

Standard Operating Practices for the Environmental Monitoring of the Marine Finfish Cage Aquaculture Industry in New Brunswick

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1.0 INTRODUCTION

This document is the *Standard Operating Practices (SOP) for the Environmental Monitoring of the Marine Finfish Cage Aquaculture Industry in New Brunswick*. As a requirement of the Certificate of Approval, administered by the New Brunswick Department of Environment (DENV), approval holders must have the environmental monitoring at their aquaculture sites conducted in compliance with this SOP. This will ensure that environmental monitoring requirements are consistent and that the results will be of the highest standard of quality possible for all aquaculture sites, facilitating their use in the regulatory process, as described in the document titled *Environmental Management Program for the Marine Finfish Cage Aquaculture Industry in New Brunswick*, issued by DENV.

This SOP is applicable to Tiers 1, 2 and 3 monitoring. Tier 1 monitoring is conducted once annually, between August 1 and October 31. Tier 2 monitoring is conducted once, within 20 calendar days after Tier 1 and Tier 3 if the average sediment sulfide concentration observed in Tier 1 or Tier 3 is greater than or equal to 3000 μM . Tier 3 monitoring is conducted once annually, between March 1 and May 31, if the average sediment sulfide concentration observed in Tier 1 is greater than or equal to 4500 μM . Other environmental monitoring may be required to be conducted in accordance to this SOP, at the discretion of DENV.

For all three monitoring tiers, guidance is provided in this SOP for determining the number and position of transects and sediment samples, video recordings, site plans, collecting and analyzing sediment samples, waste disposal and record keeping. Questions regarding this SOP should be directed to DENV. The Aquaculture Approvals Officer may be contacted at (506) 453-6633 and the Marine Aquaculture Biologist at (506) 658-2558.

2.0 NUMBER AND POSITION OF TRANSECTS AND SEDIMENT SAMPLES FOR TIERS 1 AND 3 MONITORING

Information contained within this section provides guidance for determining the number and position of transects and sediment samples for Tiers 1 and 3 monitoring. The site criteria, presented in the order in which they will be considered in making these determinations are as follows:

- At sites where harvesting has not begun for the current production cycle, sediment samples and transects will be positioned based on the number of fish onsite at the time the monitoring is conducted;
- At sites where harvesting has begun for the current production cycle, sediment samples and transects will be positioned in the same location as those in the most recent Tiers 1 or 3 monitoring by referring to their DGPS coordinates;
- At sites where no cages are present or where cages are present that do not contain fish, sediment samples will be positioned in the same location as those in the most recent Tiers 1 or 3 monitoring by referring to their DGPS coordinates;
- Water depth of sampling stations at low tide;
- Prevailing water current pattern;
- Site layout;
- Biomass of stock in each cage;

Tables 1, 2 and 3 will be used by those conducting the monitoring to record completion of the decisions regarding each criterion. Because site-specific conditions may preclude positioning transects or sediment samples as described in this SOP, Tables 1, 2 and 3 will also be used to record the information pertaining to the subsequent deviations. The completed tables will be provided to the approval holder by those conducting the monitoring. When such site-specific conditions are known before the monitoring is conducted, approval holders are required to notify DENV and receive approval for deviations from this SOP before the monitoring is conducted.

Deviations resulting from site-specific conditions that cannot be foreseen by either the approval holder or those conducting the monitoring do not require approval from DENV, but do require the table(s) used to record the information pertaining to the deviations to be submitted with the monitoring results. An example of this type of deviation may be due to the limits of bottom time for the SCUBA divers, regardless of water depth at site center at mean low tide. In such instances, bottom time limitations may not allow enough time for everything to be completed for each transect. In these cases, the monitoring will be conducted at

low tide; transect positions will be determined by prevailing water current pattern, site layout and biomass of stock in each cage; and the deviation will be to not video record each 50 m transect.

2.1 Number of transects and sediment samples

The number of transects and sediment samples for Tiers 1 and 3 monitoring will be determined in accordance to the following protocol:

- At sites with fish present and harvesting has not begun for the current production cycle refer to the following:
 - As shown in Table 1, at sites with water depth at all sampling stations less than 30.0 m at low tide, one transect will be laid and three sediment samples will be collected for each 100,000 fish, or part thereof, that are onsite at the time the monitoring is conducted, with a minimum of two transects and six sediment samples at sites with 1 - 200,000 fish;
 - As shown in Table 1, at sites with water depth at any one sampling station greater than 30.0 m at low tide , one video transect and three sediment samples will be collected for each 100,000 fish, or part thereof, that are onsite at the time the monitoring is conducted, with a minimum of two transects and six sediment samples at sites with 1 - 200,001 fish;
 - At sites where harvesting has begun for the current production cycle, sediment samples and transects will be positioned in the same location as those in the most recent Tiers 1 or 3 monitoring by referring to their DGPS coordinates;
 - At sites where no cages are present or where cages are present that do not contain fish, sediment samples will be positioned in the same location as those in the most recent Tiers 1 or 3 monitoring by referring to their DGPS coordinates;
 - Regardless of water depth, if the number of fish onsite is 0 then no transect will be laid.
-

Table 1: Number of transects and sediment samples for Tiers 1 and 3 monitoring.

Number of fish onsite at the time the monitoring is conducted	Water depth at all sampling stations < 30.0 m at low tide		Water depth at any one sampling station > 30.0 m at low tide		Add checkmark for completion of step	Information regarding deviations, if applicable
	Number of transects	Number of sediment samples	Number of transects	Number of sediment samples		
0	0	6	0	6		
1-200,000	2	6	2	6		
200,001-300,000	3	9	3	9		
300,001-400,000	4	12	4	12		
400,001-500,000	5	15	5	15		
500,001-600,000	6	18	6	18		
600,001-700,000	7	21	7	21		
700,001-800,000	8	24	8	24		

2.2 Position of transects and sediment samples

The position of transects for Tiers 1 and 3 monitoring will be determined in accordance to the protocol shown in Table 2. In all cases, cages along the outside perimeter of the cage configuration will be selected for positioning of transects. Also, separate cages will be selected for positioning of transects, beginning in order from the cage with the highest to lowest biomass, relative to others, in relation to the prevailing water current pattern, current speed, and direction of the shoreline. Figure 1 shows transect positions for Tiers 1 and 3 at sites with generally linear water current patterns with moderate or high current speeds. Figure 2 shows transect positions for Tiers 1 and 3 at sites with generally curving water current patterns or low current speeds.

The position of sediment samples for Tiers 1 and 3 monitoring will be determined in accordance to the protocol shown in Table 3. All sediment samples will be positioned at cage edge, where one set of three samples will be collected in similar substrate, within a 1 metre square area surrounding the end of a weighted drop line on the sea floor. The weighted drop line shall have graduated measurements. Each 1 metre shall be marked by an indicator line, each 5 metre must be marked with a tag indicating the measurement, ie. 5 m, 10 m, 15 m. At sites where harvesting has begun for the current production cycle, sediment samples and transects will be positioned in the same location as those in the most recent Tiers 1 or 3 monitoring by referring to their DGPS coordinates. At sites where no cages are present or where cages are present that do not contain fish, sediment samples will be positioned in the same location as those in the most recent Tiers 1 or 3 monitoring by referring to their DGPS coordinates. .

The DGPS coordinates of each set of three samples will be recorded in degrees, minutes and decimal minutes (3 decimals) using the NAD83 reference. Sediment sample positions for Tiers 1 and 3 monitoring, in relation to an individual cage, is shown in Figure 3.

Table 2: Position of transects for Tiers 1 and 3 monitoring.

Prevailing water current pattern of site	Transect position	Add checkmark for completion of step	Information regarding deviations, if applicable
Generally linear (uni- or bi-directional) with moderate or high current speeds.	<ol style="list-style-type: none"> 1) Cages along the outside perimeter of the cage configuration will be selected for positioning of transects; 2) When more than one transect is on the same side of a site, they will be positioned at separate cages, beginning in order from the cage with the highest to lowest biomass relative to the others along the same side; 3) The first two transects will be positioned at opposite sides of the site, in alignment with the prevailing water current pattern; 4) The third and fourth transects, if required, will be positioned approximately at right angles to the prevailing water current pattern, on sides of the site that do not yet have a transect; 5) The third transect, if required, will be positioned on the shoreward side of the site, as long as space is available; 6) The fourth transect, if required, will be positioned on the side of the site furthest away from the shore; 7) The fifth transect and others, if required, will be positioned parallel to one of the first two transects, continuing around the site as for the second, third, and fourth transects. 		
Generally curving (eddies or follows shoreline, uni- or multi-directional) or low current speeds.	<ol style="list-style-type: none"> 1) Cages along the outside perimeter of the cage configuration will be selected for positioning of transects; 2) When more than one transect is on the same side of a site, they will be positioned at separate cages, beginning in order from the cage with the highest to lowest biomass relative to the others along the perimeter; 3) The first two transects will be positioned approximately at right angles to each other, with one transect on the shoreward side of the site, as long as space is available, and the other transect aligned approximately with the general directional trend of the shore; 4) The third and fourth transects, if required, will be positioned on the opposite sides of the site to the first two transects; 5) The third transect, if required, will be aligned approximately with the general directional trend of the shore; 6) The fourth transect, if required, will be positioned on the side of the site furthest away from the shore; 7) The fifth transect and others, if required, will be positioned parallel to one of the first two transects, continuing around the site as for the second, third, and fourth transects. 		

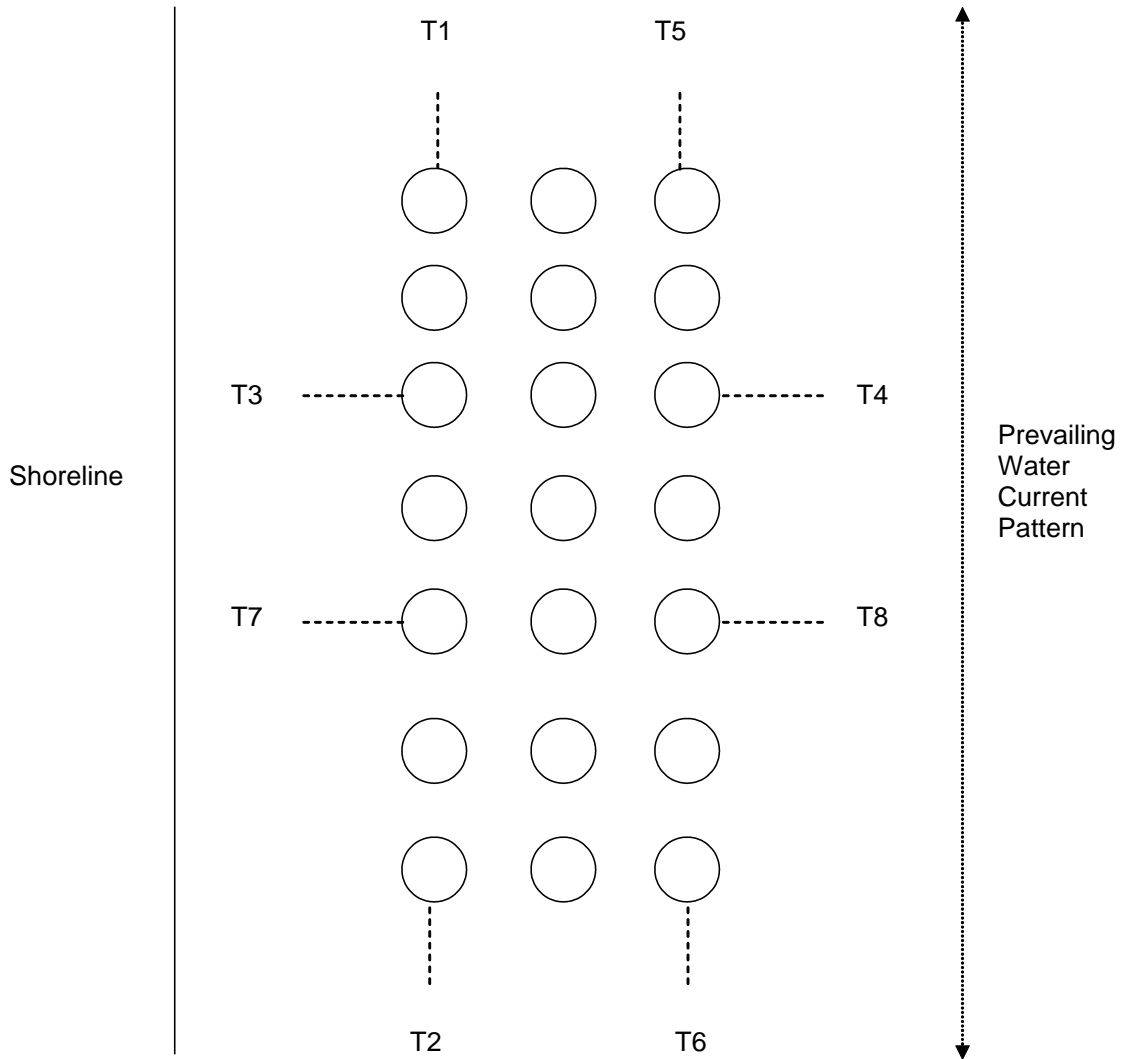


Figure 1: Transect positions for Tiers 1 and 3 monitoring at sites with generally linear water current patterns with moderate or high current speeds.

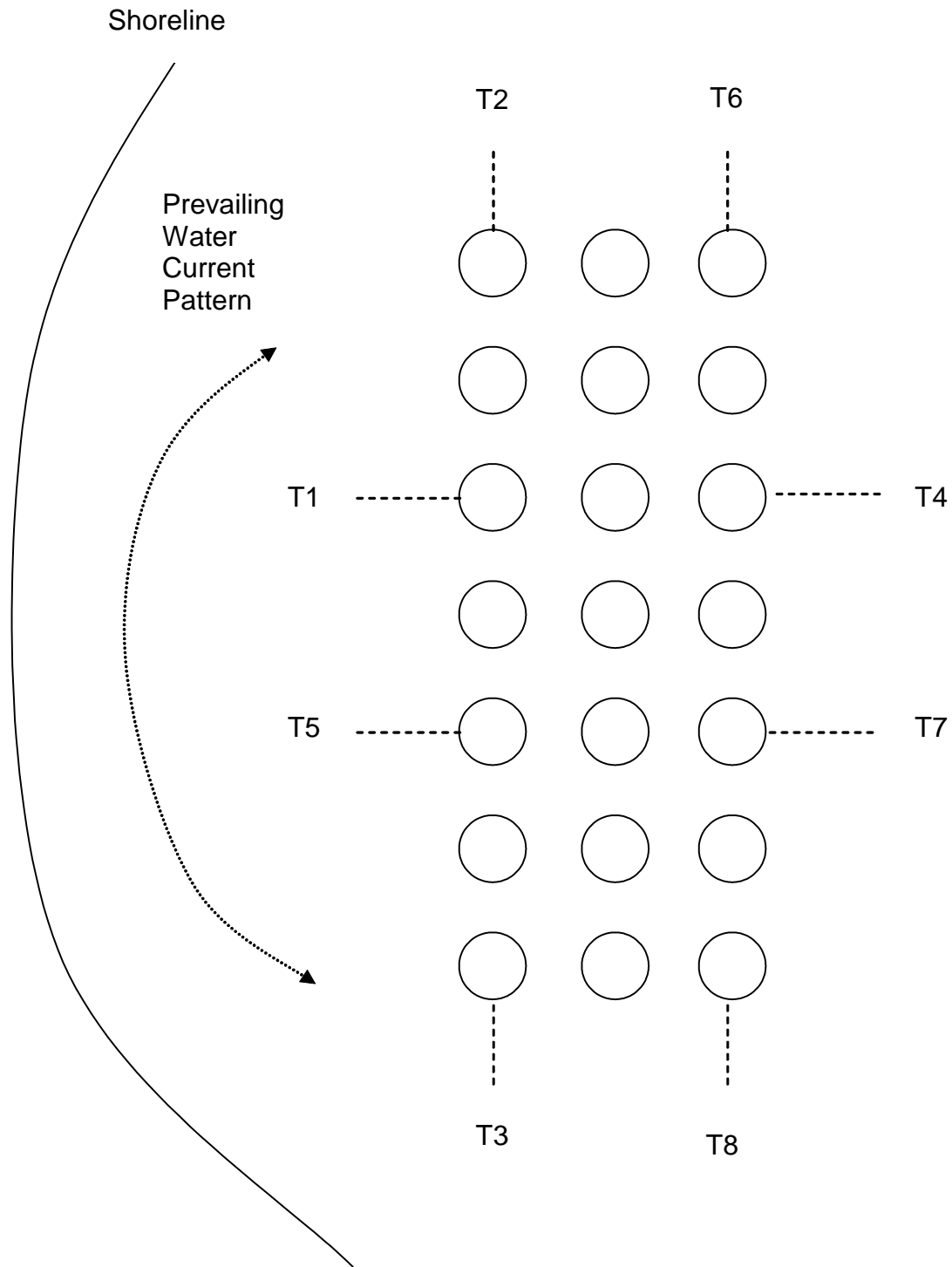


Figure 2: Transect positions for Tiers 1 and 3 monitoring at sites with generally curving water current patterns or low current speeds.

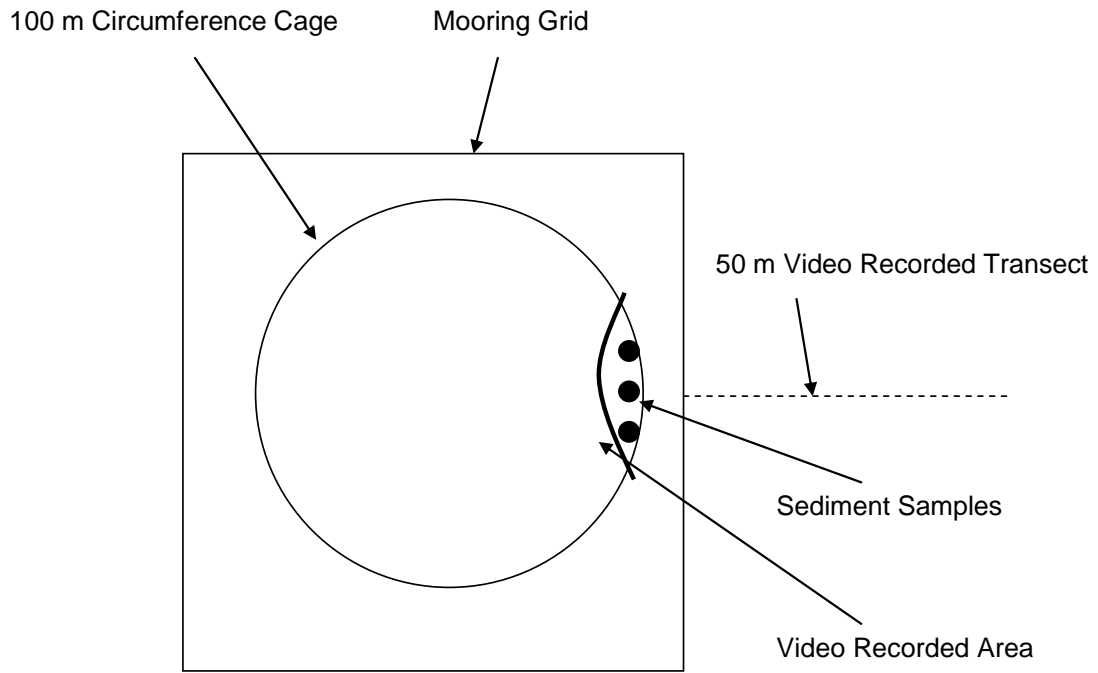


Figure 3: Positions of sediment samples and video recorded areas for Tiers 1 and 3 monitoring, in relation to an individual cage.

Table 3: Position of sediment samples for Tiers 1 and 3 monitoring.

	Add checkmark for completion of step	Information regarding deviations, if applicable
All sediment samples will be positioned at cage edge, where one set of three samples will be collected in similar substrate, within a 1 metre square area surrounding the end of a weighted drop line on the sea floor.		
At sites where harvesting has begun for the current production cycle, sediment samples and transects will be positioned in the same location as those in the most recent Tiers 1 or 3 monitoring by referring to their DGPS coordinates.		
At sites where no cages are present or where cages are present that do not contain fish, sediment samples will be positioned in the same location as those in the most recent Tiers 1 or 3 monitoring by referring to their DGPS coordinates.		
The DGPS coordinates of each set of three samples will be recorded in degrees, minutes and decimal minutes (3 decimals) using the NAD83 reference. The accuracy of the coordinates is ensured through the use of a weighted drop line deployed from the cage edge to the sea floor. The drop line must have visible graduated measurements to calculate water depth at time of sampling. Each 1 metre shall be marked by an indicator line, each 5 metre must be marked with a tag indicating the measurement, ie. 5 m, 10 m, 15 m.		

3.0 POSITION OF SEDIMENT SAMPLES FOR TIER 2 MONITORING

Information contained within this section provides guidance for determining the position of sediment samples for Tier 2 monitoring. The position of sediment samples, as shown in Figure 4, for Tier 2 monitoring will be determined in accordance to the protocol shown in Table 4. Regardless of the number of fish onsite at the time the monitoring is conducted, the position of sediment samples will be the same for all sites.

Table 4 will be used by those conducting the monitoring to record completion of the decisions regarding each criterion. Because site-specific conditions may preclude positioning of sediment samples as described in this SOP, Table 4 will also be used to record the information pertaining to the subsequent deviations. The completed table will be provided to the approval holder by those conducting the monitoring. When such site-specific conditions are known before the monitoring is conducted, approval holders are required to notify DENV and receive approval for deviations from this SOP before the monitoring is conducted. Deviations resulting from site-specific conditions that cannot be foreseen by either the approval holder or those conducting the monitoring do not require approval from DENV.

Deviations resulting from site-specific conditions that cannot be foreseen by either the approval holder or those conducting the monitoring do not require approval from DENV, but do require the table(s) used to record the information pertaining to the deviations to be submitted with the monitoring results.

Table 4: Position of sediment samples for Tier 2 monitoring.

	Add checkmark for completion of step	Information regarding deviations, if applicable
Sediment samples will be positioned as shown in Figure 4. The 4 corner samples and outside samples are at cage edge while the others are between the cages as shown in Figure 4.		
At each sediment sample position, one set of three core samples or one grab will be collected.		
The DGPS coordinates of each set of samples will be recorded in degrees, minutes and decimal minutes (3 decimals) using the NAD83 reference.		

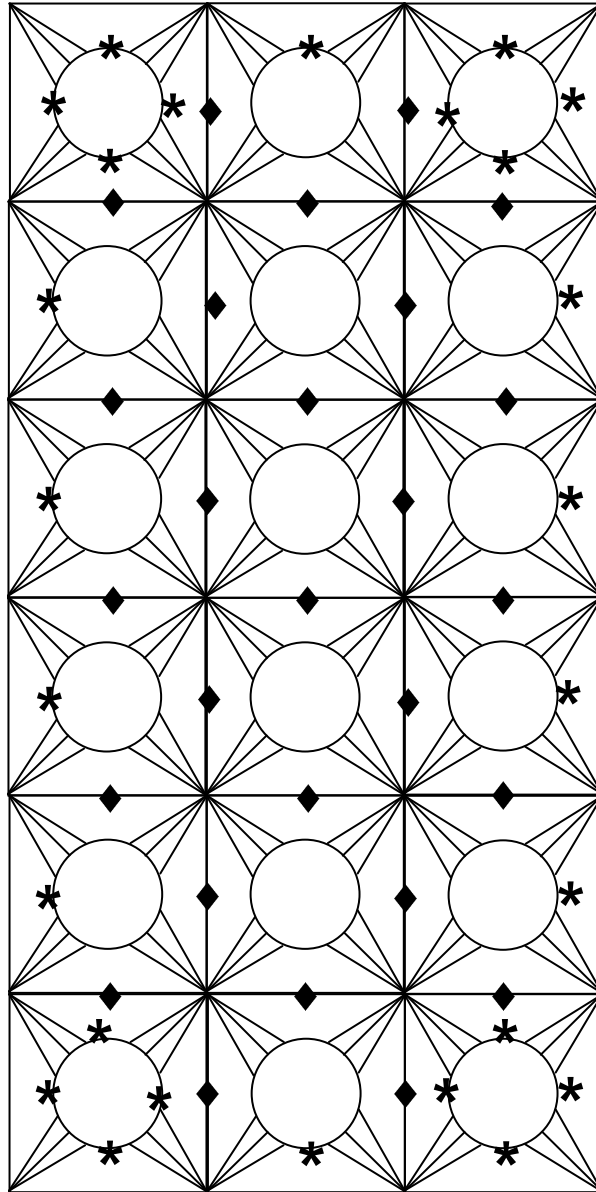


Figure 4: Position of sediment samples for Tier 2 monitoring.
(diamond shapes show sample positions between cages while stars show sample positions at cage edge)

4.0 VIDEO RECORDINGS FOR TIERS 1 AND 3 MONITORING

Information contained within this section provides guidance for video recordings for Tiers 1 and 3 monitoring. Video recordings will be performed by using a hand held video camera or a drop camera system. A video recording will be made of the seafloor conditions in the areas shown in Figure 3, and of the samples before analysis once onboard the vessel, in accordance to the following protocol for Tiers 1 and 3 monitoring:

- Regardless if samples are diver collected or collected using surface deployed methods, each 50 m transect will be video recorded showing the seafloor conditions along the transect, starting at the transect end farthest from cage edge;
 - Each sampling station will be clearly labeled on the video by using a placard (date, sample station identification) prior to submersion;
 - The collection of all diver-collected core samples will be video recorded;
 - The end of the weighted drop line must be clearly visible on the video recording;
 - Beneath each cage under which diver collected samples are taken, seafloor conditions will be recorded by panning the camera from one side of cage edge to the other while remaining at cage edge;
 - A video recording the seafloor conditions at all sediment sample positions where surface deployed samples are performed will be collected. The video recording will be collected to show an undisturbed sea floor prior to the grab sampler being deployed;
 - Video image quality must be sufficient for a trained biologist to recognize and identify sediment type, condition, and any benthic macrofauna/flora present;
 - Each core or grab sample will be video or still photo recorded before analysis once onboard the vessel (still photos will be time and date stamped on photograph);
 - If diver collected core samples are performed, seafloor observations made at each transect end farthest from the cage edge and at cage edge will be recorded in Table 5;
 - If surface deployed samples are performed, seafloor observations made at each transect end farthest from the cage edge and at cage edge will be obtained from the video footage and recorded in Table 5;
 - Grab sample observations on vessel will be recorded in the 4th column of table 5.
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Table 5: Seafloor observations for each transect end farthest from cage edge, at cage edge, at sample location and surface of grab sample for Tiers 1 and 3 monitoring.

	Transect end farthest from cage edge	Cage edge	Sample location (surfaced deployed only)	Surface of grab (if applicable)
DGPS coordinates (NAD83)	Not Required			N/A
Approximate sediment thickness (cm)				
Sediment color (black; gray, brown)				
Sediment consistency (mud; clay; rock; cobble; sand/silt)				
Sediment surface consolidation (firm packed; consolidated but easily disturbed; unconsolidated and very easily disturbed)				
Gas bubbles (prevalent; some; rare; none)				
% beggiatoa coverage (50-100%; 25-50%; 10-25%; 0-10%)				
Presence of feed (prevalent; some; rare; none)				
Presence of feces (prevalent; some; rare; none)				
Macrofauna/flora (none; relative abundance of polychaetes, molluscs, echinoderms and crustaceans; note which species are in relative abundance)				
Presence of detritus and fouling organisms, including mussel shells, unattached algae, etc. (prevalent; some; rare; none)				

5.0 VIDEO RECORDINGS FOR TIER 2 MONITORING

Information contained within this section provides guidance for video recordings for Tier 2 monitoring. A video recording will be made of the seafloor conditions at sediment sample positions if a sediment sample cannot be collected after a minimum of three attempts, due to substrate type. As well, all samples will be video or still picture recorded before analysis once onboard the vessel, in accordance to the following protocol for Tier 2 monitoring:

- Video recordings of the sample area will show the bottom substrate in clear detail;
 - Each station will be clearly labeled on the video by using a placard (date, sample station identification) prior to submersion;
 - Each core or grab sample will be video recorded or still picture recorded before analysis once onboard the vessel;
 - Still photos must be in focus and have the time and date stamped on the front of the photo
 - Drop cameras will confirm sediment conditions of the area that sampling was attempted in (approx. 0.5m² area), and the seafloor observations will be recorded in Table 6.
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Table 6: Seafloor observations for Tier 2 monitoring on deck from samples.

	Sample Area __ (as per site plan)	Sample Area __ (as per site plan)	Sample Area __ (as per site plan)
Drop Camera Deployed (yes / no)			
DGPS Coordinates (NAD83)			
Approximate sediment thickness (cm)			
Sediment color (black; gray, brown)			
Sediment consistency (mud; clay; rock; cobble; sand/silt)			
Sediment surface consolidation (firm packed; consolidated but easily disturbed; unconsolidated and very easily disturbed)			
Presence of feed (prevalent; some; rare; none)			
Presence of feces (prevalent; some; rare; none)			
Presence of detritus and fouling organisms, including mussel shells, unattached algae, etc. (prevalent; some; rare; none)			

6.0 SITE PLANS FOR TIERS 1, 2 AND 3 MONITORING

Information contained within this section provides guidance for preparing a site plan for Tiers 1, 2 and 3 monitoring. The site plan will be prepared for Tiers 1, 2 and 3 monitoring at a scale of no greater than 1:5000, preferably 1:2000. It will include the following:

- Distance scale bar;
 - North arrow;
 - Depth at site center at mean low tide;
 - Depth (as measured by a graduated sampling line) at all sampling stations;
 - Existing layout of cages at the time the monitoring was conducted;
 - Year class;
 - Species of fish cultured;
 - Number of fish on site at time of monitoring;
 - Percentage of total biomass in each cage at the time the monitoring was conducted;
 - Prevailing water current pattern;
 - Position of transects, (if applicable), and sediment samples with identifications as per Tables 7 and 8.
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7.0 COLLECTION OF SEDIMENT SAMPLES FOR TIERS 1, 2 AND 3 MONITORING

Information contained within this section provides guidance for the collection of sediment samples for Tiers 1, 2 and 3 monitoring to ensure that sediment sample collection is of a high standard of quality. The collection of samples at sites with water depth at all sampling stations less than 30.0 m at low tide follows section 7.1. The collection of samples at sites with water depth at any one sampling station greater than 30.0 m at low tide follows section 7.1 or 7.2. Tier 2 monitoring at sites of with water depth at all sampling stations less than 30.0 m at low tide can be conducted following section 7.1 or 7.2.

7.1 Collection of core samples by diver

The collection of sediment samples conducted by divers in accordance to the following protocol:

- Core samples will be collected using clear core tubes approximately 30 cm long by 5 cm in diameter, with tape-covered holes, to allow for redox measurement of the top 2 cm of sample while contained within the core tube;
- At each sample location, the diver will push the core tube vertically into the sediment as deep as possible, to a maximum depth of 10 cm;
- The core sample will be removed, capped, and handled in a manner such that disturbance of the sample is minimized and the sediment-water interface is as undisturbed as possible.

7.2 Collection of grab samples by surface-deployed equipment

Sediment samples will be collected by surface-deployed grabs which will have an opening on the top to access and analyze the top 2 cm of sample collected. Before emptying the grab 3 samples will be collected from the top 2cm of the grab collection.

The New Brunswick Department of Environment also supports alternative means of obtaining surface deployed samples, such as the use of a Remotely Operated Vehicle. Specific sampling techniques should be pre-approved by the Department on a case by case basis.

8.0 ANALYSIS OF SEDIMENT SAMPLES FOR TIERS 1, 2 AND 3 MONITORING

Information contained within this section provides guidance for the analysis of sediment samples for Tiers 1, 2 and 3 monitoring to ensure that sediment sample analysis is of a high standard of quality. It is based largely on the work of Scientists with the Department of Fisheries and Oceans, Canada. References to their technical documents and research papers will be made available upon request from DENV. An example data-recording table for Tiers 1 and 3 monitoring is shown in Table 7, and one for Tier 2 monitoring is shown in Table 8.

8.1 Redox analysis

The analysis of sediment samples for redox will be conducted in accordance to the following protocol for Tiers 1 and 3 monitoring. For Tier 2 monitoring, one redox reading will be taken for each station sampled.

- Redox measurements will be taken with a Hanna electrode (part no. HI3230B) which has had an accuracy check according to the redox electrode accuracy check section below;
- Redox measurements will be made within 2 hours of sample collection, or within 24 hours if samples are stored in an ice-bath;
- One redox measurement of each core sample will be taken by inserting the electrode through the tape into the hole closest to the sediment-water interface, within the top 2 cm of sample, and twisting the electrode between the thumb and forefinger;
- One redox measurement of each grab sample will be taken by inserting the electrode a maximum of 2 cm into the surface of the sample through an opening in the top of the grab sampler (note: 1/3 of all samples will be redox sampled in Tier 2 monitoring only);
- An alternative methodology for redox measurements, for core or grab samples, is to take the redox measurement on the 5 ml sub-sample collected for sulfide analysis;
- The temperature of each sample will be measured and recorded;
- Redox measurements will be recorded as millivolts relative to the normal hydrogen electrode (mV_{NHE}) using the equation $mV_{NHE}=E_o+(224-T)$, where $E_o=mV$ of unknown and T =temperature of unknown ($^{\circ}C$) or as millivolts (mV), once the value has stabilized (drift < 10 mV/minute) or 2 minutes after commencement of measurement;

- The redox electrode will be rinsed with distilled water and dried between measurements.

8.2 Redox electrode accuracy check

An accuracy check of the redox electrode will be conducted in accordance to the following protocol for Tiers 1, 2 and 3 monitoring:

- The accuracy check of the redox electrode will be done using the Hanna 240 mV test solution (part no. HI7021), in which the electrode should read between 220-260 mV;
- Hanna pretreatment oxidizing (part no. HI7091) and reducing (part no. HI7092) solutions will be used to adjust the accuracy of the redox electrode within the recommended acceptable range;
- The temperatures of the solutions used for the accuracy check do not have to be the same as those of the samples to be analyzed;
- The date and time of the accuracy check will be provided to the approval holder by those conducting the monitoring.

8.3 Sulfide analysis

The analysis of sediment samples for sulfide will be conducted in accordance to the following protocol for Tiers 1, 2 and 3 monitoring:

- One 5 ml sub-sample for sulfide analysis will be collected from the top 2 cm of each core or 3, 5ml sub-samples per grab sample immediately after redox analysis;
 - The 5 ml sub-sample will be analyzed immediately or stored on ice in an air-tight container with no head-space and analyzed within 72 hours;
 - Sulfide measurements will be taken with a Thermo Orion Silver/Sulfide electrode (model 9616) which has been calibrated according to the sulfide electrode calibration section below;
 - Each sub-sample will be mixed with 5 ml of a solution of L-ascorbic acid and sulfide anti-oxidant buffer (SAOB) provided by a chemical supplier;
 - The solution of L-ascorbic acid and SAOB will be prepared within 3 hours of being mixed with each sub-sample as per manufacturers recommendations;
 - Once the solution of L-ascorbic acid and SAOB is mixed with the sub-sample, the sample will be brought to the same temperature at which the electrode was calibrated, and then the sulfide will be measured once the value has stabilized or within 2 minutes;
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- The sulfide electrode will be rinsed with distilled water and dried between measurements.

8.4 Sulfide electrode calibration

The sulfide electrode will be calibrated in accordance to the following protocol for Tiers 1, 2 and 3 monitoring:

- The sulfide electrode will be filled with Orion Optimum Results B (cat. No. 900062) at least 24 hours before use;
- Three sulfide standards will be used for calibration (100 μM , 1000 μM and 10000 μM);
- The 10000 μM sulfide standard will be prepared using de-aerated water and stored in the dark, bottled under nitrogen, and opened immediately before use;
- The temperature of the sulfide standards will be known by those conducting the sulfide analyses so that the samples can be brought to the same temperature when analyzed;
- Regardless of the number of samples analyzed, the calibrated sulfide electrode will be used for a maximum of 3 hours from the time the first measurement is taken to the time the last measurement is taken, before re-calibration is necessary;
- The sulfide electrode will be used to a maximum of 72 hours post calibration;
- If the Accumet AP63 meter is used, the meter's default calibration values will be a factor of 10 times less than the actual standard concentrations, therefore the results must be multiplied by 10 to obtain the correct concentrations;
- The date, time and temperature at which the electrode was calibrated will be provided to the approval holder by those conducting the monitoring.

8.5 Waste disposal

Disposal of waste chemicals and solutions used in calibrations and accuracy checks will be in accordance to label directions, at facilities approved for disposal of such wastes, or in a manner otherwise acceptable to DENV.

Table 7: Example data-recording table for Tiers 1 and 3 monitoring.

Site identification:					
Date:					
Time of collection:					
Time of analysis:					
Name of sample collector:					
Name of sample analyzer:					
Transect number	Sample number	Redox sample temperature (°C)	Redox (denote mV or mV _{NHE})	Sulfide sample temperature (°C)	Sulfide (µM)
1	1				
	2				
	3				
Mean Redox:			Mean Sulfide:		
2	1				
	2				
	3				
Mean Redox:			Mean Sulfide:		
Site Mean Redox:			Site Mean Sulfide:		

Table 8: Example data-recording table for Tier 2 monitoring.

Site identification:					
Date:					
Time of collection:					
Time of analysis:					
Name of sample collector:					
Name of sample analyzer:					
Sample Identification	Sample number	Redox sample temperature (°C)	Redox (denote mV or mV _{NHE})	Sulfide sample temperature (°C)	Sulfide (µM)
Sample area____	1				
	2	N/A	N/A		
	3	N/A	N/A		
Mean Sulfide:					
Sample area____	1				
	2	N/A	N/A		
	3	N/A	N/A		
Mean Sulfide:					
Sample area____	1				
	2	N/A	N/A		
	3	N/A	N/A		
Mean Sulfide:					
Sample area____	1				
	2	N/A	N/A		
	3	N/A	N/A		
Mean Sulfide:					
Sample area____	1				
	2	N/A	N/A		
	3	N/A	N/A		
Mean Sulfide:					
Sample area____	1				
	2	N/A	N/A		
	3	N/A	N/A		
Mean Sulfide:					

9.0 RECORD KEEPING FOR TIERS 1, 2 AND 3 MONITORING

The record keeping requirements related to the environmental monitoring and this SOP are consistent with those of the Certificate of Approval. Because the approval holder is held accountable for complying with their Certificate of Approval, and for conducting the environmental monitoring at their site in compliance with this SOP, it is their responsibility to comply with the record keeping requirements. The records the approval holder is required to keep for each monitoring event include the following:

- Tables 1-8 (where applicable);
 - The date and time of the most recent accuracy check of the redox electrode;
 - The date, time and temperature at which the sulfide electrode was most recently calibrated;
 - Video recording or still pictures;
 - Site plan.
-