Shellfish Health Management Plan

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Prepared for: BC Shellfish Growers Association
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1 Introduction

1.1 Objective
The objective of this Shellfish Health Management Plan is to provide good health conditions for cultured shellfish owned by operators in British Columbia. All private operators and public shellfish culture facilities will develop and maintain an up-to-date Shellfish Health Management Plan (SHMP).

1.2 Definitions
Terms used in this document are defined in the glossary. This document includes the following definition:

Standard Operating Procedures (SOP’s) must include:
- A description of specific management practices
- A review and endorsement by the plan’s holder
- An understanding of and training in the plan by the individuals responsible for the implementation
- A record keeping component

1.3 Target Audience
This document is intended for use as a template from which each operator can build a Shellfish Health Management Plan. The plans are used by each operator and their staff in training and during day to day contact with the shellfish.

1.4 Document Structure
This document is generic and includes sections for beach culture of Pacific oyster (*Crassostera gigas*) and Manila clams (*Tapes philippinarum*) as well as deep water culture of oysters (*Crassostera gigas*). Sections requiring an operator-specific Standard Operating Procedure (SOP) are noted in the document.

1.5 Annual Review
This document will be subject to an annual review by the operator's veterinarian and/or shellfish health staff to make sure it is up-to-date.

1.6 Living Document
Changes will be made to this document as required.
1.7 Personnel duties and responsibilities

1.7.1 Shellfish Health Management

Shellfish Health Management refers to those personnel who have responsibility for major shellfish health decisions. Shellfish Health Management is responsible for identifying and managing risk factors in order to minimize their effect on shellfish health. British Columbia Ministry of Agriculture and Lands (BCMAL) will supply expertise in the form of veterinarians and/or shellfish pathologists through its Animal Health Lab facility in Abbotsford.

1.7.2 On Site Staff

Farm site staff may be assigned shellfish health duties from time to time. Site staff is expected to follow good biosecurity practices and shellfish health procedures.

1.7.3 Contact names and numbers

Contact names and numbers for all key shellfish health personnel, including emergency numbers will be posted in an easily identifiable location at each site.

1.8 Communication to enhance disease prevention and control

Over and above regulatory reporting requirements to government, aquaculture companies will communicate incidents of disease that are significant to their industry association, i.e. BC Shellfish Growers Association (BCSGA), so that clinically unaffected sites in the geographic vicinity can be alerted to the concern. Operators are encouraged to contact each other directly regarding such concerns.
Shellfish Health Management Plan

Section 2

Beach Culture Sites
2 Marine Beach Culture Sites

2.1 Biosecurity

All stakeholders will take necessary action to minimize potential introduction and transmission of diseases onto beach leases. This will be achieved by using and maintaining healthy stocks, by maintaining good growing conditions, and by frequent monitoring to facilitate early detection of problems. Disease diagnostic services and veterinary expertise will be made available through the BC Animal Health Lab in Abbotsford, B.C., and these resources will be utilized by the shellfish aquaculture industry.

Maintaining a clean, safe growing environment will reduce the possibility of exposure of stock to infectious, parasitic or other harmful agents. Pathogens may be spread by sick shellfish through the water, by contact with contaminated equipment, or by contact with personnel, visitors, and gear. Contact with potential pathogens will be prevented or reduced by an effective biosecurity “barrier” at each facility. Biosecurity measures will be applied to all personnel (staff, management), visitors, gear and equipment. These measures will also reduce the spread of disease if an event occurs.

Biosecurity includes three main components:

- Maintaining healthy stocks
- Limiting stock contact with known and potential harmful agents
- Minimizing the spread and impact of disease within the site and to other sites.

Pathogens are normally present in any healthy population. However, biosecurity measures will be employed to limit the possibility and potential impacts of a disease outbreak.

2.1.1 Personnel movement

Staff will adhere to biosecurity procedures for the site. Where possible, personnel will not travel between sites. If such travel is unavoidable, personnel will adhere to all biosecurity procedures at each site.

Standard Operating Procedures

*Site and staff disinfection and biosecurity procedures*
2.1.2 **Stock movement**
Movement of stock between beaches will be minimized. When movement is necessary, a health assessment will be done by Shellfish Health Management prior to moving the animals. If there is a disease concern, shellfish cannot be moved. Particular care will be paid to handling of the animal to avoid undue stress. When there is a possible shellfish health concern, the risk will be assessed by a shellfish health professional.

*Standard Operating Procedures*

| Oyster/clam transport procedure |

2.1.3 **Predators**
All attempts will be made to prevent predators from accessing the lease. Predators include mammals, birds, marine invertebrates, and shellfish. Non-lethal methods will be used only. If a lethal method must be used, adherence to Provincial and Federal laws will be mandatory.

*Standard Operating Procedures*

| Predator exclusion |

2.1.4 **Hygiene and disinfection – personnel**
All personnel will adhere to the facility hygiene and disinfection procedures as per Sections 2.1.1.

2.1.5 **Hygiene and disinfection – equipment**
Equipment will be kept clean, in good working order and disinfected as per Sections 2.4.3.

2.2 **Husbandry**
Keeping shellfish as healthy as possible is critical to preventing disease from coming on site and/or spreading within a site.

2.2.1 **Suitable rearing environment**
The operator’s management is responsible for ensuring and maintaining a suitable rearing environment for the shellfish, so they remain healthy. Materials used to culture stocks in the intertidal environment will be chosen to minimize potential harm or damage to the shellfish and the environment. Equipment will be built to withstand extreme weather events and will be checked regularly for integrity. Facilities will be monitored to minimize the occurrence of vandalism.
2.2.2 Normal shellfish behaviour/ appearance

Shellfish will be routinely monitored for signs of good health and disease. All staff will be familiar with normal behaviour, appearance, and mortality rates. Key signs that indicate changed health status include, but are not limited to:

- Physical appearance – changes from normal i.e. holes in shell, slow closing reaction, gaping, meat colour, shell thickness, etc.
- Growth parameters – deviation in growth rates, changes in condition indices.

Shellfish will be kept at reasonable densities. Changes in behaviour or physical condition will be reported to site management. Early detection is crucial to good disease management.

2.2.3 Feed and Nutrition

The objective of good nutrition is to keep shellfish healthy; fish must receive sufficient quantity and quality of feed. Providing good quality nutrition is a function of site selection and animal density in growing areas. The carrying capacity of each site will not be exceeded except at harvest time whereupon decreasing density will happen as stock is removed from site.

2.2.4 Common Shellfish Handling Techniques

The operator will maintain Standard Operating Procedures for handling shellfish (e.g. grading, sorting, harvesting). All handling procedures will include types and maintenance of equipment used and will be designed to minimize injury to the shellfish and/or predisposal of individual animals or populations to disease.

**Standard Operating Procedures**

| Shellfish handling techniques |
2.3 Monitoring and Surveillance

2.3.1 Environmental Monitoring
Good water quality is vital to good aquatic animal health. The operator will maintain a regular program for monitoring and recording water quality parameters. Monitoring will vary between sites depending on location and specifics of the aquatic environment.

Standard Operating Procedures
Water quality monitoring

2.3.1.1 Contingency Plans
The operator will maintain a contingency plan in the event of acute deterioration of water quality. Water quality monitoring is immediately increased to determine the cause and to estimate how long the problem may persist. Shellfish will be monitored and will not be handled until water quality is acceptable. Records will be kept.

2.3.2 Shellfish Monitoring
Shellfish on the beach will be monitored regularly for any unusual behaviour, visible trauma/lesions, or other signs of disease or predator attacks. Changes in behaviour and physical condition will be recorded and reported to site management. Water quality will also be routinely monitored as per Section 2.3.1. Collection and analysis of fresh dead and moribund animals will provide the best opportunity for identifying cause of mortality.

2.3.2.1 Mortality/Fresh collection
Fresh mortalities collected on routine walkovers will be examined for signs of disease. Suspected causes of mortality must be recorded and Health Management will be notified of any unusual numbers or types of mortalities.

Standard Operating Procedures
Mortality collection and disposal

Standard Operating Procedures
Mortality classification

Standard Operating Procedures
Shellfish health sampling procedures, e.g., proper collection and shipping of samples, lab work (on-site, in house or referred)
2.4 Minimizing disease within the lease

All efforts will be made to minimize disease on a site. Adequate hygiene, disinfection, and mortality collection help to keep shellfish healthy and to minimize exposure to pathogens.

2.4.1 Visitors/Suppliers

Each site shall have procedures for all visitors and suppliers, and they will be expected to follow these procedures. Suppliers will be advised of operator and site procedures in advance. Suppliers, or visitors, who visit multiple sites shall be subject to strict biosecurity measures and may be requested not to come on site.

<table>
<thead>
<tr>
<th>Standard Operating Procedures</th>
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<td>Visitor/Supplier procedures</td>
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2.4.2 Equipment

Equipment will be kept clean at all times. This is to prevent possible spread of pathogens by shellfish (whole or part) or personnel or via water borne route. Equipment will be properly cleaned and air dried or disinfected after each use and put away in its proper place.

Disinfectants available include:

**Bleach**: 10% solution will kill viruses but is not effective on wood and is corrosive. Bleach will also kill shellfish.

**Iodophors** (i.e. Ovadine): Iodine-based disinfectant used at a concentration of 100ppm. Brown colour indicates activeness but does take 20 minutes of contact to kill viruses and bacteria. Iodophors will stain but will not kill marine animals.

**Virkon**: peroxygen/surfactant/organic acids and inorganic buffering agents. Used at 1% and provides a quick kill of bacteria/viruses. It has a pink colour that indicates activeness.
2.4.3 Handling disinfectants and chemicals

2.4.3.1 Disinfectants
Disinfectants will be stored in clearly marked containers. A Material Safety Data Sheet (MSDS) for each disinfectant that is on site will be kept in a safe, readily accessible place, e.g. binder in the site office. As per Workplace Hazardous Materials Information System (WHMIS), all chemicals must be handled safely by trained staff e.g. by wearing appropriate protective gear and by taking suitable precautions.

The BC industry is currently developing Best Management Practices for handling spent disinfectants. When complete, these will be added in to this document.

Best Management Practices

| Disposal of spent disinfectants (in process) |

2.4.3.2 Chemicals
Chemicals include but are not limited to fixatives, such as formalin or Davidson’s solution, used for preserving shellfish tissues. These chemicals will be stored in clearly marked containers. A MSDS for each chemical that is on site will be kept in a safe, readily accessible place, e.g. binder in the site office. As per WHMIS, all chemicals must be handled safely by trained staff, e.g. by wearing appropriate protective gear and taking suitable precautions.

2.4.4 Equipment movement
Where possible, equipment will not be shared between sites if sites are in different areas. This includes shellfish handling equipment, vessels, monitoring and other equipment. Vessels and equipment, which must be used at multiple sites, will be subject to strict biosecurity and disinfection measures between uses.

Standard Operating Procedures

| Equipment disinfection/cleaning |
2.5 Shellfish Health Records

Shellfish health records will include but will not be limited to:

- Inventory records
- Production records
- Shellfish movement records
- Water quality records
- Signs of increased morbidity
- Mortality records including mortality/morbidity cause
- Diagnostic sampling records and results
- Lab work
- Records of mitigatory actions taken
- Records of reporting to Provincial or Federal authorities, in accordance with any existing regulation

Records will be easily accessible and protected from damage, e.g. kept in binders in the site office.

Records will be kept for the duration of time the shellfish are on site. The operator will keep archived records at a suitable location in head office or securely stored off site.

Aquaculture facility records will be available for inspection upon request by CFIA.

Records will be reviewed on a routine basis by the operator’s Shellfish Health Management to look for patterns in shellfish health and disease.

2.5.1 Reporting of mortalities

Operators will keep mortality/morbidity and associated records and will have them available for inspection by CFIA.

2.6 Major Mortality Event (Outbreaks)

A major mortality event is defined as an unexpected occurrence of mortality. Not all outbreaks are shellfish health emergencies. Infectious diseases may differ in how contagious they are and, therefore, how easy or difficult they are to control. Mortality or morbidity could also be caused by water quality changes such as plankton blooms or sudden, severe decreases in dissolved oxygen levels or temperature or toxic runoff. A distinction will be made if changes are anthropogenic in nature.

Rapid response is essential but will be determined on a case-by-case basis in conjunction with the Shellfish Health personnel. If a shellfish health emergency has been recognized, and determined to be caused by a
contagious disease, certain steps will be followed. The objective is to keep the pathogen “load” as low as possible and to prevent spread of the problem on or off the site.

Vigilant monitoring and early detection is crucial to good management of emergencies.

**Standard Operating Procedures**

| Shellfish Health Emergency Procedures |

2.6.1 **Infectious Disease Emergencies**

**Isolation/Quarantine**

At CFIA’s recommendation, the site may be isolated or quarantined. Isolation/Quarantine remains in effect until such time as the problem has been diagnosed and/or managed.

**Reporting to authorities**

Where appropriate and/or in accordance with existent regulation, operator’s management will report the outbreak to CFIA (Federal authority).

**Communicating with other operators**

As per Section 1.8, the operator’s head office will notify the BC Shellfish Grower’s Association office who will then decide on how to notify other members in the geographical area.
3 Deep Water Culture - Saltwater (Marine) Sites

3.1 Biosecurity

All stakeholders will take any necessary action to minimize potential for introduction and transmission of diseases onto a beach lease. This will be achieved by using and maintaining healthy stocks, by maintaining good growing conditions, and by frequent monitoring to facilitate early detection. Disease diagnostic services and veterinary expertise will be made available through the BC Animal Health Lab in Abbotsford, B.C. and these resources will be utilized by the shellfish aquaculture industry.

Maintaining a clean, safe growing environment will reduce the possibility of exposure of stock to infectious or parasitic diseases or other harmful agents. Pathogens may be spread by sick shellfish through the water, by contact with shared equipment, or by contact with personnel, visitors, and gear. Contact with potential pathogens will be prevented or reduced by an effective biosecurity “barrier” at each facility. Biosecurity measures will be applied to all personnel (staff, management), visitors, gear and equipment. These measures will also reduce the spread of disease if an event occurs.

Biosecurity includes three main components:

- Maintaining healthy stocks
- Limiting stock contact with known and potential harmful agents
- Minimizing the spread and impact of disease within the site and to other sites.

Pathogens are normally present in any healthy population. However, biosecurity measures will be employed to limit the possibility and potential impacts of a disease outbreak.

3.1.1 Personnel movement

Staff will adhere to biosecurity procedures for the site. Where possible, personnel will not travel between sites. If such travel is unavoidable, personnel will adhere to all biosecurity procedures at each site.

*Standard Operating Procedures*

| Site and staff disinfection and biosecurity procedures |

3.1.2 Stock movement

Movement of stock between leases, i.e. deepwater lease to beach lease, will be minimized. When movement is necessary, a health assessment will be done by Shellfish Health Management prior to
moving the animals, and permits will be obtained. If there is a disease of concern, shellfish cannot be moved. Particular care will be paid to handling of the animal to avoid undue stress. Where there is a possible shellfish health concern, the risk will be assessed by a shellfish health professional.

**Standard Operating Procedures**

| Oyster transport procedure |

### 3.1.3 Predators

All attempts will be made to prevent predators from accessing the lease. Predators include mammals, birds, marine invertebrates, and shellfish. Non-lethal methods will be used only. If a lethal method must be used, adherence to Provincial and Federal laws will be mandatory.

**Standard Operating Procedures**

| Predator exclusion |

### 3.1.4 Hygiene and disinfection – personnel

All personnel will adhere to the facility hygiene and disinfection procedures as per Sections 3.1.1.

### 3.1.5 Hygiene and disinfection – equipment

Equipment will be kept clean, in good working order and disinfected as per Sections 3.4.2 and 3.4.3

### 3.2 Husbandry

Keeping shellfish as healthy as possible is critical to preventing disease from coming on site and/or spreading within a site.

#### 3.2.1 Suitable rearing environment

The operator’s management is responsible for ensuring a suitable rearing environment for the shellfish, so they can stay healthy. Materials used in the construction and maintenance of growout areas are chosen to minimize potential harm to the shellfish. Rearing structures will be built to withstand extreme weather events and will be checked regularly for integrity. Facilities will be monitored to minimize the occurrence of vandalism.

#### 3.2.2 Normal shellfish behaviour

Shellfish will be routinely monitored for signs of good health and disease. All staff will be familiar with normal behaviour, appearance, and mortality rates. Key signs that indicate changed health status include but are not limited to:
• Physical appearance – changes from normal i.e. holes in shell, slow closing reaction, gaping
• Growth parameters – deviation in growth rates, changes in condition indices.

Shellfish will be kept at reasonable densities. Changes in behaviour or physical condition will be reported to site management. Early detection is crucial to good disease management.

### 3.2.3 Feed and Nutrition

The objective of good nutrition is to keep shellfish healthy; shellfish must receive sufficient quantity and quality of feed. Providing good quality nutrition is a function of site selection and animal density in growing areas. The carrying capacity of each site will not be exceeded except at harvest time whereupon decreasing density will happen as stock is removed from site.

### 3.2.4 Common Shellfish Handling Techniques

The operator will maintain Standard Operating Procedures for handling shellfish (e.g. grading, sorting, harvesting). All handling procedures will include types and maintenance of equipment used and will be designed to minimize injury to the shellfish and/or predisposal of individual animals or populations to disease.

### 3.3 Monitoring and Surveillance

#### 3.3.1 Environmental Monitoring

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#### 3.3.1.1 Contingency Plans

The operator will maintain a contingency plan in the event of acute deterioration of water quality. Water quality monitoring is immediately increased to determine the cause and to estimate how long the problem may persist. Shellfish will be
monitored and will not be handled until water quality is acceptable. Records will be kept.

3.3.2 Shellfish Monitoring

Shellfish will be monitored regularly for any unusual behaviour, visible trauma/lesions, or other signs of disease or predator attacks. Changes in behaviour and physical condition will be recorded and reported to site management. Water quality will also be routinely monitored (as per 3.2.1 above). Collection and analysis of fresh dead and moribund animals will provide the best opportunity for identifying cause of mortality.

All necessary precautions will be taken to ensure disease is kept out of a growout area.

Standard Operating Procedures

- Mortality collection and disposal
- Mortality classification
- Shellfish health sampling procedures, e.g., proper collection and shipping of samples, lab work (on-site, in house or referred)

3.4 Minimizing disease within the lease

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- Visitor/Supplier procedures
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Standard Operating Procedures
Equipment disinfection cleaning

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- Records of reporting to Provincial or Federal authorities, in accordance with any existing regulation

Records will be easily accessible and protected from damage, e.g. kept in binders in the site office.

Records will be kept for the duration of time the shellfish are on site or as required by regulation. The operator will keep archived records at a suitable location in head office or securely stored off site.

Aquaculture facility records will be available for inspection upon request by CFIA.

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Standard Operating Procedure

Shellfish Health Emergency Procedures

3.6.1 Infectious Disease Emergencies

Isolation/Quarantine
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