong need to certify the source in order to ensure that the standards are sufficiently robust. The ShAD recognizes the challenges for the auditing of this standard, as not all countries will have fisheries management plans. However, the ShAD views this as an opportunity to create incentives for producers to ensure strong management of the fisheries they use for broodstock.

Guidance for Implementation
The GSC recognizes that auditing these standards is based on documentary evidence supplied by the hatchery, and that this may be a challenge for non-vertically integrated operations.
6.2.1 - Demonstrated by hatchery permits and import licenses. Farmers must also demonstrate that they have a working knowledge of the guidelines and have complied with them when they are culturing a non-native species.
6.2.2 - Farmers must provide evidence of PL origin and SPF certification.
6.2.3 - Continuous improvement must be demonstrated with the goal of 100% within six years of the date of SHAD publication. This standard is to be in line with the EU Organic Standard.
6.2.4 – The ShAD is considering allowing time for compliance with this standard.

[87] **Domestication:** Altering the behaviors, size and genetics of animals and plants (http://archaeology.about.com/od/domestications/Domestications_of_Animals_and_Plants.htm)

6.2.5 – Farms must be able to demonstrate the source of their post larvae.

Criterion 6.3: Escapes from culture facilities

	Indicator	Standards
6.3.1	Evidence of a well-designed and well-maintained culture system to prevent escapes at harvest and during grow-out demonstrated through the following requirements:	
	A. Presence of effective screens or barriers of appropriate mesh size for the smallest animals present	Yes
	B. Evidence that pond banks or dykes are of adequate height and construction to prevent breaching in exceptional flood events	yes
	C. Regular, timely inspections are performed, and recorded in a permanent register	Yes
	D. Evidence of timely repairs to the system are recorded	Yes
	E. Installation and management of trapping devices to sample for the existence of escapes; data is recorded.	Yes
	F. Traps on water outlets to catch/kill escapes	Yes
	G. Evidence of escape recovery protocols	Yes
	H. Harvested shrimp shall be killed or slaughtered on site	Yes
6.3.2	Evidence of records on escapes and actions taken to prevent reoccurrence	Yes

Rationale

Globally, escapes from aquaculture facilities have been found to be a significant vector for the introduction of exotic species and, in some cases, the escape of native species has been found to have significant impacts on native wild species (e.g. salmon aquaculture). In the case of *L. vannemei*, there is no evidence that the culture of these animals outside their native range poses a significant risk to adjacent wild shrimp populations and ecosystems via escaped animals. However, there is evidence that escaped *P. monodon* can establish feral populations in areas where they are or have been farmed, even though the degree to which these populations impact local ecosystems is not certain at this time (see rationale for 6.1). Another important reason to manage escapes is that disease can be transferred from the farming environment to the wild environment.

The reality for shrimp farmers is that, in the absence of a system that is closed cycle or full recirculation, escapes are inevitable and complete prevention is impossible. The current ShAD standards address the escape issue via a series of BMPs (e.g. physical infrastructure to limit risks of potential escapes), data collection, and record keeping. This will serve as a first step for these standards. Percent recovery standards were also considered, but it is not currently feasible to accurately count the number of shrimp that enter a pond. This makes it impossible to estimate how many disappear due to escapes versus other causes (e.g., mortality and predators). This may be reconsidered for future versions of the standard, when escapes data is more available and counting technologies are further advanced.

Severe weather events are the most likely cause of catastrophic escapes from shrimp farms. The ShAD standards require that shrimp farms be designed to prevent catastrophic escapes due to human error or storms. This is an issue of risk reduction in relation to the fluctuation of weather patterns. Farms need to be built to withstand weather conditions based on regional norms for weather in the farming region. There is a biosecurity risk when shrimp are transported as live animals

off the farm. Therefore, the ShAD standards mandate that all harvested shrimp be killed or slaughtered on site.

Guidance for Implementation

6.3.1 – Records and protocol documents must be made available for inspection during the audit.

6.3.2 – Escapes records must be made available for inspection, as future versions of the standards may require third party validation. The ShAD recognizes the challenges of recording all escapes but expects farmers to do due diligence on this standard.

Criterion 6.4: Transgenic shrimp[88]

	Indicator	Standards
6.4.1	Allowance for the culture of transgenic shrimp (including the offspring of genetically engineered shrimp)	None

Rationale

The culture of transgenic or genetically enhanced[89] shrimp is prohibited under the ShAD standards. The ShAD is concerned about the uncertainty surrounding the potential impacts of escaped transgenic shrimp breeding with wild shrimp and the potential for transgenic shrimp to establish feral populations in the wild environment. Invoking the precautionary principle, the ShAD cannot allow for these species to be cultured until there is conclusive evidence that demonstrates that they pose an acceptable risk to adjacent ecosystems.

Principle 7: Use resources in an environmentally efficient and responsible manner

Impact: The culture of shrimp often requires the intensive use of resources. The use of wild-caught (e.g. pelagic fish) and terrestrial farmed ingredients (e.g. soy, etc) in shrimp feeds has a potentially negative impact on marine and terrestrial ecosystems. Energy use also requires specific attention. This principle addresses not only the origin of those resources but as well seeks to improve the overall efficiency of the production system and ensure that effluent has limited impact and wastes are treated properly.

Criterion 7.1 - Origin of aquatic ingredients

	Indicator	Standards
7.1.1	Timeframe for producers to source feed containing fishmeal or fish oil originating from fisheries certified by an ISEAL member's certification scheme that addresses environmental and social sustainability	100% within five years of commercial availability
7.1.2	By-product feed ingredients used are unsuitable for human consumption, not from *Penaeid* shrimp, and acquired from a sustainable source	Yes
7.1.3	The certified farm, via its feed supplier, must provide a feed formulation showing all major (> 5%) marine ingredients	Yes

[88] **Transgenic Shrimp:** a subset of GMOs, are organisms which have inserted DNA that originated in a different species. Some GMOs contain no DNA from other species and are therefore not transgenic but cisgenic.

[89] **Genetic enhancement:** the process of genetic improvement via selective breeding that can result in better growth performance and domestication but does not involve the insertion of any foreign genes into the genome of the animal.

Interim Plan for 7.1.1

	Indicator	Standards
7.1.1a	Allowance for fisheries that are classified as depleted or overfished by regional, national or local fisheries management authorities	None
7.1.1b	Allowance for the use of fishmeal and fish oil in shrimp feed (including those made from fisheries by-products) containing products from fisheries that are listed on CITES Appendix I, on the IUCN's Red List (in categories: Near Threatened, Vulnerable, Endangered, and Critically Endangered)	None
7.1.1c	Stock status or assessment of fisheries used for feed sourcing must have been assessed within three (exact number of years to be determined) years and must be peer reviewed by individuals outside the organization that created the assessment	Yes
7.1.1d	Demonstrate consideration for species interaction issues	Yes

7.1.1c: How should an acceptable stock assessment result be defined? What is a credible assessor?

7.1.1d: How should an acceptable demonstration for species interaction issues be defined?

Rationale

The issue of fisheries sourcing is a key off farm issue that was identified by the ShAD as an issue that needed to be addressed. However, traceability and fisheries certification are still in their infancy, making the process of creating auditable standards very challenging. The goal of the standards below is to mandate continuous improvement. Over time, the ShAD recommends that sustainable and traceable sourcing of feed be requirements under the ShAD standards. The current plan for implementation calls for the producer to declare all sources of fishmeal and fish oil and then working to the greatest extent possible to verify these sources. The ShAD standards will require that, after three years of their publication, all fisheries sources must be traceable and, after five years, the entire chain of custody must be certified.

7.1: Origin of Aquatic Ingredients: Is the proposed implementation plan requiring compliance within three years strong enough to sufficiently drive change in the feed marketplace? How feasible is this for producers?

Currently, more than 75% of the world's fisheries are at or over capacity (ref). Aquaculture is touted to relieve pressure on wild fisheries by generating an alternative seafood supply. However, this will only be true if aquaculture operations make efficient use of wild fish ingredients (Naylor 2009). One of the greatest challenges for the ShAD in Principle 7 is defining sustainable sourcing of marine feed ingredients for shrimp farmers.

Key obstacles in defining a standard are the uncertainty inherent in fisheries management arising from unpredictable variation in ocean systems, limited understanding of how fishing impacts ecosystem function (i.e., forage fish play a key role in marine ecosystems), and poor capacity to monitor true take from oceans (IUU, unrecorded artisanal and recreational catches). Furthermore, climate change is creating additional challenges for fisheries management by adding to the uncertainty around the distribution and availability of fish and it is difficult to ensure that management regimes are appropriate, given the rapidly changing climatic conditions.

The key goal of this principle is to ensure that the fisheries that are clearly unmanaged or mismanaged are not used in feeds for certified farmed shrimp. The ShAD GSC recognizes that the interim ShAD standards document (Criteria 7.1) does not define an acceptable fishery stock status. The GSC is debating the merits of various options (including FishSource) for achieving this goal. The GSC welcomes comments in this respect.

The ShAD GSC also recognizes that the interim ShAD standards may be insufficient to fully address the impact of removing forage fish in large quantities from the base of the marine food chain. However, existing fisheries management regimes and certification bodies lack the science and capacity to develop fisheries management systems that can address ecosystem impacts of the fisheries. The ShAD recognizes that the definition we have proposed here will need to evolve with new developments in science and from research groups like the Lenfest Forage Fish Research Group.[90] The GSC is committed to staying abreast of this knowledge as it emerges. The following standards are intended to ensure that marine-derived ingredients can be traced to their source. The standards also seek to avoid the use of marine ingredients from IUU fisheries, unmanaged/ mismanaged fisheries, fisheries with unknown stock status, and unsustainable fisheries.

The ShAD supports the use of human food filleting waste from environmentally- preferable fisheries or aquaculture facilities. The International Fishmeal and Fish Oil Organization (IFFO) reports that 25% of fishmeal currently being used for aquaculture is coming from by-products of fish processing. This amount is expected to increase. While the ShAD encourages the use of by-products, it recognizes that this can result in higher feed conversion ratios (FCRs), resulting in tradeoffs between effluent concentration and efficient use of marine resources. The ShAD has attempted to address this tradeoff by creating an FCR standard and having effluent standards in Principle 7. The ShAD allows the use of by-products from fish processing, provided they do not come from *Penaeid* shrimp, and are from fish destined for human consumption.
A responsible shrimp farm must be able to ensure that the feed it is using contains responsibly-sourced ingredients. The ShAD standards require the use of feeds of known composition and demonstrable ingredient origin. This is to ensure that ingredients used in shrimp production do not include illegal or unsustainable marine or non-marine ingredients. The mislabeling or fraudulent labeling of fisheries products is a major problem in the seafood industry and can undermine sustainability initiatives for proper sourcing. This standard is designed to create incentives to protect producers from this problem.

All ingredients above a 5% inclusion rate must be reported, along with their source, to the auditor. Proprietary arguments against the full traceability and transparency of ingredients are not an acceptable argument for non-compliance, as the standards require innovations on behalf of producers and full traceability of feed ingredients to ensure the long-term sustainability of feed sources. Furthermore, the disclosure of only significant ingredients and not the micronutrients allows a better probability of compliance with this standard.

Guidance for Implementation
7.1.1 - ISEAL is a global association for social and environmental standards systems. More information can be found at www.isealalliance.org. The Aquaculture Dialogues strive to meet the guidelines for standard setting that have been set by ISEAL. Fisheries ingredients must be certified by a process that conforms to the ISEAL guidelines within five years of the publication date of the ShAD standards.
7.1.2 – Company must have a document that proves the source of fisheries by-products, which must demonstrate that they are not suitable for human consumption.

[90] http://www.oceanconservationscience.org/foragefish

7.1.3 – A document from the feed supplier (on company letterhead) must be provided to the auditor that lists the ingredients above 5%. The source of ingredients must be specified to the auditor. Also required is the date of production or harvest, location of production or harvest, method of production or harvest, and species produced. Initially, the farmer is required to provide all the information that they have available in order to help clarify where work needs to happen. The farmer will be required to have full chain of custody certification within three years of the ShAD standards publication date.
7.1.1a and 7.1.1b – Fishery status information may be accessed through many venues, such as FishSource (http://www.fishsource.org/) and the IFFO Responsible Fisheries (http://www.iffo.net/default.asp?fname=1&sWebIdiomas=1&url=368)
7.1.1c - Peer review must have taken place outside the agency that produced the stock assessment and the stock assessment must be reviewed by individuals who were not directly involved with its production.
7.1.1d – Companies are required to request that the feed company demonstrate that species interactions are considered in the fisheries management regimes of source fisheries.

Criterion 7.2 – Origin and content of terrestrial feed ingredients

	Indicator	Standards
7.2.1	Timeframe for producers to source non-marine ingredients from sources certified by an ISEAL member's certification scheme that addresses environmental and social sustainability	Within five years of commercial availability
7.2.2	The certified farm, via its feed supplier, must provide a feed formulation showing all major (> 5%) non-marine ingredients	Yes

In the interim period, the following indicators and standards apply for compliance with 7.2.1:

	Indicator	Standards
7.2.1a	Presence and evidence of a responsible sourcing policy from the feed manufacturer for feed ingredients which comply with internationally recognized moratoriums and local laws, including vegetable ingredients or products derived from vegetable ingredients. The ingredients must not come from the Amazon Biome, as geographically defined by the Brazilian Soya Moratorium.	Yes
7.2.1b 	Chemical and Pesticide Use in agriculture	

7.2.1.b: Should the issue of chemical and pesticide use be included as a standard and what should the standard be? How could you audit such a standard?

Rationale
The ShAD standards recognize that the production of terrestrial feed ingredients also has potentially significant environmental impacts and intends to avoid replacing unsustainable marine feed ingredients with equally damaging or unsustainable non-marine alternatives. For non-marine feed ingredients, the conversion of important biodiversity areas (e.g. the Amazon rainforest) for

ingredients used in aquaculture production (e.g. soy) and the use of pesticides and other chemicals were identified by the ShAD as environmental impacts of concern.

The ShAD will require that ingredients of non-marine origin (e.g. terrestrial proteins and oils) are certified using standards that were developed by a multi-stakeholder process conforming to ISEAL guidelines for standard setting (www.isealalliance.org) within five years of the ShAD standards publication date. During the interim period, when certified feed ingredients are not commercially available, the ShAD advocates the use of interim standards (7.2.1 a– 7.2.1.b).

The goal of the standards below is to mandate continuous improvement while building towards having sustainable and traceable sourcing as requirements for non-marine feed ingredients. The current plan is to ensure that the producer declares all sources of non-marine ingredients and then work to the greatest extent possible to verify these sources. The ShAD standards will require that, after three years of their publication, all non-marine ingredient sources must be traceable and, after five years, the entire chain of custody must be certified.

Land Conversion
While the ShAD's standards document will include standards preventing the conversion of sensitive habitats (e.g. mangroves or other wetlands) to shrimp farms, it is possible that the production of terrestrial feed ingredients (e.g. cereals and grains) will also have been at the expense of sensitive terrestrial habitats, such as rainforests. The GSC considers this an important aspect of the overall shrimp production system, but continues to debate (and welcomes comments) on how these impact categories can be addressed in the ShAD standards and audited at the farm level.

Pesticide Use
While the ShAD GSC includes standards that limit or prevent the use of chemicals in shrimp ponds and/or their discharge into the environment, the GSC recognizes that the production of terrestrial feed ingredients is typically associated with widespread chemical use in the form of fertilizers and pesticides for plant-based ingredients and antibiotics, hormones and other pesticides for land animal derived feed ingredients. The GSC considers this an important aspect of the overall shrimp production system, but continues to debate (and welcomes comments) on how these impact categories can be addressed in the ShAD standards and audited at the farm level.

Guidance for Implementation
7.2.1: see 7.1.1 and for example, soy must originate from sources certified under the Roundtable for Responsible Soy Production when certified product that is produced under those standards is commercially available. We will add other geographical areas as the ability to define them becomes available.

7.2.2: A document from the feed supplier (on company letterhead) must be provided to the auditor that lists the ingredients above 5%. The source of ingredients must be specified to the auditor including date of production or harvest, location of production or harvest, method or production or harvest, and species produced. Initially the farmer is required to provide all the information that they have available in order to help clarify where work needs to happen. It will be required to have full chain of custody certification within 3 years of the ShAD publication date.

Criterion 7.3: Use of GMO ingredient in feed

	Indicator	***Standards***
7.3.1 	*%* feed that is of GMO origin	***Options:*** a) 0% GMO b) GMO allowed with label c) GMO allowed, but no labeling d) GMO allowed with GMO free label on product that don't use GMO's e) other

7.3.1: Which option for use of GMOs would be the most appropriate for the ShAD standards and why?

Rationale

Whether or not to ban genetically modified (GM) feed ingredients was a controversial issue within the ShAD. The ShAD standards aim to ensure that standards are based on the best available scientific information and appropriately employ the precautionary principle.[91] The ShAD recognized that there are documented impacts of GM ingredients and GM crop production on ecosystems, human and animal welfare and social justice. The science on the GMO issue does suggest that the ShAD should take a precautionary approach and ban GMOs for use in shrimp feed. However, concern was raised about how a standard that bans GMOs could affect the ultimate use of the standards if some producers are ineligible due to one standard. Therefore, the ShAD has to carefully consider the tradeoffs of including or excluding GMOs.

One major tradeoff was to balance market credibility and market realities. Doing so would recognize that European and North American consumers have different perceptions of the human health and ecological risks conferred by GMOs, North American markets depend more heavily on GMOs than European markets, and North American consumers are less risk averse to GMOs than are European consumers.

A further consideration was the fact that inclusion/exclusion of GM plant proteins has regional implications in terms of market access for shrimp farmers. For shrimp producers in America, the use of non-GM soy protein comes at a significantly higher cost than the use of GM soy protein, which could affect the global uptake of the ShAD standards.

Another tradeoff was between the inclusion/exclusion of protein from GM plants in feed. The current availability of GM soy could support present levels of aquaculture, whereas increasing demand for GM-free plant protein has the potential to cause further deforestation in important biodiversity areas (e.g. the Amazon rainforest). There may also be risks related to genetic introgression/decreased genetic fitness of key agricultural commodities through hybridization between heirloom seeds strains and their GM counterparts. Such hybridization has ecological effects and legal implications for farmers.

[91] Defined As: when an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically (takingprecaution.org)

The ShAD GSC recognizes that its choices may have long-term consequences by creating demand for more/less GM plant protein. Current science does not provide an adequate understanding of the environmental and health risks/benefits associated with GMs, yet decisions with real market consequences need to be taken prior to the advent of perfect information. Neutrality to GMs, versus exclusion of GMs, is an issue that the ShAD GSC considers important to carefully monitor so that future versions of the standards respond fairly and rapidly to emerging information.

Finally, the ShAD GSC strongly recommends that the end product and/or packaging be clearly marked "Fed with GM ingredients" in order to maintain full transparency and information for the end consumer.

Criterion 7.4: Use of land animal by product in feed

	Indicator	Standards
7.4.1 	Land Animal Byproducts	***Options:*** a) 0% Land Animal Byproducts b) Land Animal Byproducts allowed with label c) Land Animal Byproducts allowed, but no labeling d) Land Animal Byproduct allowed with Land Animal Byproduct free labeled on products that don't use them e) other

7.4.1

a) Which option for use of land animal by-products would be the most appropriate for the ShAD standards and why?

b) What would you consider to be ethically acceptable to give to shrimp as land animal by-products, considering that these are not present in the natural food chain of this animal ? Blood meal, meat meal, feather meal, respectively from ruminants (beef, sheep), pork, chicken or other industrially reared animals.

Rationale

The ShAD also considered the use of land animal by-products (offal and other process wastes) for farms certified under the standards. The ShAD GSC considers the human health risks associated with the use of these by-products in production to be negligible, but recognizes the increasing awareness of the overall life cycle costs of producing these ingredients. The ShAD standards acknowledge that the most comprehensive method of accounting for the use of land animal by-products would be to conduct comprehensive life cycle analyses (LCA) for all resources that make up land animal by-products. Currently, these methods are not sufficiently developed to apply in a standardized and cost-effective way for aquaculture certification. Continuous improvement efforts should target research that finds ways to affect pragmatic LCA considerations in the standards, particularly around energy use, water use, land use, and trophic considerations related to feed inputs. Standards that monitor energy use are the first steps toward developing more holistic methods in the ShAD standards. Therefore, the potential use of land animal by-products is currently neither encouraged nor discouraged in the standards, but may be reconsidered in future standards revisions. However,

producers must be aware that products made with terrestrial by-products are not allowed in certain markets.

Finally, the ShAD GSC strongly recommends that the end product and/or packaging be clearly marked "Fed with land animal by product ingredients" in order to maintain full transparency and information for the end consumer.

Criterion 7.5: Use of wild fish for fishmeal and oil

	Indicator	Standards
7.5.1	Feed Fish Equivalence Ratio (FFER)[92]	*L. vannemei*: 1:1 *P. monodon*: 1.5:1
7.5.2	Economic Feed Conversation Ratio (eFCR)[93]	MAXIMUM 2.5 or Standard deviation

7.5.2: Should an FCR standard be included in the ShAD standards document? If so, what should the rationale be for setting the appropriate limit?

Rationale

The ShAD standards mandate an FFER that measures the efficiency of wild fish inputs used for production. While sustainable source of feed ingredients is one important criterion for sustainable production, the efficiency of use is another. Efficient use of resources will likely grow in importance as global resources become more limited. Use of forage fish as a feed input for shrimp is a great concern, given that aquaculture production is rapidly growing and there is a finite supply of forage fish from global oceans. In the interest of providing the greatest social and nutritional benefits from such resources, fish must be harvested sustainably and, subsequently, used efficiently. The ShAD standards mandate that *L. vannemei* have an FFER equal to 1 and *P. monodon* have an FFER equal to 1.5. This difference is based on different nutritional requirements between the two species of shrimp and may be harmonized over time.

The maximum eFCR authorized under the present certification is 2.5 (Reference France Official Organic Shrimp AB Regulation CC-REPAB-F published 13.2.2007 under EU Organic Regulation n°834-2007). The eFCR standard is included to help guard against wasteful feeding rates that could still achieve FFER performance thresholds when using feeds with particularly low inclusion rates. Such low inclusion rate feeds can be achieved by increasing the proportion of fisheries by-products or plant proteins in formulations. The former still represents an important marine resource while the latter may have its own environmental and social impacts (e.g. deforestation, pesticide use, etc.). As such, both must be used efficiently.

Asking farmers to achieve threshold eFCRs aligns incentives around the following: accurate tracking of fish weight/biomass, good feed management to keep feed fresh and assure no waste prior to use, careful tracking of parameters to optimize feed uptake by fish (dO2, presentation, frequency of offering, correct pellet size, time of feeding, etc.).

While eFCR varies with the size of shrimp harvested, the GSC has decided to set a threshold eFCR of 2.5 as published in the Reference France Official Organic Shrimp AB Regulation CC-REPAB-F published 13.2.2007 under EU Organic Regulation n°834-2007). While eFCR varies with the size of shrimp harvested, the GSC has decided to set a threshold eFCR, as opposed to scaling eFCR with shrimp size.

[92] Feed Fish Equivalency Ratio (FFER): the quantity of wild fish used per quantity of cultured fish produced.
[93] Economic Feed Conversion Ratio (eFCR): the quantity of feed used to produce the quantity of fish harvested

The GSC recognizes that this approach will challenge the producers of large size-class shrimp more than producers of smaller size-class shrimp. However, this is in keeping with the spirit of the Aquaculture Dialogues, whose objective is to minimize the key environmental and social impacts of aquaculture, where minimizing the use of wild forage fish needs to be a priority. In this respect, farmers that use more marine resources (harvesting large shrimp) will need to prioritize alternative feed formulations and highly efficient feeding more than farmers who use fewer marine resources (harvesting smaller size classes).

The GSC recognizes that there are also disadvantages to including eFCR in the standards, which include:

- eFCR relates directly to efficient farming, but indirectly to efficient use of marine resources. Marine resources reflect the amount of primary productivity (phytoplankton) from oceans that is converted into biomass in the food chain. However, fish higher up in food chains are the sum of a greater total amount of primary productivity than their counterparts lower down on the food chain. Including an eFCR standard that treats all species in the food chain as equivalent by weight is not representative of the biological "expense" of producing different species and even different ages/size of the same species. Including an eFCR standard unintentionally obscures the ecological costs of using different species of forage fish in feeds, by valuing all species biologically equivalent in their cost to produce.
- Including an FFER standard encourages the use of fisheries by-products, which tend to have higher ash contents. Higher ash content in feeds creates higher feeding rates, which can lead to increased risk of pollution impacts.

Continuous improvement

We would like to see future FFER calculations include weighting factors that account for the relative trophic level of species used in feeds.

Guidance for Implementation

7.5.1: This measure can be weighted for fish meal or fish oil, whichever component creates a larger burden of wild fish in feed. In the case of shrimp at current status, the fish meal will be the determining factor for the FFER, thus $FFER_m$ is the equation used in the ShAD.

$FFER_m$ = (%fishmeal in feed x eFCR) / 22.2

$FFER_o$ = (%fishoil in feed x eFCR) / 5.0

7.5.2: eFCR = Feed, Kg or MT / Net aquacultural production, Kg or MT (wet weight).

Criterion7.6: Effluent contaminant load

	Indicator	Standards
7.6.1	Amount of nitrogen released from the culture system per ton of shrimp produced: see formula below	**<**17.6 kg/tonne of shrimp for *P. vannamei* <28.5 kg/tonne of shrimp for *P. monodon* and other *Penaeid* shrimp species
7.6.2	Amount of phosphorus released from the culture system per ton of shrimp produced: see formula below	**<**2.7 Kg/tonne of shrimp for *P. vannamei* < 5.5 kg/tone of shrimp for *P. monodon* and other *Penaeid* shrimp species
7.6.3	Concentration of settleable solids in effluent water from aerated ponds	< 3.3 mL/L
7.6.4	Average, daily, minimum dissolved oxygen concentration in receiving water body[94]	> 35% of saturation

Rationale

This criterion addresses the issues of emission of contaminants from shrimp farms and its effect on receiving water bodies. The ShAD believes that standards should be ecologically meaningful and equally accessible to all producers no matter their scale. Therefore the ShAD standards use a mass balance approach in which the overall nutrient discharge loads into receiving waters are minimized by reducing both inputs and outputs simultaneously. Nitrogen (N) and phosphorus (P) are the key nutrients to control in order to reduce the risk of eutrophication of receiving water bodies. Water discharged from shrimp farms cannot be expected to have equal or better quality than receiving water bodies. Thus, there must be allowance in certification standards for discharge of a portion of the N/P applied to ponds. Based on the performance of a well-operated shrimp farm, maximum allowable effluent N/P loads could be established by multiplying N/P inputs by typical proportions of feed N/P released to the environment.

Shrimp have a rather constant nitrogen and phosphorus content and these quantities can be subtracted from inputs to give actual nutrient pollution loads to ponds. Nitrogen is removed from pond water through de-nitrification, ammonia volatilization, and sequestration in organic matter that accumulates in sediment (Boyd and Tucker 1998). Phosphorus is strongly sequestered in sediment by chemical reactions (Haygarth and Jarvis 2002; Hieltjes and Liklema 1982). The review of nutrient budget studies showed that the typical fate of nitrogen inputs are as follows: harvest, ≈30%; ammonia volatilization, ≈10%; de-nitrification, ≈10%; sedimentation in pond, ≈25%; effluent, ≈25% (Funge-Smith and Briggs 1994; Paez-Osuna 1997 ; Martin et al. 1998; Teichert-Coddington et al. 2000; Gross et al. 2000). The fate of phosphorus inputs is simpler: shrimp harvest, 10%; bottom soil uptake, 70%; effluent, 20 % (Funge-Smith and Briggs 1994; Paez-Osuna 1997 ; Teichert-Coddington et al. 2000; Boyd 1985; Boyd et al. 2006).

[94] measured at a station at least 200 m down current from the farm outfall

The following assumptions have been made, based on published shrimp composition data, and reports of performing feed composition, FCR and water exchange:

	L vannamei	*P. monodon*
% Nitrogen in feed	5.6% (35% protein)	6.0% (37.5% protein)
% Phosphorus in feed	1.3%	1.5%
% Nitrogen in shrimp*	2.86%	3.09%
% Phosphorus in shrimp*	0.32%	0.26%
Average FCR**	1.5:1	1.8:1
Daily water exchange	0%	0%

*Boyd and Teichert-Coddington 1995; Gomes and Boyd 2003.
**Papers presented at World Aquaculture Society meeting in Kuala Lumpur, Malaysia, Nov 2009 revealed that FCR for production of *L. vannamei* should not exceed 1.5 in well-managed ponds.

The amounts of nitrogen and phosphorus in aquaculture effluents can be minimized by reducing concentrations of nitrogen and phosphorus in feed, lowering the FCR, and using smaller water exchange rates. Lowering nitrogen and phosphorus content in feed has less effect than reducing FCR. This provides farmers opportunity and accountability to improve nutrient load over time. Intensive farming will use nutrient dense feeds versus other farming systems, but maximize internal nutrient loss capture by minimizing water exchange. On the other hand, semi-intensive farmers will have a higher water exchange but their feed will be less nutrient-dense as well.

Effluent treatment
Shrimp ponds, like ponds for most other aquaculture species, are drained for harvest. The usual situation is to release water through a gate with water level established by dam boards. The drawdown is caused by removing dam boards; water level falls as water flows out from the surface of the pond. Thus, effluent quality is identical to pond water quality for most of the drawdown period. After about 75% of the water has been discharged, sediment begins to be re-suspended by the shallow, out-flowing water. Workers also enter the pond with nets or seines, which further disturbs the sediment. As much as 90% of the load of potential pollutants may be discharged with the final 25% of the pond water (Boyd 1978; Schwartz and Boyd 1994b; Teichert-Coddington et al. 1999). Soil particles and organic matter accumulate in the bottom of aerated ponds. This results from erosion of pond bottoms by aerator-generated water currents and sedimentation of these particles in areas of the pond where water currents are weaker. Plastic-lined ponds are a special case. The aerators do not erode the bottom, but they force the coarser particles of uneaten feed, dead plankton, etc. to settle in the center of ponds. When ponds are drained, the recently-accumulated wastes are relatively fluid and tend to be lost in out-flowing water (Boyd 1995; Boyd and Tucker 1998). There is less erosion of the bottoms of semi-intensive and extensive ponds because aerators are not used. Particles settle over the entire pond bottom rather than being concentrated in small areas by aerator action. Thus, the sediment from intensive ponds is of lower density (more fluid) and more enriched in organic matter than sediment in semi-intensive and extensive ponds. This reinforces the rationale for requiring sedimentation basins for intensive ponds but not for semi-intensive and extensive ponds.

The use of settleable solids (SS) rather than Total Settleable Solids (TSS) in effluent monitoring is recommended because SS can be measured easily and represent the fraction of the TSS that will settle out fairly rapidly. Settleable solids are the environmentally harmful fraction of the TSS, as most of the turbidity and sediment results from SS, and a lot of organic matter and phosphorus are associated with the solids (Boyd 1978). Removal of SS from water will lessen the Biological Oxygen Demand (BOD) and total phosphorus concentration.

A settling basin can improve the quality of final draining effluents from intensive farms. Although settling basins are not effective in removing plankton, detritus, or colloidal clay particles from water, they are effective in removing larger particles (Boyd and Queiroz 2001; Ozbay and Boyd 2004). About 100% of SS, 90% of TSS, 60% of BOD, 50% of phosphorus and 30% of nitrogen in draining effluent can be removed by sedimentation in a basin with a hydraulic retention time (HRT) of 6 hr or more (Teichert-Coddington et al. 1999). There probably is little benefit in increasing HRT beyond 6 hours for removal of solids, but a greater retention time might enhance water quality. For example, a longer sedimentation period of 12 hours would allow more time for re-oxygenation of the water, ammonia volatilization, nitrification, and phosphate uptake by bottom soil. Moreover, the settling basin should have a volume 1.5 times larger than the 12-hr HRT volume in order to have sediment storage capacity necessary to maintain the 12-hr HRT over time.

The ShAD proposes a surrogate variable to address the cumulative impact of shrimp farms on receiving water bodies. The most characteristic feature of eutrophication is wide, daily, excursions in dissolved oxygen concentration resulting from the large abundance of algae and other microorganisms. Feeding and growth decline at dissolved oxygen concentrations below 50% saturation and especially below 36% of saturation[95]. Of course, occasional excursions of dissolved oxygen concentration as low as 25% of saturation for one or two hours in the early morning on a few days per year apparently do not adversely affect warmwater, aquatic animals[96]. This information suggests that the average, minimum, daily dissolved oxygen concentration in estuaries should not be below 35% of saturation during either the dry season or the rainy season. Season is an important factor to include, because DO concentration may be lower in some estuaries during the dry season because of less flushing by freshwater inflow.

Guidance for implementation

7.6.1 and 7.6.2: Annual nutrient balances are calculated for an entire farm over a period of 12 months (harvested ponds) to take into account seasonal and between-pond variations.

N balance (kg/ton of shrimp):

$$\text{Effluent N} = \frac{(\text{Feed N} + \text{Fertilizer N}) - \text{Shrimp N} - [(\text{Sediment N} + \text{Gaseous N}) \text{x F}]}{\text{Shrimp production}} \quad (3)$$

P balance (kg/ton of shrimp):

$$\text{Effluent P} = \frac{\textit{Feed P} + \textit{Fert}\text{ilizer P} - \text{Shrimp P} - \text{Sediment P x F})}{\text{Shrimp production}}$$

Feed N/P (kg) = (kg Feed 1 applied) x (% N/P Feed 1 content) + (kg Feed 2 applied) x (% N/P Feed 2 content) + etc.
Fertilizer N/P (kg) = (kg Fertilizer 1 applied) x (% N/P Fertilizer 1 content) + (kg Fertilizer 2 applied) x (% N/P Fertilizer 2 content) + etc.
Shrimp N/P (kg) = (kg Shrimp harvested) x (% N/P Shrimp content)
Sediment P = (kg P from feed) x 0.7
Sediment N = (kg N from feed) x 0.25
Gaseous N = (kg N from feed) x 0.2

[95] Collins 1984; Andrews et al. 1973
[96] Boyd and Tucker 1998

F = water exchange factor recommended by Boyd (personal communication) based on the review of studies of the effect of water exchange on pond water quality (see table below).

Daily water exchange rate (% of pond volume)	Factor F
0	1
<2.5	0.95
2.6 – 5.0	0.90
5.1 – 10	0.85
11 – 20	0.75
21 – 50	0.30
>50	0.00

Shrimp production = annual production of farm in tonnes

7.6.3: Settling basins should be constructed according to the following specifications:

(1) Hydraulic retention time (HRT) = 18 hr; (This will avoid the settling basin from having to be cleaned out frequently in order to maintain a minimum HRT of 12 hr.)
(2) Design of basin must include seepage and erosion reduction control features (e.g. proper soil texture, good compaction, and grass cover);
(3) Water enters at surface of basin through a weir;
(4) Water exits surface of basin through a weir on opposite side;
(5) If basin is square or nearly so, a baffle must be provided to avoid short-circuiting of flow;
(6) A drain structure should be provided so that the basin can be emptied;
(7) Posts must be placed at five places in the basin. These posts will extend to the height of the full-basin water level. They will be used to estimate average depth of sediment accumulation. Sediment depth cannot exceed one-fourth (25%) original basin depth as measured by the distance from the top of the post to the sediment surface.

Farms that do not have enough space for a settling basin can use production ponds adjacent to the pond being harvested as settling basins. Another alternative is to use discharge canals as settling basins, and sills can be installed at intervals in the bottoms to trap sediment. The use of production ponds and discharge canals as settling basins allows for treating and recycling 100% of the water from harvested ponds, a practice that the ShAD standards would promote. Alternatively, grassed strips or vegetated ditches, and mangrove areas or other wetlands have been used for treating freshwater effluents. Suspended solids and other wastes are removed as the effluent passes over or through the vegetation.

The settleable solids concentration in basin effluent must be measured at 4-hr intervals when shrimp ponds are being drained. Settleable solids are measured as the volume of solids that settles to the bottom of a conical cone (Imhoff cone) in 1 hour. It is a simple analysis and is inexpensive to conduct. A limit of 3.3 ml/L of settleable solids was defined for discharge permits in the United States after the first USEPA study of aquaculture facilities in the mid 1970s (USEPA 1974).

7.6.4: Shrimp farms may discharge into channels or streams connected to larger, open water areas of a river or estuary. The sampling site for dissolved oxygen concentration in the receiving water for a particular farm should be located in the segment of the water system into which effluent is directly discharged. Sampling stations should be outside of the zone where mixing is not yet complete and concentrations of some water quality variables would be elevated above ambient for the receiving water. There are several complicated methods for determining the area of the mixing zone, none of which were considered practical for use in an eco-label certification program (USEPA 2003). Thus, aside from making measurements at a site, there is no way of determining the extent of the mixing

zone. Experience suggests that the mixing zones for shrimp farm effluents in which the concentrations of some water quality variables may be higher than ambient concentrations usually do not extend more than 100 or 200 m into estuarine water bodies (Boyd personal communication). Of course, the mixing zone could be roughly delineated by a relatively simple procedure. Shrimp farm effluents are seldom of the same turbidity as receiving waters. Thus, Secchi disk visibility measurements could be made at 25-m intervals downstream of the farm outfall and points beyond the distance at which the Secchi disk readings become constant would be outside of the mixing zone.

At some farms where effluents are discharged directly into the sea, it would be difficult to sample offshore when waters are rough. In this case, the sample could be taken at some point at least 200 m from the outfall, but near the shore to avoid a dangerous situation related to sample collection.

Criterion 7.7: Energy efficiency

	Indicator	Standards
7.7.1	Presence of records summarizing the facilities' energy consumption by sources[97]	Yes
7.7.2	Presence of records verifying the Annual Cumulative Energy Demand (MJ or kWh/ tonne of shrimp)	Yes

Rationale

Energy is consumed throughout the culturing, harvesting, processing and transportation stages of shrimp production. There are also many other energy drains to consider, such as energy consumed during construction of facilities; while maintaining and updating facilities; during the production of those construction materials; and during the production of liming materials, fertilizers and other inputs. The ShAD acknowledges that, at this time, there is insufficient data available for setting energy use standards. Therefore, the ShAD standards require the collection of energy consumption data by audited farms in order to be able to set up energy standards in the future. To be useful for addressing the issue of carbon emission in the future, data collection needs to be as exhaustive as possible so that the conversion of energy consumption to carbon emission will be feasible.

Criterion 7.8: Handling and disposal of hazardous materials and wastes

	Indicators	Standards
7.8.1	Percentage of combustibles contained in bunds	100%
7.8.2	Percentage of chemicals stored in impermeable containers or buildings	100%
7.8.3	Percentage of used lubricants recycled or turned over to an accredited waste management company	100%
7.8.4	Percentage of chemical containers reused or turned over to an accredited waste management company	100%
7.8.5	Percentage of non-hazardous, non-recyclable wastes turned over to an accredited waste management company or landfilled	100%
7.8.6	Percentage of non-hazardous recyclable wastes reused or turned over to a recycling company	>50%

Rationale

The construction and operation of shrimp farms imply the use of hazardous chemicals, including combustibles, lubricants, fertilizers, etc. and the generation of wastes. The storage, handling and disposal of such hazardous materials and wastes must be done responsibly, according to their respective potential impacts on the environment and human health. The ShAD proposes quantifiable

[97] Including fuel use and equipment (i.e. tractor, generator, boat, etc.); quantity of electricity purchased / consumed; quantity of HFCs / R gases used in refrigerants and air conditioning as per the GHG Protocol Corporate Standard

indicators that imply the implementation of a management plan and the separation of wastes depending on their destination. The Shad determined that all hazardous materials and wastes must be strictly controlled and that the proportion of recycled waste should be improved over time, with an initial target of 50% of recyclable wastes.

Guidance for Implementation

7.8.1: Bunds must be waterproof, with a capacity of 110% of the volume of combustible stored, and must not have any drain (rainwater needs to be pumped or scooped periodically).

7.8.2: Dry chemicals must be protected from humidity inside buildings. All containers of liquid chemicals must close hermetically. Access to all chemicals should be restricted to authorized personnel.

7.8.3 to 7.8.5: The Shad appreciates that shrimp farms are generally located in remote areas where accredited waste management companies are not necessarily established or accessible, and farmers need to demonstrate the use of the most responsible disposal solutions based on local possibilities. In case of absence of a managed landfill in the area, shrimp farms are allowed to burry non-hazardous solid wastes on site, provided all precautions have been taken to prevent the contamination of surrounding surface and underground waters. Non-organic wastes must not be burned on site because of the possible emissions of toxic gases.

7.8.6: Recyclable wastes need to be identified and separated at the point of generation. Some wastes (for example feed bags and plastic containers) can be reused, and their return to suppliers should be encouraged. When selling recyclable wastes to a local collector, the final destination of wastes should be determined. The income generated by the sales of recyclable wastes should be used for incentivizing employees to separate wastes and increase the percentage of recycling.