



ABALONE AQUACULTURE DIALOGUE STANDARDS



Created by the
Abalone Aquaculture Dialogue

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INTRODUCTION

Seafood is one of the most popular sources of protein worldwide. By volume, approximately half of the seafood we eat is wild-caught. But the other half is from aquaculture, the fastest-growing food production system in the world.

As with any rapidly growing activity, the growth in aquaculture production has raised concerns about the potential negative social and environmental impacts related to farming. It is important that we face the challenge of promoting and spreading practices that contribute to resolving these issues, while reducing those that have a negative impact.

One solution to this challenge is creating standards for responsible aquaculture production, as well as a process for certifying producers who adopt the standards. Standards, when adopted, can help reassure seafood buyers throughout the value chain and at the consumer level that aquaculture products do not have adverse impacts on environmental or social sustainability. One way buyers can support sustainability is by purchasing certified products that have been produced in compliance with these standards.

Through a multi-stakeholder process called the Abalone Aquaculture Dialogue (AAD), measurable performance-based standards have been created for farmed abalone. The standards, when adopted, will help minimize the potential negative effects of abalone aquaculture while permitting the abalone farming industry to remain economically viable. Although these standards will be applicable at the farm level, they will help protect and maintain ecosystem function and ecosystem services in abalone producing areas, with the recognition that aquaculture operations are not solely responsible for total ecosystem health.

The standards presented in this document are based on sound science and input from the 100-plus people who have been involved in the Abalone Aquaculture Dialogue since it began in April 2008. The Dialogue is coordinated by World Wildlife Fund (WWF).

Feedback received during the two 60-day public comment periods was used by the Dialogue's Steering Committee, the 10-person entity that manages the Dialogue process, to revise the standards. In order to encourage continuous improvement, the standards will be revisited and updated periodically (i.e., once every three to five years) to ensure that they are based on the most recent scientific knowledge and best available management practices.

The standards will be handed over to an independent third-party certifying body known as the Aquaculture Stewardship Council (ASC). The ASC intends to use these standards as the basis for independent third-party assessments for compliance. If a specific aquaculture operation "passes" this assessment, and provided that chain-of-custody certification is also in place, users of products arising from that aquaculture operation to end consumers will be permitted to use the ASC label on its product. Intermediate users in the supply chain will be able to promote the product as being certified to the ASC standards. The rights to promote certificated products and use the ASC consumer label will be subject to licensing fees.

PURPOSE, JUSTIFICATION AND SCOPE OF THE STANDARDS

Purpose of the standards

The purpose of the Abalone Aquaculture Dialogue standards is to provide a means for abalone farmers to measurably demonstrate the environmental and social sustainability of their farming operations.

Justification for the standards

According to United Nations Food and Agriculture Organization statistics, farmed shellfish make up more than 80 percent of the world's marine aquaculture production. There is growing consumer demand for environmentally certified seafood products, and there also is demand from abalone farmers for a process that will validate the environmental and social sustainability of their farming operations.

Scope of the standards

Issue areas of abalone aquaculture to which the standards apply

The Abalone Aquaculture Dialogue created principles, criteria, indicators and standards for addressing the following potential negative social and environmental issues related to abalone aquaculture: farm siting/infrastructure, energy use, feed inputs, biosecurity, ecosystem effects, waste management and social responsibility.

Principles are the high-level goals for addressing the issues, criteria are the areas to focus on to address each issue, indicators are what to measure in order to determine the extent of each issue, and standards are the numbers and/or performance levels that must be reached to determine if the issue is being minimized.

Geographic scope and range of activities to which the standards apply

The Abalone Aquaculture Dialogue standards apply globally to all locations and scales of abalone aquaculture production systems. Abalone aquaculture is defined as active husbandry at any stage from seed to harvest within a defined area and with defined ownership of the abalone being cultured.

Unit of certification to which the standards apply

The unit of certification refers to the extent of the specific aquaculture operation to be assessed and monitored for compliance with the standards. The size of the production operation can vary considerably and needs careful consideration when determining the entity that will seek assessment for compliance. As the focus of these standards is on production, the unit of certification will typically consist of a single farm or other production unit.

The unit of certification may also encompass a group of operations that should be considered collectively as the aquaculture operation under consideration, especially in the case of small-scale farms raising the same species and using similar management regimes. For example, they may be in proximity to each other, share resources or infrastructure, share a landscape unit (e.g., a bay or water body), and/or have the same production system. Farms will also have cumulative effects, which will often be the main environmental issue. Determining the unit of certification requires that an appropriate spatial scale and level of potential cumulative effects be considered. The certification body will determine the ultimate unit of certification and procedures for auditing.

PROCESS FOR CREATING THE STANDARDS

The Abalone Aquaculture Dialogue standards were developed through transparent, consensus-oriented discussions with a broad and diverse group of stakeholders (i.e., producers, NGOs, researchers, government representatives, scientists, buyers and allied businesses). The process included the following steps:

- WWF notified the International Social and Environmental Accreditation and Labeling Alliance (ISEAL) of the intent to apply ISEAL's "Code of Good Practice for Setting Social and Environmental Standards" to the AAD. ISEAL approved this step and accepted WWF as an associate member on behalf of all the Aquaculture Dialogues.
- The inaugural meeting of the AAD—as were later AAD meetings—was publicized on the Aquaculture Dialogues website, in seafood trade publications and in several other publications read by key stakeholders, so as to maximize involvement in the process. Although the AAD is open to the public, key stakeholders were contacted directly by WWF and others to participate in the AAD in order to ensure its credibility.
- AAD meetings were held in the three initial target regions: Australia, South Africa and Asia.
- AAD participants agreed on the objectives of and justification for the Dialogue, as well as the process for creating the standards.
- AAD participants agreed on a governance structure for the development of the standards.

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- AAD participants selected individuals to serve on a globally representative Steering Committee. Committee decisions are informed by Dialogue participants, technical experts and external stakeholders.
 - AAD participants agreed on seven key environmental and social issues associated with abalone aquaculture and the principles to address each issue.
 - AAD participants discussed potential criteria, indicators and standards for abalone farming. The Steering Committee used information from those discussions as the basis for developing this document.
 - The Steering Committee finalized an outreach plan to ensure that new stakeholders were continually engaged in the AAD process.
 - The first draft of the standards was posted for the first of two 60-day public comment periods.
 - The Steering Committee addressed stakeholder comments from the first round of public consultation and incorporated feedback received into the second draft of the standards.
 - The draft Abalone Aquaculture Dialogue standards were posted for a second and final 60-day public consultation period. In finalizing the Abalone Aquaculture Dialogue standards, the steering committee took into consideration all comments received during the two 60-day public comment periods.
 - The document will be supplemented by an auditor checklist and guidance document detailing the methodologies used to determine if the standards are being met, as well as a Better Management Practices (BMP) manual explaining specific steps that can be taken by producers to achieve 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 Abalone Aquaculture Dialogue standards.
 - Abalone producers will be able to apply to the Aquaculture Stewardship Council to be assessed for certification.

CONTINUOUS IMPROVEMENT OF THE ABALONE 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 Abalone Aquaculture Dialogue standards that the numerical values, or “performance 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 standards are also recognized as a way to reward better performance, and as science and technology allow for more precise and effective measures, the Abalone Aquaculture Dialogue shall remain open to adopt these new findings within the scope of the standards.

CONTENT OF THE STANDARDS

1. PRINCIPLE: OBEY THE LAW AND COMPLY WITH ALL APPLICABLE LEGAL REQUIREMENTS AND REGULATIONS WHERE FARMING OPERATION IS LOCATED

1.1 Criterion: All applicable legal requirements and regulations where farming operation is located

INDICATOR	STANDARD
1.1.1 Evidence of compliance with all applicable legal requirements and regulations where the farming operation is located (e.g., permits, licenses, evidence of lease, concessions and rights to land and/or water use)	Yes

Rationale—Abalone aquaculture operations must, at a minimum, adhere to national and local laws. The Abalone Aquaculture Dialogue may develop sustainability standards beyond those required by law, but the baseline requirement for any aquaculture operation must be compliance with the legal obligations of the producing country. Laws that compel a farmer to take a certain action take precedence over voluntary standards.

2. PRINCIPLE: AVOID, REMEDY OR MITIGATE SIGNIFICANT ADVERSE EFFECTS ON HABITATS AND BIODIVERSITY

Improperly sited abalone farms can adversely impact sensitive ecological communities and potentially threaten critical habitat or endangered species. In many instances, local regulations will require farms to conduct proper environmental impact assessments before they become operational, but this is not always the case. One of the main areas of potential environmental concern associated with abalone aquaculture is the effect that effluents from land-based farms could have on the ecological communities in proximity to farming operations. For sea-based farming, the main concern is impacts on benthic communities from increased organic deposition. The standards prescribe indicators and assessment procedures for hard substrates and depositional substrates.

2.1 Criterion: Critical habitat and species interactions

INDICATOR	STANDARD
2.1.1 Where not otherwise mandated by local law or covered by recognized environmental impact assessments permitting the farming activity, evidence proving no significant adverse effects on threatened/endangered species ¹ or the habitat on which they depend	Yes

Rationale—Abalone aquaculture will not be considered acceptable if it causes adverse impacts within specific areas occupied by critical habitat/endangered species or containing physical and biological features essential to the conservation of the endangered species in question and that may require special management considerations or protection (e.g., critical habitat essential for endangered species survival).

¹ As defined by national law or as found in the IUCN Red List of Threatened Species.

2.2 Criterion: Benthic impacts of sea-based farming on depositional substrate

INDICATOR	STANDARD
2.2.1 Acceptable levels of total “free” sulfide in surficial sediment (0-2 centimeters from the surface) measured beneath sea-based farms	<p>≤ 1,500 μM, monitoring every five years² is required.</p> <p>≥ 1,500 μM and ≤ 3,000 μM, monitoring every year is required.</p>
2.2.2 Unacceptable levels of total “free” sulfide in surficial sediment measured beneath sea-based farms	≥ 3,000 μM
2.2.3 Sulfide analysis may be replaced by direct analysis of benthic community structure (i.e., infaunal surveys) in areas where this biotic approach is preferred by the applicant or is already mandated by a regulatory body. ³	Yes
2.2.4 Allowance for sea-based farming of abalone over areas that provide a particularly significant or essential biological or ecological function within the broader ecosystem ⁴	None

Rationale—Sea-based farming of abalone can result in increased organic deposition underneath and adjacent to farms. The accumulation and mineralization of this excess organic matter in sediments can cause stress on benthic organisms through oxygen depletion and the toxic effects of hydrogen sulfide (H²S). The impacts on benthic communities due to increased organic matter sedimentation, oxygen deficiency (hypoxia and anoxia) and toxic effects of H₂S are well-known (e.g., Pearson and Rosenberg, 1978; Hargrave et al., 2008b) and can include changes in the size and structure of benthic infaunal communities. Various organic enrichment indicators and impact classification systems have been proposed in the scientific literature. Biotic indexes for assessing benthic habitat environmental quality range from simple indicators of species richness to more complex statistical approaches. These classical methods of macrofauna analysis directly address our objective of assessing potential impacts on seabed biological communities. However, taxonomic descriptions and determinations of numerical abundance and biomass require highly trained personnel working over extended periods, and the associated costs are prohibitive for routine site assessments and monitoring purposes.

Total “free” sulfide (S²) in surficial (0-2 centimeters) sediments is a cost-effective indicator of the organic enrichment effects of shellfish aquaculture on benthic communities. In general, there is a consistency between changes in various biological and geochemical variables and total S² in surface sediments along organic enrichment gradients (see Hargrave et al., 2008a). Other metrics such as redox potential, sediment oxygen demand, sediment organic content and benthic diversity indexes were also considered but rejected because of measurement challenges, costs and/or inherent variation.

By comparing the level of total “free” sulfide in the sediment beneath a farm to nearby control sites, the degree of organic enrichment can be assessed. Sediment organic enrichment classifications have been identified based

² If a farm increases standing biomass by more than 100 percent from the date of last assessment, the sulfide measurement must be taken and serve as the new baseline.

³ Biotic indicator decision thresholds need to be assessed to ensure equivalency with the thresholds identified for total “free” sulfide given in Standard 2.1.1. There are several papers that have been published linking specific benthic sulfide levels to indexes for benthic biodiversity. Please refer to the References section for examples (e.g., Hargrave et al., 2008a and 2008b).

⁴ Areas containing biogenic structures that are not particularly adapted to sedimentation or organic enrichment (e.g., tubeworm mounds, bryozoan mounds, bivalve beds, and reefs or sponge gardens that form a structure for other epifauna).

on the known effects of changes in sediment sulfide on the biodiversity of macrofauna (see Hargrave et al., 2008b and cited references). The associated sulfide threshold values enable managers to distinguish normal ranges of “background” concentrations from those indicative of benthic habitat degradation.

Relationships between biological variables are consistent with changes in sulfide levels as sediments are transformed from oxic to anoxic status. Impacts to benthic fauna biodiversity resulting from increased S concentrations can be significant and occur at low S levels. The transition from oxic to hypoxic conditions has been identified as occurring at 1,500 $\mu\text{M S}$. This threshold represents a transition from “moderate” to “reduced” macrobenthic sulfide concentration, and changes in the benthic macrofauna community structure have been described by Hargrave et al. (2008b). A nomogram was used to show that various benthic enrichment classification schemes based on changes in different interrelated chemical and infaunal biodiversity (defined by Pearson and Rosenberg, 1975) at which the mean number of taxa are reduced by approximately 50 to 60 percent relative to typical oxic conditions (Hargrave et al., 2008b). Anoxic sediments were characterized by S concentrations $>6,000 \mu\text{M S}$. A transition within the hypoxic class of sediments at 3000 μM has been identified where less S-tolerant taxa disappear but more tolerant opportunistic species have not increased in abundance. S levels above 3,000 μM represent a condition that exerts “severe hypoxic stress” on benthic community structure (defined by Diaz and Rosenberg, 1995) and characterize a “polluted” sediment condition (defined by Pearson and Rosenberg, 1975) that poses a high risk to benthic habitat.

2.3 Criterion: Benthic impacts of sea-based farming on hard or rocky substrate

INDICATOR	STANDARD
2.3.1 Observable detrimental accumulation of sediment underneath the farm compared to a control site based on bottom video	None

Rationale—Sedimentation can have negative effects on the settlement and development of marine invertebrate larvae (Airoldi, 2003). Aquaculture activities, particularly in situ cage-rearing methods, release feces and excess feed, which can exacerbate local sedimentation and enhance sulfide production (Holmer et al., 2001). Fine sediments can inhibit larval settlement and normal invertebrate development (Hodgson, 1990; Walker, 1999). Sedimentation has been shown to have a negative impact on the larvae of hard-bottom marine invertebrates, including sea urchin and abalone larvae (Onitsuka et al., 2008).

Sedimentation from aquaculture operations however, is notoriously difficult to quantify. Collection of sediment in traps can overestimate local sedimentation impacts, as traps with high sides by design reduce local flows and shear forces. Accordingly, the downward flux of sediments may not equal the rate of accumulation on the bottom. Furthermore, once sediments are trapped and quantified, assigning potential negative impacts to a given level of sediment is problematic.

Monitoring programs are one approach to assessing the potential impacts of sediments from aquaculture operations (Airoldi, 2004). Simple quantitative measures of sediment depth (thickness) using a ruler can be made as part of the monitoring program if there is accumulation. Where possible, before and after aquaculture operations should be quantified. We recommend underwater video surveys before abalone aquaculture cages are deployed, to assess the community composition under the proposed sites at both control (no cages planned) and aquaculture sites (where cages will be sited). To be able to test the impacts in a scientifically rigorous way, we recommend multiple transects ($N \geq 4$) underneath the aquaculture site and multiple control transects ($N \geq 4$) outside of the site to serve as replicates, since there can be inherent site-specific differences. The video transects should be representative of hard-substrate area directly beneath production units. Since seasonal differences may be strong at some sites, we recommend video monitoring of all the sites in a short time and monitoring at the same time each year.

Video images can be reviewed for sediment accumulation and changes in community structure comparing before to after and/or comparing control and aquaculture sites. Statistical treatments of the data can take advantage of the BACI (Before After Control Impact) design (Stewart-Oaten et al., 1986; Schroeter et al., 1993). This information (results from the BACI tests) about significant changes in accumulation and community composition should feed back into the operation decisions, to minimize benthic impacts of abalone aquaculture operations.

2.4 Criterion: Effluents from land-based farming

INDICATOR	STANDARD
2.4.1 Annual median concentration ⁵ of total ammonia nitrogen in effluent or receiving water beyond mixing zone ⁶	<0.6 mg/L
2.4.2 Annual median concentration ⁵ of total suspended solids in effluent compared to influent measured in the outflow or in the receiving water beyond zone of initial dilution ⁶	<5 mg/L
2.4.3 Evidence that all chemicals used on the farm that are discharged to effluent are recorded and quantified	Yes

Rationale—Given that abalone are invertebrate herbivores and rank low in the food chain, abalone farms generally produce very dilute effluents, usually containing small quantities of waste feed, abalone feces and dissolved nutrients. The majority of effluent water has come directly from growout units containing abalone, which themselves are highly sensitive to water quality. This ensures that the effluent is relatively innocuous.

When abalone farms are located in dynamic coastal environments, rapid dispersal of effluents is likely to reduce the significance of any potential impacts. Abalone farm effluents are therefore unlikely to exceed water-quality targets for coastal marine waters beyond the effluent “mixing zone.” At the point of outfall, local impacts such as sediment accumulation and algal growth may be observed, but these effects typically occur within a few meters of the outfall and are undetectable by 50 meters from the outfall (Britz and Godfrey, 2008). The wave action and mixing of the effluent rapidly disperses and assimilates the particulate organics and dissolved nutrients.

Abalone farms generally do not discharge chemicals in concentrations that pose significant threats to the aquatic environment. For example, bleach used on the farm is either neutralized or diluted to such a degree that by the time it reaches the sea it is no longer toxic. The Steering Committee decided, therefore, that as suspended solids and nutrients are likely to be the major concerns for effluent standards, these would be used as indicators of effluent quality.

A wide range of established water-quality guidelines, including those from California, South Africa, Canada and Australia/New Zealand, were examined, each set of which is based on a comprehensive review of relevant literature. The total ammonia-N limit of 0.6 mg/L, used in the standards, is taken from the California Ocean

⁵ Based on quarterly samples.

⁶ The mixing zone as defined by the local regulatory authority, or if that does not exist, then the zone of initial dilution as defined in the California Ocean Plan (SWRCB, 2009). The California Ocean Plan defines initial dilution as the process that results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge. If the concentrations of ammonia and suspended solids in the effluent comply with the recommended standard, effluent sampling is all that is required. Otherwise, a dilution study is necessary to estimate concentrations at the edge of a mixing zone, under conditions of minimal dilution. A dilution factor should then be applied to the effluent concentration to estimate concentration at the edge of the mixing zone. Where a mixing zone has been defined by a local authority, the defined mixing zone will apply. Otherwise the mixing zone should be the zone of initial dilution as defined in the California Ocean Plan (SWRCB, 2009).

Plan (SWRCB, 2009) and the South African Water Quality Guidelines for Coastal Marine Waters (DWAF, 1995). The standard for suspended solids is based on the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2002).

2.5 Criterion: Chemical and hydrocarbon waste

INDICATOR	STANDARD
2.5.1 Evidence of proper disposal of chemical and hydrocarbon waste	Yes

Rationale—Abalone growers should be responsible about disposing of waste and protecting against harmful chemical and hydrocarbon spills. Farming operations should have sufficient prevention and response plans in place, and farm employees should have the proper training necessary to properly dispose of waste and prevent and manage chemical and hydrocarbon spills.

2.6 Criterion: Biological waste (e.g., shells, dead animals and sludge)

INDICATOR	STANDARD
2.6.1 Evidence of proper disposal of biological waste	Yes

Rationale—Mortality removal is a necessary step to reduce the decomposition of dead abalone in culture systems or in the environment. There is a need for the appropriate disposal of dead animals to reduce the risk of disease and to help minimize predation. Removing mortalities and disposing of them in an acceptable manner is required in the Abalone Aquaculture Dialogue standards.

3. PRINCIPLE: AVOID AND MITIGATE DETRIMENTAL EFFECTS TO THE HEALTH AND GENETIC DIVERSITY OF WILD POPULATIONS

Abalone farms are often situated contiguous to wild abalone populations and hence can potentially have an impact on the health and genetics of wild populations. As several abalone diseases and parasites are common to many mollusc species, the potential health impacts on other wild molluscan populations also needs to be considered. In some countries, abalone species have been introduced for aquaculture purposes, and the possible establishment of feral populations and/or the introduction of associated parasites and diseases into the receiving ecosystem are potential risks. It is therefore necessary for abalone farms seeking certification to provide evidence that these risks are avoided or minimized and mitigated through responsible practices.

3.1 Criterion: Escapes

INDICATOR	STANDARD
3.1.1 Documented protocol and evidence of best management practices to minimize escapes (e.g., removal of escapees from channels, drains and settlement ponds)	Yes

Rationale—The prevention of escapes is one means to minimize disease and genetic impact of farmed abalone on wild populations. Farms should be able to demonstrate evidence of best management practices for the prevention of escapes. This may include the removal of escapees from channels, drains and settlement ponds; maintenance of structures; mesh at outlets; and other containment mechanisms.

3.2 Criterion: Genetic management

INDICATOR	STANDARD
3.2.1 Sea-based farm seed originates from native wild broodstock (not selectively bred animals) in situations where the wild population is threatened or endangered	Yes

Rationale—The key mechanism for detrimental genetic impacts on wild abalone populations is through selectively bred animals from abalone farms recruiting into, and breeding with, wild abalone populations. The greater the genetic difference between the farmed and wild population, the greater the potential genetic impact. Potential genetic impacts to at-risk populations can be mitigated by means of minimizing escapes from abalone farms and by farming with stock originating from the same genetic stock as the local wild populations surrounding the farm. In situations where wild populations are not threatened and there is healthy local recruitment, the genetic risk posed by escapees of selectively bred or hybrid farm populations is minimal. This is so because settled juvenile and mature individuals that escape from production units are unlikely to form large spawning populations in the wild, and the proportional contribution of their gametes to the total of wild-spawned larval production is likely to be minimal.

In addition, viable larvae originating from the spawning of abalone in land- or sea-based production units are unlikely to make a significant contribution to recruitment into the wild, due to the localized distribution of the larvae and extremely low survival of abalone recruits. Hawkins and Jones (2002), who modeled the probability of escaped farmed larvae successfully settling, maturing and contributing to wild spawning populations, concluded that the risk was minimal.

3.3 Criterion: Translocated broodstock and seed

INDICATOR	STANDARD
3.3.1 For farm-to-farm translocations: batch certification using diagnostic tests capable of detecting all diseases and parasites/pests of concern ⁷ followed by minimum eight-week isolation (not mixed with other animals on the farm). ⁸	Required
3.3.2 For wild-to-farm translocations: an eight-week minimum biosecure quarantine (treated effluent) with cohabitation and disease surveillance ⁹	Required

Rationale—Abalone farms maintain high densities of animals in confined spaces and thus have potential for propagating and spreading disease to wild populations. The movement of abalone between farms is a particular concern, as disease vectors can be spread between regions, potentially introducing new pathogens into local wild populations. It is possible to minimize the risks of spreading diseases and parasites affecting abalone and other molluscs by means of ongoing health surveillance, disease management procedures, quarantine and minimized escape of farmed animals to the wild. Quarantine of animals following translocation, combined with cohabitation, is regarded as a judicious precaution for minimizing the risk of disease spread by abalone farms.

3.4 Criterion: Exotics

INDICATOR	STANDARD
3.4.1 Evidence of responsible ¹⁰ introduction of non-native abalone species	Required

Rationale—Abalone species have been introduced into several countries for aquaculture purposes, including Chile, Ireland, China, Namibia, USA (Hawaii), Israel and Iceland. Abalone are generally regarded as noninvasive, due to their ecology and specific habitat requirements. To date, there have been no reports of introduced abalone establishing feral breeding populations. The greatest environmental risk associated with introduced abalone is the potential introduction of associated diseases and parasites into the receiving ecosystem. Aquaculture based on non-native abalone species should thus be based on responsible procedures that minimize the disease risks associated with the introduction.

⁷ Notifiable diseases present in the country of origin, plus diseases that have been the primary cause of abalone mortality in the country of origin, plus organisms that may be transferred with the abalone and are regarded as pests.

⁸ If a mortality event occurs in the translocated stock during the eight-week period, then the procedures prescribed in Appendix I shall be followed. The stock will remain in isolation for a minimum of a further eight weeks following the cessation of the mortality event, unless there is an obvious noninfectious cause.

⁹ Farmed stock added to the quarantined wild stock growout units as sentinels for disease. Methods to be followed and responses required are detailed in Section 7 of Appendix I.

¹⁰ At a minimum, includes permits based on a credible risk or environmental assessment procedure and environmental management plan (e.g., ICES Code of Practice on the Introductions and Transfers of Marine Organisms) and certification to ICES requirements regarding parasites and pathogens.

3.5 Criterion: Transgenic abalone

INDICATOR	STANDARD
3.5.1 Allowance for farming of transgenic ¹¹ abalone	None

Rationale—Transgenic abalone pose unknown and potentially substantial risks to the health and genetics of wild abalone populations. For this reason, transgenic abalone are not allowed under the Abalone Aquaculture Dialogue standards.

¹¹ Introduced genes from other species.

4. PRINCIPLE: MANAGE DISEASE AND PESTS IN AN ENVIRONMENTALLY RESPONSIBLE MANNER

Management of diseases is a key issue in any form of intensive farming. For abalone farming, disease management is critical both to the success of the farm and to the protection of wild stocks and other species in the vicinity of the farm. For abalone this challenge is heightened by the lack of established veterinary medicines with which to treat diseases in most countries. Many facets of biosecurity affect disease risk. The responsible management of biological wastes was covered under Principle 2. Principle 3 deals with two key vectors for disease introduction and spread, namely translocation of live abalone broodstock/seed and the control of escapees. Principle 4 addresses key risks relating to the detection and control of infectious diseases.

4.1 Criterion: Disease and pest management practices

INDICATOR	STANDARD
4.1.1 Evidence of compliance with a documented protocol for health surveillance and disease response (Minimum requirements are found in Appendix I.)	Yes
4.1.2 Evidence that all equipment and clothing from other abalone farms or seafood processors are disinfected before being brought onto a farm	Yes
4.1.3 Evidence that access to farmed abalone by birds and other animal vectors is minimized (e.g., indoor growout units, fencing, netting and deterrents)	Yes
4.1.4 Allowance for the prophylactic use of antibiotics	None
4.1.5 Where farms use fresh seaweed, it must be locally sourced.	Yes

Rationale—Principle 4 requires compliance with an appended protocol for abalone health surveillance and disease response. Because early detection is so important to disease management, the protocol requires that all growout units and broodstock tanks are inspected at intervals not exceeding 10 days in sufficient detail to detect abnormal abalone behavior and abnormal mortality. Farms that are unable to meet this level of vigilance will not be certified. Most abalone farms will closely inspect a large number of their abalone on a daily basis, for example, during cleaning, feeding and stock movement, but the need to regularly inspect each and every growout unit is seen as an important minimum requirement. Abnormal behavior must be investigated and recorded. Any mortality above a defined level triggers a tiered investigation process that ensures prompt isolation of affected stock, disease testing and expert advice as appropriate. Nursery and hatchery growout units are excluded from the mortality monitoring here, as these early life stages have higher mortality rates and quantification of dead abalone is impractical in many cases.

The protocol also prescribes six-monthly disease surveillance testing of at least 66 abalone. This number of test animals gives each survey a 95 percent chance of detecting a disease, with 5 percent prevalence, assuming that the test procedure has 90 percent sensitivity and 100 percent specificity (OIE, 2009).

Two potential disease transfer vectors are specifically addressed in standards under Principle 4, namely, disinfection of equipment and minimizing access by birds and other animals. An abalone farm should have in

place a raft of additional practices in relation to general on-farm biosecurity. Most are operational matters that will vary between farms, depending on such factors as growing systems, food types and water temperature. It is not appropriate for this standard to prescribe a detailed protocol for general farm biosecurity. Rather, it is recommended that each farm should document and implement its general on-farm biosecurity procedures based on site-specific conditions.

Prophylactic use of antibiotics is not justified in abalone farming and is specifically precluded by the standards. This does not preclude the use of antibiotics to treat a known disease in accordance with expert advice, as in some cases this may represent the best course of action. Given the limited tools available to treat abalone diseases, it is critical that there is effective biosecurity and disease surveillance on farms and appropriate disease response plans in place (OIE, 2009; Department of Primary Industries, 2007, 2008).

Fresh seaweed is a potential vector for parasites, pests, diseases and associated organisms. For this reason, farms that use fresh seaweed must use local sources.

5. PRINCIPLE: USE RESOURCES EFFICIENTLY

Farmed abalone is fed wild kelp and manufactured feed. Wild fish sourced for manufactured feed in the form of fish meal and/or oil can originate from fish stocks that are being harvested at an unsustainable rate. The Abalone Aquaculture Dialogue standards recognize that the sourcing of feed for abalone farming could have potential negative impacts on the environment. For this reason, the standards mandate the efficient use of feed from non-depleted sources.

5.1 Criterion: Use of wild seaweed and kelp

INDICATOR	STANDARD
5.1.1 Documented evidence that wild seaweed used for abalone feed is obtained from a regulated or recognized well-managed resource	Yes

Rationale—Some land-based and most sea-based abalone farms worldwide depend primarily on kelps (e.g., *Ecklonia* spp., *Macrocystis* spp. and *Laminaria* spp.) and smaller red seaweeds (e.g., *Gracilaria* spp.). Abalone farms may utilize several tons of seaweed per day, depending on their level of production.

Although seaweed such as kelp can be fast-growing and has high turnover rates, excessive harvesting by many farms in one region could lead to resource depletion and overexploitation. It is imperative, therefore, that farms demonstrate that the seaweed they use is obtained from a well-managed resource.

5.2 Criterion: Manufactured feed

INDICATOR	STANDARD
5.2.1 Forage Fish Equivalency Ratio (FFER) for abalone fed manufactured feed.	<1 ¹²
5.2.2 >95 percent of fish meal and fish oil component in feed originating from fisheries deemed sustainable by an ISEAL compliant certification scheme for sustainable forage fisheries	Within five years of commercial availability in the farming region

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

Wild small pelagic fish play a critical role in the ecosystem and the marine food chain. Some conservation groups and scientists are concerned that even fisheries that are not classified as overfished from a population perspective are, or could be, overfished from an ecological perspective. Good fisheries management is crucial to ensuring that these fisheries are sustainable. The source of fish product used in feeds is also addressed in the Abalone Dialogue standards under Criterion 5.2.

¹² The standard for FFER will be reduced to 0.8 within three years of the publication date of the standards.

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

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

For this reason, a Forage Fish Equivalency Ratio (FFER) (see Appendix II for calculations) is included as an indicator in the Dialogue to address dependency of aquaculture producers on wild pelagic fish populations. FFER measures the dependency on wild forage fish resources. Its inclusion encourages the use of sources other than fish harvested exclusively for conversion into fish meal (FM) and fish oil (FO). Note the calculation in Appendix II is for both fish meal and fish oil, but it is the highest number (dependency) that is relevant and that must be used in Criterion 5.2.1.

The dependency can be driven by either the use of fish meal or the use of fish oil. The calculation takes into account the yield of forage fish live weight to dry fish meal weight and fish oil weight, the efficiency of feed use (the feed conversion ratio or FCR), and the inclusion rates of fish meal and fish oil in feed. It can be used to evaluate the trend in dependency on wild fish resources over time or to compare this dependency across farms or species produced. Producers will be able to improve their FFER by using a greater percentage of FM and FO from trimmings, through substitution of FM by other sources of protein and oil (e.g., vegetable), and through improving their feeding efficiency.

5.3 Criterion: Solid waste disposal

INDICATOR	STANDARD
5.3.1 Evidence of proper disposal of waste and presence of recycling programs	Yes

Rationale—Responsible abalone farming requires the proper disposal of waste and an effort made to reduce, reuse and recycle wherever possible.

5.4 Criterion: Energy use

INDICATOR	STANDARD
5.4.1 Records of energy used on farm per ton of production	Yes
5.4.2 Evidence of energy audit or in-house assessment if independent auditors are not nationally available	Yes

Rationale—Energy consumption used in food production is a source of major public concern. The Abalone Aquaculture Dialogue recognizes the importance of efficient and sustainable energy use. Therefore, the standards state that on-farm energy consumption should be monitored on a continual basis and that it is

recommended that growers develop means to improve efficiency and reduce consumption of energy sources, particularly those that are limited or carbon-based.

5.5 Criterion: Freshwater use

INDICATOR	STANDARD
5.5.1 Records of reticulated freshwater used on farm	Yes

Rationale—In many areas where abalone are farmed, freshwater resources are limited. By requiring farmers to monitor the amounts of freshwater used on the farm, the standards seek to establish a baseline. It is recommended that growers improve efficiency and reduce consumption of reticulated freshwater, with the expectation that performance thresholds may be established in future iterations of the standards.

6. PRINCIPLE: BE A GOOD NEIGHBOR AND CONSCIENTIOUS COASTAL CITIZEN

Conflict resulting from a lack of agreement over how coastal resources should be used can severely impact the social sustainability of an abalone farming operation. Regular proactive communication and consultation can build trusting relationships with local communities and prevent or minimize conflicts. Some stakeholders may not want abalone farming to exist near their communities. However, by fostering an open dialogue and engagement, abalone farmers can strive to earn the trust of local communities and gain the social license to operate. While it is hard to incorporate this type of proactive approach into a set of standards, the Abalone Aquaculture Dialogue feels that it is very important for abalone farmers to establish good relationships with the communities in which they operate.

6.1 Criterion: Community relations and interaction

INDICATOR	STANDARD
6.1.1 Rights of access to public resources are maintained	Yes
6.1.2 Evidence of compliance with all applicable navigational rules and regulations	Yes
6.1.3 Documented complaints response protocol that includes, at a minimum, a register of complaints and appropriate responses	Yes

Rationale—The siting of farms requires appropriate consultation with communities to understand and address concerns that relate to the blocking of access to natural or physical assets in the environment where the farm is operating.

Other conflicts may also occur between producers and surrounding communities. These conflicts shall be addressed through a verifiable conflict resolution policy in which complaints from communities are responded to and addressed in a timely manner. Community rights and interactions with farmers, groups of farmers and corporate farms are complex and often dynamic. The intent of these standards is to enable communities to have a clear and transparent way to interact with producers and for producers to have frameworks to interact with communities.

7. PRINCIPLE: DEVELOP AND OPERATE FARMS IN A SOCIALLY AND CULTURALLY RESPONSIBLE MANNER

*Abalone aquaculture should be undertaken in a socially responsible manner that ensures that the operations do not negatively impact farm workers and local communities. The labor rights of individuals working on abalone farms are important, and farm working conditions should ensure that employees are treated and paid fairly. Appropriate farm conditions include no child labor, no forced labor and no discrimination. Socially responsible abalone farming should ensure worker health and welfare through safe and hygienic working conditions, with relevant training available for workers and managers. Please refer to **Appendix III** for guidance for the following social standards.*

7.1 Criterion: Child labor

INDICATOR	STANDARD
7.1.1 Incidences of child ¹³ labor ¹⁴	0

Rationale—Adherence to the child labor codes and definitions included in this section indicates alignment with what the International Labour Organization (ILO) and international conventions generally recognize as the key areas for the protection of child and young workers.¹⁵ 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 hazardous¹⁶ to their physical or mental well-being. To this end, the standards related to what constitutes child labor are designed to protect the interests of children and young workers in certified aquaculture operations.

7.2 Criterion: Forced, bonded or compulsory labor

INDICATOR	STANDARD
7.2.1 Incidences of forced, ¹⁷ bonded, ¹⁸ or compulsory labor	0

Rationale—Forced labor—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 is critical to determining that labor is not forced. The inability of a worker to freely leave the workplace and/or an employer withholding original identity documents of workers are indicators that employment may not be at-

¹³ A “child” is defined as any person less than 15 years of age. A higher age would apply if the minimum-age law stipulates a higher age for work or mandatory schooling. If, however, the local minimum-age law is set at 14, in accordance with developing country exceptions under ILO Convention 138, the lower age will apply.

¹⁴ “Child labor” is defined as any work by a child younger than the age specified in the definition of a child, except for light work as provided for by ILO Convention 138, Article 7.

¹⁵ A “young worker” is defined as any worker between the age of child, as defined above, and under the age of 18.

¹⁶ “Hazardous work” is defined as work that, by its nature or circumstances in which it is carried out, is likely to harm the health or safety of workers.

¹⁷ All work or service that is extracted from any person under the menace of any penalty for which said person has not offered him- or herself voluntarily or for which such work or service is demanded as a repayment of debt. “Penalty” can imply monetary sanctions, physical punishment such as loss of rights and privileges, or restriction of movement (or withholding of identity documents).

¹⁸ When a person is forced by the employer or creditor to work to repay a financial debt to the crediting agency.

will. Employees shall always be permitted to leave the workplace and manage their own nonwork 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.

7.3 Criterion: Discrimination

INDICATOR	STANDARD
7.3.1 Incidences of discrimination ¹⁹	0

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 and 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.

7.4 Criterion: Health and safety

INDICATOR	STANDARD
7.4.1 All health- and safety-related accidents and violations are recorded, and corrective action is taken when necessary.	Yes
7.4.2 Occupational health and safety training is available for all employees	Yes
7.4.3 Employer responsibility and proof of insurance (accident/injury) for employee medical costs in a job-related accident or injury, unless otherwise covered	Yes

Rationale—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. Consistent and effective employee training in health and safety practices is an important preventative measure. Finally, while many national laws require that employers assume responsibility for job-related accidents and injuries, not all countries require this and not all employees (e.g., in some cases, migrant and other workers) will be covered under such laws.

¹⁹ Any distinction, exclusion or preference that 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.

7.5 Criterion: Fair and decent wages

INDICATOR	STANDARD
7.5.1 Payment of fair and decent wages	Yes

Rationale—Workers shall be paid fair and equitable wages. Company policies and practice shall also prohibit deductions in pay for disciplinary actions, and payments shall be made in a manner convenient to workers.

7.6 Criterion: Freedom of association and collective bargaining

INDICATOR	STANDARD
7.6.1 Employees have access to freedom of association and collective bargaining.	Yes

Rationale—Having the freedom to associate and bargain collectively 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.

7.7 Criterion: Nonabusive disciplinary practices

INDICATOR	STANDARD
7.7.1 Incidences of abusive disciplinary practices occurring on the farm	0

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 mental²⁰ health or dignity. Employers that support nonabusive 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.

²⁰ Mental abuse: characterized by the intentional use of power, including verbal abuse, isolation, sexual or racial harassment, intimidation, or threat of physical force.

7.8 Criterion: Working hours

INDICATOR	STANDARD
7.8.1 Incidences of violations or abuse of working hours and overtime laws or expectations (See guidance for details.)	0

Rationale—Abuse of 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 workweek hours but must be compensated at premium rates.²¹ Requirements for time off, working hours and compensation rates as described should reduce the impacts of overtime.

²¹ Premium rate: A rate of pay higher than the regular workweek rate. Must comply with national laws/regulations and/or industry standards.

APPENDIX I: FARMED ABALONE HEALTH SURVEILLANCE AND DISEASE RESPONSE PROTOCOL

1. Objectives of the Protocol

This protocol sets out minimum standards for health surveillance and disease response in abalone farming. It is intended to be applicable to both land- and sea-based farms.

2. Identification of key diseases of concern

All farms must identify the key infectious diseases of concern for the abalone in their area and ensure that the following protocol incorporates measures for their detection. Thus the laboratories used for pathology work must have diagnostic procedures that would detect these diseases (if present) or confirm absence of these diseases (if absent). Where listed diseases have externally visible symptoms, farm staff should be trained to recognize these and report them to management. It is acknowledged that from time to time new diseases emerge—this protocol is designed to ensure early detection of a new disease through regular observation of stock and mortalities (Section 3) and health surveillance (Section 4).

3. Observation of stock and recording of mortalities

All farms should observe stock on a regular basis to help ensure that any mortality event²² or abnormal behavior of the abalone is quickly investigated. The frequency of stock inspection on an abalone farm varies with feed type, growout unit design, weather and management strategies. Every growout unit on the farm must be inspected at least once every 10 days in sufficient detail to detect abnormal behavior or abnormal mortality of abalone. If the number of mortalities in any growout unit exceeds the trigger level for a mortality event (as defined in Section 5) or if abnormal behavior is observed, then the details must be recorded and the procedures outlined in Section 5 must be followed. Each farm will compile over time records of growout abalone mortality rates by year class and season. These will be used as a reference point in Section 7 and will help the farm identify trends that could relate to diseases.

4. Routine health surveillance

As a minimum, all farms will routinely submit at least twice per year 66 abalone to an auditor-approved service provider experienced in aquatic animal pathology. One of these samples will be taken during a period of high stress (e.g., high seawater temperature at sites with stressfully warm summers, or immediately after spawning at cool water sites) as identified by past experience, and the second sample approximately six months later. Sampling and fixation procedures should be as advised by the pathology laboratory. The pathology laboratory or veterinarian will provide a written report to the farm as a permanent record of the surveillance results. The report should explain the significance of the results.

5. Nonroutine sampling and mortality event investigation

- A. Farms may experience a *mortality event*. A mortality event is defined here as follows:
- More than 1 percent of the abalone in a growout unit²³ or broodstock tank have died since the growout unit was last inspected.
 - The total number of abalone dead in the growout unit or broodstock tank is greater than 50 abalone. (This is to exclude triggering by a small number of deaths in a growout unit holding a very low number of abalone. Mortality >1 percent but less than 50 abalone is covered in Section 6.)

²² The definition of a *mortality event* is provided in Section 5 of this Appendix.

²³ Growout unit, raceway, sea-cage, barrel, etc.

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- It is the first time the population has experienced this level of mortality over the previous 10 days (to avoid repeated triggering from the same growout unit during the same mortality event).

If a mortality event occurs, or abnormal abalone behavior is observed, the event must be investigated and a satisfactory explanation for the mortality event provided and logged. Relevant details to be recorded in the log are date, abalone behavior, growout unit number, cause of event, action taken and conclusion.

- B. If there is **an obvious noninfectious cause** of abalone dying (e.g., equipment failure), then farms are required to correct the problem and continue to monitor the affected population daily for at least 10 days. If mortalities do not decrease within 10 days of the problem being fixed, then farms must follow the procedure outlined in C below. The event should be recorded, detailing the problem that led to increased mortalities, the remedial action taken and the subsequent response of the abalone population.
- C. If there is **no** obvious noninfectious cause of abalone dying, or if mortality continues to increase, then farms must take the following actions:
- Isolate²⁴ the affected growout unit(s).
 - Submit moribund abalone (at least five if available) from the affected growout unit(s) for pathological analysis to an auditor-approved laboratory experienced in aquatic animal pathology.
 - Submit apparently unaffected abalone (at least five) from the same production unit and from a completely unaffected unit matched as closely as possible with respect to size, age, parentage, etc.
 - Seek advice from an aquatic health expert.
 - Continue to monitor and record the behavior and mortality of the abalone population daily.
 - If the level of mortalities continues to increase or if similar mortalities occur in other growout units/cages on the farm, the farm must immediately consult with their aquatic health expert to decide a course of action and notify the competent authority (as defined by OIE, 2009).
 - In cases where the aquatic health expert's determination is that the disease cannot be effectively mitigated or treated, the animals in the affected production unit(s) must be culled and the unit(s) disinfected.
 - A report on the mortality event shall be filed detailing the course of events. The report shall include the results of the pathology testing, a record of any instructions from the farm's veterinarian or relevant authorities, and the farm's response to these.

6. Lower-level unexplained mortality

If an inspection finds that mortality in a growout unit exceeds 1 percent but is less than 50 abalone and there is no obvious noninfectious cause, then the number of dead abalone in that growout unit will be counted daily and the dead abalone removed. Counts will continue for at least 10 days, and longer if required to demonstrate that mortality has declined to levels typical for that farm in that season (as documented in Section 3 above). If cumulative mortality exceeds a further 2 percent within 10 days, then the event will be treated as a mortality event and the procedures in Section 5C followed.

7. Testing of wild abalone translocated onto a farm

Abalone translocated from the wild to a farm represent a high risk of disease introduction for abalone farms and so are required to be held in a biosecure quarantine facility with effluent treatment for at least eight weeks before being moved elsewhere on the farm. It is often not an option to sacrifice wild abalone to screen for diseases. To help detect any diseases present in the wild abalone, farmed "sentinel" abalone must be placed in the growout units containing the wild stock for the duration of the quarantine period (minimum eight weeks) and monitored as follows.

²⁴ Separate from the rest of farm by means of signage and notification, physical partitioning, dedicated equipment, controlling staff access, biosecure disposal of mortalities.

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- A batch of at least 50 farmed abalone >30 millimeter shell length will be placed in the growout units with each batch of translocated wild abalone. Both the wild and farmed abalone will be inspected for abnormal behavior or mortality at least once every 10 days.
 - If more than two of the farmed sentinel abalone in a growout unit have died or become moribund since that growout unit was last inspected, then this shall be regarded as a mortality event and the procedures in sections 5B and C followed.
 - Before the wild stock is released from quarantine, at least 10 abalone should be submitted for pathological analysis and found free of significant infectious diseases. These abalone should include in order of priority (1) any moribund wild abalone, (2) any moribund farmed sentinel abalone, and (3) a selection of farmed abalone including any that show signs of ill health. During the quarantine period farm staff must attempt to identify moribund abalone and preserve them for pathology testing.

APPENDIX II: FEED RESOURCE CALCULATIONS AND METHODOLOGIES

1. Forage Fish Equivalency Ratio (FFER) calculation

Forage Fish Equivalency Ratio (FFER): the quantity of wild fish used per quantity of cultured fish produced. 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 abalone at current status, the fish meal will be the determining factor for the FFER in most cases. The dependency on wild forage fish resources should be calculated for both fish meal and fish oil using the formulas noted below. In this standard, it is the highest number (dependency) that is relevant and that must be used. These formulas calculate the dependency of a single site on wild forage fish resources, independent of any other farm.

$$\text{FFER}_m = \frac{(\% \text{ fish meal in feed from forage fisheries}) \times (\text{eFCR})}{22.2}$$

$$\text{FFER}_o = \frac{(\% \text{ fish oil in feed from forage fisheries}) \times (\text{eFCR})}{5.0}$$

Where

- The percentages of fish meal and fish oil exclude meal and oil derived from fishery byproducts.²⁵ Only fish meal and fish oil that is derived directly from a pelagic fishery (e.g., anchoveta) is to be included in the calculation of the FFER. Meal and oil derived from fishery byproducts (trimmings, offal) should not be included, because the FFER is intended to be a calculation of direct dependency on wild fisheries.
- The amount of fish meal in the diet is calculated back to live fish weight by using a yield of 22.2 percent. This is an assumed average yield. If a different yield is used, documentation must be provided.
- The amount of fish oil in the diet is calculated back to live fish weight by using a yield of 5 percent. This is an assumed average yield. If a different yield is used, documentation must be provided.
- **Economic Feed Conversion Ratio (eFCR):** the quantity of feed used to produce the quantity of fish harvested.

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

²⁵ Trimmings are defined as byproducts when fish are processed for human consumption or if whole fish is rejected for use of human consumption because the quality at the time of landing does not meet official regulations with regard to fish suitable for human consumption.

Fish meal and fish oil that are produced from trimmings can be excluded from the calculation as long as the origin of the trimmings do come from any species that are classified as Critically Endangered or Endangered in the IUCN Red List (The International Union for the Conservation of Nature and Natural Resources, reference can be found at <http://www.iucnredlist.org/static/introduction>).

APPENDIX III: GUIDANCE FOR THE SOCIAL COMPONENT OF THE ABALONE AQUACULTURE DIALOGUE STANDARDS

The standards related to labor issues and work conditions on the farm were created with input from Social Accountability International (SAI), a recognized leader on labor issues. SAI also recommended the following guidance to accompany the social component of the Abalone Aquaculture Dialogue standards.

1. Child labor

Guidance

- Child workers under the age of 15 perform only light work (see definition below) as long as it does not exceed two hours per day on a school day or holiday and the total number of hours spent on light work and on school should not exceed seven hours/day.
- For employees aged 15-18 (young workers), work should not conflict with schooling (combination of daily transportation, school time and work time should not exceed 10 hours). Hazardous work is not performed by those below age 18 (including heavy lifting disproportionate to their size, operating heavy machinery, working night shift, exposure to any toxic chemicals).

Definitions

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 a child's attendance at school, limit a child's participation in vocational orientation or training programs, or diminish a child's capacity to benefit from instruction received.

2. Forced, bonded or compulsory labor

Guidance

- Employers should never be permitted to withhold original identity documents.
- Contracts should be clearly stated and understood by employees and never lead to an employee being indebted (such as employees paying for training programs).
- Employees should be free to leave the workplace when not working and to manage their own nonwork time.

(Note: Extra care should be given to migrants and contractor/subcontractor situations.)

3. Discrimination

Guidance

- Company shall not engage in or support discrimination in hiring, remuneration, access to training, promotion, termination or retirement based on caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation or age.
- Company shall not interfere with employee rights to exercise or observe tenets or practices or to meet needs related to race, caste, national origin, religion, disability, gender, sexual orientation, union membership or political affiliation.

4. Health and safety

Guidance

- Minimization of hazards/risks in the working environment, including documented procedures and policies to prevent workplace accidents/injuries. Emergency response procedures should exist and be known by employees.
- Documentation of occupational health and safety violations.
- Access to clean lavatories, potable water and sanitary facilities. Dormitories must be clean and safe and meet the basic needs of employees.
- Insurance, if not otherwise provided, to cover employees who suffer accident or injury in the work environment. Special consideration must be given to migrant or foreign workers who may fall outside of local or national laws and legislation.
- Corrective action plan for accidents that have occurred.

5. Fair and decent wages

Guidance

- No deductions for disciplinary actions; wages and benefits must be clearly articulated to employees; wages and benefits must be rendered in a manner convenient to employees (no travel, no promissory notes, coupons or products/merchandise to replace cash/check or electronic methods).
- No labor-only contracting relationships or false apprenticeship schemes (See below.).

Definitions

Labor-only contracting arrangement: 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.

False apprenticeship scheme: practice of hiring workers under apprenticeship terms without stipulating terms of the apprenticeship/wages under contract. It is a “false” apprenticeship if purpose is to underpay people, avoid legal obligations or employ children.

6. Freedom of association and collective bargaining

Guidance

- Employers should respect the right of all personnel to form and join trade unions of their choice and to bargain collectively.
- When such situations are restricted under law, employers should facilitate parallel means of independent and free association and bargaining and ensure that they are not the subject of discrimination. (When rights are restricted, the company needs to make clear to workers that they are willing to engage workers in collective dialogue through a representative structure and that they are willing to provide workers with the opportunity to engage in such dialogue.)

7. Nonabusive disciplinary practices

Guidance

- Absolutely no engagement in or support of corporal punishment, mental or physical coercion, or verbal abuse. Fines or wage deductions are also not an acceptable method of disciplining workers.

8. Working hours

Guidance

- Auditors shall be aware of working hours and overtime requirements in local legislation. They can check time sheets and payroll and verify through worker interviews that workers are working legally allowed hours. Pay slips and pay records can confirm whether overtime hours are being paid at a premium. To verify that overtime is not the norm, interviews can be conducted and production records checked, as well as time sheets or other records of working hours, for at least one year before. Some exceptions can be made for overtime not being voluntary, if there is a collective bargaining agreement in place that allows it.
- 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.
- All overtime shall be paid at a premium and should not exceed 12 hours per week. 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.

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