

**PUBLIC SECTOR REGULATORY SYSTEMS  
FOR  
ECOSYSTEMS BASED MANAGEMENT OF AQUACULTURE**

**—A GAP ANALYSIS TOOL**

**Ramesh P. Perera**

**FAO/NACA/APFIC**

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# 1. INTRODUCTION

Following from a recommendation by the Asia-Pacific Fishery Commission (APFIC) regional consultative workshop on *Strengthening Assessments of Fisheries and Aquaculture in the Asia-Pacific Region for Policy Development and Management* (4-6 October 2011, Yangon, Myanmar), the Food and agriculture Organization the United Nations (FAO), the Network of Aquaculture Centres in Asia-Pacific (NACA) and the Asia-Pacific Fishery Commission (APFIC) organized the *Regional Study/Workshop on Adoption of Aquaculture Assessment Tools (AAT) for Sustainability in Asia-Pacific* (3-5 July 2012, Pattaya, Thailand). This was followed by the FAO/NACA/APFIC *Regional Consultation on the Sustainable Intensification of Aquaculture Production in the Asia Pacific*, (9-11 October 2012, Bangkok, Thailand). Discussions leading up to, during and following these meetings pointed to a need for a gap analysis tool to identify deficiencies in public sector (i.e. government) systems aimed at meeting the objective of ecologically sustainable development of aquaculture (ESD) or as more recently articulated, an ecosystems approach to aquaculture (EAA).

This document presents a tool, in the form of an audit table, that can be used to broadly screen and identify gaps in the current management systems of government agencies responsible for regulating aquaculture. These gaps once identified can be a first step toward building regulatory frameworks that can better deliver on jurisdictional ESD/EAA objectives. The end product of an assessment is a report for consideration by decision makers that lists the identified systems deficiencies and recommends aspects of aquaculture regulatory systems that should be developed, improved or subject to closer investigation.

The audit tool is intended for self-assessment by interested government jurisdictions and should ideally be conducted by a small team comprising individuals with relevant expertise taken from within government agencies, external consultants or a combination thereof.

The tool is *not intended to assess the adequacy of each element of a regulatory framework in detail*, rather to enable general gaps to be identified, following which systems deficiencies can be more closely examined with a view to capacity building. There are other assessment tools available that would assist in this regard. Of note, the World Animal Health Organisation (OIE) has developed the *OIE Tool for the Evaluation of Performance of Veterinary Services* (OIE PVS Tool) as part of its mechanism for assisting veterinary services to identify gaps in their ability to comply with OIE international standards (OIE, 2010).

This document is intended to be a ‘living document’ in that it can be updated as best practice in regulating ESD/EAA-based aquaculture evolves over time.

## 2. ESD/EAA

Ecologically sustainable development of aquaculture (ESD) has generated much interest over the last few decades. As a regulatory goal, ESD has made its way more recently into some national aquaculture regulations and policies, whereby some governments have adopted contemporary management practices with ESD as a core principle.

ESD is a concept that seeks to integrate short and long-term economic, social and environmental effects and values in all decision making (Fletcher et al., 2005). The World Commission on Environment and Development (WCED) defined sustainable development as that which “meets the needs of the present without compromising the ability of future generations, to meet their own needs” (WCED, 1987).

The Government of South Australia’s aquaculture legislation, the Aquaculture Act 2001, is the first of its kind in Australia and takes development to be ecologically sustainable if it is:

*‘managed to ensure that communities provide for their economic, social and physical well-being while—*

- (a) natural and physical resources are maintained to meet the reasonably foreseeable needs of future generations; and*
- (b) biological diversity and ecological processes and systems are protected; and*
- (c) adverse effects on the environment are avoided, remedied or mitigated.’ (Government of South Australia, 2001)*

This legislation further states that:

*‘in making decisions as to whether development is ecologically sustainable or to ensure that development is ecologically sustainable—*

- (a) long-term and short-term economic, environmental, social and equity considerations should be effectively integrated; and*

- (b) *if there are threats of serious or irreversible environmental harm, lack of full scientific certainty should not be taken to justify the postponement of decisions or measures to prevent the environmental harm’.*

A related concept more specifically related to aquaculture is ecosystems approach to aquaculture (EAA), defined by the FAO as an approach that:

*“strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems including their interactions, flows and processes and applying an integrated approach to aquaculture within ecologically and operationally meaningful boundaries. The purpose of EAA should be to plan, develop and manage the sector in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by aquatic ecosystems”* (FAO, 2006).

The FAO more recently described EAA as:

*“a strategy for the integration of the activity within the wider ecosystem in such a way that it promotes sustainable development, equity, and resilience of interlinked social and ecological systems”* (FAO, 2008).

Despite the general acceptance of ESD/EAA-based resource management as principles, many government agencies responsible for managing aquaculture have struggled to apply these principles at an operational level.

This gap analysis tool provides a method by which a government jurisdiction can:

- evaluate the characteristics (features) of its existing framework for regulating aquaculture against the features of a framework considered best practice, and thereby
- identify development needs to build a comprehensive ESD/EAA based regulatory framework that meets the individual needs of that agency or jurisdiction, and the needs of the aquaculture sector for which it is responsible.

### 3. CORE AREAS OF REGULATORY RESPONSIBILITY FOR ESD/EAA

The aquaculture supply chain can be broadly divided into three components:

- aquaculture **planning**,
- **farming activities** (including harvesting), and
- **post-harvest** processes (including transport, processing and sale).

From the perspective of regulatory oversight, several government agencies and jurisdictions would likely play a role along the supply chain. The role of those government agencies responsible for regulating aquaculture typically stop after the point of harvest—the first two of the above, *aquaculture planning* and *farming activity*. This is taken to be the case for the purposes of this document, in that it focuses on the *regulation of the aquaculture supply chain from the point of natural resource allocation, through production grow-out, up to and including the point of harvest*.

A jurisdiction's regulatory activities aimed at meeting its ESD or EAA obligations for aquaculture fall into five core areas of responsibility; namely, to:

1. mitigate the **environmental impacts** of aquaculture,
2. minimise **socio-economic impacts** and optimise socio-economic **benefits** of aquaculture,
3. ensure **food safety** and **quality** of aquaculture product,
4. manage **biosecurity risks** (pathogen, pest and genetic risks) associated with aquaculture, and
5. manage **animal welfare**.

Figure A depicts where these core areas of regulatory responsibility are applied along the aquaculture supply chain, identifying those responsibilities that are typically considered to be the purview of government agencies that directly regulate aquaculture.

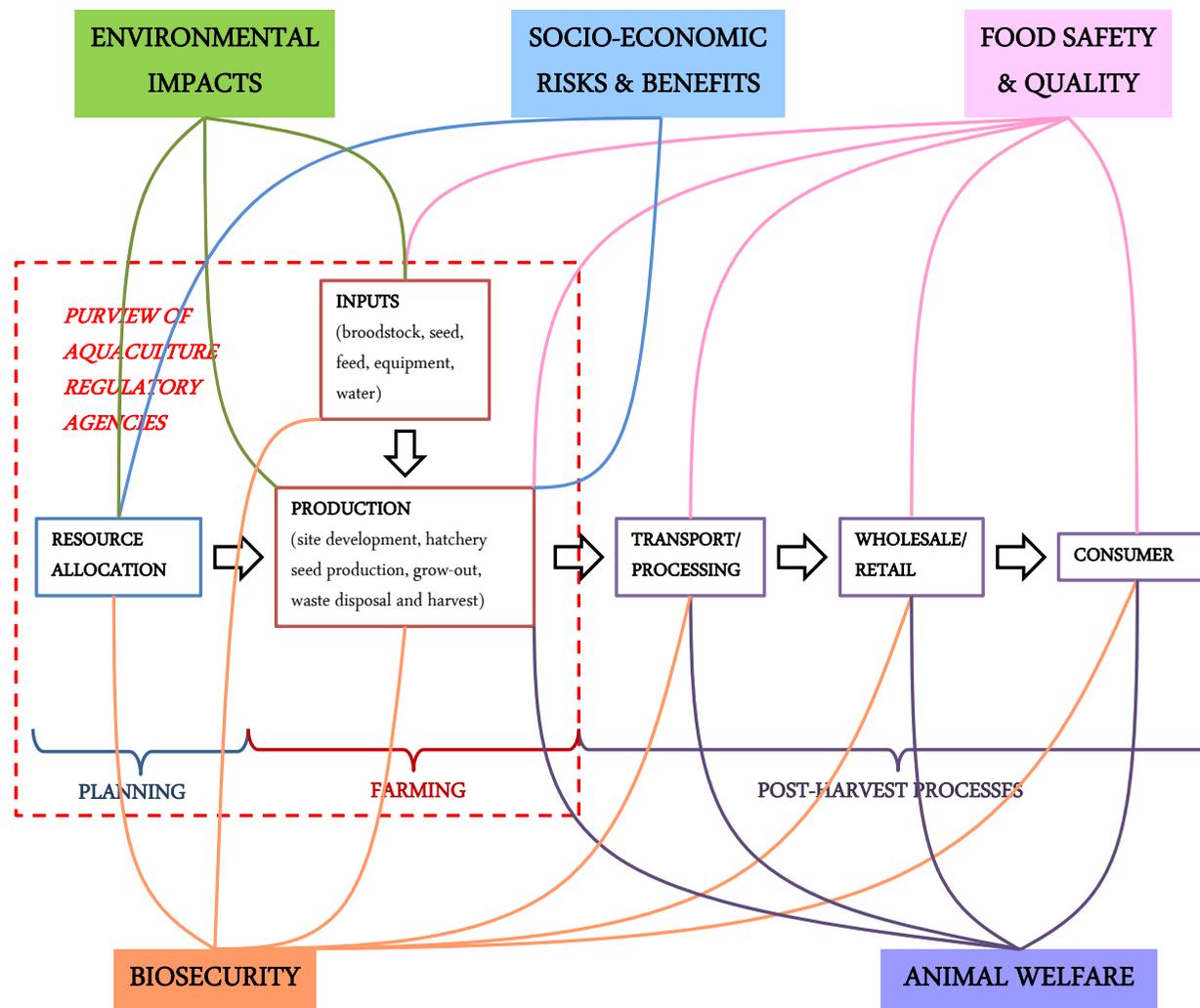
Several agencies within a *jurisdiction*<sup>1</sup> may have direct and overlapping regulatory responsibility for aquaculture. For example, departments of fisheries or aquaculture may

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<sup>1</sup> A *jurisdiction* can be of any level of government, ranging from national government, through provincial governments, down to local area governments, depending on the government structure of a country and the authority given at each level to manage aquaculture. Each jurisdiction is typically comprised of several agencies (e.g. 'ministries' or 'departments').

regulate production aspects of aquaculture activity, whilst departments of environment may control water pollution aspects, departments of human health may control food safety and animal health departments take responsibility for biosecurity aspects of aquaculture.

The management systems applied by these agencies with direct responsibility for aquaculture make up a jurisdiction's framework for regulating aquaculture.



**Figure A.** The five core areas of government responsibility for ESD/EAA-based aquaculture management in the context of the aquaculture supply chain, and the parts of the supply chain typically considered to be within the purview of aquaculture regulatory agencies.

## 4. GAP ANALYSIS TOOL

An aquaculture *regulatory framework* is made up of several management systems, such as geographic area based management plans (aquaculture zones); food safety, biosecurity and environmental monitoring systems; and systems for licensing and regulatory enforcement. Embedded in these systems are underlying approaches or principles, such as ESD and EAA, as well as more specific management tools like environmental impact assessment and risk analysis. A regulatory framework is taken in the context of this document to also include the wider management systems that support regulatory activities, such as extension services.

This document presents a gap analysis tool that can be used to *assess* a jurisdiction's current regulatory framework against its ability to meet its ESD/EAA objectives. The tool is essentially an audit table (or checklist) comprising a list of *features* or characteristics of a best practice framework for regulating aquaculture—see **Table 1**.

The framework features are categorised in the audit table into the five core areas of responsibility to which they apply (environmental impacts, socio-economic impacts and benefits, food safety and quality, biosecurity and animal welfare, as identified in Section 3), plus a sixth group of general cross-cutting management framework features.

The tool is intended for self-assessment by interested government jurisdictions and should ideally be conducted by a small team of individuals with audit skills and expertise across the areas of regulatory responsibility as determined in the scope of the assessment. Team individuals can be taken from within the relevant agencies, be external parties (e.g. private consultants) or a combination thereof.

The table allows for documenting assessment findings for each framework feature in terms of the following five assessment criteria:

- i. Legal instruments (underpinning laws, regulations and subordinate legislation),
- ii. Standard operating procedures (documented procedures),
- iii. Capacity (infrastructure and resourcing, including financial resourcing),
- iv. Capability (technical expertise, including training and succession planning), and
- v. Implementation (operational application, compliance monitoring and enforcement).

The table also allows for a **priority** (high, moderate or low) to be assigned to each feature. The priority reflects the relative importance of the feature, particularly with respect to the urgency with

which the feature, if found deficient, should be developed. A suggested priority is included in the table. However, as a first step in an assessment, these pre-assigned priorities should be modified to align with the individual jurisdiction's situation and its aspirations for aquaculture development.

The tool can be applied to a single regulatory agency, multiple agencies, a whole jurisdiction, multiple jurisdictions or a combination thereof, depending on an individual country's government structure.

Potential features that are considered to be less well operationally developed (e.g. carbon foot print assessment) are not included on this list. This document, and the list of systems features therein, is intended to be a 'living document' that can be updated as new systems, approaches and management tools emerge and start becoming embedded in operational practice.

Importantly, this tool is not intended to assess the adequacy of each framework feature in detail. Rather, it is a means by which an agency can more broadly screen and identify framework deficiencies with a view to closer examination and, if needed, capacity building.

## 5. APPLYING THE TOOL

The following guiding steps are provided for planning and conducting an assessment.

### PLANNING/SCOPING

1. **Jurisdiction seeks and gains formal, in-principle agreement by jurisdictional decision makers to undertake an assessment** of its aquaculture regulatory systems and in-principle agreement on resourcing the assessment.
2. **Jurisdiction identifies the aquaculture sectors of interest.** This may range from a single sector (e.g. shrimp farming sector), groups of sectors (e.g. in-sea and land-based coastal aquaculture sectors), to all aquaculture sectors within a jurisdiction.
3. **Jurisdiction identifies the regulatory areas of interest** in terms of the five key responsibilities described in Section 3.
4. **Jurisdiction identifies the government agencies** involved in regulating the aquaculture sectors of interest (step 2) in terms of the identified regulatory areas of interest (step 3).
5. **Jurisdiction establishes an assessment team** of 1-5 individuals who between them have auditing skills and knowledge about the identified regulatory areas of interest (step 3), and nominates a team leader.
6. **Each government agency nominates a key contact point within each agency.** The contact point has responsibility for collecting and reporting to the assessment team on information about the agency's current regulatory arrangements. The contact person is also responsible for liaising with agency managers and staff and the assessment team, as necessary.
7. **Jurisdiction and assessment team agrees on and confirms with all relevant parties the timeframe and details of resourcing of the assessment.**

### DESK ASSESSMENT

8. **Assessment team in consultation with the agency contact points assigns priority to each of the framework features** identified in Table 1, taking into consideration the

scope of the assessment as determined by the identified aquaculture sectors (step 2) and regulatory areas of interest (step 3).

9. **Assessment team develops a questionnaire for each agency.** The questionnaire is developed based on the features of the audit table (Table 1) that are relevant to the identified areas of regulatory responsibility (step 3). For example, for framework feature #7 in Table 1, *Monitoring of farming activities in relation to ESD/EAA performance criteria*, the questionnaire could for example read:
  - i. *Does the agency have a program of monitoring farming activities in relation to ESD/EAA performance criteria?*
  - ii. *Is there a legal basis for undertaking the monitoring – if so, what is the relevant legislation?*
  - iii. *Are there documented operational procedures for conducting the monitoring?*
  - iv. *Does the agency have the operational capacity to undertake the monitoring (including for sample collection and laboratory testing)?*
  - v. *Does the agency have technical expertise to undertake the monitoring (including for sample collection and laboratory testing)?*
  - vi. *Does the agency have a system for ensuring that monitoring is undertaken routinely by the agency?*
10. **Assessment team sends the questionnaire to the agency contact points** with clear indication of timeframe for response.
11. **Assessment team collects, collates and summarises the information received from agencies into the audit table** with reference documentation appended as necessary. This should be an iterative process between the assessment team and the agency contact points, whereby the audit team would seek additional information and clarification on aspects of the responses to the questionnaire. For practical purposes of applying the tool, it is suggested that a separate audit table be developed for each government agency involved in regulating aquaculture within a jurisdiction (e.g. the department of fisheries or the department of environment). Similarly, depending on the intended scope of the assessment, a separate table could be

developed for each of the major aquaculture industry sectors of interest (e.g. marine cage culture, coastal shrimp farming or land-based abalone aquaculture).

12. **Assessment team sends the draft completed audit table/s to the agency contact points for comment**, with clear timeframe for response.
13. **Assessment team updates the audit table**, incorporating any input from agencies.

## ON-GROUND VERIFICATION

14. **Assessment team organises a program of on-ground verification visits** in consultation with agency contact points and industry/farmer representatives. The purpose of these visits is to make on-ground observations to verify the findings of the desk assessment.
15. **Assessment team conducts the on-ground verification visits.** The assessment team undertakes visits to agency headquarters and regional offices to sight evidence relating to each regulatory framework feature (for example, record keeping systems, documented operational procedures, laboratory facilities, testing records etc.) as relevant to each of the framework features and interviews agency staff about its regulatory systems to gather additional evidence. The visits should include formal entry and exit meetings so as to make clear the intent of the exercise, confirm the itinerary and logistical arrangements for the visits and the preliminary findings from observations made during the visits. The on-ground verification should include visits to farming operations to make observations and interview farmers about their knowledge of, and adherence to, regulatory requirements.

## REPORTING

16. **Assessment team updates the audit table based on observations made during the verification visits and drafts assessment report.** The assessment report includes an introduction and background to the assessment, details of the assessment scope, methodology and the assessment team and agency contact points. Based on the findings of the audit table, the draft report must clearly list the systems deficiencies (gap analysis) identified and make recommendations for further more detailed assessment and/or capacity building.

17. **Assessment team sends draft assessment report to agency contact points** for comment, with clear time frame for response.
18. **Assessment team finalises the assessment report**, incorporating the feedback from agencies and forwards the final report to all agency heads (copied to agency contact points as a minimum).

**Table 1.** Audit table for assessing regulatory frameworks for ESD/EAA-based aquaculture

FEATURE	PRIORITY	ASSESSMENT FINDINGS				
		Legal instruments	Standard operating procedures (SOPs)	Capacity (infrastructure/ resourcing)	Capability (expertise)	Implementation (application/ compliance monitoring/ enforcement)
<i>Environmental Impact Mitigation</i>						
1. <b>Authority to manage environmental impacts</b> of aquaculture based on ESD/EAA principles	H		Not applicable	Not applicable	Not applicable	Not applicable
2. Geographic are based management plans ( <b>aquaculture zones</b> ) for purposes of resource allocation— aquaculture zones established based on the biological <b>carrying capacity</b> of each management area and <b>environmental impact assessment</b> (EIA)	M					
3. Standardised <b>methodology for EIA</b> for zoning purposes, which includes consideration of biological carrying capacity, sensitive habitats and	M					

vulnerable species						
4. Controlled <b>allocation of sites</b> (or access to aquatic resources) based on ESD/EAA principles—aquaculture leases (site approvals) issued consistent with the <b>environmental performance targets</b> of the corresponding aquaculture zone	H					
5. ESD/EAA-based management of <b>farming activity</b> —aquaculture approvals granted based on <b>site specific EIA</b> , including consideration of biological carrying capacity, sensitive habitats and vulnerable species	H					
6. <b>Environmental risk management measures included as conditions of approval to farm</b> , e.g. discharge controls (settlement, screening, volume, timing, treatment), testing/monitoring discharge water, input controls—feed, chemical use, stocking limits etc.	H					
7. <b>Monitoring of farming activities – requirement for the farmer to routinely report on farming activities</b> —including reporting on environmental performance criteria such as level of production, feeding	H					

practices, water discharge levels/patterns, chemical use and wildlife interactions						
<b>8. System of evaluating farm reports</b> —including triggers for corrective actions	H					
<b>9. Monitoring of biotic/abiotic environmental changes</b> —aimed at detecting adverse environmental impacts, including analysis of limiting nutrients, sensitive habitats and vulnerable species	M					
<b><i>Socio-Economic Impacts and Benefits</i></b>						
<b>10. Authority to manage socio-economic impacts and benefits</b> of aquaculture based on ESD/EAA principles	H		Not applicable	Not applicable	Not applicable	Not applicable
<b>11. Aquaculture zones</b> established based on consideration of <b>socio-economic risks and benefits of aquaculture</b>	M					
<b>12. Standardised methodology for socio-economic risk/benefit assessment</b> —includes consideration of other uses/users of the aquatic resource such as recreational, commercial and subsistence fishing, boating/shipping and tourism	H					
<b>13. Controlled allocation of sites</b> (or	H					

access to aquatic resources) based on ESD/EAA principles— <b>site approvals</b> (aquaculture leases) issued consistent with the <b>socio-economic performance targets</b> of the corresponding aquaculture zone						
14. <b>Requirement for the farmer to routinely report on socio-economic performance</b> criteria such as production volumes and employment	H					
15. <b>System of evaluating farm reports</b> — including triggers for corrective actions	H					
<b><i>Food Safety and Quality</i></b>						
16. <b>Authority to manage farming activities that impact on food safety and quality</b> , up to and including harvest	H		Not applicable	Not applicable	Not applicable	Not applicable
17. <b>Control of farm inputs</b> that may pose a food safety hazard—including <b>water, feed, fertilisers</b> and other chemicals	H					
18. <b>Mechanisms to impose prohibition or withholding periods</b> for chemicals (e.g. therapeutics, anaesthetics) used on farmed organisms	H					
19. Inclusion of <b>chemical use in farm</b>	M					

reporting requirements						
20. System of evaluating farm reports—including triggers for corrective actions	M					
21. Residue testing of farmed animals	H					
22. Shellfish quality assurance programs—structured system for establishing, monitoring and managing the closure of growing areas based on shellfish quality risks, e.g. faecal coliforms, PSPs	H					
23. Whole of supply chain traceability systems—requirements for record keeping and traceability of farm inputs and products, that allows for and fits into a system of whole of supply chain traceability	M					
<b><i>Biosecurity - Pathogen Risk Management</i></b>						
24. Authority to manage aquatic animal and plant health	H		Not applicable	Not applicable	Not applicable	Not applicable
25. Biosecurity/animal health management considered in developing aquaculture zones—aquaculture zones are developed in line with jurisdictional aquatic animal/plant health management requirements/objectives	M					

26. <b>Farm level biosecurity plans—</b> minimum standards for farm biosecurity plans as a condition of approval to farm	M					
27. <b>Disease diagnostic and aquatic animal health advice services</b>	H					
28. <b>Risk analysis based controls on the transboundary movement of risk commodities, including live animals/plants, aquatic animal/plant products and farming equipment, including (as relevant) —</b>	H					
a. movement restrictions						
b. sourcing from disease free populations (zones, compartments, or countries)						
c. end-use controls for high risk commodities (e.g. feeding of aquatic animals to hatchery brood-stock)						
d. quarantine isolation/second-generation release						
e. health certification						
f. inspection for signs of						

disease						
g. pathogen testing						
h. treatment of animal or products (e.g. chemotherapeutants for live animals and heat treatment of products)						
<b>29. Farmer reporting on biosecurity performance criteria</b>	H					
<b>30. Disease monitoring and surveillance systems</b>	M					
<b>31. Emergency disease response systems</b> [eradication/containment, biological controls, physical/chemical controls, waste disposal, compensation]	L					
<b>32. Awareness building programs</b>	H					
<b><i>Biosecurity - Pest (Invasive Species) Risk Management</i></b>						
<b>33. Authority to manage pest risks</b>	M		Not applicable	Not applicable	Not applicable	Not applicable
<b>34. Pest risks considered in developing aquaculture zones</b> —aquaculture zones are developed in line with jurisdictional invasive species management requirements/objectives	M					
<b>35. Farm level biosecurity plans</b> —minimum standards for farm	M					

biosecurity plans as a condition of approval to farm						
<b>36. Pest identification services</b>	H					
<b>37. Risk analysis based controls on the transboundary movement of commodities that pose a pest risk, including live animals/plants and farming equipment, including (as relevant)—</b>	H					
a. movement restrictions						
b. inspections						
c. treatment of high risk vectors such as aquaculture equipment						
d. segregation/isolation						
e. pilot trials						
<b>38. Farm reporting systems</b>	M					
<b>39. Invasive species surveillance programs</b>	L					
<b>40. Invasive species emergency response systems</b> [eradication/containment, biological controls, physical/chemical controls]	L					
<b>41. Awareness building programs</b>	H					

***Biosecurity – Genetic Risk Management***

<b>42. Authority to manage genetic risks</b>	H		Not applicable	Not applicable	Not applicable	Not applicable
<b>43. Genetic risks considered in developing aquaculture zones</b> —aquaculture zones are developed in line with jurisdictional genetic risk management requirements/objectives	M					
<b>44. Farm level biosecurity plans</b> —minimum standards for farm biosecurity plans as a condition of approval to farm	L					
<b>45. Genetic analysis services</b>	H					
<b>46. Risk analysis based controls on the transboundary movement of commodities that pose a genetic risk, including live animals/plants, including (as relevant)—</b>	H					
a. movement restrictions						
b. inspections						
c. testing						
d. segregation/isolation						
e. pilot trials						
<b>47. Farm reporting systems</b>	M					

48. Genetic risk surveillance systems	L					
49. Emergency response systems [eradication/containment, physical/chemical controls]	L					
50. Awareness building programs	H					
<i>Animal Welfare</i>						
51. Authority to manage animal welfare	M		Not applicable	Not applicable	Not applicable	Not applicable
52. Requirement to meet animal welfare/husbandry standards	M					
53. Farm reporting on welfare performance criteria	M					
54. Awareness building programs	M					
<i>General requirements</i>						
55. Strategic aquaculture policy direction, vision and leadership	H					
56. Institutional framework/agency coordination/formal interagency linkages	H					
57. Human resources – general, including training and succession planning	H					
58. Financial resources – capital (e.g. accommodation facilities, vehicles)	H					

<p><b>59. Financial resources – operational</b> (e.g. salaries, travel, administration) [financing mechanisms including administered versus cost-recovered funding, licence/lease/permit fee charging mechanisms etc.)]</p>	H					
<p><b>60. System for allocating sites specific aquatic resources – e.g. leasing of marine sites or allocation of water rights</b></p>	H					
<p><b>61. System for approving site specific farming activity – e.g. licensing or permitting systems</b></p>	H					
<p><b>62. Systems for evidence based, consultative decision-making, including on resource allocation – e.g. advisory boards, stakeholder registers</b></p>	M					
<p><b>63. Governance systems, including for managing potential conflicts of interest</b></p>	H					
<p><b>64. Monitoring of international best practice and harmonising legislation and operational procedures as necessary.</b></p>	L					
<p><b>65. Information technology for management (interrogatable databases for leasing/licensing/reporting etc.)</b></p>	H					

66. Institutional mechanisms to accommodate <b>private-public partnerships</b>	L					
67. <b>Extension services</b>	M					
68. <b>R&amp;D capability/capacity and coordination</b>	L					

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