

Aquaculture Facility Certification

Mollusk Farms

Best Aquaculture Practices
Certification Standards, Guidelines



Community • Environment • Animal Welfare • Food Safety • Traceability



Mollusk Farms BAP Standards, Guidelines

BEST AQUACULTURE PRACTICES CERTIFICATION

The following Best Aquaculture Practices standards and guidelines apply to the culture of molluscan shellfish, including all species of bivalves, such as clams, cockles, geoducks, oysters, scallops, and mussels, but excluding grazing gastropods (whelks, abalone) for which the BAP Farm Standard applies instead. They also apply to other species, such as holothurian echinoderms, if they are reared in open waters and rely exclusively on natural productivity for their sustenance.

Culture methods can include direct sowing onto the seabed, or containerized or attached to structures on or above the seabed, both intertidally and subtidally. Shallow and deep water systems of over 5 meters depth may suspend mollusks from longlines, rafts or other floating structures. However, the scope of this standard does not include intensive or nursery culture systems that use raceways, ponds or tanks, on shore or floating, for which the BAP Farm Standard or the BAP Hatchery and Nursery Standard apply.

The BAP standards are achievable, science-based and continuously improved global performance standards for the aquaculture supply chain that assure healthful foods produced through environmentally and socially responsible means. They are designed to assist program applicants in performing self-assessments of the environmental and social impacts, and food safety controls of their facilities. BAP Standards lead to certification of compliance after verification of the applicant's facilities by BAP approved third-party certification bodies. For further information, please refer to the additional resources listed throughout this document.

BAP standards demand compliance with local regulations as the first step toward certification. However, not all regulations are equally rigorous. For this reason, BAP standards set out requirements for documentation and procedures that shall be in facility management plans, whether they are prescribed by local regulations or not. By so doing, they seek, where possible, to impose consistency in performance among facilities in different producing regions and to engage the industry as a whole in a process of continuous improvement.

In common with ISO usage, these standards use the words "shall" to mean compliance is required and "should" to mean compliance is recommended. Auditable points are "shall" statements listed at the end of each section.

The Certification Process

1. Program Management

Best Aquaculture Practices is a division of the Global Seafood Alliance (GSA), with offices headquartered in Portsmouth, New Hampshire, USA. Best Aquaculture Practices manages multiple GSA standards including the BAP Mollusk Farm Standard on behalf of the GSA.

To obtain BAP certification, applicant farms shall be audited by an independent, BAP-approved certification body (CB). To apply for certification, please contact:

Best Aquaculture Practices
85 New Hampshire Avenue, Suite 200
Portsmouth, NH 03801 USA
Tel: +1-603-317-5000
Email: bapcert@bapcertification.org
BAP Website: www.bapcertification.org
GSA Website: www.globalseafood.org

2. Self-Assessment

New applicant farms are expected to carry out a self-assessment against the Standard to ascertain their preparedness for a third-party CB audit.

3. Third-party CB Assessments

Once a self-assessment has been carried out by the farm and it is satisfied that all deficiencies identified have been rectified, they can proceed to Certification. To become certified, farms must be able to demonstrate compliance with this Standard, through an independent third-party on-site assessment by a GSA approved CB. The chosen CB will formulate an agreement between the farm

and the CB detailing the requirements and commitments needed from the farm.

New farms must be in operation for at least 3 months from commencing production to ensure that they can demonstrate full compliance to the Standard during the assessment.

4. Assessment Frequency

Audits to the BAP Mollusk Farm Standard are conducted at a frequency of once per annum. However, additional audits, re-audits, short notice, or unannounced audits shall also be conducted at the discretion of GSA and Certification Bodies where facility compliance concerns arise.

5. Duration of Assessments

The duration of an assessment is dependent on factors such as size of the operation/farm and number of personnel. In most cases the actual on-site audit duration for an individual farm facility is one full day. CBs are required to inform GSA-BAP where a deviation in audit duration is foreseen. The assessment format includes systems review and physical inspection of the site and production process. Time allocation during the assessment shall be such to provide sufficient and proportionate time for each activity to be carried out in full and where appropriate, additional time may be given when the auditor is required to carry out further investigation.

6. Audit Process (Figure 1)

All requirements in the Standard shall be addressed. As with other BAP standards, the audit against the BAP Mollusk Farm Standard will consist of elements listed in Figure 1 in accordance with ISO19011.

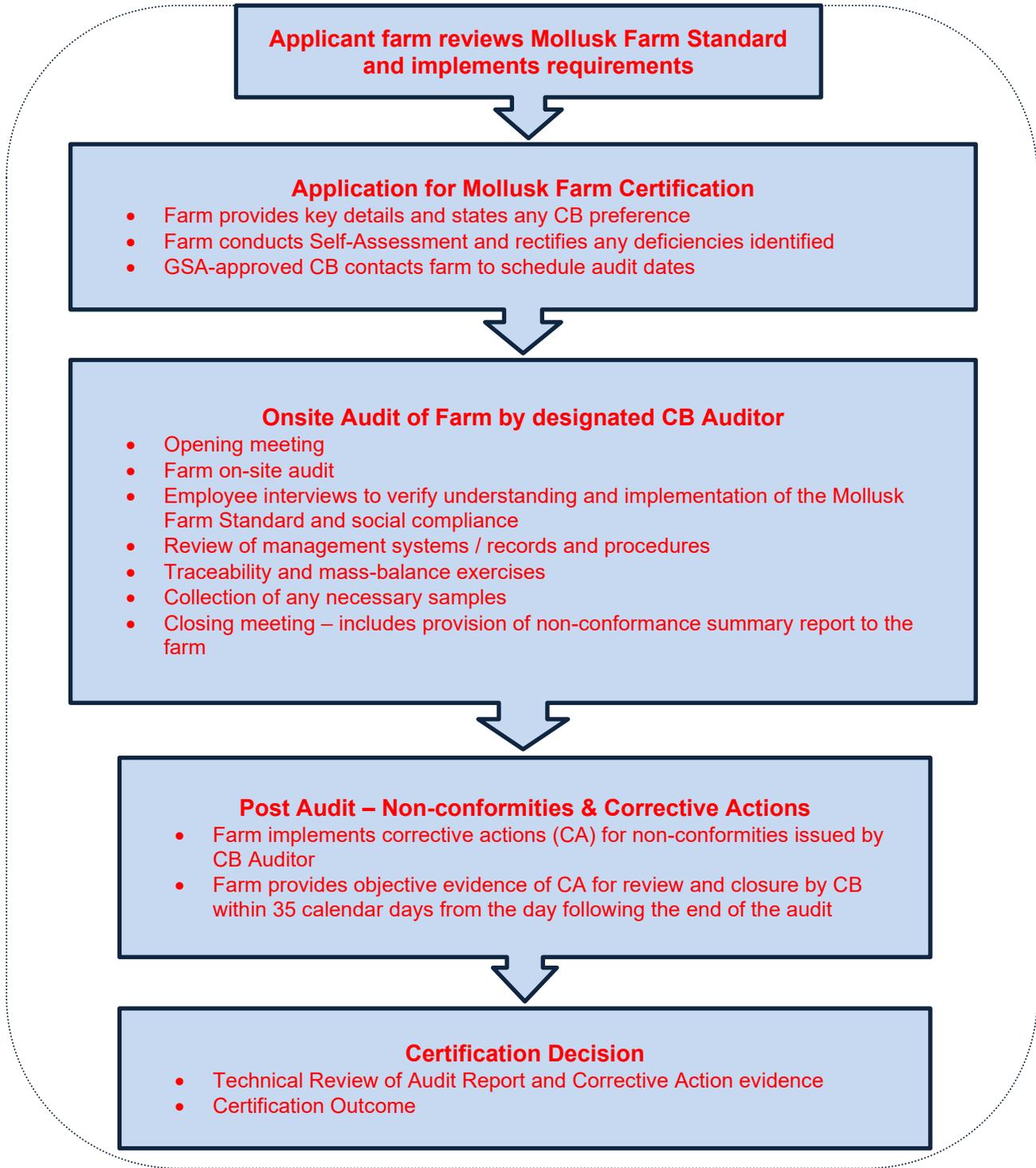


Figure 1. BAP Audit Process

7. Non-Conformities and Corrective Actions

Any non-conformity issued during the assessment will be recorded by the auditor as either:

NC Rating	Definition	Required Action
Critical	Where there is a critical failure to comply with a food safety and/or legal issue or a risk to the integrity of the scheme.	The auditor will immediately inform the Certification Body, who will inform the GSA-BAP office. Immediate temporary suspension may ensue pending clarifications and a re-audit may be necessary.
Major	Where there is a substantial failure to meet the requirements and/or intent of any clause in the Standard but there is no food safety risk and/or legal issue or immediate risk to the Integrity of the scheme. (Generally, policy)	Objective evidence verifying the proper implementation of corrective action and closing of non-conformities must be submitted to the Certification Body in accordance with GSA-BAP certification management rules.
Minor	Where absolute compliance with requirements and/or the intent of any clause in the Standard has not been demonstrated. The matter does not rise to the level of Major or Critical and tends to be lower risk issues or isolated instances rather than patterns. Not indicative of an overall breakdown in compliance and systems.	Objective evidence verifying the proper implementation of corrective actions and closure of non-conformities must be submitted to the Certification Body in accordance with GSA-BAP certification management rules.

At the closing meeting, the auditor shall present his/her findings and review all non-conformities that have been identified during the assessment but shall not make comment on the likely outcome of the assessment. A written summary of the non-conformities discussed at the closing meeting shall be agreed upon and signatures from the farm representative obtained. A copy of the non-conformity report must be left with the farm prior to the auditor departing the farm. The farm shall provide the CB, in accordance with GSA/BAP certification management rules, suitable and adequate objective evidence that corrective action has been implemented to rectify the non-conformity. This evidence shall also address root cause and future prevention. The evidence will be reviewed, and the CB will respond either confirming closure of the non-conformity or requesting further evidence. The farm must submit evidence to the CB in order to close out all non-conformities within 35 calendar days from the day following the end of the audit. Failure to close out non-conformities in the given timeframe will result in certification not being granted or continued, and facilities will be required to re-apply for a full assessment for certification.

8. Audit Reporting and the Certification Decision

The auditor will provide a full report of the assessment, including the details of any non-conformities issued. The auditor will submit the report to the CB. The report shall include brief statements of objective evidence of both conformity, and non-conformity.

The report shall follow the format specified by the GSA-BAP. The report shall be issued in accordance with the GSA-BAP Report Guidelines. Within the audit report there shall be a record of the duration of the assessment (expressed as hours) and any reason for the lengthening or shortening of the duration from that which is typical.

The audit report along with the corrective actions submitted by the farm will be evaluated by a Certification Committee of the CB, who will make the final certification decision post closure of all non-conformities. The timelines for audit, closure of non-conformities, technical review and certification decision are as specified in the GSA-BAP CB Requirements Document available on the GSA-BAP website. In order to achieve certification to the BAP Mollusk Farm Standard, the applicant farm must meet all of the requirements of the Standard.

BAP standards are developed by committees of technical experts following a process aligned to the FAO Technical Guidelines on Aquaculture Certification.

References:

<https://www.bapcertification.org/Standards>
<http://www.fao.org/3/a-i2296t.pdf>

Acknowledgements

An expert group, the BAP Mollusk Farm Standard Technical Committee, develops and endorses the Standard, with representatives

throughout the supply chain and interested parties including industry associations, processors, producers, regulators, non-governmental organizations and conformity assessment and standards experts. The GSA is grateful to the members of the Mollusk Farm Standard Technical Committee members who created the Standard and to other specialists that offered valuable input during the review process.

BAP Mollusk Farm Standard Technical Committee

Brian Kingzett (Chair), Centre for Shellfish Research, Nanaimo, BC, Canada
Paul Casburn, SAIGlobal, Ireland
Don Collier, Pacific Marine Farms, New Zealand
Liang Jun, Zhangzidao Fisheries Group, Dalian, China
Thuy Nguyen, Aquaculture Research Institute, Nha Trang, Vietnam
Marco Pinchot, Taylor Shellfish, Washington, USA
Mandy Pyke, Seafish, UK
Simone Suhnel, Federal University of Santa Catarina, Florianopolis, Brazil
Bill Walton, Auburn University, Alabama, USA
Satoshi Watanabe, National Research Institute of Aquaculture, Japan
Rowan Yearsley, Aquinion, South Africa
Ana Rubio Zuazo, The Select Oyster Company Pty, Sydney , Australia
Javier Unibaso Zuniga, AVS Chile S.A., Chile

Standard Version History

2013 – Mussel Farm Standard
2016 – Mollusk Farm Standard 1.0
2020 – Mollusk Farm Standard 1.1

Summary of Key Changes from Issue 1.0 to 1.1

The scope of the BAP Mollusk Farm Standard has been changed, removing “fed” species of mollusks (such as whelks and abalone), which will now be covered in the new BAP Farm Standard.

The scope of the BAP Mollusk Farm Standard now also includes extensively farmed holothurian echinoderms (sea cucumbers).

The scope of the BAP Mollusk Farm Standard does not include intensive land-based or floating growout or nursery systems in raceways, ponds, or tanks, which are covered by the respective BAP Farm or BAP Hatchery and Nursery Standards.

Section 11 (Environment - Fishmeal, Fish Oil and Kelp Conservation) from Issue 1.0 has been removed in its entirety, and what was Section 12 (Food Safety – Control of Potential Food Safety Hazards) in Issue 1.0 is now Section 11 in Issue 1.1, and what was Section 13 (Traceability – Record-Keeping Requirement) in Issue 1.0 is now Section 12 in Issue 1.1. Clauses have been renumbered accordingly.

1. Community

Property Rights and Regulatory Compliance

Aquaculture sites shall comply with local and national laws and environmental regulations and provide current documentation that demonstrates legal rights for land and seabed use, water use, construction, operation, food safety compliance and waste disposal.

Reasons for Standard

Regulations are needed to assure that cultivation sites provide pertinent information to governments and pay fees to support relevant programs. The BAP program requires compliance with applicable business-related laws and environmental, social and food safety regulations, including those concerning protection of sensitive habitats, effluents, operation of landfills and predator control, because it recognizes that not all governmental agencies have sufficient resources to effectively enforce laws.

Some mollusk cultivation sites and their support facilities may be sited in water bodies or on land to which cultivation site owners do not have sole legal rights. These areas may be used by coastal communities for fishing, recreation, tourism and other uses. Unauthorized installation of cultivation sites can interfere with the use of resources by local communities.

Implementation

Regulations regarding the operation and resource use of cultivation sites vary significantly from place to place. Among other requirements, such laws may call for:

- business licenses
- aquaculture licenses
- land deeds, leases or concession agreements
- land use taxes
- construction permits

- water use permits or leases
- waste and sewage water discharge permits and licenses
- predator control permits
- protection of sensitive habitats
- protection of the rights of native peoples
- environmental impact assessments
- vessel and dive operating licenses, permits and certifications.

BAP auditors cannot know all laws that apply to mollusk cultivation in all nations. Participating cultivation sites have the responsibility to obtain all necessary documentation for siting, constructing and operating their facilities, and make these available to auditors.

Assistance in determining these necessary permits and licenses can be sought from governmental agencies responsible for agriculture, environmental protection, fisheries and aquaculture, water management and transportation, as well as local aquaculture associations. BAP auditors must also become familiar with the legal requirements within the areas they service.

The BAP program imposes repeated audits of participating facilities. It augments existing regulations that may require aquaculture facilities to perform environmental impact assessments before beginning construction and comply with regulations during operation.

During the BAP site inspection, the representative of the cultivation site shall present all necessary documents to the auditor. Cultivation sites must be in compliance with the requirements stipulated by the documents. In cases where governmental agencies have waived one or more permits, or the need for compliance with existing permits, proof of these waivers shall be available.

Standards

- 1.1: Current documents shall be available to prove legal land, seabed and/or water use, where applicable.
- 1.2: Current documents shall be available to prove all business and operating licenses have been acquired.
- 1.3: Current documents shall be available to prove compliance with applicable environmental regulations for construction and operation.
- 1.4: Where applicable, current documents shall be available to prove compliance with laws protecting the resources of indigenous peoples and/or independent agreements the applicant may have made with them.
- 1.5: Where applicable, current documents shall be available to show compliance with the cultivation site's own regional industry codes of practice, if they exist.

2. Community

Community Relations

Cultivation sites shall strive for good community relations, conduct their businesses responsibly and be responsive to those affected by their operations.

Reasons for Standard

Aquaculture sites are often located in rural areas, where some individuals may rely on varied natural resources to supplement their livelihoods. Some local residents benefit from employment or infrastructure improvements associated with large-scale aquaculture development, but others may face limited access to areas used for fishing or recreation as a result of an aquaculture facility. Thus, it is intended that the BAP program will provide the framework to alleviate these difficulties to the extent that is practicable.

Implementation

Participants in the BAP program shall be good neighbors within local communities and cooperate with other rightful users of land and water to minimize conflicts. Cultivation

site managers are encouraged to communicate regularly with local leaders. They should also respond helpfully to public requests for information.

To the extent practical, access to cultivation sites shall be limited only to authorized persons, and signs shall be posted to identify possible safety hazards. However, traditional uses of natural resources shall be accommodated, to the extent practical, through cooperation with local interests to ensure the highest possible level of environmental stewardship.

During facility or farm site inspection, the auditor must verify compliance with the good neighbor standards through examination of maps that define public and private zones and concession areas; on-site inspection of fences and other barriers (e.g., marker buoys); and interviews with local people and cultivation site workers. The auditor should select the individuals for interview, rather than being provided a group of interviewees by cultivation site management. Through such interviews, auditors shall determine the helpfulness of the participant's responses.

Standards

- 2.1: The applicant shall demonstrate that the aquaculture facility does not prevent legal access to traditional fishing areas and other established public resources, except as permitted by law.
- 2.2: The applicant shall clearly identify all land-based aquaculture facility boundaries and post signs that warn the public and staff of potential safety hazards, where appropriate.
- 2.3: The applicant shall demonstrate interaction and communication with the local community in response to issues that arise.
- 2.4: The applicant shall demonstrate a process, including but not limited to written policies, to avoid or resolve conflicts – for example, through meetings, committees, correspondence, service projects or other activities. The applicant shall record all conflicts, steps taken to resolve them and outcomes.
- 2.5 : Where applicable, the applicant must demonstrate dialogue with local indigenous peoples and written policies and procedures for conflict resolution with them under the laws governing their rights. The applicant shall record all conflicts, steps taken to resolve them and outcomes.
- 2.6 : In residential locations, the applicant shall demonstrate that noise, on site and from vehicles entering and leaving the facility, and night lighting have been minimized to the greatest extent practicable.

3. Community

Worker Safety and Employee Relations

Cultivation sites shall comply with local and national labor laws, including those related to young and/or underage workers, to assure adequate worker safety, compensation and, where applicable, on-site living conditions.

Reasons for Standard

Cultivation site work is potentially dangerous because of the types of equipment employed and the nature of the work in and on water. Workers may not fully understand the risks at cultivation sites and safety instructions related to them.

Mollusk cultivation sites may be located in remote areas, requiring that staff live on site for periods to provide security and respond to emergencies. Conditions of employment for mollusk cultivation site employees or subcontracted workers must reflect these special demands, in addition to provision of fair wages, fair working hours and employee benefits according to national laws.

Implementation

At a minimum, the owners of certified cultivation sites shall provide legal wages, a safe working environment and adequate living conditions when it is required that workers live on the farm. Cultivation site management must demonstrate that the facility complies with national or local laws governing the rights and conditions of employment of cultivation site personnel, including casual labor and work by subcontractors.

Local and national laws notwithstanding, cultivation sites

shall comply with International Labour Organization conventions and standards regarding forced or bonded labor, and employment of workers under legal working age.

Safety equipment such as goggles, gloves, hard hats and life jackets shall be provided free of charge when appropriate and kept in working order. A plan shall be available for obtaining prompt medical assistance for injured or ill workers.

Mollusk cultivation operations that operate vessels shall comply with national laws governing the safety of commercial vessels. In the absence of national regulations, vessels shall be operated in compliance with the International Convention for the Safety of Life at Sea (SOLAS) regulations, where they apply. Cultivation site management shall ensure that all staff and crew hold the appropriate maritime qualifications to operate vessels used for cultivation operations.

For subcontractors who work at the cultivation site, the subcontracting companies or individuals shall provide documents to prove they are legally licensed or registered to work in the relevant jurisdiction.

During facility inspection, the auditor will evaluate whether conditions comply with labor laws. The auditor will also interview a random sample of workers to obtain their opinions about wages, safety and living conditions. Any discrepancies will be investigated.

Additional Information

International Maritime Organization Fishing Vessel Safety <http://www.imo.org/OurWork/Safety/Regulations/FishingVessels/Pages/Default.aspx>

Standards

- 3.1: The applicant shall meet or exceed the minimum wage rate and benefits required by local and national labor laws.
- 3.2: The applicant shall comply with national child labor laws regarding minimum working age or ILO Minimum Age Convention 138, whichever is higher. ILO Minimum Age Convention 138 states the minimum age shall be 15, unless local law in developing nations is set at 14 – in accordance with developing nations exceptions under this convention.
- 3.3: The employment of young workers above the minimum age but under 18 years old shall be in compliance with local laws, including required access to compulsory school attendance and any restrictions on hours and time of day.
- 3.4: Young workers above the minimum age but under 18 years old shall not be subjected to hazardous work that can compromise their health and safety.
- 3.5: All work, including overtime, must be voluntary. The facility shall not engage in any form of forced or bonded labor. This includes human trafficking, the holding of original identity papers, prohibiting workers from leaving the premises after their shift or other coercion intended to force anyone to work. Where the holding of original identity papers is required by national law, such papers must be immediately returned to employees upon request and readily available to them at all times.
- 3.6: The applicant shall abide by the national mandated work week, where applicable.
- 3.7: The applicant shall comply with national labor laws for pay, overtime and holiday compensation for hours worked beyond the regular workday or week.
- 3.8: The facility shall not require the payment of deposits, deduction from wages or withholding of pay that is not part of a legal contractual agreement with the employee and/or that is not provided for or permitted by national law. Deductions from wages and payments to employers or agents must be transparent.
- 3.9: The facility shall not make deductions from wages as part of a disciplinary process.
- 3.10: The applicant shall only employ legally documented workers, whether nationals or migrants. Retained records for all workers shall include a copy of photographic identity.

- 3.11: The facility shall maintain all relevant documents that verify any contracted/subcontracted workers, whether contracted through a labor service or otherwise, are paid in compliance with all local wage, hour and overtime laws.
- 3.12: All labor, recruiting or employment services used by the facility must be licensed to operate by the local or national government as a labor provider, where such provisions exist in law.
- 3.13: The facility shall maintain all relevant documents that verify piece workers (those paid a fixed "piece rate" for each unit produced or action performed, regardless of time) are paid in compliance with local law, including regulations regarding equivalence to or exceeding minimum requirements for wages, hours, overtime and holiday pay.
- 3.14: The facility shall provide to each worker, whether hourly, salaried, piece-rate, temporary, seasonal or otherwise, prior to hire and during employment, written and understandable information regarding the terms of employment, worker rights, benefits, compensation, hours expected, details of wages for each pay period and facility policies regarding disciplinary actions, grievance procedures, authorized deductions from pay and similar labor-related issues.
- 3.15: Where contracted/subcontracted or temporary workers are hired through a labor or employment service, the facility shall ensure that the labor or employment service provides the above information prior to and during hire, in appropriate languages, to ensure workers are aware of their rights and conditions of employment as described above.
- 3.16: Workers shall have the right to terminate their employment after reasonable notice.
- 3.17: The facility shall appoint a management person responsible for ensuring worker health, safety and training.
- 3.18: The facility shall identify and eliminate or minimize any workplace health and safety hazards by conducting a thorough risk assessment, which is reviewed and updated as needed. This includes a requirement for incident or accident investigation.
- 3.19: Workers shall have the right to collective bargaining, or at least one employee shall be elected by the workers to represent them to management.
- 3.20: There shall be a written worker grievance process, made available to all workers, that allows for the anonymous reporting of grievances to management without fear of retaliation.
- 3.21: The facility shall provide equal opportunity with respect to recruitment, compensation, access to training, promotion, termination and retirement, regardless of race, gender, pregnancy, age, sexual orientation or faith.
- 3.22: The facility shall treat workers with respect and not engage in or permit physical, verbal or sexual abuse, bullying or harassment.
- 3.23: If provided, employee housing shall meet local and national standards (e.g., water-tight structures, adequate space, heating/ventilation/cooling), and shall be free of accumulated trash and garbage.
- 3.24: Safe drinking water shall be readily available to employees. If meals are provided, they shall be wholesome and commensurate with local eating customs.
- 3.25: Toilets and hand-washing facilities shall be available to employees.
- 3.26: In the event of accidents or emergencies, the applicant shall provide basic medical care, including access to or communication with medical authorities. Additionally, first aid kits shall be readily available to employees, and any expired content shall be replaced.
- 3.27: The applicant shall provide appropriate training to employees in general health, personal hygiene and safety (including onshore as well as aquatic safety and the use of boats and associated equipment) and product contamination risks. Safety procedures must be understood by all of the workforce.
- 3.28: Emergency response plans shall be prepared as appropriate based on regional and site-specific risks. These may include natural disasters, serious illnesses or accidents.
- 3.29: Select workers shall be made familiar with details in emergency response plans and trained in the first aid of electrical shock, profuse bleeding, drowning and other possible medical emergencies.
- 3.30: Protective gear and equipment in good working order shall be provided for employees (e.g., eye protection for welding, gloves for shop work, boots for wet areas). Auditor to verify deployment.
- 3.31: All electrical and mechanical tools and machinery shall be maintained and used according to manufacturers' recommendations and national advisory and legislative standards. Machinery shall have proper driveshaft and/or drive belt safety guards.
- 3.32: The applicant shall comply with laws that govern diving on aquaculture farms and develop a written dive safety plan that requires only divers trained to national or international commercial standards are used and the maintenance of logs that document procedures, safety-related incidents and equipment maintenance. Limits for time under water shall be established and monitored.
- 3.33: The applicant shall provide written procedures and staff training for handling diving emergencies and regularly audit records and procedures. The emergency response plan shall include provisions for access to appropriate equipment.
- 3.34: Boat operations shall be safe and licensed as appropriate.

4. Environment

Production Carrying Capacity

Cultivation sites shall be of an appropriate scale and operated so they do not exceed the production carrying capacity of the water body or disrupt the ecosystem's natural function and ability to support existing communities.

Reasons for Standard

Bivalve mollusks are efficient filter feeders. Where they are cultivated in high densities, there is potential for the production carrying capacity (PCC) of the water body to be exceeded. The risk of this is higher in enclosed water bodies such as estuaries and embayments, and where the stocks of natural and cultivated bivalve molluscan shellfish are relatively high.

If the rate at which phytoplankton is removed by the shellfish exceeds the rate at which the ecosystem refreshes the supply – whether by tidal flushing or primary production in situ – the reduced availability of food can have a negative impact on the growth and health of shellfish and other organisms.

Aside from ecosystem-level effects, which are likely to be experienced under a limited set of circumstances, high stocking densities can be detrimental on a local scale, which has implications for growth rates and yield within the mollusk cultivation site.

Background

Production carrying capacity is a fundamental component of sustainability in bivalve culture. It is thus integral to any management and regulatory regime applied to bivalve farming. Although conceptually simple, PCC is difficult to measure in practice and thus challenging to implement according to an auditable standard.

Because bivalves are suspension feeders dependent on waterborne delivery of food (largely phytoplankton), high-density culture can result in food limitation and thus reduced bivalve growth. In the scientific literature, this phenomenon is referred to as seston depletion. For this reason, PCC defined by food limitation is an indicator of sustainability. However, phytoplankton is the base of the trophic web, and a PCC definition derived from chlorophyll is also an ecosystem wide indicator of sustainability. This ecosystem aspect is a rare but highly desired quality in potential standards.

Although chlorophyll is technically practical to measure in coastal waters, seston depletion occurs over large spatial scales for intermittent time periods and is impractical to document, even in research programs. Simulation modelling has been successfully applied to seston depletion but is too complex for routine use in an aquaculture standard.

Instead, the growth trajectory of cultured animals provides a direct, sensitive and reliable approach to assessing food limitation in bivalves. Bivalve growth integrates the effects of changing environmental conditions over time, such as intermittent periods of food limitation, and consequently summarizes the performance in the long term. In short, reduced food availability results in reduced bivalve growth, which can be quantified.

Implementation

Cultivation sites are usually located in water bodies known to support high rates of growth for bivalves. Depending on local management, there may be a predefined limit to the area available for cultivation based on what is known about the productivity and food availability for bivalve shellfish locally.

There may also be existing monitoring programs to collect physical, chemical and biological data, which can be used to ensure that mollusk cultivation sites do not have a measurable effect on the wider ecosystem or water body. However, some monitoring should also take place at the local cultivation site level. Regulatory programs within relevant jurisdictions may address production carrying capacity by setting science-based area or farm production limits to prevent the exceeding of potentially limiting production levels.

When previous regulatory programs, zonal management or third-party studies, or pre-existing environmental impact assessments do not take production carrying capacity into account, the standard of review will be based on a monitoring approach consisting of the following components:

- regular sampling of shell length and tissue weight, and/or condition index at farm sites
- establishment of reference sites for similar measurements
- verified (georeferenced) sample location information.

Since different methods or combinations of methods may be required by different jurisdictions, no preferred method is specified in the BAP standards, only that whatever method is used shall be undertaken using methods of sampling and analysis that conform to generally accepted international standards. GSA and stakeholder partners are developing new global standards for Area Management that will extend to monitoring programs and sampling methods.

All applicants for BAP certification shall:

- For established farms, provide evidence of responsible practices in setting stocking densities appropriate to local conditions for a period of at least three years prior to application or for as long as the cultivation site has been in operation.
- Demonstrate via records that growth rate and meat yield are taken into account when setting stocking density for mollusks and in general husbandry practices at the cultivation site.

Either the applicant shall comply with one or more of the following:

- Show evidence (e.g., pre-existing research on carrying capacity modeling) that the total cultivation effort within the water body does not exceed the production carrying capacity of that water body. This evidence shall be provided to and verified by GSA or an agreed independent reviewer.
- Demonstrate a suitable monitoring and/or regulatory regime, and/or zonal management program is in place to ensure future levels of cultivation do not exceed the production carrying capacity of the water body.

Or the applicant shall write and implement a monitoring plan for the cultivation site to:

- Conduct a monitoring program, including regular sampling of shell length and tissue weight, and/or

condition index at farm sites, and establish and monitor a reference site as per established protocols or those developed in GSA Area Management standards.

- Maintain stocking densities within the farm site to maintain more than 70 percent of the monitored variable (shell length and tissue weight and/or condition index) at the reference site for a minimum of three culture cycles prior to application or for as long as the site has been in operation, if less than three culture cycles.
- Produce a management plan that describes the corrective or collaborative actions to be taken when production carrying capacity at the farm or ecosystem level is exceeded.

If, by reference to the reference sites, it is clear that external factors are responsible for changes in PCC rather than cultivation activity, then this should be reflected in the management plan. In anticipation of more rigorous data collection, it is expected that farmers will collect data on stocking density and production levels from the time they apply for certification.

Standards

Either

4.1: The applicant shall provide evidence of local regulation or scientific evidence that cultivation operations do not and will not exceed the production carrying capacity of the water body, alone or in combination with other cultivation operations, based on regulatory limits or prior research as specified in the implementation requirements. The supporting evidence shall be provided to and verified by auditor or an agreed independent reviewer.

Or

- 4.2.1: For established cultivation sites, the applicant shall provide evidence of responsible practices in setting stocking densities appropriate to local conditions, including biological measurements of growth rate and/or meat yield, during a period of at least three culture cycles prior to application, or for as long as the cultivation site has been in operation, if for less than three cycles.
- 4.2.2: The applicant shall conduct regular sampling of shell length and tissue weight, and/or condition index or other relevant growth variables at farm sites, and this value shall not be less than 70 percent of the respective metric at a reference site for a minimum of three culture cycles prior to application or for as long as the site has been in operation.
- 4.2.3: The applicant shall produce a management plan that describes the corrective or collaborative actions to be taken when production carrying capacity at the farm or ecosystem level is exceeded.

Additional Information

Modelling Carrying Capacity of Bivalve Aquaculture: A Review of Definitions and Methods

Canadian Science Advisory Secretariat (CSAS) Research Document

R. Filgueira, L. A. Comeau, T. Guyondet – 2015

http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2015/2015_002-eng.pdf

Review of Recent Carrying Capacity Models for Bivalve Culture, Recommendations for Research and Management

Aquaculture, Volume 261:2 2, 24, pp. 451-462, ISSN

C. W. McKindsey, H. Thetmeyer, T. Landry, W. Silvert – 2006

Farm Aquaculture Resource Management

Web-based modeling resource to gauge

aquaculture sustainability

<http://www.farmscale.org>

An Overview of Factors Affecting the Carrying Capacity of Coastal Embayments for Mussel Culture

National Institute of Water and Atmospheric Research Ltd.

report for the New Zealand Ministry for the Environment

Graeme J. Inglis, Barbara J. Hayden, Alex H. Ross – 2000

<http://www.aqua.stir.ac.uk/public/GISAP/pdfs/NIWA.pdf>

5. Environment

Wild and Hatchery Seed Supply

The collection of wild mollusk larvae, seed or juveniles, or the purchase of seed or stock for growout from third parties whose seed is sourced from wild stocks shall be carried out with the aim of ensuring that the level of removal of wild seed is sustainable, and the collection or harvest method is environmentally sensitive. The translocation of seed mollusks from hatchery- or wild-derived stocks must also avoid the importation or spread of alien invasive or pest species.

Reasons for Standard

The use of shellfish hatcheries is increasing, and with it comes the ability to ship larvae and juveniles of various species among both countries and continents. In the past, this has had serious consequences involving disease introductions, such as the disease impacts related to the *Bonamia ostreae* oyster parasite into Europe, presumably with oyster seed. The movement of oyster herpes virus is an example of a significant present risk.

While some regions have developed successful hatchery production of mollusk seed, and ongoing research promises continued advances in seed production, most mollusk aquaculture is still currently dependent on the availability and utilization of wild mollusk seed for both seabed and suspended culture. Some regions have developed techniques for the rearing of seed but are still dependent upon the harvesting of wild broodstock as the source of the larvae.

Unregulated and unsustainable harvesting of wild seed or broodstock from shellfish beds risks future depletion of mollusk stocks and a consequent decline of the broodstock needed to ensure further seed production. These mollusk stocks may also provide a food source for other animals, such as birds, fish and other predators, either directly or in the role they play in providing a habitat and refuge for other marine organisms.

Harvesting of wild seed or broodstock from permanent mollusk beds should therefore be carried out in a way that is sustainable and with harvesting techniques and equipment that are environmentally sensitive. Alternative sources of mollusk seed, the harvest from which is generally considered environmentally sustainable, are ephemeral beds, collection of planktonic juveniles through the deployment of settlement collectors or hatchery-produced seed.

Hatchery production can also potentially alter genetic diversity in native populations by introducing genetic material from other regions within the species or by amplifying certain genetic groups through selective breeding.

Translocation of molluscan shellfish has in the past been implicated in the introduction or spread of alien invasive and other pest species, as well as biotoxins and diseases that pose a threat to commercial shellfish species, wild mollusk populations and the wider marine environment. Therefore, when moving mollusk broodstock or seed, care must be

exercised to ensure that unwanted organisms are not transported to water bodies where they are not already present.

Implementation

Many species are now being produced from hatchery seed, and this is expected to increase in the future. The aim of the BAP program is to promote hatchery-based aquaculture while ensuring that the movement of hatchery stocks does not transmit diseases or pests or have negative impacts on the genetics of wild populations. If wild mollusk seed is used in preference to hatchery seed, this must be for justifiable reasons. For example, if there is no local availability of hatchery seed, if there are significant disease or genetic impact risks associated with bringing in hatchery seed, or if the supplies of wild seed are derived from demonstrably sustainable, wild stocks.

In order for a cultivation site to prove that its mollusk seed supply originates from a sustainable source or is free from alien invasive species, diseases or parasites, it is important that any seed movements into or leaving the cultivation site have sufficient documentation to describe or fulfill the following:

- The name and contact details of the harvester or producer of the mollusk broodstock or seed.
- The geographic location of the mollusk stocks or facility from which the broodstock, seed or juvenile mollusks were produced.
- The name, reference or any other identification mark of any vessels used in harvesting wild mollusks, together with relevant contact details.
- A description of the type of collection method used in harvesting the wild broodstock or seed mollusks.
- A copy of any regulatory documentation required under applicable national legislation concerning the harvest or collection of wild mollusks.
- A copy of any regulatory documentation showing that seed has been transported and imported as required under applicable national legislation concerning hatchery-produced seed.
- Seed mollusk supplies shall only be obtained from facilities that do not contain diseases or parasites that could result in the infection of cultivation areas or affect a cultivation site's biosecurity plan or status.
- Where legislation does not apply, hatchery seed moving between biological regions must have documentation of a high health program at the originating hatchery that includes monitoring for OIE-reportable shellfish diseases.
- Where legislation does not apply, efforts to address genetic concerns specific to species and geographic regions where the seed will be out-planted must be documented.

To prevent any introduction or spread of alien invasive or pest species to a cultivation site, observations of previously unknown marine species in/on stocks of mollusks brought into the cultivation site shall be monitored. All shellfish health and movement documentation shall be securely stored.

Additional Information

ICES Code of Practice on the Introductions and Transfers of Marine Organisms 2005

International Council for the Exploration of the Sea <http://www.ices.dk/publications/Documents/Miscellaneous%20pubs/ICES%20Code%20of%20Practice.pdf>

Standards

- 5.1: The applicant shall designate a trained staff member to oversee and authorize all movements of broodstock, seed or juvenile mollusks into and out of the cultivation site.
- 5.2: The designated staff member shall ensure compliance with all legal requirements for shellfish movements and reporting of any notifiable alien invasive or pest species. (See also Section 9.)
- 5.3: The applicant shall maintain current, accurate records of all seed mollusk movements into and out of the cultivation site to ensure full traceability and to demonstrate compliance with any regulations related to the transport of hatchery-produced seed and the wild harvest or collection of broodstock or seed.
- 5.4: Where not covered by legislation, the applicant will provide documentation that hatchery-produced seed from other oceanographic bioregions comes from facilities with health-monitoring programs that take into consideration enzootic pathogens, notifiable organisms and OIE-listed pathogens; and the seed can be demonstrated to be of equivalent or higher health status than that of the receiving area.
- 5.5: The applicant shall have written procedures and proof of their implementation for the control of alien invasive species that includes monitoring for any previously unknown marine species in or on mollusk stocks. (See also Section 9.)
- 5.6: The applicant shall train staff in applying monitoring procedures.
- 5.7: Seedstock shall not be accepted on site from any supply originating in or passing through a facility or area under restriction for official disease management reasons, except where the competent authority has approved appropriate risk mitigation techniques that may be applied.
- 5.8: Where legislation does not apply, the applicant shall document efforts to address genetic concerns particular to the species and geographic regions where the seed will be planted.
- 5.9: If wild mollusk seed is used in preference to hatchery seed, valid justifications shall be provided.
- 5.10 : For the collection of wild seed, in the absence of appropriately targeted regulations, a control plan shall be drawn up and implemented to minimize any detrimental impacts on wild target and non-target mollusk populations and on the wider ecosystem. The plan shall encompass any environmentally damaging collection practices.

6. Environment Sediment Effects

Cultivation areas shall be located and operated so that they minimize negative impacts on sediment quality and the benthic community, and that any effects are localized and at an acceptable level for the receiving environment.

Reasons for Standard

Mollusk cultivation areas have the potential to cause environmental harm due to sediment accumulation under sea-based cultivation sites or at the effluent outfall of land-based cultivation sites. The causes include fall off of pseudofeces, feces, dead mollusks and accretion of fine sediment. In addition, the presence of the aquaculture facility can change the hydrodynamic conditions and result in a change in sediment characteristics in the immediate vicinity of the facility.

The addition of substrates such as shells, raking the seabed to remove silt and increase settlement areas, and other practices can also affect sediment composition. These changes may constitute a physical alteration in the biotope, particularly when compounded by the deposition of shells or live mollusks underneath a suspended culture plot.

Culture activities associated with seabed preparation, predator removal or harvesting activities (including mechanical or hydraulic dredging, trawling, suction or water jetting) can result in sediment plumes that accumulate or affect critical habitats. These plumes can extend outside site boundaries.

Additionally, the accumulation of organic matter has potential implications for benthic biodiversity due to related effects, including oxygen depletion and increased levels of hydrogen sulfide. Where shell is deposited, the change in texture of the seabed can represent a habitat alteration with implications for enhancements or declines in species richness and diversity.

The occurrence or severity of these effects varies greatly among locations and regions depending on local tidal geography, benthic ecology and the size of the mollusk cultivation site. Although biological effects can be measured, sediment monitoring is the most practical means of detecting change.

Implementation

Cultivation areas are usually located following a hydrographic, biological and physical study of the site to determine that cultivation operations shall not have significant negative impacts on animal populations that comprise the benthos under or near the cultivation site.

Generally, the location of a cultivation site is the most significant step in determining and mitigating its ecological impact. Local regulations can require consideration of the effects of tides and currents on the dispersal of sediment. Additionally, site selection can be required to be based on the similarity of the existing environment, such as favoring muddy habitats over sandy seabed.

When a cultivation site is in operation, maintenance and husbandry practices can limit the effects of deposition. At some cultivation sites, regular cleaning or dredging of the seabed under suspended culture plots has been undertaken to remove empty shells and disperse or remove the built-up mud and pseudofeces with the aim of maintaining the

sediment characteristics of the original habitat.

Allowable benthic impacts may be set as conditions in the operating permits for the cultivation site, often defined in terms of one or more of several chemical properties of the sediments. Sometimes these are then correlated with species density and diversity determinations, which are based on prior knowledge of local sediment biology or analysis of sediment reference samples collected from the cultivation site location.

Because biological sampling of sediments requires special expertise and is time-consuming and expensive, chemical sediment properties are usually used as leading indicators of sediment condition. Biological sampling is only required in some jurisdictions if an indicator trigger point is exceeded. Chemical indicators used for this purpose include sulfide, REDOX potential, total organic carbon or total volatile solids, or visual inspection with documentation by video. Some methods are better suited to some environments than others.

In general, it can be assumed there will be some level of change to the benthic environment within the immediate footprint of a cultivation site. Local regulations regarding monitoring of within-site effects – and what might be deemed “acceptable” levels of effect – shall be followed. A basic requirement of sediment sampling should be an attempt to monitor effects outside the cultivation site, perhaps comparing near-field and far-field effects upstream and downstream.

Since different methods or combinations of methods may be required by different jurisdictions based on local hydrographic or benthic conditions, no preferred method is specified in the BAP standards, only that whatever method is used shall be undertaken using standard methods of sampling and analysis that conform to generally accepted international standards.

Additional Information

FAO Fisheries and Aquaculture Department Fact Sheets
<http://www.fao.org/fishery/culturedspecies/search/en>

Environmental Code of Practice for the Sustainable Management of Western Australia’s Mussel and Oyster Aquaculture Industries

Aquaculture Council of Western Australia
http://www.aquaculturecouncilwa.com/files/5314/0462/7621/06-07-2014_1420_241.pdf

Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples

Puget Sound Estuary Program – 1997
<http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=4CA111D2A631C5F61498F47B7F475FC6?doi=10.1.1.296.5819&rep=rep1&type=pdf>

Standards

- 6.1: Applicants for BAP certification shall produce a background report that describes hydrographic and benthic conditions at the cultivation site and notes any local standards for benthic impacts underneath and adjacent to mollusk cultivation areas.
- 6.2: In countries or regions where sediment monitoring is required with respect to mollusk cultivation, applicants shall demonstrate a history of compliance for two years or two production cycles for established farms, whichever is longer, with any statutory monitoring schemes or best practice initiatives deemed appropriate by local or national regulators.
- 6.3: In countries or regions where sediment monitoring is not required, and where the background site report identified the potential for significant local impacts, applicants shall nominate an independent individual or company with demonstrated expertise in sediment sampling and analysis to design a sediment sampling and analysis program appropriate to the cultivation site conditions and to conduct sediment monitoring. The program shall define appropriate environmental quality standards and actions to mitigate impacts if these are exceeded.
- 6.4: In countries or regions where sediment monitoring is not required, and where the background site report identified the potential for significant local impacts, applicants shall conduct sediment sampling at time intervals and at a spatial scale appropriate both to the cultivation and harvesting methods, and the local geography of the cultivation site according to the sediment-sampling program recommended by the individual or company in Standard 6.3.
- 6.5: Monitoring of sediment conditions shall be undertaken according to the requirements of the cultivation site's operating permits or its own plan in countries or regions where sediment monitoring is not required, and as specified in the implementation requirements.
- 6.6: Sediment sampling and analysis performed as part of any monitoring program shall be conducted using methods that conform to generally accepted international standards.
- 6.7: The applicant shall adopt any suitable husbandry measures or local best practices available to mitigate potential negative sediment impacts from mollusk cultivation as assessed by and agreed to by local or national regulators, as appropriate.
- 6.8: In cases where significant adverse impacts are identified by the sediment-monitoring program, the applicant shall adopt corrective actions.

7. Environment

Predator and Wildlife Interactions

Mollusk cultivation sites shall manage physical interactions with wildlife and not negatively impact the biodiversity of adjacent ecosystems.

Reasons for Standard

Mollusk cultivation is carried out in a range of coastal habitats ranging from coastal lands, intertidal shallows, shallow soft sediments along the open coast and sheltered estuaries to deep-water fjords and rias. While mollusk culture operations contribute a variety of ecosystem services, including habitat generation, they can shift species abundance and diversity.

Wildlife species that interact with mollusk cultivation sites include, but are not limited to, diving ducks that feed on mollusks, piscivorous (fish-eating) and wading birds, invertebrate predators (e.g., cephalopods, sea stars, crabs, gastropods) and fish predators (e.g., species of the Sparid and Myliobatidae families), and fish species that aggregate around cultivation site structures. Wild species can be attracted to mollusk cultivation sites and associated structures as a source of food or for refuge or spawning, and others may be displaced through disturbance.

Physical impacts on the seabed (digging, suction, trawling or compaction from intertidal machinery) or the removal of equipment and stock can affect the eggs and larvae of marine species. Processes such as shading, sedimentation, trampling or prop wash can affect important associated wildlife habitats, such as sea grass beds and other submerged aquatic vegetation. Exclusion or control of predators can reduce food availability, result in entanglement or have lethal impacts on predators.

Mollusk cultivation can have a variety of potential effects on wild species and affect wider ecosystem biodiversity. Specific interactions with the environment, such as carrying capacity and seabed nitrification, are addressed in Sections 5 and 6. Many interactions with wildlife are harmless, but in some cases, they can injure wildlife through entanglement and drowning, or damage by cultivation equipment.

Wildlife in areas designated as “critical” or “sensitive” habitat can be particularly vulnerable to adverse interactions. Mollusk cultivation sites may be required to adopt special precautions if they are permitted to locate in such an area.

Implementation

Applicants shall implement a written Wildlife Interaction Plan (WIP) that includes provisions stipulated in local laws and the cultivation site’s operating permits. The WIP shall highlight specific points of concern or ecological sensitivity, and itemize policies and procedures that the cultivation site will follow to accomplish the goal of avoiding harm to wildlife while protecting the mollusk crop and cultivation site infrastructure.

All marine mammals, seabirds and species listed as “critically endangered” or “endangered” in the International Union for Conservation of Nature (IUCN) Red List or protected by local or national laws shall not be subject to control by any means except physical exclusion, unless human safety is at risk or an independent environmental audit provides justification for such control, and specific written permission for an alternative means of control has

been granted by the regulator with jurisdiction.

The WIP shall include but not be limited to:

- A list of relevant local laws and specific conditions of the cultivation site’s operating permits that apply to wildlife management and protection.
- Identification of farm area by maps and coordinates.
- Mapping of culture areas indicating areas of critical habitats, e.g., protected submerged aquatic vegetation and other essential fish habitat.
- Establishment of critical habitat buffers appropriate to site, critical habitats and environmental conditions, including depth off seabed for floating operations.
- Written protocols for nuisance species management, with inventory of existing problems.
- Monitoring as applicable for predator control methods, maintenance of structures and critical temporal events such as spawning and migration.
- Responsible disposal of removed predators.
- Use, when possible, of devices to lessen the effects of nuisance species (predator protection devices, fencing, etc.) or tactics such as fresh or saline water dipping, spraying, rinsing or dropping longlines infested with unwanted co-species.
- Use of best practices with appropriate mechanical harvesting devices such as dredges and mechanical diggers to lessen impacts on benthos.
- Conducting of harvest, seeding and culture activities to avoid conflicts with documented critical habitats (e.g., sedimentation when dredge harvesting).
- Allowance, when possible, for mobile organisms released in the marine environment during harvest operations.
- Periodic updates to reflect current science, regulations and recommendations.
- Formal Environmental Impact Assessment for any application of chemical herbicides and pesticides – typically covered in permits – with mitigation undertaken where negative effects are determined.
- A list, if applicable, of local species classified as endangered or threatened under local laws and/or listed as “critically endangered” or “endangered” on the IUCN Red List.
- Staff training and proactive searching for information and surveys on endangered or threatened species in the vicinity of the farm.
- A report produced or reviewed by an appropriate third party that demonstrates, in the expert’s opinion (given without liability), the cultivation site does not or will not have a significant detrimental effect on the habitats of IUCN Red-Listed species (as above) at current or proposed production levels.

Additional Information

International Union for Conservation of Nature Red List of Threatened Species

<http://www.iucnredlist.org>

Towards Safe and Effective Use of Chemicals in Coastal Aquaculture

Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection Reports and Studies No. 65
Food and Agriculture Organization of the United Nations – 1997

<ftp://ftp.fao.org/docrep/fao/003/w6435e/w6435e00.pdf>

Standards

- 7.1: If the mollusk cultivation site operates in a jurisdiction with government regulations related to interactions with wildlife and predator control, the applicant shall comply with the regulations. Proof of compliance may include a certification and/or official letter from the governing body.
- 7.2: Local rules notwithstanding, the applicant shall have a written Wildlife Interaction Plan consistent with the implementation requirements above and that complies with the procedural, performance and reporting requirements therein.
- 7.3: If the cultivation site operates in a jurisdiction without government regulations related to interactions with wildlife and predator control, the WIP shall provide an impact assessment that the site will not have a significant negative impact on the local wildlife, if operated correctly. This opinion shall be verified by reference to WIP monitoring results, where appropriate, at the next audit.
- 7.4: The facility shall use humane methods of predator deterrence and actively favor non-lethal control methods. Where applicable, government permits for predator control shall be made available for review.
- 7.5: The facility shall maintain a list of species that occur within the vicinity of the farm that are classified as endangered or threatened under regional laws and/or the IUCN Red List.
- 7.6: Except in exceptional circumstances, such as risk to human life, no controls other than non-lethal exclusion shall be applied to predator species listed as endangered or critically endangered on the IUCN Red List or protected by local or national laws.
- 7.7: The facility shall record and report, where required, the species and numbers of all avian, mammalian and reptilian mortalities.
- 7.8: Farm employees shall be familiar with the provisions of the WIP and trained in aspects of it that they may be called upon to implement. Specific members of staff designated to carry out lethal control measures on vertebrate predators shall be trained in humane slaughter methods.
- 7.9: The applicant shall provide a list of relevant local laws and specific conditions of operating permits that apply to wildlife management and protection.
- 7.10 : Marine sites shall retain maps that identify ecologically sensitive areas (ESAs) in the region, including but not limited to officially designated critical habitat areas. Staff shall be made aware of appropriate measures for operating in and adjacent to these areas.
- 7.11 : Documents shall be available that describe the passive measures in place to deter would-be predators and procedures for the routine inspection and maintenance of the measures.
- 7.12 : Documents shall be available to show that any active but non-lethal deterrent measures used are approved by regulators through a review of environmental impacts with specific reference to endangered, protected or cetacean species in the area. Such devices shall not be deployed if the review shows they can adversely affect these species.

8. Environment

Storage and Disposal of Supplies

Fuel, lubricants and chemicals shall be stored and disposed of in a safe and responsible manner. Paper, plastic, shells and other refuse shall be disposed of in a sanitary and responsible way. Human waste and cleaning process water shall be disposed of in a sanitary and responsible way.

Reasons for Standard

Mollusk cultivation sites use fuel, oil and grease to power and lubricate vessels, and other mechanical devices. Some cultivation sites, particularly those employing vessels, may use antifoulants. Other products employed include paints, disinfectants and detergents.

Fuels and other chemicals are highly flammable and/or explosive, and antifoulants can be toxic. They shall therefore be considered potential hazards to workers and the environment. Spills or careless disposal of petroleum products and chemicals can affect aquatic organisms and other wildlife in the immediate vicinity, and result in water pollution over a wider area.

Cultivation sites generate waste that can cause pollution, odors and human health hazards when not disposed of properly. Human food scraps, dead mollusks and other organic waste can attract scavengers. Empty plastic bags and other containers used in cultivation site operations do not decompose quickly. They can be a hazard to animals that become entangled in them or ingest them.

An environmentally friendly approach shall be taken to dispose of waste material, including synthetic waste (e.g., polypropylene rope, flats, marker poles, nets, cages, trays), concrete dead weights, etc.

These wastes may be stored prior to disposal at a land base from which the cultivation site is supplied, as well as transported on boats and barges to and from the cultivation site. Safe, responsible transport, storage, handling and disposal of these materials are necessary at all times.

Procedures for the collection and sanitary disposal of dead mollusks recovered during grading and harvest are described under biosecurity procedures in Section 7.

Implementation

Applicants shall have a written Materials Storage, Handling and Waste Disposal Plan (MSHWDP) that includes provisions stipulated in local laws and the cultivation site's operating permits, as well as the following requirements, if not so stipulated:

- A current inventory of all hazardous materials used and wastes stored and/or disposed of by the cultivation site or on-board vessels.

- Availability of material safety data sheets on site for all hazardous materials in the inventory.
- Procedures for the storage, transport, handling, labeling and use of fuel, oil, chemicals and other potentially toxic materials on the cultivation site that limit the risk of accidental spills and release into the environment.
- Refueling, maintenance and record-keeping procedures for all equipment that uses oil or fuel in order to prevent leaks or spills, and document that used oil is sent to an approved handling facility.
- Procedures for the collection, storage and disposal of trash, garbage, refuse and other waste materials.
- Procedures and the necessary materials and equipment for emergency containment and cleanup of spilled materials.
- Procedures for washing cultivation site equipment treated with copper or other toxicant-based antifouling materials. Equipment and vessels treated with antifoulants that are deemed toxic, such as copper, shall be cleaned out of the water at a licensed off-cultivation site cleaning establishment or on the cultivation site, if equipment and procedures are in place to treat the wash water and collect the solid waste before disposal, or in accordance with approved in-water cleaning standards in the relevant jurisdiction, which have been developed following biosecurity and environmental risk assessments. In all cases, methods of collection and treatment shall comply with national or regional regulations governing the disposal of toxic wastes.
- Procedures for the sanitary storage and disposal of human waste (black water).
- Procedures for recycling waste, where this is feasible.
- A written waste reduction plan for measuring and recording waste volumes and how such volumes will be reduced by recycling or other means over time.

Additional Information

Spill Prevention, Control and Countermeasures for Agriculture

United States Environmental Protection Agency
<http://www2.epa.gov/oil-spills-prevention-and-preparedness-regulations/spill-prevention-control-and-countermeasure-spcc>

Best Management Practices: Agricultural Waste Management

Prince Edward Island Departments of Agriculture and Forestry; Fisheries, Aquaculture and Environment
http://www.gov.pe.ca/photos/original/af_bmp_wastemgt.pdf

Standards

- 8.1: The applicant shall have a written Material Storage, Handling and Waste Disposal Plan (MSHWD) that meets the BAP requirements for proper handling and disposal, as outlined in the implementation requirements.
- 8.2: Cultivation site staff shall be familiar with the MSHWDP and trained in aspects of it they may be required to implement.
- 8.3: An inventory shall be kept of all hazardous materials or wastes that are stored on or disposed of by the cultivation site.
- 8.4: Material Safety Data Sheets shall be available for all hazardous materials at their location of use. The applicant shall demonstrate that all applicable guidance on the MSDS sheet (e.g., safe use, safety equipment and disposal) is followed.
- 8.5: Fuel, lubricants and chemicals shall be labeled, and stored and disposed of in a safe and responsible manner, and marked with warning signs.
- 8.6: Precautions shall be taken to prevent spills, fires and explosions, and procedures and supplies shall be readily available to manage chemical and fuel spills or leaks.
- 8.7: Garbage from housing and food waste shall be retained in watertight receptacles with covers to protect contents from insects, rodents and other animals.
- 8.8: Garbage and other solid waste shall be disposed of to comply with local regulations and avoid environmental contamination.
- 8.9: If any cultivation site equipment or vessels is/are treated with copper or other toxicant-based antifouling materials, and/or their process washing has the ability to produce contaminants, cleaning procedures shall collect, treat and dispose of wash water in a manner that does not result in environmental contamination or in accordance with approved in-water cleaning standards in the relevant jurisdiction, which have been developed following biosecurity and environmental risk assessments.
- 8.10: The applicant shall demonstrate that best management practices have been implemented to prevent derelict gear (e.g., proper installation and regular inspections of infrastructure) and that there are policies to locate, retrieve and properly dispose of derelict gear.

9. Environment

Biosecurity and Disease Management

Cultivation sites shall operate with the aim of preventing the spread of infectious mollusk diseases or parasites, and diseases for which mollusks can act as vectors. Monitoring for possible disease outbreaks shall be carried out, and due care shall be exercised during translocation of seed or adult stock to avoid or limit the importation and/or spread of alien invasive species or other pest and fouling organisms.

Reasons for Standard

Diseases and Parasites

The movement of mollusk seed or adult stock brings with it the risk of introducing infectious diseases and parasites of mollusks or diseases of other shellfish for which mollusks can act as a vector. Diseases and parasites of mollusks can result in stock mortality, reduced condition (meat:shell ratio) or appearance, reduced growth rates and reduced market value. Infectious diseases for which mollusks can act as vectors pose a potential risk to other commercial shellfish species or wild shellfish populations. As there are typically no cures or remedies for mollusk diseases, monitoring must be undertaken for disease outbreaks so that any spread can be contained.

Alien Invasive Species

Movements of shellfish during commercial aquaculture operations have in the past been implicated in the unintentional introduction and spread of alien invasive species. These non-native species can pose a potential threat to other commercial shellfish species and wild shellfish populations, as well as the overall marine environment.

Pest and Fouling Organisms

The presence of pest organisms may not directly interfere with or adversely affect the normal biological processes or health of cultivated mollusks. However, their presence can lower market values. The potential for hybridization with non-commercial mollusk species should also be avoided.

Fouling organisms in aquaculture are acknowledged as potentially requiring major resources to remove during routine maintenance of stocks or final processing of the finished product. The negative effects of fouling can include reduced growth rates of the mollusks, reduced space for culture, increased handling and processing or reduced market values.

Implementation

There are currently no therapeutic treatments for mollusk diseases or parasites. Alien invasive species are often very difficult to eradicate after introduction, as are other pests and fouling organisms. Therefore, prevention rather than cure is the primary driver underpinning successful Shellfish Health Management Plans (SHMPs). The SHMP operates at two geographic scales: the local cultivation site and among neighboring sites and aquaculture establishments within a defined

area. Thereafter, the SHMP considers movements into and out of the local cultivation site from both national and international perspectives.

Additionally, those staff members responsible for biosecurity and the health of shellfish stocks shall ensure compliance with all legal requirements for disease testing, monitoring, shellfish movements and reporting of notifiable diseases, if these are identified or suspected.

Cultivation Site Management Measures

The Shellfish Health Management Plan should include, but not be limited to, written biosecurity and health management procedures and training of staff in the practice of these procedures commensurate with their level of work responsibilities, and cover:

- Careful selection of any new culture sites with respect to any disease, parasites or other pest or fouling organisms of mollusks.
- Careful selection of seed or adult mollusks during translocation or importation with regard to the presence of alien invasive species and other pest or fouling organisms specified in applicable national legislation, and with regard to OIE-listed diseases and parasites.
- Monitoring for any signs of disease or unexplained high mortality levels.
- Reporting procedures for possible disease outbreaks or increased mortality levels in mollusk stocks, including reporting to regulatory authorities of OIE reportable diseases.
- Monitoring for observations of previously unknown pest or fouling marine species in/on stocks of mollusks brought into the cultivation site.
- Reporting procedures for pest or fouling marine species not previously seen on the cultivation site.
- An alert status that defines extra precautions, containment, checks on shellfish and increased vigilance if an occurrence of infectious disease is known or suspected in the region.
- Accurate recording of all shellfish movements and transfers to, from and within the cultivation site, with due regard to applicable national shellfish movement legislation.
- Secure storage of all shellfish health and movement documentation.
- Cleaning of all shellfish-handling equipment before it enters or leaves the cultivation site.
- Procedures for the sanitary disposal of dead shellfish recovered as “normal mortality” during routine grading and husbandry operations.
- A recovery and disposal plan for dead shellfish in the event of mass mortalities, with available equipment in place and identified services that can be called on to quickly provide assistance.

Monitoring

Written procedures for shellfish disease observations, containment, diagnosis and treatment shall include:

- Monitoring for endemic diseases, parasites, pests and fouling organisms and recording of findings and actions taken, which may or may not be mandated by national legislation.
- Guidelines for cultivation site staff regarding reporting procedures, both internal and external, in the event of abnormal mortality levels in shellfish stocks.

Removal of Fouling Organisms

Written procedures to help minimize or remove fouling organisms shall include:

- Guidelines for cultivation site staff regarding how to avoid or minimize settlement of local fouling organisms.
- Written procedures for cultivation site staff on the techniques and use of equipment to physically remove or treat fouling organisms in order to ensure minimum damage to shellfish stocks and the least possible environmental impact during disposal of fouling organisms.

- Written procedures for cultivation site staff based on current guidelines for best practices on the use and disposal of any non-medicinal chemicals for treatment of fouling (e.g., brine, lime, acetic acid, formic acid).

Additional Information

ICES Code of Practice on the Introductions and Transfers of Marine Organisms 2005

International Council for the Exploration of the Sea
<http://www.ices.dk/publications/Documents/Miscellaneous%20pubs/ICES%20Code%20of%20Practice.pdf>

Aquatic Animal Health Code 2015

OIE World Organisation for Animal Health
<http://www.oie.int/international-standard-setting/aquatic-code/access-online/>

Standards

- 9.1: The applicant shall designate a trained member of staff with relevant experience in shellfish health and biosecurity to oversee the development and updating of a Shellfish Health Management Plan (SHMP).
- 9.2: The trained staff member shall ensure that all employees are kept updated on any changes or amendments to the SHMP and that new staff members undergo an induction appropriate to their activities and responsibilities within the cultivation site.
- 9.3: The applicant shall have written biosecurity and health management plans and monitoring procedures consistent with the implementation requirements.
- 9.4: The trained staff member shall ensure compliance with all legal requirements for disease testing, shellfish movements (including zoosanitary regulations for inbound and outbound transports) and reporting of notifiable diseases, alien invasive species, pests and fouling organisms.
- 9.5: The applicant shall have proof of the implementation of written procedures for the control of disease in shellfish that include monitoring for endemic diseases, as well as parasites, pests and fouling organisms.
- 9.6: The applicant shall have written procedures for handling mass mortality, including the removal of dead stock.
- 9.7: The applicant shall have proof of the implementation of written procedures for the control of alien invasive species that include monitoring for any previously unknown marine species in or on mollusk stocks.
- 9.8: The applicant shall train cultivation site staff in applying biosecurity, monitoring and health management procedures.
- 9.9: Observations by cultivation site staff of abnormal mortality levels or disease indicators, and resulting actions concerning disease diagnosis and treatment shall be reported to the designated staff member and recorded.
- 9.10: The applicant shall have proof of the implementation of procedures for the sanitary disposal of dead shellfish under normal and abnormal mortality levels.
- 9.11: The applicant shall have proof of the implementation of written procedures for removing and disposing of fouling organisms. These procedures shall include the use and disposal of any chemical treatments, which shall be applied in accordance with the instructions of the manufacturer and in compliance with any existing local and national regulations.
- 9.12: The applicant shall record data on disease outbreaks and actions taken so this information can be made available to auditors.

10. Environment

Protection of Ecologically Sensitive Areas

Mollusk culture operations shall protect and conserve ecologically sensitive areas with environmental attributes worthy of retention or special care. Adverse impacts upon wetland and intertidal areas removed or modified for allowed purposes shall be mitigated.

Reasons for Standard

Nearshore culture systems can involve the modification of coastal habitats. Examples include the construction of ponds for oyster conditioning in France, modifications of intertidal areas to create clam habitat and efforts to gain access to waterways or “harrowing” of oyster beds.

Coastal environments can include ecologically sensitive areas that have special environmental attributes worthy of retention or special care. These areas, which can include, but are not limited to, mangrove and wetland areas and sensitive shoreline habitat, are critical to the maintenance of productive and diverse plant and wildlife populations. Culture facilities use different rearing methods and can be built in ecologically sensitive areas and adjacent to natural water bodies. This can potentially harm sensitive areas in various ways.

Standards

- 10.1: When the site plan shows an ESA has been damaged by facility construction and/or operation since 1999, the loss shall have been only for allowable purposes.
- 10.2: If net loss of ecologically sensitive area occurred on facility property since 1999, the loss shall have been mitigated by restoring an area three times as large or by an equivalent donation to restoration projects.
- 10.3: For facilities constructed before 1999 and where an ESA was damaged but not restored, the applicant shall propose a plan, subject to local regulations, that within five years from the date of initial BAP certification shall restore the damaged area, mitigate the damage by restoring an equal area of similar habitat or make a donation of equivalent value to other restoration projects. Alternatively, the applicant shall provide an explanation of the extenuating circumstances regarding the damage for consideration of exemption from this standard.
- 10.4: Operation of the facility shall not lead to erosion or coastal deterioration, or cause other ecosystem damage that will not recover within the natural life cycle of the major fauna or flora damaged.
- 10.5: Unless specific permits apply, facility operations shall not alter the hydrological conditions of the surrounding watershed, and the normal flow of brackish water to mangroves or freshwater to wetlands shall not be altered.

Implementation

The BAP standards seek to prevent damage, if possible, or mitigate damage where prevention is not possible. In all cases, culture facilities shall employ appropriate construction and operation methods to protect the natural resources they use.

Ecologically sensitive areas shall be identified and protected during construction. Facilities shall be designed and operated to prevent erosion or sedimentation due to effluent discharge, water flow or flooding that result from culture operations and facility construction.

- If culture operations require access to water across an ecologically sensitive area, this shall only be allowed for the installation of inlet and outlet canals, pump stations and docks.
- Ecologically Sensitive Areas (ESAs) damaged by construction or operations since 1999 shall be mitigated by restoration of an area of similar habitat three times the size of the area damaged or by a donation of equivalent value to other restoration projects. This practice is only allowable if local regulations permit it.
- In cases where ESAs were damaged before 1999, the facility shall be the subject of a five-year restoration or mitigation plan. To be considered for a possible exemption, the facility shall explain the extenuating circumstances regarding the damage.

11. Food Safety

Control of Potential Food Safety Hazards

Shellfish culture practices shall prevent the introduction of potential consumer health hazards resulting from contaminated mollusk products. Threats to human health shall be controlled below regulatory limits through good practices and ensured by end product testing.

Reasons for Standard

Bivalve shellfish are filter feeders that can accumulate hazardous levels of biotoxins, other toxins and pathogenic microorganisms (viruses, protozoa, bacteria and helminths) in their flesh, causing them to become naturally contaminated.

In many cases, no thermal process is applied to shellfish prior to sale to eliminate pathogens. Therefore, further microbiological multiplication is likely to occur if postharvest cold chain is not maintained. The presence of biotoxins is also not eliminated by cooking. Good cultivation practices therefore require a significant awareness of external threats, in addition to the implementation of responsive internal management.

As mollusks are at risk of contamination by health hazards in their aquatic environment, they are considered high-risk foods. Consequently their safety, as a food-stuff, is highly regulated and is likely to present a major influence, or potential limitation, to placing product on the market and the extent of export opportunities.

Mollusks can be exposed to a wide range of potential contaminants dependent on the culture area, culture method, chemicals used in culture and background water quality. These contaminants include:

- Microbiological: bacteria, viruses and protozoans.
- Chemical: biotoxins, heavy metals, hydrocarbons, veterinary drugs and persistent organics.
- Radiological: radio nuclides.

Many contaminants widely present at trace levels within the freshwater and marine environments are unlikely to compromise product safety. Other contaminants can be elevated in certain areas due to continuous proximity to direct or indirect sources. Alternatively, some areas with generally high water quality can be subject to periodic deterioration due to intermittent discharges, pollution spills or even natural events such as algae blooms.

The relationship between contaminant content in shellfish flesh and uptake from ambient seawater is complex and subject to variation according to species response to salinity and temperature. It should be noted that regulatory monitoring programs for bivalve shellfish can differ on a national

or regional basis as to whether they are based upon water quality (as in the United States) or shellfish flesh quality (as in the European Union). Compliance with a regulatory monitoring program and the appropriate standards set by a competent national responsible authority are fundamental requirements to ensure food safety measures are translated to export market access.

As microbiological threats are often associated with fecal contamination in bivalves, there is universal use of indicator organisms (e.g., fecal coliforms or *Escherichia coli*). These surrogates provide an assessment of the potential for fecal contamination and therefore form the foundation of regulatory monitoring for both food products and water quality. Fecal indicator organisms provide information to classification schemes to set management requirements against assessed hygiene risk and control programs such as end product testing to ensure food safety.

While the principal reason for food safety standards is the protection of the consumer, it should be recognized that there are also important commercial reasons. Mollusk aquaculture contributes a very small proportion of the global trade of fishery products however they can be important in fragile fringe coastal economies. International trade in bivalve shellfish is regionalized and, in many cases, regulatory barriers prevent countries from penetrating distant markets.

Implementation

At a minimum, food safety management and monitoring shall be conducted in accordance with national and/or regional standards. Bivalve export/import trade requirements are based upon implementation by national competent authorities that are designated as responsible agencies to enforce checks and controls. Some bivalve shellfish may be exempt from standards in certain cases and jurisdictions. In consequence, cultivation site-specific standards need to operate within a national regulatory framework.

Specific biotoxin, chemical and radiological contaminant limits in food products are generally specified by the target market. These can include action levels in addition to mandatory upper limits.

In contrast, microbiological threats are controlled by a range of management requirements in response to ongoing culture area-specific quality classification. Harvest bed and facility quality assessments can be based upon shellfish flesh, water quality or hybrid requirements:

- Water-based standards: For example, the United States and its supplier countries (e.g., Canada, Mexico, Chile and New Zealand) comply with the U.S. Food and Drug Administration National Shellfish Sanitation Program (NSSP). Water quality standards based upon fecal coliform indicators provide evaluations ranging from “approved” and “conditionally approved” to “conditionally restricted” and “restricted.”

- Flesh-based standards: For example, in E.U. member states, *E. coli* indicator ratings include Class A, B, C and Prohibited.
- Hybrid water and flesh standards: Some schemes incorporate both food product and environmental health components. For example, New Zealand has been highly successful in utilizing both NSSP and E.U. regulatory components to form a hybrid system that meets the requirements of both target markets, allowing universal export opportunities.

Although details of classification schemes vary, in general, they incorporate similar elements:

- Highest quality: where product is safe to eat with no additional treatment.
- Moderate/intermittent quality: where additional requirements or treatments are needed prior to consumption.
- Lowest quality: where consumption is prohibited.

Classification schemes also include a requirement for an initial assessment of quality and identification of potential contamination sources with an ongoing need for reevaluation. This should include establishing the optimum representative sampling and frequency for the regulatory monitoring program. It should also be noted that the indicator test parameter (e.g., fecal coliforms or *E. coli* levels) and testing methodology can also be scheme-specific. Details should therefore be obtained from the responsible authority in the host country.

Management responses for intermittently contaminated areas, which are likely to form the bulk of classified areas, vary among schemes. Such “conditional” classification dictates restrictions on harvesting and the type and level of post-harvest treatment (e.g., depuration or heat treatment). In essence, these variable management responses should be proportionate to the risk.

It should be recognized that while most regulatory programs are based on the use of fecal indicator organisms, they do not provide a full assessment of risk from specific pathogens. Viral pathogens, in particular, can pose additional risks, as they may be more resistant than indicator organisms. Consequently, mollusk culture operators should always be aware of relevant local microbiological risks and protect consumers as part of their due diligence commitment.

The identification of hazard analysis critical control points (HACCP) is widely cited as a vital requirement in both national and international documentation, and should form a central component within cultivation site standard practices. A HACCP system should be site-specific and relevant to the individual shellfish operation, and incorporate both preharvest prevention of contamination and postharvest decontamination/prevention of recontamination components.

Most regulatory classification schemes are retrospective, and as such are not always fully effective in protecting public health. A proactive approach to site-specific risks should be encouraged within good practice. Ideally, a risk management approach is responsive to changing conditions by establishing a matrix of risk scores throughout the

environmental and production cycle. This allows dynamic monitoring and precautions proportionate with risks.

For example, shellfish that are primarily cooked present a lower risk than those consumed raw for microbiological risks. Conversely, however, cooking may increase toxicity for biotoxins, and cooking to retain organoleptic attributes does not denature norovirus. At times of low risk, reduced depuration duration may align with national guidance, while at times of increased risk, enhanced depuration may be advisable—ranging up to voluntarily ceasing all harvesting.

All proactive management systems need to be based upon direct or indirect measures of environmental or shellfish quality. Surveillance monitoring can examine preharvest shellfish quality (e.g., deployment of defensive biomonitoring), water quality at site boundaries (including surrogate water quality parameters such as turbidity and salinity) or source loading data (e.g., riverine gauging, rainfall data or combined sewer overflow spill data).

The use of external data sources, such as satellite imagery and buoy-mounted fluorimeters for harmful algal bloom monitoring or alerts from polluters, to assess risk is likely to be of increasing importance in predicting threats. Access to external data sources will vary among nations.

Other emerging aquaculture trends include the increasing importance of polyculture systems, which could also be adopted through a desire to attain an enhanced accreditation status for an aquaculture operation (e.g., bivalve culture in association with finfish culture to improve water quality). Care should be adopted to prevent potential cross-contamination with pathogens or contaminants (e.g., residual drugs used in support of finfish health). Appropriate monitoring/ control systems need to be developed.

Every shellfish culture setting is unique. Operator knowledge of specific species' responses to the external marine environment is critical to ensure consistent production of safe shellfish.

Additional Information

National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish

2013 Revision

U.S. Food and Drug Administration

<http://www.fda.gov/downloads/Food/GuidanceRegulation/FederalStateFoodPrograms/UCM415522.pdf>

E.U. Import Conditions for Seafood and Other Fishery Products

European Commission

http://ec.europa.eu/food/international/trade/im_cond_fish_en.pdf

Safe Management of Shellfish and Harvest Waters

World Health Organization – 2010

http://whqlibdoc.who.int/publications/2010/9789241563826_eng.pdf

Assessment and Management of Seafood Safety and Quality

FAO Fisheries Technical Paper 444
H. Huss, L. Ababouch, L. Gram – 2003
<http://www.fao.org/docrep/006/y4743e/y4743e00.htm#Contents>

Australian Shellfish Quality Assurance Program: Export Standards 2004

Australian Quarantine and Inspection Service
Department of Agriculture, Fisheries and Forestry
<http://www.agriculture.gov.au/export/controlled-goods/fish/shellfish-qa>

Fish and Fishery Products Hazards and Controls Guidance

Department of Health and Human Services
U.S. Food and Drug Administration Office of Food Safety
– 2011
<http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM251970.pdf>

South African Live Molluscan Shellfish Monitoring and Control Programme

Republic of South Africa Department of Agriculture, Forestry and Fisheries
Fisheries Management Branch, Aquaculture and Economic Development Directorate
Sustainable Aquaculture Management
Issue 3, January 2012
[http://www.nda.agric.za/daaDev/sideMenu fisheries/03areasofwork/Aquaculture/SAMSMCP/SMP%20Final%2020120116.pdf](http://www.nda.agric.za/daaDev/sideMenu%20fisheries/03areasofwork/Aquaculture/SAMSMCP/SMP%20Final%2020120116.pdf)

Standards

- 11.1: Documentation shall be available that demonstrates participation in and compliance with the host country's national classification/regulatory program.
- 11.2: Documentation shall be available that reports a site risk assessment to identify potential impact from sources of contamination in culture waters. Where possible, this should reference any sanitary survey undertaken and proximity to impacting wastewater discharges and historical sources, such as heavy metals that may persist in the environment.
- 11.3: Documentation shall be available that demonstrates the implementation of a working HACCP or equivalent food safety management system within the value chain prior to receipt by consumers. The food safety plan shall include risk assessment for all potential food safety hazards that is anchored with a program to document locations and times for cultivation and harvest.
- 11.4: Documentation shall be available for a site-monitoring program that includes preharvest shellfish data and/or water quality data obtained at sufficient frequency to reflect the trends in magnitude and variability in contamination levels. This standard can be satisfied with effort and information by the assigned authorities and/or the equivalent producer program.
- 11.5: Documentation shall include a written recall plan supported with initial product identity for cultivation and time of harvest through distribution to consumption (e.g., product tagging at moment of harvest).
- 11.6: Documentation shall be available that demonstrates end product testing to meet regulatory, due diligence and HACCP requirements specified by exporting and importing countries.
- 11.7: Equipment and containers used to harvest and transport shellfish shall be clean and free of lubricants, fuel, metal fragments and other foreign material.
- 11.8: Ice in which shellfish are placed following harvest shall be made from potable water or seawater that has been disinfected to an equivalent standard.
- 11.9: Where depuration or other postharvest treatment facilities are used to cleanse the mollusks or reduce potential contaminants, documentation shall be provided to evidence the recognized or licensed status of the particular operation in accordance with regulatory guidelines and/or measures for effective operation.
- 11.10: Harvested product shall be protected from exposure to adverse weather conditions, excessive heat, birds and other potential contaminants or product abuse.

12. Traceability

Record-Keeping Requirement

To establish product traceability, the following data shall be recorded for each culture unit and each production cycle:

- culture unit identification number
- unit area
- common and scientific names of shellstock cultivated
- stocking date
- quantity of seed stocked
- source(s) of seed
- chemical use
- harvest date
- harvest quantity
- movement document number (if applicable)
- purchaser(s) (identify all if any harvest quantity goes to more than one purchaser).

Reasons for Standard

Product traceability is a crucial component of the BAP program. It interconnects links in the mollusk production chain and allows tracing of each processed lot back to the culture unit and inputs of origin. Food quality and safety analyses by accredited laboratories can also be included. Traceability ultimately assures purchasers that all steps in the production process were in compliance with environmental, social and food safety standards.

Implementation

The traceability requirements for mollusks should begin with a customary unit for commerce, such as a bag of shell stock, bulk grouping or other distinguishable lot that is usually restricted to harvest within one region or day. Cultivation sites may utilize any traceability system that meets the BAP requirements. This can be an online system; the cultivation site's own in-house database, paper records, files and documents; or a combination thereof.

Where paper records, documents or notebooks are used, if possible, the information should also be transferred to computer database files to allow electronic transmission. The original files or paper records shall be kept to allow verification of the electronic data.

The data referenced in BAP's standards on seed sources, etc. are required for traceability. This information and other related records can be captured on the sample Product Traceability Form in Appendix I. Each form corresponds to the shipment of products on a particular day from a particular culture unit.

In addition to the requirements for BAP traceability, which naturally would include basic facility information, traceability records can include:

- government registration/license numbers, where applicable
- type of culture unit
- seed collection time and method
- unusual events that could affect quality or safety
- results of tests for contaminants before harvest
- harvest method and container type
- harvester identity
- time produce out of water prior to receipt by processing/depuration/dispatch facility
- use of depuration with details for application
- cold chain storage.

The record-keeping process requires a high degree of care and organization. At large cultivation sites, managers could collect initial data for those mollusks for which they are responsible. A single clerk could then be given the task of collecting the data from individual managers and transferring it to a computer database. Cultivation site management shall, of course, review the effort at intervals to verify it satisfies BAP requirements.

Product Identity Preservation

To assure the integrity of the Best Aquaculture Practices "star" system, traceability controls must allow verification of all facilities that contribute to a claim of multiple-star BAP-certified status.

To ensure the proper separation and traceability of all farm inputs and outputs, the following components must be in place:

- Farms that purchase all of their mollusk seed from BAP-certified sources shall maintain records of the sources of seed used.
- Farms that purchase seed from both BAP- and non-BAP-certified sources shall identify all sources and have adequate systems in place to prevent mixing of BAP and non-BAP production lots.
- To enable mass balance verification of multiple-star products, certified farms shall maintain a list, including harvest dates and volumes, of the processors to which they sell or deliver products.
- The number of backward and forward trace exercises conducted by the auditor will be determined by farm volume.

BAP Logo Use

Use of the Best Aquaculture Practices logo, a registered trademark of the Global Seafood Alliance, for any purpose shall be approved by BAP in advance and used in compliance with the BAP trademark usage agreement.

Customer Complaints

The applicant must prepare and implement an effective system for the management of complaints and complaint data to control and correct shortcomings related to its products' compliance with the BAP standards.

Standards

12.1: Traceability records shall be maintained for each of the specified parameters for every production unit and every production cycle allow tracing of mollusks back to the harvesting area, any relaying area or subsequent handling location, such as a dispatch/packing center or depuration center. Records for consolidated batches should retain original documentation from the differing harvesting and handling locations that will aid traceability.

12.2: The facility shall operate an effective record-keeping system that provides timely, organized, accurate entries, performed and overseen by a designated trained person or team responsible for collecting the data, ensuring it is complete and accurate, and that traceability requirements are met.

12.3: The facility shall keep complete and accurate records for each culture unit and production cycle, including the culture unit identification number, unit area and species.

12.4: The facility shall keep complete and accurate records concerning chemical use at the facility.

12.5: The facility shall maintain complete and accurate records of the sources and numbers of seed stocked, and stocking dates for each culture unit.

12.6: Complete and accurate records regarding harvest date, harvest quantity, movement document number (if applicable) and processing plant(s) or purchaser(s) shall be maintained. If product lots are destined to more than one plant or purchaser, each lot shall be separately identified.

12.7: In order to use the BAP logo, facilities shall have such use approved and registered in advance with BAP management.

12.8: The facility shall keep records of any customer complaints related to its products' compliance with the BAP standards.

12.9: The facility shall keep records of investigations of such complaints and actions taken to address/correct them.

Appendix I

Sample Product Traceability Form

Facility Name	Culture Unit Number Culture Area (ha)
SEED	CHEMICAL USE
Stocking Date	Compound 1
Stocking Quantity	Condition Treated
Species (Common/Scientific Names)	Application Rate
Seed Source	Application Period
	Compound 2
	Condition Treated
	Application Rate
	Application Period
HARVEST	
Harvest Date	Harvest Purchaser Name/Address
Harvest Quantity (kg)	
Movement Document Number	