



# **Where Food Comes From<sup>®</sup> Seafood:** AQUACULTURE STANDARD



## Introduction and Purpose

The WFCF Seafood: Aquaculture Standard has two pillars, each with its own set of criteria:

1. **Animal Husbandry:** The purpose of the Animal Husbandry pillar is to reinforce care measures taken in aquaculture production. Operations adhere to species-specific indicators to ensure that fish husbandry needs are fulfilled.
2. **Environmental Stewardship:** The purpose of the Environmental Stewardship pillar is to support the maintenance of a healthy environment for future generations by promoting practices that encourage the management of natural and renewable resources, while reducing waste and the carbon footprint and optimizing aquaculture productivity. Good environmental management practices help ensure the longevity and success of the aquaculture industry.

Locations certified under the WFCF Seafood: Aquaculture Standard maintain a quality manual describing how the operation meets the program criteria. The WFCF Standard is modified as necessary to continually integrate improved fish husbandry practices and environmental stewardship techniques. A formal review of the program standards is conducted annually and recommendations for updates are brought forward to an external advisory committee for consideration/approval. Any changes are made on an annual basis.

The WFCF Aquaculture Standard is audited at the farm level and focused on the production facility where  $\geq 75\%$  or more of the animals' life is spent (typically described as the grow-out, rather than the hatchery or nursery facility). If hatchery and/or nursery facilities are situated at the same location as grow out facilities (e.g. for land-based facilities that move from a "nursery" tank to a "grow-out" tank at the same site), all related facilities and processes are subject to the same standard and verification. If harvest is conducted on-site, harvest activities are included in the scope of the audit.

The WFCF Aquaculture Standard is designed to cover aquaculture production of crustacea and finfish in all conventional production systems, including those on land (ponds, flow-through, or recirculating systems) and marine net-pen system. Some requirements are not applicable to all production systems; applicability is identified for each requirement within the standard document. Currently, the Standard scope does not include seaweed or shellfish.



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## Using the Standard



This standard is divided into two pillars: Animal Husbandry and Environmental Stewardship. Each pillar includes attributes that identify and address key challenges in aquaculture production. Each attribute is followed by relevant criteria which the operation must meet to be considered compliant with the goals of this document. The Standard aims to promote improved production practices and highlight the need for animal care. Upon certification, producers are recognized for their efforts to lead in both environmental and animal husbandry practices.

The format of the standard is as below:

Criterion #	Requirement	Production System	
		Land Based	Net Pen
<b>Key Attribute</b>			
No.	<i>Defines the specific requirement that the operation is expected to comply with to meet the underlying goals of the key attributes and components.</i>	x	x

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## ANIMAL HUSBANDRY FOR AQUACULTURE OPERATIONS

Criterion #	Requirement	Production System	
<b>AAH1. Animal Care &amp; Management</b>		Land Based	Net Pen
AAH1a.	The farm has a written Operational Plan which includes the following sections (each is detailed further in the relevant section): Animal Health & Welfare, Biosecurity, Escape Prevention, Energy Management, Wildlife Management, and Waste Management.	x	x
AAH1b.	The Animal Health & Welfare Plan (AHWP, from AAH1a.) is approved by a veterinarian or aquatic animal health professional (AAHP) and identifies the staff member responsible for overseeing animal health and welfare on site.	x	x
AAH1c.	The AHWP includes a policy outlining the expectation of caretakers, including all service providers, which states willful abuse, neglect or cruelty will not be tolerated, and any incidences are reported and documented.	x	x
AAH1d.	The AHWP details training requirements to ensure that all staff caring for animals are trained upon hiring, and at a minimum annually thereafter, on all elements covered by the AHWP.	x	x
AAH1e.	The AHWP includes emergency procedures (including relevant contacts and contingency plans) to respond to disease outbreak, water quality events, escape events, extreme weather or other emergencies which may affect animal health.	x	x
AAH1f.	All elements of the AHWP are reviewed annually and updated as necessary based on production results.	x	x
AAH1g.	No willful acts of abuse, nor willful acts of neglect, are observed.	x	x
AAH1h.	Any cohabitant animal species not intended for human consumption (i.e., cleaner fish) are subject to the same health, care and handling requirements as the farmed species.	x	x
<b>AAH2. Disease Monitoring and Prevention</b>		Land Based	Net Pen
AAH2a.	The AHWP includes, at a minimum: <ul style="list-style-type: none"> <li>i. Survival goals for each completed cycle, and a defined process for improving survival over time.</li> </ul>	x	x



	<ul style="list-style-type: none"> <li>ii. Disease and health assessment/monitoring procedures and frequency.</li> <li>iii. Disease response procedures, including quarantine (when feasible), depopulation, and notification.</li> <li>iv. Sick and/or injured animal response procedures (including appropriate disposal/treatment of dead/infected animals).</li> <li>v. Disease prevention procedures (through vaccination,<sup>1</sup> treatment, water quality and stress minimization).</li> <li>vi. Mortality management (AAH3).</li> <li>vii. Monitoring procedures for environmental conditions (AAH7g) and action thresholds/procedures should conditions threaten animal health.</li> <li>viii. Schedule for visits from animal health professionals on-site, and emergency procedures triggering unscheduled visits (e.g., mortality or morbidity thresholds).</li> </ul>		
AAH2b.	<p>Records demonstrate monitoring of animal health and disease prevalence (AAH2a.ii) include:</p> <ul style="list-style-type: none"> <li>i. Sampling for disease prevalence inside farm (continuous via technology,<sup>2</sup> or at least once per week in person).</li> <li>ii. Presence/absence of disease and subsequent actions (if positive).</li> <li>iii. Records of environmental monitoring and responses, if taken.</li> <li>iv. Notification to the relevant authority upon evidence of outbreak<sup>3</sup>.</li> <li>v. Evidence of communication with neighbouring farms (if relevant) of disease status on farm.</li> </ul>	x	x
AAH2c.	<p>New or previously unknown disease identification triggers a procedure for evaluating and addressing the risk posed by new disease. Response includes at a minimum:</p> <ul style="list-style-type: none"> <li>i. Veterinary consultation.</li> <li>ii. Immediate removal of any diseased animal.</li> <li>iii. Morbidity/mortality thresholds for emergency harvest.</li> <li>iv. Reporting of the issue to area-based management (if applicable).</li> </ul>	x	x
AAH2d.	The AHWP describes procedures for responding to invasive disease, including depopulation, where necessary.	x	x
AAH2e.	The AHWP includes a list of diseases present in the operating region which may be encountered during production.		

<sup>1</sup> Vaccination is conducted for all relevant disease for which vaccines are available and effective.

<sup>2</sup> Operation should evaluate which diseases can be monitored for via technology vs those requiring physical presence.

<sup>3</sup> An outbreak is defined as any pathogen affecting more than 5% of the farmed population.



<b>AAH3. Mortality Management</b>		Land Based	Net Pen
AAH3a.	The AHWP includes a Mortality Management section.	x	x
AAH3b.	Mortalities are removed as soon as observed (finfish) or as possible (crustacea).	x	x
AAH3c.	Mortalities are disposed of in accordance with applicable laws and regulations. If disposal on farmland is permitted, it occurs a sufficient distance from the production area to prevent potential disease transfer to live animal or surrounding waters.	x	x
AAH3d.	All mortalities, including culls, are classified, and recorded.	x	x
AAH3e.	Animals in poor condition (ill, deformed, or unmarketable) are promptly removed, and euthanized without unnecessary distress/discomfort. <sup>4</sup>	x	x
<b>AAH4. Responsible Use of Therapeutants</b>		Land Based	Net Pen
AAH4a.	The AHWP includes procedures for Responsible Use of Therapeutants.	x	x
AAH4b.	All treatments performed on site conform to the Principles for Responsible & Prudent Use of Antimicrobial Agents in Aquatic Animals <sup>5</sup> and relevant OIE Guidance. <sup>6</sup>	x	x
AAH4c.	All antibiotic treatments are undertaken in response to diagnosed disease; prophylactic or non-therapeutic use of antibiotics is prohibited.	x	x
AAH4d.	Use of antibiotics critically important for human medicine <sup>7</sup> is prohibited.	x	x
AAH4e.	Use of antibiotics is limited to one treatment <sup>8</sup> per production cycle (or one treatment per year for longer production cycles).	x	x
AAH4f.	The facility does not exceed one therapeutant <sup>9</sup> treatment (in addition to the antibiotic treatment allowance under <b>AAH4e</b> ) per production cycle, or one therapeutant treatment per year for longer production cycles.	x	x

<sup>4</sup> Non-stunned aerial suffocation and non-stunned live bleeding are prohibited, including for culling.

<sup>5</sup> <https://www.fao.org/3/ca7029en/CA7029EN.pdf>

<sup>6</sup> <https://www.woah.org/en/what-we-do/standards/codes-and-manuals/aquatic-code-online-access/>

<sup>7</sup> Critically Important Antimicrobials for Human Medicine - World Health Organization <https://www.who.int/publications/i/item/-9789241515528>

<sup>8</sup> A single course of antibiotics given to address a specific disease which occurs over a prescribed time period.

<sup>9</sup> Therapeutant limit includes, but is not limited to: parasiticides, biocides, algacides. Treatment with salt, hydrogen peroxide, and chloramine-T are exempt from this limit.





AAH4g.	Records of all treatments are maintained on site, and include: i. Name of prescribing veterinarian or AAHP. ii. Disease treated. iii. Treatment regime, including dosage, method of application, duration, number of animals treated and withdrawal period.	x	x
AAH4h.	If the facility exceeds the antibiotic frequency limit defined in AAH4e., both antibiotic residue testing and assessment for antimicrobial resistance are conducted in sediment below the facility (marine net-pen operations).	x	x
AAH4i.	If the facility exceeds the antibiotic frequency limit defined in AAH4e., an independent antibiotic sensitivity assessment is performed to ensure efficacy of antibiotics against bacteria sampled from the farm prior to subsequent antibiotic applications.	x	x
AAH4j.	After therapeutic use, water is treated or retained to avoid or reduce the release of active chemicals into the surrounding ecosystem	x	
AAH4k.	All animal health products are approved for use in aquaculture, <sup>10</sup> administered according to label instruction by trained staff and following governing body guidelines and/or veterinary prescription.	x	x
AAJ4l.	Animals diagnosed with disease are treated as appropriate. If treatment is not compliant with the therapeutic/antibiotic restrictions listed in AAH4., animals within this production unit cannot be sold as certified.	x	x
AAH4m.	Prebiotics, probiotics, and other bioremediation agents are used in accordance with the instructions on the manufacturer's label or as advised by the competent authority and records are maintained (i.e., product name, type, and dose).	x	x
AAJ4n.	Health treatment procedures undergo annual review and revision as required based on observations and monitoring of welfare indicators during and after procedures.	x	x
AAJ5o.	Alternatives to chemical treatments are utilized where possible (e.g., mechanical parasite removal or use of snorkels or sleeves to reduce external parasite loads).	x	x
<b>AAH5. Biosecurity &amp; Emergency Preparedness</b>		Land Based	Net Pen
AAH5a.	The AHWP includes a Biosecurity section.	x	x

<sup>10</sup> Products are approved for use on the species, or operations provide data/evidence on the use of a particular fish health product on the farmed species.



AAH5b.	Health status of incoming stock (e.g. fry, fingerling, eggs, broodstock) complies with all national and/or regional regulations.	x	x
AAH5c.	Hatchery raised seed or broodstock are tested and verified to be free of any notifiable aquatic animal disease <sup>11</sup> prior to transfer to the facility.	x	x
AAH5d.	Where commercially available, sourced juveniles or eggs are Specific Pathogen Free (SPF), Specific Pathogen Resistant (SPR) stock or certified disease free.	x	x
AAH5e.	The health inspections completed prior to transferring live animals into marine waters cover any known pathogens and parasites of concern. <sup>12</sup> Procedures follow the ICES Code of Practice on the Introductions and Transfers of Marine Organisms. <sup>13</sup>	x	x
AAH5f.	The farm assesses disease vectors into and out of the farm (e.g., wildlife, visitors, deliveries, etc.), maintains logs for all visitors to site, and has procedures in place to mitigate risks.	x	x
AAH5g.	The farm has and follows procedures for sanitation and cleaning requirements for farm equipment and infrastructure and ensures animals are either not in the system or procedures are managed to cause minimal disturbance.	x	x
AAH5h.	The Biosecurity section includes a list of aquaculture producers sharing the waterbody. A formal relationship is in place which covers information sharing and communication regarding biosecurity with the intent of reducing disease transfer between farms and responding to disease outbreaks.	x	x
<b>AAH6. Feed Management</b>		<b>Land Based</b>	<b>Net Pen</b>
AAH6a.	The AWHP includes a Feed Management section.	x	x
AAH6b.	Feeding is managed to prevent any stress due to over or under feeding.	x	x
AAH6c.	Farms define, and have documented justification for, upper limits for fasting periods and maintain records to demonstrate compliance.	x	x

<sup>11</sup> As listed by the WOAHP Chapter 1.3. Aquatic Code [https://www.woah.org/en/what-we-do/standards/codes-and-manuals/aquatic-code-online-access/?id=169&L=1&htmlfile=chapitre\\_diseases\\_listed.htm](https://www.woah.org/en/what-we-do/standards/codes-and-manuals/aquatic-code-online-access/?id=169&L=1&htmlfile=chapitre_diseases_listed.htm)

<sup>12</sup> Novel or previously unknown diseases are added as they are identified.

<sup>13</sup> [https://ices-library.figshare.com/articles/report/ICES\\_Code\\_of\\_Practice\\_on\\_the\\_Introductions\\_and\\_Transfers\\_of\\_Marine\\_Organisms\\_2005/18623948](https://ices-library.figshare.com/articles/report/ICES_Code_of_Practice_on_the_Introductions_and_Transfers_of_Marine_Organisms_2005/18623948)



AAH6d.	Feed quantity, quality, frequency, sizing etc. is specific to the species, life stage, rearing system etc., and the feed is formulated to meet all known nutrient requirements of the species being farmed.	x	x
AAH6e.	Feeding is performed in a manner to prevent unreasonable competition. <sup>14</sup>	x	x
AAH6f.	Feeding is monitored and performed in a manner to minimize feed waste and over feeding.	x	x
<b>AAH7. Animal Husbandry</b>		<b>Land Based</b>	<b>Net Pen</b>
AAH7a.	The AWHP includes an Animal Husbandry section.	x	x
AAH7b.	Farms monitor animals for signs of physical damage or deformity, which includes: <ul style="list-style-type: none"> <li>i. Regular<sup>15</sup> monitoring during production (based on production conditions).</li> <li>ii. Scoring of condition/damage on a sample of animals during slaughter.<sup>16</sup></li> </ul> Records are maintained and include calculation of the percent of animals affected.	x	x
AAH7c.	Facilities define a damage/deformity threshold (severity and percent of animals affected) and outline measures required to minimize the risk of unacceptable physical damage attributable to the farm environment, husbandry procedure or unrecognized disease issues.	x	x
AAH7d.	Facilities utilize technology to increase monitoring frequency and allow faster response when signs of damage or disease occur.	x	x
AAH7e.	The AHWP includes a description of OWIs (Appendix I) and justified scoring criteria for Optimal (preferred target range), Acceptable (within allowable range) and Unacceptable (outside of Acceptable thresholds) for all OWIs.	x	x
AAH7f.	Records are available to verify that monitoring of OWIs takes place according to the schedule outlined in the AHWP.	x	x
AAH7g.	Water quality parameters are maintained at or above the Acceptable range (per <b>AAH7d</b> ) for the production species.	x	

<sup>14</sup> E.g. sustained increased swimming speeds during a meal or competition between fish for individual pellets.

<sup>15</sup> Minimum daily. If conditions do not allow for daily monitoring, records provide conditions and justification.

<sup>16</sup> If slaughter occurs on site at the grow-out facility.



AAH7h.	Records show appropriate action is taken if parameters fall outside of optimal ranges.	x	
AAH7i.	Evidence is available to show action was taken any time OWIs (AAH7d) reached Unacceptable ranges.		x
AAH7j.	Farms evaluate and apply a maximum biomass limit (stocking density) based on indicators of stress, health and survival outcomes specific to the farmed species, production unit size and life stage.	x	x
AAH7k.	Behaviour and oxygen levels are monitored while animals are undergoing health treatments <sup>17</sup> that may compromise such indicators, and while they recover.	x	x
AAH7l.	The operation provides environmental enrichment opportunities appropriate to the species and life stage that encourages expression of natural behaviors.	x	x
<b>AAH8. Handling</b>		<b>Land Based</b>	<b>Net Pen</b>
AAH8a.	The AWHP includes a Handling section.	x	x
AAH8b.	Removal from water and/or handling <sup>18</sup> only occurs when necessary and is performed in a manner that minimizes distress.	x	x
AAH8c.	Procedures that increase risk of stress or injury to farm animals are minimized and only performed when necessary.	x	x
AAH8d.	Each instance of handling and active crowding/grading <sup>19</sup> is recorded and includes: <ul style="list-style-type: none"> <li>i. Health assessment prior to grading</li> <li>ii. Time out of water</li> <li>iii. Water quality</li> <li>iv. Temperature</li> <li>v. Density<sup>20</sup> throughout the procedure</li> </ul>	x	x
AAH8e.	Handling procedures are performed with consideration for all potential points of acute injury (e.g. equipment malfunction/ damage, hard handling). <sup>21</sup>	x	x

<sup>17</sup> Monitoring focuses on active, physical procedures, but may include passive treatments (e.g. immersion baths) if conditions are not consistent with production conditions and there are potential adverse outcomes associated with these procedures.

<sup>18</sup> Handling procedures include, but are not limited to live examination, grading, pumping.

<sup>19</sup> Passive grading is exempt from this if a monitoring record is already included in harvest record or farm's internal movement record.

<sup>20</sup> Farms demonstrate compliance with justifiable species-specific crowding thresholds for stocking density and time.

<sup>21</sup> When pumping, flow rate or pumping speed must be set to ensure that there is continuous movement, fish are unable to reverse direction, fish are not colliding with the pipe or other fish. Flushing must be performed if any pump stoppage occurs and/or at the end of pumping to prevent any fish from remaining in the pipe.



AAH8f.	Farm equipment (e.g., nets, grading equipment, etc.) is designed and maintained to prevent damage/stress to animals; the use of knotted nets is prohibited.	x	x
<b>AAH9. Transport</b>		<b>Land Based</b>	<b>Net Pen</b>
AAH9a.	The AWHP includes a Transport section.	x	x
AAH9b.	Transport plans (including estimated total time, acceptable water quality parameters, monitoring regime, maximum allowable density, emergency procedures, person responsible for overseeing welfare) are in place for each movement of live animals.	x	x
AAH9c.	All wellboats, tanks, and other transport equipment are cleaned and in good functioning condition prior to movements.	x	x
AAH9d.	Health status of animals is tested prior to all movements and only healthy animals are transported.	x	x
AAH9e.	All transport procedures are undertaken in a manner that minimizes stress and discomfort to animals and are in line with the handling requirements in AAH8.	x	x
AAH9f.	Records of all movements of stock are available, including all necessary permits for movement, shipping and receiving site, method of and date of transport, and number of animals.	x	x
AAH9g.	Water quality and conditions <sup>22</sup> are monitored and maintained throughout transport as close as possible to those from which the fish came.	x	x
<b>AAH10. Slaughter</b>		<b>Land Based</b>	<b>Net Pen</b>
AAH10a.	Slaughter techniques appropriate for the farmed species are used. <sup>23</sup>	x	x
AAH10b.	Operations stun animals prior to slaughter and ensure absence of consciousness. <sup>24</sup>	x	x
AAH10c.	Where electrical or mechanical stunning/slaughter is not yet in use, farms have a time-bound commitment to implementing these methods on site.	x	x

<sup>22</sup> At a minimum, temperature, dissolved oxygen and pH are consistent with production system conditions, and stocking density is maintained at or below justified thresholds for the farmed species for the duration of transport.

<sup>23</sup> Non-stunned aerial suffocation and non-stunned live bleeding are prohibited. Recommended species-specific guidance provided in the Aquatic Animal Health Code Chapter 7.3 [https://www.woah.org/en/what-we-do/standards/codes-and-manuals/aquatic-code-online-access/?id=169&L=1&htmlfile=chaptre\\_welfare\\_stunning\\_killing.htm](https://www.woah.org/en/what-we-do/standards/codes-and-manuals/aquatic-code-online-access/?id=169&L=1&htmlfile=chaptre_welfare_stunning_killing.htm)

<sup>24</sup> Signs of correct stunning include loss of body or respiratory movement, loss of visual evoked response, loss of vestibulo-ocular reflex, IBID.



AAH10d.	Starvation periods prior to harvest do not exceed allowable timelines as outlined in <b>AAH6c</b> .	x	x
AAH10e.	All staff involved with harvesting animals are specifically trained for the process.	x	x
AAH10f.	Stunning and slaughter equipment is calibrated according to manufacturers instructions, and records demonstrate animals are stunned within approved guidelines. <sup>25</sup>	x	x
AAH10g.	Animals found to be seriously injured or sick are humanely euthanized without delay. <sup>26</sup> Animals are not left to die in the open air.	x	x
AAH10h.	Records are available for each slaughter event, including number of animals and slaughter method.	x	x

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<sup>25</sup> Fish are stunned before slaughter using a method that ensures immediate and irreversible loss of consciousness. If the stunning is not irreversible, fish are slaughtered before consciousness is recovered.

<sup>26</sup> Emergency killing of fish (while in production systems) may follow different methods than those used during regular slaughter but must render immediate and irreversible loss of consciousness (e.g. non-stunned aerial suffocation is prohibited, but anesthetic overdose or mechanical percussive culling are acceptable).



## ENVIRONMENTAL STEWARDSHIP FOR LAND-BASED AQUACULTURE OPERATIONS

Criterion #	Requirement		
<b>AES1 Regulatory Compliance</b>		Land Based	Net Pen
AES1a.	The operation complies with all business and operation legal requirements.	x	x
AES1b.	The operation complies with all land and water use legal requirements.	x	x
AES1c.	The operation complies with all relevant environmental legal requirements.	x	x
<b>AES2 Identification &amp; Traceability</b>		Land Based	Net Pen
AES2a.	Farms have an on-farm tracking system to ensure the identity and history of all animals <sup>27</sup> from arrival on farm to point of sale to processor.	x	x
AES2b.	If farms are producing both certified and non-certified product, a written procedure for differentiating certified product throughout its lifecycle is in place.	x	x
AES2c.	Farms have a tracking system to record all feed used on-farm. Records include source, batch/lot ID, date of purchase and delivery date.	x	x
<b>AES3. Water Management</b>		Land Based	Net Pen
AES3a.	Records of farm water intake and discharge volumes are maintained.	x	
AES3b.	Fresh groundwater use complies with local regulations guiding its use. Records of use of fresh groundwater are kept.	x	

<sup>27</sup> Including: purchase/sales records of stock with batch number, and number and biomass for all receiving, movement of stock, mortality, transport, harvest, and processing events.



AES3c.	Effluent is tested <sup>28</sup> quarterly, at minimum, and at peak biomass. Results recorded comply with relevant laws, regulations and permits.	x	
AES3d.	For pond production, <sup>29</sup> daily average water exchange per farm does not exceed 10% of pond volume, calculated over the entire production cycle. <sup>30</sup>	x	
AES3e.	Effluent water is treated if the water quality poses a significant risk of impact to the receiving water.	x	
AES3f.	An effluent monitoring program is in place that monitors water quality and demonstrates compliance with all relevant regulations. <sup>31</sup> This program outlines distances and depths from the farm in which monitoring data is collected. <sup>32</sup>		x
AES3g.	Benthic monitoring is in place and results demonstrate compliance with all relevant regulations, or with requirements of Appendix II where regulatory thresholds are not in place.		x
AES3h.	Operations do not release more than 49 kg of nitrogen per ton of production. <sup>33</sup> OR Operations provide evidence that effluent discharge impacts within the immediate vicinity of the farm are occasional <sup>34</sup> and temporary. <sup>35</sup>		x
AES3i.	If copper treated nets are used, no net cleaning occurs in situ; land-based cleaning sites have effluent treatment.		x
AES3j.	Any violation of effluent laws, regulations or permits disqualifies a farm from WFCF certification.	x	x
AES3k.	The farm declares all inputs <sup>36</sup> used at the facility.	x	x

<sup>28</sup> At least quarterly and at peak biomass for the following parameters: pH, total nitrogen, total phosphorus, total suspended solids, dissolved oxygen, 5-day biochemical oxygen demand.

<sup>29</sup> Including earthen and concrete ponds; raceways are exempt if subject to state or federal effluent permitting or limitations.

<sup>30</sup> Overflow from heaving rain periods can be excluded from calculation.

<sup>31</sup> Effluent is monitored at least quarterly and at peak biomass for the following parameters: pH, total nitrogen, total ammonia nitrogen or NO<sub>3</sub>, total phosphorus, total suspended solids, dissolved oxygen, 5-day biochemical oxygen demand.

<sup>32</sup> Monitoring sites include reference sites used to assess if impacts can be attributed to operation effluent, natural variation or other influences. Reference sites should be located outside the area potentially influenced by the operation, but with similar physical, chemical, and biological attributes as the other monitoring sites where disturbance is minimal.

<sup>33</sup> See WFCF Certified Fish Feed Tool for calculation.

<sup>34</sup> Observable in ≤10% of measurements taken or ≤10% of the total duration of a year (and do not have).

<sup>35</sup> Impacts are reversible through fallowing or other strategies to return the affected areas to reference/pre-farming conditions.

<sup>36</sup> Including: fertilizers, soil conditioners, compost, compost activators, disinfectants, microorganism, probiotics, pest control substances (pesticides, microorganisms, substances used in traps/dispensers) and any disinfectant or antifouling agents.





AES3l.	Chemicals used in production are compliant with local regulations and are used according to manufacturer's instructions.	x	x
AES3m.	Chemicals listed as 1a and 1b pesticides by the World Health Organization <sup>37</sup> or in Annex III of the Rotterdam Convention <sup>38</sup> are not used.	x	x
AES3n.	Farm participates in an Area-Based Management scheme or similar for cumulative effluent if there are neighbouring farms or other effluent discharging facilities within 3 km that share the same waterbody or source/receiving waterbodies. <sup>39</sup>	x	x
<b>AES4. Facilities Management and Waste Disposal</b>		<b>Land Based</b>	<b>Net Pen</b>
AES4a.	The operation implements a Waste Management System (WMS) which outlines procedures for good culture and hygienic conditions, ensuring that all wastes <sup>40</sup> are stored, handled and disposed of in a way that does not have a detrimental impact on the environment, and which prioritizes recycling, where possible.	x	x
AES4b.	The WMS describes procedures for construction, operation and decommissioning of site infrastructure to ensure negative environmental impacts are minimized.	x	x
AES4c.	The WMS outlines procedures to ensure access to chemicals, fuels and other hazardous materials is limited (e.g., locked), proper containment is in place to prevent spills, and Safety Data Sheets (SDS) are available.	x	x
AES4d.	The WMS includes a feed storage system that ensures First In: First Out principles are followed, and pest control procedures are in place.	x	x
AES4f.	Regular inspections are made of all facilities to ensure production areas are clean and equipment is in good working order.	x	x
AES4g.	Maintenance and repairs to facilities are carried out in a timely manner (including escape prevention and wildlife/predator control mechanisms).	x	x

<sup>37</sup> <https://iris.who.int/bitstream/handle/10665/332193/9789240005662-eng.pdf?sequence=1>

<sup>38</sup> [www.pic.int/TheConvention/Chemicals/AnnexIIIChecklist/tabid/1132/language/en-US/Default.aspx](http://www.pic.int/TheConvention/Chemicals/AnnexIIIChecklist/tabid/1132/language/en-US/Default.aspx)

<sup>39</sup> Farms subject to regulation from [Total Maximum Daily Loads](#) are exempt.

<sup>40</sup> Including biological and non-biological wastes



AES4h.	Dredged sediment from canals, watercourses and ponds and collected waste from land-based production is properly contained and/or disposed of to prevent the salinization of soil and groundwater and does not cause other significant ecological impacts to receiving and/or surrounding environments.	x	x
AES4i.	Blood water from harvest activities is held and treated appropriately to ensure environmental and biosecurity risks are mitigated prior to discharge.	x	x
<b>AES5. Siting and Habitat Functionality</b>		<b>Land Based</b>	<b>Net Pen</b>
AES5a.	Farm siting takes into consideration the farm's potential impacts on biodiversity and nearby ecosystems and the cumulative impact of farms in the area. This includes environmental impact assessment (EIA) which includes, at a minimum: <ul style="list-style-type: none"> <li>i. Site survey.</li> <li>ii. Risk analysis.</li> <li>iii. Design, dimension, installation and operation parameters.</li> <li>iv. Siting considerations/restriction.</li> <li>v. Climate change projections and mitigations.</li> <li>vi. Identification of any endangered species (ETP), as listed by the IUCN or protected under the Endangered Species Act (ESA)<sup>41</sup> or equivalent found in the vicinity of the farm.</li> </ul>	x	x
AES5b.	Farm participates in an ecosystem- or area-based management scheme to address potential cumulative impacts on the environment.	x	x
AES5c.	Farms have not been sited/built in high value habitat <sup>42</sup> after 1999. <sup>43</sup>	x	x
AES5d.	Any expansion into high value habitat after 1999 has only occurred for permitted activities <sup>44</sup> and is mitigated according to the Compensatory Mitigation Requirements under CWA Section 404 <sup>45</sup> or equivalent.	x	x
AES5e.	Expansion of farms requiring conversion of previously unconverted high value habitat is prohibited. <sup>46</sup>	x	x

<sup>41</sup> Evaluation of impact includes critical habitat for listed species.

<sup>42</sup> High value habitat includes, but is not limited to, coastal intertidal areas, estuaries, tidal wetlands and forests, freshwater wetlands, coral reefs, seagrass/ algae beds, freshwater lakes, rivers and streams, and tropical broadleaf mixed forests.

<sup>43</sup> 1999 recognizes the year of the signing of the Ramsar Convention on Wetlands [www.ramsar.org](http://www.ramsar.org).

<sup>44</sup> Pumping stations or canals, others to be evaluated by the WFCF Seafood Committee on a case-by-case basis.

<sup>45</sup> <https://www.epa.gov/cwa-404/compensatory-mitigation-losses-aquatic-resources-under-cwa-section-404-final-rule>.

<sup>46</sup> Requests for exemption are reviewed by the WFCF Seafood Committee and must include plans for restoration activity of 3x the size of the disturbed area.



AES5f.	Farm sites or related facilities are not within a national or international Protected Area, unless permitted by the relevant authorities and an effective management plan exists.	x	x
AES5g.	Any expansion of farms into habitat not previously converted does not impact threatened and endangered species, as listed by the IUCN or protected under the Endangered Species Act (ESA) <sup>47</sup> or equivalent.	x	x
AES5h.	Construction or operation of the farm has not resulted in the loss of habitat functionality, as defined Appendix II. <sup>48</sup>	x	x
<b>AES6. Wildlife Interaction</b>		<b>Land Based</b>	<b>Net Pen</b>
AES6a.	A risk assessment is conducted on infrastructure components to minimize occurrence of entanglement/accidental drownings.		x
AES6b.	Baseline surveys are undertaken on endangered marine species in the area to evaluate if the presence of operations adversely impact habitat ranges or activities of these species (e.g., through removal of access to foraging grounds or impeding movement).		x
AES6c.	A marine protected species monitoring and reporting plan is in place that identifies marine protected species per the IUCN; <sup>49</sup> any observed or entangled IUCN-listed species is reported to the appropriate authority.		x
AES6d..	Active lethal wildlife <sup>50</sup> control is prohibited. <sup>51</sup>	x	x
AES6e.	Farming activities do not cause mortality of any ETP species.	x	x
AES6f.	A wildlife management plan is in place to ensure that wildlife mortalities (excluding vermin) do not occur beyond exceptional <sup>52</sup> cases.	x	x

<sup>47</sup>Ibid

<sup>48</sup> Any farm expansion that results in the loss of previously unconverted habitat requires a supplemental Environmental Impact Statement (EIS) analysis.

<sup>49</sup> As listed by the IUCN (Categories Critically Endangered (CR), Endangered (EN), Vulnerable (VU)) or protected under any national or regional legislation.

<sup>50</sup> Including birds, mammals, reptiles, etc. Vermin (nuisance animals that are harmful to farm animals or carry disease etc. e.g., rodents) are excluded.

<sup>51</sup> Unless authorized by the appropriate regulatory body, confirmed by copies of permit or depredation order, and records to demonstrate compliance with permitted limits.

<sup>52</sup> ≤1 per year; only when unavoidable (in cases where euthanization is necessary due to injury or worker safety is compromised).



AES6g.	All interactions (including incidental - e.g., drownings or entanglements in predator nets) with wildlife are recorded. <sup>53</sup> Corrective actions are taken as appropriate.	x	x
<b>AES7. Source of Stock and Wild Population Impacts</b>		<b>Land Based</b>	<b>Net Pen</b>
AES7a.	Facilities responsible for early life stages (e.g., hatchery or nursery) sign a declaration indicating compliance with relevant sourcing requirements and confirming that prohibited substances (AAH4c., d.; AES3e., f.) are not used.	x	x
AES7b.	Shrimp production facilities collaborate with suppliers to develop alternatives to eyestalk ablation and document a time-bound commitment to removing ablation from their supply chains.	x	x
AES7c.	Wild broodstock is sourced in accordance with national laws and regulations, where they exist, and is undertaken in a responsible manner from sustainable populations. <sup>54</sup>	x	x
AES7d.	Wild juveniles are sourced in accordance with national laws and regulations, where they exist, and is undertaken in a responsible manner from sustainable populations. <sup>55</sup>	x	x
AES7e.	If native species are produced in marine net pens, they may have some genetic differentiation from wild populations, but there is no evidence of phenotypic differences. <sup>56</sup>	x	x
AES7f.	Production of non-native species is not permitted unless records indicate the species is already established for commercial production, OR the species has been fully ecologically established in the region for ≥10 years.	x	x
AES7g.	Production of bioengineered animals is not permitted. <sup>57</sup>	x	x
AES7h.	If hatchery production for the species is still in development, inclusion of wild broodstock capturing a wide range of known wild genetic diversity is required	x	x

<sup>53</sup> Details include species involved and root cause.

<sup>54</sup> I.e., removal does not reduce stock biomass from year to year, assuming that environmental conditions remain the same ([http://www.wh.who.edu/homepage/tech\\_terms.html](http://www.wh.who.edu/homepage/tech_terms.html)); destructive fishing methods are not used.

<sup>55</sup> Ibid.

<sup>56</sup> Fish are hatchery-raised ≤2 generations or the source hatchery has a comprehensive broodstock management plan to prevent genetic drift and inbreeding.

<sup>57</sup> Ploidy manipulation, hybrid and genetic enhancement through selective breeding are not considered GMO.



	(and must be compliant with MES7f.).		
AES7i.	The number of animals stocked, sources, their average weight, and total biomass are recorded at stocking and at harvest (and transfer if applicable).	x	x
AES7j.	Design and construction of the farm follow Best Management Practices for the region/species with regards to escape prevention.	x	x
AES7k.	Net structure, mooring systems and other containment structures must be built to withstand the expected ongoing typical and extreme weather events.	x	x
AES7l.	Facilities have an Escape Prevention Plan that includes: <ul style="list-style-type: none"> <li>i. Protocols and schedules for regular inspection of escape prevention mechanisms (and repair if necessary).</li> <li>ii. List of critical control points (points of higher escape likelihood).</li> <li>iii. Size/grading specifications for fish before transfer to production system.</li> <li>iv. Mesh/barrier size requirements relative to fish size.</li> <li>v. Methods for preparing/for responding to storms or other emergencies,</li> <li>vi. Procedures for responding to escapes should they occur.</li> <li>vii. Procedure for immediate repair to infrastructure to prevent further escape.</li> <li>viii. List of recapture methods available.</li> <li>ix. Required notification procedures.</li> <li>x. Estimated survival rates for escapees not recaptured.</li> </ul>	x	x
AES7m.	Farms employ appropriate measures to prevent escape, including secondary containment at harvest and during transfers. Appropriate escape prevention measures include screens, barriers, and containment ponds (when applicable) sized to the smallest cultured animal present.	x	x
AES7n.	Records (size of animal, estimated number of escapees, and estimated recapture, <sup>58</sup> if applicable) of any escape event are maintained.	x	x
AES7o.	Any large escapes (>50 animals) triggers a review and revision of the facility's Escape Prevention Plan.	x	x
AES7p.	The Escape Prevention Plan has a documented history of effectiveness. <sup>59</sup>	x	x

<sup>58</sup> If recapture is successful, records must be maintained but reporting is not required, outside of legal requirements.

<sup>59</sup> Documented record of low escapes/failures, i.e., insufficient numbers to result in population level impacts through competition, predation, disturbance or other impacts on wild species, habitats or ecosystems or to become established.



AES7q.	Technology is used to monitor within and outside the marine net-pens for escape events (i.e., through fish counts and detection of faults in the system).	x	x
AES7r.	Operations engage with government, academics, or other institutions to monitor disease load in wild populations and establish protocols for disease response. <sup>60</sup>	x	x
<b>AES8. Feed Sourcing and Content</b>		<b>Land Based</b>	<b>Net Pen</b>
AES8a.	Animals are fed 100% commercial pelleted feed purchased from manufacturers/sellers/importers that have an operational license from the relevant governmental body and comply with local regulations.	x	x
AES7b.	Feed manufacturers supply a written policy verifying compliance with the requirements of this standard and including their commitment to responsible sourcing of marine feed ingredients. This policy includes a commitment to supporting source fishery improvements, where possible.	x	x
AES7c.	Feed additives and supplements <sup>61</sup> are legal/registered. Their use, including name/type and dose, are identified, and recorded.	x	x
AES7e.	All ingredients in feed (>1%) are listed; fishmeal/fish oil derived from byproducts are identified as such. <sup>62</sup>	x	x
AES7f.	Fishmeal and fish oil in feed (>1%) are sourced from fisheries certified by standards compliant with the FAO's ecolabelling guidelines. <sup>63</sup>	x	x
AES7g.	Fishmeal and fish oil are not sourced from illegal, unreported, or unregulated (IUU) fisheries, endangered species, or from Seafood Watch Red rated fisheries. <sup>64</sup>	x	x
AES7h.	Fishmeal and fish oil are not sourced from the same species and genus as the species being farmed.	x	x

<sup>60</sup> This can be demonstrated via relevant evidence from an Area-Based Management scheme if applicable.

<sup>61</sup> Including probiotics, prebiotics, synbiotics, immunostimulants, organic acids, nucleotides and medicinal herbs.

<sup>62</sup> Marine, soy and palm ingredients include evidence of source origin.

<sup>63</sup> <https://www.fao.org/3/i/1119t/i1119t.pdf>

<sup>64</sup> As listed by the IUCN (Categories Critically Endangered (CR), Endangered (EN), Vulnerable (VU)) or protected under any national or regional legislation.



AES7i.	≥75% of fishmeal and fish oil derived from reduction fisheries originate from fisheries that are either MSC certified, Seafood Watch Yellow rated or fisheries with all FishSource scores ≥6 and ≥8 for Criteria 4 (spawning biomass assessment).	x	x
AES7j.	Farms calculate feed conversion ratio (FCR) for each completed production cycle.	x	x
AES7k.	Fish In:Fish Out ratios (excluding byproducts) for fishmeal and fish oil (individually) do not exceed 1.0.	x	x
AES7l.	All terrestrial animal ingredients in feed are non-edible byproducts.	x	x
AES7m.	All soy ingredients are certified by standards successfully benchmarked against the FEFAC Guidelines for Responsible Soy Sourcing. <sup>65</sup>	x	x
AES7n.	All palm oil ingredients are certified by the Roundtable on Sustainable Palm Oil (RSPO) or equivalent program.	x	x
AES7o.	Farms explore opportunities to utilize fishmeal and fish oil alternatives (e.g. algal oil, insect meal).	x	x
AES7p.	Calculation of net protein demonstrates that loss is not ≥ 80%.	x	x
AES7q.	Operation provides a completed and signed WFCF Feed Declaration for all feed types used.	x	x
AES7r.	Farms calculate emissions from feed and proactively engage in opportunities for improvement in composition/formulation. <sup>66</sup>	x	x
AES7s.	Feed manufacturers have a policy regarding responsible and sustainable sourcing of marine feed ingredients that includes a commitment to supporting source fishery improvements.	x	x

<sup>65</sup> <https://standardsmap.org/en/identify?client=FEFAC>.

<sup>66</sup> Tools such as <https://fishscores.com/> can aid in calculating emissions.



<b>AES8. Energy Management, and Emissions Reduction</b>		<b>Land Based</b>	<b>Net Pen</b>
AES8a.	An energy management plan is implemented which includes goals (e.g., energy targets) for reduced emissions or increased efficiency related to vehicles, equipment, lighting, pumping, aeration, water systems and other energy-use areas. Progress is evaluated and assessed annually at minimum.	x	x
AES8b.	Farms undertake an internal energy use assessment and maintain records covering Scope 1 emissions. <sup>67</sup>	x	x
AES8c.	Emission planning and minimization are considered during operation development. <sup>68</sup>	x	x
<b>AES9. Innovation &amp; Continuous Education</b>		<b>Land Based</b>	<b>Net Pen</b>
AES9a.	The operation maintains awareness of innovation and applies innovative practices where possible.	x	x
AES9b.	The operation pursues educational opportunities to learn more about environmentally sustainable animal production.	x	x

<sup>67</sup> Records include fuels or other energy sources and farms calculate kilojoule/ton fish produced/production cycle and greenhouse gas emissions on farm.

<sup>68</sup> Potential climate impacts of feed can be examined using <https://fishscores.com/> or other tools as relevant.





## APPENDIX 1

### Operational Welfare Indicator Examples

Table 1. is not a comprehensive list but includes examples of the categories and parameters that may be outlined by an operation. Environmental OWIs are those related to the rearing environment, Individual OWIs are those used to evaluate status of a sample of fish and Group OWIs address the farmed population as a whole. An operation should define scoring criteria for each operational welfare indicator that includes, at a minimum: Optimal (the preferred target value for all individuals), Acceptable (lower scoring, but above a defined threshold), and Unacceptable (below the defined threshold for Acceptable). The monitoring schedule for OWI status is outlined in the Fish Welfare section of the Operational Plan.

Table 1. Examples of operational welfare indicators that may be used by an operation.

Category	Parameter	Category	Parameter
Individual	Damage (eye, fin, skin etc.)	Group	Appetite
	Deformity (jaw, vertebral etc.)		Mortality
	Emaciation		Growth
	Lesions/wounds		Disease
	Feed in intestine		Swimming behaviour
	Abdominal organs		Aggression
	Body cavity		
	Rigor mortis		
Environmental	Stocking density		
	Lighting		
	Water velocity		
	External disturbances		
	Oxygen		
	Temperature		
	pH		
	Carbon dioxide		



## APPENDIX II

Criterion **MES3b** describes benthic monitoring required at the farm. Table 2 describes monitoring thresholds which must meet to pass this requirement. Either faunal or macrofaunal index values must be available for review. Monitoring should be conducted at peak biomass, or as determined by the regulatory scheme.

Table 2. Benthic monitoring thresholds required for compliance with Requirement MES3b.

Species group	Location for sampling	Monitoring measure	Required result
Faunal	Edge of the allowable zone of effects (AZE): - as determined by site-specific modelling OR - 30 m from cage edge	AZTI Marine Biotic Index (AMBI)	≤ 3.3
		Shannon-Weiner Index (H')	≥ 3
		EcoQ	Good
		Diversity	≥ 70% of reference station value
Macrofaunal	Within the AZE	Highly abundant species (that are not pollution indicator species)	≥ 2