7. Conclusions

Quarantine is an important risk management measure that can be applied to reduce the risk posed by serious aquatic animal diseases when aquatic animals are moved internationally or domestically between different regions or zones, or when new broodstock or other life cycle stages are introduced into hatcheries and other aquaculture production facilities.

For international movements, the decision to require pre-border, border and/or post-border quarantine of live aquatic animals should be made based on risk analysis, and stringency of quarantine to be applied should be commensurate with the estimated risk. The first movement (introduction) of a new species (an exotic) is likely to require use of highly stringent protocols, such as those outlined by ICES (2005).

The quarantine of broodstock and other life cycle stages entering aquaculture production facilities can be routinely applied to reduce the likelihood of introducing serious diseases to the facility that will cause morbidity, mortality and associated production and financial losses.

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ANNEX 1

Policy for the importation of Atlantic salmon into British Columbia

INTRODUCTION

The introduction of new disease agents or new strains of enzootic disease agents has caused significant economic losses to countries around the world with industries that depend upon the harvest of wild and cultured fish.

The Protocol described below has been developed in recognition of the importance of protecting the commercial fisheries, recreational fisheries, and cultured fish stocks of British Columbia from the importation of non-indigenous disease agents and parasites such as, but not limited to:

- Infectious Pancreatic Necrosis Virus,
- Viral Hemorrhagic Septicemia Virus,
- Exotic strains of the Infectious Hematopoietic Necrosis Virus,
- The causative parasite of whirling disease,
- Erythrocytic Inclusion Body Syndrome,
- Atypical *Aeromonas salmonicida* (furunculosis).

Proposals to import Atlantic salmon into British Columbia will be assessed and authorized by the Department of Fisheries and Oceans (DFO) on the basis of their compliance with this protocol. DFO will consult with provincial fisheries agencies (Ministry of Agriculture, Fisheries and Food; Ministry of Environment, Lands and Parks) on all decisions made in regard to this Policy.

PROTOCOL

All importations must comply with the Canadian Fish Health Protection Regulations (CFHPR). All applications to import eggs or milt must be received at least 45 days prior to the "taking of the eggs or milt" destined for B.C.

Only surface-disinfected, fertilized eggs will be imported. No live fish or unfertilized eggs will be allowed. Milt may be allowed if:

a) the broodstock from which the milt is collected complies with the CFRPR; and

b) 100 % of the ripe males from which milt is collected are lethally sampled for the viral disease agents of concern; and

c) eggs fertilized with imported milt must be held under quarantine and isolation as outlined below.

1. Egg imports will be allowed only from broodstock that has been held in captivity by the source company for one full generation. The eyed eggs must arrive in B.C. a minimum of 15 days before hatch.
2. Importations will only be allowed from:
   a) facilities inspected and approved by a Local Fish Health Officer (LFHO)[1] at least 15 days prior to receipt of eggs or milt in B.C.;
   b) facilities operated within a program of regular fish health monitoring and documentation by an CFHPR approved fish health official;
   c) freshwater facilities that use a fish-free ground water supply and isolation areas for egg incubation; and
   d) facilities that provide access to complete fish health, mortality, pedigree and production records for the facility and stock from which the sex products destined for B.C. have been collected.
3. The acceptability of a facility as a source of Atlantic salmon eggs and milt will be determined by a LFHO and will be based upon the extent and reliability of the available fish health data and disease histories for all species held in the facility. The acceptability will also depend upon the extent and reliability of the fish health data and disease history of the watershed in which the facility or fish holding units are located.

No importations will be allowed from facilities or sites:

a) in which a salmonid pathogen not known to occur in B.C. exists;
b) in which a fish pathogen exists that has been designated as a problematic strain by a LFHO because of drug resistance or enhanced pathogenicity;
c) that do not take measures designed to prevent the movement, importation, control, and eradication of fish disease of concern to B.C.

4. All imported Atlantic salmon eggs must be held under strict quarantine immediately upon their arrival in B.C. in an approved facility. The quarantine procedures will consist of:
   a) disinfection of the facility's effluent until all stocks of fish under quarantine have reached an average size of 3 grams. The minimum length of time that the fish are quarantined with effluent disinfection shall not be less than 120 days. The quarantine period must be followed by total isolation of the fish from all other fish in the facility until they are introduced to sea water. The isolation must be carried out in the quarantine facility or an approved alternate land based facility.
   b) discharge of all effluent from the facility "to ground" in an approved manner for the entire quarantine period. The maximum volume of effluent that can be "discharged to ground" on the lands of the quarantine facility must be determined by a qualified hydrologist approved by DFO.
   c) testing by a DFO approved laboratory of 30 moribund and dead fish every 4 weeks during the quarantine period in addition to the examination of 120

[1] as defined in Chapter 1 of the CFHPR; appointed by the Minister of Fisheries and Oceans for Canada.

fish per stock 2 weeks prior to the introduction of each stock to sea water. Additional spot checks may be carried out on moribund and dead fish by a LFHO. As well, additional fish health testing may be required at anytime by the LFHO.

d) no live fish may be removed from the quarantine facility until all fish and eggs in the facility have met the minimum quarantine requirements and the written approval of a LFHO has been obtained.

e) all dead fish or fish eggs must be placed in a solution of 10% formalin for a minimum of 5 days before removal from the quarantine facility.

5. The importers of the fertilized Atlantic salmon eggs or milt shall bear all costs of the inspectors described in Chapter 4, all costs of the testing of fish described in Chapter 6(c), and all costs of the hydrological testing and surveys required under Chapter 6(b).
6. All companies operating a quarantine/isolation facility must agree to enter into a legal contract with DFO regarding the design, operation, and monitoring of the facility.
7. If a disease agent of concern to DFO is detected in the imported stocks during the quarantine and isolation period, all stocks within the quarantine/isolation facility must be destroyed and a full program of facility disinfection carried out.
8. All mortality records and the results of all routine or clinical testing carried out on the quarantined or isolated fish stocks must be submitted every 4 weeks to DFO. The results of tests carried out under 6(c) by independent laboratories must be reported to DFO within 48 hours of their completion.
9. All requests for permission to import live Atlantic salmon eggs and/or milt into B.C. must be addressed to the Transplant Committee DFO, Pacific Biological Station, Nanaimo, B.C. V9R 5K6.

ANNEX 2

Disinfectants and disinfecting procedures mentioned in this manual

(Note: for additional information on the safe and effective use of disinfectants: DAFF, 2006; Danner & Merrill, 2006; OIE, 2006a, 2006b)

Chemical or treatment (generic/trade names)	Use	Effective concentration/ level	Application	Notes	Manual reference (section)
Chemicals					3.4
Alcohol (ethanol)	disinfecting hands	70%	apply directly to hands	replenish bottles as needed	6.3.3
Iodine (iodophore, povidone iodine, Betadine®, Wescodine®)	a) disinfecting equipment, aprons, footwear	a) 0.5% available iodine	a) minimum treatment time of 5 min		4.3, 4.5, 4.6.1, 5.5, 5.8.1
	b) footbaths	b) 200 mg iodine/ litre	b) treatment time of a few seconds	b) replenish footbaths regularly & record in logbook. Discard colorless iodophor solutions as they are no longer active	4.6.1
	c) disinfecting hands	c) 20 ppm povidone iodine	c) a few seconds	c) replenish bottles as needed	6.3.3
	d) surface disinfection of shrimp broodstock upon entry to quarantine unit	d) 20 ppm povidone iodine	d) 30–60 s dip	d) immediately transfer broodstock to clean water in receiving tanks following treatment	6.4

DISINFECTANTS AND DISINFECTING PROCEDURES MENTIONED IN THIS MANUAL *(continued)*

Chemical or treatment (generic/trade names)	Use	Effective concentration/ level	Application	Notes	Manual reference (section)
Sodium hypochlorite (hypochlorite, Chlorox®, bleach)	a) sterilizing wastewater & transport water	a) Final chlorine concentration > 200 ppm (200 mg/litre)	a) 1.6 ml hypochlorite solution (12.5% available chlorine)/ litre of water followed by agitation for at least 10 min & retention for at least 1 h	a) filter wastewater to remove organic material test pH of water to be treated and adjust to between 5.0–7.0, if necessary test level of residual chlorine to ensure conc. of 5 mg/litre or less before discharge. Retreat if necessary.	3.4, 4,4.2, 5.4.2
	b) disinfecting equipment, boxes, cartons & other potentially contaminated material intended for reuse	b) As above	b) treat for a minimum of 5 min	b) thoroughly clean items before disinfection	4.3, 4.5, 5.5
	c) footbaths			c) replenish footbaths regularly & record in logbook	4.6.1, 6.3.3
	d) disinfecting hands	d) > 50 ppm active ingredient			6.3.3
	e) disinfecting plastic containers & hoses in shrimp broodstock quarantine units	e) 20 ppm			6.4
	f) disinfecting intake seawater for use in shrimp broodstock quarantine unit	f) 20 ppm active ingredient	f) not less than 30 min	f) treatment conducted in intake water storage tank; neutralize with sodium thiosuphate at 1 ppm for every 1 ppm of residual chlorine at strong aeration	6.4.1
	g) treating effluent waters from shrimp broodstock quarantine units	g) >20 ppm or > 50 ppm active chlorine	g) >60 min or >30 min	g) neutralize as above	6.4.2

DISINFECTANTS AND DISINFECTING PROCEDURES MENTIONED IN THIS MANUAL *(continued)*

Chemical or treatment (generic/trade names)	Use	Effective concentration/ level	Application	Notes	Manual reference (section)
Calcium hypochlorite (hypochlorite powder, Pool Chlor® (65–70% available chlorine))	Sterilizing discharge water	a) final chlorine concentration > 200 ppm (200 mg/litre)	a) 0.3 g/litre water followed by agitation for at least 10 min & retention for at least 1 hr		3.4,4,4,2, 5.4.2
		b) as above		b) replenish footbaths regularly & record in logbook also uses e, f & g under sodium hypochlorite.	4.6.1, 6.3.3
Copper sulphate ($CuSO_4$, copper control)	disposing of dead aquatic animals, filter material, wet bags, boxes, cartons & other burnable potentially contaminated materials	0.1 ppm	aerated bath		6.4
Formalin	disposing of dead aquatic animals, filter material, wet bags, boxes, cartons & other potentially contaminated materials	a) 50–100 ppm	a) 30–60 s, as dip	a) immediately transfer broodstock to clean water in receiving tanks following treatment	6.4
		b) 30–50 ppm	b) 1 h aerated bath		6.4
		c) 50–100 ppm	c) 30–60 min, with strong aeration		6.4
Oxytetracycline	a) Decontaminating small equipment, filters etc.	a) 10 ppm	a) as bath, 5–7 times per day	identification of the bacteria involved & antibiotic sensitivity testing strongly recommended.	3.4, 6.4
	b) Disposing of dead aquatic animals	b) 1–2 ppm	b) in feed		
Potassium permanganate ($KMnO_4$)	external disinfection of shrimp broodstock upon arrival at quarantine	100 ppm	30–60 sec, as dip	immediately transfer broodstock to clean water in receiving tanks following treatment	6.4
Sodium thiosulphate (photographic hypo)	neutralizing chlorine in wastewater or transport water prior to discharge		1.25 g (2.5 ml of 50 % sodium thiosulphate solution)/litre followed by agitation for not less than 10 min before discharge		3.4, 4.4.2, 5.4.2, 6.4.1, 6.4.2

DISINFECTANTS AND DISINFECTING PROCEDURES MENTIONED IN THIS MANUAL *(continued)*

Chemical or treatment (generic/trade names)	Use	Effective concentration/ level	Application	Notes	Manual reference (section)
Irradiation					
Ultra-violet light	disinfecting waste water & transport water	>130 mWs/cm^2	commercial UV water treatment units operating in the spectral range of 190–280 nm (254 nm recommended) are required.	filter all water to be treated to remove all suspended organic material prior to irradiation. monitor burning time of UV lamp & replace as per manufacturer's specifications	4.4.2, 5.4.2
Physical					
Filtration	removing suspended organic matter prior to wastewater or transport water sterilization			filter to be approved by Competent Authority. Record filter changes in logbook.	4.4.1,4,4,2, 4.3, 4.6.1, 4.8.3, 5.4.2, 5.8.1, 5.12
Heat treatment	Sterilizing discharge water		85°C for not less than 30 min	heating units must be fitted with temperature & flow recorders & approved by Competent Authority	4.4.2
Incineration	disposing of dead aquatic animals, filter material, wet bags, boxes, cartons & other burnable potentially contaminated materials			incineration facility to be approved by Competent Authority.	4.4, 4.5, 4.6.1, 4.6.2, 4,7, 5.6, 5.7, 5.8.1, 5.10, 6.4.3
Deep burial	disposing of dead aquatic animals, filter material, wet bags, boxes, cartons & other potentially contaminated materials			burial site to be approved by Competent Authority.	4.4, 4.5, 4.6..2, 5.6, 5.8.1
Autoclaving	a) Decontaminating small equipment, filters etc. b) Disposing of dead aquatic animals				4.3, 4.6.1, 4.6.2, 5.5, 5.6, 5.8.1 4.4, 4.6.2

Quarantine is an important risk management measure and a key activity that should be considered when developing national strategies on aquatic animal health management. This manual outlines the technical requirements for setting up quarantine facilities at three levels, based on the general level of risk (as determined by risk analysis) represented by the specific consignment of aquatic animals being moved: (i) the quarantine of "high risk" species (e.g. aquatic animals being moved either internationally [introductions and transfers] or domestically between regions of different health status) that are destined for use in aquaculture, capture fishery development or other applications where release or escape of animals or any pathogens they may be carrying into the natural environment is likely to occur; (ii) the quarantine of "lower risk" species (e.g. aquatic animals destined for the ornamental trade) to improve biosecurity for aquatic animals whose trade is an established practice; and (iii) the routine quarantine of aquatic animals at production facilities (e.g. new, domestically produced or locally captured broodstock or juveniles or animals whose movement has been contingent upon additional, more stringent, risk management measures, such as the use of specific pathogen free stocks, international health certification and pre-border and/or border quarantine).

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