

Determining and Mitigating Risks of Disease Introduction

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Outline

- Biosecurity (bioexclusion)
- Introduction Risk Assessment
- Biosecurity Plan
- Footnotes for the future



Biosecurity

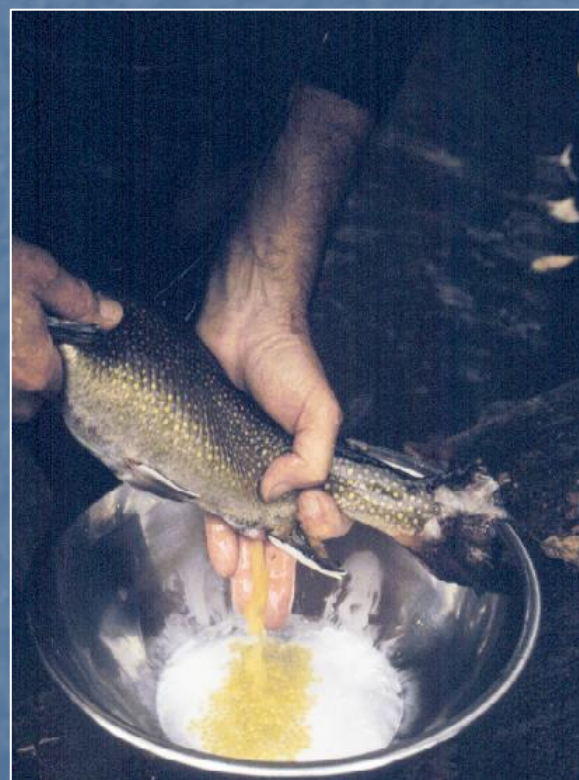
- Definition:
 - a system of measures (i.e., inputs, movements and other activities), each with a set of procedures, that taken together minimize the risk of introduction and spread of infectious organisms within or between aquatic animal populations.

Biosecurity measures - at the site level

- Bioexclusion (prevention of pathogen entry)
 - Within-site infectious disease control (management of pathogens within a facility)
 - Biocontainment (prevention of pathogens release)
- For this discussion: bioexclusion (prevention of entry) of Viral Hemorrhagic Septicaemia Virus (VHSV) in a commercial Atlantic salmon aquaculture hatchery.

Introduction scenarios

- In a commercial Atlantic salmon hatchery that raises smolts for saltwater entry into net pen sites, consider the introduction of VHSV through:
 - Eggs harvested from broodstock in saltwater
 - Fry transferred from a sister hatchery in the company
 - Influent water into the hatchery



Introduction Risk Assessment

- Estimate the risks of introducing pathogenic organisms or disease into an aquatic animal site
 - Provide recommendations for mitigation of the risks
- Components
 - hazard identification
 - hazard characterization
 - estimation of the likelihood of introduction of each identified hazard given the introduction scenario

Hazard identification

- VHSV
 - Regulated disease under upcoming federal legislation in Canada (*Health of Animals Act and Regulations*)
 - Sublineage IVa - Pacific
 - Sublineage East Coast - Atlantic
 - Sublineage IVb – Great Lakes

Hazard characterization: VHSV

- Physical
 - Response to light, temperature and moisture (desiccation, survival in freshwater, seawater and sediments)
- Chemical
 - Response to disinfectants
- Biological
 - Susceptible species, infectious dose, modes of transmission, incubation period, persistence, prevalence, clinical signs, pathology, mortality curves, global distribution



Likelihood of introduction

- Sources of pathogen introduction
 1. Aquatic animals
 2. Water
 3. Fomites
 4. Vectors
 5. Feed

Mitigation measures

- In place *at each step* to reduce the risk to negligible should be identified.
 - Approximately 15 generic mitigation measures
 - Gaps where mitigation measures should be in place → residual risk

Mitigation measures

Water

- Influent water is pathogen free – treatment methods defined
- Water quality monitoring

Feed

- Feed source is pathogen free

Animals

- Source animals are pathogen free
- Post introduction quarantine
- Routine health and disease monitoring
- Mortality collection and disposal procedures
- Treatments
- Emergency response plan
- Egg disinfection procedures

Vectors

Procedures in place to prevent introduction via:

- Feral aquatic animals
- Ectoparasites
- Predator and scavenger control

Fomites

Procedures in place to prevent introduction via:

- Vehicles and Vessels
- Staff, Visitors and Suppliers
- Equipment
- Limited access to facility
- Cleaning and Disinfection procedures

Biosecurity Plan

- A documented biosecurity plan is the only way of demonstrating that disease control is happening without an ongoing effective testing plan



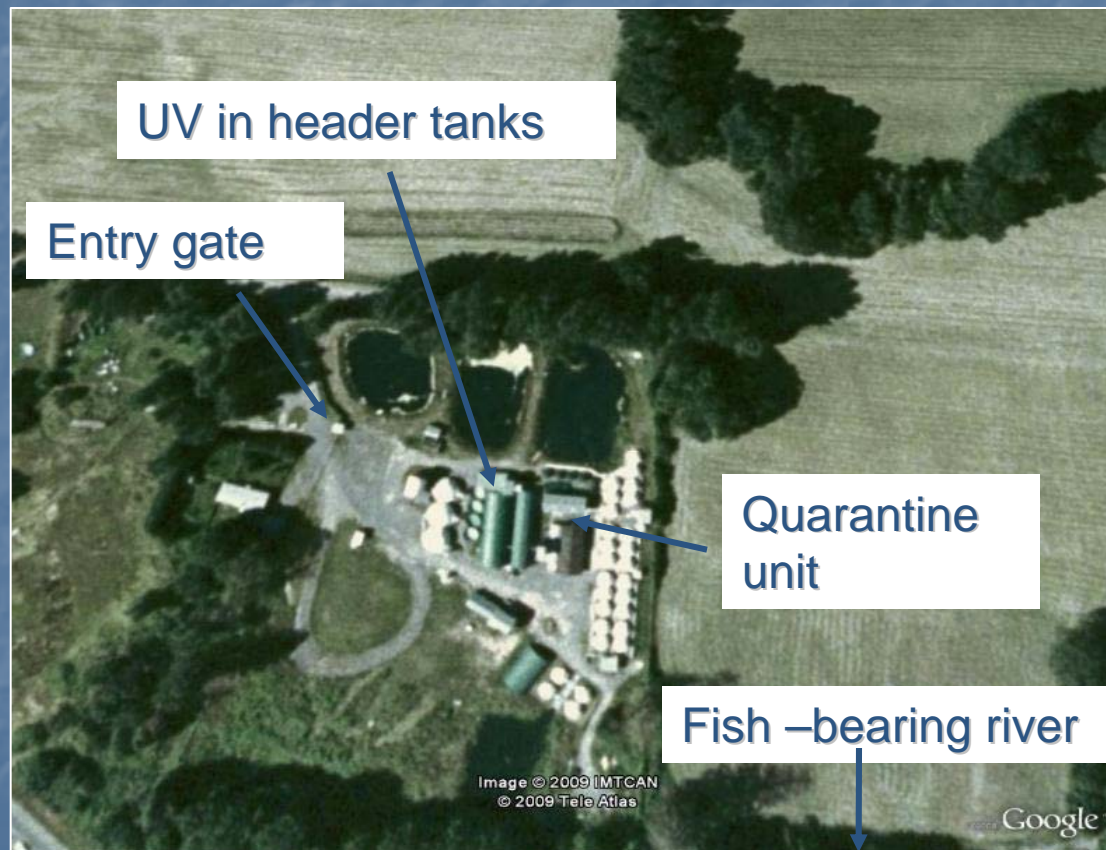
Elements of a Biosecurity Plan

1. Prerequisite information
2. Identified sources of introduction
3. Identified mitigation measures
 - Introduction risk assessment *
4. SOP's for each measure
5. Records, to substantiate implementation of the Plan
6. Verification
7. Periodic review and validation of the Plan

1. Prerequisite information

- Production biology of the species
 - Lifestages: eggs, fry
- Physical layout of the facility
 - Influent water source and treatment
- Normal steps in hatchery operations
 - Steps prior to receipt of eggs/fry
 - Receipt of eggs/fry

Physical layout of the site



2. Identified Sources of Introduction

- Eggs
 - Surface of Eggs
 - Ovarian fluid
 - Milt?
- Fry
 - Infected fry
- Associated fomites
 - Transport water
 - Cleaning water used for fomites (e.g., equipment such as transport containers)



3. Identified Mitigation Measures

Measure	Eggs	Fry
<u><i>ANIMALS</i></u>	X	X
Effective testing at source site of source population	Broodstock	Source population
Egg disinfection	X	
And/or upon entry, keep population distinctly separate from others on site (quarantine), and effluent handled separately; close observation	X	X
<u><i>FOMITES</i></u>		
Proper disinfection and/or disposal of transport water	X	X
Cleaning and disinfection of transport equipment (e.g., containers) and proper disposal of cleaning water	X	X

3. Identified Mitigation Measures

Measure

WATER

Large particle filtration through sand filters

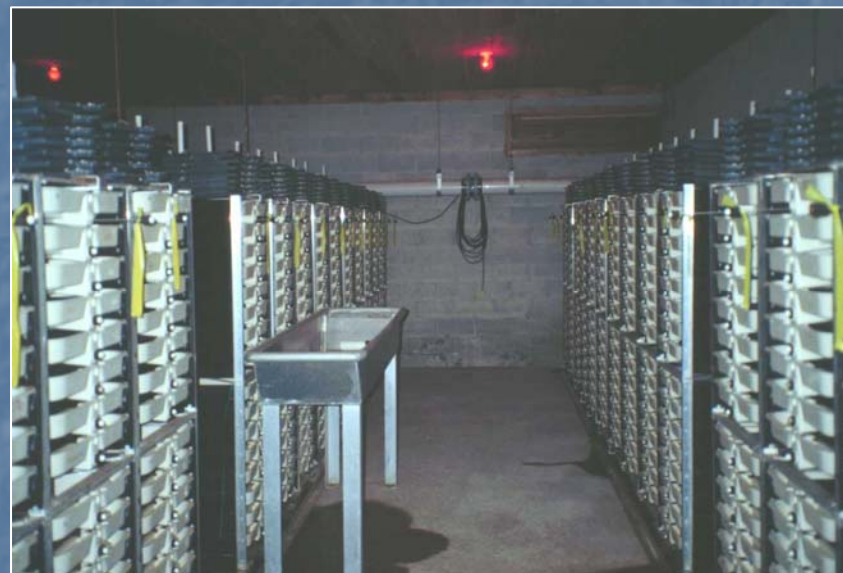
In-line ultraviolet light source in header tanks

- Efficacy for site's influent water volume tested on site by manufacturer's representative



4. Standard Operating Procedures (SOP's)

- Each mitigation measure should have one or more associated SOP's
- SOP's should contain some or all of the following sections:
 - Defined purpose
 - Responsibility – who may conduct the activity
 - Equipment and Supplies required
 - Procedure
 - Records required
 - Cautions
 - Training required to complete the activity
 - References, linked SOPs and definitions



5. Records

- To substantiate implementation of the plan
- Examples (eggs and fry)
 - Health certificate, testing results and records of treatments at source site
 - Egg disinfection records
 - Inventory and movements
 - Transport in (e.g., bills of lading)
 - Quarantine records
 - Cleaning and Disinfection records, protocols
 - Transport equipment, supplies and water
- Examples (water)
 - Water treatment
 - Process monitoring (e.g., UV, ozone and/or filtration in use for influent treatment)

6. Verification

- Verifying that the plan is being implemented as written (approved)
 - For eggs and fry
 - Records review
 - Inspections of facility and animals
 - Testing of animals
 - Traceouts for disease outbreak investigations in epidemiologically linked populations (on- and off-site)
 - For water treatment
 - Treatment process record review
 - Water testing

7. Periodic review of the Plan

- Whenever there is an unexpected event (i.e., breach of biosecurity)
- Annually (recommended)
- “Re-validation”
 - Epidemiology and risk assessments will be revised as the scientific evidence advances
 - Role of active observational surveillance?



Implications/ considerations

1. Verification and validation of the Plan

Voluntary or regulatory?

2. Costs vs. realized benefits of the Plan for the owner/operator/occupier

Many small enterprises

Business decision

Trade-off in the short- and long-term between (1) costs and effort of testing each shipment and (2) the costs of implementing the biosecurity Plan

3. Audit paradigm (verification and validation)

HACCP provides monitoring and audit process but was not designed to address infectious disease control

Host as well as environment required for pathogen replication

Biosecurity Plan - Summary

- Introduction Risk Assessment
 - Hazard identification, hazard characterization, likelihood of introduction
 - Identified mitigation measures and gaps in measures
- Biosecurity Plan
 - Prerequisites
 - Identified sources of introduction
 - Mitigation measures
 - SOP's
 - Records
 - Verification
 - Periodic review
- Costs and benefits
- Monitoring and Audit

Acknowledgements

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