Fisheries and Oceans Canada | Pêches et Océans Canada

Finfish Aquaculture Licence 2010 under the Pacific Aquaculture Regulations

Licensed for: Aquaculture | Date Issued: «DATE_ISSUED»

LICENCE No. «DFO_Prefix» «DFO_Lic_No» «YEAR» | Expiry Date: «EXPIRY_DATE»

ISSUED TO:
«LICENCE_HOLDER»
«Attention»
«COMPANYADDRESS»
«PHONE_NO»
«FAX_NO»

This licence is issued under the authority of the *Fisheries Act* and confers, subject to provisions of the *Fisheries Act* and Regulations made there under, the authority to carry out aquaculture activities including cultivation and harvest of fish and prescribed activities under the conditions included herein and/or attached hereto.

The above licence holder is authorized by this licence to carry on the business of aquaculture at following location and for the following species:

| Site Reference Number | Location and Legal Description |
|---|---|
| «REFERENCENUMBER» | «SITECOMMONNAME»<br>«LEGALDESCRIPTION»<br>«LANDFILENUMBER» |

| | Common name | Maximum Allowable Peak Biomass (T) |
|---|---|---|
| 1 | «SPECIES_1» | «SPECIES_1_MAX» |
| 2 | «SPECIES_2» | «SPECIES_2_MAX» |
| 3 | «SPECIES_3» | «SPECIES_3_MAX» |
| 4 | «SPECIES_4» | «SPECIES_4_MAX» |
| 5 | «SPECIES_5» | «SPECIES_5_MAX» |
| 6 | «SPECIES_6» | «SPECIES_6_MAX» |
| 7 | «SPECIES_7» | «SPECIES_7_MAX» |
| | Total Peak Biomass | |

**Marine Finfish Commercial Aquaculture Licence**

Designated Escape Recapture Vessel(s):

«RECAPTURE_VESSELS_1»
«RECAPTURE_VESSELS_2»
«RECAPTURE_VESSELS_3»
«RECAPTURE_VESSELS_4»
«RECAPTURE_VESSELS_5»
«RECAPTURE_VESSELS_6»
«RECAPTURE_VESSELS_7»

Site specific conditions:

*«Section_B_Comment_1»*

**Required Record Keeping and Reporting**: Details are contained within the attached conditions of this licence.

**Compliance Advisory**: Contravening a condition of this licence is an offence under the *Fisheries Act.*

It is the responsibility of individual licence holder to be informed of, and comply with, the *Fisheries Act* and the regulations made there under as well comply with all laws, bylaws and orders of any competent government authorities which affect the aquaculture facility described herein, in addition to these conditions.

## PART A. Definitions

"Baseline survey" means the gathering of environmental information typically conducted prior to a facility becoming operational

"*Beggiatoa*" is a genus of bacteria that forms white mats on the sediment surface in areas of organic enrichment

"Benthic" means on or in the seabed

"Biofouling" means the organisms that attach and/or live on nets and other structures (excluding herring spawn)

"Compliance station" means a geographical location relating to the containment structure as measured at higher high water referenced to chart datum

"Containment structures" are net pens, bag cages, tanks or similar structures used to contain finfish for the purposes of aquaculture

"Containment structure array" means a group of containment structures physically attached to each other or, in the case of circular structures, up to a maximum of 60 metres apart

"Department" means the Department of Fisheries and Oceans

"Facility" means the collective structures used for the purposes of aquaculture, including net pens, walkways, barges, floats and living accommodations plus associated lines and anchors

"Finfish" means fish of the class Osteichthyes.

"Fish Habitat" as per the *Fisheries Act* means spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes

"Fish Health Event" means an active disease occurrence or a suspected infectious event on a farm that triggers: 1) veterinary involvement and 2) an action, such as: lab diagnosis, recommendation/report, husbandry change, prescription medication, further investigation, etc. where such action is intended to reduce or mitigate risk associated with that event.

"Footprint" means the area of the seabed on which there is a measureable accumulation of nutrient enrichment originating from containment structures such as net pens, bag cages, tanks or similar structures and deposited by normal ocean currents

"Free sulphide" means dissolved "free" porewater sulphide ions not chemically bound to any other chemical constituent

"Hard ocean substrate" means a seabed type that cannot be sampled using sediment grab devices

"Harvest/transfer pens" means pens that are temporarily secured to the main containment structure array for the purpose of feeding, handling, holding, harvesting or moving fish

"In-situ net cleaning" means any kind of net cleaning that occurs in the water at the aquaculture facility

"Marine mammal" includes cetaceans, pinnipeds and sea otters

"Marine mammal accidental drowning" means the drowning death of a marine mammal after having made all reasonable attempts to prevent the event

"Mixed ocean substrate" means a seabed with characteristics of both soft ocean substrates and hard ocean substrates

"OPC" stands for opportunistic polychaete complexes; specific classes/genus of infaunal marine worms, including *Capitella*, found in organically enriched environments

"Peak biomass" means the maximum biomass of finfish within a facility during a production cycle

"Production cycle" means

(a) the period of time from stocking the containment structures to the time of harvest or removal of all finfish, prior to the facility being restocked; or
(b) for facilities containing broodstock, from the period of time immediately after peak biomass is reached up to and including the next date peak biomass is reached

"Reference station" means a sampling station

(a) within 0.5 – 2.0 kilometres from the facility
(b) having the same types of habitats and similar hydrographic, physical and morphological characteristics as the facility sampling stations, and
(c) representing background conditions

"ROV" stands for remotely operated vehicle which is used for video monitoring at an aquaculture facility

"Soft ocean substrates" means a seabed type that can be sampled using sediment grab devices

"Statistically significant" means an observed effect so large that it would rarely occur by chance and has been analyzed by statistical tools

"Time unit" in the context of benthic monitoring is a 20 second long video clip equating to a linear 4 metre distance across the seafloor based on a maximum ROV speed of 0.2 metres per second

"Video transects" means video generated by an underwater camera in the form of a long continuous strip in association with the monitoring of a facility

"Zone of compliance" means a 24 meter linear strip of seabed, comprised of a sequence of 6 time units where hard ocean bottom compliance parameter standards shall be met with the beginning of the zone located at 100 metres from the zero metre station.

## Part B. Licence Conditions:

### 1. Application and Licensed Species

1.1 This licence authorizes the licence holder to cultivate and harvest the species listed as part of the "Species" section on the face of this licence.

1.2 This licence, or a copy of it, shall be kept on-site and available for inspection by the Department.

### 2. Peak Biomass

2.1 The peak biomass of cultivated fish at this site per growing cycle shall not exceed the maximum set out on the face of this licence.

2.2 The licence holder shall submit to the Department by January 15, 2011, a report on the biomass and age class of all licenced species on-site as of January 1, 2011.

2.3 The licence holder shall submit to the Department by March 31, 2011, an inventory plan for all licenced species at this facility for the current calendar year using the template set out in Appendix I.

### 3. Containment Array Requirements

3.1 The licence holder shall submit to the Department by March 31, 2011, and comply with, a Containment Array Management Plan reflecting all the elements set out in Appendix II. This submission:

(a) must include the currently operational containment structure array; and

(b) may include any other array(s) that have been previously approved by the province of BC or the Department.

3.2 The licence holder shall submit to the Department by March 31, 2011, a written attestation completed by a qualified individual confirming that the facility design, equipment and systems are designed and installed in such a way and using such equipment as to be able to withstand the prevailing oceanographic and/or meteorological conditions of the licenced location.

3.3 If the containment array structure is re-anchored, the licence holder shall submit a new attestation as per Section 3.2 to the Department prior to transferring fish on-site.

3.4 The written attestations from Section 3.2 and 3.3, or copies thereof, shall be kept on-site and available for inspection by the Department.

3.5 The licence holder shall obtain accurate locational information (+/- 10 m) for each corner of the containment structure array at high slack tide. This information shall be collected:

(a) by a dGPS unit, or if this is not possible;

(b) by alternate "land survey" type approaches; and

(c) submitted to the Department at least 30 days prior to conducting the peak biomass monitoring per Appendix XVI.

3.6 The licence holder shall notify the Department when he/she are planning to change from one approved containment structure array to another 10 days prior to transferring fish on-site.

## 4. Transfer of Fish

4.1 The licence holder may transfer to this facility live Atlantic or Pacific salmon fish or eggs from a facility possessing a valid aquaculture licence issued pursuant to Section 3 of the Pacific Aquaculture Regulations within the same salmonid transfer zone (Appendix III: Map of Salmonid Transfer Zones) provided:

(a) the species of live salmonid fish or eggs are the same as those listed on the face of this licence;

(b) the licence holder has obtained written confirmation, executed by the source facility's veterinarian or fish health staff, that, in his/her professional judgment:

(i) mortalities in any stock reared at the source facility have not exceeded 1% per day due to any infectious diseases, for any four consecutive day period during the rearing period; and

(ii) the stock to be moved from the source facility shows no signs of clinical disease requiring treatment;

(iii) no stock at the source facility is known to have had any diseases listed in Appendix IV; or

(iv) where conditions 4.1 (b) (i), 4(b)(ii), and / or 4(b)(iii) cannot be met, the facility veterinarian has conducted a risk assessment of facility fish health records, review of diagnostic reports, evaluation of stock compartmentalization, and related biosecurity measures.

4.2 The written confirmation, or a copy thereof, described in licence condition 4.1(b) shall:

(a) be kept on-site and available for inspection; and

(b) except for movement of harvested fish, a copy shall accompany all shipments of fish to and from this facility.

4.3 For transfers between salmonid transfer zones or for transfers of non-salmonid species or where the above conditions cannot be met, a separate licence is required. Application for this licence shall be made to the Department and approval granted prior to shipment.

4.4 The licence holder shall notify the Department not less than 10 days prior to the transfer of fish to the site of the following:

(a) the source of fish;

(b) the age/life stage of fish being transferred;

(c) species;

(d) the quantities of fish being transferred;

(e) the destination of fish being transferred; and

(f) the proposed date of transfer.

4.5 The notification shall include a copy of written confirmation described in Section 4.1(b).

## 5. Fish Health Management Plan

5.1 Licence holders culturing salmonids shall have in place and follow a Fish Health Management Plan (FHMP) containing the elements listed in Appendix V. This FHMP shall be submitted to the Department by March 31, 2011.

5.2 The licence holder shall submit to the Department any amendments to this FHMP annually by March 31.

## 6. Sea Lice Monitoring

6.1 The licence holder shall carry out the sea lice monitoring program as per 6.2 and 6.3 on cultivated Atlantic salmon, except when:

(a) cultivating Atlantic salmon in Fish Health Zone 3.1 (Sechelt Inlet in Appendix VI – Fish Health Zones);

(b) the farm is harvesting and < 3 pens are left stocked on the farm;

(c) smolt entry and < 3 pens on farm, or < 1 month since third smolt pen entered the sea water;

(d) fish are being medicated for sea lice at that time point;

(e) fish are being medicated/managed for a fish health event; or

(f) fish can not be handled due to an environmental problem (as reported using Appendix VII).

6.2 The licence holder shall carry out the sea lice monitoring program on cultivated Atlantic salmon as follows:

(a) sea lice abundance shall be monitored following the protocols in Appendix VII:

(i) a minimum of once every two weeks during the period from March 01 to July 01 (i.e. during the spring out-migration period of juvenile salmonids); and

(ii) a minimum of once each month during all other periods; and

(b) sea lice counters shall be trained to support accurate and consistent observations.

6.3 Should the average motile *Lepeophtheirus salmonis* levels reach or exceed 3 lice per cultivated Atlantic salmon, the licence holder shall:

(a) increase monitoring to at least once every two weeks; and

(b) during the period from March 01 to July 01, initiate action to reduce the average sea lice count below 3 motile *Lepeophtheirus salmonis* per cultivated Atlantic salmon within 15 days of exceeding the threshold; or

(c) during all other periods, initiate action to manage motile *Lepeophtheirus salmonis* on cultivated Atlantic salmon within 30 days of exceeding the threshold; and

(d) notify the Department as per Section 9.2.

6.4 The licence holder shall ensure sea lice monitoring is conducted on cultivated Pacific salmon at the facility during routine inspections, including during harvests or on large fish in the autumn of the year. Sea lice observations shall be documented, and if 3 motile *Lepeophtheirus salmonis* per cultivated Pacific salmon are counted, the licence holder shall notify the Department as per Section 9.2.

## 7. Fish Health Record Keeping

7.1 The licence holder shall keep complete and accurate records of stocking activity and fish health for the facility, including the following:

(a) inventory records (including source, number, location and lot of fish at the site);

(b) daily feed consumption and growth rate;

(c) mortality records including classification and morbidity records;

(d) signs of increased morbidity;

(e) fish health monitoring observations (routine and during handling and other activities that may cause stress);

(f) biosecurity-related records;

(g) records of fish health events;

(h) records of fish health emergencies;

(i) samples taken and laboratory analysis related to fish health;

(j) surveillance and diagnostic sampling records;

(k) water quality records;

(l) records of mitigative actions (other than therapeutants) taken to prevent or mitigate disease, e.g. taking fish off feed due to a plankton bloom;

(m) all veterinarian or fish health staff reports; and

(n) records of reporting fish health information to Federal authorities.

7.2 The licence holder shall maintain records of the use of all therapeutants for the licenced facility including the following:

(a) the aquaculture licence number and the name of holder;

(b) the species of fin fish cultivated on-site;

(c) the name of the prescribing veterinarian;

(d) a log naming all drugs administered (therapeutants);

(e) how therapeutants were administered and dosage;

(f) the treatment schedule including the date treatment commenced;

(g) the date of last treatment;

(h) the name and signature of the person responsible for administering each treatment;

(i) the detailed records of medicated feed administration;

(j) traceability information related to treated groups that allows them to be readily identifiable through treatment and withdrawal times; and

(k) treated fish movement records;

(l) any mixing of treated fish into non-treated fish on-site. If this occurs, the mixed group of fish will be recorded and handled as if all were treated.

7.3 The licence holder shall provide training to site personnel to support accurate and consistent observations and recording of fish health information and maintain records of this training.

7.4 The licence holder shall ensure fish health records are reviewed by the licence holder's veterinarian and/or fish health staff to look for patterns in fish health and disease. These reviews shall be documented and kept as part of the fish health records.

7.5 The licence holder shall ensure that fish health records for this facility are kept and made available upon request by the Department.

## 8. Fish Health Event Response

8.1 Should a fish health event occur, the licence holder shall:

(a) take action to manage the event;

(b) undertake follow up measures to determine the cause of the outbreak and the efficacy of the management measures; and

(c) implement a response plan to contain an infectious disease if suspected or diagnosed.

## 9. Fish Health and Sea lice Reporting

9.1 The licence holder shall submit to the Department monthly reports on the results of his/her sea lice monitoring program as per Section 6 by the 15th of the following month.

9.2 Between March 01 and July 01 (i.e. during the spring out-migration period of juvenile salmonids), should the average sea lice count reach or exceed 3 motile *Lepeophtheirus salmonis* per cultivated Pacific or Atlantic salmon, the licence holder shall report within 48 hours:

(a) the results of on-site sea lice monitoring; and

(b) the details of the proposed management response.

9.3 Beginning on April 15, 2011, the licence holder shall submit to the Department quarterly reports on fish health and mortality event information as per Appendix VIII (Fish Health and Fish Mortality Event Report).

9.4 The licence holder shall submit reports on suspected or diagnosed outbreaks of those diseases listed in Appendix IV as per Parts A and C of Appendix VIII to the Department within 48 hours of observation.

## 10. Escape prevention, reporting and response

10.1 The licence holder shall take all reasonable measures to prevent the escape of cultivated fish and shall comply with all the requirements of Appendix IX (Escape Prevention through Maintenance of Cage and Net Integrity).

10.2 The licence holder shall:

(a) have a written escape response plan, and

(i) ensure the escape response plans are posted in visible locations at the facility;

(ii) ensure the locations and contents of the posted plans are made known to all staff; and

(iii) ensure the escape response plans include step-by-step procedures for preventing further escapes, undertaking a recapture fishery and for reporting escapes.

(b) take immediate corrective action to control, mitigate, remedy and confine an escape or a suspected escape of fish from the containment structure array.

10.3 The licence holder shall submit to the Department monthly reports using Appendix X summarizing the number of fish or estimated number of fish (including nil reports) that have escaped from the licenced facility or that cannot be accounted for based on inventory records by the 15th of the following month.

10.4 The licence holder shall ensure that any escape, or evidence of escape of cultivated fish from the facility is reported within 48 hours to the Department,

providing as much of the detail under Appendix X as possible, to the following location:

Observe, Record, Report (ORR) Line: 1-800-465-4336

10.5 The licence holder shall submit to the Department a report as per Appendix X of any escape reported in Section 10.5 within 7 days of the escape or suspected escape.

10.6 The licence holder shall ensure that the following activites are undertaken to recapture escaped Atlantic salmon:

(a) a recapture fishery is conducted utilizing the vessel(s) listed on the first page of this licence;

(b) the recapture fishery is conducted in accordance with Appendix XI (Escape Recapture);

(c) the recapture fishery is commenced within 24 hours of the escape;

(d) the recapture fishery is concluded within 24 hours of commencement;

(e) the recapture fishery is conducted only within 1 (one) nautical mile of the licenced facility from which the escape or suspected escape occurred; and

(f) only Atlantic Salmon (Salmo salar) shall be retained.

10.7 The licence holder shall submit to the Department a report detailing the results of the recapture fishery within 48 hours of the completed recapture or recapture attempt and shall include:

(a) the estimated number of cultivated fish that escaped;

(b) the number of escaped fish that were recaptured; and

(c) an incidental catch report as per Appendix XII.

## 11. Incidental Catch

11.1 The licence holder shall use reasonable care in designing and using nets and other gear or equipment in a way that reduces the risk of incidental catch, and causes the least amount of harm to incidental catch.

11.2 The licence holder shall ensure that any live wild fish caught during the transfer or harvest of cultured stock are immediately returned to waters outside the aquaculture facility in a manner that causes it the least harm.

11.3 The licence holder shall take all reasonable measures to retain dead wild finfish captured during the transfer or harvest of cultivated stock and dispose of them in the same manner that cultivated stock mortalities are disposed of as per Section 14.2.

11.4 The licence holder shall maintain an incidental catch log following the template provided in Appendix XII (Aquaculture Incidental Catch) of all fish that are caught within the net cages during transfer or harvest that are of a different species to those listed on the face of this licence.

11.5 Beginning on April 15, 2011, the licence holder shall submit to the Department quarterly reports on incidental catch summarizing results from Section 11.4.

## 12. Predator Control

12.1 By March 31, 2011, the licence holder shall submit to the Department a Predator Management Plan which includes Appendix XIII and describes measures to deter and minimize predator interactions.

12.2 The licence holder shall ensure that all reasonable methods are used to deter seals and sea lions from interfering or interacting with the aquaculture facility operation, but shall not use acoustical deterrents.

12.3 The licence holder shall report immediately any marine mammal accidental drowning mortality to the Department's Observe, Record and Report (ORR) fax line at 1-604-607-4156 or call 1-800-465-4336 for immediate assistance. The report is to be in the form found in Appendix XIV.

12.4 Should a marine mammal be observed entangled but not dead, the licence holder shall ensure that reasonable measures are taken to assist in its release. Should release not be possible, the licence holder shall attempt to dispatch the animal as per Section 12.5.

12.5 Should deterrence efforts fail, the licence holder may decide to kill, by means of firearms, Harbour Seals and California Sea Lions which represent an imminent danger to the aquaculture facility or human life. The licence holder shall then ensure that the following conditions are met:

(a) only Harbour Seals (*Phoca vitulina*) and California Sea Lions (*Zalophus californianus*) are permitted to be killed under the authority of this licence;

(b) only those Harbour Seals or California Sea Lions within or attempting to get within the containment structure array may be killed;

(c) the area where killing is permitted is restricted to the immediate site of the containment structure array;

(d) only employees and/or agents of the licence holder who meet one or both of the following qualifications may kill Harbour Seals or California Sea Lions under the authority of this licence:

(i) possessing a valid Federal Firearms Acquisition Certificate (FAC); or,

(ii) possessing a valid Federal Possession and Acquisition Licence (FPAL).

(e) persons killing Harbour Seals or California Sea Lions under authority of this licence shall carry documentation confirming that he/she meet one of the criteria listed in subsection (d) and produce it on demand of a Fishery Officer or Constable;

(f) all firearms used to kill Harbour Seals or California Sea Lions shall have a muzzle velocity of not less than 1,800 feet per second, and a muzzle energy of not less than 1,100 foot pounds; or not less than a 12 gauge shotgun, utilizing a single rifled slug;

(g) every attempt shall be made to retrieve all Harbour Seals or California Sea Lions killed under authority of this licence and within 24 hours the carcasses:

(i) shall be biologically sampled according to instructions provided by the Pacific Biological Station (Marine Mammal Research); or

(ii) if the mammal can not be sampled, the tooth dentition pattern of the upper jaw shall be photographed with a date stamp; and

(iii) shall be disposed of in accordance with applicable federal, provincial and municipal legislation and in a manner that will not attract predators, interfere with marine traffic or disturb fish habitat or at an appropriate land-based facility.

12.6 If a Harbour Seal or California Sea Lion is wounded or killed under the authority of this licence, a reasonable effort shall be taken to retrieve it without delay and ensure that the animal is dead.

12.7 Beginning on April 15, 2011, the licence holder shall submit to the Department quarterly reports containing the following information:

(a) the name of the facility and aquaculture licence number;

(b) the photographs (as per 12.5(g)(ii) above) with date stamp;

(c) the number of Harbour Seals killed;

(d) the number of California Sea Lions killed;

(e) the date each seal/sea lion was killed; and

(f) the date, species, number and cause of accidental marine mammal drowning deaths.

## 13. Protection of Fish Habitat

13.1 The licence holder shall maintain on-site records on the in-situ removal of biofouling, including the following information:

(a) the date of cleaning;

(b) the equipment or procedure used for cleaning;

(c) the type and number of nets or infrastructure;

(d) the cumulative net or infrastructure area;

(e) the average size mussels, if greater than 2 cm in length, prior to removal; and

(f) the type of anti-foulant and the date of application where applicable.

13.2 The licence holder shall comply with the requirements laid out in the Benthic Monitoring Program set out in Appendix XVI, including the submission reports to the Department as laid out in the Appendix XVI.

13.3 The licence holder shall ensure that the following compliance standards are attained at peak biomass:

(a) for soft ocean substrates, the mean free sulphide concentration:

(i) shall not exceed 4,500 µmol at or beyond the 30 m compliance station; and

(ii) shall not exceed 700 µmol at or beyond the 125 m compliance station.

(b) for hard ocean substrates, the coverage of Beggiatoa or OPC:

(i) shall not exceed 10% at or beyond the zone of compliance (100-124 metres from the containment structure array) in the last two time units of a sequence; and

(ii) shall not exceed 10% at or beyond the zone of compliance (100-124 metres from the containment structure array) in four out of six time units.

13.4 Subject to Section 13.2, sediment sampling using a grab is required.

13.5 When a grab sample for sediment cannot be taken, the protocols for video surveys will be conducted.

13.6 The licence holder shall ensure that the aquaculture facility is not restocked until the following compliance standards are attained:

(a) for soft ocean substrates, the mean free sulphide concentration:

(i) shall not exceed 1,300 µmol at or beyond the 30 m compliance station; and

(ii) shall not exceed 700 µmol at or beyond the 125 m compliance station.

(b) for hard ocean substrates, the coverage of Beggiatoa or OPC shall not exceed 10% in any time unit at or beyond the zone of compliance (100-124 metres from the containment structure array).

13.7 Where the licence holder has multiple containment structure arrays in a Containment Array Management Plan under Appendix II: the licence holder shall:

(a) notify the Department if he/she are planning to change from one containment structure array to another, 10 days prior to transferring fish on-site; and

(b) ensure compliance with the pre-stocking standards from Section 13.6 at all facility compliance sampling stations associated with the most recently used containment structure array prior to transferring fish on-site.

13.8 Should the Department determine that the monitoring stations used for reporting under Section 13.2 are not likely representative of worst case conditions, the Department may prescribe additional or alternate monitoring locations.

13.9 The licence holder shall keep records of raw benthic monitoring data and analytical reports for a six year period including the following information:

(a) all raw sampling/video transect data;

(b) field notes;

(c) protocols;

(d) QA/QC data; and

(e) a master copy of the final analysis report.

13.10 For proposed amendments where production or infrastructure changes will increase or alter the existing benthic footprint, prior to transfer of fish on-site, the licence holder shall:

(a) submit an application to amend the licence;

(b) collect baseline survey data if required by the Department;

(c) provide habitat compensation as approved by the Department; and

(d) undertake measures to mitigate the loss of productivity to the seabed.

13.11 For proposed amendments where production remains the same or decreases, or when infrastructure changes would maintain or reduce the existing benthic footprint, prior to transfer of fish to the facility the licence holder shall notify the Department.

13.12 Where harvest or transfer pens are used for less than 90 days in the same location:

(a) they shall remain empty for the equivalent time they are in operation; and

(b) the licence holder shall maintain records on-site of harvest and transfer pen usage to make available upon request of the Department. These records shall include start and end dates of harvest and transfer pen use.

13.13 Where harvest or transfer pens are used for more than 90 days in the same location, the licence holder shall ensure that during peak biomass monitoring as per Section 13.2, additional sampling is taken along a transect bisecting the transfer or harvest pen and meets compliance standards as per Sections 13.3 and 13.6.

13.14 The licence holder shall not conduct harrowing (the manipulating of sediments under containment structure arrays to increase oxidation of organically rich sediments).

13.15 The licence holder shall ensure that the only infrastructure contacting the sea bed is anchoring equipment.

13.16 By March 31, 2011, the licence holder shall prepare, implement, and produce upon the request of the Department a Chemical and Other Substances Management Plan including the management and control of therapeutants, disinfectants, pesticides, anti-fouling agents, hydrocarbons and bloodwater.

13.17 The licence holder shall retain blood water generated during harvest in the harvest vessel to be sterilized and disposed of at a land-based facility.

13.18 The licence holder shall ensure all debris generated or used on-site is collected or treated and disposed of at appropriate locations.

13.19 The licence holder shall ensure fuels and lubricants are safely contained according to petroleum industry standards and are not discharged into the marine environment or any other watercourse.

13.20 Should a spill occur, the licence holder shall ensure employees stop work and minimize the damage. All spills shall be reported to the Canadian Coast Guard at 1-800-889-8852.

13.21 The licence holder shall ensure all equipment is maintained in good proper running order to prevent the leaking or spilling of hydraulic fluid, diesel, gasoline and other petroleum products.

13.22 The licence holder shall ensure appropriate spill containment and cleanup supplies are kept available on-site whenever the site is operational and all personnel are familiar with the appropriate handling and storage of all hazardous materials on-site in order to:

(a) prevent incidental and serious spills;

(b) implement the spill cleanup plan and deploy of spill response material; and

(c) ensure any materials used in the cleanup are disposed in an approved manner.

13.23 The licence holder shall ensure that when therapeutants bound to feed pellets are utilized, they are prepared at the feed mill and not on-site.

13.24 The licence holder shall ensure that spent disinfectants from site footbaths are added to the mortality storage totes, and disposed of along with the deceased fish at on-land facilities.

13.25 Beginning on February 15, 2011, the licence holder shall submit to the Department annual reports on for the previous calendar year on the following:

(a) the monthly total dry weight of feed purchased and used, including weight or concentration of:

(i) therapeutants;

(ii) pigments;

(iii) pesticides; and

(iv) zinc and copper formulations;

(b) the names of all materials that are directly or indirectly released into the water during the reporting period including anaesthetics, anti-fouling agents, and/or other substances;

(c) the monthly weight, in tonnes, of mortalities and disposal method; and

(d) the average monthly finfish biomass in tonnes.

13.26 The licence holder shall ensure that domestic sewage produced from the facility and discharged to the marine environment associated with the facility complies with the following requirements:

(a) the maximum daily discharge rate does not exceed 2.5 $m^3$/day;

(b) the domestic sewage is treated by:

(i) a septic tank designed with a retention time of not less than 2 days prior to discharge, or

(ii) a device other than a septic tank with the concentration of total suspended solids in the effluent not exceeding 130 mg/L;

(c) the location of the sewage discharge point to the environment is at a depth not less than 15 metres below the surface of the water; and

(d) all records related to the construction, operation and maintenance of sewage treatment and disposal works are retained for inspection by the Department.

## 14. Fish Mortalities

14.1 The licence holder shall submit to the Department a report of the estimated weight (in kg) of fish mortalities within 24 hours if either of the following events occur:

(a) fish mortalities equivalent to 4000 kg or more within a 24 hour period are recorded; or

(b) fish mortalities equivalent to 10,000 kg or more within a maximum 5 day period are recorded.

14.2 By March 31, 2011, the licence holder shall submit to the Department and implement a Mortality Management Plan. The Mortality Management Plan will include measures addressing the following:

(a) collection, storage and disposal of normal operational levels of fish mortalities, including:

(i) the regular collection of mortalities and transferral to mortality storage totes;

(ii) the transfer of stored mortalities to land-based facilities;

(iii) the location of stored mortalities while awaiting transfer to land-based facilities;

(iv) the procedures to prevent leachates entering receiving waters;

(v) the methods to clean and disinfect "mort" storage and other handling facilities; and

(vi) bio-security protocols or direction provided by fish health specialists.

(b) procedures to manage incidental catch mortalities; and

(c) a mass fish mortality disposal plan, which will include:

(i) actions required to handle the additional biomass associated with a fish mortality event of the magnitude described in 14.1 ; and

(ii) use of identified vessels that will be used to collect and transport mortalities to on-land facilities in the case of elevated mortality events.

14.3 The licence holder shall not dispose fish carcasses at sea.

## 15. Boat Operations

15.1 The licence holder shall ensure that all boats in use at the aquaculture facility are operated so as to prevent damage to containment structures and anchoring systems.

15.2 The licence holder shall post signs at designated docking stations.

15.3 The licence holder shall post restricted use signs in those areas where boats not involved in the cultivation of fish are not permitted access.

## 16. Annual Aquaculture Statistical Report

16.1 By January 25, 2011, the licence holder shall complete and submit to the Department the Annual Aquaculture Statistical Report (Appendix XVII) by to the following e-mail address:

fishstats@dfo-mpo.gc.ca

## 17. Use of Lights

17.1 The licence holder may use lights to promote fish growth and alter fish physiology and shall record the following:

(a) type of lights used;

(b) the intensity of lights used;

(c) the number of lights used; and

(d) dates and times when the lights are used (period of day; season).

17.2 Beginning February 15, 2011, the licence holder shall submit to the Department annual light use reports summarizing results from Section 17.1 for the previous calendar year.

## 18. Fish Harvest

18.1 The licence holder shall submit to the Department planned harvests as per Section 2.3 and Appendix I. If modifications are made to this plan, the licence holder shall notify the Department prior to commencement of the harvest with:

(a) the facility name;

(b) the location destination; and

(c) the dates of harvest including anticipated length of harvest in days.

18.2 The licence holder shall include a Population Harvest Declaration Form (Appendix XVIII) with harvested fish and provide this form to the fish processing plant. This form will include the following information:

(a) the aquaculture licence number;

(b) the species of fish;

(c) the date of harvest;

(d) the name of the processing plant to which finfish are delivered;

(e) the estimated quantity of fish harvested in pieces;

(f) the lot number to identify the shipment of fish;

(g) the date of the last treatment(s) applied to any fish within the lot, if any, including the;

(i) name of the drug;

(ii) treatment schedule;

(iii) dates treatment commenced and finished;

(iv) established withdrawal period;

(v) name of the veterinarian, if any, who prescribed the drug; and

(vi) name of the person responsible for administering the treatment.

## 19. Administrative matters

19.1 For all types of management plans referenced in this licence, the licence holder shall submit a request to the Department to approve modifications; once the Department has approved it an amendment to the licence will be issued.

19.2 The licence holder shall keep all records required by these conditions in the following manner:

(a) With respect to duration:

(i) On-site for the duration of the production cycle; and

(ii) In a suitable location, on-site, in a corporate office, or other accessible storage off-site for a minimum of four additional years.

(b) accessible, legible and protected from damage; and

(c) in either computerized or paper versions.

19.3 Unless otherwise noted in specific licence conditions, all other reports and submissions required by this licence shall be submitted by e-mail to:

Aquaculture Management Division
Pacific Region, Fisheries & Oceans Canada
#200 – 401 Burrard Street
Vancouver, BC, V6C 3S4
E-mail: Marine.Finfish.Aquaculture@dfo-mpo.gc.ca

**Appendix I – Licence Holder Inventory and Stocking Plan**

The Inventory Plan is to include by month estimates of volume (tones) and numbers of fish broken down by:

1. First Year Production;
2. Second Year Production;
3. Broodstock; and
4. Fallow Periods.

The Stock Transfer Plan is to include the following information by source and transfer date:

1. Source of fish (i.e. facility fish are being transferred from);
2. Age/life stage of fish being transferred;
3. Species;
4. Quantities being transferred (estimated numbers, weight);
5. Transfer period dates;
6. Destination of fish; and
7. Estimated harvest time.

**APPENDIX II – Containment Array Management Plan**

The Plan will include the following elements with respect to Site Location Information and Area Usage:

1. Where multiple anchoring options are provided, the following information must be provided for each anchoring option and the licence holder must submit diagrams of all possible options accompanied by a brief description of how and when the different configurations would be used.

2. An Operational Layout Diagram must be included indicating area of:

    - Intensive use encompassing net cages, netting, float camps, net storage, docks, mort sheds and other structures and will include a 30-metre buffer around these structures. This buffer is intended to cover the area where anchor lines are most likely to pose a restriction to navigation due to the scope and angle of lines closest to the structures.

    - Extensive use including the area used for anchoring structures outside of intensive areas but that do not impede navigation or access to lands beyond (in other words, the portion of the tenure area not occupied by farm structures).

3. The Operational layout diagrams must also, at a minimum, include one or more to-scale plan-view diagram(s) of the facility showing all the features in the following list, preferably at a 1:5,000 scale in order to capture the required features:
    - the tenure boundary (current and/or proposed);
    - the net cage array(s) and/or other containment structures (indicate the maximum number of structures that may be installed);
    - anchor blocks and mooring lines (indicate the depth of anchor blocks);
    - navigational markers (required only if NWPA permit is already in place);
    - potential navigational pathways through or around facility structures;
    - buildings and floats, including staff quarters (if applicable);
    - domestic water lines (if applicable);
    - mortality storage and net cleaning stations (if applicable);
    - bottom depth contours (in recommended 10- metre intervals from the lowest low-water mark (LLWM)) indicating source(s) of bathymetric data if not derived from Canadian Hydrographic Service charts;
    - predominant current direction(s);
    - true north; and,
    - Label diagram(s) as Figures.

4. A 1:2000 to-scale, side-view diagram of the containment array must be provided which, at a minimum, must illustrate and itemize all structures above the surface and include all underwater structures to a depth of 10 metres (required by Coast Guard for navigation purposes). The diagram does *not* need to show bathymetry, anchor lines or other structures below a 10-metre depth.

5. The 30 metre and 125 metre compliance monitoring stations must be established by the following process.

   a. The licence holder shall obtain differential GPS readings from each corner of the containment structure array at high slack tide, and ensure this is consistent with the approved location of the array within the lease or licence of occupation boundary.

      High slack tide is that point in time in any given location where the water depth has reached its maximum height (above chart datum) and any water movement has ceased, up until the current reverses direction. Official tide tables are to be used to determine the predicted time for maximum height of the nearest tidal station and then extrapolate for the specific aquaculture facility location.

      The following criteria must be met when obtaining dGPS readings:

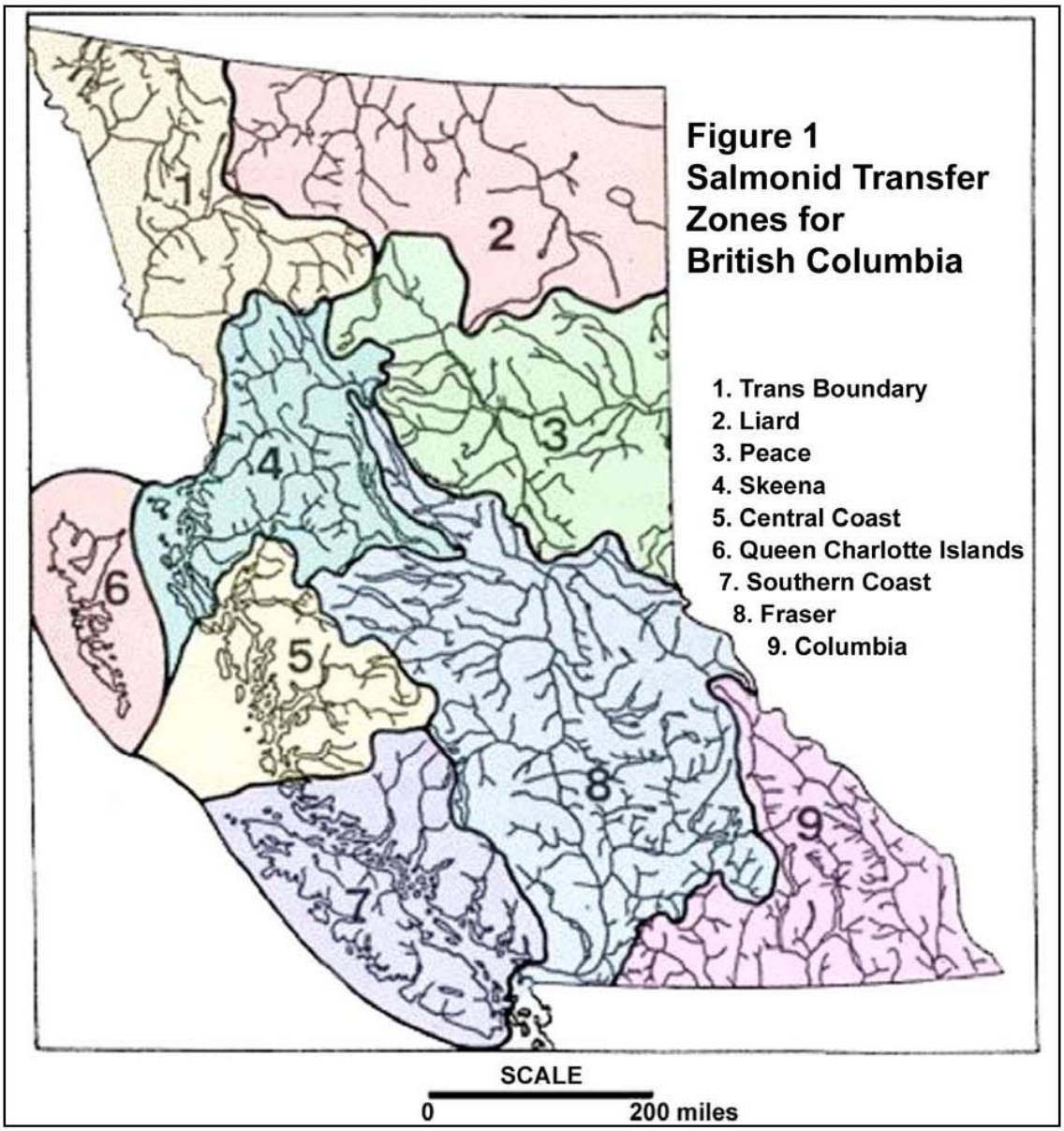
      - Use a "professional" model differential GPS as they have the ability to be better able to screen out multi-path signals;
      - Ensure the dGPS has good signals to work with before taking readings. A minimum of 4 satellites must be tracked prior to obtaining readings. If possible monitor the DOP (dilution of precision) of the satellite signals as this will indicate the relative level of confidence of the signals;
      - Avoid measuring beside or under large obstacles; and
      - Averaging several readings for one location can minimize effects of an erroneous reading.

   b. Through electronic mapping procedures, a 30 metre and 125 metre linear offset on all sides of the containment structure array are to be established. The specific locations of each 30 metre and 125 metre compliance monitoring station along the linear offsets shall be located such that it intersects with the area where the highest degree of impact is expected to occur. Information to be considered when selecting these stations include:

      - Most recent peak biomass sampling and monitoring data;
      - Historic sampling and monitoring data;
      - Licence holder internal in-cycle monitoring data;
      - MOE or DFO historic audit data;
      - Modelling data;
      - Localized observed current directions.

   c. For the zone of compliance associated with hard ocean bottom sites each transect shall be located such that it intersects with the area where the highest degree of impact is expected to occur. The information to be considered when selecting the transect directions is the same as outlined in (b).

Appendix III - Map of Salmonid Transfer Zones



**Appendix IV - List of Significant Diseases**

1. Infectious Hematopoietic Necrosis (IHN)
   (causative agent: Infectious hematopoietic necrosis virus (rhabdovirus)

2. Infectious Pancreatic Necrosis (IPN)
   (causative agent: Infectious pancreatic necrosis virus (birnavirus)

3. Viral Hemorrhagic Septicemia (VHS) – European Strain
   (causative agent: Viral hemorrhagic septicemia virus (rhabdovirus)

4. Infectious Salmon Anemia (ISA)
   (causative agent: Infectious salmon anemia virus (orthomyxovirus)

5. *Oncorhynchus masou* Virus Disease (OMV)
   (causative agent: *Oncorhynchus masou* virus (herpes virus)

6. Any filterable agent causing cytopathic effects in tissue culture other than the above.

7. Whirling disease
   (causative agent: *Myxobolus cerebralis*)

8. Cold Water Vibriosis (Hitra disease)
   (causative agent: *Vibrio salmonicida*)

**APPENDIX V – Required Elements of a Fish Health Management Plan**

The current licence holder Fish Health Management Plan will be attached.

These plans will lay out measures related to:

- Keeping Fish Healthy
  - Fish Handling Techniques
  - Monitoring water quality and responding to water quality events
  - Predator Exclusion
  - Use of vaccines
  - Keeping Pathogens out
  - Biosecurity including protocols:
    - Site and staff disinfection
    - Visitor
    - Equipment disinfection
    - Diver disinfection onsite
    - Diver protocols if diving multiple sites
    - Supplier protocols
  - Minimizing Disease within the site and transfer to the site
  - Management of Fish Disease Outbreaks including but not limited to:
    - Quarantine and other response measures
    - Fish health sampling protocols for proper collection and shipping of samples and Lab work (on site, in house, referral)
  - Mortality collection, disposal and classification
  - Special reporting related to Fish Escape
  - Handling and storage of vaccines, medicated feeds and chemicals used in fish health (e.g., disinfectants)

- Monitoring Fish Health

- Euthanasia

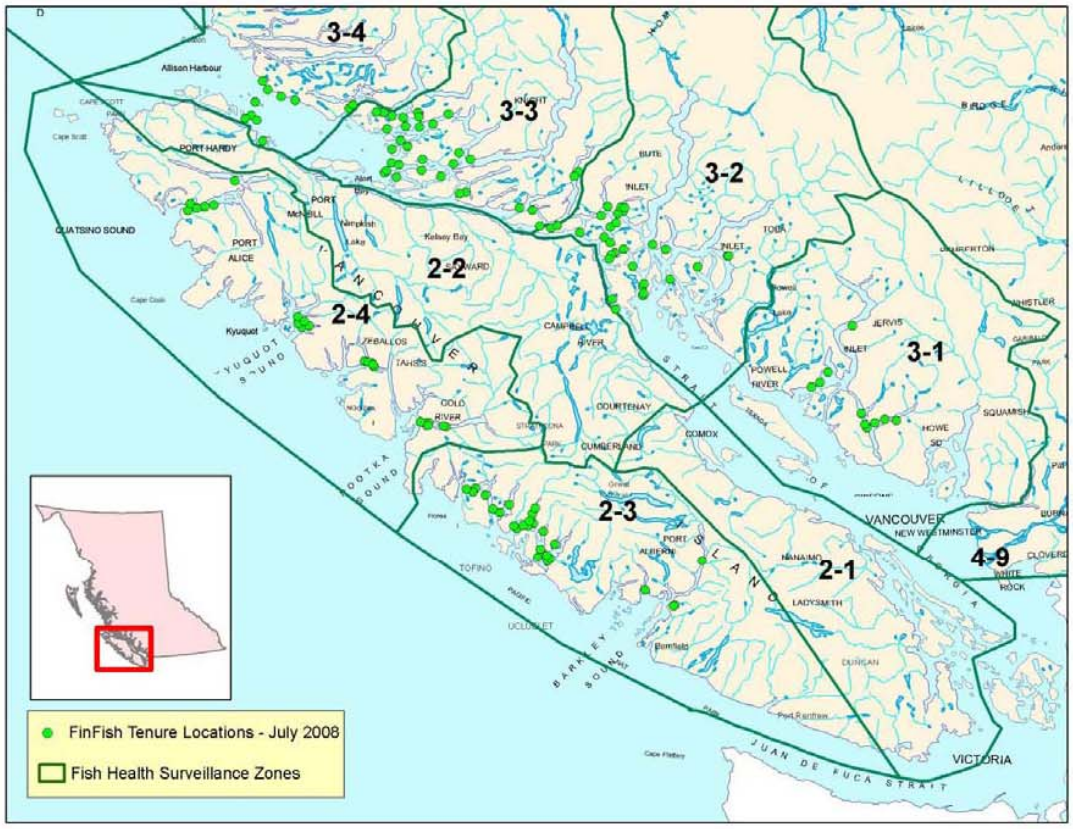
- Procedures to record and store the following information:
  - Inventory records
  - Fish movement records
  - Feed consumption records
  - Mortality records including classification and morbidity records
  - Fish Health monitoring observations records
  - Records of Biosecurity
  - Records and reports of Fish Health Events
  - Records of Fish Health emergencies, including outbreaks of significant diseases
  - Sampling and laboratory results of fish health
  - Surveillance and diagnostic sampling records
  - Water quality records

- Medicated feed records
- Therapeutic treatment records
- Records of mitigative action (non-therapeutic)
- Veterinary or fish health staff reports
- Records of reporting fish health information to federal authorities.
- Fish Health training records of staff

For sites holding broodstock, the following special considerations will be addressed:

- Suitable rearing environment
- Feed and nutrition
- Biosecurity
- Selection and Handling
- Treatment
- Egg and Milt collection
- Disease Screening
- Egg disinfection
- Egg (and/or) milt transport

Appendix VI. Map of Fish Health Zones




Not shown here is **sub-zone 3.5** (central coast) that spans the mainland coast from Deas Channel northward to Douglas Channel which includes fish farms near Klemtu and Bella Bella.

**APPENDIX VII - Sea Lice Monitoring Protocols**

Definitions

**Lice life stages**

| | |
|---|---|
| *Lepeophtheirus salmonis* | Adult female<br>Includes adult female lice, with egg strings (i.e. gravid) or without egg strings<br>Motile Lice<br>Includes all 'not permanently attached' free-moving life stages:<br>Adult females (as above)<br>Adult males<br>Pre-adult male and female lice |
| Caligus sp. | Total numbers of motile *Caligus* species |
| Both of the above | Chalimus<br>Attached early stages of both *Caligus* and *Lepeophtheirus* species. Both species are categorized as chalimus since louse identification at these early life stages is not practical at cage-side. |

**Year class – age of fish in saltwater:**

| | |
|---|---|
| Year class 1 | Represents fish groups that share a similar date of salt water entry with the first fish on farm (i.e. within 6 months), plus subsequent 12 months. |
| Year class 2 | Is defined as the remaining time in saltwater after that initial 12 months, not including broodstock |
| Broodstock | Non-food fish that are designated as broodstock and are not part of the production populations.<br><br>Broodstock may initially enter saltwater directly into designated broodstock pens, or be entered to a production farm and later become designated the broodstock population, yet remain at the production farm. Often these brood fish are moved to another group of pens designated as the brood site. |

1. Sea Lice Sampling Protocols – Year classes 1 and 2

1.1. Sampling at each farm shall be conducted in three pens. Pens chosen for sampling shall include:.

(a) one "reference" or "index" pen (i.e. first pen entered in the system, or the pen with the highest probability of having lice burden based on historical farm information). The fish from this pen are assessed EVERY sampling event; and

(b) Two additional pens selected at random on each sampling event.

1.2. A total of 60 live fish (20 per pen) shall be assessed.

1.3. In order to ensure a random sample of fish are collected from the net pen:
(a) numerous fish shall be initially captured using a seine net (or alternate method provided it ensures a crowding and representative collection of the pen's entire population).
(b) A sub-sample of 20 fish (i.e. 5 groups of 4) shall be randomly collected using a dip net.

1.4. Fish shall then be placed in an anaesthetic bath (or 'tote') or humanely euthanized (e.g. in cases when collection of other biological samples is required).

1.5. Physical handling shall be minimized to protect the fish and avoid dislodging lice.

1.6. All sampled fish shall be examined for the presence of lice regardless of the health status or size (i.e robust, moribund or runt).

1.7. Sea lice on each sampled fish shall be counted and discriminated according to the following six categories:

- Adult females (without egg strings)
- Gravid females (with egg strings)
- Adult males
- Pre-adults (females and males)

} Motiles

- Chalimus (non-motiles, regardless of species), and
- *Caligus* (combined totals of adults and pre-adults

1.8. When sampling for each pen is completed, water in the anaesthetic tote shall be examined for detached sea lice. All detached sea lice shall be categorized as above, counted and recorded as the 'tote count' and included in the calculation of the total pen lice number and average abundance (per fish).

2. <u>Sea Lice Sampling Protocols for Broodstock</u>

2.1. Fish designated as broodstock shall be sampled in the same manner as production fish until their second winter at sea (i.e. the broodstock pens may be selected in the normal course of selecting three pens on the site during the month for sampling). If a broodstock pen is selected, 20 fish shall be sampled.
2.2. In January/February of their second and subsequent wintersat sea (immediately prior to the out-migration period of the wild salmon fry) all broodstock populations on broodstock sites and all broodstock at production farms that are a different year class than the production fish at that same farm, shall be sampled. Twenty fish per pen shall be assessed.

2.3. After January/February of the year of in which those brood are anticipated to spawn as two-winter brood, and to reduce handling-related injuries and stress on broodstock,

(a) all sea lice monitoring shall be conducted opportunistically (or via other husbandry sampling). In other words, all sea lice monitoring shall be coordinated with other routine broodstock handling procedures, such as sorting, moving or immunizing.

(b) Broodstock shall be subject to a visual inspection twice per month for the presence of sea lice and any associated grazing blemishes.

3. Licence Holder Reporting requirements

Licence holder records and all reports submitted to the Department shall contain the following information:

3.1 Date of most recent use of anti-sea louse product

3.2 Sampling results as follows (reporting "nil" if no monitoring required/undertaken):

(a) Date of sampling

(b) By unique cage/pen identifier, total number of lice per pen with lice categorized as follows:

- Capture methodology
- Observations on lice grazing blemishes
- Motiles per fish including:
  - *Lepeophtheirus salmonis*
    - Adult females (without egg strings)
    - Gravid females (with egg stings)
    - Adult males
  - *Lepeophtheirus salmonis* Pre-adults
  - Caligus
  - Chalimus

(c) Average abundance of motile lice (per fish) by pen and cage site.

3.3 Environmental parameters measured at the farm site, including:

(a) monthly average dissolved oxygen concentration,

(b) water temperature and salinity at 1, 5 and 10 metres depth.

(c) algal bloom events

(d) other relevant environmental factors

For monthly sampling reports, this environmental data shall be reported to DFO irrespective of whether sea lice monitoring has been undertaken.

## APPENDIX VIII – Fish Health and Fish Mortality Event Report

**PART A.**

Reporting Month and Year (if monthly report):
Reporting date (if an emergency fish health report):
Farm name and Licence number:
Contact Name:
Phone Number:

**PART B.**

**The following fish health events occurred in the reported month (circle):**

Unusually high fish mortalities (if so – attributed to)

Vet or Lab Diagnosis of Significance (identify pathogen)

Disease Outbreak (i.e elevated losses) (identify pathogen)

Cull Event (explain)

Emergency Fish Health Response required Y / N (if yes – was DFO notified as per licence conditions and section 9 of PAR Y / N )

**Part C.**

**The following details of are to be completed for <u>each</u> individual fish health event:**

Date of Event
Cause and/or Diagnosis:

| ID or Lot # (of affected fish) | Diagnosis | Fish Species and Common Names | Number of Fish on Site (pieces) |
|---|---|---|---|
| Were treated fish mixed in with non-treated fish?<br><br>Y / N | Estimated mortalities (numbers, volume)<br><br>Over _____ (number) days | Recent Escape from lot during reporting period?<br>Y / N | Harvest from lot during reporting period?<br>Y / N |

| 1. Name of Drug and Prescription No. (if any) | 2. Date Treatment Commenced | 3. Date Treatment Ended |
|---|---|---|
| | | |

| | | |
|---|---|---|
| | | |

4. Treatment Information (withdrawal time prescribed, how applied to animals (in-feed or bath), amount per Kg of feed, etc.) / Response description

Treatment file and details are available at rearing site: Yes No

5. Name of Prescribing Veterinarian

| 6.Name of Person Responsible for Administering the Treatment | Signature of Person Responsible for the information of this declaration<br><br>Date: |
|---|---|

## APPENDIX IX - Escape Prevention through Maintenance of Cage and Net Integrity

### A – General Equipment Design, Use and Maintenance

1. All equipment, materials and structures employed at a marine finfish aquaculture facility shall be designed, constructed, installed, inspected and maintained in a manner that prevents escapes, including escapes caused by damage, holes or tears to net cages or containment structures through entanglements with other equipment.

2. The facility operator shall monitor, evaluate and maintain containment structures, including cage support systems and net cages, in order to prevent escapes and to detect and respond to any escapes once detected or suspected.

### B – Containament Structures and Cage Support Systems

3. The requirements for containment structures are as follows:
    a. Licence holders shall ensure that equipment used at the aquaculture facility is designed and constructed to meet generally accepted standards prevalent in the aquaculture industry;
    b. Licence holders shall evaluate new or experimental containment structure system designs through:
        i. field trials,
        ii. consultation with other aquaculture producers who have used the design,
        iii. comprehensive analysis of the manufacturer's performance trials, or
        iv. review by a professional engineer,

    to ensure compatibility with conditions at the proposed location of the marine finfish aquaculture facility and with containment requirements;
    c. Licence holders shall ensure that containment structures are installed by a person who knows the risks of finfish escapement from the containment structures and the measures needed to minimize these risks;
    d. Licence holders shall ensure that containment structures are repaired or replaced with materials that meet or exceed the accepted standards prevalent in the aquaculture industry and of the standards required to meet all Licence Conditions and in particular Section 3.
4. The requirements for cage support systems are as follows:
    a. all cage support system weights and other equipment shall be designed, constructed and installed with the aim of preventing entanglement and chafing with containment nets, predator nets and shark guard nets;
    b. all cage support system weights, anchoring equipment, and other equipment that has the potential to come into physical contact with the net cage shall be maintained to prevent catching or abrading nets;
    c. daily above-water visual inspections of active cage support systems including, anchoring-line buoy orientation and the general integrity of the anchoring system shall be conducted at all marine finfish aquaculture facilities;

d. any irregularity noted in paragraph (c) that increases the risk of escape shall be corrected or repaired immediately;
e. a record of the daily visual inspection and any repairs under this section shall be made and a copy of the record retained at the marine finfish aquaculture facility for one year.

5. The requirements for anchoring equipment are as follows:
    a. anchoring equipment design shall be compatible with the containment structure equipment and biophysical conditions of the location;
    b. anchoring equipment shall be repaired or replaced with materials that meet or exceed the standards prevalent in the aquaculture industry and of the standards required to meet all Licence Conditions and in particular Section 3.

**C – Net Cages**
**I – Design, Installation and Maintenance**

6. All net cages that do not have a permanently attached mesh top shall be attached by the water line rope of the net cage to the cage support system as a primary point of attachment. Any attachment of net cages to the cage support system railing shall be for support of the jump net only.
7. Jump nets extending at least one metre above the surface of the water shall be installed at the top of any net cage that does not have a permanently attached mesh top or similar barrier.
8. Sufficient weight or pressure shall be used to produce tension on net cage panels with the aim of maintaining a taut net.
9. Net cages shall be weighted at a sufficient number of points to ensure the tension or weight is distributed evenly.
10. Netting mesh size shall be small enough to contain the smallest fish to be placed in the net cage.
11. Net cages shall be stored in a manner that minimizes deterioration of the net material.
12. The licence holder shall ensure that all tears found while handling or inspecting net cages in use or intended for use at any time are repaired immediately.

**II – Net Cage Mesh Strength**

13. According to the dimension classification identified in Table 1, the mesh of any part of a net cage, including any repairs, shall meet the minimum breaking strength standards established in Tables 2 through 6.
14. Tests to determine the net cage mesh breaking strengths of a net cage's mesh as established in section 13 of this Appendix shall be conducted in accordance with the protocol set out in Section IV of this Appendix - Net Cage Mesh Strength Testing Procedure.
15. At the request of the Department, licence holders shall demonstrate that net cage mesh meets minimum breaking strengths established in section 13 of this Appendix, within a period of time determined by the Department.

16. Net cages with mesh that does not pass the breaking strength test requirements established in section 13 of this Appendix shall be repaired or retired as soon as possible.

**III - Inspections and Record Keeping**

17. The requirements for complete out-of-water servicing and inspection of net cages are as follows:
    a. servicing and inspections shall be carried out by a person who knows the risks of finfish escapement from the net cages and the measures needed to minimize these risks;
    b. a complete visual inspection of the entire net cage shall be completed for signs of abrasions, tears or holes;
    c. any damage to the net cage shall be repaired as needed;
    d. the net cage mesh shall be tested in accordance with the protocol in section 14 of this Appendix;
    e. a record of testing shall be completed in accordance with the protocol in section 14 of this Appendix;
    f. the record of testing shall be signed by the person who carried out the inspection.
18. The licence holder shall ensure that complete inspection and repair of active net cages and any similar structure that contains fish at their marine finfish aquaculture facilities takes place as follows:
    a. an underwater inspection, by divers or other comparable method[1], shall be conducted on any net cages or any similar structure used to contain fish prior to the initial introduction of a new group of fish;
    b. active net cages and similar structures used to contain fish shall be inspected every 60 days by divers or another comparable method;
    c. despite paragraph (b), active net cages and any similar structure used to contain fish shall be inspected as soon as is practicable by divers or another comparable method after any operational activity or event that increases risk of net failure, including extreme environmental conditions, net cage changes, fish delivery, recurring predator attacks, vandalism to net cages or equipment or towing of active containment structures;
    d. despite paragraph (b), active net cages and any similar structure used to contain fish shall be inspected by divers or another comparable method as soon as is practicable after any event that occurs during routine harvesting, grading or any other routine activity which leads a holder or person acting on their behalf to suspect there is a material increase in the risk of net failure.
19. Each net cage shall be marked with an inventory control number that is permanently marked on a permanent tag attached at the top of the net cage within one metre of a corner down line or a main down line of a circular net cage.

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[1] In this section, "other comparable methods" means a method of inspection designated in writing by the manager to be equivalent to inspection by divers for purposes of this section

20. At the marine finfish aquaculture facility where the net cage is deployed, the licence holder shall ensure that a written maintenance record for each net cage is maintained, that includes:
    a. the inventory control number referred to in section 19 of this Appendix,
    b. the dimensions of each net cage,
    c. the mesh size,
    d. a record of the most recent complete out-of-water servicing and inspection under section 18 of this Appendix,
    e. the accumulated time-in-water since the most recent complete out-of-water servicing and inspection under section 18 of this Appendix,
    f. a description and the dates of each inspection under section 18 of this Appendix since most recent complete out-of water servicing and inspection under section 17 of this Appendix, and
    g. a description and the dates of all repairs, including reasons for repairs, made to the net cage since the most recent complete out-of-water servicing and inspection under section 17 of this Appendix.
21. Records required to be kept under section 18 and 20 of this Appendix that were recorded prior to the last out-of-water servicing and inspection under section 17 of this Appendix shall be retained for six months after that out-of-water servicing and inspection.
22. The licence holder shall ensure that written records are maintained for each net cage that includes:
    a. the inventory control number in section 19 of this Appendix,
    b. the manufacturer's name,
    c. the year produced,
    d. the dates and records of all complete out-of-water servicings and inspections since October 31, 2000, under section 17 of this Appendix, and
    e. if applicable, the date of retirement.
23. Records for each net cage under section 22 of this Appendix shall be retained for 1 year following retirement of the net cage.

**IV – Net Cage Mesh Strength Testing Procedure**

24. This procedure specifies the method that shall be used for the purpose of determining the tensile (breaking) strength of mesh used for the containment of farmed fish.
25. This procedure is intended for use with nets commonly used in the British Columbia finfish aquaculture industry. These nets are generally made with knotless nylon mesh with published breaking strengths of between 50 and 400 lbs. This procedure may not be suitable for other types of nets.
26. Principle – a mesh is extended until it ruptures under the applied load. The test is performed using a suitable apparatus that records or indicates the load at the point of rupture. The testing machine is operated at a rate of elongation which is both constant and within prescribed limits.

27. APPARATUS

a. Testing Machine
   The machine used for testing shall meet the following criteria
      i. Machine shall include a digital load cell or dynamometer providing direct measurement (in units of force) of the load applied to the mesh. The load cell or dynamometer shall be accurate to within 2.5 lbs (11 N), or 1.0% of the mesh breaking strength, whichever is greater.
      ii. The load cell or dynamometer shall have an accurate means of recording the peak load applied prior to failure of the mesh.
      iii. Machine shall apply load to a single mesh at a constant rate of elongation equal to 10 inches per minute (25 cm per minute), plus or minus 10%.
      iv. For testing machines which apply force in discrete steps (such as by way of a hydraulic cylinder with a hand pump), the rate of elongation, per (iii) above, shall be the average rate of elongation. During each step, the rate of elongation shall be as close as possible to the average rate required, that is the steps must be consistently applied at a given rate. The maximum mesh elongation for each step shall be 0.20 inches (5 mm). Testing machines of this nature shall be designed such that the user can readily apply the load at a rate that will meet these requirements.
      v. The machine shall engage a single mesh for testing with steel pins or hooks formed from round material with a diameter of 0.1875 inches (5 mm). The pins or hooks shall be so mounted as to remain in direct line with the applied load in order to provide a true reading on the load cell or dynamometer. The pins or hooks shall be smooth and free of any sharp edges or roughness.

b. Calibration and Maintenance
      i. The dynamometer or load cell from each testing machine shall be calibrated annually in accordance with the manufacturer's recommendations. Testing machines shall also be calibrated annually to ensure that the specified elongation rate is maintained. The owner of the machine shall keep calibration certificates on file, with a copy kept with the machine.
      ii. The testing machine shall be properly maintained in order to continue to provide accurate results and to meet the requirements above. This will include replacement of the testing hooks as necessary due to wear, corrosion or roughness.

28. TESTING REQUIREMENTS.
   a. A net cage shall be tested according to the testing protocol in Section 29 of this document at the following locations:
      i. two locations separated by greater than 10 meters on the underwater portion of the net; and
      ii. one location on the jump net.
   b. For each location tested on a net cage, the reported result shall be the average of 5 breaks.

c. Test locations shall be representative of the mesh making up the whole net, and shall not be located in a previously repaired area. If a net has large areas of repair or is fabricated from different sources of mesh, the test procedure (Section 29) shall be performed on each different mesh type or age of mesh, and the reported result must be the average of 5 breaks.
d. Testing may be done on mesh remaining in the net or on a sample cut from a net. Cut samples shall be large enough to accommodate the required number of breaks within a single sample.
e. Testing done on mesh remaining in the net shall be performed by pulling the net slack around the area to be tested, such that no outside forces are acting upon the mesh being tested, and maintaining such slack for the duration of the test.
f. Testing may be performed on dry or wet mesh. Temperature shall be within normal ambient temperatures for the B.C. coast. Tests shall not be conducted on frozen mesh.

***NOTE:** - 'Mesh size' refers to the distance between the centers of two opposite joints (or knots) in the same mesh when fully stretched; this information should be obtained from the original tagging on the net cage.

29. TEST PROCEDURE

a. Testing shall be performed on a single mesh, oriented so that the pillars (bars) of the mesh are engaged over the pins or hooks, not the knots or joints of the mesh.
b. Mount the mesh over the pins or hooks, and take up the slack.
c. Apply load at a steady rate of elongation, as defined in 3.1, until the mesh breaks. Record the peak load indicated.
d. Repeat for a total of five breaks at the location being tested.
e. Average the five results to get the recorded breaking strength for that location

Example: 200 lbs, 210 lbs, 230 lbs, 195 lbs, 185 lbs
Record breaking strength of (200+210+230+195+185)/5 = 204 lbs

f. Record breaking strength to the nearest pound force.

30. REPORTING

Test results shall be recorded on a form that also includes information about the net. Information recorded shall include:

a. Owner of net and net identification number.
b. Mesh manufacturer and manufacturer's published mesh-breaking strength.
c. Net fabricator and date of net fabrication.
d. Accumulated in-water service time.
e. Size and gauge of mesh and dimensions of net cage.
f. Date and location of testing, company and name of person doing test.
g. Information on antifoulant treatment of net, if any.
h. Whether net was tested wet or dry.

i. Approximate ambient temperature at test.
j. Breaking strength test results for each prescribed location, and pass/fail grades per requirements of the section 13 of this appendix.
k. General comments and notes on overall condition of net.
l. Signature of tester.

**Table 1: Net Cage Dimension Classification**

| **Perimeter** | Up to 50 m (164 ft.) | > 50 m to 60 m (197 ft.) | > 60 m to 70 m (230 ft.) | > 70 m to 80 m (262 ft.) | > 80 m to 90 m (295 ft.) | > 90 m to 110 m (361 ft.) | > 110 m |
|---|---|---|---|---|---|---|---|
| **Depth** | | | | | | | |
| Up to 5 m (16 ft.) | A | A | B | C | D | D | E |
| >5 m to 10 m (33 ft.) | A | A | B | C | D | D | E |
| >10 m to 15 m (49 ft.) | A | B | B | C | D | D | E |
| >15 m to 20 m (66 ft.) | B | B | C | D | D | D | E |
| >20 m to 30 m (98 ft.) | D | D | D | D | D | E | E |
| >30 m | E | E | E | E | E | E | E |

A to E establishes net cage dimension classification. Depth is from waterline rope to net cage bottom. Perimeter refers to the line bounding the top of the net cage.

**Table 2: Dimension Classification A**

| Mesh Size | Minimum Required Mesh Breaking Strength (below surface of water) | Minimum Required Mesh Breaking Strength (jump netting, above surface of water) |
|---|---|---|
| < 22 mm (7/8") | 20 kg (44 lbs) | 18 kg (41 lbs) |
| > 22 mm (7/8") to < 38 mm (1-1/2") | 26 kg (58 lbs) | 24 kg (52 lbs) |
| 38 mm (1-1/2") | 31 kg (68 lbs) | 28 kg (62 lbs) |
| > 38 mm (1-1/2") | 41 kg (90 lbs) | 38 kg (83 lbs) |

**Table 3: Dimension Classification B**

| Mesh Size | Minimum Required Mesh Breaking Strength (below surface of water) | Minimum Required Mesh Breaking Strength (jump netting, above surface of water) |
|---|---|---|
| < 22 mm (7/8") | 25 kg (56 lbs) | 24 kg (52 lbs) |
| > 22 mm (7/8") to < 38 mm (1-1/2") | 31 kg (68 lbs) | 28 kg (62 lbs) |
| 38 mm (1-1/2") | 41 kg (90 lbs) | 38 kg (83 lbs) |
| > 38 mm (1-1/2") | 46 kg (102 lbs) | 43 kg (94 lbs) |

**Table 4: Dimension Classification C**

| Mesh Size | Minimum Required Mesh Breaking Strength (below surface of water) | Minimum Required Mesh Breaking Strength (jump netting, above surface of water) |
|---|---|---|
| < 38 mm (1-1/2") | 36 kg (79 lbs) | 33 kg (73 lbs) |
| 38 mm (1-1/2") | 46 kg (102 lbs) | 43 kg (94 lbs) |
| > 38 mm (1-1/2") | 51 kg (113 lbs) | 47 kg (104 lbs) |

**Table 5: Dimension Classification D**

| **Mesh Size** | Minimum Required Mesh Breaking Strength (below surface of water) | Minimum Required Mesh Breaking Strength (jump netting, above surface of water) |
|---|---|---|
| < 38 mm (1-1/2") | 41 kg (90 lbs) | 38 kg (83 lbs) |
| 38 mm (1-1/2") | 51 kg (113 lbs) | 47 kg (104 lbs) |
| > 38 mm (1-1/2") | 62 kg (136 lbs) | 57 kg (125 lbs) |

**Table 6: Dimension Class E**

| **Mesh Size** | Minimum Required Mesh Breaking Strength (below surface of water) | Minimum Required Mesh Breaking Strength (jump netting, above surface of water) |
|---|---|---|
| < 38 mm (1-1/2") | 46 kg (102 lbs) | 43 kg (94 lbs) |
| 38 mm (1-1/2") | 62 kg (136 lbs) | 57 kg (125 lbs) |
| > 38 mm (1-1/2") | 77 kg (169 lbs) | 71 kg (156 lbs) |

# EXAMPLE NET CAGE TESTING REPORTING FORM

## NET CAGE TESTING RECORD

| Date of Testing: | Net ID: | Job Order No.: |
|---|---|---|
| Owner of Net (Company): | Name of Company performing testing: | |
| Name of Contact: | Location of Testing: | Name of Tester: |

| Mesh Manufacturer: | Dimensions: (ft) or (m)? _____x_____x _____deep: |
|---|---|
| Net Fabricator: | Mesh Size (mid knot to mid knot): (in) (mm) |
| Date of Net Fabrication: / Accumulated in-water service time: | Gauge: 210/ |
| Mesh Manufacturer Breaking Strength (lbs): | Tested: WET or DRY ? |
| Required Strength ( lbs or kg ? ) BELOW WATERLINE: JUMP: | Test temperature (approx.): |

**Breaking Strength ( lbs or Kg ? )**

| | Dipped? | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Average | Pass/ Fail | Initials of Tester |
|---|---|---|---|---|---|---|---|---|---|
| BELOW WATERLINE 1 | Yes ☐ No ☐ | | | | | | | | |
| BELOW WATERLINE 2 | Yes ☐ No ☐ | | | | | | | | |
| JUMPNET | Yes ☐ No ☐ | | | | | | | | |

Details of Complete Visual Inspection:

Repairs Completed:

Comments:

Signature of Tester:

**APPENDIX X – Escape Reporting Form**

| **Finfish Aquaculture Escape Reporting Form** |
|---|
| Complete Section A and either Section B *or* Section C. |

| **Section A – General Information** | |
|---|---|
| Date of Report: | |
| Number of supplemental pages: | |
| Farm Site Name: | |
| Aquaculture License Number: | |
| Farm Contact Number: | |

| **Section B – Monthly Summary Reporting of Escapes** | |
|---|---|
| Month/Year of reported information: | |
| Species of Finfish: | |
| Number (or estimate) of fish that have escaped facility in the above month. | |

| **Section C – Report of Escape Incident** | |
|---|---|
| Date of Escape or Suspected Escape: | |
| Estimated Time of Incident: | |
| Species of Finfish: | |
| Estimated number of escapes: | |

| | |
|---|---|
| Calendar year in which finfish were stocked at aquaculture facility: | |
| Average weight of finfish that escaped or may have escaped: | |
| Name of rearing facility from which the finfish were received by the facility: | |

**CONTINUED OVERLEAF**

| **Section C – Report of Escape Incident - Continued** |
|---|

| Record of therapeutants administered finfish | |
|---|---|
| Name of drug: | |
| Period of administration, including dates of commencement and completion of drug treatment: | |
| Name of prescribing veterinarian: | |
| The prescribed withdrawal period: | |
| Identification of the lots of finfish treated: | |

| Cause of suspected cause of the incident: |
|---|
| |

| Escape Response and Recapture Attempts: |
|---|
| |

| Additional Comments |
|---|
| |

| Submitted by: | | | |
|---|---|---|---|
| | **Signature** | **Printed Name** | **Title and Company** |

## APPENDIX XI - Escape Recapture

### A - Type, size and quantity of fishing gear and equipment that is permitted to be used and the manner in which it may be used.

1. One salmon seine net shall be used.

2. Seine nets shall have:
    a. a mesh size of no less then 70 mm;
    b. a length of at least 270 m; and
    c. a depth of at least 20 m.

3. All fish captured by the seine net shall be removed from the seine net, prior to the seine net being removed from the water, by using a brailer or a dip net.

4. Only one standard brailer as defined in section 5 or one sock brailer as defined in section 6 shall be used to transfer fish from the water enclosed by a seine net to the vessel. The brailer may be operated by a winch.

5. Definition of Standard Brailer: The standard brailer shall be constructed in the following manner and with the following specifications:
    a. a bag of web hung on a rigid hoop attached to a handle;
    b. the bag shall be opened by releasing a line running through rings attached to the bottom of the bag;
    c. the hoop,
        i. if formed in a circle, shall have a maximum inside diameter of 122 cm or
        ii. if in a shape other than a circle, shall have a maximum inside circumference of 381 cm;
    d. the web shall be of soft knotless construction and the mesh size shall not exceed 57 mm measured along two contiguous sides of a single mesh; and
    e. the maximum distance from the top of the hoop to the bottom of the web when in an open condition shall not exceed 148 cm.

6. Definition of Sock Brailer: A sock brailer is constructed of a sleeve of non-porous material fastened to a rigid hoop and handle at one end and the sorting box at the other. This forms a tube that lifts water as well as fish, keeping the fish wet and reducing pressure on them while they are transferred from the seine net to the sorting box. There may be a narrow band of soft, knotless web between the hoop and the top of the sleeve. The sock brailer shall be constructed in the following manner and with the following specifications:
    a. the hoop, formed in a circle, shall have a maximum inside diameter of 91 cm;
    b. the hoop shall have a handle attached to it;
    c. if soft knotless web is attached between the hoop and non-porous material, it shall not exceed 30 cm in width and the mesh size shall not exceed 57 mm (stretched measure);

d. the sleeve of non-porous material or non-porous material and knotless web shall have a maximum inside diameter of not more than 91 cm and not less than 51 cm;
e. the end of the sleeve opposite the hoop shall be attached to a sorting box in such a manner that fish are deposited smoothly into the sorting box. The sorting box shall be constructed of material that is smooth (e.g. aluminium) and be large enough to temporarily hold the fish and water from one sock brailer load; and
f. when fish and water are being moved from the seine net to the sorting box the loaded weight of the sleeve shall be supported by a ramp from the vessel railing to the sorting box.

7. Hand held dip nets may be used to transfer fish from the water enclosed by a seine net to the vessel. No mechanical or electrical power shall be used to operate a dip net.

8. The dip net shall be constructed of a shallow bag of soft, knotless web attached to a handle.

9. While fishing for salmon, the licensed vessel shall be equipped with a revival tank, the purpose of which is to temporarily hold and revive injured or stressed fish which the vessel is prohibited from retaining. Those salmon and steelhead that are lethargic or appear dead shall be placed in the revival tank until revived to a vigorous condition or for at least one hour and then released back into the water from which they were caught in the manner that causes the least harm.

10. The revival tank shall meet the following specifications:
    a. constructed of non-transparent material;
    b. designed to hold a minimum of 250 litres of water;
    c. inside dimensions of which two must be minimum of 90 cm x 49 cm;
    d. equipped with a tight fitting lid; and
    e. designed so as to receive a continuous flow of oxygenated seawater throughout the tank at a rate of 90-110 litres per minute (20-24 imperial gallons per minute).

11. The revival tank shall be operating at all times while the seine net is in the water, from the initial setting to the final retrieval back on board. The tank shall be full of oxygenated seawater that is the same temperature as the seawater from which it is drawn prior to placing fish in the tank. When the revival tank is holding fish during fishing or after fishing is completed, the revival tank shall remain filled with seawater and there shall be a constant exchange of oxygenated seawater throughout the tank.

    The revival tank and equipment shall be kept clean and the tank shall be used for no other purpose than that set out above.

    NOTE: A fish hold is not an acceptable revival tank.

**B – Sorting of catch and segregation of species.**

12. All fish brought on board the vessel shall be sorted in a wet area prior to the fish being placed in the hold. If a sock brailer is used, fish shall be sorted in a sorting box.

13. All fish, except Atlantic salmon, shall be segregated from the Atlantic salmon and released back to the water in a manner which causes them the least harm. This may include the use of the revival tank to increase the chances of a fish surviving once it is released.

**C - Information that the vessel master shall report to the Department**

14. The vessel master shall immediately, upon demand by the Department, provide orally in person or by radio, or in writing, any or all of the following information which may be requested:
    a. an accurate estimate of the amount of fish on board the vessel as well as fish caught and released;
    b. information concerning the location of catch, rate of catch and method of transporting of the catch; and
    c. the name and location of the person or company buying the catch.

**D – Information that the licence holder shall report to the Department prior to the commencement of fishing**

15. Prior to attempting to recapture any farmed Atlantic salmon, the licence holder shall report the following information to

    DFO LOCATION

    a. Facility identifier (name, DFO number);
    b. geographical co-ordinates (latitude and longitude) and Subarea of the farm that the Atlantic salmon have escaped from;
    c. name, address, telephone number and fax number of the licence holder;
    d. estimated date and time of escape
    e. estimate of the average fish size (cm) and weight (kg);
    f. estimate of the number of fish that have escaped;
    g. name and vessel registration number of the vessel that will be attempting to recapture the farmed Atlantic salmon; and
    h. name of the vessel master.

**E - Records that the vessel master shall keep.**

16. The vessel master shall maintain a log supplied by the Department of Fisheries and Oceans of all harvest operations carried out under authority of this licence subject to the following:
    a. the record shall be kept in the manner set out in the log and shall be complete;

b. the information shall be recorded in the log for each set, immediately after completion of the set;
c. the log shall be kept on board the licensed vessel while fishing;
d. the log shall contain data pertaining to only a single vessel;
e. the log shall be produced for examination on demand of a fishery officer or a fishery guardian;
f. all recording in the log shall be in ink. If an error is made while completing an entry, the entry shall be crossed-out. Erasure of an entry in the log is not permitted; and
g. the completed log pages (original copy) shall be given to the at-sea observer if one is present on board the vessel immediately upon completion of the recapture attempt. Where no observer is present, the completed log pages shall be sent forthwith to

DFO LOCATION.

**F - Observers:**

17. All owners and masters of fishery vessels participating in a fishery for the recapture of farmed Atlantic salmon are required to take on board an observer when requested to do so by the Regional Director-General for the Pacific Region.

**Appendix XII – Incidental Catch Log for Transfer, Harvest or Escape Recapture**

Aquaculture Site Name:_____ Cultured Species:_____
DFO Licence Number: _____
Amount Transferred, Harvested (kg) or Pieces Recaptured:_____
Location:_____ Date of Incidental Catch:_____
Destination Location: _____ Vessel Name : _____
Contact Person and telephone number : _____

| Species caught Scientific name | Species caught Common name[1] | Record catch by species in pieces | | Average weight in grams[2] |
|---|---|---|---|---|
| | | # released | | |
| | | # mortalities | | |
| | | # released | | |
| | | # mortalities | | |
| | | # released | | |
| | | # mortalities | | |
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| | | # released | | |
| | | # mortalities | | |
| | | # released | | |
| | | # mortalities | | |

[1] Include herring spawn in report if observed
[2] To be approximated by the person recording incidental catch

Fisheries and Oceans Canada | Pêches et Océans Canada

# Appendix XIII - Predator Management Annual Report

*Submit by March 31, 2011 and in future years by September 1*

**Company and General Information:**

Year:_____

Company Name:_____ Farm Site Name:_____

DFO licence #: _____

Company contact and information:_____ Telephone: _____

**Predator netting:**

Does the site have predator nets? Yes___No___ If yes, complete below questions.

Does this site have a separate predator net and grow out net? Yes__ No__

What type of predator net is used? _____ (i.e. Dyneema)

What is the mesh size? In centimetres_____

Is there a barrier above the water line? Yes___No___

How high does the barrier reach above the water line in meters_____.

Are net cages and predator nets inspected by divers after predator interactions? Yes__ No__

If yes above, depth of inspection in meters_____.

Depth of predator nets in meters_____.

**Non-lethal Deterrents Used:**

| | |
|---|---|
| Electric fences? Yes__ No__ | If yes, provide description?_____ |
| Shark guards? Yes__ No__ | If yes, provide description?_____ |
| Visual repellents? Yes__ No__ | If yes, provide description?_____ |
| Noise makers? Yes__ No__ | If yes, provide description?_____ |
| Other Physical barriers? Yes__ No__ | If yes, provide description?_____ |
| Do you any other methods? Yes__ No__ | If yes, provide description?_____ |

**Site specific comments:**

Fisheries and Oceans Canada | Pêches et Océans Canada

# APPENDIX XIV-MARINE MAMMAL ACCIDENTAL MORTALITY REPORTING FORM

PLEASE REPORT ALL INCIDENTS *IMMEDIATELY*

**Company Information**

Company:_____

Contact name:_____

Address: _____

_____

Phone: _____

Email: _____

**Dates & Location Details**

Report Date: _____

Discovery Date: _____

Farm site:_____

Pen #: _____

Net Tag:_____

☐ Fish on site ☐ No fish on site_____

***Please indicate how long site has been without fish on site***

**File numbers**

RR#:_____

DFO licence#:_____

**Site Biomass**

On site:_____

Size of fish targeted:_____

**Incident Details**

| Species | Number of animals | Incident type<br>Definitions below | System Component<br>Containment net, Predator net, Shark guard, other (please specify) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

****Please use one line per incident type & species involved*****

**Incident types:**

Accidental Drowning - animal entrapped in infrastructure resulting in drowning

Entanglement - animal caught or ensnared in net resulting in drowning

**Animal Condition**

☐ Freshly dead (Fresh carcass, no skin peeling, possibly dead only a few days)

☐ Mod-adv decomposition (Moderate to major bloating, skin peeling or missing, smelly, evidence of some disturbance by scavengers to bones exposed due to decomposition)

**Actions taken with carcass(s):**

☐ Collected and being stored until DFO advises further

☐ Photograph of tooth dentition pattern with datestamp

☐ Collected, discarded with fish mortalities

☐ Cut from and/or out of net, animal(s) sunk/floated away

***DFO requests all dolphins & porpoises are collected and stored on ice until arrangement can be made for their collection & necropsy***

**Comments:**_____

_____

_____

_____

_____

_____

FAX To Fisheries & Oceans Canada Reporting Hotline (ORR) at 604-607-4156 or call 1-800-465-4336 for immediate assistance.

## Appendix XV- Biofouling Management Annual Report

To be developed. Initial report due February 15, 2012.

**APPENDIX XVI - Benthic Monitoring Program**

**Sampling Station Locations**

Sampling station locations shall be defined as described in Appendix II.

**SOFT OCEAN SUBSTRATE SITES**

**Peak Biomass Monitoring**

1. Grab samples and associated chemical analysis must be taken:
    a. within 30 days either side of peak finfish biomass for each production cycle; and
    b. at the end of every 24 month period if the production cycle is longer than 24 months; or
    c. every 24 months for farms with finfish continuously on site; or
    d. every 18 months for farms with annual multiple production cycles; and
    e. at location(s) where the highest degree of impact is anticipated or has been observed or where directed by DFO ; and
    f. at 6 compliance monitoring stations:
        i. That will be set as outlined in the *Protocols for Marine Environmental Monitoring* – document (Annex 1) and located as below.
        ii. Three replicate samples at 0 metres from the containment structure array on a transect (called Transect 1) called Station 0A,
        iii. Three replicate samples at 0 metres from the containment structure array on a transect (called Transect 2) called Station 0B,
        iv. Three replicate samples at 30 metres from the containment structure array on Transect 1 called Station 30A,
        v. Three replicate samples at 30 metres from the containment structure array on Transect 2 called Station 30B,
        vi. Three replicate samples at 125 metres from the containment structure array on Transect 1 called Station 125A,
        vii. Three replicate samples at 125 metres from the containment structure array on Transect 2 called Station 125B,
        viii. Three replicate samples at Reference Station 1[1].
        ix. Three replicate samples at Reference Station 2[1].
    g. If the containment structure array is perpendicular to the dominant current direction and is greater than 200 metres in length the following is required:
        i. An additional two transects for every 200 metre increment;
        ii. The location of the secondary transects will be based on modeling or other assessment methods indicating the location of the 5g C/m2/day contour as follows:
            1. if the 5g C/m2/day contour extends beyond 30 metres from the containment structure array on the shoreward end of the

[1] Only if triggered by exceeding 30 metre or 125 metre standards.

array the transects are to be located such that they transit the contour at its furthest extent;

2. if the 5g C/m2/day contour does not extend beyond 30 metres from the containment structure array on the shoreward end the transects are to be located on the seaward end of the array;

iii. transects shall be a minimum of 50 metres apart.

2. The samples reported will be the first three samples that meet quality standards as outlined in the *Protocols for Marine Environmental Monitoring* (Annex 1).
3. The licence holder shall notify the Department within 14 days of sampling if:
    a. The mean free sulphide concentration at the compliance monitoring stations 30A or 30B are statistically significantly greater than 1,300 micromolar, or
    b. The mean free sulphide concentration at the compliance monitoring stations 125A or 125B are statistically significantly greater than 700 micromolar.

**Pre-Stocking Monitoring**

Additional sampling prior to re-stocking the site must be conducted if the pre-stocking standards in licence Section 13.8 (a) are exceeded during peak biomass sampling. Monitoring, with exception of brood stock facilities, may only be undertaken once all finfish from the most recent production cycle have been harvested or removed.

1. If the standard in licence Section 13.3 (a)(i) is not exceeded but the mean free sulphide concentration exceeds the pre-stocking standard in Licence Section 13.6 (a)(i) the operator must not stock the facility until compliance with the pre-stocking standard is confirmed by:
    a. conducting sulphide monitoring at the same compliance station(s) where the standard was exceeded;
    b. conducting sulphide monitoring at the corresponding 125 metre compliance station; and
    c. in accordance with the *Protocols for Marine Environmental Monitoring* (Annex 1).
2. If the standard in Licence Section 13.3 (a)(i) is exceeded the operator must not stock the facility until compliance with the pre-stocking standard in licence Section 13.8 (a)(i) is confirmed by:
    a. conducting repeat sulphide monitoring at the compliance station(s) where the specified sulphide level was exceeded;
    b. conducting sulphide monitoring at the corresponding 125 metre station;
    c. undertaking biological monitoring at the same compliance station(s) where the specified sulphide level was exceeded and two reference stations; and
    d. in accordance with the *Protocols for Marine Environmental Monitoring* (Annex 1).
3. If the standard in licence Section 13.3 (a)(ii) is exceeded the operator must not stock the facility until compliance with the pre-stocking standard in licence Section 13.6 (a)(ii) is confirmed by:

a. undertaking biological monitoring and sulphide monitoring at the compliance station(s) where the specified sulphide level was exceeded, and two reference stations, within 30 days of the date on which the excess was measured; and
b. conducting repeat sulphide sampling at the same compliance station(s) where the specified sulphide level was exceeded, and two reference stations; if pre-stocking standard not initially met in (a); and
c. in accordance with the *Protocols for Marine Environmental Monitoring* (Annex 1).

**HARD OCEAN SUBSTRATE SITES**

**Peak Biomass Monitoring**

1. Video data must be taken at this facility, following procedures outlined in the *Protocols for Marine Environmental Monitoring* (Annex 1). They will be taken:
    a. within 30 days either side of peak finfish biomass for each production cycle; and
    b. at the end of every 24 month period if the production cycle is longer than 24 months; or
    c. every 24 months for farms with finfish continuously on site; or
    d. every 18 months for farms with annual multiple production cycles; and
    e. at location(s) where the highest degree of impact is anticipated or has been observed or where directed by DFO; and
    f. at the following locations:
        i. That will be set as outlined in the *Protocols for Marine Environmental Monitoring* (Annex 1) document and located as below.
        ii. From 0 metres from the cage array on a transect (called Transect 1) to a minimum distance of 140 metres from the cage array or until six successive time units do not exceed 10% cover of *Beggiatoa sp.*, or OPC.
        iii. From 0 metres from the cage array on a transect (called Transect 2) to a minimum of 140 metres or until six successive time units do not exceed 10% of fish feed or feces, bacterial mats such as *Beggiatoa sp.*, or OPC.
        iv. Two reference stations, each 100 metres in length[2].
    g. If the containment structure array is perpendicular to the dominant current direction and is greater than 200 metres in length the following is required;
        i. An additional two transects for every 200 metre increment;
        ii. The location of the secondary transects will be based on modeling or other assessment methods indicating the location of the 5g C/m2/day contour as follows:
            1. if the 5g C/m2/day contour extends beyond 30 metres from the containment structure array on the shoreward end of the

[2] Only if triggered by exceeding *Beggiatoa sp* or OPC standards

array the transects are to be located such that they transit the contour at its furthest extent;

2. if the 5g C/m2/day contour does not extend beyond 30 metres from the containment structure array on the shoreward end the transects are to be located on the seaward end of the array;

iii. transects shall be a minimum of 50 metres apart.

2. The operator will notify the Department within 28 days of sampling if the percent cover of OPC or *Beggiatoa sp.* at or beyond the zone of compliance (100 – 124 metres from the containment structure array) exceeds:
    a. 10% in the last two time units of a sequence; and/or
    b. 10% in four out of six time units.

**Pre-Stocking Monitoring**

Additional sampling prior to re-stocking must be conducted if the pre-stocking standards in Licence Section 13.6 (b) are exceeded Monitoring, with exception of brood stock facilities, may only be undertaken once all finfish from the most recent production cycle have been harvested or removed.

If the production standards in Licence Section 13.3 (b) are exceeded the operator must not stock the facility until compliance with the pre-stocking standard in licence Section 13.8 (b) is confirmed by:

a. conducting video monitoring at the same station where the specified standard was exceeded with the survey terminating six time units beyond the last time unit in the sequence that exceeded the standard;
b. conducting video monitoring at two reference stations; and
c. in accordance with the *Protocols for Marine Environmental Monitoring* (Annex 1).

**Mixed Ocean Substrate Sites**

1. Sites that have a mixture of soft and hard ocean substrate stations will conduct both grab samples and video as required in the above sections.

**All Sites**

1. A licence holder shall have all biological samples taxonomically identified as directed in *the Protocols for Marine Environmental Monitoring* (Annex 1);
2. The licence holder shall ensure that the sampling and monitoring program is designed and supervised in accordance with the *Protocols for Marine Environmental Monitoring* (Annex 1).

**Reporting Frequency and Timing**

Reports must be provided at the following frequency and timing in a format approved by the Department:

1. Peak biomass reports must be submitted:

a. Within 30 days of monitoring for physical and chemical parameters for soft ocean substrate sites and prior to restocking the site;
b. Within 60 days of monitoring by video surveys for hard ocean substrate and mixed ocean substrate sites and prior to restocking the site;
c. Specifying the biomass at peak production; and
d. Including a site plan indicating the number and location of containment structures including harvest pens and transfer pens, location of video survey transects and/or location of sediment sampling stations;

2. Pre-stocking reports must be submitted:
    a. A minimum of 14 days prior to planned fish entry on site;
3. Taxonomic data must be submitted:
    a. Within 6 months of collecting samples submitted for taxonomic identification and within 14 days of receipt of the results from the taxonomist.

**Baseline Monitoring Design**

Design of Baseline Video Survey and Sediment Sampling Program

*To be developed.*

**Peak Biomass Monitoring Design**

**Video Survey**

1. A minimum of two video transects per containment structure array must be surveyed, typically one will be located along the dominant current direction and the second along the subdominant current direction unless otherwise directed by the Department. The surveys are to be completed as follows:
    a. Each transect must start at the edge of the containment structure and extend to:
        i. 150 metres from the containment structure array or;
        ii. 24 metres beyond where Beggiatoa or OPC was last observed to exceed 10% cover, whichever is the greatest distance.
    b. Each transect will consist of two sections described as follows:
        i. 0 – 80 metres;
        ii. 81 metres – to transect termination point as described in (a) above.

    Macrofauna analysis using an authorised video classification database shall be completed on part ii of each transect including the zone of compliance (100 – 124 metres from the edge of the containment structure array).

    In addition, two reference stations located in accordance with the *Protocols for Marine Environmental Monitoring* (Annex 1) are to be sampled as required.

2. Transects are to be located in areas where the greatest concentration of farm derived organic material is expected taking into consideration the following factors:

i. most recent peak biomass sampling and monitoring data;
ii. historic sampling and monitoring data
iii. company internal in-cycle monitoring data;
iv. MOE or DFO audit data;
v. modelling data
vi. observed localized current direction

unless otherwise directed by the Department

3. If adjacent containment structures or containment structure arrays are less than 60 metres apart they will be considered to be a single array when transects are located.

**Sediment Sampling**

4. A minimum of two transects per containment structure array must be sampled, typically one will be located along the dominant current direction and the second along the subdominant current direction unless otherwise directed by the Department. Each transect must have the following sampling stations, with the locations selected based on the criteria in Section 5 (b) of the Licence's Appendix II:
   a. zero metre station;
   b. 30 metres from the edge of the containment structure array; and
   c. 125 metres from the edge of the containment structure array.
   In addition, the two reference stations located in accordance with the *Protocols for Marine Environmental Monitoring – Annex 1* are to be sampled as required.

5. Transects are to be located in areas where the greatest concentration of farm derived organic material is expected taking into consideration the following factors:
   i most recent peak biomass sampling and monitoring data;
   ii. historic sampling and monitoring data
   iii. company internal in-cycle monitoring data;
   iv. MOE or DFO audit data;
   v. modelling data;
   vi. observed localized current direction,

   unless otherwise directed by the Department.

6. If adjacent containment structures or containment structure arrays are less than 60 metres apart they will be considered to be a single array when transects are located.

7. The following parameters must be measured at the sampling stations listed in below as follows:

   a. Peak Production:
      i. zero metre station: free sulphides, redox potential, metals package (including copper, zinc and lithium), and TVS (total volatile solids);

ii. 30 metre station: free sulphides, redox potential, SGS (sediment grain size) and/or moisture content and TVS;
iii. 125 metre station: free sulphide, redox potential and TVS. If the free sulphide concentration exceeds 700 micromolar repeat monitoring must be undertaken within 30 days as follows:
a. 125 metre station: free sulphide, redox potential, SGS and/or moisture content, metals, TVS and biological;
b. reference stations: free sulphide, redox potential, SGS and/or moisture content, metals, TVS and biological.

b. Pre-stocking – metals exceeded guidelines (CCME ISQG) at zero metre station:
i. corresponding 30 metre station: metals package; and
ii. corresponding 125 metre station; metals package.

c. Pre-stocking – free sulphide concentration at 30 metre station exceeds 1,300 micromolar but is less than 4,500 micromolar:
i. 30 metre station: free sulphide and redox potential; and
ii. corresponding 125 metre station: free sulphide and redox potential.

d. Pre-stocking – free sulphide concentration at 30 metre station exceeds 4,500 micromolar:
i. 30 metre station: free sulphide, redox potential, SGS and/or moisture content, metals, TVS and biological;
ii. corresponding 125 metre station: free sulphide, redox potential and TVS; and
iii. reference stations: free sulphide, redox potential, SGS and/or moisture content, metals, TVS and biological.

e. Pre-stocking – free sulphide concentration at 125 metre station exceeds 700 micromolar:
i. 125 metre station: free sulphide and redox potential; and
ii. reference stations: free sulphide and redox potential.

8. A minimum of 3 grab samples must be taken at each station. If the free sulphide concentration in any of the 3 samples exceed the standard for that station an additional two samples must be taken and analyzed for free sulphides and redox potential.

9. The abundance of infaunal and epifaunal must be quantified for all biological sediment samples. Biota must be taxonomically identified to at least the level of family with all major taxa identified to species, and counted. After processing these samples are to be properly maintained, stored and archived for at least five years.

10. Perform data analyses according to the protocols described in Section 9 of the *Protocols for Marine Environmental Monitoring* (Annex 1) to determine whether the facility has had any statistically significant effects.

**Annex 1 to Appendix XVI Benthic Monitoring Program**
**Protocols for Marine Environmental Monitoring**

## 1. ACRONYMS, ABBREVIATIONS, & DEFINITIONS

**ANOVA:** analysis of variance
**Beggiatoa:** a genus of bacteria that forms white mats on the sediment surface in areas of organic enrichment
**Capitella:** a genus of polychaetes that thrive in areas of organic enrichment
**COL:** Condition of licence
**Cu:** copper concentration (expressed in ìg/ g dry sediment)
**DGPS:** Differential Global Positioning System
**DI:** de-ionized
**EDTA:** ethylenediaminetetraacetic acid Disodium Salt Dihydrate
**Eh:** redox potential (expressed in millivolts, mV)
**Epifauna:** animals that live on top of the substratum
**HA:** alternate hypothesis
**HO:** null hypothesis
**Infauna:** animals that live within the substratum.
**M:** median
**Macrofauna:** animals with body sizes on the scale of millimetres
**Megafauna:** animals with body sizes on the scale of centimetres
**N:** sample size
**NAD:** North American datum
**OPC:** Opportunistic Polychaete Complexes
**Operational monitoring:** sampling conducted during operation of a finfish aquaculture facility and as outlined Conditions of Licence
**QA/ QC:** quality assurance/ quality control
**ROV:** remotely operated vehicle
**S=:** free sulfide concentration (expressed in micromolar, uM)
**SAOB:** sulphide anti-oxidant buffer
**SD:** standard deviation
**SGS:** sediment grain size
**TVS:** total volatile solids (expressed as a percentage)
***x*** **:** sample mean
**Zn:** zinc concentration (expressed in ug/g dry sediment)

## 2. DATA REQUIREMENTS TO SUPPORT RUNNING OF DEPOMOD

Models are a useful tool when predicting the potential carbon footprint of an aquaculture facility and can be used to appropriately site the containment structure array as well locate appropriate compliance monitoring stations or zones of compliance. The following information is typically required in order to support the running of a DEPOMOD model:

### 2.1 Model details, requirements and settings

A number of models are commercially available that produce predictions of

the nature and scale of effect of marine finfish aquaculture operations on the proximal benthic environment. The following information has been compiled with the model package DEPOMOD in mind and details data inputs specific to its requirements.

## 2.2 Determination of model domain

Fish cage groups are typically 150 metres to 250 metres in length. To allow for a tidal inequality in the residual flow, the deposition footprint may be offset by 100 metres (if not further). Thus a minimum model domain might be in the order of 500 metres in length. A standard grid of twice this distance (1.0 km x 1.0 km centred on the cage group) should been adopted in order that predictions can be made of waste deposition further afield due to particles at the slowest end of the settling velocity distribution.

Additionally, the site specific current meter data used to generate the flow field in DEPOMOD are collected at a single location and applied to the entire model domain. As such, the degree to which the current meter data are representative of the whole model grid will depend on additional factors such as the complexity of the bathymetry, topographical features and distance from the location of the observations. Consequently, the model domain should not exceed the 1.0 km x 1.0 km size.

## 2.3 Particle information

The next stage in the modeling process is to define the particle information (mass, digestibility, carbon and moisture content, and settling velocities), cage set-up (feed input and sizes), current velocity data (the advective flow field through which the particles settle), the turbulence characteristics of the water column and the number of particles to be modeled.

The trajectories of individual particles are modeled as the sum of an advective and a turbulent component. The advective component is based on the current meter observations at different depths in the water column, whilst the turbulent component is modeled as a random walk process parameterized with dispersion coefficients. Waste solids are divided into two categories, waste feed –food pellets not ingested by the fish –and faecal particles. Within the faecal fraction a distribution of settling velocities and mass proportions may be applied. Simulations then entail the individual tracking of many ($\sim 10^5$) waste particles at discrete time steps until they settle onto the seabed.

## 2.4 Feed and waste parameter settings

Food wastage rates are difficult to quantify as they are not routinely monitored and may vary considerably with husbandry practices. For all simulations a feed wastage rate of 3% should be used.

Feed formulations have tended towards high digestibility and low moisture content. At present, the settings are 90% and 10% for feed digestibility and

moisture content respectively.

The carbon content of feed pellets should be 33% unless more recent analyses are available.

The sinking rate of waste pellets should be parameterized as a single food group using 11 $cm.s^{-1}$.

The sinking rate of fecal material should be parameterized as a normal distribution with a mean velocity of 3.2 $cm.s^{-1}$ and standard deviation of 1.1 $cm.s^{-1}$.

Changes in feed formulation, feeding systems, fish health and husbandry practices will result in changes to the characteristics of the feed, feces and feed wastage rates. Also new determinations of the sinking rates of feed pellets and faecel particles will result in improved parameterizations of these sinking wastes. Where deviations from the default settings are appropriate, the justification and supporting literature references should be included in the modeling report.

## 2.5 Hydrographic data quality

High quality hydrographic data are critical to the application of particle tracking models in assessing the distribution of waste material to the seabed. If the HG data used do not accurately represent the overall current flow field around the farm site then any model output using these data should be regarded with a high degree of scepticism. Data verisimilitude and representativeness should be assessed through appropriate Quality Assurance/Control (QA/QC) methods.

## 2.6 Particle Trajectory Settings

In reality, a very large number of particles are released from a fish farm site. Following the principle that ensembles of these particles (often with different settling velocities) will follow similar paths, a representative number of particles that describes the behaviour of the ensemble of particles is defined. If the number of particles released during a model run is small, then, depending on the number of time steps, an inaccurate simulation of deposition could result. Thus, the model result could be a poor description of the real particle deposition footprint. Increasing the number of particles released will generally increase the 'accuracy' of the model result. However, this increase in accuracy is not limitless. There will be a point in any simulation, beyond which, no significant increase in accuracy will be gained from an increase in part/group/cage/$\Delta t$. In addition, increasing part/group/cage/$\Delta t$ increases the time required to achieve a model run result.

In an effort to balance computational time against estimates of accuracy, and achieve consistency between sites, a value of 10 part/group/cage/$\Delta t$ should be

used when running the model.

**2.7 Turbulence model settings**

The effects of turbulence are generally simulated through the use of random walk model applied to horizontal and vertical dispersion co-efficients. The turbulence model should be used in all simulations with the default settings of 0.1 $m^2 s^{-1}$ and 0.001 $m^2 s^{-1}$ for the horizontal ($x$ and $y$) and vertical ($z$) dispersion coefficients respectively.

**2.8 Resuspension Processes**

Resuspension processes are NOT simulated in the prediction of the effect of organic enrichment on the proximal seabed conditions.

**2.9 Model output processing**

The output of the model to be used in subsequent calculations is generally in the form of an x, y, z array. These data require interpolation and gridding processes to produce a 'footprint of deposition'. Since the data take the form of a regular grid, a minimal amount of interpolation is necessary and spacing should be appropriate for the scale of model output

## 3. CURRENTS METERING

The intention of metering currents is to characterize the current flow in the vicinity of the farm site. The data is used to determine the dispersive nature of the site, assess the potential fate and extent of waste material released at the farm site (modeling of footprint) and estimate the site carrying capacity. These protocols are directed to fixed mooring recording current meters, rather than profiling instruments such as acoustic doppler current profiling (ADCP).

*Equipment*

At minimum, two electronic current meters capable of determining both speed and direction are necessary. The meters must have an internal data-logger, which can be pre-set for a selected sampling interval with measurements automatically recorded. Both vector averaging and instantaneous type meters area acceptable. Only those with expertise in using current meters should program and deploy these devices and extract and process the collected data.

*Deployment Procedures*

- Synchronous deployment is required
- Measure the currents at a minimum of two depths, 15 metres below the surface and 5 metres above the substrate, unless the water depth is greater than 50 metres at which point an additional measurement must be obtained mid-water.
- At minimum, measure the currents at each containment structure array. In some cases, because of complex bathymetry, additional locations in proximity to the array may have to be measured.

- Program current meter to record current speed and direction instantaneously or, preferably, as averages from continuous measurements over a two minute period at least once every 30 minutes over a minimum period of 30 days.
- At sites with a containment structure array in place, locate the meter within 100 metres of the array but away from any attenuation effects (anthropogenic, temporary), and in line with the dominant current direction.
- At sites where the containment structure is not yet in place, locate the meter with 30 metres of the proposed location of the array.

*Reporting*

This information must be included with a text file containing the raw current data (and including any ancillary data recorded by the meter (e.g. pressure, battery level, pitch and roll) and associated data summaries:

*Current meter moorings and deployment locations*

a. Supply both a site plan and a written description (e.g. 30 m at 270$^{o}$ from the southwest corner of the (proposed) containment structure array), including DGPS co-ordinates, of the location(s) of the current meters. A 1:20,000 scale map is recommended. Indicate whether the DGPS co-ordinates and maps are based on the NAD27 or NAD83 co-ordinate system.
b. Supply a mooring diagram showing how the current meters were deployed. Include:
    i. the type and position (surface and sub-surface) of the flotation devices used to support the current meters during deployment
    ii. the distances between the current meter and the flotation device
    iii. the type and weights of anchors used.

*Start date and time*

Record the data and time that the current monitoring commenced (i.e. the individual date and time that each meter began to collect and record good quality data). Indicate whether time is recorded as Pacific Daylight Time (UTC-7) or Pacific Standard Time (UTC-8).

*End date and time*

Record the date and time that the current monitoring was terminated for each meter (i.e. the date and time the current meter collected its last good record of the currents before it was recovered). Indicate whether time is recorded as UTC-7 or UTC-8.

*Instrument details*

Provide the make and model of the current meters used, including a copy of the manufacturer's specifications, and date of last calibration and servicing.

*Number of data points*

Report the actual number of instantaneous or average measurements recorded by

the meter. If either instantaneous measurements or average values for 2 minute intervals are taken every 30 minutes, there will be approximately 1400 data points for the 30 day mooring period.

*Sample rate and interval*

Report the sample interval (minutes) between consecutive 2 minute measurements. The sampling interval must be 30 minutes or less.

*Data processing and reporting*

Describe the data-processing methods and software used to correct and process the current meter data. Indicate whether the current direction is in degrees *True* (recommended) or degrees *magnetic*.

Indicate whether the current meter average or instantaneous measurements are recorded, and describe the instrument's set-up or configuration. If the meter records average measurements, indicate the averaging interval.

Details should be provided in distinct sections of the report under the appropriate section headings or titles.

*Depth of meter*

Report the depth of the meter below the water surface or the distance of the meter from the substrate. The meter should be 15m below the surface for surface-currents measurements, midway between surface and substrate for mid-water measurements (if overall depth of water is greater than 50 metres) and 5 metres above the substrate for bottom-current measurements.

*Water depth and tidal range*

Report the water depth and tidal range at the location of deployment.

*Average current speed and direction*

Calculate the average current speed and direction for the entire data-collection period (minimum of 30 days and 1440 measurements). Values should be calculated from the entire dataset, not from the summary data. Data to be reported in matrix, histogram and rosette formats. The current speed is to be reported in cm/s while current direction is to be in degrees True (include magnetic north readings and correction factor).

*Contact names*

Provide the name and contact information of the staff person or consulting company responsible for collecting and reporting the current measurements.

## 4. VIDEO SURVEYS

There are several video survey methods for visually assessing the ocean substrate. The focus of these protocols is on the continuous video transect method using a remote operated vehicle (ROV). The video transect approach is useful when assessing the spatial extent of an impact and has been developed for use over the past five years. Standard deployment and positional methods as well as video quality specifications are detailed. The primary vehicle for carrying video equipment is a ROV. If other vehicles such as a cable camera apparatus (used for drop cameras) or scuba diver, where appropriate, meet the protocols for deployment and position and video quality specifications they may be acceptable to the Department. The use of quadrats, which has been the historic approach for video surveys and assessment, is briefly described. Protocols for the selection of reference stations are also included in this section.

*ROV – General*

*Equipment*

ROV - Minimum requirements:

- Horizontal and vertical thrusters. A lateral thruster is also recommended.
- Compass to be calibrated to accuracy of $\pm 3^0$ with surveys run in accordance to the calibrated bearing (calibration biannually at minimum).
- Depth gauge accurate to $\pm 2$ % full scale calibration using a minimum of three depths between 10 metres and 100 metres (calibration biannually at minimum).
- Paired lights – positioned laterally and on the same plane as camera to provide uniform illumination of a minimum 0.5 metres in width for at least 75% of the field of view.
- Illumination intensity is to be balanced with the light sensitivity of camera.
- Use of light diffusers to reduce backscatter and shadowing as necessary.
- Paired laser lights –required to provide a horizontal scale and estimate of the field of view. Lasers must be positioned a minimum of 20 – 25 cm apart with recommended distance being 25 cm. The ROV operator must be familiar with the use of onscreen laser scale as an aid in maintaining an appropriate field of view at a given zoom setting.
- Camera zoom and tilt functions.
- Tether float – sufficient flotation 3 – 5 metres behind ROV to ensure tether floats above substrate (protects sensitive flora and fauna from damage).
- Sufficient umbilical line to record images at a depth of at least 150 metres.

Camera and Recording– Minimum requirements:

- Minimum camera resolution for digital memory must be 640 x 480 and minimum for analog imagery to be 470 TV lines.
- Recording/storage media should be of quality that combined resolution should yield an overall image quality not less than the minimum camera resolution (DV format recommended).

- Imagery must be capable of resolving biota 1-2 centimetres in size within a 0.5 metre horizontal field of view.
- Real time video display and video image burn-on of time, depth and compass bearing. Recommend that transect identification number also be included.
- Original video must be transferable to digital-format storage media (i.e. no post survey video compression).

General:

- Two marker buoys with sufficient length of line and an applicable sized weight to mark the transect start point and the 80 metre transect location.
- Brightly coloured weighted transect lines (potentially used in areas that are relatively shallow and flat).

*Positioning and Mapping Requirements*

- Real time dGPS or WAAS enabled GPS system capable of $\pm$5 metres positional accuracy when available. If not available, report alternate positional methodology.
- Track plotting software such as Nobletec (using WGS 84 (NAD83) horizontal datum) with minimum 10 metre depth contours and showing the containment structure array and associated anchor line locations.
- Encourage use of acoustic positioning systems such as Track Point 2 if available.

*Conditions and requirements*

- Operate ROV during slack tide and/or minimal current conditions to minimize drifting.
- Deploy ROV during daylight hours, when well-diffused light is available for the shallower transects.
- Field view must be a minimum of 0.5 metres horizontal width with substrate illumination balanced over field of view.
- Illumination intensity is to be balanced with the light sensitivity of camera.
- Video transects are to begin at edge of containment structure array.
- Each transect is to be comprised of two sections; 0 – 80 metres and 80 – 150 metres (minimum).
- Optimum ROV speed over seabed is 0.2m/sec. The acceptable range of speed is between 0.15 – 0.25m/sec.
- Maximum variance from planned transect is +/- 10% of planned transect length and +/- 20% of planned transect bearing.

*Deployment*

- Use bathymetric, tidal current and production data to choose location of video transects to correspond with the area of highest expected impact in both the dominant and subdominant current directions.
- Deploy weighted line with marker buoy adjacent to containment structure array at point where transect is to start.

- Deploy second weighted line with marker buoy on projected transect bearing 80 metres from first line using navigational aids such as GPS and navigational software and range finder to confirm distance.
- Fly ROV from moored vessel to ocean floor following weighted line adjacent to containment structure array.
- Use pre-determined compass bearing to fly ROV toward 80 metre weighted line. Estimate distance using time and deployed tether length. Bring ROV to surface and calculate variances for length and width.
- Fly ROV to second weighted line and follow line to ocean substrate.
- Use predetermined compass bearing fly ROV along transect an additional 70 metres (150 metres from containment structure array). Bring ROV to surface and calculate variances for length and width. NOTE: The second section of transect may be extended depending on compliance with Opportunistic Polychaete Complex (OPC) and Beggiatoa standards.
- Maintain the ROV in a horizontal position relative to the substrate.
- Record dGPS location at start and endpoints of both legs of each transect.

*Video Assessment*

- Review entire transect to obtain an overall sense of the substrate, habitat and biota prior to starting the classification process.
- Classify the video imagery in 20 second video segments (one compliance time unit) rather than a series of still images. Divide each 20 second segment into 5 second intervals to improve accuracy of the segment classification.
- Assess only the bottom 2/3rds of video screen; the area considered to be "near field".
- Ensure no "overlap" of 20 second video segment classification occurs.
- Calculate length of video transects using the time at start and end points, subtracting all camera stoppages of more than 3 seconds and assuming speed over ground of 0.2m/sec unless otherwise specified.
- For parameters such as Beggiatoa and OPC, mentally or physically place a grid over the video screen, visualize the compliance parameter moved to one corner of the screen and then estimate percent coverage for each 20 second segment.
- A segment length of 20 seconds equates to a linear distance of 4 metres; if ROV speed of 0.2 m/sec cannot be maintained, the time of each segment should be adjusted such that each segment represents 4 linear metres
- Input data into the *Hard Seabed Aquaculture Classification Database Version 2.2 June 30, 2009*; use the report generating function in the database and the report templates to submit the data.
- For a classification tutorial and additional video assessment and classification resources, see *Hard Seabed Aquaculture Video Monitoring Classification Tutorial DVD June 30, 2009.*

*Quadrats*

Quadrats are not recommended for use when assessing the spatial extent and degree of impact of specific parameters. They are useful in situations where detailed and repeated

assessment of a specific location(s) is required or for obtaining a preliminary indication of spatial extent of potential change to the ocean floor. Acceptable quadrat types include:

- A wire frame (1 x 1 metre square with nine 33 x 33 cm sections) physically placed on the seafloor.
- A wire frame mounted on a drop camera or ROV in such a manner that it is part of the image at all times.
- A laser delineated frame.

*Reference Station Selection (if necessary)*

- Locate stations 0.5 – 2.0 km from the nearest containment structure associated with the facility.
- Reference stations must be a minimum of 0.5 km apart.
- Ensure mean depth is within 25% of the mean depth of all facility stations. This may require additional reference stations if there is significant variability in the depth associated with the facility stations.
- Ensure that characteristics such as topography, seabed type, current and tidal regimes, amount of freshwater run-off and other applicable characteristics are similar to those at facility stations.

*Reporting*

- Irrespective of the recording medium (digital recorder, Hi8, Mini DV tape, etc) video images are to be transferred to high resolution DVD discs.
- DVD discs are to be submitted with the completed report template and the survey data associated with the classification database.
- Data must be submitted in an acceptable format and within the period of time specified in Appendix XVI of the Conditions of Licence.
- Video survey direction must be labelled consistently using the following protocol. Surveys along the dominant current direction must be identified as T1, T3, etc. while surveys along the subdominant current direction must be identified as T2, T4, etc.
- Maps indicating location of surveys, including zone of compliance, must be at a scale of 1:5000.

## 5. SEDIMENT SAMPLING

Although sediment sampling can be used to assess the spatial extent of an impact it can be time-consuming and expensive. For the purposes of this protocol sediment sampling is primarily used for compliance purposes. The primary sampling method is the Anova based Multiple Control Impact (MCI) approach which compares facility stations to reference conditions. A second sampling method is the regression approach where data is collected at stations along transects extending outward from the facility along prevailing current directions.

This section describes the protocols on how to choose a sample station, obtain and handle samples, use of electrodes and generation of physical and chemical data. Statistical methods suitable for analysis of data are described in Section 9.

*Sampling – General*

*Equipment*

- Acceptable sampling devices for soft sediments for physical, chemical and biological variables include the Ponar, Smith-MacIntyre, Van Veen and other appropriate grab designs. (It is recommended that grabs with 50 x 50 cm mouth opening and a 0.1 m2 area be used if multivariate sampling is occurring as a larger volume of sediment will be required. Several grabs from a Ponar or similar sized grab is not recommended as the relationship between the variables will be weaker).
- Meters and electrodes to measure sulphide ($Ag^{+}/S^{=}$) and redox (Pt) (See Section 7 and 8 for standardization and calibration procedures).
- Hydraulically powered davit system.

*Positioning and Mapping Requirements*

- Real time dGPS or WAAS enabled GPS system capable of $\pm$5 metres positional accuracy when available. If not available, report alternate positional methodology.
- Track plotting software such as Nobletec (using WGS 84 (NAD83) horizontal datum) with minimum 10 metre depth contours and showing the containment structure array and associated anchor line locations.
- Transects for the 0, 30 and 125 metre facility stations are to be located along the axis of the dominant current directions unless otherwise directed by the Department.
- Use at least one transect for each dominant current direction unless otherwise directed by the Department.

*Reference Station Selection*

- Locate stations 0.5 – 2.0 km from the nearest containment structure associated with the facility.
- Reference stations must be a minimum of 0.5 km apart.
- Mean water depth is within 25% of the mean depth of all facility stations. This may require additional reference stations if there is significant variability in the depth associated with the facility stations.
- Characteristics such as topography, seabed type, current and tidal regimes, amount of freshwater run-off and other applicable characteristics are similar to those at facility stations.
- The silt/clay fraction of Sediment Grain Size (SGS) is within 15% of the facility stations' silt/clay fraction. This may require additional reference stations if there is significant variability in the silt/clay fractions associated with the facility stations.
- If the facility stations appear to have been influenced by anthropogenic activity ensure that the reference stations have similar effects (e.g. log dumps).

*Sampling Preparation and Information*

- Prepare the 'S' stock solution ($10^{-2}$ M $Na_2S$) and SAOB (EDTA/NaOH) solutions in advance (See Section 7).
- Add L-Ascorbic acid to the SAOB solution just prior to calibration of silver/sulphide electrode.
- If electrode requires filling solution ensure solution is added at least 30 minutes prior to electrode use to ensure stability of electrode.
- Calibrate silver/sulphide ($Ag^{+}/S^{=}$) electrode and standardize redox (Eh) electrode just prior to sampling.
- Check tidal conditions. If possible sample during slack tide and in low wind conditions to minimize drift and facilitate accurate sampling of predetermined monitoring station locations.
- Record latitude/longitude for sampled locations using DGPS (minimum accuracy of $\pm$ 5 metres) at each station (must be on site for 20 minutes before recording position).
- For 30 meter and 125 meter facility compliance stations not already predetermined by way points, use range finder to locate stations. (In most situations it is recommended that once stations are located vessel is tied off to net pen array to maintain position).
- Record true-north bearings of transects (should be based on moving away from farm).
- Report water depth.
- Record time that sample was successfully obtained.
- Recalibrate $Ag^{+}/S^{=}$ electrode a minimum of **every 3 hours.**
- Recheck the redox electrode against standard at same time $Ag^{+}/S^{=}$ electrode is recalibrated.
- If potentials recorded with the $Ag^{+}/S^{=}$ electrode in a sediment sample do not stabilize in 1 – 2 minutes performance can be assessed without a full recalibration. The 'S' concentration can be measured in one of the dilute 'S' standards if it has been stored in a dark cooled container with a minimum head space. Do not attempt to correct the data for drift if deviations are less than 10 – 20% of expected standard values. If measured values have a greater deviation than the expected value a full recalibration should be performed following protocols in Section 7.

*Sample Collection and Description*

- Where protective latex gloves when handling and analyzing sediments.
- Deploy and retrieve sampling device at a maximum rate of 0.3 m/s to minimize disturbance of ocean substrate and sediment sample.
- Ensure successive samples are not obtained from divot formed by first sample grab.
- Do not dispose of excess sediment from grabs in vicinity of area where subsequent grabs will be obtained.
- Check for indicators of an acceptable grab sample:

- Overlying water present – indicating minimal leakage and associated disturbance;
- Overlying water not excessively turbid - indicating minimal sediment disturbance;
- Sediment surface relatively flat – indicating minimal sediment loss due to wash-out;
- Minimum penetration depth of 5 cm for surficial sediments is achieved;
- If sampling device overfilled – remove some or all of the detachable weights and/or reduce deployment rate.

- Do not make more than 4 attempts to obtain a suitable sample grab at any sampling station location. If unsuccessful:
  - Move vessel over 1 – 3 metres and attempt to obtain sample. If unsuccessful after one attempt;
  - Move vessel in opposite direction from original location and attempt to obtain sample. If still unsuccessful provide video to show that hard bottom substrates occur at this sampling location.
- Siphon the overlying water from the sample. Retain for sieving if samples for macrofauna analysis are to be collected.
- Examine the sediment sample and record the following:
  - Sediment texture;
  - Sediment colour;
  - Odour on a scale of 0 – 4 with 4 being the strongest;
  - Presence of gas bubbles;
  - Bacterial mats (Beggiatoa);
  - Polychaete mats (OPC);
  - Presence of fish feed;
  - Presence of fish feces;
  - Flocculent organic material;
  - Macrophytes;
  - Megafauna;
  - Terrigenous material;
  - Farm litter.
- Take colour photo of the sample or score sediment colour by comparing with a calibrated system.
- Record the depth of sediment in the grab in centimetres.

*Preparing Sediment Subsamples*

- Upon completion of the physical analysis begin Eh and 'S' analysis as soon as possible (within 5 minutes) by completing the following steps:
  - Collect duplicate subsamples from the top 2 centimetres of sediment from the centre of each side of the grab using a plastic spatula or shallow spoon. Cut-off plastic syringes can also be used depending on the coarseness of the sediment. The volume of sediment removed is dependent on the number of analyses required. A minimum of 25 mL is required for Eh and 'S' analysis;

- Remove all unrepresentative material (e.g. large shell fragments, megafauna, wood waste, rock) before measuring 'S' and Eh or placing in containers for lab analysis.
- Place the two sub-samples in a suitable container and homogenize by gently mixing the sediment;
- Remove the sediment needed for Eh and S analyses. The remaining sediments are to be placed in whirl packs or tissue cups for lab analysis. TVS and percent moisture (water content) analysis can be done on the same sample. SGS and metals require separate subsamples for analysis. All storage containers must be kept cool and be air-tight to prevent desiccation and exposure to excess air.

*Measurement of 'S'*

In order to measure 'S' a 1:1 volume ratio of SAOB to sediment is required.

- Place 10 mL of SAOB in a small plastic or glass graduated container and then add sediment until meniscus is at the 20 mL gradation. (Always add SAOB first).
- Briefly stir mixture and then insert the $Ag^{+}/S^{=}$ electrode into the sample. Ensure the tip of the electrode is fully covered by the SAOB/sediment slurry.
- Gently move the electrode in the slurry until electrode stabilizes. Depending on electrode a **Ready** message appears on the meter screen and/or a beep is heard (typically 1 – 4 minutes)
  NOTE: Solid phase metal-'S' complexes may be solubilised under alkaline conditions and prolonged exposure of sediment to SAOB before the electrode potential is recorded should be avoided.
- Gently wipe the electrode, removing all sediment, prior to insertion into the next sample.
- Any oily residue on the electrode must be removed prior to further use.

*Measurement of Eh*

- At same time the subsample for 'S' is removed place redox electrode in remaining subsample ensuring that Pt tip is in contact with the sediments. The electrode should be held in one position without movement. Drift will occur as a rest potential is achieved. This occurs when a relatively stable value (drift <10 mV/min) is achieved (usually within 3 minutes).
- Record the Eh value and temperature at the same time.
- Correct Eh value using temperature correction factors supplied by manufacturer. Some electrodes may not require correction or the associated meter has a setting to account for correction internally. (Check with manufacturer).
- Gently wipe the electrode, removing all sediment, prior to insertion into the next sample.
- Any oily residue on the electrode must be removed prior to further use.

**Note:** Measured Eh potentials are converted to be relative to the normal hydrogen electrode (NHE) by addition of a potential characteristic for the filling solution used and the sample temperature. For example, the correction factor applied to a potential measured at 20 C with a 4M KCL in saturated Ag/AgCl reference solution is +204

mV. This value is added to the measured Eh potential (irrespective of whether the potential is positive or negative) to calculate the $Eh_{NHE}$ potential. Correction factors for different filling solutions are usually provided by a manufacturer in the electrode instruction manual.

*Biological Sampling*

- All sediment should be scraped and rinsed from the grab into pre-cleaned containers when collecting samples for analysis of benthic macrofauna. Save the rinse water as part of the infaunal sample.
  NOTE: Rinse water must be filtered through a minimum 250 µm screen to remove ambient fauna prior to use.
- When sieving biological samples in the field:
  - Sieve each sediment sample, associated overlying water and rinse water through a 1.0 mm screen. Care must be taken when sieving that fauna is not damaged by abrasion or water pressure. Depending on the volume of the sample, sieving it in batches should be considered;
  - Count, identify, photograph and record megafauna then return to the ocean causing it the least amount of harm;
  - Retain all coarse gravel and cobble less than 2.5 cm in diameter. Remove attached epifauna and include with infauna separated in the sieved sample;
  - Fix the faunal sample in 10% buffered formalin;
  - After 4 days, rinse the preserved fauna samples on a 0.5 mm screen to remove formalin and then preserve in 70% isopropyl alcohol or ethyl alcohol.
    NOTE: Formalin/rinse water mixture must be contained and appropriately treated prior to disposal.

*Reporting*

- Data must be submitted in an acceptable format and within the period of time specified in the Conditions of Licence.
- Sampling transect direction must be labelled consistently using the following protocol. Transects along the dominant current direction must be identified as T1, T3, etc. while transects along the subdominant current direction must be identified as T2, T4, etc.
- Maps, indicating transect and sampling stations in relation to facility structures, must be at a scale of 1:5,000.

## 6. QUALITY ASSURANCE/QUALITY CONTROL OF SEDIMENT SAMPLES

Quality assurance and quality control are essential components of a sampling and monitoring program. Quality assurance can be described as "all those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality" or in other words "a well documented plan that specifies the measures required to guarantee results of known accuracy and precision." Quality control can be described as "the operational techniques and activities that are

used to fulfill requirements for quality" or "a well documented plan that ensures results are within a consistent level of error."

There is both a field and lab component to QA/QC. Commercial labs are required to obtain certification from the Canadian Association for Environmental Analytical Laboratories (CAEAL) which requires them to participate in a proficiency testing interlaboratory program. Not all parameters associated with marine sediment analysis are part of this program. For those that are not labs must follow a standard quality assurance plan that includes the use of blanks, duplicate samples and reference standards.

*Physical and Chemical QA/QC*

- **Redox Potential**
  - Ensure the Pt electrode is prepared with filling solution, if required, and standardize using recommended redox standards (Section 8);
  - Obtain a triplicate measurement of Eh once every 20 samples, or once per batch if fewer than 20 samples are taken;
  - If potentials do not stabilize (drift >10 mv/min) select a standard wait time (3 minutes recommended) and record values after this period. Note the lack of stabilization and the standard time at which readings were taken.

- **Total Free Sulphides ('S') in SAOB**
  - Ensure filling solution is added to the $Ag^{+}/S^{=}$ electrode several hours prior to calibration;
  - Calibrate electrode using standards and protocols outlined in Section 7. Calibrations must be carried out before each sampling event and a minimum of every 3 hours thereafter;
  - Obtain an additional 'S' measurement from a sample once every 20 samples or once per batch if fewer than 20 samples are analyzed;
  - A minimum of three samples, one from each of three grabs taken at each station, are required for determining the mean value of 'S' and for comparison with compliance standards. If one or more samples exceed station compliance standard an additional two samples and corresponding 'S' and Eh measurements must be taken (Section 9).

- **Laboratory Analyses**
  - Obtain one additional sediment sub-sample from a sample after every batch of 20 samples or once per batch if fewer than 20 samples are taken, for duplicate analyses of TVR, SGS, metals, % moisture (water content) and other applicable parameters;
  - Ensure sample is homogenized and large enough to provide sub-samples for analysis representative of the composite sample.
  - Upon receiving lab data confirm that:
    - 35% Relative Standard Difference for SGS has not been exceeded;
    - 20% Relative Standard Difference for TVR has not been exceeded;
    - % Relative Standard Difference for metals has not been exceeded.

*Biological QA/QC*

There are two options for QA/QC on biological samples:

1. Submit QA samples to an expert contract taxonomist. The taxonomist's lab must have its own QA/QC program;
2. Have certified facility staff* complete the sampling for macrofauna on site by completing the following steps:
    - For every 10 grabs, one additional grab should be collected, split into two equal parts, screened and fauna from both parts preserved. Macrofauna should be enumerated and identified from one half of the sample by facility staff while the other half is submitted to a recognized contract laboratory for similar analysis;
    - The results obtained by facility staff and the recognized taxonomy lab should be comparable at a similarity level of at least 70%. Results from the contract lab must be reported directly to the regulatory body.

Samples analyzed by a contract lab and certified facility staff must be preserved and stored for a minimum of 5 years.

*Staff must be certified by an educational institute recognized for expertise in taxonomic identification of macrofauna to the family level.

*Reporting*

Taxonomic data must be submitted in an acceptable format and within the period of time specified in the Conditions of Licence.

## 7. CALIBRATING THE SULPHIDE (Ag+/S=) ELECTRODE

$Ag^{+}/S^{=}$ electrodes are used to measure free sulphide ions ($S^{=}$ or 'S') in sediment samples treated with an antioxidant buffer solution (SAOB). As noted in Section 3, exposure of sediments to alkaline conditions created by the buffer (pH 12 and greater) may solubilise some fraction of solid phase 'S' (pyrite and other metal complexes) in a sample. 'S' is therefore operationally defined as total free 'S' ions measured in sediment samples buffered with SAOB. Ag+/S= electrodes must be calibrated before the start of each sampling event, and recalibrated a minimum of every 3 hours during an analytical session.

The following protocols are generic to the $Ag^{+}/S^{=}$ electrode. Specific models may have slightly different specific requirements and the operator must be familiar with the model prior to calibrating the electrode.

If routinely used $Ag^{+}/S^{=}$ combination electrodes should be replaced every couple of years as they tend to become less accurate due to wear and tear.

*Materials and Equipment*

- $Ag^{+}/S^{=}$ combination electrodes should be used with an appropriate multimeter for measuring electrode potentials. Any millivolt meter with connectors suitable for the electrode can be used.
- The choice of filling solution affects electrode potentials (e.g. if an Orion 96-16BNWP Sure-flow combination electrode is used, Optimum Results A Orion 900061 filling solution is the appropriate reference filling solution). The level of the electrode filling solution should always be maintained just below the filler hole in the barrel.

*Summary Table of Required Solutions*

| **Solutions** | **Expiration Period** |
|---|---|
| Sulphide Anti-oxidant Buffer (SAOB) | 3 hours |
| Sulphide Anti-oxidant Buffer excluding L-ascorbic acid | 7 days |
| Stock $S^{=}$ solution 10,000 µM ($10^{-2}$ M $Na_2S$)* | 48 hours (cool, dark and air excluded) |
| Standard $S^{=}$ solution 1,000 µM ($10^{-3}$ M $Na_2S$)* | 3 hours |
| Standard $S^{=}$ solution 100 µM ($10^{-4}$ M $Na_2S$)* | 3 hours |
| Standard $S^{=}$ solution 10 µM ($10^{-5}$ M $Na_2S$) | 3 hours |

NOTE: The three standards (*) in the table are recommended for the 3 – point calibration. If samples are expected or found to have 'S' concentrations below 100 µM then a 10 µM standard should be prepared to create a 3 – point calibration series consisting of 10 µM, 100 µM and 1,000 µM. 'S' solutions below 100 µM are unstable and these values are also at the minimum sensitivity of most commercially available $Ag^{+}/S^{=}$ combination electrodes.

**Solution Preparation**

**A. Sulphide Anti-Oxidant Buffer (SAOB)**

**1. Materials**

- 20.0 g NaOH (sodium hydroxide crystals)
- 17.9 g EDTA (ethylenediaminetetraacetic acid disodium salt dehydrate)
- 8.75 g L-ascorbic acid
- De-aerated (Nitrogen bubbled) DI water

**2. Procedure**

- Dissolve the NaOH crystals in 250 ml of de-aerated DI water (use a volumetric-type flask).
- Add EDTA to NaOH solution and swirl until dissolved.

- Place solution in plastic screw top jar. (Solution is stable for up to 7 days when refrigerated.) Larger volumes can be prepared as necessary provided ratio of reagents is maintained.
- Add L-ascorbic acid just prior to the calibration process or analyses of samples. Store in the dark at 4°C. (Solution is stable for up to 3 hours).
- De-aerated DI water must be at similar temperature as that of the sediment to be sampled.

**B. Stock $S^{=}$ solution 10,000 µM**

**1. Materials**

- 0.2402 g $Na_2S*9H_2O$ (10,000 µM) (pre-weighed and stored in ampoules under nitrogen).
- De-aerated (Nitrogen bubbled) DI water

**2. Procedures**

- Working in a fume-hood or well ventilated area, add the 0.2402 g Na2S*9H2O to a volumetric flask containing 100 mL of de-aerated DI water. Swirl until dissolved. Store refrigerated in dark, air-tight bottle with minimum head space. (Solution is stable for up to 48 hours).
- Prepare a decreasing concentration series (10,000 µM, 1,000 µM, 100 µM and 10 µM (if required)) of 'S' standards immediately before calibrating the Ag+/S= combination electrode by transferring 10 mL of the 10,000 µM Na2S stock solution into a volumetric flask and diluting with 90 mL of the de-aerated DI water. This procedure is repeated sequentially using 10 mL of each successive standard and diluting with 90 mL of de-aerated DI water.
- De-aerated DI water must be at similar temperature as that of the sediment to be sampled.

*Calibration Procedures*

**A. Frequency and Handling**

- The $Ag^{+}/S^{=}$ combination electrode must be recalibrated a minimum of once every 3 hours and each time sampling is initiated at a new farm.
- The tip of the electrode should be gently cleaned using an abrasive strip or detergent solution before each calibration. If difficulty is experienced in obtaining the expected slope for the relationship between mV potential and log 'S' concentrations (see subsection B below) cleaning may be necessary to remove coatings formed on the electrode tip. The level of the filling solution should also be checked and either topped up or replaced with fresh electrolyte (if the latter option is chosen wait at least 30 minutes for electrode to stabilize prior to using it).

**B. Electrode Calibration**

- Calibration of the $Ag^{+}/S^{=}$ combination electrode is to be carried out by working from the lowest to highest concentration in a standard 3 - point series. A fixed volume of a standard is diluted with an equal volume of SAOB (1:1 by volume) immediately before each potential is measured.
- The range of standards used for the 3 – point calibration should bracket the range of 'S' concentration expected in the sediment samples.
- mV potentials are stored by the multimeter after they become stable (usually between 1 – 3 minutes depending on the make of the meter.
- Upon completing the measurement of the third standard instruct the meter to calculate the slope of the concentrations. The theoretical slope is -28 mV for each 10-fold increase in the 'S' concentration but because of temperature sensitivities and differences in electrodes the accepted range of values for the slope is between -27 to -33. If the slope is outside this range repeat the calibration using fresh standards (also check cleanliness of probe, filling solution level, battery function, etc prior to recalibrating).
- Following calibration, rinse the electrode with DI water and blot dry before measuring the first sample.
- Upon completion of sediment measurements rinse the electrode and drain filling solution (unless electrode will be used within week).

## 8. STANDARDIZING THE REDOX (Pt) ELECTRODE

The Pt electrode is used to measure $Eh_{NHE}$ potentials to indicate oxidation/reduction potentials in sediment samples. The measurements do not specify what thermodynamic reactions are involved in forming the potentials measured. Standardization should occur every 3 hours or at the end of a set of samples if less than 3 hours. If used in conjunction with an Ag+/S= combination electrode measuring free sulphide, standardize electrode at same time Ag+/S= electrode is calibrated.

The following protocols are generic to the redox (Pt) electrode. Specific models may have slightly different specific requirements and the operator must be familiar with the model prior to standardizing the electrode.

*Materials and Equipment*

- Any commercially available ion specific electrode (ISE) meter or mV meter with connectors suitable for a combination Pt electrode can be used for $Eh_{NHE}$ (redox) measurements.
- Redox combination (internal reference) electrodes are refillable or gel-filled and have a BNC connector to allow connection to a mV meter with a similar connector. The refillable option is recommended. It is also recommended that the electrode have a thin disc of Pt (surface area ˜ 1 cm2) rather than a pin at the end of the electrode.
- If using a refillable electrode it must be filled with a reference solution. A solution with 4 M KCl saturated with Ag/AgCl is recommended for marine samples.

- At least one redox reference solution is required for Pt electrode standardization. These can be purchased from the manufacturer of the electrode.
- Abrasive cleaning strips can be used for cleaning (polishing) the Pt tip of the electrode if coatings are formed during use. A fine powdered detergent can also be used.

*Procedures*

- If using a refillable Pt electrode add filling solution (4 M KCl with saturated Ag/AgCl) at least 24 hours before use.
- The reference chamber of the electrode must be completely filled. Check that filling solution is present around the reference junction.
- Calibrate the electrode by placing it in a standard solution with a temperature close to that expected in the sediment samples. Record the actual temperature immediately prior to measurements. mV readings should stabilize rapidly (<30 sec) due to strong oxidation-reduction coupled reactions in a standard solution. Record the potential for comparison with the expected standard value of +220 mV (the potential for a triiodide/iodide redox couple standard at 20°C). The measured value should not exceed $\pm$ 5 mV. If so, recalibrate electrode following instructions in applicable manual.
- Upon completion of sediment measurements rinse the refillable electrode and drain filling solution (unless electrode will be used within week).

## 9. PERFORMING STATISTICAL ANALYSES

For soft sediment sites statistical analyses are performed for compliance purposes to determine if there are significant differences ($p<0.05$) between observed mean sediment total free sulphide ('S') or metal (Li/Zn/Cu/etc) concentrations and background conditions or designated threshold (standard) values. Nonparametric tests may be used to assess between-station differences in median values of 'S' at facility stations and reference stations. Multivariate tests may also be used to group sites based on similarity/dissimilarity of combined sediment chemical and benthic community variables measured at various locations.

For hard substrate sites, video surveys are used to estimate bottom cover by Opportunistic Polychaete Complex (OPC) and *Beggiatoa* mats along transects between 100 and 124 metres or greater distances from net pen arrays for comparison against compliance and restocking standards based on percent coverage.

*Transect and Sampling Station Validation*

1. **Reference Stations**
   - A minimum of two reference stations.
   - Stations, if at all possible, are to be 0.2 – 2.0 km from the facility.
   - Reference stations are at least 0.5 km apart.
   - The mean depth of reference stations must be within 25% of the depth of facility stations (e.g. 25% of 60 metres deep facility station is 15 metres –

station must be 45 – 75 metres deep). Depending on variation in depth at facility stations additional reference stations may be required.
- The mean % silt/clay fraction of the sediment at the reference stations must be within 15% (15% of 100%) of that at the facility station. Depending on variation of % silt/clay fraction at the facility stations additional reference stations may be required.

**2. Transects**

- Typically located along prevailing currents but dependent on site specific factors including historic monitoring data and operational nature of facility.
- Variance from planned transect is +/- 10% of planned transect length and +/- 20% of planned transect direction.

*Statistical Methods to Determine if Requirements Have Been Met*

The following study designs and statistical tests are to be used to determine whether facilities are meeting chemical and biological requirements. (See Attachment C for specific instructions and examples).

**A. Descriptive Statistics (*required)***

1. Calculate summary statistics including sample number, mean, median and standard deviation for all stations.
2. Draw a box-and-whisker plot showing all stations.

**B. Statistical Test to Determine Compliance (*required*)**

1. Perform a one-sample one-tailed t-test to determine if:
   - The mean total free sulphide at 30 metres is statistically greater than 1300 µM; and
   - The mean total free sulphide at 125 metres (ecological threshold) is statistically greater than 700 µM.

**C. Univariate Statistical Tests to Explain Variations (*may be required*)**

*These may be required if there is a question about the concentration of mean free sulphides at a facility station compared to background conditions.*

1. Perform a Mann-Whitney U test to compare median values for two independent sampling stations to test for significant differences.
2. Perform a Kruskal-Wallis test to compare median values for more than two independent sampling stations to test for significant differences.
3. Perform a Wilcoxon Signed-rank paired test to compare median values between paired sampling stations to test for significant differences (e.g. a 30 m station before and after fallowing).

**D. Multivariate Statistical Test to Explain Variations (*may be required*)**

*These tests may be required if there is a question about the overall recovery of a facility station compared to background conditions.*

Perform a multivariate analysis of variance (MANOVA) to compare multiple variables from several stations to test whether there is a significant difference between stations.

**ATTACHMENT A - Statistical Examples and Specific Instructions**

*Note: different statistical software may produce slightly different results. The following are examples only, and were produced using the open-source statistical computing environment, R (http://www.r-project.org).*

**Example Dataset**

*Table 1. Mean free sulphide concentrations (µM) at facility and reference stations.*

| station | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 |
|---|---|---|---|---|---|
| **30m** | 1200 | 1500 | 3000 | 1900 | 800 |
| **125m** | 900 | 700 | 1000 | 600 | 800 |
| **Ref 1** | 100 | 150 | 175 | | |
| **Ref 2** | 200 | 300 | 250 | | |
| **30m post-fallow** | 800 | 650 | 1100 | 540 | 200 |

**A) Descriptive Statistics (required)**

These descriptive statistics provide a summary of the data from each station. The box-and-whisker plots show the median value (centre of the box), the $25^{th}$ and $75^{th}$ percentiles (edges of the box), the minimum and maximum values (end of whiskers) and outliers (dots).

*Table 2. Summary Statistics.*

| Station | number | mean | median | standard deviation |
|---|---|---|---|---|
| **30m** | 5 | 1680 | 1500 | 841 |
| **125m** | 5 | 800 | 800 | 158 |
| **Ref 1** | 3 | 142 | 150 | 38 |
| **Ref 2** | 3 | 250 | 250 | 50 |
| **30m post-fallow** | 5 | 658 | 650 | 331 |

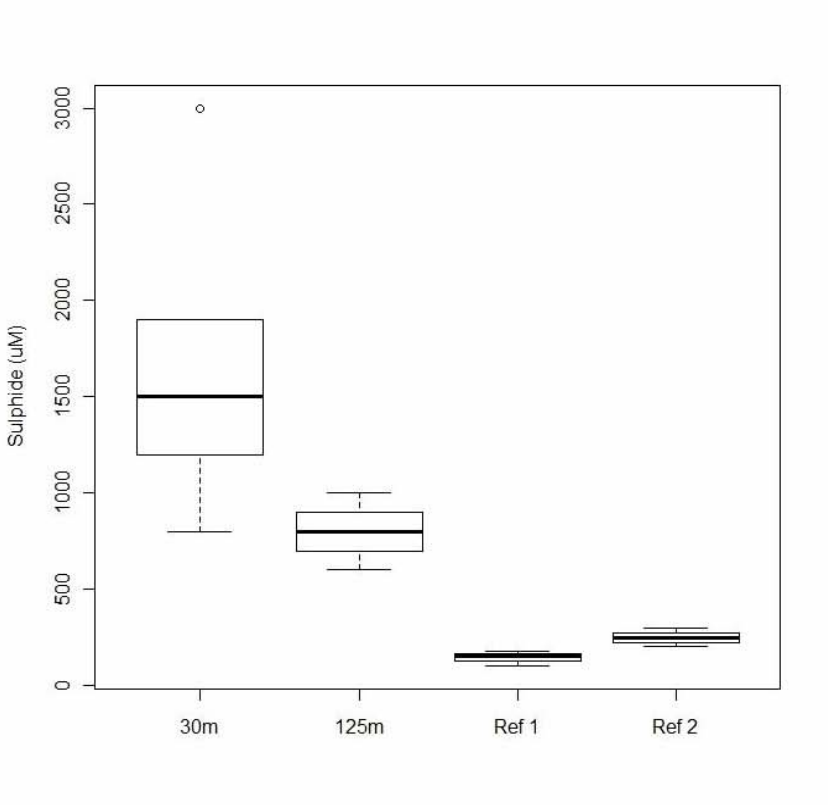


*Figure 1. Box-and-whisker plot*

**B) Statistical Test to Determine Compliance (required)**

The one-sample t-test is a parametric test to compare a single station to a standard. It is recognized that with only three to five data points per station, there is not enough information to determine whether the assumptions of the test have been met. However, a non-parametric equivalent to this test does not exist. As such, the t-test will be used as the primary method for assessing compliance. The null hypothesis is rejected if the p-value is less than the accepted significance level (á = 0.05).

Perform a one-sample one-tailed t-test to test whether:

a) mean free sulphide at 30m is statistically greater than 1300 µM

Example:
*H0 = the true mean is equal to 1300 µM*
*HA = the true mean is greater than 1300 µM*

Results:
*t = 1.011, df = 4, p-value = 0.185*
*There is no evidence that the mean free sulphide concentration at the 30m station is significantly greater than the standard of 1300 µM (p>0.05).*

b) mean free sulphide at 125m is statistically greater than 700 µM

Example:
*H0 = the true mean is equal to 700 µM*
*HA = the true mean is greater than 700 µM*

Results:
*t = 1.414, df = 4, p-value = 0.115*
*There is no evidence that the mean free sulphide concentration at the 125m station is significantly greater than the standard of 700 µM (p<0.05).*

**C) Univariate Statistical Tests to Explain Variations (may be required)**

1) Perform a Mann-Whitney U test to compare median values for two independent sampling stations to test for significant differences
This is a non-parametric test to compare two stations to each other. It could be used to test for differences between two reference stations. If no difference is found, reference station data could be combined as one station. It could also be used to test for a difference in median free sulphide concentration between an ecological threshold station and a reference station.
   a) Ref 1 versus Ref 2
   Example:
   *H0 = median values of the two distribution functions are the same*
   *HA =median values for the distribution functions are different*

   Results:
   *W = 0, p-value = 0.100*

   *There is no evidence of a significant difference in the median free sulphide concentration between the two reference stations (p>0.05). They can be pooled into one station.*
   b) Pooled references versus 125m (ecological threshold)
   Example:

   *H0 = median values of the two distribution functions are the same*
   *HA = median values for the distribution functions are different*

   Results:
   *W = 0, p-value =0.004*
   *There is a significant difference between median values for these two groups of stations (p=0.004).*

2) Perform a Kruskal-Wallis test to compare median values for more than two independent sampling stations to test for significant differences
This is a non-parametric test to compare median values between two or more stations. It could be used to test for differences in median free sulphide concentration between all the sampling stations.

a) 30m vs. 125m vs. Ref 1 vs. Ref 2

Example:

*H0 = median values of the two distribution functions are the same*

*HA = median values for the distribution functions are different*

Results:

*Kruskal-Wallis chi-squared = 12.968, df = 3, p-value = 0.005*

There is a significant difference between median values for these four groups of stations (p=0.005).

If results are significant, it is possible to determine which of the four stations are different by performing a Mann-Whitney U test between two stations at a time (refer to (2), above).

3) Perform a Wilcoxon signed-rank paired test to compare median values between two paired sampling stations, e.g. before and after fallowing, to test for significant differences

This is a non-parametric test to compare median values for two paired stations to each other. It could be used to test for significant differences at a station before and after fallowing.

a) 30m vs. 30m post-fallow

Example:

*H0 = median values of the two distribution functions are the same*

*HA = median values for the distribution functions are different*

Results:

*V = 15, p-value = 0.063*

*There is no evidence of a significant difference in the median free sulphide concentration between the 30 m station pre- and post-fallow (p>0.05).*

**D) Multivariate Statistical Test to Explain Variations (may be required)**

This is a parametric test to determine whether there is a significant difference between two or more stations based on several variables measured at all locations (e.g. mean free sulphide, redox, copper, zinc, Shannon Index, Total Abundance)

This test assumes that the data are normally distributed. A Shapiro-Wilk test for normality is thus required for each parameter.

If the data are not normally distributed, or if the sample size is too small to determine this (n<20), normality can be approached using a log transformation for the variable(s) with non-normal distributions. Redox data may have to be adjusted (e.g. +200 to all values) to eliminate any negative values before log transformation. Following that, a multivariate analysis of variance (MANOVA) can be performed on the data. Note that the small sample size may limit the accuracy of this test.

**Example Dataset**

*Table 3. Chemical and biological data at a facility station and two reference stations.*

| Station | S | Eh | Cu | Zn | Species Richness | Family Richness | Shannon Index | Total Abundance |
|---|---|---|---|---|---|---|---|---|
| 125 m | 1080 | -131.6 | 8.7 | 33 | 8 | 7 | 1.3 | 49 |
| 125 m | 716 | -146.9 | 3.9 | 16 | 10 | 9 | 1.6 | 102 |
| 125 m | 810 | -131.2 | 9.6 | 38 | 8 | 5 | 1.5 | 34 |
| 125 m | 520 | -111.7 | 8.8 | 35 | 5 | 5 | 1.3 | 40 |
| 125 m | 420 | -117.9 | 5.4 | 22 | 10 | 9 | 1.7 | 52 |
| Ref 1 | 125.2 | 23.5 | 5.9 | 18 | 7 | 7 | 1.6 | 15 |
| Ref 1 | 125.2 | 22.8 | 10 | 31 | 14 | 12 | 2.1 | 39 |
| Ref 1 | 100.2 | 18.1 | 8.9 | 25 | 7 | 7 | 1.8 | 19 |
| Ref 2 | 132.1 | 63.7 | 6.5 | 18 | 15 | 12 | 2.3 | 38 |
| Ref 2 | 150 | 14.6 | 7.7 | 21 | 19 | 15 | 2.8 | 31 |
| Ref 2 | 167 | 20.5 | 6.2 | 17 | 21 | 15 | 2.9 | 37 |

A Shapiro-Wilk test for normality gives the following results:

*S* *W = 0.824, p-value = 0.019 (not normally distributed)*
*Eh* *W = 0.799, p-value = 0.009 (not normally distributed)*
*Cu* *W = 0.943, p-value = 0.556*
*Zn* *W = 0.894, p-value = 0.155*
*SR* *W = 0.898, p-value = 0.173*
*FR* *W = 0.897, p-value = 0.168*
*H* *W = 0.883, p-value = 0.113*
*TA* *W = 0.799, p-value = 0.009 (not normally distributed)*

*Table 4. $Log_{10}$ transformed data; note that a value of 200 was added to all redox data prior to the log transformation.*

| Station | log(S) | log(Eh+200) | Cu | Zn | Species Richness | Family Richness | Shannon Index | log(TA) |
|---|---|---|---|---|---|---|---|---|
| 125 m | 3.033 | 1.835 | 8.7 | 32.8 | 8 | 7 | 1.3 | 1.690 |
| 125 m | 2.855 | 1.725 | 3.9 | 16 | 10 | 9 | 1.6 | 2.009 |
| 125 m | 2.908 | 1.838 | 9.6 | 38.2 | 8 | 5 | 1.5 | 1.531 |
| 125 m | 2.716 | 1.946 | 8.8 | 35.2 | 5 | 5 | 1.3 | 1.602 |
| 125 m | 2.623 | 1.914 | 5.4 | 22.3 | 10 | 9 | 1.7 | 1.716 |
| Ref 1 | 2.098 | 2.349 | 5.9 | 18 | 7 | 7 | 1.6 | 1.176 |
| Ref 1 | 2.098 | 2.348 | 10 | 31.1 | 14 | 12 | 2.1 | 1.591 |
| Ref 1 | 2.001 | 2.339 | 8.9 | 25 | 7 | 7 | 1.8 | 1.279 |
| Ref 2 | 2.121 | 2.421 | 6.5 | 18 | 15 | 12 | 2.3 | 1.580 |
| Ref 2 | 2.176 | 2.332 | 7.7 | 21 | 19 | 15 | 2.8 | 1.491 |
| Ref 2 | 2.223 | 2.343 | 6.2 | 17 | 21 | 15 | 2.9 | 1.568 |

Perform a multi-way ANOVA using Station as the factor and all eight variables to determine whether a significant difference exists between the three stations.
Results indicate that there is a significant difference between 125m, Ref 1 and Ref 2, which is driven by one or more of the eight parameters.

*Table 5. Summary of p values derived for a multiple analysis of variance analysis (MANOVA) using variables listed in Table 4 comparing observations from three station locations (125 m, Ref 1 and Ref 2). log S, log Eh, SR, FR and H have a significant effect (*) in creating differences between the three groups of stations.*

| Univariate Test Statistics | | | | Multivariate Test Statistics | |
|---|---|---|---|---|---|
| Variable | F | p value | | Pillai Trace | 1.954 |
| log S | 48.02 | <0.001* | | F-statistic | 10.626 |
| log Eh | 81.23 | <0.001* | | df | 16, 4 |
| Cu | 0.39 | 0.69 | | p | 0.017 |
| Zn | 1.76 | 0.232 | | | |
| SR | 12.21 | 0.004* | | | |
| FR | 9.71 | 0.007* | | | |
| H | 23.05 | <0.001* | | | |
| log TA | 4.26 | 0.055 | | | |

The analysis can be run using combined stations, for example combining results from the two Ref stations and making the comparison of pooled observations with those at the 125 m station. The reference stations should first be tested for a significant difference between them, using a MANOVA.
Results indicate that there is no significant difference between the two reference stations ($p>0.05$).

*Table 6. Summary of p values derived for a multiple analysis of variance analysis (MANOVA) using variables listed in Table 4 comparing observations from two station groups (125 m vs. Ref 1 + Ref 2). log S, logEh, FR, H and logTA have a significant effect (*) in creating differences between the two groups of stations.*

| Univariate Test Statistics | | | | Multivariate Test Statistics | |
|---|---|---|---|---|---|
| Variable | F | p value | | Pillai Trace | 0.993 |
| log S | 8.59 | <0.001* | | F-statistic | 34.862 |
| Eh | 14.14 | <0.001* | | df | 8, 2 |
| Cu | 0.04 | 0.844 | | p | 0.028 |
| Zn | 2.55 | 0.145 | | | |
| SR | 0.04 | 0.073 | | | |
| FR | 0.29 | 0.041* | | | |
| H | 5.31 | 0.012* | | | |
| log TA | 0.94 | 0.039* | | | |

Fisheries and Oceans
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| | |
|---|---|
| Reporting Year: | 2010 |
| DFO Licence # | |
| Licence Holder: | |
| Land File (Tenure) #: | |
| Legal Description & Location: | |

# Annual Aquaculture Statistical Report

Confidential within the provisions of the *Access to Information* and *Privacy Act*

**Grand Total Sales $**

# FINFISH

## Introduction

Fisheries and Oceans Canada is responsible for the collection and analysis of production statistics for the British Columbia aquaculture industry. This information is collected via the Annual Aquaculture Statistical Reports (AASR). All aquaculture licence holders are required to complete the AASR under Section 61 of the Federal *Fisheries Act*. The completed forms are due no later than January 25, 2011.

## Instructions for Completing the AASR

- ► Complete all sections (1 through 7) on this form.
- ► The completed form may be faxed to 1 (604) 666 1076 or mailed. An electronic version of the form may be downloaded from **http://www.dfo-mpo.gc.ca/aquaculture/aquaculture-eng.htm** and completed and submitted via email to fishstats@dfo-mpo.gc.ca.

## Section 1 - Harvest For Food Market Sales

**If nil, please check here:** ☐

► All weights provided in this section are in (check one): ☐ Kilograms ☐ Pounds

| Product Type | Species (please specify) | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | Weight | Value ($) | Weight | Value ($) | Weight | Value ($) |
| Round | | | | | | |
| Live | | | | | | |
| Fresh Dressed Head On | | | | | | |
| Fresh Dressed Head Off | | | | | | |
| Frozen Dressed Head On | | | | | | |
| Frozen Dressed Head Off | | | | | | |
| Fresh Fillets | | | | | | |
| Frozen Fillets | | | | | | |
| Other (specify) | | | | | | |
| Other (specify) | | | | | | |

**Total Food Market Sales $**

## Section 2 - Processing Information

**If not applicable please check here:** ☐

► Who processed your fish? _____

► Did you own the fish after processing and sell to market (i.e. have your fish self- or custom-processed)?

☐ No ☐ Yes, all of it ☐ Yes, a portion of it. Provide details:

DFO Licence # _____

## FINFISH - Annual Aquaculture Statistical Report - 2010 (continued)

### Section 3 - "U-Catch-Em" Sales

If nil, please check here: ☐

| Species | Average Length (in) | Total Number | Total Weight (lb or kg) | Specify lb or kg | Total Value $ |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | Total "U-Catch-Em" Sales $ | |

### Section 4 - Sales of Live Fish or Eggs for Restocking

If nil, please check here: ☐

| Species | Stage | | | | | | Exports Out of B.C. (Yes/No) |
|---|---|---|---|---|---|---|---|
| | Eggs | | Fry/Fingerlings Juveniles/Smolts | | Adults | | |
| | Number | Value ($) | Number | Value ($) | Number | Value ($) | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | Total Live Fish and Eggs for Restocking Sales $ | | | |

### Section 5 - Stocking Information

**Freshwater Section 5 - Stocking Information for Freshwater Sites**

► **Freshwater Sites - Was any Stock Brought On-Site During the 2010 Calendar Year?**

**If nil** - please check here: ☐

**If yes - list all species brought on-site during 2010:** _____

**Marine Section 5 - Stocking Information for Marine Sites**

► **Marine Sites - Was any Stock Brought On-Site During the 2010 Calendar Year?**

**If nil** - please check here: ☐

**If yes:**

► **For fish stocked <u>from another marine site</u> (a lensing site is considered a marine site)**

- list all species brought on-site during 2010: _____

► **For fish stocked <u>from a freshwater site</u> (a lensing site is considered a marine site)**

- list species, number and average weight of fish brought on-site during 2010.

| Species | Number | Average Weight (grams) | Total Weight (kilograms) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

### Section 6 - Stock On Hand and Future Plans

► Did this site have any stock on hand on December 31, 2010? ☐ YES ☐ NO

If YES, what species? _____

► Will this site be operating next reporting year? ☐ YES ☐ NO ☐ FALLOW

► Additional comments on site activity? _____

### Section 7 - Declaration

**DECLARATION: I have read all information contained on this report and it is true to the best of my knowledge and belief.**

| *Name (please print)* | *Signature* | *Date* |
|---|---|---|
| *Position in Company* | *Email address* | *Phone #* |

*DFO 2nd Revision - Rev. Nov/10*

# Appendix XVIII. Population Harvest Declaration Form

## Part A.

Company Name:

Address:

Phone number:

Aquaculture Licence Number:

| Fish ID or Lot # | Date of Harvest | Fish Species and Common Names | Quantity Shipped (pieces) |
|---|---|---|---|
| | | | |

Name of Market venue, Distributor, next Grower, or Processor:

**PART B. Details of Drug/Chemical Treatment While Fish in this Lot Held at the Licence Facility**
**Details of Last Drug/Chemical Treatment:**

| 1. Name of Drug and Prescription No. (if any) | 2. Date Treatment Commenced | 3. Date Treatment Ended |
|---|---|---|
| • | | |
| • | | |

4. Treatment Information (withdrawal time prescribed, how applied to animals (in-feed or bath), amount per Kg of feed, etc.)

Treatment file and details are available at rearing site: Yes No

5. Name of Prescribing Veterinarian

| Name of Person Responsible for Administering the Treatment | Signature of Person Responsible for the information of this declaration<br><br>Date: |
|---|---|

This form may be used by a holder or his agent to satisfy the information requirements specified in Licence condition 19.2 concerning shipping of fish/seafood to a market venue or processing plant. The form must accompany the fish/seafood and must be retained by the market or processing licensee for a period of one year. Please note that a form must be submitted even if there has been no drug treatment of the animals in the shipment.