NOVA SCOTIA AQUACULTURE REVIEW BOARD

Application by Kelly Cove Salmon Ltd. for a boundary amendment to marine finfish licence and lease AQ#1039 in the Annapolis Basin, Digby County

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Affidavit of RONALD NEUFELD
affirmed on April 22, 2021

Volume 2 of 3

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4.2 Equipment and Calibrations

Redox measurements were taken using a combination meter (Fisher Accumet AP125) and probe (Orion Epoxy Sure-Flow Combination Redox/ORP Electrode), which was checked for electrical function just prior to and after use. Readings were taken according to the SOP protocols. Sulphide measurements were taken using a calibrated combination meter (Fisher Accumet AP125) and probe (Orion 96-16 Sure-Flow Combination Silver/Sulphide Electrode). Meter and sulphide probe calibration took place in accordance with SOP protocols at 09:55 on July 21, 2016. One probe was calibrated and used to analyse the samples. The calibration event resulted in a final slope range between -27 and -33 mV (-30.0 mV) the calibration curve was between -25 to -30 mV [500 to 5000 µM read: -25.6 mV, 1000 to 10000 µM read: -25.1 mV]. The results of the five-point, factor-calibration are located in Appendix A. The calibration temperature was 20.8°C.

4.3 ADCP Deployment

Measurements of the current speed and direction were collected at Rattling Beach using a 600 kHz Teledyne RDI Workhorse Sentinel ADCP unit deployed by the Nova Scotia Department of Fisheries and Aquaculture (Fig. 4). The current meter could not be deployed at the center of the proposed site due to the presence of gear and fish. Therefore, a location between the current and proposed site boundaries was chosen, greater than 100 m from the nearest aquaculture site gear to avoid distortion of data. This meter was deployed at site #1039 for a period of approximately 37 days between June 29 and August 4, 2016. The ADCP was configured to record the current speed and direction of the water column in one (1) meter bins, collecting a profile every fifteen (15) minutes. Once the unit was recovered, the data were downloaded and analysed by NSDFA and processed by SIMCorp Marine Environmental Biologist [redacted]. Graphs and figures illustrating the frequency distribution of both current speed and direction are presented in Appendix H and raw current speed and direction data is included in the supplementary material attached to this report (*RattlingBeach.xls*).

5.0 RESULTS AND OBSERVATIONS

The following are baseline sampling station benthic characteristics at proposed marine aquaculture lease #1039 in the order they were sampled.

Table 6 – ANB-A Benthic Log

Sampling Date:	July 20th, 2016
Water Body:	Annapolis Basin
Lease Name and Number:	Rattling Beach #1039
Water Temperature (°C)	14.4 °C
Wind Direction and Speed:	NW 15 knots shifting to SW 15-20 knots
Wave Action:	calm
Current Direction & Speed:	Strong SW->NE with the wind
Tide Schedule:	High: 12:40 Low: 18:49
Vessel:	Carolina Skiff

Lease # or Reference Site:	Reference	**Station Comments:**
Video Start Time:	10:36 AM	
Recorder Name(s):	[redacted]	
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]	**Video Notes:**
Sampling Station ID:	ANB-A	Moderately easily disturbed, fine, brown sand & pebbles; scallop shells; rock crabs; macroalgae
Dist. and Dir. from Waypoint:	8 m @ 330°	
Sampling Coordinates:	N44 38.946 W65 45.228	Benthic Descriptor Key:
Station Depth (m):	11	[1] e.g. Gas bubbles, feed faeces, sediment colour, type, and consistency
Video (Y/N):	Y	[2] e.g. Strong, slight, none
Number of Collection Attempts:	6	[3] e.g. Eelgrass, kelp, lobster, starfish, Beggiatoa , polychaetes, etc.

Sample/Collection method	Ascension Speed (m/s)	Sample (Y/N)	Sample ID	Sediment Description[1]	Odour[2]	Sediment Sample Depth (cm)	Flora/Fauna[3]
Benthic Replicate 1 (10 mL) Standard Ponar Grab	0.28	Y	ANB - A (1)	Brown mud, sand, gravel	None	4	Scallop shell
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.23	Y	ANB - A (2)	Brown mud, sand, gravel	None	1	Scallop shell
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.28	Y	ANB - A (3)	Brown mud, sand, gravel	None	1	Whelks, fish bone

Table 7 – Corner #4 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:**
Video Start Time:	11:28 AM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:**
Sampling Station ID:	Corner #4						Moderately easily disturbed, brown sand, mud, pebbles, boulders & shell hash; rock crabs; scallop shells; macroalgae
Dist. and Dir. from Waypoint:	8 m @ 3.2 °						
Sampling Coordinates:	N44 38. 9977 W65 45.1614						Benthic Descriptor Key:
Station Depth (m):	20						[1] e.g. Gas bubbles, feed, faeces, sediment colour, type, and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	3						[3] e.g. Eel grass, kelp, lobster, starfish, *Beggiatoa*, polycheates, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab	0.28	Y	RB4 (1)	Brown mud, sand, pebbles, shell hash	None	2	Shell, whelk, barnacles
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.28	Y	RB4 (2)	Brown mud, sand, pebbles, shell hash	None	5	Whelks
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.27	Y	RB4 (3)	Brown mud, sand, pebbles, shell hash	None	3	Whelks, barnacles

Table 8 – Corner #5 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** No sediment samples were able to be collected.
Video Start Time:	12:10 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						Video Notes:
Sampling Station ID:	Corner #5						Moderately easily disturbed, brown mud, sand & boulders; kelp; algae; macroalgae; barnacles; rock crabs; other crab species (possibly green crabs)
Dist. and Dir. from Waypoint:	7 m @ 310°						
Sampling Coordinates:	N44 38.9975 W64 45.4425						Benthic Descriptor Key:
Station Depth (m):	7.4						[1] e.g. Gas bubbles, feces, algae, sediment colour, type, and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	5						[3] e.g. Eelgrass, kelp, lobster, starfish, Beggiatoa, polychaetes, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 9 – Corner #6 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** No sediment samples were able to be collected.
Video Start Time:	12:31 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:**
Sampling Station ID:	Corner #6						Moderately easily disturbed, light-brown sand, silt & boulders; kelp; red algae; periwinkles; sea star
Dist. and Dir. from Waypoint:	6 m @ 336°						
Sampling Coordinates:	N44 39.0996 W65 45.4401						Benthic Descriptor Key:
Station Depth (m):	7						[1] e.g. Gas bubbles, feed, faeces, sediment, colour, type and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	5						[3] e.g. Eelgrass, kelp, lobster, starfish, Beggiatoa, polycheates, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 10 – Corner #7 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** No sediment samples were able to be collected.
Video Start Time:	12:54 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:** Mostly boulders covered in barnacles and crustose algae; small patches of brown sand and mud; rockweed, green crab
Sampling Station ID:	Corner #7						
Dist. and Dir. from Waypoint:	5 m @ 335						
Sampling Coordinates:	N44 39.316 W65 45.452						Benthic Descriptor Key:
Station Depth (m):	6						[1] e.g. Gas bubbles, reed tasces, sediment colour type, and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	5						[3] e.g. Eelgrass, kelp, lobster, starfish, Aegiotoa, polychaetes, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 11 – Corner #1 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** No sediment samples were able to be collected
Video Start Time:	1:11 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:**
Sampling Station ID:	Corner #1						Mostly boulders covered in barnacles; some light brown mud with sand patches; red algae and kelp
Dist. and Dir. from Waypoint:	4 m @ 128°						
Sampling Coordinates:	N44 39.4502 W65 45.4058						Benthic Descriptor Key:
Station Depth (m):	6.7						[illegible] e.g. Gas bubbles, fecal faeces, sediment colour, type and consistency
Video (Y/N):	Y						[illegible] e.g. Strong, slight, none
Number of Collection Attempts:	5						[illegible] e.g. Eel grass, kelp, lobster, starfish, *Beggiatoa*, polychaetes, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 12 – ANB-01 Benthic Log

Table 13 – Corner #2 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:**
Video Start Time:	2:10 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:** Moderately to easily disturbed brown mud, sand & cobble; lots of shell debris and scallop shells; some *Flustra*
Sampling Station ID:	Corner #2						
Dist. and Dir. from Waypoint:	4 m @ 153°						
Sampling Coordinates:	N44 39.4480 W65 45.3020						**Benthic Descriptor Key:** [1] e.g. Gas bubbles, feed, faeces, sediment colour, type, and consistency [2] e.g. Strong, slight, none [3] e.g. Eel grass, kelp, lobster, starfish, *Beggiatoa*, polycheates, etc.
Station Depth (m):	27						
Video (Y/N):	Y						
Number of Collection Attempts:	5						
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab	0.3	Y	RB2 (1)	Brown mud, sand, rocks	Moderate	4.5	Rockweed, *Flustra*, quahog, whelk
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.28	Y	RB2 (2)	Brown mud, sand, pebbles, cobble, gravel	None	3	Quahog, scallop shell, amphipods
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.29	Y	RB2 (3)	Brown mud, sand, pebbles, rocks	None	1	Shells, whelks, worm tubes, barnacles

Table 14 – Corner #3 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** 1st video was scrapped due to the camera shifting in the frame. Lots of strong current affecting this station at the time of sampling.
Video Start Time:	2:59 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:** Moderately easily disturbed mud, sand & cobble; shell debris; scallop shells; *Flustra;* rock crab; hermit crab
Sampling Station ID:	Corner #3						
Dist. and Dir. from Waypoint:	12 m @ 145°						
Sampling Coordinates:	N44 39.3764 W65 45.2049						Benthic Descriptor Key:
Station Depth (m):	31						[1] e.g. Gas bubbles, feed faeces, sediment colour, type and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	3						[3] e.g. Eel grass, kelp, lobster, starfish, *Beggiatoa*, polychaetes, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab	0.27	Y	RB3 (1)	Brown mud, sand	None	1	Shells, whelks
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.28	Y	RB3 (2)	Brown mud, sand, shell debris, rocks	None	5	Whelks
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.29	Y	RB3 (3)	Brown mud, sand, gravel, shell debris	None	2	Whelks

Table 15 – Redox potential and sulphide ion concentration for samples collected at proposed marine aquaculture lease #1039

Site #1039 – Rattling Beach

Sample Collection: July 20, 2016 10:20 - 15:30
Sample Analysis: Redox: July 21 2016 10:05 - 10:55
Sulphides: July 21, 2016 10:10 - 10:55

Sample I.D.		Core Sample Temp	Redox	Redox	Sulphide	
Station	ID #	°C	mV	mVNHE	µM	mV
ANB-01	1	8.9	11.6	226.7	313	-869.9
	2	10.5	-209.0	4.5	193	-864.2
	3	10.5	-75.8	137.7	467	-875.1
Means		**10.0**	**-91.1**	**123.0**	**324**	**-869.7**
ANB-A	1	8.2	-15.8	200.0	25	-837.1
	2	7.5	70.0	286.5	58	-848.1
	3	10.8	55.0	268.2	55	-847.2
Means		**8.8**	**36.4**	**251.6**	**46**	**-844.1**
Corner #1	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Corner #2	1	8.8	-35.8	179.4	343	-871.0
	2	12.0	-36.5	175.5	382	-872.4
	3	10.4	-119.6	94.0	292	-869.2
Means		**10.4**	**-64.0**	**149.6**	**339**	**-870.9**
Corner #3	1	8.2	-109.7	106.1	34	-840.8
	2	8.2	-66.9	148.9	19	-833.2
	3	9.9	-11.2	202.9	51	-846.2
Means		**8.8**	**-62.6**	**152.6**	**35**	**-840.1**
Corner #4	1	10.0	-125.4	88.6	29	-838.9
	2	8.0	-112.1	103.9	117	-857.0
	3	10.2	46.3	260.1	23	-835.5
Means		**9.4**	**-63.7**	**150.9**	**56**	**-843.8**
Corner #5	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Corner #6	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Corner #7	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Redox Test Solution
Prior to analysis: 220.8 mV @ 25°C
Post analysis: 220.8 mV @ 25°C

Sulphide Probe 1 Calibration:

Standard	mV
100	-855.3
500	-876.3
1000	-884.6
5000	-901.9
10000	-909.7

Sulphide Probe Calibration Temperatures: 20.8°C

Sample met all grab quality criteria
Sample did not meet all quality criteria
Reference Station
NS = No Sample

Figure 5 – Mean redox potential and sulphide ion concentration at proposed marine aquaculture lease #1039

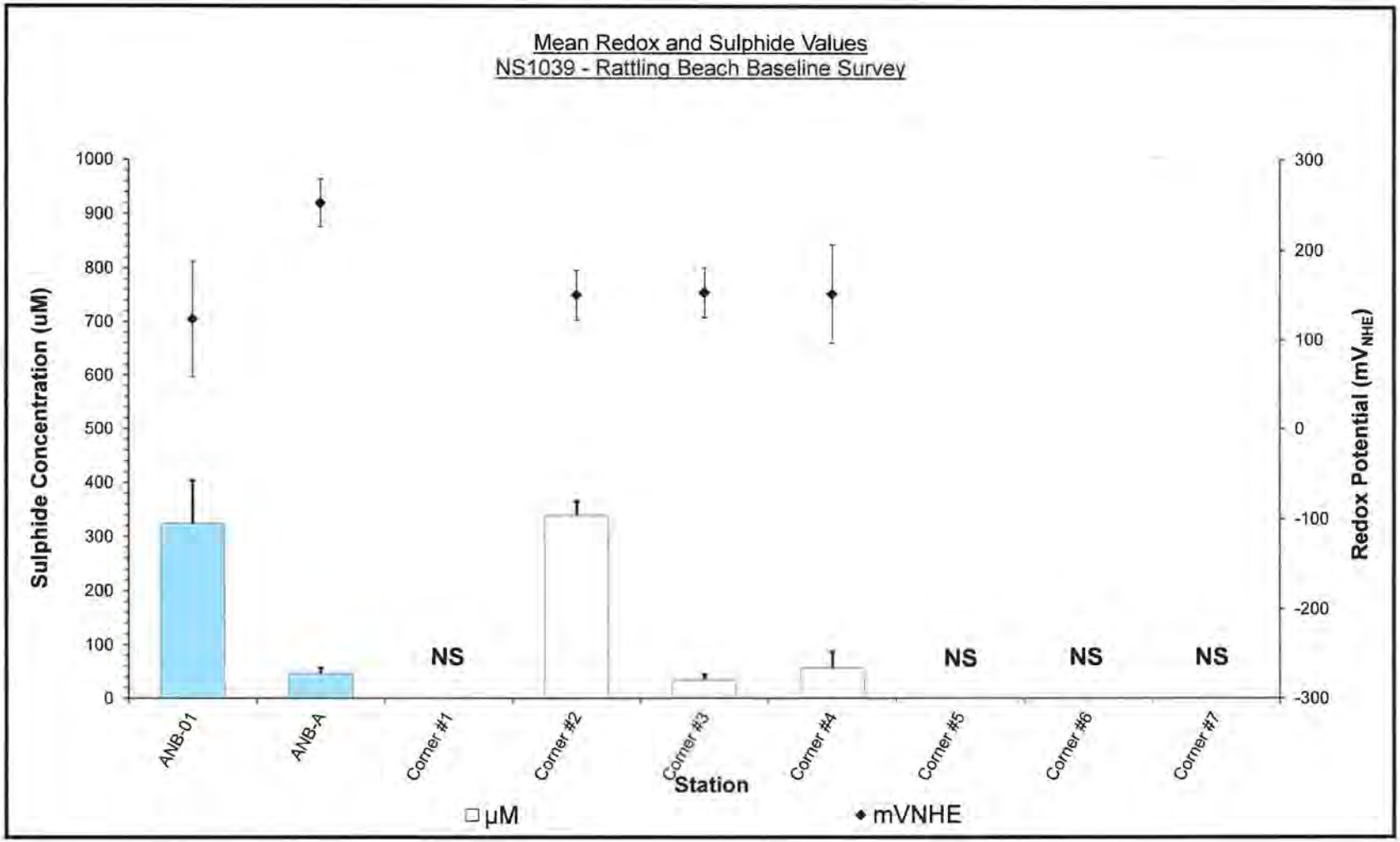


Table 16 – 2016 Baseline porosity and percent organic matter data for site #1039

Station	Sample #	Porosity Value (%)	% Organic Matter
ANB-01	1	30.16	2.29
ANB-01	2	25.83	1.99
ANB-01	3	44.22	4.34
ANB-A	1	21.40	1.65
ANB-A	2	20.01	1.27
ANB-A	3	17.84	1.55
Corner #1	1	NS	NS
Corner #1	2	NS	NS
Corner #1	3	NS	NS
Corner #2	1	17.61	1.39
Corner #2	2	15.59	1.94
Corner #2	3	19.18	1.45
Corner #3	1	12.61	0.77
Corner #3	2	21.22	1.36
Corner #3	3	18.67	1.16
Corner #4	1	18.16	1.31
Corner #4	2	25.01	1.78
Corner #4	3	26.12	1.88
Corner #5	1	NS	NS
Corner #5	2	NS	NS
Corner #5	3	NS	NS
Corner #6	1	NS	NS
Corner #6	2	NS	NS
Corner #6	3	NS	NS
Corner #7	1	NS	NS
Corner #7	2	NS	NS
Corner #7	3	NS	NS

Note: samples in turquoise are from reference stations

6.0 DISCUSSION

6.1 Benthic Observation and Analysis

Review of the video footage and grab observations collected from the proposed lease area in the Annapolis Basin reveal no evidence of waste feed, salmon faeces, or other organic deposits. The substrate beneath site #1039 consisted mainly of cobble stones and pebbles at the western most stations closer to shore where sediment was not retrievable by surface-deployed grab. The remaining stations, where sediment was obtained, consisted mostly of medium to fine sand, gravel, and mud that was moderately packed. Shell hash and scallop shells were also very common due to scallop shucking that occurs in the area. Grain size analysis results are presented in Appendix C and further support these observations.

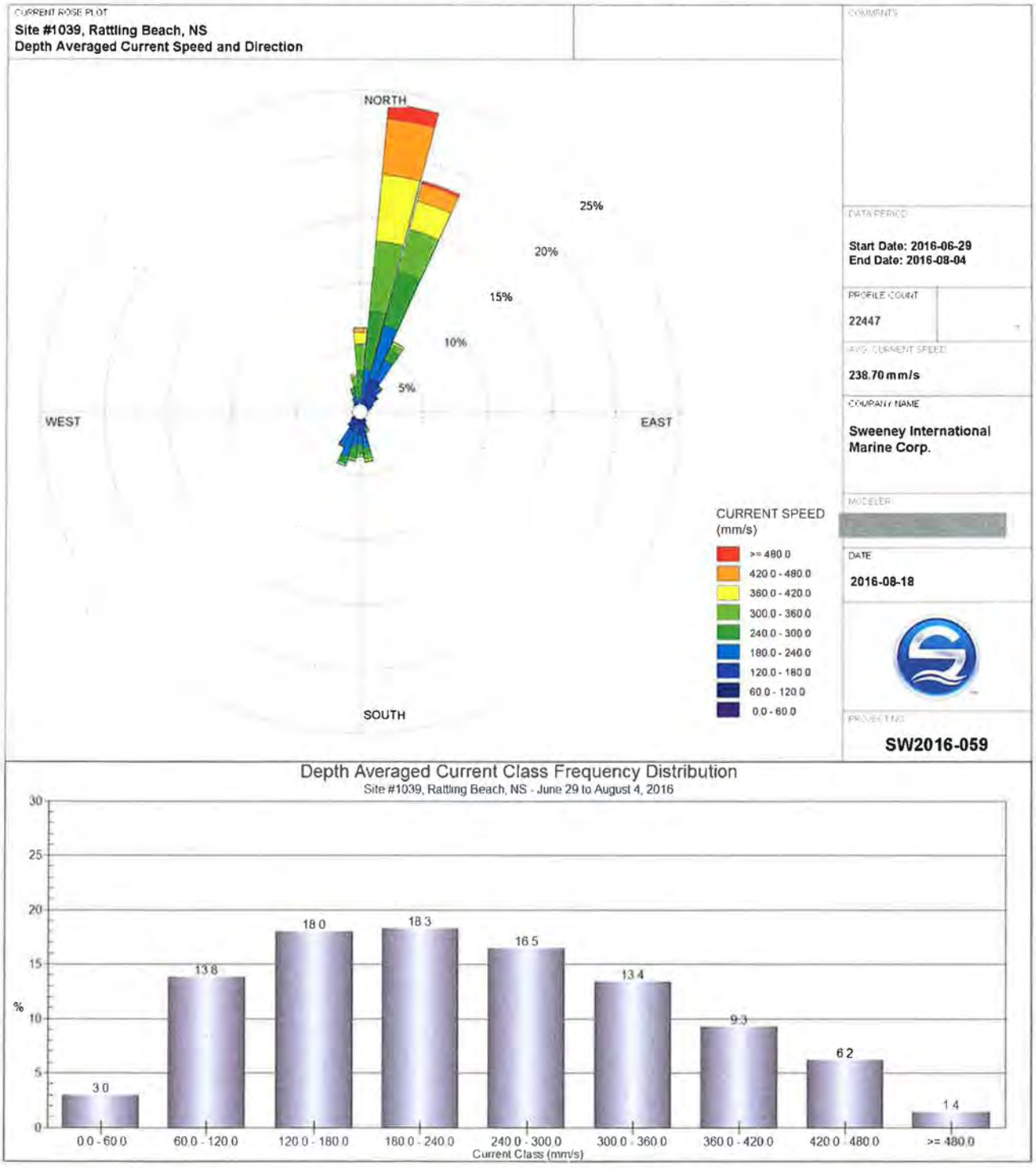
Flora and fauna observed in the video footage and in collected grab samples included rock crabs, green crabs, hermit crabs, whelks, barnacles, kelp, rockweed, sea stars, *Flustra,* periwinkles, and quahogs.

Analysis of the sulphide concentration and redox potential of the collected sediments revealed oxic conditions at every station where sediment could be collected. It should be noted that none of the grabs that yielded sediment met all of the necessary grab criteria; however, samples were collected when possible. The highest mean sulphide concentration obtained during this baseline assessment was 339 µM at the station located at corner #2 of the proposed lease.

6.2 Current Speed and Direction

The petals on the current rose diagrams indicate the direction in which the current was flowing (*i.e.* if the broad ends of the petals are pointing to the east, then the current was flowing to the east). Analysis of the depth averaged current speed and direction at site #1039 shows that the majority of water flow experienced at this location flowed towards the north northeast, with approximately 42% of all recorded currents travelling between 5 and 25 degrees (NNE). The depth averaged current speed of all recorded profiles at this site was 23.87 cm/s (Fig. 6). In the depth profiles analysed, 3 – 10 m above the ocean bottom, the maximum recorded speed was 81.0 cm/s occurring 10 m from the bottom. The most frequently observed speeds were between 18 and 24 cm/s near the seafloor (25.3% at 3 m) and between 36 and 42 cm/s within the upper water column (22.2% at 10 m). The figures in Appendix H illustrate some of the trends in current flow throughout the water column at Rattling Beach. The direction of current flow remains relatively consistent throughout the water column, but the upper-most cell had a nearly unidirectional flow travelling between about 5 and 25 degrees. Data obtained from cells higher in the water column did not yield reliable data. Less than 75% of the data was present and was omitted from analysis. Average current speeds significantly varied with depth, with the cell nearest to the surface having the highest occurrence of currents greater than 80 cm/s.

Figure 6 – Average current speed and direction recorded at site #1039 within 3 – 10 m above the seafloor



6.3 Bathymetry

Side scan-based, depth profiling of lease #1039 was carried out on October 5, 2016 and the data gathered used to produce both a three-dimensional, surface map and a two-dimensional, contour diagram of the site. Figures 7 - 8 show the water depth within the survey area at the time of scanning, which ranged from approximately 2m at the northwest and southwest corners. The eastern side of site is in deeper water ranging from 20 m in the southeast corner to 36 m in the northeast corner.

It should be noted that the Z axis of the 3D surface map is not displayed at the same scale as that of the X and Y axes. This exaggerates relatively small and gradual depth changes over a large geographical area allowing for a more easily understood bathymetric profile. Depths in both the 2D and 3D contour diagrams have not been corrected for tidal influences, thus the soundings displayed represent the depths at the time of recording and not depth relative to chart datum.

Figure 7 – Interpolated 2D bathymetric profiles of site #1039 at Rattling Beach

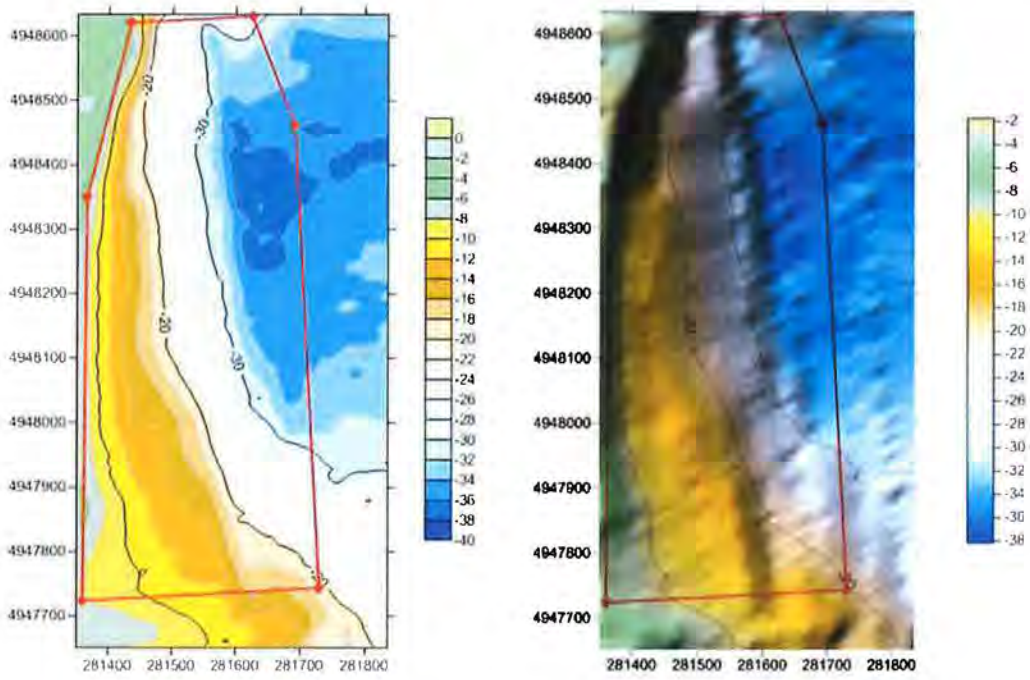
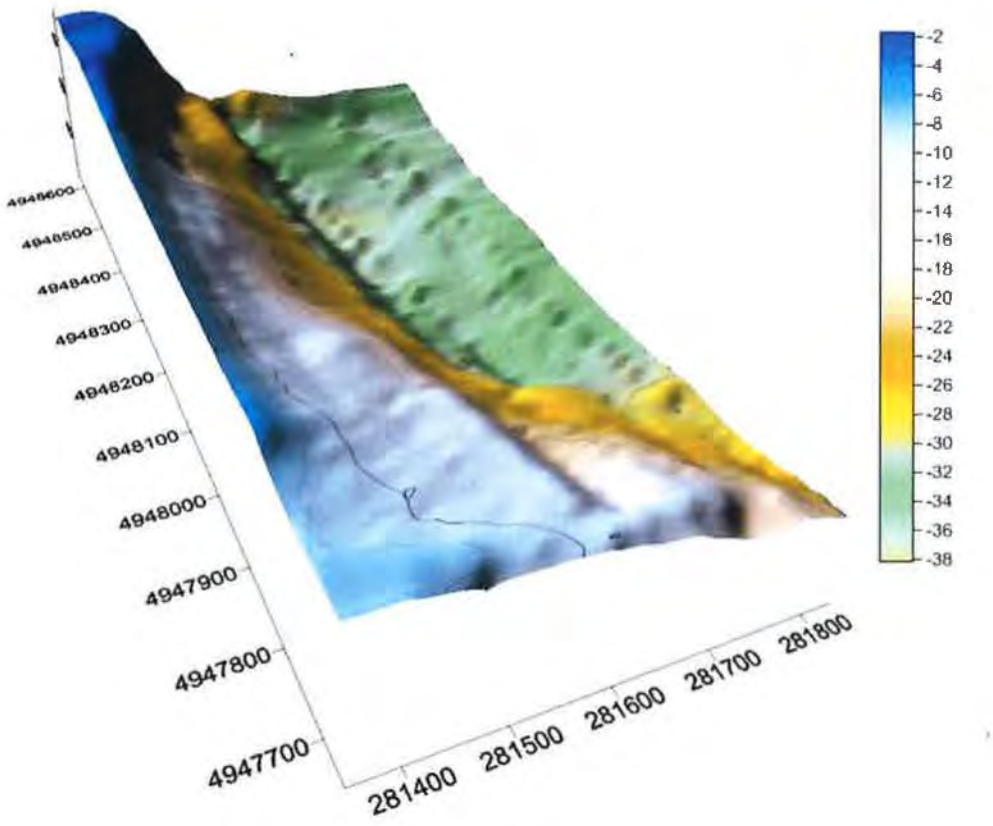


Figure 8 – Interpolated 3D surface map of site #1039 at Rattling Beach site



APPENDIX A
Sulphide Probe Calibration Certificate

NRC-IMB Research Facilities
1411 Oxford Street
Suite 367-368
Halifax, NS
B3H 3Z1
Tel: (902) 492-7865
(902) 492-0359
Fax: (902) 492-7734

Date: 21-Jul-16
Meter: 2007891
Sulfide Probe ID: RS1-12416

Project: SW2016-059 Rattling Beach (#1039)

5-point calibration using 100, 500, 1000, 5 000 and 10 000 µM sulphide standards.

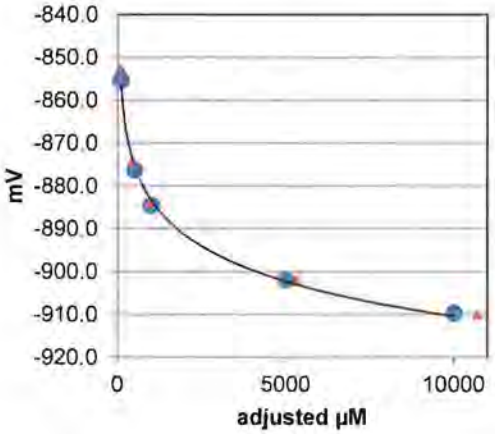
Date calibration performed: 21-Jul-16
Time calibration completed: 9:55am **Expiration time:** 12:55pm
Calibration performed by: [redacted]

Temperature calibration performed at: 20.8°C

Calibration -

After calibration the standards were re-measured to verify calibration.

10 µM (really 100 µM)	set at	-855.3 mV	read at	8.19 µM at	-852.6 mV
50 µM (really 500 µM)	set at	-876.3 mV	read at	44.2 µM at	-874.2 mV
100 µM (really 1000 µM)	set at	-884.6 mV	read at	94.3 µM at	-883.7 mV
500 µM (really 5 000 µM)	set at	-901.9 mV	read at	532 µM at	-902.1 mV
1 000 µM (really 10 000 µM)	set at	-909.7 mV	read at	1070 µM at	-910.0 mV



Final slope (meter) = -30.0 mV

10 fold slope (validation)

500 to 5 000 µM: -25.6 mV
1000 to 10 000 µM: -25.1 mV

Calibration meets final slope range of -27 to -33 mV and 10-fold slope of -25 to -30 mV.

Signed off by:

[redacted], M.Sc.
Senior Laboratory Manager

APPENDIX B
Redox and Sulphide Data Sheet

NRC-IMB Research Facilities
1411 Oxford Street
Suite 367-368
Halifax, NS
B3H 3Z1
Tel: (902) 492-7865
(902) 492-0359
Fax: (902) 492-7734
www.simcorp.ca

Site #: Rattling Beach (#1039)
Redox Start: 10:05am on 21-Jul-16
Sulphide Start: 10:10am on 21-Jul-16

Sample Collection: 20-Jul-16
Redox Stop: 10:55am on 21-Jul-16
Sulphide Stop: 10:55am on 21-Jul-16

Sample I.D.		Temp	Redox	Sulphide		
Station	ID #	°C	mV	unadjusted µM	mV	adjusted µM
ANB-01	1	8.9	11.6	31.3	-869.9	313
	2	10.5	-209.0	19.3	-864.2	193
	3	10.5	-75.8	46.7	-875.1	467
ANB-A	1	8.2	-15.8	2.48	-837.1	24.8
	2	7.5	70.0	5.80	-848.1	58.0
	3	10.8	55.0	5.52	-847.2	55.2
Corner #1	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Corner #2	1	8.8	-35.8	34.3	-871.0	343
	2	12.0	-36.5	38.2	-872.4	382
	3	10.4	-199.6	29.2	-869.2	292
Corner #3	1	8.2	-109.7	3.42	-840.8	34.2
	2	8.2	-66.9	1.86	-833.2	18.6
	3	9.9	-11.2	5.13	-846.2	51.3
Corner #4	1	10.0	-125.4	2.89	-838.9	28.9
	2	8.0	-112.1	11.7	-857.0	117
	3	10.2	46.3	2.31	-835.5	23.1
Corner #5	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Corner #6	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Corner #7	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-

Field Crew: [redacted]

Analysis Crew: [redacted]

Redox Check (mV):
Prior to analysis: 220.8 mV @ 25°C
Post analysis: 220.8 mV @ 25°C

Sulphide Temp: 20.8°C

[redacted] Redox reading at 2 minutes

Equipment:

Sulphide Analysis		Redox Analysis	
Probe kit:	NSLAB004	**Meter number:**	487142
Sulphide probe:	RS1-12416	**Redox probe:**	R002
Temperature probe:	T012	**Temperature probe:**	T007

SAOB + L-AA mixture

Addition: 10:00am

Expiration: 1:00pm

Signed off by:

[redacted], M.Sc.
Senior Laboratory Manager

APPENDIX C
Sediment Grain Size Analysis

NRC-IMB Research
Facilities
1411 Oxford Street
Suite 367-368
Halifax, NS
B3H 3Z1
Tel: (902) 492-7865
(902) 492-0359
Fax: (902) 492-7734

Date: 02-Aug-16
File No.: SW2016-114
Site Name/#: Rattling Beach (#1039)
Province: Nova Scotia

Grain Size Analysis

			% Fraction								
		mm	Corner #1	Corner #2	Corner #3	Corner #4	Corner #5	Corner #6	Corner #7	ANB-01	ANB-A
Gravel	Pebble	>4	NS	40.745	22.918	22.694	NS	NS	NS	13.406	24.511
	Granule	2-4	NS	6.308	4.643	5.258	NS	NS	NS	2.759	4.891
Sand	Very Coarse	1-2	NS	4.365	2.687	4.147	NS	NS	NS	2.086	7.075
	Coarse	0.5-1	NS	5.592	8.040	6.531	NS	NS	NS	6.765	13.920
	Medium	0.25-0.5	NS	11.257	14.015	10.581	NS	NS	NS	32.562	19.261
	Fine	0.125-0.25	NS	12.377	22.035	17.301	NS	NS	NS	16.193	7.386
	Very Fine	0.063-0.125	NS	15.261	15.278	19.990	NS	NS	NS	13.742	12.561
Mud	Silt	0.004 - 0.063	NS	4.094	10.383	13.497	NS	NS	NS	12.486	10.396
% Gravel			NS	47.054	27.561	27.952	NS	NS	NS	16.165	29.402
% Sand			NS	48.852	62.055	58.551	NS	NS	NS	71.349	60.202
% Mud			NS	4.094	10.383	13.497	NS	NS	NS	12.486	10.396

Note: NS - No Sample Collected

Signed off by:

[redacted], M.Sc.
Senior Laboratory Manager

APPENDIX D
Grab Photos

ANB-A

Pre-siphon

Post-siphon

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Corner #4

Pre-siphon

Post-siphon

Grab leaked and was not siphoned

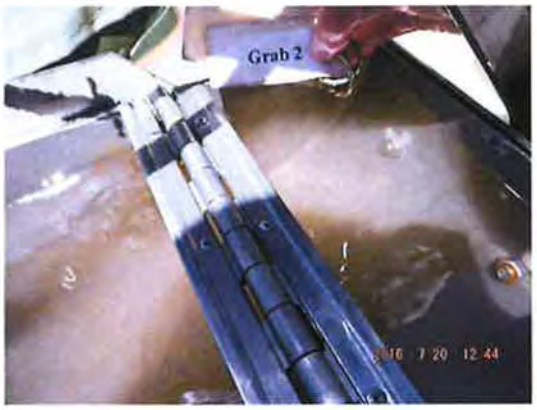
Grab leaked and was not siphoned

Corner #5

Grabs were not sampled

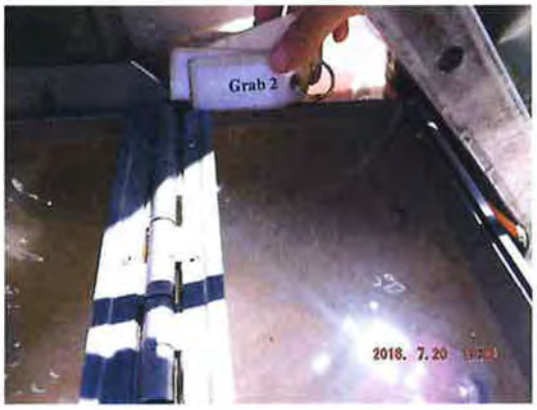
Corner #6

Grabs were not sampled



Corner #7

Grabs were not sampled



Corner #1

Grabs were not sampled

ANB-01

Pre-siphon

Post-siphon

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Corner #2

Pre-siphon

Post-siphon

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Corner #3

Pre-siphon

Post-siphon

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Grab leaked and was not siphoned

APPENDIX E
Screen Captures of the Seafloor


ANB-A
44 38.9476 N
065 45.2351 W
2016/07/20 10:41:49


Corner #4
44 39.0016 N
065 45.1475 W
2016/07/20 11:33:37


Corner #5
44 38.9954 N
065 45.4358 W
2016/07/20 12:12:16


Corner #6
44 39.0980 N
065 45.4412 W
2016/07/20 12:36:28


Corner #7
44 39.3135 N
065 45.4520 W
2016/07/20 12:56:60

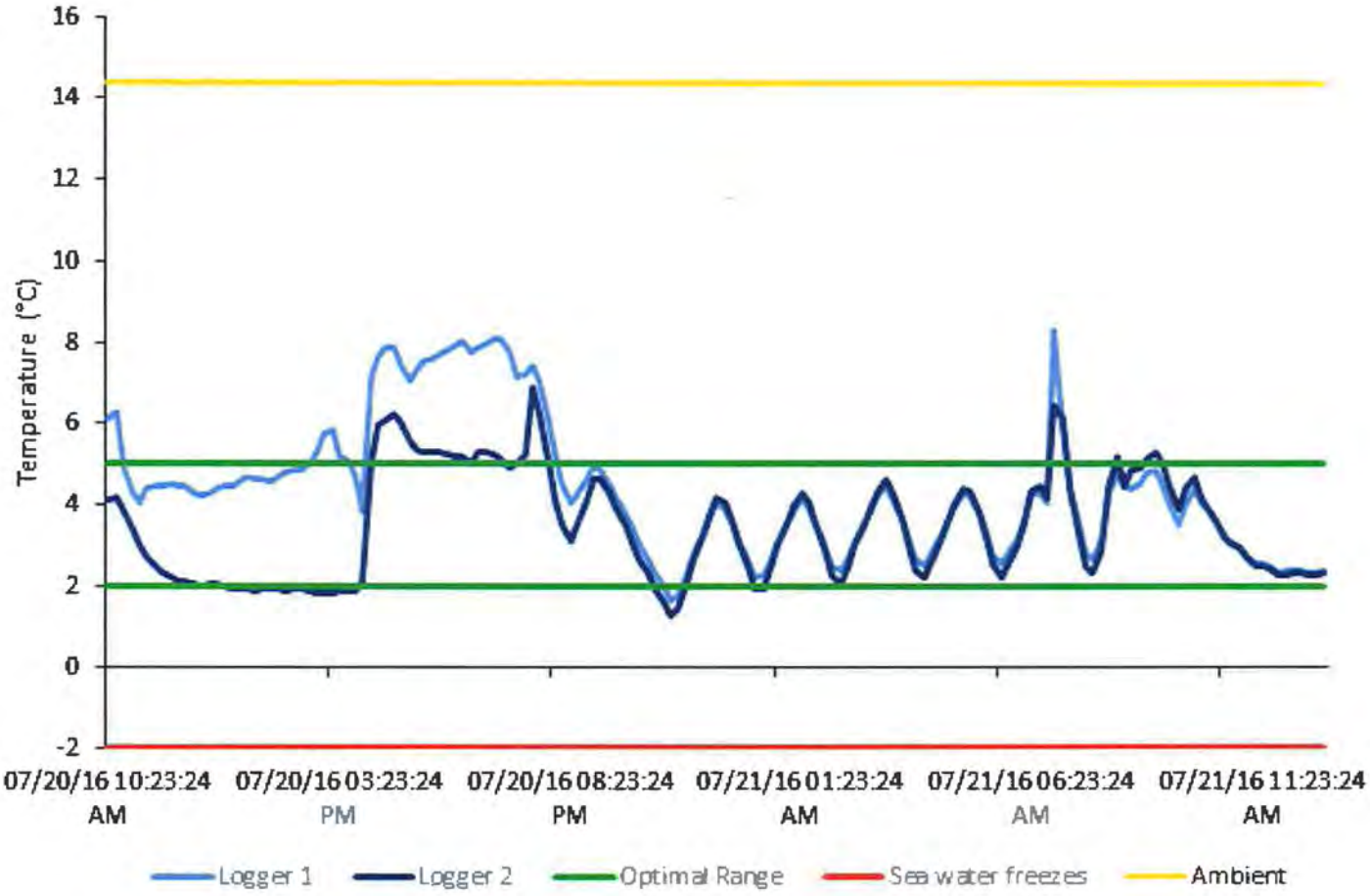

Corner #1
44 39.4482 N
065 45.4057 W
2016/07/20 13:14:29


ANB-01
44 39.5483 N
065 45.3614 W
2016/07/20 13:34:53


Corner #2
144 39.4607 N
065 45.9053 W
2016/07/20 14:12:22


Corner #3
44 39.3845 N
065 45.2038 W
2016/07/20 16:02:22

APPENDIX F
Sample Storage Temperature


16
14
12
10
8
6
4
2
0
-2
Temperature (°C)
07/20/16 10:23:24 AM
07/20/16 03:23:24 PM
07/20/16 08:23:24 PM
07/21/16 01:23:24 AM
07/21/16 06:23:24 AM
07/21/16 11:23:24 AM
Logger 1
Logger 2
Optimal Range
Sea water freezes
Ambient

APPENDIX G
Sediment Sample Quality Criteria

Station	Grab attempts	Grabs that were subsampled	Grab retrieval speeds (cm/s)	Flap position	Sediment depths (cm)	Reason for rejecting grab	Free-falls
ANB-A	6	4, 5, 6	28, 23, 28	Down	4, 1, 1	1 - no sediment 2 - no sediment 3 - no sediment	Yes
Corner #4	3	1, 2, 3	28, 28, 27	Down	2, 5, 3	N/A	No, yes, yes
Corner #5	5	None	N/A	N/A	N/A	1 - no sediment 2 - no sediment 3 - no sediment 4 - no sediment 5 - no sediment	N/A
Corner #6	5	None	N/A	N/A	N/A	1 - no sediment 2 - no sediment 3 - no sediment 4 - no sediment 5 - no sediment	N/A
Corner #7	5	None	N/A	N/A	N/A	1 - no sediment 2 - no sediment 3 - no sediment 4 - no sediment 5 - no sediment	N/A
Corner #1	5	None	N/A	N/A	N/A	1 - no sediment 2 - no sediment 3 - no sediment 4 - no sediment 5 - no sediment	N/A
ANB-01	4	2, 3, 4	26, 27, 25	Down	4, 3, 4	1 - no sediment	Yes
Corner #2	5	3, 4, 5	30, 28, 29	Down	4.5, 3, 1	1 - no sediment 2 - no sediment	Yes
Corner #3	3	1, 2, 3	27, 28, 29	Down	1, 5, 2	N/A	No, yes, yes

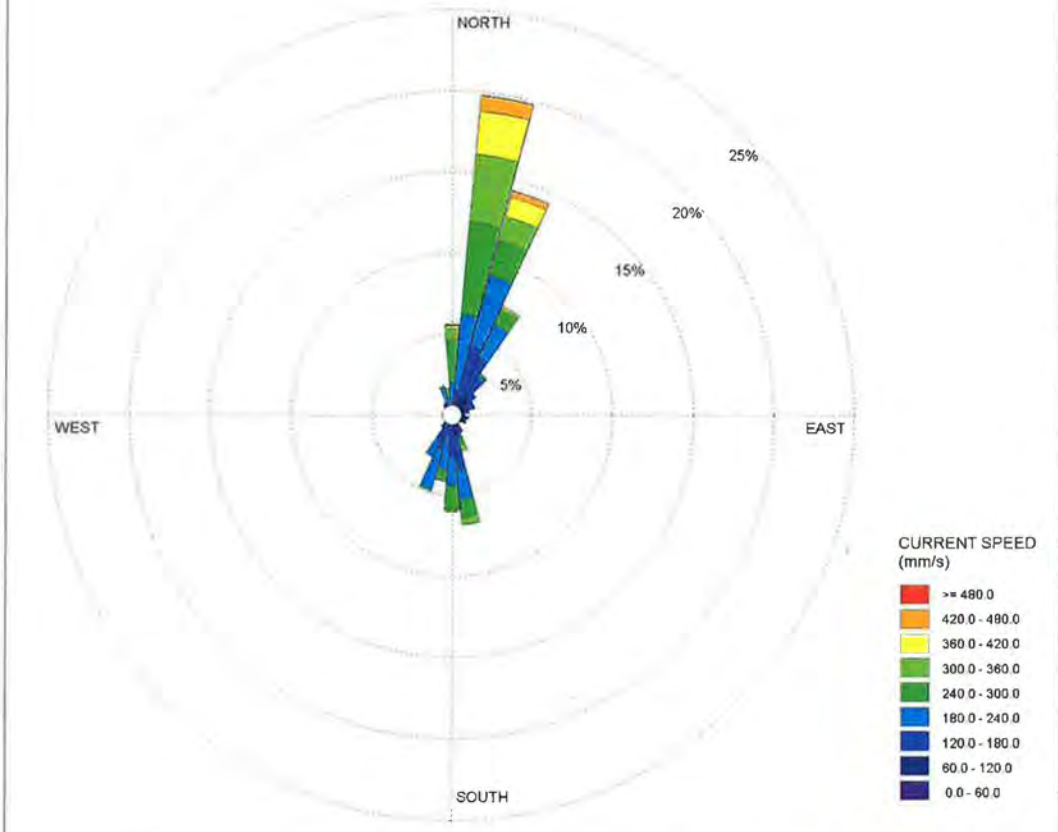
Station	Grab Attempt					
	Grab 1	Grab 2	Grab 3	Grab 4	Grab 5	Grab 6
ANB-A	SP	SP	SP	SP	SP	SP
Corner #4	SP	SP	SP	-	-	-
Corner #5	SP	SP	SP	SP	SP	-
Corner #6	SP	SP	SP	SP	SP	-
Corner #7	SP	SP	SP	SP	SP	-
Corner #1	SP	SP	SP	SP	SP	-
ANB-01	SP	SP	SP	SP	-	-
Corner #2	SP	SP	SP	SP	SP	-
Corner #3	SP	SP	SP	-	-	-

PP = Petite Ponar
SP = Standard Ponar
Grabs there were subsampled are highlighted in green

APPENDIX H
ADCP Data

CURRENT ROSE PLOT

Site #1039, Rattling Beach, NS
Current Speed and Direction - 3m Above Bottom



COMMENTS:

DATA PERIOD:
Start Date: 2016-06-29
End Date: 2016-08-04

PROFILE COUNT:
3455

AVG. CURRENT SPEED:
198.10 mm/s

COMPANY NAME:
Sweeney International Marine Corp.

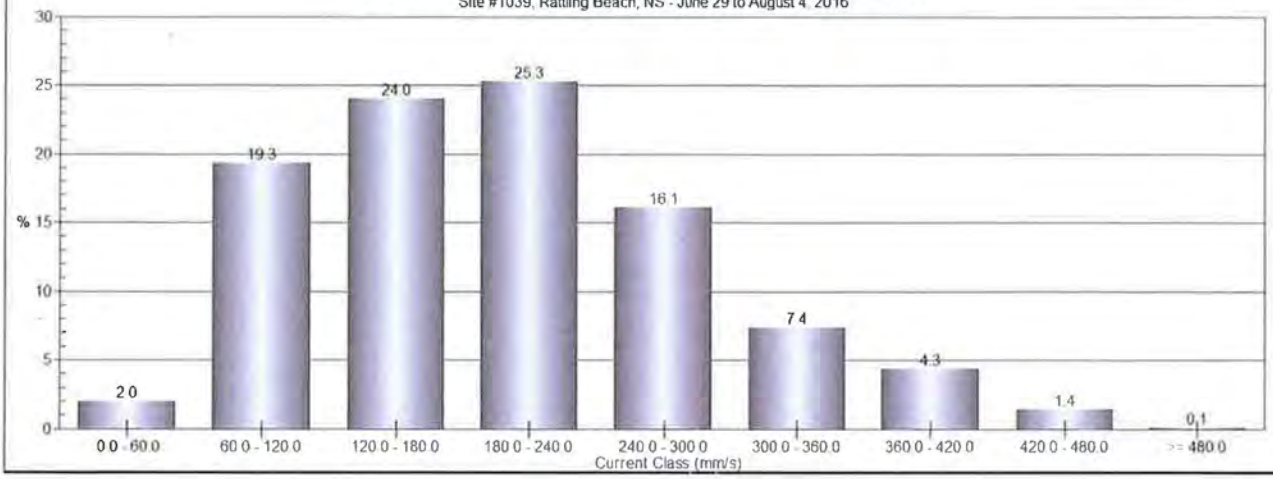
MODELER:

DATE:
2016-08-18

PROJECT NO:
SW2016-059

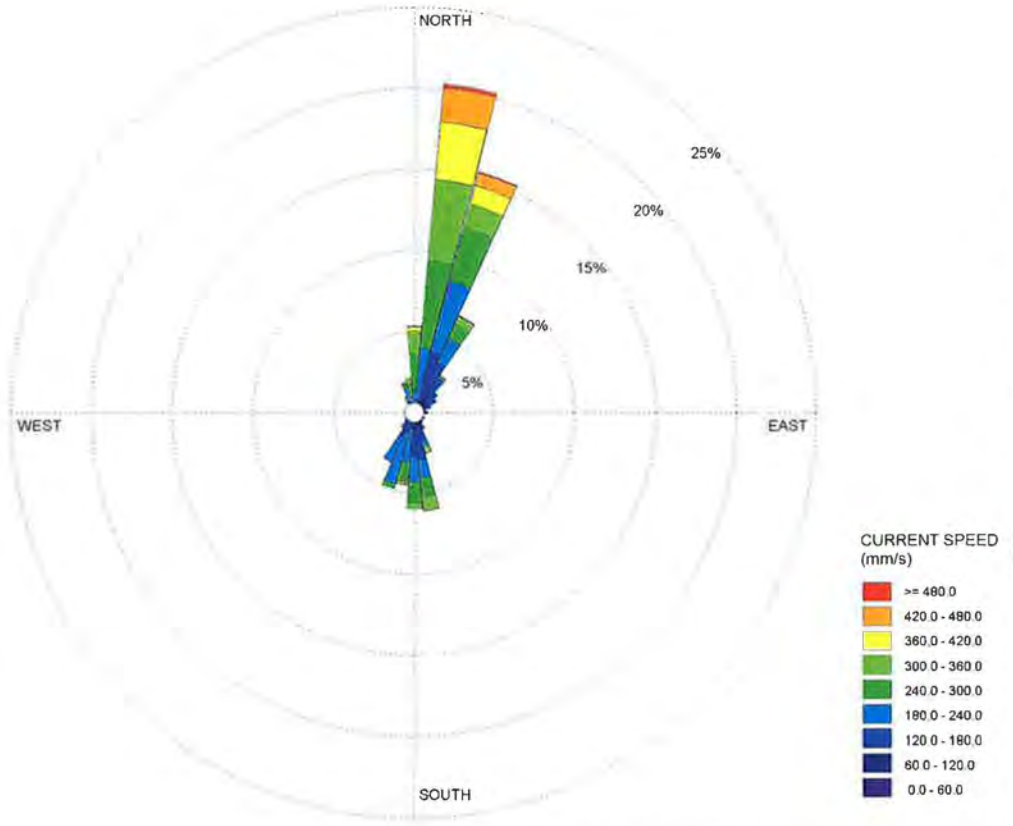
Current Class Frequency Distribution - 3m Above Bottom

Site #1039, Rattling Beach, NS - June 29 to August 4, 2016



CURRENT ROSE PLOT

Site #1039, Rattling Beach, NS
Current Speed and Direction - 4m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-06-29
End Date: 2016-08-04

PROFILE COUNT

3440

AVG. CURRENT SPEED

213.00 mm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

DATE

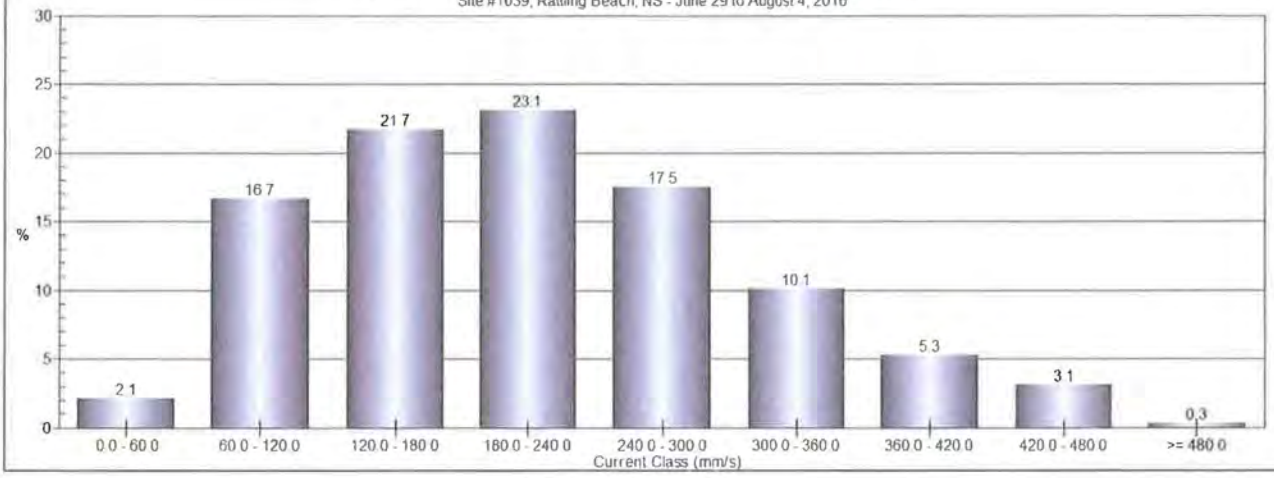
2016-08-18

PROJECT NO.

SW2016-059

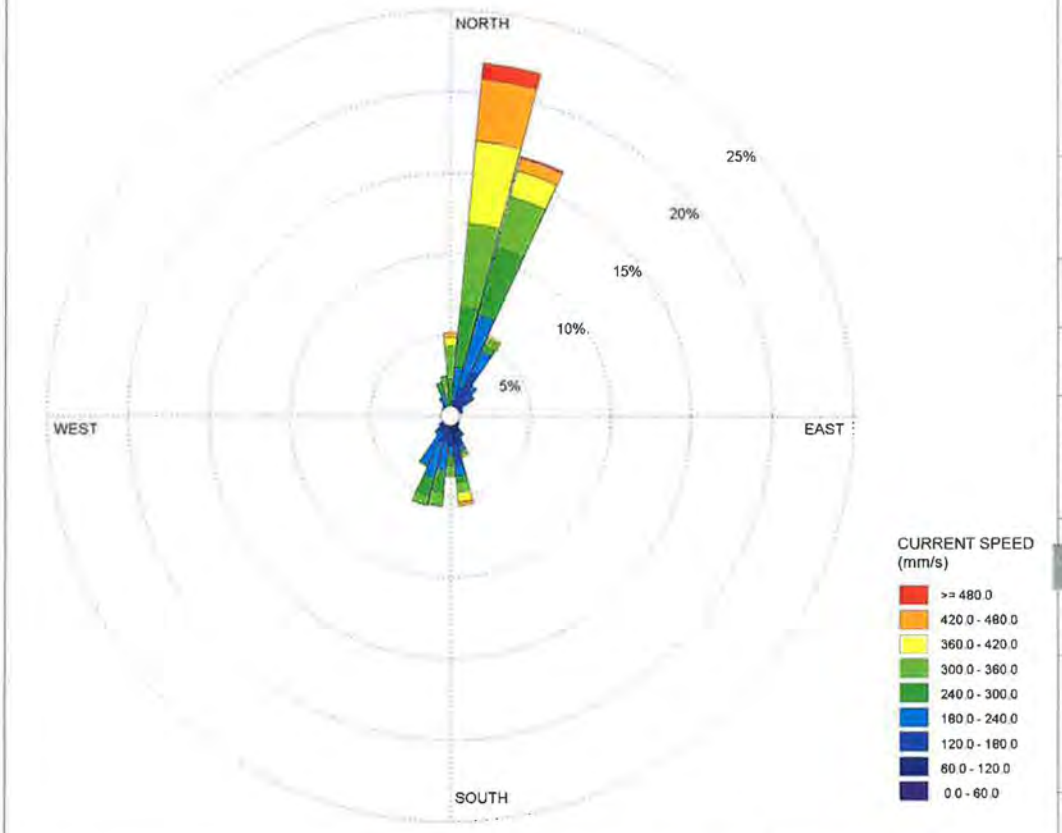
Current Class Frequency Distribution - 4m Above Bottom

Site #1039, Rattling Beach, NS - June 29 to August 4, 2016



CURRENT ROSE PLOT

Site #1039, Rattling Beach, NS
Current Speed and Direction - 6m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-06-29
End Date: 2016-08-04

PROFILE COUNT

3337

AVG. CURRENT SPEED

232.50 mm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

DATE

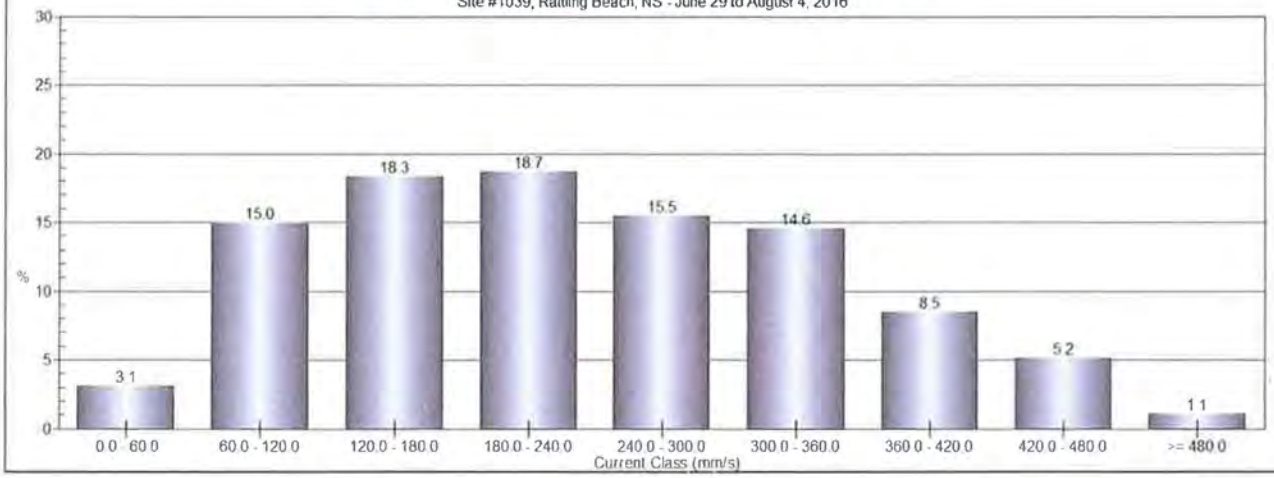
2016-08-18

PROJECT NO

SW2016-059

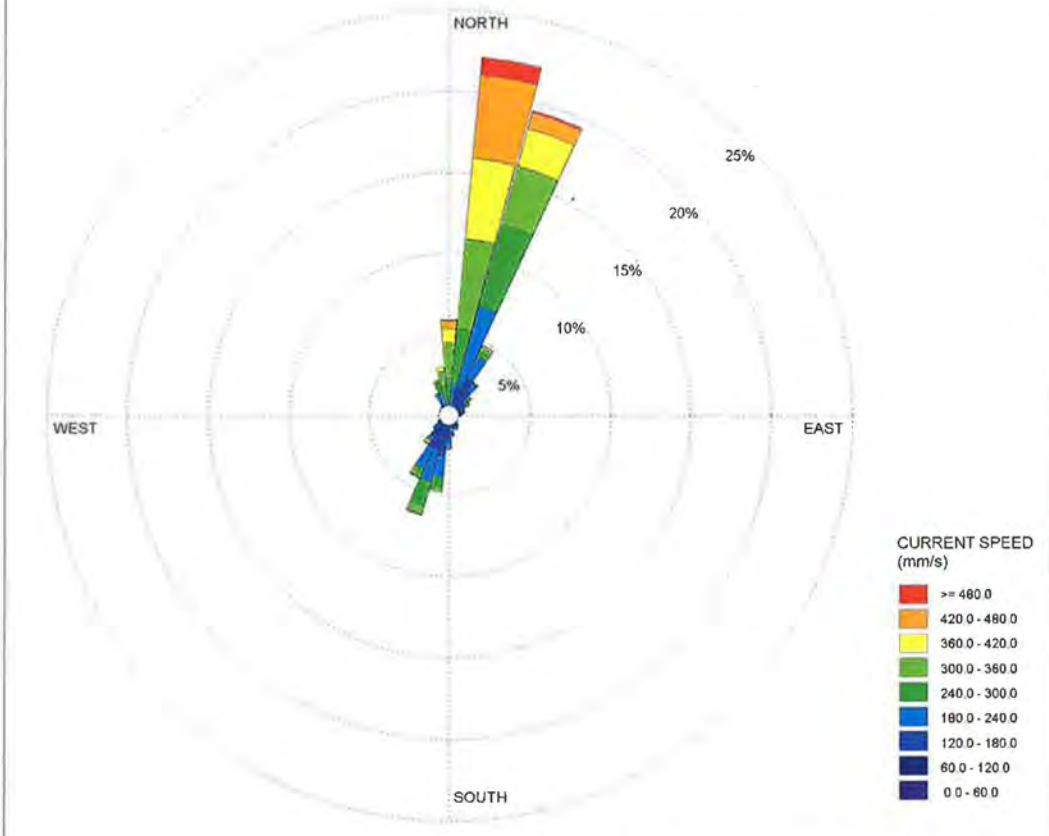
Current Class Frequency Distribution - 6m Above Bottom

Site #1039, Rattling Beach, NS - June 29 to August 4, 2016



CURRENT ROSE PLOT

Site #1039, Rattling Beach, NS
Current Speed and Direction - 7m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-06-29
End Date: 2016-08-04

PROFILE COUNT

3060

AVG. CURRENT SPEED

240.00 mm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

DATE

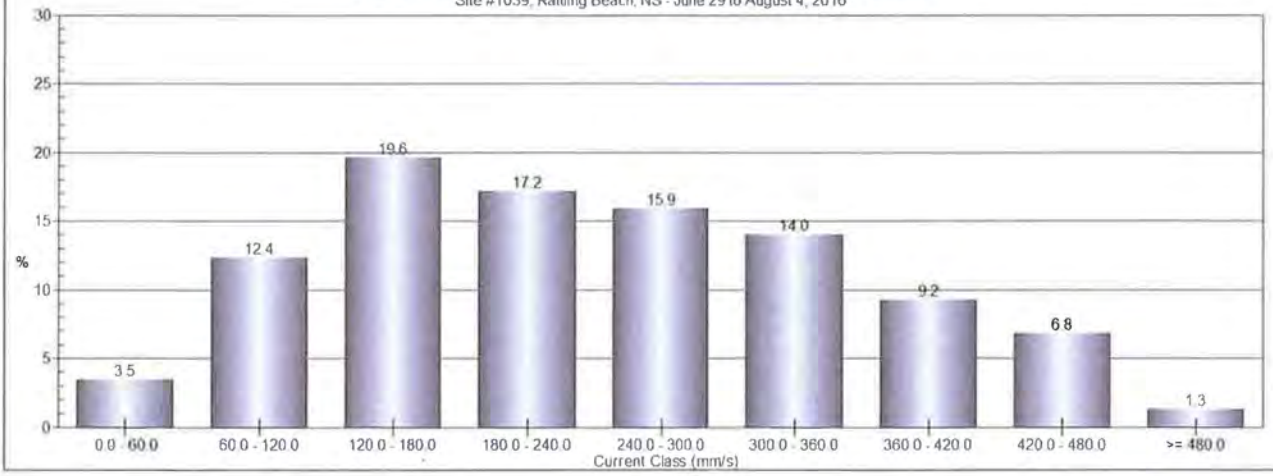
2016-08-18

PROJECT NO.

SW2016-059

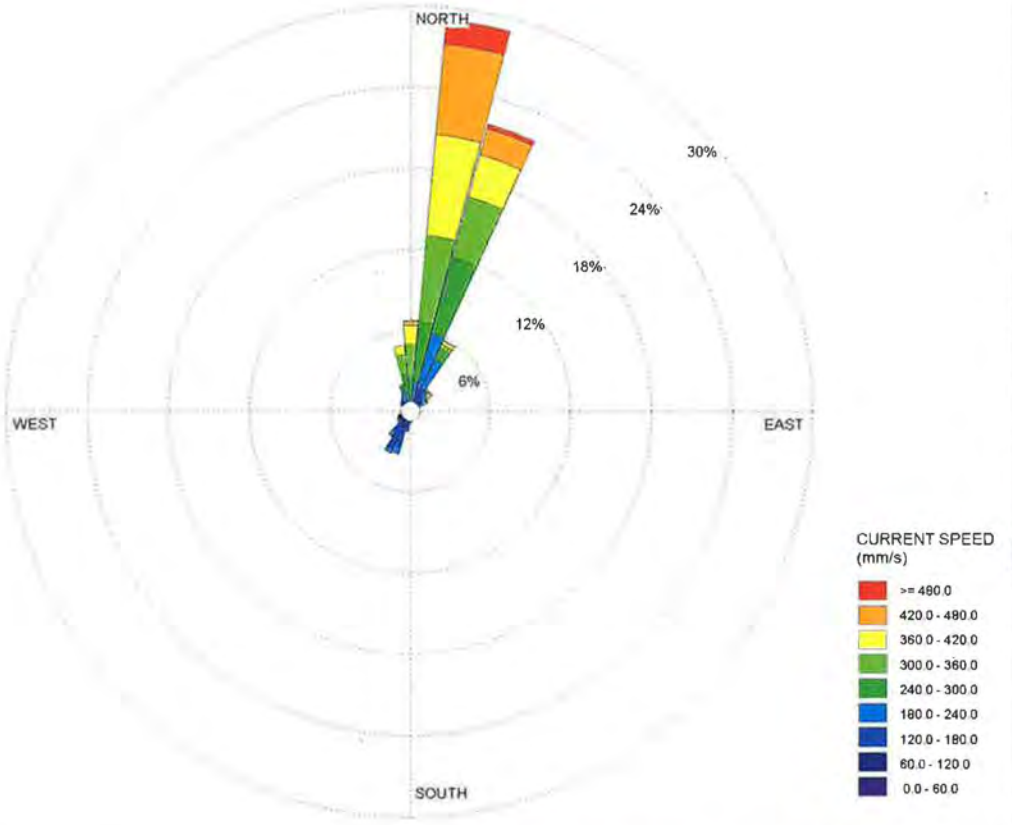
Current Class Frequency Distribution - 7m Above Bottom

Site #1039, Rattling Beach, NS - June 29 to August 4, 2016



CURRENT ROSE PLOT

Site #1039, Rattling Beach, NS
Current Speed and Direction - 8m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-06-29
End Date: 2016-08-04

PROFILE COUNT

2406

AVG. CURRENT SPEED

263.30 mm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

DATE

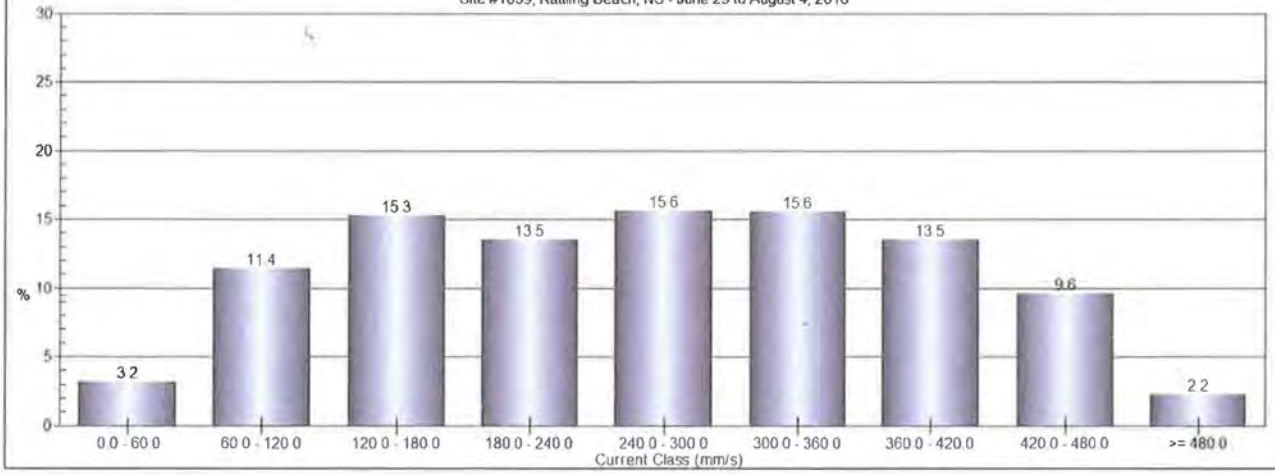
2016-08-18

PROJECT NO

SW2016-059

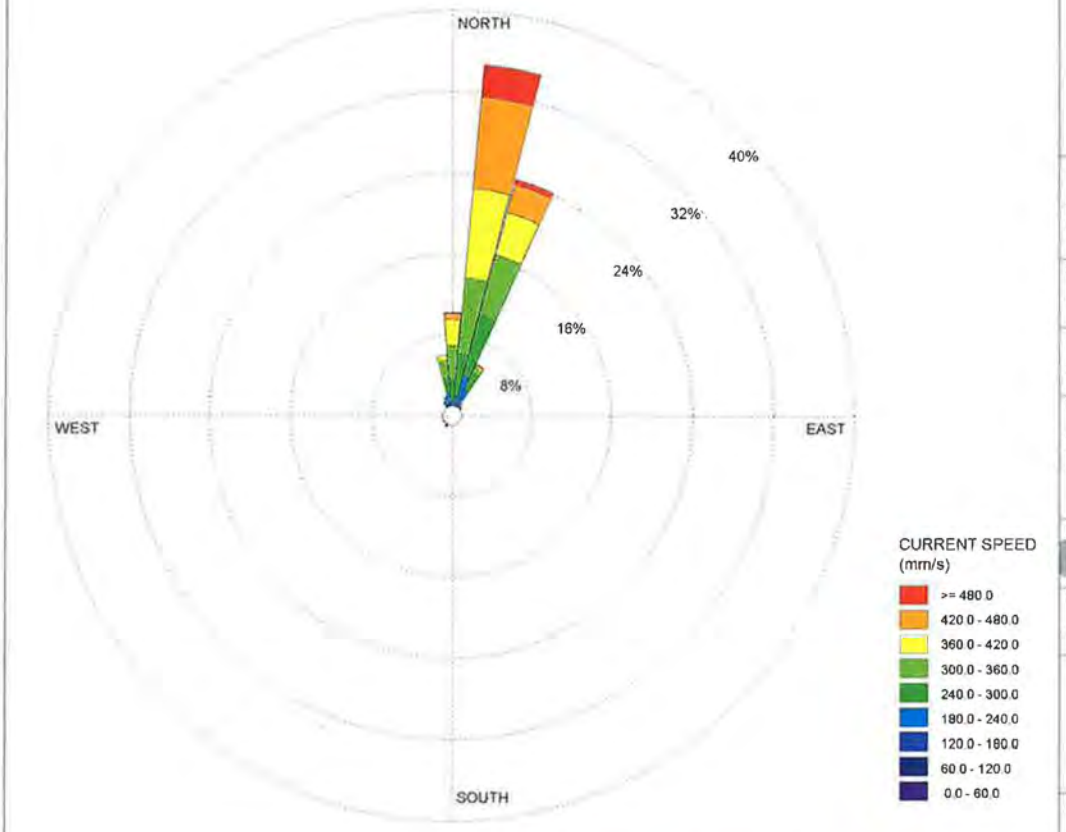
Current Class Frequency Distribution - 8m Above Bottom

Site #1039, Rattling Beach, NS - June 29 to August 4, 2016



CURRENT ROSE PLOT

Site #1039, Rattling Beach, NS
Current Speed and Direction - 9m Above Bottom



COMMENTS

DATA PERIOD
Start Date: 2016-06-29
End Date: 2016-08-04

PROFILE COUNT
1894

AVG. CURRENT SPEED
292.40 mm/s

COMPANY NAME
Sweeney International Marine Corp.

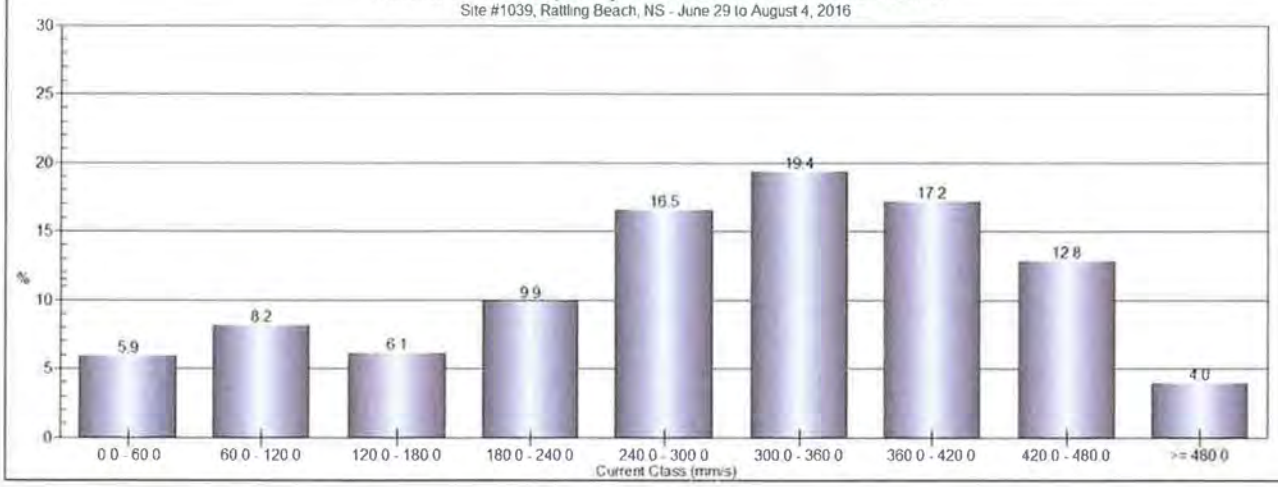
MODELER

DATE
2016-08-18

PROJECT NO
SW2016-059

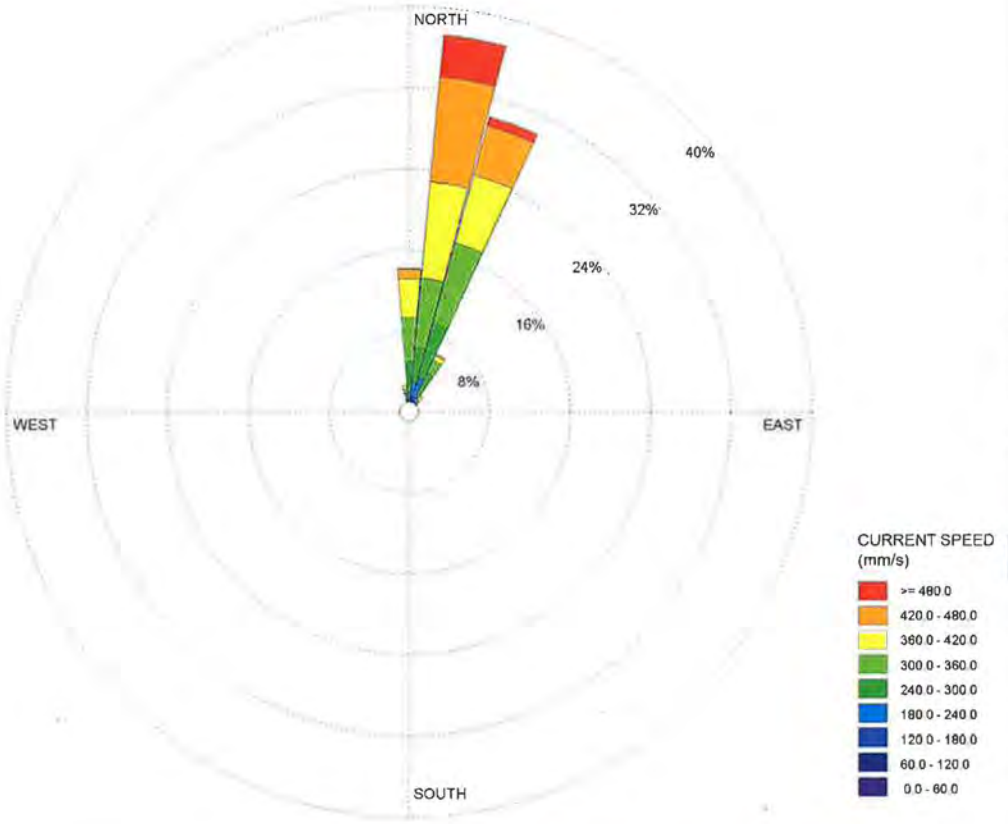
Current Class Frequency Distribution - 9m Above Bottom

Site #1039, Rattling Beach, NS - June 29 to August 4, 2016



CURRENT ROSE PLOT

Site #1039, Rattling Beach, NS
Current Speed and Direction - 10m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-06-29
End Date: 2016-08-04

PROFILE COUNT

1455

AVG. CURRENT SPEED

327.90 mm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

DATE

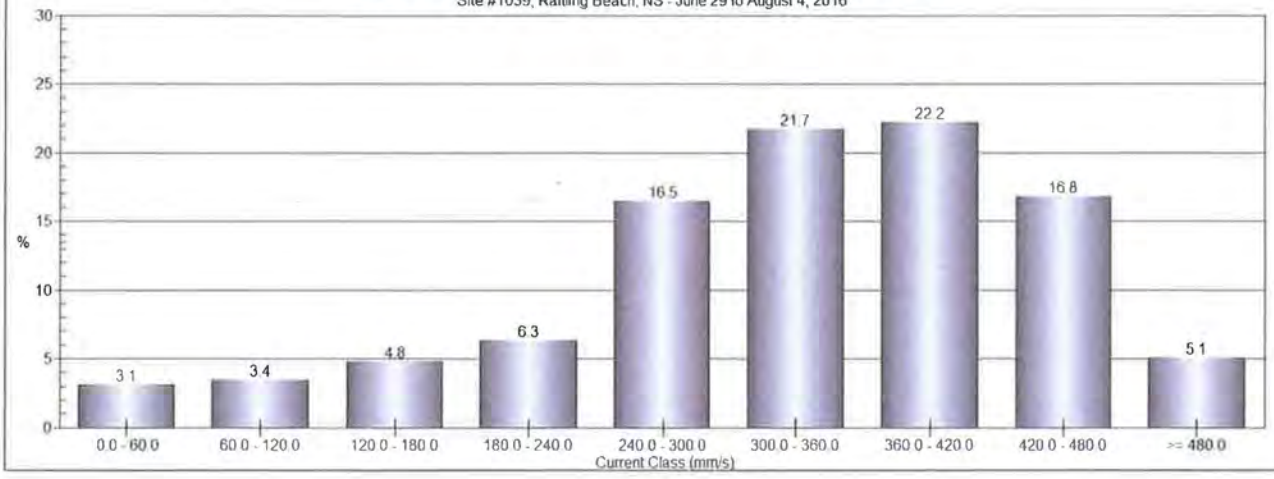
2016-08-18

PROJECT NO

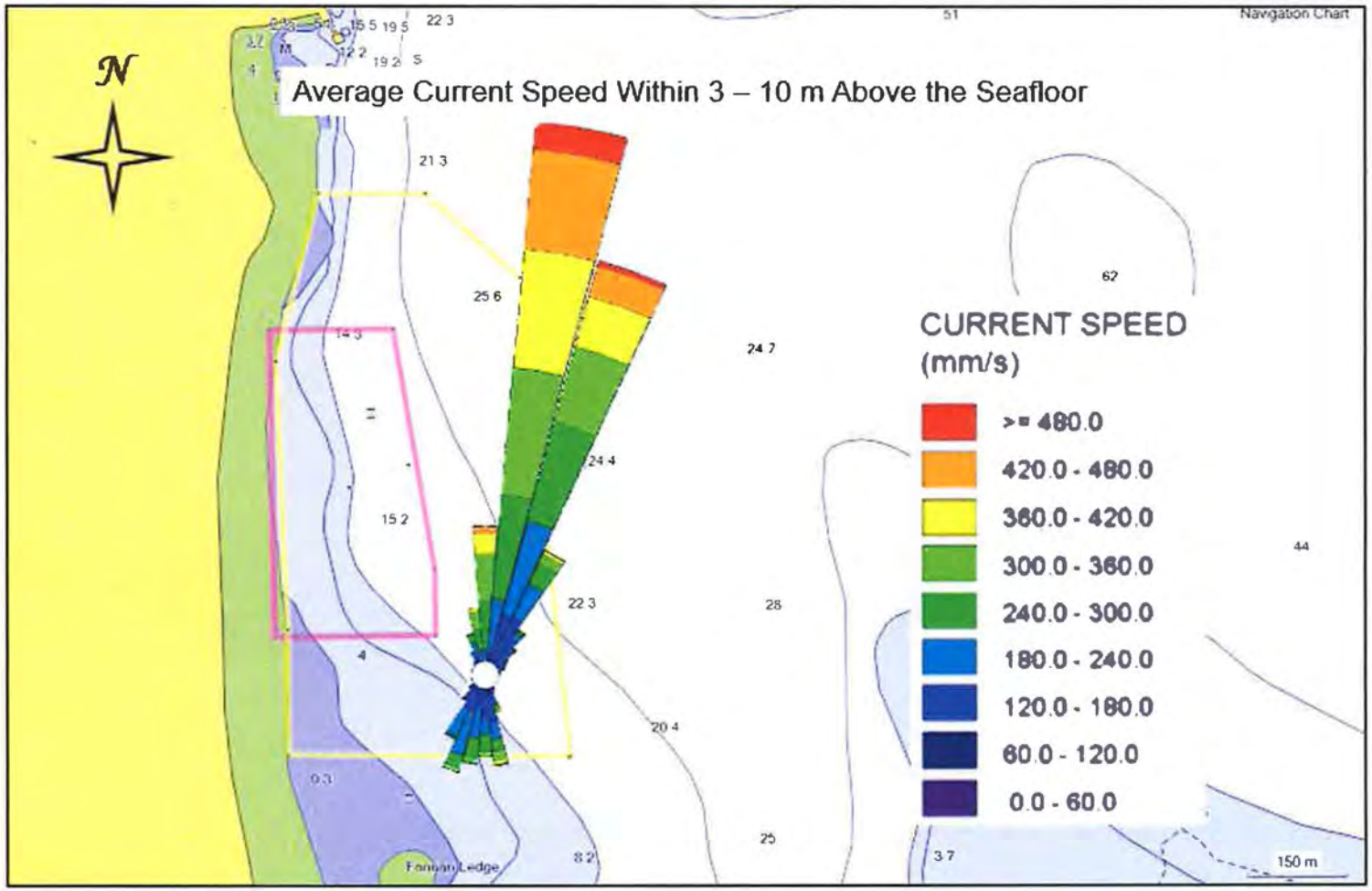
SW2016-059

Current Class Frequency Distribution - 10m Above Bottom

Site #1039, Rattling Beach, NS - June 29 to August 4, 2016

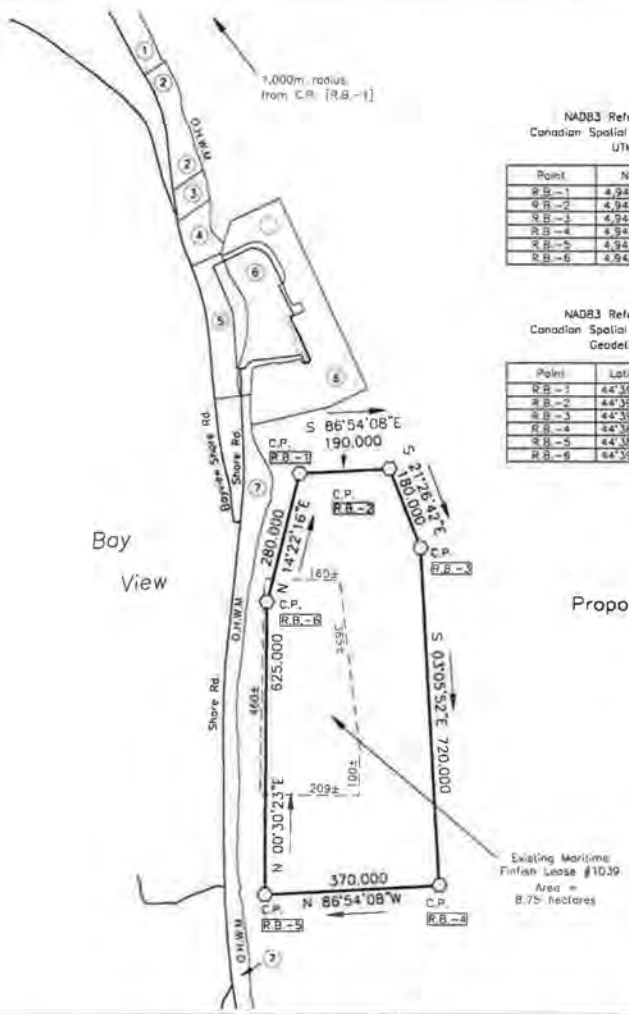


NS1039 Rattling Beach					
	Speed			Direction	
Distance from Bottom (m)	Most Frequent (cm/s)	% Occurrence	Average (cm/s)	Highest Frequency (°)	% Occurrence
3	18-24	25.3	19.8	5-15	19.7
4	18-24	23.1	21.3	5-15	20.2
5	18-12	20.6	22.5	5-15	20
6	18-24	18.7	23.3	5-15	21.0
7	18-12	19.6	24.0	5-15	19.6
8	30-36	15.6	26.3	5-15	20.2
9	30-36	19.4	29.2	5-15	19.0
10	36-42	22.2	32.8	5-15	15.7
Depth Averaged	18-24	18.3	23.9	5-15	19.4


N
Average Current Speed Within 3 – 10 m Above the Seafloor
CURRENT SPEED
(mm/s)
>= 480.0
420.0 - 480.0
360.0 - 420.0
300.0 - 360.0
240.0 - 300.0
180.0 - 240.0
120.0 - 180.0
60.0 - 120.0
0.0 - 60.0
Navigation Chart
150 m

Sweeney International Marine Corp.
46 Milltown Blvd.
St. Stephen, NB
E3L 1G3

NRC-IMB Research Facilities
1411 Oxford Street
Suite 367-368
Halifax, NS
B3H 3Z1



NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
UTM Zone 20N

Point	Northing	Easting
R.B.-1	4,948,620.731	281,435.104
R.B.-2	4,948,630.899	281,674.927
R.B.-3	4,948,463.451	281,693.636
R.B.-4	4,947,744.513	281,729.545
R.B.-5	4,947,724.516	281,360.086
R.B.-6	4,948,349.493	281,365.609

NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
Geodetic Co-ordinates

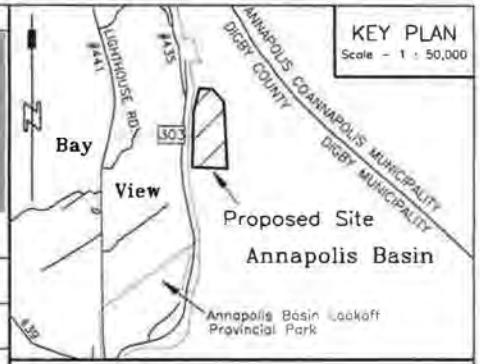
Point	Latitude (N)	Longitude (W)
R.B.-1	44°39'27.6296"	65°45'24.2922"
R.B.-2	44°39'28.1697"	65°45'15.7031"
R.B.-3	44°39'22.8183"	65°45'12.4616"
R.B.-4	44°38'59.5875"	65°45'09.5931"
R.B.-5	44°38'58.5358"	65°45'26.3187"
R.B.-6	44°39'18.7731"	65°45'27.0277"

Proposed Marine Aquaculture Site
Rattling Beach Aquaculture Site
Kelly Cove Salmon Ltd
Area = 29.08 hectares

A n n a p o l i s B a s i n
(Atlantic Ocean)

NORTH
UTM Zone 20N
(NAD83 (CSRS))

#	P.I.D. #	OWNER / ADDRESS
1	30194823	
2	30194607	
3	30286546	
4	30194781	
5	30194739	Crown Land (N.S.) P.O. Box 634 Stn. Central Charlottetown, PEI, C1A 7L3
6	30357006	Crown Land (P.W.G.S.C.) P.O. Box 634 Stn. Central Charlottetown, PEI, C1A 7L3
7	30234185	Road Parcel Bayview Shore Road
8	30130056	Crown Land (D.N.R.) PO Box 698, Halifax, N.S. B3J 2T9



Legend:

CALCULATED POINT	C.P. ○
CALCULATED	(c.)
N.S. PROPERTY IDENTIFICATION NUMBER	P.I.D. #00000000
NORTHING / EASTING	N. / E.
LOCAL REGISTRY NUMBER	Book: / Page:
ORDINARY HIGH WATER MARK	O.H.W.M.
BOUNDARY DEALT WITH BY THIS PLAN	
OTHER BOUNDARY	
TIE LINES	
NOT TO SCALE	
MAJOR CONTOURS	
MINOR CONTOURS	
DEPTH SOUNDINGS	± 00.0
CONCRETE MOORING	□
JAYCO ANCHOR	⚓

AQUACULTURE SITE DEVELOPMENT PLANS

SHOWING

PROPOSED BOUNDARY AMENDMENT TO LEASE #1039

KELLY COVE SALMON LTD. / RATTLING BEACH

LOCATED AT:

BAY VIEW (RATTLING BEACH), ANNAPOLIS BASIN,
DIGBY COUNTY, NOVA SCOTIA

Client's Statement

I, Jeff Nickerson of Kelly Cove Salmon Ltd. acknowledge and confirm that Acker & Doucette Surveying Inc., make no representations or warranties with respect to the adequacy or the integrity of the proposed cage and mooring design of system depicted.

Dated this 19th day of October, 2016.

[redacted]

Jeff Nickerson

A&D JOB #149-16-1039

SHEET 1 OF 7 | DATE: October 19, 2016

NOTES:

(1.) ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
(2.) THIS PLAN IS A COMPILATION OF THIRD PARTY DATA. DATA WAS PROVIDED BY SWEENEY INTERNATIONAL MARINE CORP. ACKER & DOUCETTE SURVEYING INC. HAS COMPLETED THIS PLAN IN ACCORDANCE WITH THE "GUIDE TO MARINE FINFISH AQUACULTURE SITE REQUIREMENTS", DATED NOVEMBER 2007.
(3.) ALL DEPTHS ARE REFERENCED TO CHART DATUM (LOWER LOW WATER, LARGE TIDE).
(4.) DEPTH CONTOUR DATA IS BASED ON GARMIN MARINE MAPSOURCE DATA AND BATHYMETRIC SOUNDING DATA PROVIDED BY SWEENEY INTERNATIONAL MARINE CORP.
(5.) SPOT SOUNDINGS ARE BASED ON SOUNDING DATA PROVIDED BY SWEENEY INTERNATIONAL MARINE CORP. SAID SOUNDINGS WERE CORRECTED TO CHART DATUM FROM G.N.S.S. OBSERVATIONS.
(6.) NATURAL FEATURES WERE DETERMINED BY NOVA SCOTIA PROPERTY ONLINE MAPPING AND GEONOVA DATA LOCATOR GEOGRAPHIC INFORMATION.
(7.) ONSHORE PROPERTY DATA IS BASED ON NOVA SCOTIA PROPERTY ONLINE MAPPING.
(8.) ALL BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE BASED ON THE NORTH AMERICAN DATUM OF 1983 (NAD83 CSRS) USING THE UNIVERSAL TRANSVERSE MERCATOR PROJECTION, ZONE 20 NORTH (UTM 20N).

KELLY COVE SALMON LTD.

THE ASSOCIATION OF NOVA SCOTIA LAND SURVEYORS
FOUNDED 1951
Stephen Acker
Stephen D.F. Acker
N.S.L.S. 639
MEMBER

PURPOSE OF PLAN (SHEET 1 OF 7)
THE PURPOSE OF THIS PLAN IS TO DEMONSTRATE THE EXTENTS OF THE PROPOSED MARINE AQUACULTURE SITE AND AS WELL AS ADJACENT PARCELS OF LAND TO THE NORTH. FOR ADDITIONAL SITE INFORMATION, REFER TO SHEETS 2 THROUGH 7.

200 0 200 400 600

SCALE - 1 : 10,000 (METRIC)

Acker & Doucette Surveying Inc.
Nova Scotia Land Surveyors

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Shelburne, Shelburne County
Nova Scotia, Canada
B0T 1W0

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info@adsurveying.ca

Proposed Marine Aquaculture Site

Rattling Beach Aquaculture Site
Kelly Cove Salmon Ltd.
Area = 29.08 hectares

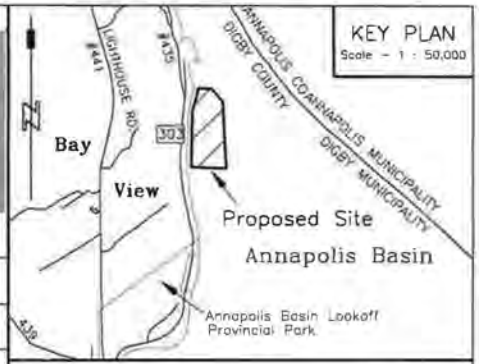
NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
UTM Zone 20N

Point	Northing	Easting
R.B.-1	4,948,620.731	281,435.104
R.B.-2	4,948,630.999	281,624.827
R.B.-3	4,948,463.461	281,690.636
R.B.-4	4,947,744.513	281,729.545
R.B.-5	4,947,724.318	281,360.066
R.B.-6	4,948,349.493	281,365.608

NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
Geodetic Co-ordinates

Point	Latitude (N)	Longitude (W)
R.B.-1	44°39'27.6796"	65°45'24.2922"
R.B.-2	44°39'28.1697"	65°45'15.7031"
R.B.-3	44°39'22.8183"	65°45'12.4616"
R.B.-4	44°38'59.5875"	65°45'09.5851"
R.B.-5	44°38'58.5358"	65°45'26.3187"
R.B.-6	44°39'18.7731"	65°45'27.0077"

#	P.I.D. #	OWNER / ADDRESS
1	30194823	
2	30194807	
3	30286546	
4	30194781	
5	30194798	Crown Land (N.S.) P.O. Box 634 Stn. Central Charlottetown, PE, C1A 7L3
6	30357008	Crown Land (P.W.G.S.C.) P.O. Box 634 Stn. Central Charlottetown, PE, C1A 7L3
7	30294185	Road Parcel Bayview Shore Road
8	30130058	Crown Land (D.N.R.) PO Box 698, Halifax, N.S. B3J 2T9



Legend:

CALCULATED POINT	C.P. ○
CALCULATED	(c.)
N.S. PROPERTY IDENTIFICATION NUMBER	P.I.D. #00000000
NORTHING / EASTING	N. / E.
LOCAL REGISTRY NUMBER	Book / Page
ORDINARY HIGH WATER MARK	O.H.W.M.
BOUNDARY DEALT WITH BY THIS PLAN	———
OTHER BOUNDARY	———
TIE LINES	- - - - -
NOT TO SCALE	- - - - -
MAJOR CONTOURS	———
MINOR CONTOURS	———
DEPTH SOUNDINGS	• 20.0
CONCRETE MOORING	□
JAYCO ANCHOR	⚑

AQUACULTURE SITE DEVELOPMENT PLANS

SHOWING
PROPOSED BOUNDARY AMENDMENT TO LEASE #1039
KELLY COVE SALMON LTD. / RATTLING BEACH
LOCATED AT:
BAY VIEW (RATTLING BEACH), ANNAPOLIS BASIN,
DIGBY COUNTY, NOVA SCOTIA

Client's Statement

I, Jeff Nickerson of Kelly Cove Salmon Ltd. acknowledge and confirm that Acker & Doucette Surveying Inc., make no representations or warranties with respect to the adequacy or the integrity of the proposed cage and mooring design of system depicted

Dated this 19th day of October, 2016

[redacted]

Jeff Nicke

A&D JOB #149-16-1039

SHEET 2 OF 7 | DATE: October 19, 2016

NOTES:
(1.) ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
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KELLY COVE SALMON LTD.

THE ASSOCIATION OF NOVA SCOTIA LAND SURVEYORS
FOUNDED 1951
Stephen Acker
Stephen D.F. Acker
N.S.L.S.
539
* MEMBER *

PURPOSE OF PLAN (SHEET 2 OF 7)
THE PURPOSE OF THIS PLAN IS TO DEMONSTRATE THE EXTENTS OF THE PROPOSED MARINE AQUACULTURE SITE AND AS WELL AS ADJACENT PARCELS OF LAND TO THE SOUTH. FOR ADDITIONAL SITE INFORMATION, REFER TO SHEETS 1 AND 3 THROUGH 7.

200 0 200 400 600
SCALE - 1 : 10,000 (METRIC)

Acker & Doucette Surveying Inc.
Nova Scotia Land Surveyors

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Shelburne, Shelburne County
Nova Scotia, Canada
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Fax: (902) 648-0185
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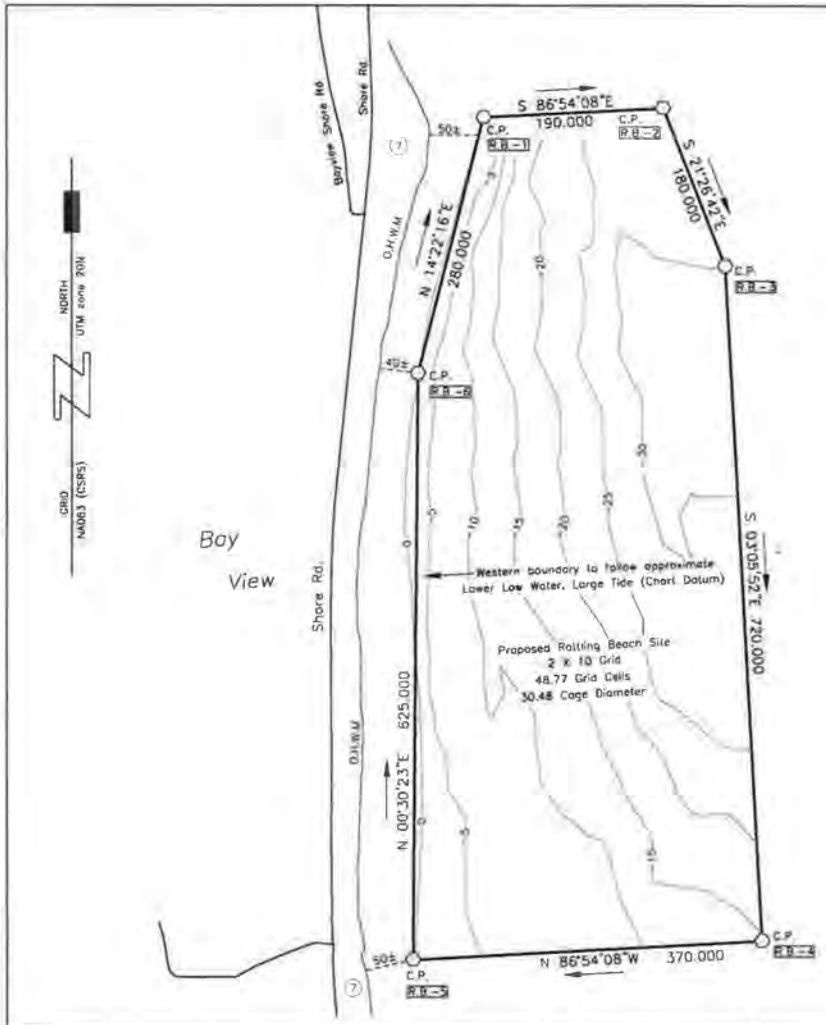


Annapolis Basin
(Atlantic Ocean)

NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
UTM Zone 20N

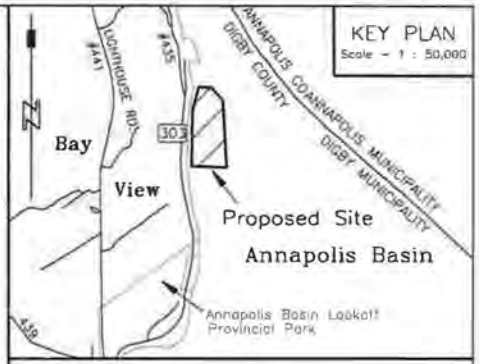
Point	Northing	Easting
RR-1	4,948,520.731	281,435.104
RR-2	4,948,630.999	281,624.827
RR-3	4,948,463.461	281,690.636
RR-4	4,947,744.513	281,729.545
RR-5	4,947,724.518	281,350.086
RR-6	4,948,349.493	281,365.608

NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
Geodetic Co-ordinates

Point	Latitude (N)	Longitude (W)
RR-1	44°39'27.6296"	65°45'24.7922"
RR-2	44°39'28.1697"	65°45'15.7031"
RR-3	44°39'22.8183"	65°45'12.4618"
RR-4	44°38'59.5875"	65°45'09.5951"
RR-5	44°38'58.5358"	65°45'28.3187"
RR-6	44°39'18.7731"	65°45'27.0277"

Proposed Marine Aquaculture Site
Rattling Beach Aquaculture Site
Kelly Cove Salmon Ltd.
Area = 29.08 hectares

Annapolis Basin
(Atlantic Ocean)



Legend:

CALCULATED POINT	C.P. ○
CALCULATED	(c)
N.S. PROPERTY IDENTIFICATION NUMBER	PID 00000000
NORTHING / EASTING	N / E
LOCAL REGISTRY NUMBER	Book / Page
ORDINARY HIGH WATER MARK	O.H.W.M.
BOUNDARY DEALT WITH BY THIS PLAN	
OTHER BOUNDARY	
TIE LINES	
NOT TO SCALE	
MAJOR CONTOURS	
MINOR CONTOURS	
DEPTH SOUNDINGS	+ 00.0
CONCRETE MOORING	□
JAYCO ANCHOR	⊕

AQUACULTURE SITE DEVELOPMENT PLANS

SHOWING
BASIC SEAFLOOR TOPOGRAPHY
KELLY COVE SALMON LTD. / RATTLING BEACH
LOCATED AT:
BAY VIEW (RATTLING BEACH), ANNAPOLIS BASIN,
DIGBY COUNTY, NOVA SCOTIA

Client's Statement

I, Jeff Nickerson of Kelly Cove Salmon Ltd. acknowledge and confirm that Acker & Doucette Surveying Inc., make no representations or warranties with respect to the adequacy or the integrity of the proposed cage and mooring design of system depicted.

Dated this 19th day of October, 2016

Jeff Nickerson

A&D JOB #149-16-1039

SHEET 3 OF 7 | DATE: October 19, 2016

NOTES:
(1.) ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
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(7.) ONSHORE PROPERTY DATA IS BASED ON NOVA SCOTIA PROPERTY ONLINE MAPPING.
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KELLY COVE SALMON LTD.

THE ASSOCIATION OF NOVA SCOTIA LAND SURVEYORS
FOUNDED 1957
Stephen D.F. Acker
N.S.L.S. 639
MEMBER

PURPOSE OF PLAN (SHEET 3 OF 7)
THE PURPOSE OF THIS PLAN IS TO DEMONSTRATE THE EXTENTS OF THE PROPOSED MARINE AQUACULTURE SITE AND BASIC SEAFLOOR TOPOGRAPHY. FOR ADDITIONAL SITE INFORMATION, REFER TO SHEETS 1-2 & 4-7.

100 0 100 200 300

SCALE - 1 : 5,000 (METRIC)

Acker & Doucette Surveying Inc.
Nova Scotia Land Surveyors

240 Belleville Road, P.O. Box 84
Tusket, Yarmouth County
Nova Scotia, Canada
B0W 3M0
Phone: (902) 648-2186
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Nova Scotia, Canada
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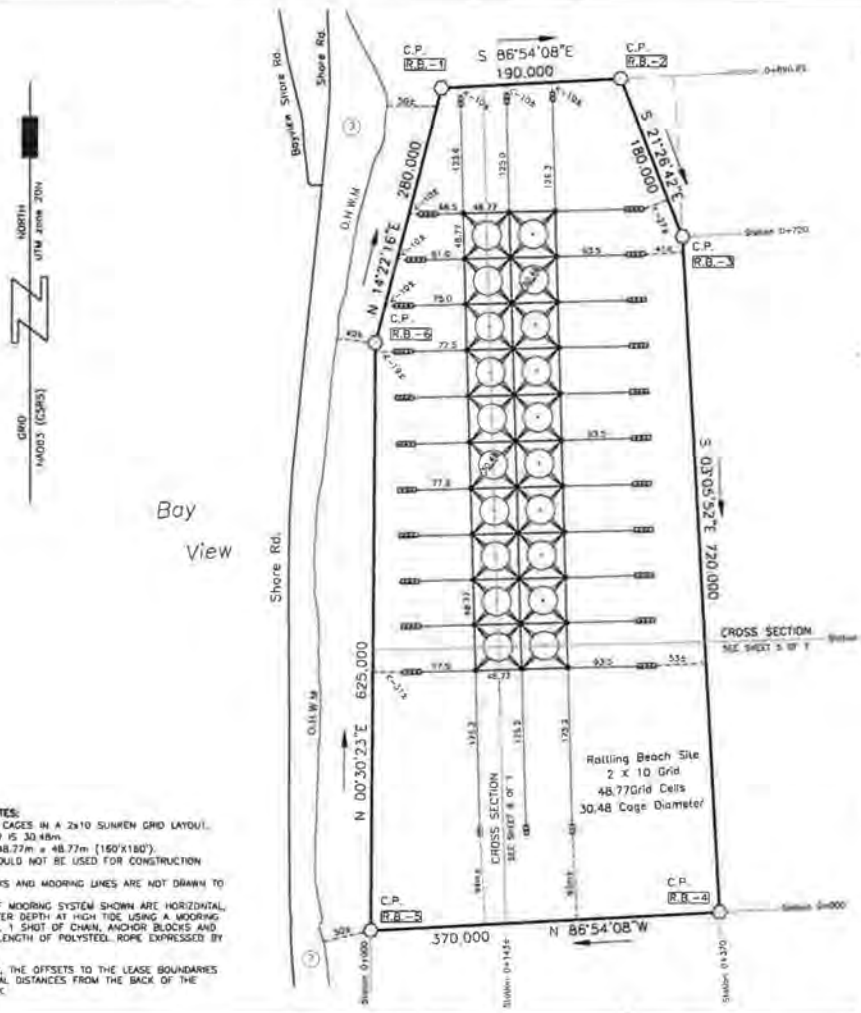

NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
UTM Zone 20N

Point	Northing	Easting
R.B.-1	4,945,670.731	261,435.104
R.B.-2	4,946,630.999	261,624.827
R.B.-3	4,946,463.461	261,690.636
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Canadian Spatial Reference System (CSRS)
Geodetic Co-ordinates

Point	Latitude (N)	Longitude (W)
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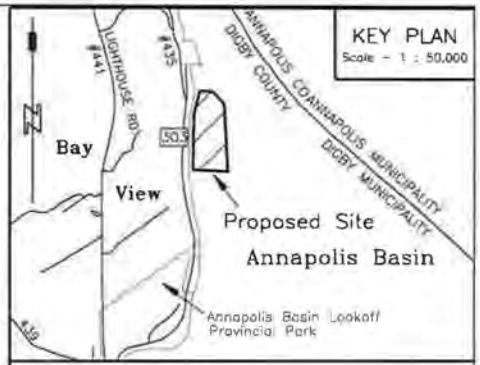
R.B.-4	44°38'59.5875"	65°45'09.5951"
R.B.-5	44°38'58.5358"	65°45'26.3187"
R.B.-6	44°39'26.7731"	65°45'27.0277"

Proposed Marine Aquaculture Site
Rattling Beach Aquaculture Site
Kelly Cove Salmon Ltd.
Area = 29.08 hectares

SHEET 3 OF 5 NOTES:
(1.) 20 PROPOSED CAGES IN A 2x10 SUNKEN GRID LAYOUT.
(2.) CAGE DIAMETER IS 30.48m.
(3.) GRID SIZE IS 48.77m x 48.77m (160'X160').
(4.) THIS PLAN SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.
(5.) ANCHOR BLOCKS AND MOORING LINES ARE NOT DRAWN TO SCALE.
(6.) DIMENSIONS OF MOORING SYSTEM SHOWN ARE HORIZONTAL, BASED ON WATER DEPTH AT HIGH TIDE USING A MOORING SCOPE OF 5:1, 1 SHOT OF CHAIN, ANCHOR BLOCKS AND THE DESIRED LENGTH OF POLYSTEEL ROPE EXPRESSED BY THE CLIENT.

SUBSEQUENTLY, THE OFFSETS TO THE LEASE BOUNDARIES ARE HORIZONTAL DISTANCES FROM THE BACK OF THE ANCHOR BLOCK.



Legend:

CALCULATED POINT	C.P. ○
CALCULATED	(c.)
N.S. PROPERTY IDENTIFICATION NUMBER	P.I.D. #00000000
NORTHING / EASTING	N. / E.
LOCAL REGISTRY NUMBER	Book / Page
ORDINARY HIGH WATER MARK	O.H.W.M.
BOUNDARY DEALT WITH BY THIS PLAN	
OTHER BOUNDARY	
TIE LINES	
NOT TO SCALE	
MAJOR CONTOURS	
MINOR CONTOURS	
DEPTH SOUNDINGS	+ 00.0
CONCRETE MOORING	□
JAYCO ANCHOR	⊕

AQUACULTURE SITE DEVELOPMENT PLANS

SHOWING
AQUACULTURE CAGE CONFIGURATION
KELLY COVE SALMON LTD. / RATTLING BEACH
LOCATED AT:
BAY VIEW (RATTLING BEACH), ANNAPOLIS BASIN,
DIGBY COUNTY, NOVA SCOTIA

Client's Statement

I, Jeff Nickerson of Kelly Cove Salmon Ltd. acknowledge and confirm that Acker & Doucette Surveying Inc., make no representations or warranties with respect to the adequacy or the integrity of the proposed cage and mooring design of system depicted.

Dated this 19th day of October, 2016.

Jeff Nickerson

A&D JOB #149-16-1039

SHEET 4 OF 7 | DATE: October 19, 2016

NOTES:
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KELLY COVE SALMON LTD.

THE ASSOCIATION OF NOVA SCOTIA LAND SURVEYORS
FOUNDED 1951
Stephen D.F. Acker
N.S.L.S. 639
MEMBER

PURPOSE OF PLAN (SHEET 4 OF 7)
THE PURPOSE OF THIS PLAN IS TO DEMONSTRATE THE LOCATIONS OF ALL ANCHORS, CAGES, AND THE GRID/MOORING CONFIGURATION RELATIVE TO THE LEASE BOUNDARIES.

100 0 100 200 300

SCALE - 1 : 5,000 (METRIC)

Acker & Doucette Surveying Inc.
Nova Scotia Land Surveyors

240 Belleville Road, P.O. Box 84
Tusket, Yarmouth County
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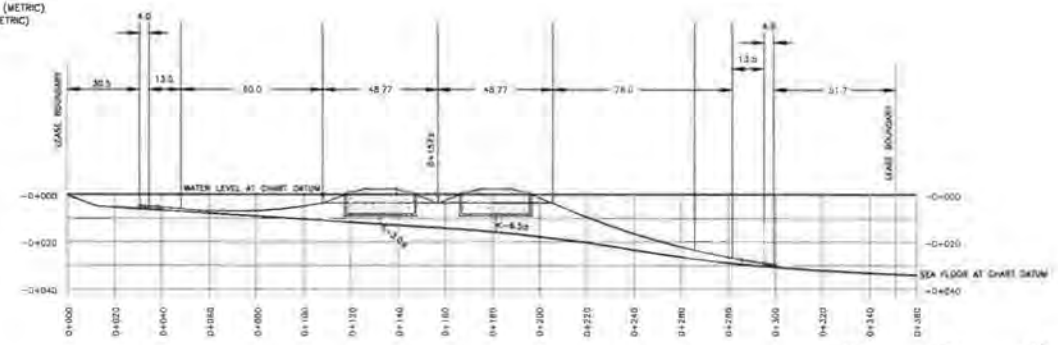
Shelburne, Shelburne County
Nova Scotia, Canada
B0T 1W0
Fax: (902) 648-0185
info@adsurveying.ca

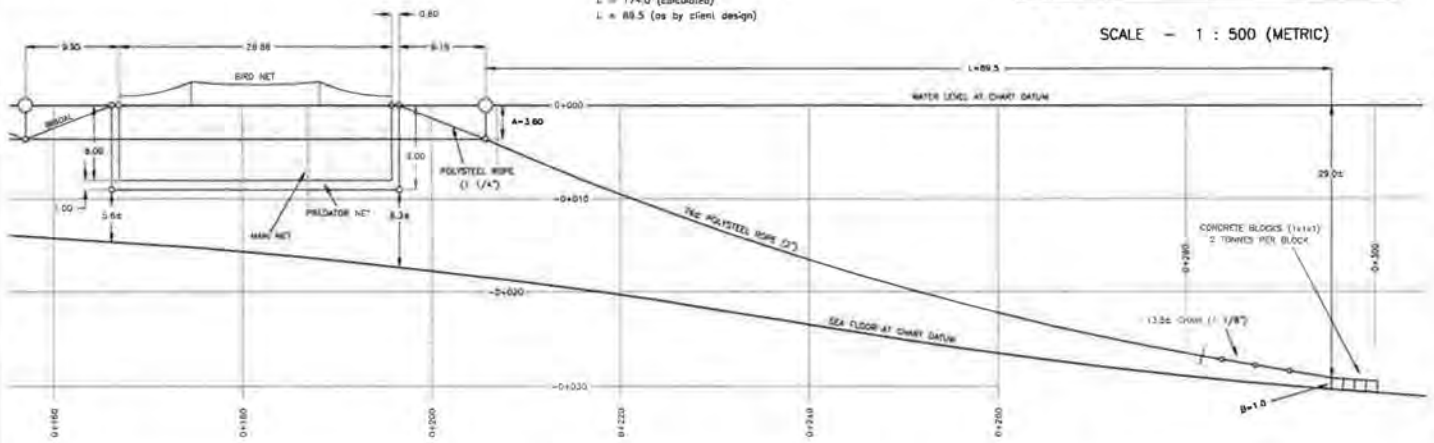
CROSS SECTION
HORIZONTAL SCALE = 1 : 2,000 (METRIC)
VERTICAL SCALE = 1 : 2,000 (METRIC)



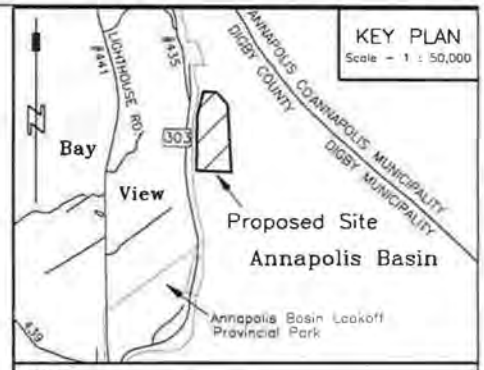
SCALE = 1 : 2,000 (METRIC)

DETAILED CROSS SECTION
HORIZONTAL SCALE = 1 : 500 (METRIC)
VERTICAL SCALE = 1 : 500 (METRIC)

5:1 Mooring Slope Calculation
L = [(max depth + max tide range) − A − B] x 5
L = [(30± + 9.4) − 3.6 − 1.0] x 5
L = 174.0 (calculated)
L = 88.5 (as by client design)



SCALE = 1 : 500 (METRIC)



Legend:

CALCULATED POINT	C.P. ○
CALCULATED	(c)
N.S. PROPERTY IDENTIFICATION NUMBER	P.I.D. #00000000
NORTHING / EASTING	N. / E.
LOCAL REGISTRY NUMBER	Book / Page:
ORDINARY HIGH WATER MARK	O.H.W.M.
BOUNDARY DEALT WITH BY THIS PLAN	
OTHER BOUNDARY	
TIE LINES	
NOT TO SCALE	
MAJOR CONTOURS	
MINOR CONTOURS	
DEPTH SOUNDINGS	+ 00.0
CONCRETE MOORING	□
JAYCO ANCHOR	⚓

AQUACULTURE SITE DEVELOPMENT PLANS

SHOWING

LATERAL CROSS-SECTION

KELLY COVE SALMON LTD. / RATTLING BEACH

LOCATED AT:

BAY VIEW (RATTLING BEACH), ANNAPOLIS BASIN,
DIGBY COUNTY, NOVA SCOTIA

Client's Statement

I, Jeff Nickerson of Kelly Cove Salmon Ltd. acknowledge and confirm that Acker & Doucette Surveying Inc., make no representations or warranties with respect to the adequacy or the integrity of the proposed cage and mooring design of system depicted.

Dated this 1

Jeff Nickerson

A&D JOB #149-16-1039

SHEET 5 OF 7 | DATE: October 19, 2016

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KELLY COVE SALMON LTD.

THE ASSOCIATION OF NOVA SCOTIA LAND SURVEYORS
FOUNDED 1951
Stephen D.F. Acker
N.S.L.S. 639
MEMBER

PURPOSE OF PLAN (SHEET 5 OF 7)
THE PURPOSE OF THIS PLAN IS TO DEMONSTRATE THE LATERAL CROSS SECTION AS SHOWN ON SHEET 4 OF 7, TO DEMONSTRATE DETAILS ASSOCIATED WITH THE CAGE INFRASTRUCTURE, ANCHOR BLOCKS AND MOORING LINES, AND SEAFLOOR PROFILE.

CROSS SECTION NOTES:
(1.) THIS PLAN IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.
(2.) FOR HORIZONTAL LOCATION OF EACH CROSS SECTION SEE SHEET 4 OF 7.
(3.) DISTANCES FROM SEA FLOOR MAY VARY DEPENDING ON TIDE AND CURRENT.
(4.) DISTANCES FROM SEA FLOOR ARE APPROXIMATE ONLY.
(5.) DEPTHS ARE REFERENCED TO CHART DATUM (LOWER LOW WATER, LARGE TIDE).

Acker & Doucette Surveying Inc.
Nova Scotia Land Surveyors

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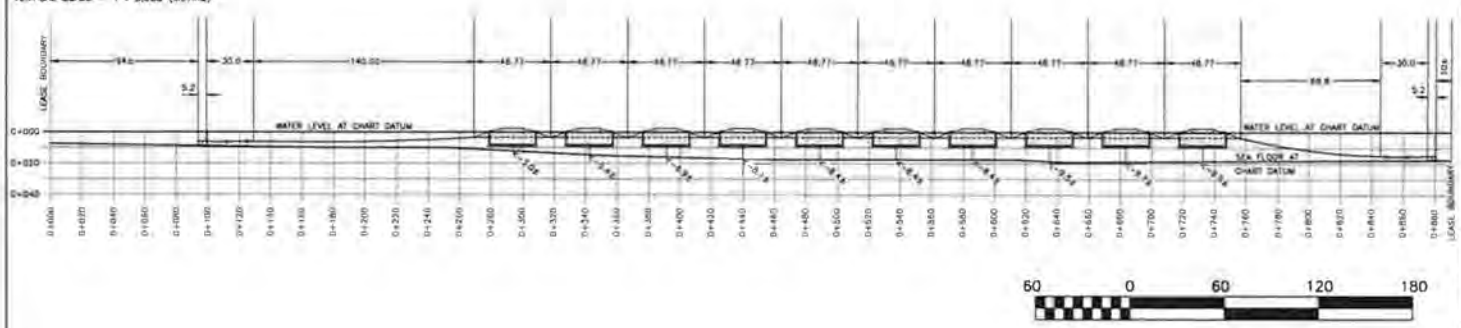
Nova Scotia, Canada
B0T 1W0
Fax: (902) 648-0185
info@adsurveying.ca

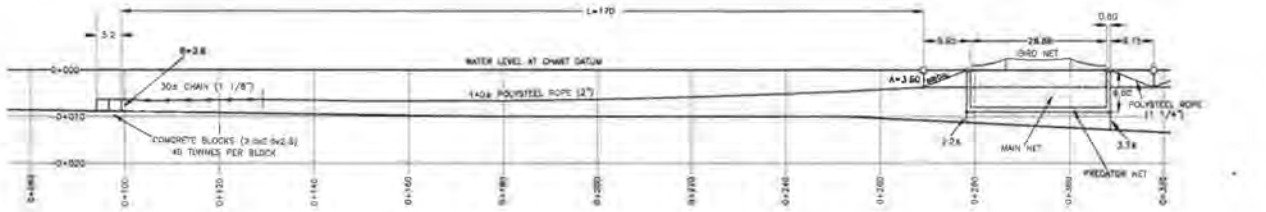
CROSS SECTION
HORIZONTAL SCALE – 1 : 3,000 (METRIC)
VERTICAL SCALE – 1 : 3,000 (METRIC)

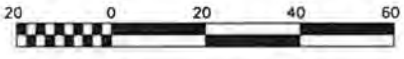


SCALE – 1 : 3,000 (METRIC)

DETAILED CROSS SECTION
HORIZONTAL SCALE – 1 : 1,000 (METRIC)
VERTICAL SCALE – 1 : 1,000 (METRIC)

5:1 Mooring Scope Calculation
L = [(max depth + max tide range) – A – B] x 5
L = [(30± + 9.4) – 3.6 – 2.8] x 5
L = 166.0 (calculated)
L = 170.0 (as by client design)





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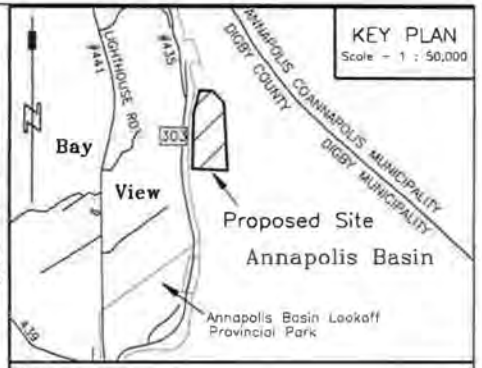

Legend:

CALCULATED POINT	C.P.
CALCULATED	(c.)
N.S. PROPERTY IDENTIFICATION NUMBER	P.I.D. #00000000
NORTHING / EASTING	N. / E.
LOCAL REGISTRY NUMBER	Book / Page
ORDINARY HIGH WATER MARK	O.H.W.M.
BOUNDARY DEALT WITH BY THIS PLAN	
OTHER BOUNDARY	
TIE LINES	
NOT TO SCALE	
MAJOR CONTOURS	
MINOR CONTOURS	
DEPTH SOUNDINGS	+ 00.0
CONCRETE MOORING	□
JAYCO ANCHOR	

AQUACULTURE SITE DEVELOPMENT PLANS

SHOWING:
LONGITUDINAL CROSS-SECTION
KELLY COVE SALMON LTD. / RATTLING BEACH
LOCATED AT:
BAY VIEW (RATTLING BEACH), ANNAPOLIS BASIN,
DIGBY COUNTY, NOVA SCOTIA

Client's Statement

I, Jeff Nickerson of Kelly Cove Salmon Ltd. acknowledge and confirm that Acker & Doucette Surveying Inc., make no representations or warranties with respect to the adequacy or the integrity of the proposed cage and mooring design of system depicted

Dated this 19th day of October, 2016

Jeff Nickerson

A&D JOB #149-16-1039

SHEET 6 OF 7 | DATE: October 19, 2016

NOTES:
(1.) ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
(2.) THIS PLAN IS A COMPILATION OF THIRD PARTY DATA. DATA WAS PROVIDED BY SWEENEY INTERNATIONAL MARINE CORP. ACKER & DOUCETTE SURVEYING INC. HAS COMPLETED THIS PLAN IN ACCORDANCE WITH THE "GUIDE TO MARINE FINFISH AQUACULTURE SITE REQUIREMENTS", DATED NOVEMBER 2007.
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THE ASSOCIATION OF NOVA SCOTIA LAND SURVEYORS
FOUNDED 1951
Stephen D.F. Acker
N.S.L.S. 639
* MEMBER *

PURPOSE OF PLAN (SHEET 6 OF 7)
THE PURPOSE OF THIS PLAN IS TO DEMONSTRATE THE LONGITUDINAL CROSS SECTION AS SHOWN ON SHEET 4 OF 7, TO DEMONSTRATE DETAILS ASSOCIATED WITH THE CAGE INFRASTRUCTURE, ANCHOR BLOCKS AND MOORING LINES, AND SEAFLOOR PROFILE.

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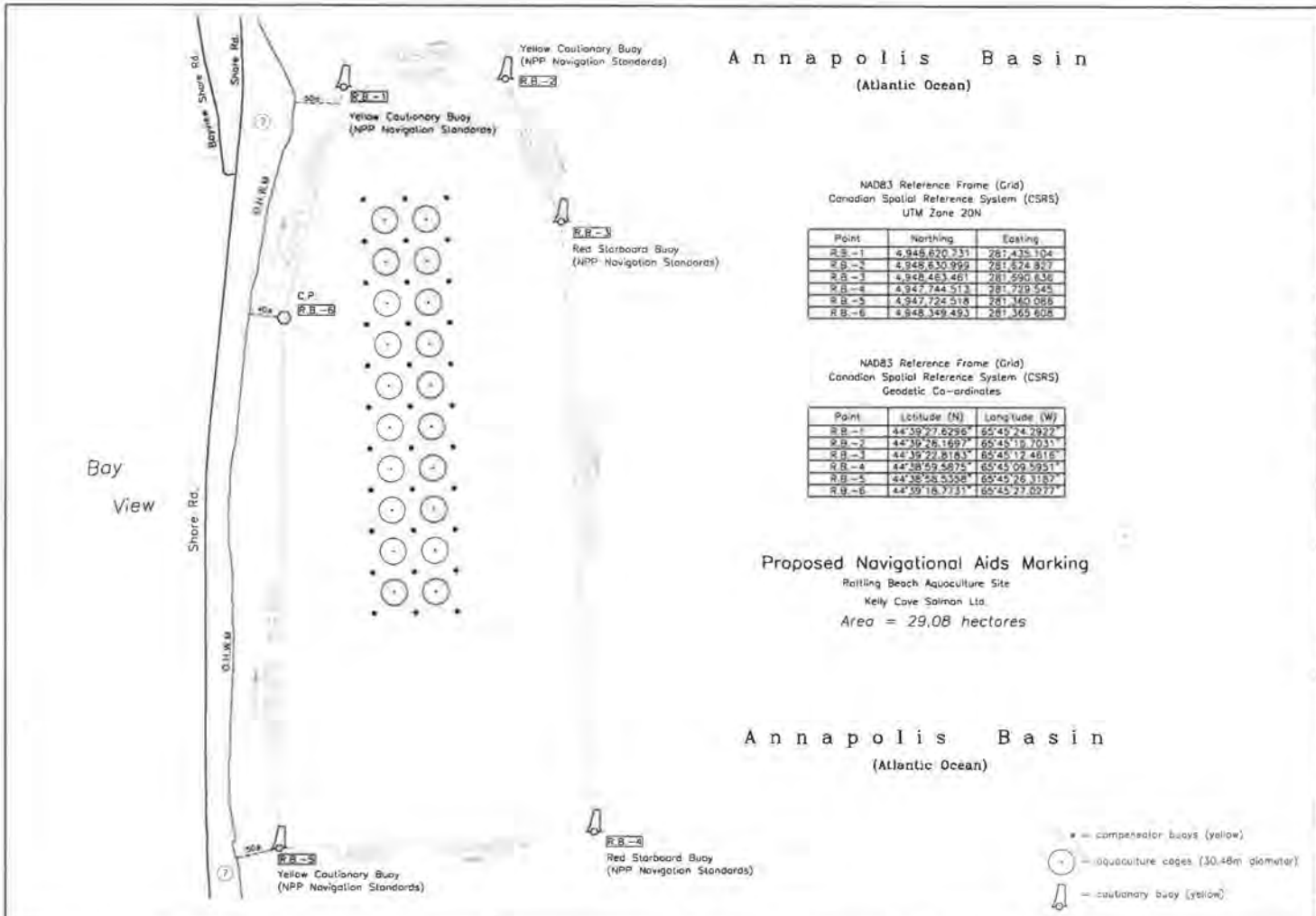


NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
UTM Zone 20N

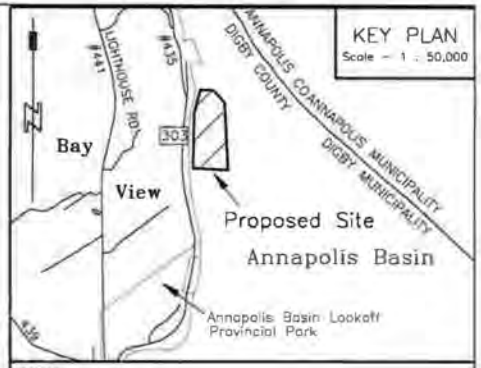
Point	Northing	Easting
R.B.-1	4,948,620.231	281,435.104
R.B.-2	4,948,630.999	281,624.827
R.B.-3	4,948,463.461	281,590.836
R.B.-4	4,947,744.513	281,729.545
R.B.-5	4,947,724.518	281,160.088
R.B.-6	4,948,349.493	281,369.606

NAD83 Reference Frame (Grid)
Canadian Spatial Reference System (CSRS)
Geodetic Co-ordinates

Point	Latitude (N)	Longitude (W)
R.B.-1	44°39'27.6296"	65°45'24.2922"
R.B.-2	44°39'28.1697"	65°45'15.7031"
R.B.-3	44°39'22.8183"	65°45'17.4616"
R.B.-4	44°38'59.5875"	65°45'09.5951"
R.B.-5	44°38'58.5358"	65°45'26.3182"
R.B.-6	44°39'18.7731"	65°45'27.0977"

Proposed Navigational Aids Marking

Rattling Beach Aquaculture Site
Kelly Cove Salmon Ltd.
Area = 29.08 hectares



Legend:

CALCULATED POINT	C.P. ○
CALCULATED	(c.)
N.S. PROPERTY IDENTIFICATION NUMBER	P.I.D. #00000000
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BOUNDARY DEALT WITH BY THIS PLAN	———
OTHER BOUNDARY	———
TIE LINES	- - - -
NOT TO SCALE	- - - -
MAJOR CONTOURS	———
MINOR CONTOURS	———
DEPTH SOUNDINGS	+ 00.0
CONCRETE MOORING	□
JAYCO ANCHOR	⚓

AQUACULTURE SITE DEVELOPMENT PLANS

SHOWING
PROPOSED NAVIGATIONAL AIDS MARKING PLAN
KELLY COVE SALMON LTD. / RATTLING BEACH
LOCATED AT:
BAY VIEW (RATTLING BEACH), ANNAPOLIS BASIN,
DIGBY COUNTY, NOVA SCOTIA

Client's Statement

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Dated this 19th day of October, 2016.

[redacted]

Jeff Nickerson

A&D JOB #149-16-1039

SHEET 7 OF 7 | DATE: October 19, 2016

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N.S.L.S. 639
* MEMBER *

PURPOSE OF PLAN (SHEET 7 OF 7)
THE PURPOSE OF THIS PLAN IS TO DEMONSTRATE THE LOCATION AND TYPES OF ALL NAVIGATIONAL AIDS RELATIVE TO THE PROPOSED LEASE BOUNDARIES.

100 0 100 200 300
SCALE - 1 : 5,000 (METRIC)

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Nova Scotia Land Surveyors

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NS1039 Rattling Beach – Boundary Amendment

Finfish Marine Aquaculture Development Plan

Kelly Cove Salmon
134 North Street. Bridgewater. NS. B4V2V6

Table of Contents

Section 1: Optimum Use of Marine Resources

Aquaculture site Rattling Beach (#1039) is owned and operated by Kelly Cove Salmon Ltd. (KCS). The marine farm consists of twenty, 49-m grid cells in a 2 x 10 configuration. The proposed lease incorporates all aquaculture-related gear, above and below the water line, with lease dimensions of 190 x 180 x 720 x 370 x 630 x 280 m, resulting in a farm area of 29.08 ha. The boundary amendment is necessary to incorporate all gear within the lease. KCS is not requesting an increase in production nor additional cages on site.

The general area around site #1039 appears on Canadian Hydrographic Service (CHS) Nautical chart #4396 (Annapolis Basin) and National Topographic System Map, Sector 021A (Annapolis Royale, Nova Scotia). The coordinates, obtained using DGPS, of the corners of the proposed lease area are located in Table 1.

Site #1039 is located on the western side of the Annapolis Basin, near the mouth of the Digby Gut channel in Digby County, Nova Scotia (Fig. 1). The site is approximately 2.5 km north of Digby. Rattling Beach is located in the Annapolis Basin, along with seven marine shellfish and two other marine finfish aquaculture sites. The basin also provides many different resources for humans and animals. Fishing, specifically lobster, scallops, and harvesting of rockweed, are also important activities contributing to the economic wellbeing of cities and towns surrounding the basin. In addition, this area is a significant habitat for migratory birds supported by the presence of unique microenvironments such as salt marshes, bogs, and fens. The basin is a tourist destination, were people enjoy whale watching, kayaking, camping, recreational fishing, and boating to name a few activities, in and surrounding Annapolis Basin. KCS has implemented policies and procedures to manage their farms and protect wildlife.

Aquaculture in the Annapolis Basin has been able to successfully co-exist with other resources in the area, providing increased employment and industry diversity. KCS is Cooke Aquaculture's farming division, and Cooke employs 152 people in Nova Scotia through its various divisions. Rattling Beach is an existing site and does not displace or adversely affect other industries in the area. Extensive benthic and water quality monitoring programs are in place at the site. KCS participates in various salmon restoration projects through Atlantic Canada and uses various operational measures to ensure wildlife interaction is as minimal and positive as possible.

Table 1. Coordinates for the Boundary Amendment in Annapolis Basin

APPROXIMATE SITE CO-ORDINATES (NAD 83)		
Corner	Latitude	Longitude
1	44° 39' 27.6"	65° 45' 24.3"
2	44° 39' 28.2"	65° 45' 15.7"
3	44° 39' 22.8"	65° 45' 12.5"
4	44° 38' 59.6"	64° 45' 09.6"
5	44° 38' 58.5"	64° 45' 26.3"
6	44° 39' 18.8"	64° 45' 27.0"
Approximate Site Center	44° 39' 13.6"	65° 45' 19.8"

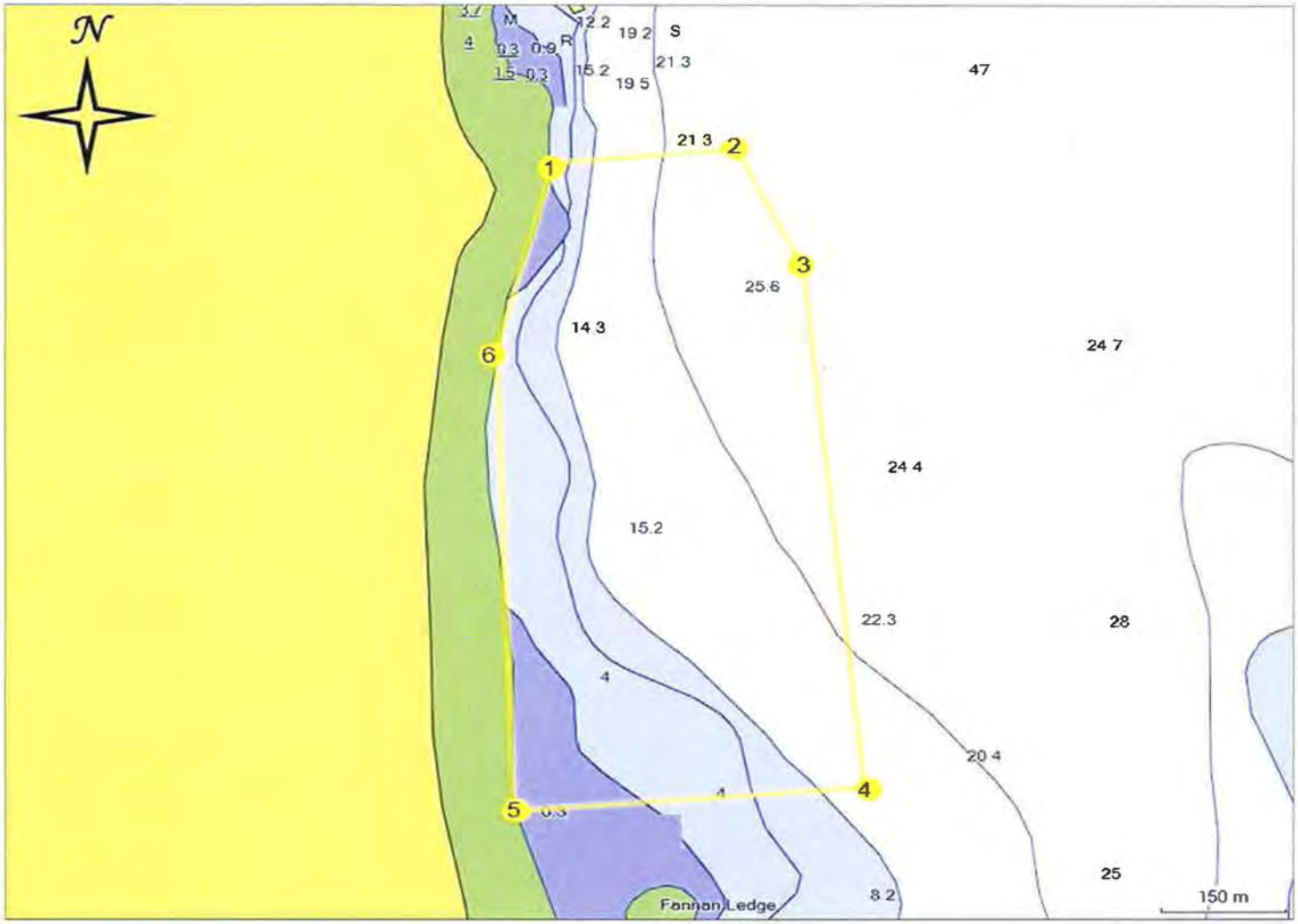

Figure 1. Proposed Boundary Location for Rattling Beach #1039 in Annapolis Basin

Section 2: The Contribution of the Proposed Operation to Community and Provincial Economic Development

2.1 Production Plan

The expected grow out period is 22 months. In future years, actual stocking number may be lower or higher than projections and is determined by operational performance outcomes experienced at the site.

Table 2. Projected maximum values for production cycle (assuming a mortality of 10% and an FCR of 1.2)

Species and Strain	Stock Source (hatchery)	Number of Cages and Type	Cage Size (m)	Rearing & Predator Net Volume (m^3)		Total Number of Fish Introduced	Mean Weight of Fish Introduced (g)	*Length of Grow-out Period	*Maximum Stocking Density (kg/m^3)	*Maximum Biomass (kg)	Average Harvest Weight (kg)
Atlantic Salmon, Saint John River	Any KCS owned and operated hatchery	20, HDPE	100m	Pred.	8042	**660,000**	**150**	**20-21 months**	**25**	**3,504,000**	**6**
				Rear.	7238						

*Approximate time frame

Table 3. Harvest Plan Details

End Date	Date of Re-entry	Expected Fallow Period (months)
Jan 2018	June 2018	4

2.2 Infrastructure

Rattling beach is an existing site with the required infrastructure required to support operations already in place. Site infrastructure includes a feed barge and net cages. A lobster boat and/or skiff is used for transportation to and around the site.

Containment is an essential part of a marine finfish farm. The equipment and infrastructure must be of sturdy construction and take many factors into consideration, such as the weather, currents, ice flow, etc. to make sure the fish will stay contained.

In addition to the essential containment of fish in the marine environment, the equipment and infrastructure must be considered from a fish health perspective. Mechanical damage from either ill repaired equipment or infrastructure or improper choice of equipment or infrastructure is a welfare and fish health concern.

Cage enclosures must account for the control of predators in the natural environment as predators such as birds and seals can cause stress, injuries and losses.

GMG is the Fish Services division of Cooke Aquaculture Inc. and a sister company to Kelly Cove Salmon Ltd. GMG provides the moorings for installation and the specifications were determined to be adequate based on product testing completed by GMG.

The moorings were designed based on historical winds, wave heights, oceanography, currents and KCS's 30 years of farming experience. Each area of the grid was designed to withstand different maximum loads based on the previous criteria.

The composition of the cage components such as the hand rail, float pipes, bird stands and weight rings are HDPE.

Multiple KCS vessels are used to service the cages at the site depending on the required task. Vessels included are; feeding boats, feed barge, skiffs and maintenance barge.

While in use, the vessels will be moored to the cages, otherwise they will be moored to the wharf or in service at other locations. A feed barge has its own unique mooring system and will remain on site with the cages.

Access to shore is necessary for all marine finfish sites. Wharves may be private or shared by multiple users or multiple sites and are suitable for site activities. The wharf used by this facility is the Digby Town Wharf.

2.3 Services and Suppliers

Although Kelly Cove Salmon is a vertically integrated company, it utilizes local suppliers whenever possible. Types of suppliers used by KCS in Nova Scotia include: divers, mechanics, boat repair facilities, hardware providers, welders, heavy equipment operators, crane operators, marine supplies, fuel distribution companies, environmental consultants, electricians, boat brokers, boat builders, engine suppliers, hotels, restaurants, and ferries.

2.4 Employment

Rattling Beach site is an important component of Kelly Cove Salmon's success in Nova Scotia. Kelly Cove Salmon (KCS) is Cooke Aquaculture's farming division. Cooke Aquaculture employs over 1600 people in Atlantic Canada, with 152 people employed in NS. Kelly Cove Salmon's positions range from feed and maintenance technicians, fish health and environmental management professionals and technical support to administrative positions. The majority of positions offered by KCS in Nova Scotia are full-time. Cooke's operations also contribute to employment in service and supply industries, as listed in 2.3 – Services and Suppliers. In addition, our feed division, Northeast Nutrition Inc., is based in Truro and our Distribution Company, AC Covert is based in Dartmouth.

2.5 Other Economic Contributions to the Local Community and Province

KCS contributes to the local economy in Digby and Nova Scotia by utilizing the services and suppliers listed in section 2.3 – Services and Suppliers. Services and suppliers are located within Nova Scotia, and whenever possible, Digby.

2.6 Financial Viability

See Appendix B for a letter asserting financial viability of the operation.

2.7 Adverse Economic Impacts

The Rattling Beach site does not displace any other industry. Kelly Cove Salmon actively communicates with other local industries and permits local fishers to utilize the lease area for fishing. There are no expected adverse economic impacts.

Section 3: Fisheries Activities in the Public Waters Surrounding the Proposed Aquacultural Operation

3.1 Status of Fisheries Activities

3.1.1 Commercial Fisheries

There are over 500 species of fish found in Atlantic Canada and most of them are present off the coast of Nova Scotia. However, the number of commercially harvested finfish is much less than this and can be roughly grouped into two categories: 1) groundfish, which occur on or close to the seafloor, and 2) pelagic fish, which occur in the water column usually away from the bottom.

Various shellfish and seaweeds also support commercial fisheries. In 2015, the top five groundfish and pelagic species landed included herring, haddock, hake, redfish spp. and pollock (Table 4; Fisheries and Oceans 2017a).

Table 4. Atlantic Coast Commercial Landings for 2015
Note: sourced from Fisheries and Oceans (2017a)

2015 ATLANTIC COAST COMMERCIAL LANDINGS, BY REGION (metric tonnes, live weight)				
		Nova Scotia		Atlantic
	Maritimes	Gulf	Total	Total
Groundfish				
Atlantic Cod	1,458	22	1,480	12,234
Haddock	17,460	0	17,460	17,689
Redfish spp.	5,971	0	5,972	10,406
Halibut (Atlantic)	2,651	68	2,718	3,942
Flatfishes	1,612	130	1,742	9,124
Greenland turbot	X	X	X	14,059
Pollock	3,855	0	3,855	4,046
Hake	7,842	6	7,848	8,089
Cusk	X	0	0	200
Catfish	0	0	0	0
Skate	X	0	0	241
Dogfish	X	X	0	0
Other	2,150	90	2,240	2,299
Total	**43,292**	**319**	**43,611**	**82,330**
Pelagic & other finfish				
Herring	40,939	5,638	46,576	114,200
Mackerel	852	332	1,183	4,143
Swordfish	1,579	0	1,579	1,579
Tuna	574	76	650	879
Alewife	X	X	434	2,202
Eel	19	2	21	241
Salmon (Atlantic)	0	0	0	0
Smelt	X	X	0	114
Silversides	0	0	0	254
Shark	89	0	89	89
Capelin	0	0	0	36,942
Other	27	0	27	67
Total	**44,511**	**6,049**	**50,560**	**160,709**
GRAND TOTAL	**246,581**	**16,497**	**263,078**	**687,967**

Note: X = Values have been suppressed to meet confidentiality requirements

Groundfish

There are many commercially harvested species of groundfish off the south shore of Nova Scotia. The most common traditional fisheries include cod, haddock, and pollock. Fisheries for cod, haddock, and pollock occur mainly on the large fishing banks and in the Bay of Fundy. The fishery is conducted using mobile gear (otter trawl) and fixed gear (longline, handline, and gillnet) with the most active time of year being July through September (Fisheries and Oceans Canada 2014. Haddock in 4X is in a rebuilding phase with a positive outlook; recruitment trends look very positive with spawning stocks continuing to increase in biomass since the last decade (Fisheries and Oceans Canada 2017c. However, fish size is decreasing at age (Showell et al. 2013). Cod in 4X demonstrate poor juvenile recruitment and low biomass levels, although there is considerable uncertainty regarding stock status; this stock is accessed by a very large number of fishing vessels and sectors (Clark et al. 2015). O'Boyle (2012) listed Western Scotian Shelf cod as critical. The pollock fishery in the Western Scotian Shelf (WSS), which reached historic lows in 2000, has since increased due to improved recruitment; though, it is still considered to be in the cautious (i.e. considered neither healthy nor critical) state (O'Boyle 2012). The commercial value for haddock, cod and pollock for the Maritimes region of Nova Scotia is $26 million, $3 million and $4 million, respectively (Fisheries and Oceans 2017b).

Flatfish are also important commercial groundfish but they are caught mostly on the fishing banks and deeper areas (Fisheries and Oceans Canada 2014). In NAFO Divisions 4X5Y, these species are halibut, yellowtail flounder, American plaice, winter flounder, and witch flounder (Fisheries and Oceans Canada 2014). Overall, most flatfish species in this area are in decline or at low levels. Winter flounder is better in overall status with some positive indicators present (O'Boyle 2012), but American plaice stock status was still in decline as of 2009 and COSEWIC considers the Maritime population to be threatened (COSEWIC 2009a). O'Boyle (2012) had considered silver-hake stock status to be critical; however, recent biomass estimates have shown a large increase in number in 2014 (DFO 2015a). Halibut stocks, however, appear to be improving and the biological information for this species continues to develop (DFO 2015b). The commercial value for halibut and flatfishes for the Maritimes region of Nova Scotia is $37 million and $2.5 million, respectively (Fisheries and Oceans 2017b).

The Rattling Beach site is present in the Maritimes Statistical Districts 38 & 39. For 2015, 177,099 kg of groundfish was landed in this district with a value of $420,741. Key species landed include: Atlantic cod, witch flounder, haddock, halibut, monkfish, Pollock, redfish, sculpin, skate, white hake, and winter flounder. Both sculpin and winter flounder were noted as species caught for bait (C. O'Neil, pers. com.).

Figures 2 – 5 show the approximate groundfish landings off the coast of Nova Scotia between 1999 and 2003 (Fisheries and Oceans Canada 2014.)

Species list

Atlantic pollock (*Pollachius virens*)
Haddock (*Melanogrammus aeglefinus*)
Atlantic cod (*Gadus morhua*)
American plaice (*Hippoglossoides platessoides*)
Winter, yellowtail, and witch flounder (*Pseudopleuronectes americanus, Limanda ferruginea* and *Glyptocephalus cynoglossus*)

Atlantic halibut (*Hippoglossus hippoglossus*)
Monkfish (*Lophius americanus*)
Skate (unknown species)
Cusk (*Brosme brosme*), restricted to by-catch only Sculpin (unknown species)
Redfish (*Sebastes* sp.)
Silver hake (*Merluccius bilinearis*)
White hake (*Urophycis tenuis*), restricted to by-catch only

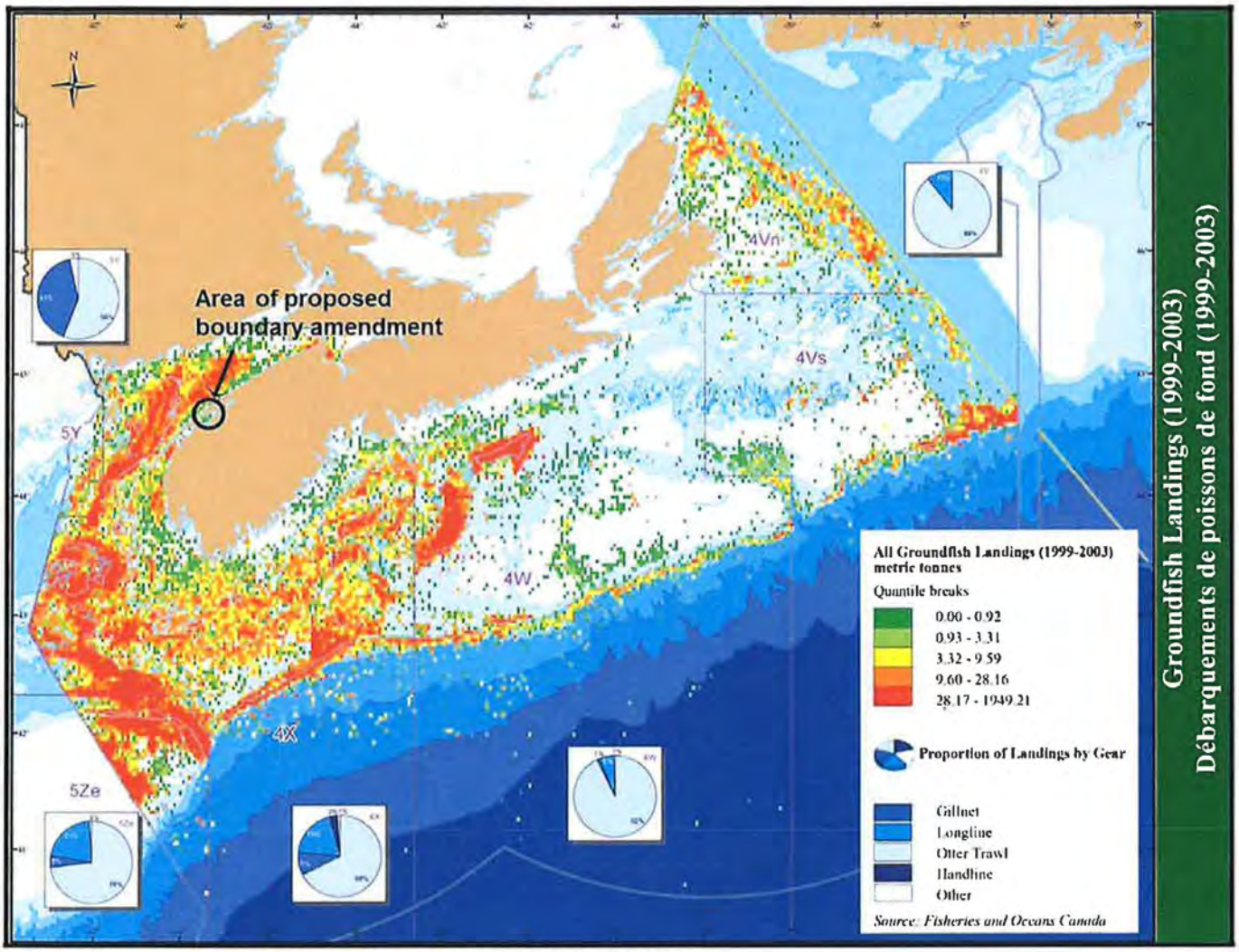

Figure 2. Commercial Groundfish Landings (1999 – 2003)

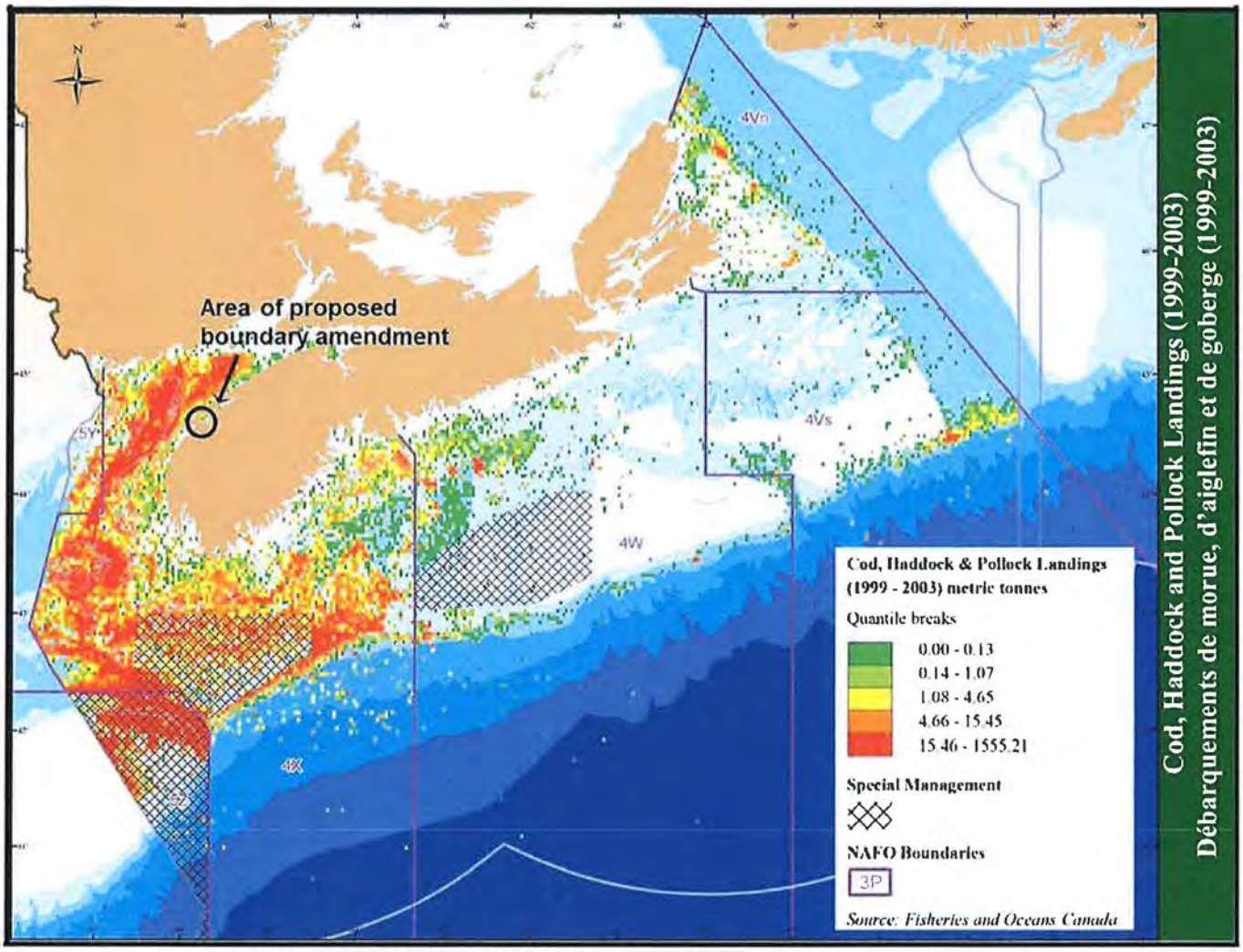

Figure 3. Commercial Cod, Haddock, and Pollock Landings (1999 – 2003)

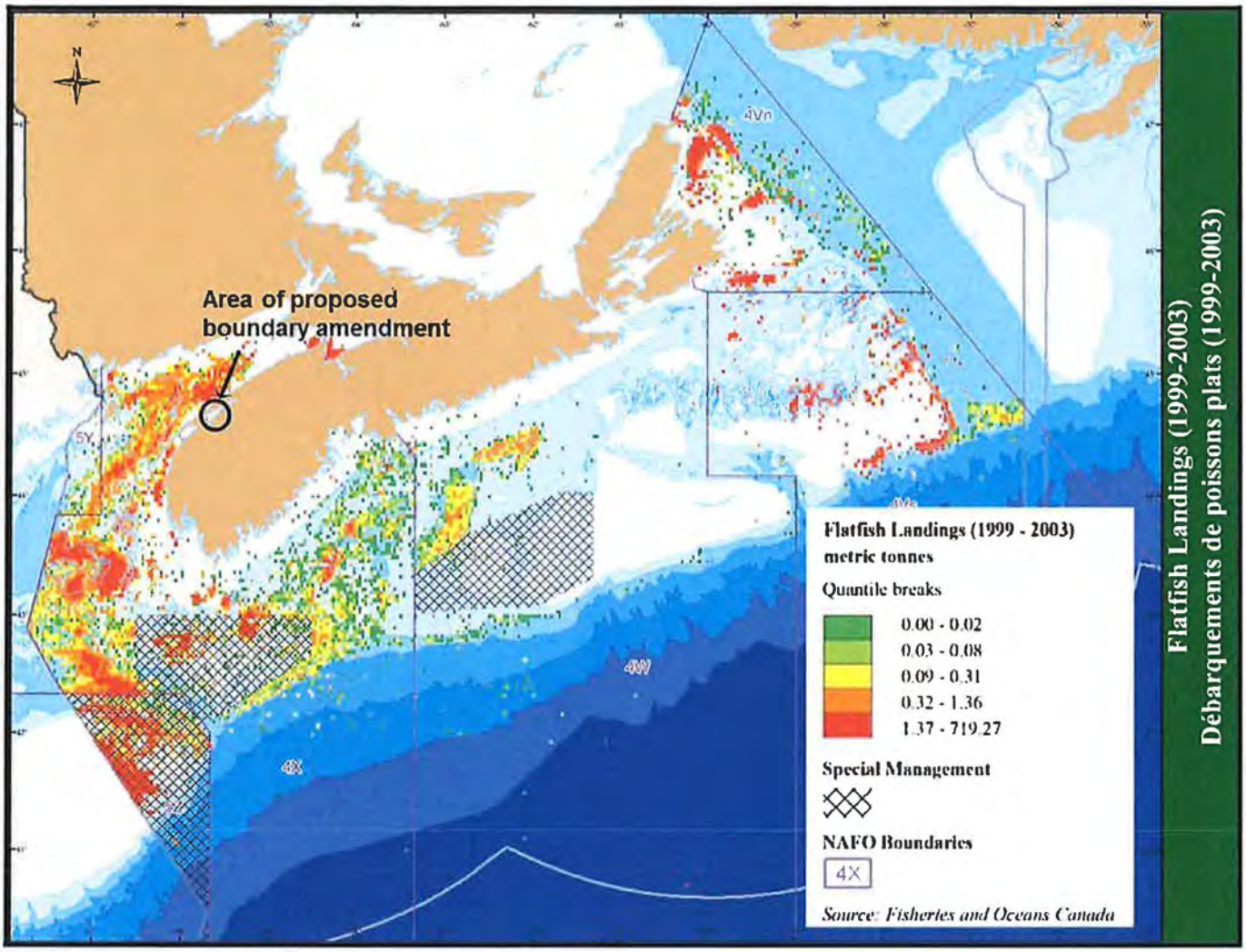

Figure 4. Commercial Flatfish Landings (1999 – 2003)

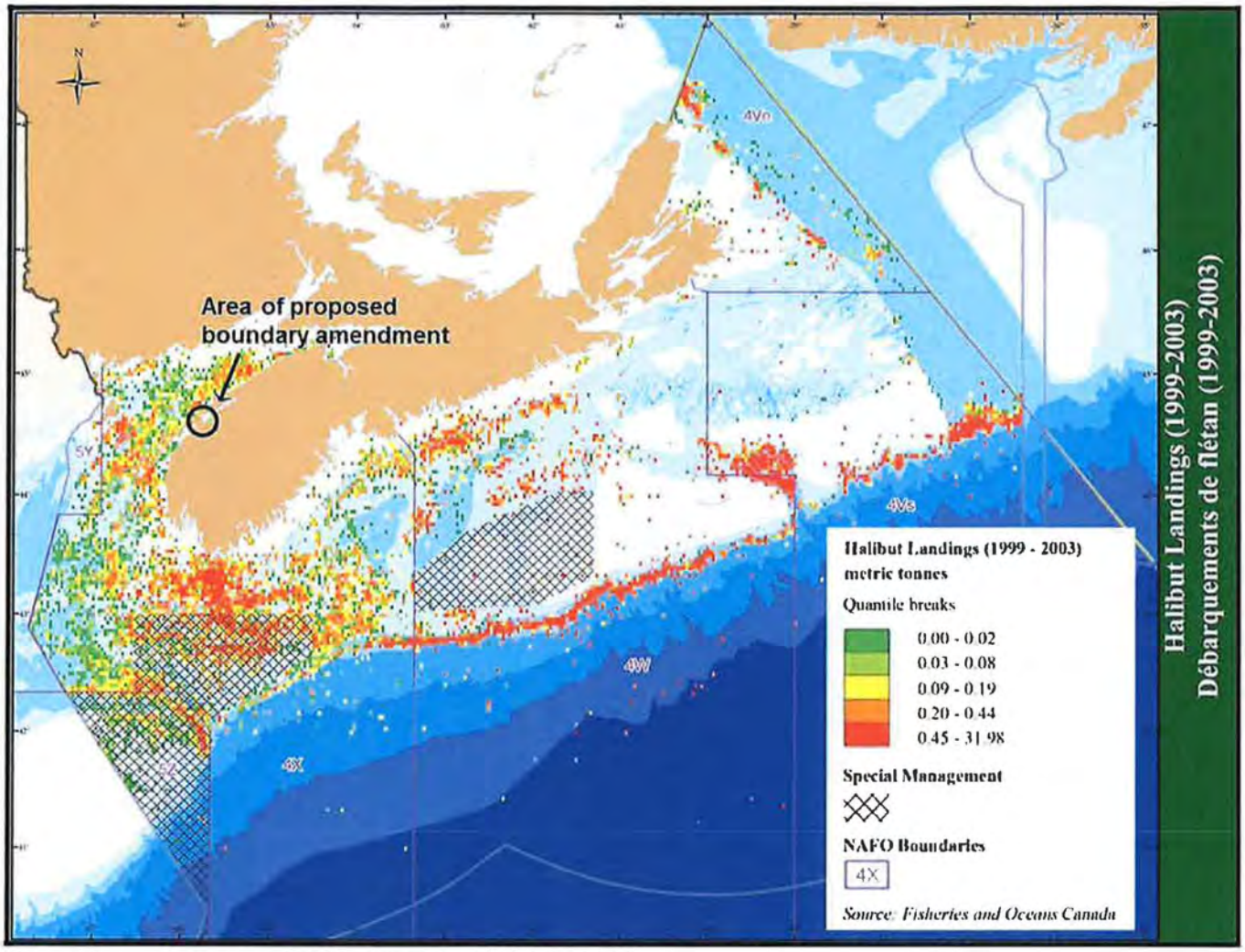

Figure 5. Commercial Halibut Landings (1999 – 2003)

Pelagics

Southwest Nova Scotia / Bay of Fundy herring spawning component have been of concern for a decade or more, and stock status reports have indicated the need for rebuilding (Clark et al. 2012). Clark et al. (2012) presented evidence of the decline in spawning grounds, targeting of juveniles in the fishery, and declines in catches. Recent biomass estimates have shown uncertainty; however, long-term trends show a general decrease in German Bank from 1999 and an increase in Scots Bay from 2005 (DFO 2016). Approximated moving biomass averages for the Southwest Nova Scotia / Bay of Fundy area have indicated slight decreases over the past three years (DFO 2016c). The herring fishery largely takes place on dense summer feeding, overwintering, and spawning locations and is dominated by purse seine, gillnet, and weir (Figure 6; DFO 2016). Commercial value of the herring fishery for the Maritimes region of Nova Scotia is $14 million (Fisheries and Oceans 2017b).

The Northwest Atlantic mackerel stock ranges from North Carolina to Labrador and has northern and southern spawning contingents (TRAC 2010). The Department of Fisheries and Oceans considered the status of the Atlantic mackerel stock to be in critical condition due to low abundances in egg and spawning biomass and appropriate reconstruction methods are being implemented (DFO 2017a). The mackerel fishery is conducted with traps, gillnets, and handlines and is primarily an inshore fishery of the spring and summer months and extends into more offshore waters for the fall and winter (Fisheries and Oceans Canada 2014a). Because of high fishing mortality, mackerel landings of recent years (2011 - 2016) have decreased within the Northwest Atlantic region when compared to numbers from years previous (DFO 2017a). Figure 7 illustrates the general distribution of mackerel fishing activities in Atlantic waters. Commercial value of the mackerel fishery for the Maritimes region of Nova Scotia is $4.5 million (Fisheries and Oceans 2017b).

The small pelagic fisheries are Scotia-Fundy wide, meaning that any gillnet license holder may fish in the area.

The North Atlantic swordfish stock has been rebuilt after a 10-year recovery plan commencing in 1999. This fishery is now sustainable and well controlled with Canadian annual landings of 1,505 t in 2013 being exported to the United States at a value of $12.3 million (Fisheries and Oceans Canada 2015a). Swordfish (Fig. 8) are caught using longline and harpoon primarily along the edge of Georges Bank, the Scotian Shelf, and the Grand Banks in vessels often less than 65 feet; DFO lists principal ports in Nova Scotia as Woods Harbour, West Head, and Pubnico (Lower East, Lower West, East) (Fisheries and Oceans Canada 2016a). The bluefin tuna (Fig. 9) is the most common tuna found off the coast of Nova Scotia and is fished with tended line, rod and reel, harpoon, longline, and trap nets (Fisheries and Oceans Canada 2014). The International Commission for the Conservation of Atlantic Tunas (ICCAT 2014) consider Atlantic bluefin and albacore tuna stocks overfished from 2010 and 2012 stock assessments, which indicated low recruitment. The bluefin and albacore tuna stocks are of a critical status whereas the bigeye and yellowfin tuna stocks are considered healthy (O'Boyle 2012). Commercial value of swordfish and tuna for the Maritime region of Nova Scotia is $12.9 million and $4.8 million, respectively.

In Maritimes Statistical Districts 38 & 39, pelagic landings and associated value was not separated in the provided "other species" category. For 2015, 11,262,144 kg was landed comprising of species other than groundfish and lobster with a value of $29,096,031. Key species include: Elver and herring (C. O'Neil, pers. com.).

Species list

North Atlantic bluefin tuna (*Thunnus thynnus*)
Swordfish (*Xiphias gladius*)
Elver (*Anguilla rostrata*)
Atlantic herring (*Clupea harengus*)
Atlantic mackerel (*Scomber scombrus*)
Alewife (*Alosa pseudoharengus*)

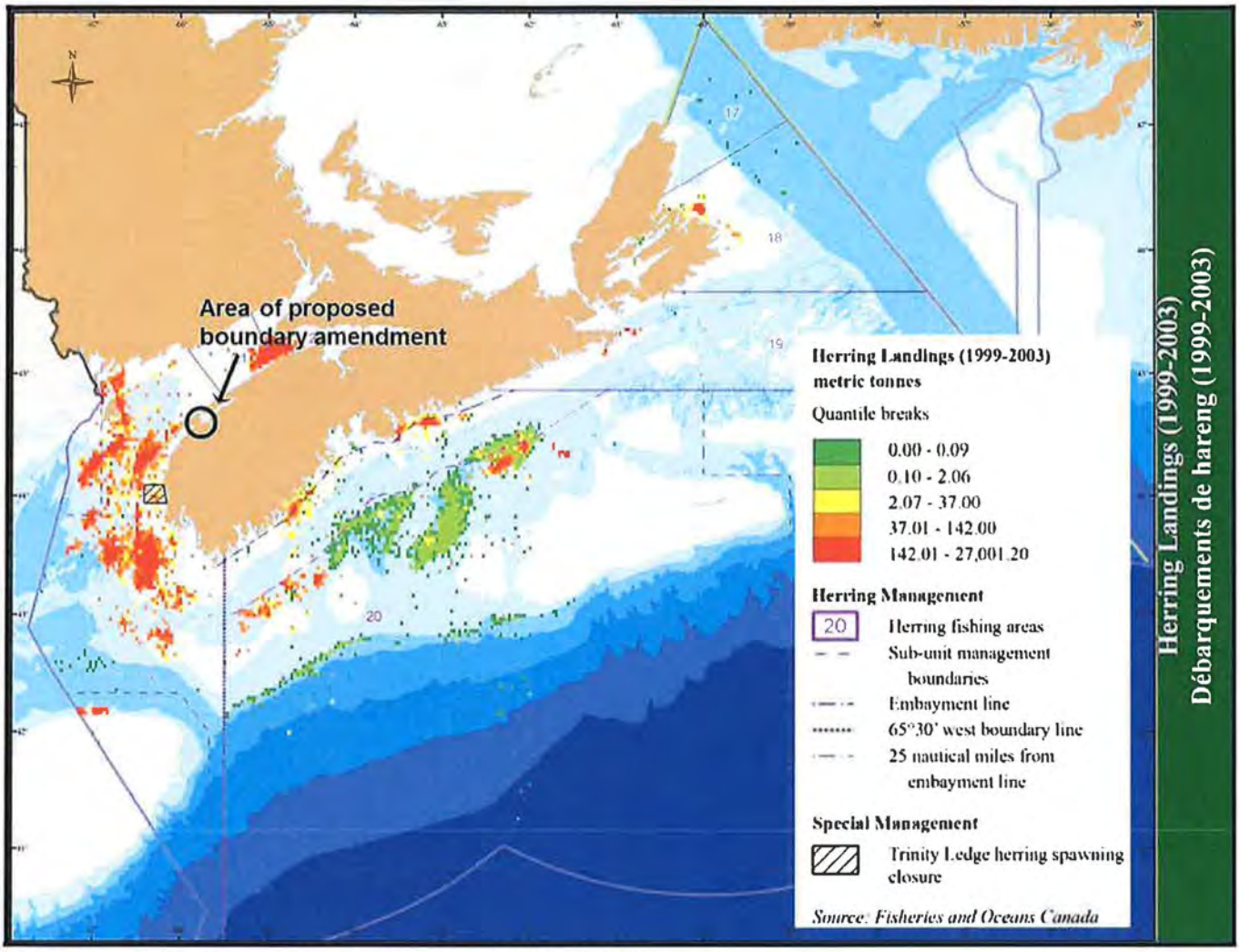

Figure 6. Commercial Herring Landings (1999 – 2003)

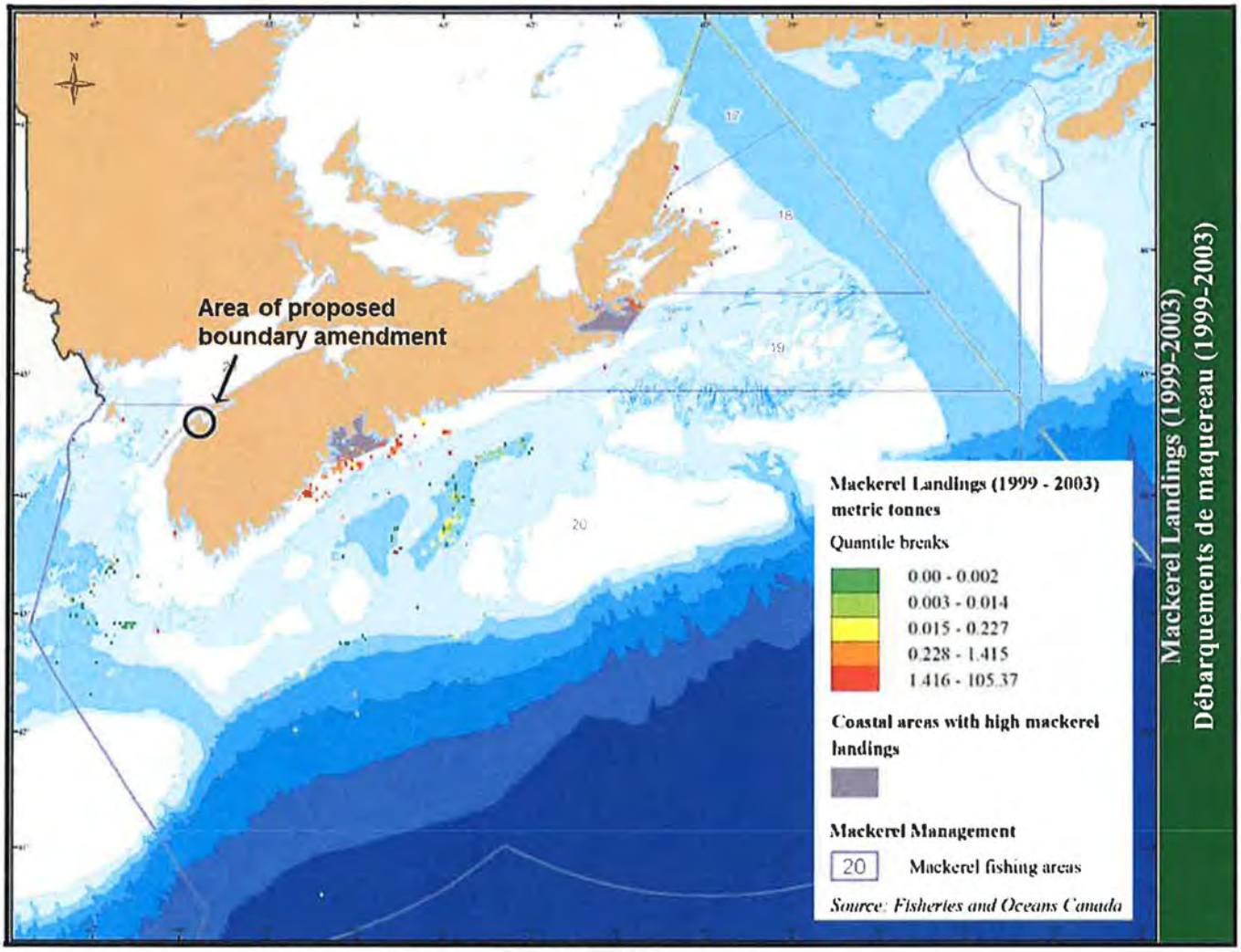

Figure 7. Commercial Mackerel Landings (1999 – 2003)

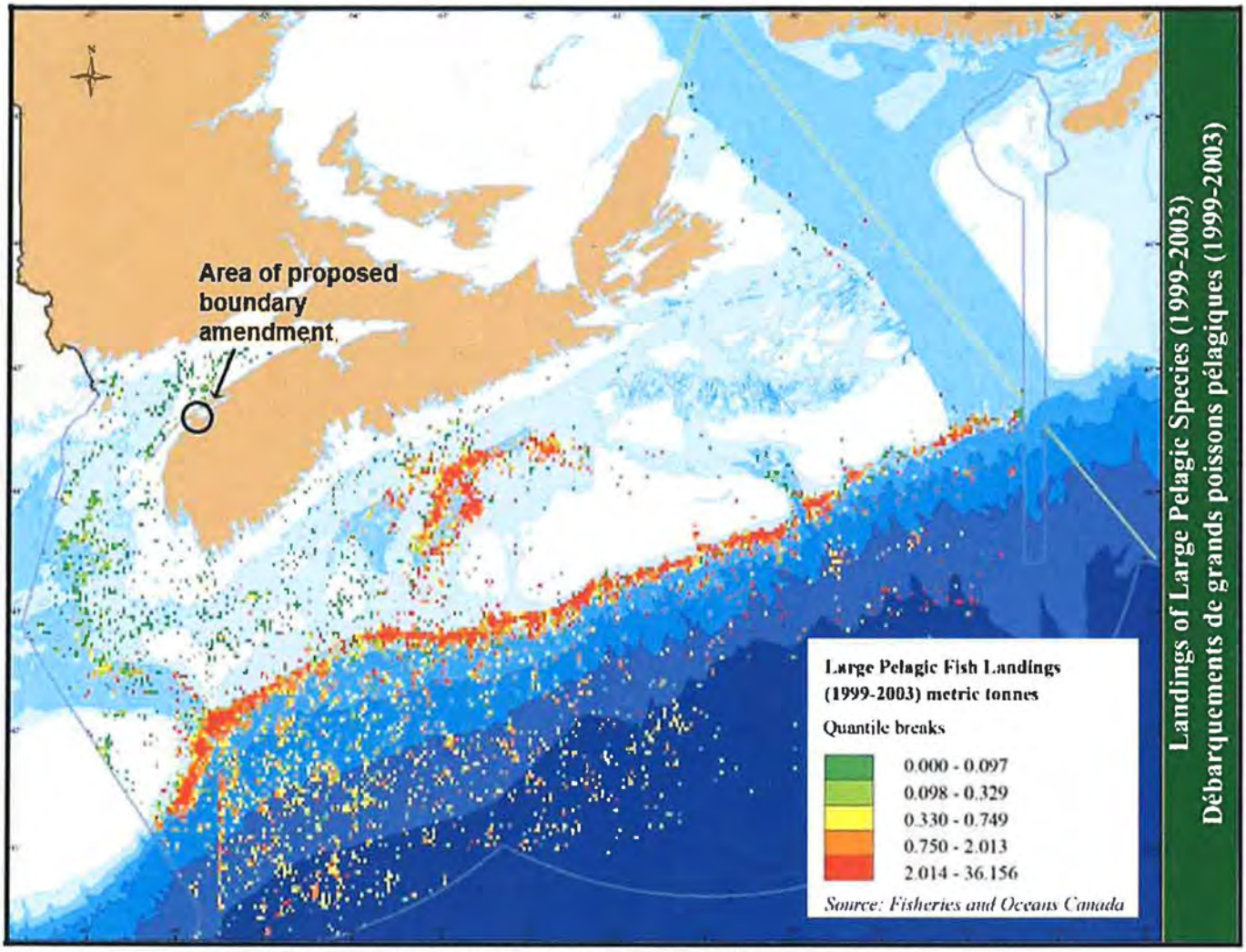

Figure 8. Commercial Large Pelagic Fish Landings, Excluding Bluefin Tuna (1999 – 2003)

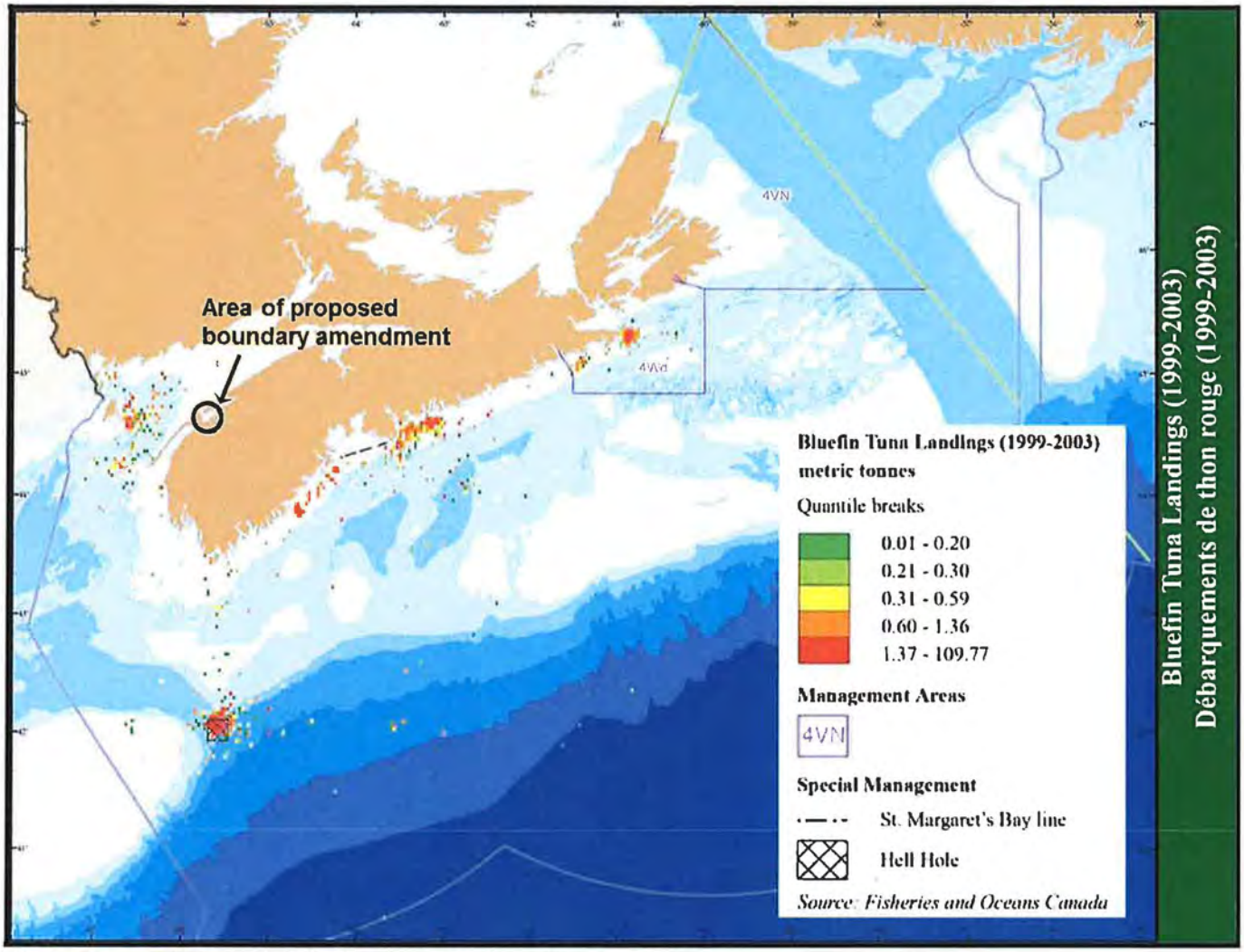

Figure 9. Commercial Bluefin Tuna Landings (1999 – 2003)

Shellfish and Other Invertebrates

There are several shellfish species that are harvested off Nova Scotia and included are such commercially important species as scallops, lobsters, shrimp, clams/quahaug and crabs (Table 5; Fisheries and Oceans 2017a). Also harvested are sea cucumber and sea urchins.

Table 5. Atlantic Coast Commercial Landings for 2015
Note: Source from Fisheries and Oceans (2017a)

2014 ATLANTIC COAST COMMERCIAL LANDINGS, BY REGION (metric tonnes, live weight)				
Species	**Maritimes**	**Nova Scotia Gulf**	**Total**	**Atlantic Total**
Shellfish				
Clams / quahaug	16,424	9	16,433	31,292
Oyster (1)	0	X	48	1,370
Scallop (2)	55,233	64	55,297	61,061
Squid	X	0	X	15
Mussel (3)	0	0	0	0
Lobster	45,355	3,900	49,255	90,875
Shrimp	X	X	25,711	134,603
Crab, Queen	12,036	5,586	17,623	93,519
Crab, Other	435	326	761	5,167
Whelks	X	0	X	3,607
Cockles	X	0	X	124
Sea cucumber	2,551	0	2,551	6,504
Sea urchin	X	0	X	2,319
Other	0	0	0	0
Total	**157,984**	**10,129**	**168,113**	**430,455**
Subtotal	**245,787**	**16,497**	**262,284**	**673,495**
Others				
Marine plants	150	0	150	11,579
Lumpfish roe	0	0	0	33
Miscellaneous (4)	644	0	644	2,860
Total	794	4	298	14,472
GRAND TOTAL (5)	**246,581**	**16,497**	**263,078**	**687,967**

Note: X = Values have been suppressed to meet confidentiality requirements

(1) Oyster: Atlantic includes wild and farmed data.

(2) Scallop includes meat with roe.

(3) PEI mussels are now classified under "aquaculture" because they are a farmed product.

(4) Miscellaneous value includes seal value.

(5) Totals may not add up due to rounding.

Source: Fisheries and Oceans Canada (DFO), Economic Analysis and Statistics

Invertebrate fisheries constitute the largest piece of the Nova Scotia fishery (Fisheries and Oceans Canada 2014), of which the lobster fishery is the primary component. In 2015, Nova Scotia landed over ~50,000 t of lobster valued at $695 million (Fisheries and Oceans Canada 2017a, Fisheries and Oceans Canada 2017d). The inshore lobster fishery accounts for ~ 90% of the lobster landings (Coffen-Smout et al. 2013, Serdynska & Coffen-Smout et al. (2017)) (Fig. 10), in which the landings have more than doubled in the past 20 years (NSDFA 2014). The proposed farm falls within lobster fishing area (LFA) 35. Typical lobster grounds are characterized by a hard seafloor such as ledge, boulder, or cobble (Lawton 1993) whereas the proposed aquaculture farm is located over mostly gravel and sandy conditions. However, lobster fishermen are known to set their traps in waters ranging from a few feet deep to 25 fathoms and on various bottom types (C. MacDonald, pers. com.).

The Jonah-crab fishery occurs in both offshore and coastal areas of southwestern Nova Scotia; the rock crab is primarily found in shallow, nearshore areas (Fisheries and Oceans Canada 2014d) (Fig. 11). An exploratory snow-crab fishery in NAFO Division 4X (the western portion of CFA 24) was initiated in 1994; catches are relatively low from 4X (generally less than 350 t per year), the season extends from November to May and only one area is considered commercially important (DFO 2017c) (Fig. 12). Commercial snow (queen) crab landings for 2015 and 2016 are illustrated in Figure 13, which indicates that the proposed boundary amendment of Rattling Beach does not fall within a snow crab fishing area. Snow crab is the second most valuable Canadian fishery export product, and the Scotia-Fundy fishable biomass has increased in most areas (Fisheries and Oceans Canada 2015b). The commercial value of snow crab for the Maritimes region of Nova Scotia is $38.9 million.

Shrimp represents Canada's fourth most valuable seafood export, with the northern shrimp being the most abundant in Atlantic Canadian waters. The fishery uses demersal otter trawl fishing vessels both in the inshore and offshore fishery. Initially, SFA 16 was the primary area for shrimp fishing on the Scotian Shelf (Fisheries and Oceans Canada 2014b). In shrimp fishing area 16, several licenses are largely inactive due to low shrimp abundance in this area (Seafish 2015; Fig 14); however, Fisheries and Oceans maintain the stock biomass as being in the healthy zone (Fisheries and Oceans Canada 2015c).

The commercial fishery for scallops is typically offshore, although a smaller inshore fishery does occur along parts of the Atlantic coast (Fig. 15). Historically, the area off Digby, in the Bay of Fundy, has been the key area for the inshore fishery (Fisheries and Oceans Canada 2014). SPA 4 and 5 were joined under one Total Allowable Catch (TAC) limit for the 2013/2014 fishing season (Fisheries and Oceans Canada, 2017e). Scallop production areas (SPAs) 4 and 5 are located off Digby and in Annapolis Basin, respectively. Scallops caught in SPA 4 were 227 t and in SPA 5 were 6.5 t for the 2016 fishing season (Fisheries and Oceans Canada, 2017d; Fig. 16). The catch rate increased in both SPA 4 and 5 in comparison to 2015. The commercial biomass in SPA 4 is in the healthy zone (Fisheries and Oceans Canada, 2017e). In 2016, the number and weight per ton of commercial scallop in SPA 5 were significantly above the medians of the 1996 to 2008 survey series, while recruit number and weight per ton were above historic long-term recruit medians in 1990 to 2008. The commercial value of the scallop fishery for the Maritimes region of Nova Scotia is $167 million dollars.

In Maritimes Statistical Districts 38 & 39, invertebrate landings and associated value was not separated in the provided "other species" category except for lobster. For 2015, 11,262,144 kg was landed comprising of species other than groundfish and lobster with a value of $29,096,031. Key invertebrate species landed include: clams (Bar, quahaugs, soft

shell and unspecified), rock crabs, sea scallops and sea urchins. Bait fisheries for rock crab were noted for these districts. In 2015, reported lobster landings weighed 2,898,078 kg with a value of $40,951,586 (C. O'Neil, pers. com.).

The area of the proposed fish farm falls within shellfish harvesting area NS-18-010-001 (Fig. 17). The majority of Annapolis Basin is classed as conditionally approved waters for harvesting shellfish; however, the Rattling Beach site is between waters to the north and the south which are prohibited for harvesting. Figure 17 was produced by Environment Canada (D. MacArthur, pers. comm.).

Species list

Lobster (*Homarus americanus*) Shrimp (*Pandalus borealis*)
Rock crab and Jonah crab (*Cancer irroratus* and *C. borealis*)
Green crab (*Carcinus maenas*)
Scallop (*Placopecten magellanicus*)
Sea urchin (*Strongylocentrotus droebachiensis*)
Soft-shell clam (*Mya arenaria*)
Bar clam (*Spisula solidissima*)
Quahaug (*Mercenaria mercenaria*)

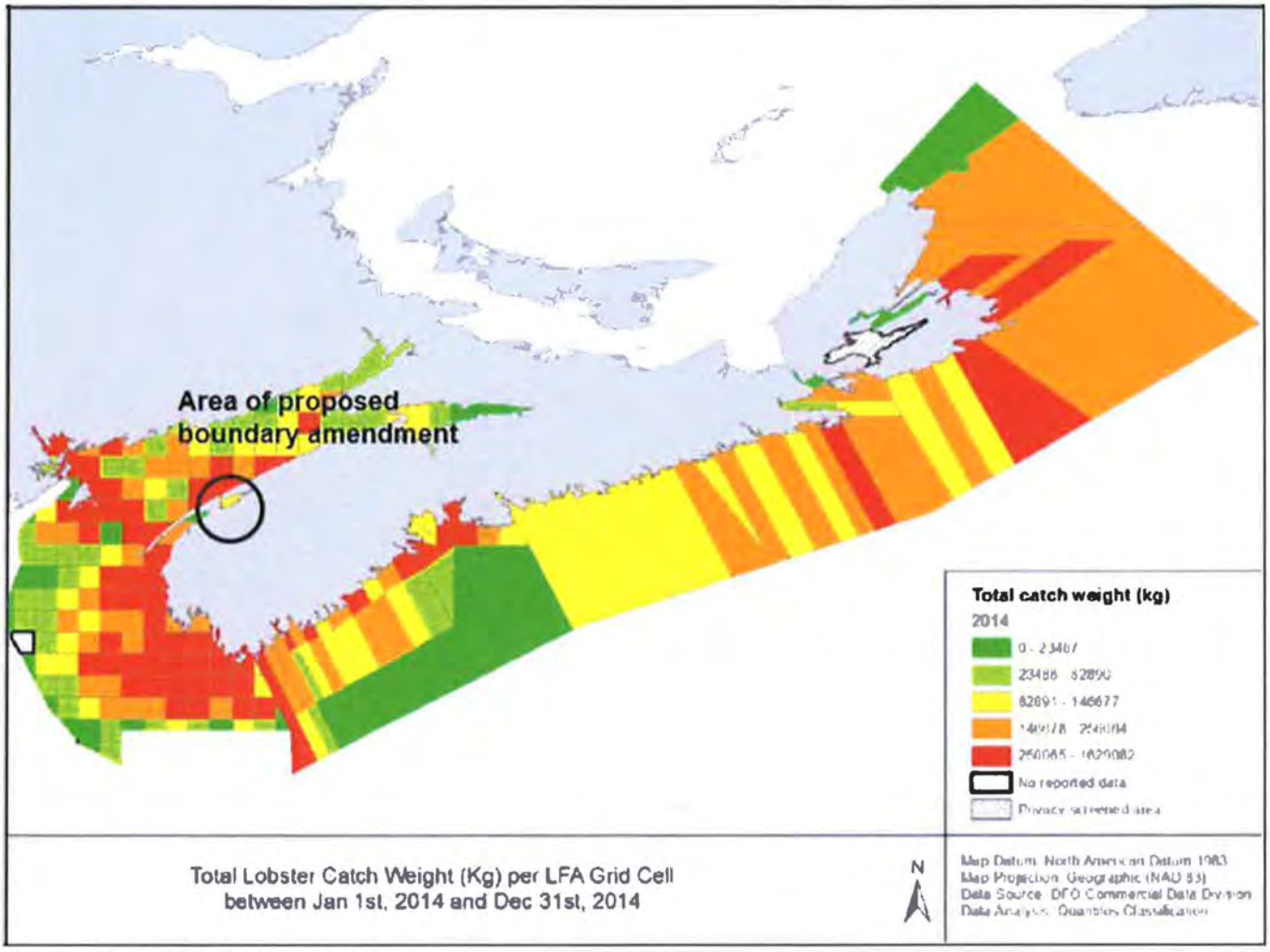

Figure 10. Total Lobster Catch
Note: sourced from Serdynska & Coffen-Smout et al. (2017)

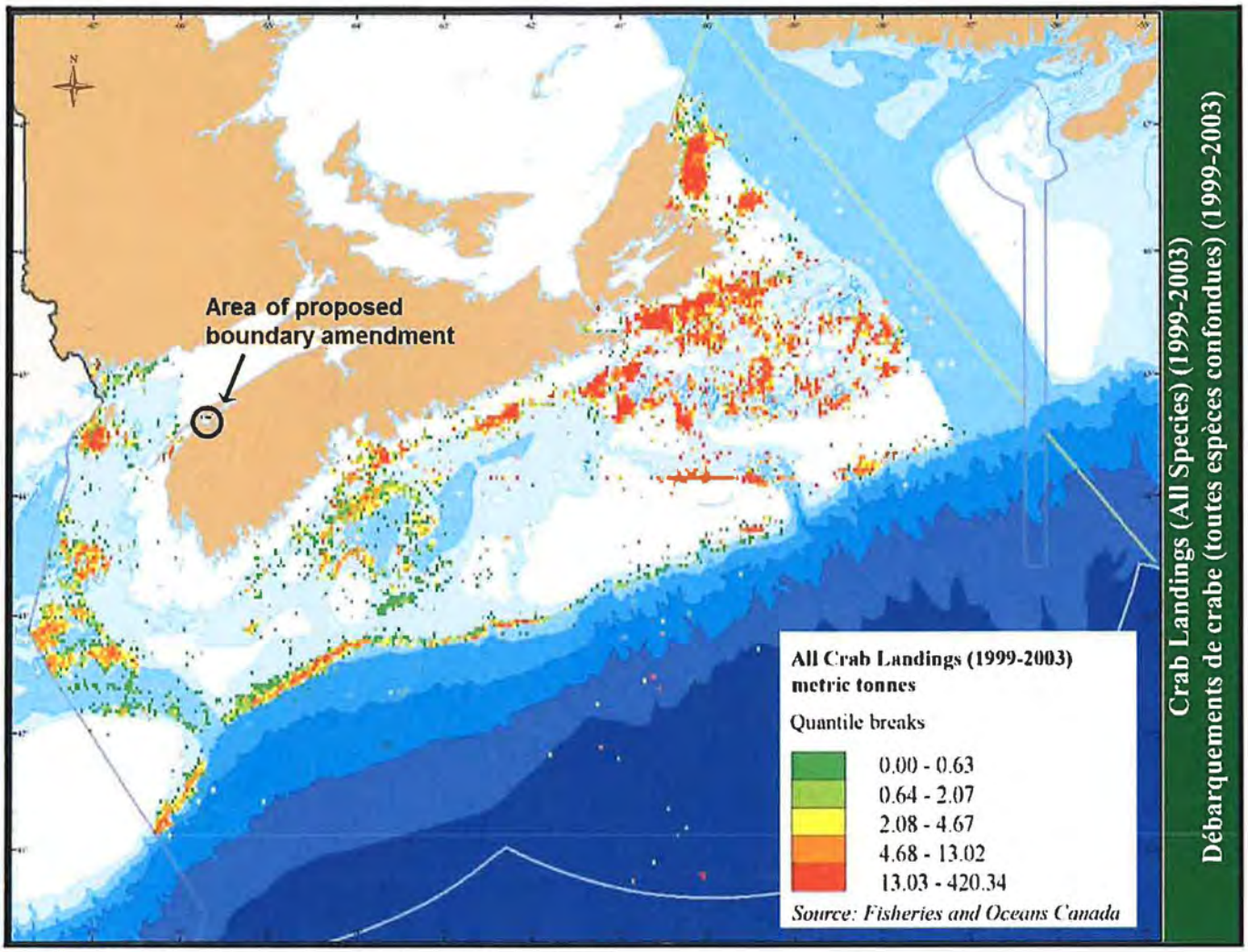

Figure 11. Commercial Crab Landings (1999 – 2003)

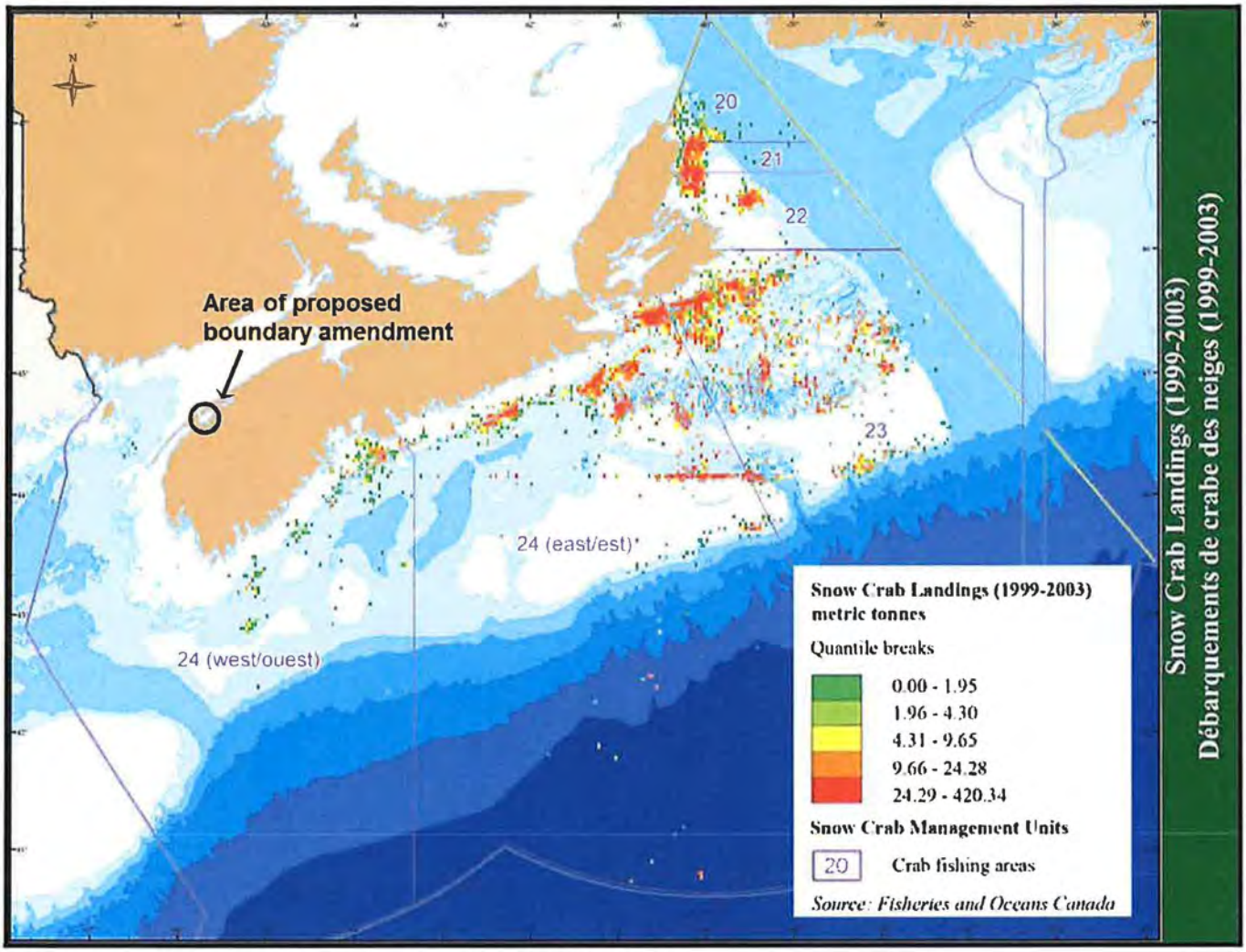

Figure 12. Commercial Snow Crab Landings (1999 – 2003)

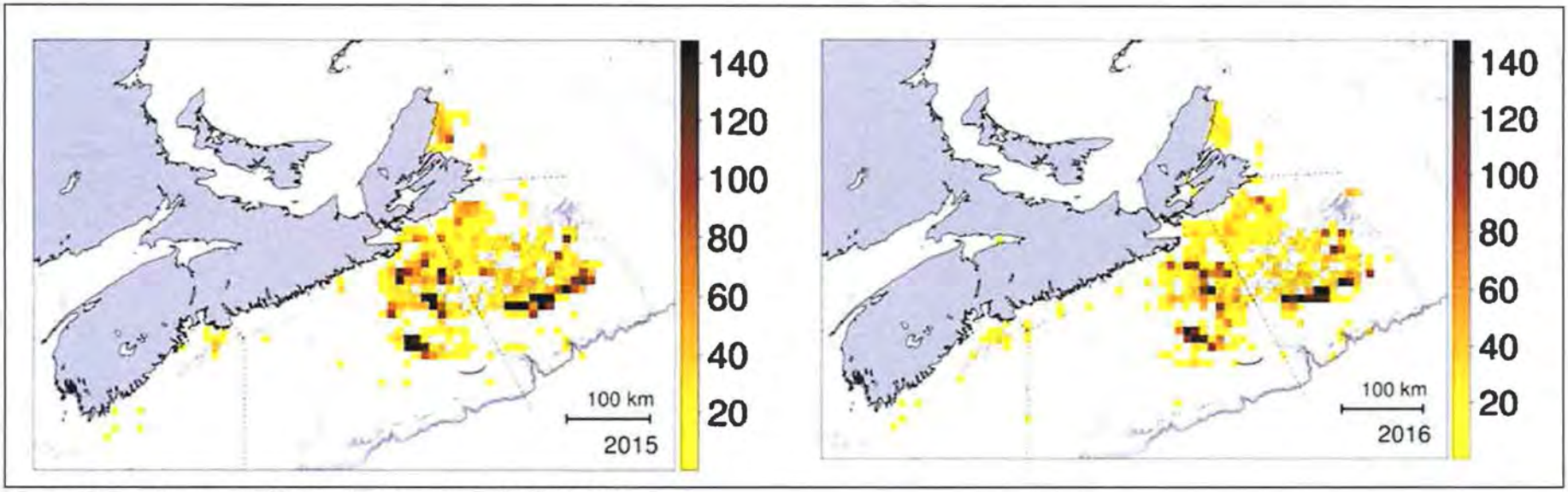

Figure 13. Commercial Snow Crab Landings (DFO 2017b)

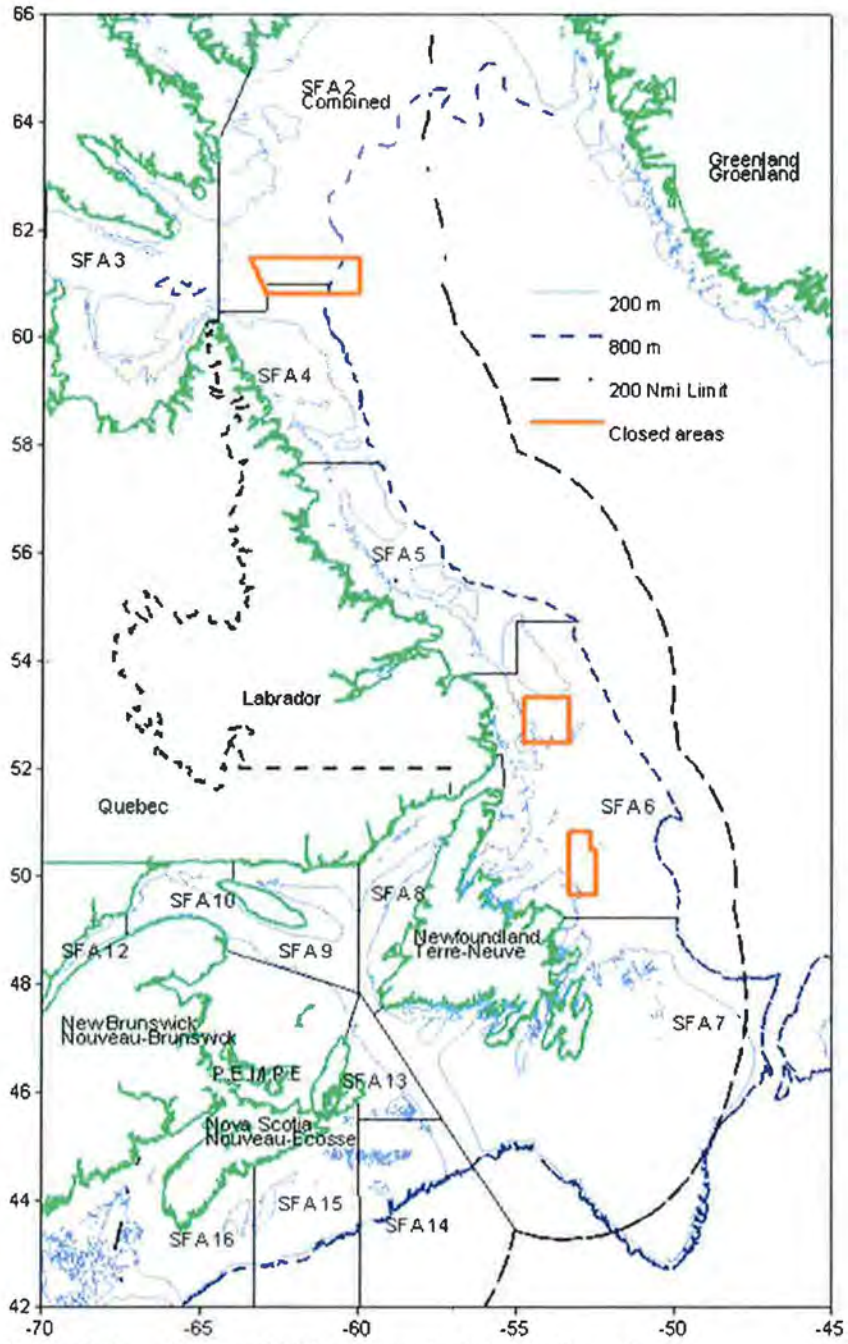

Figure 14. Shrimp Fishing Areas in Atlantic Canada
Note: Sourced from Fisheries and Oceans Canada (2015c)

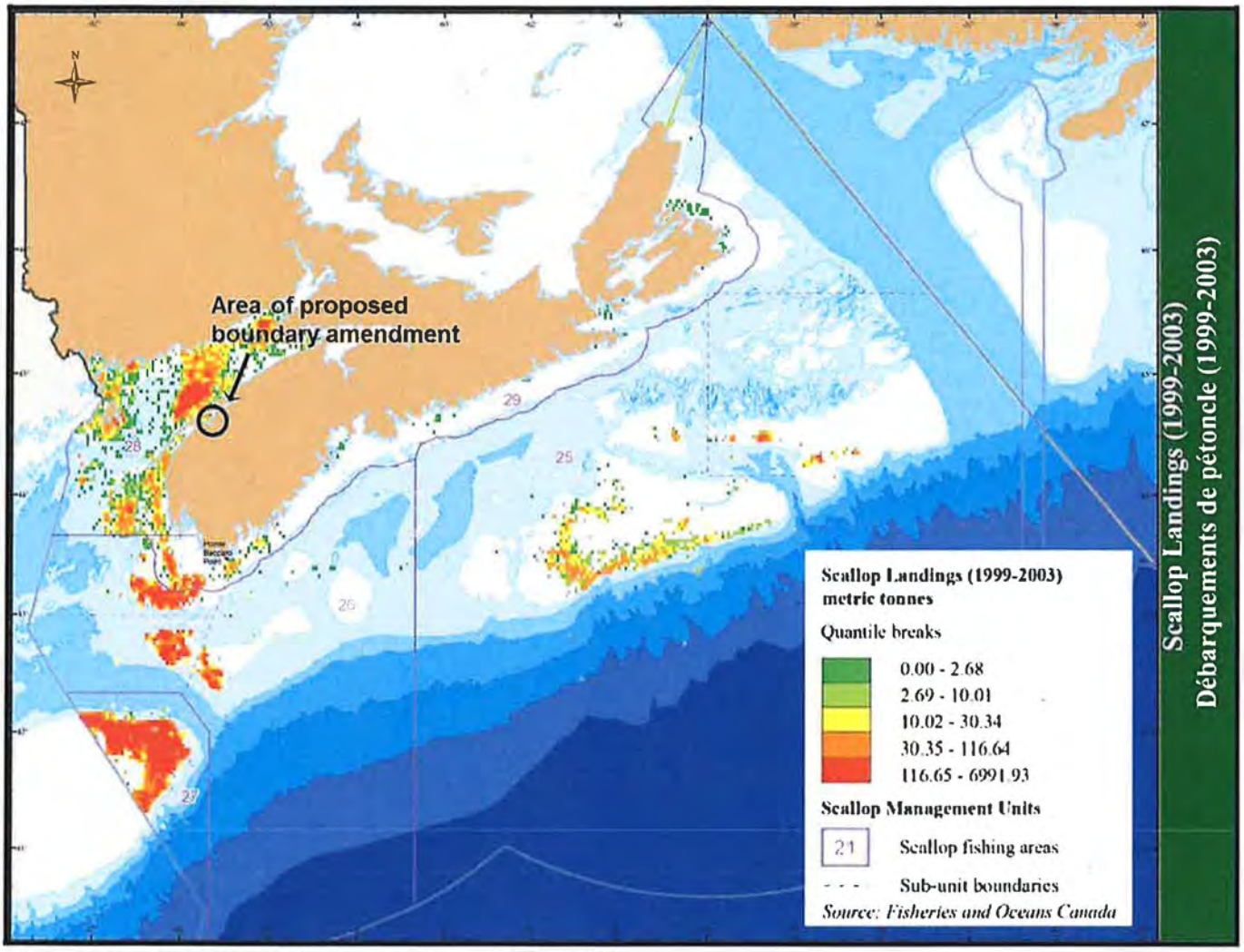

Figure 15. Commercial Scallop Landings (1999 – 2003)

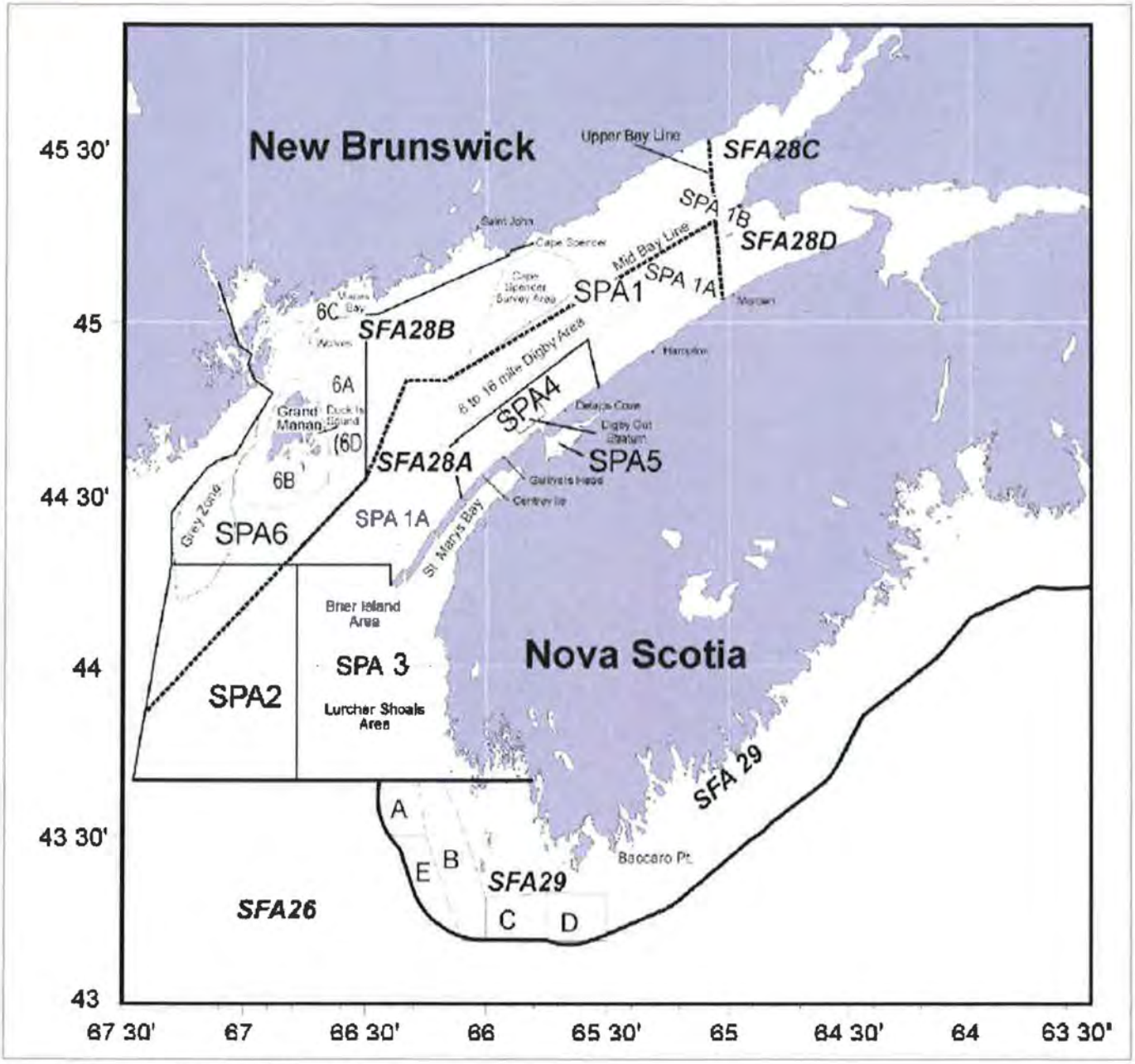

Figure 16. Scallop Production Areas
Note: sourced from Fisheries and Oceans (2017e)

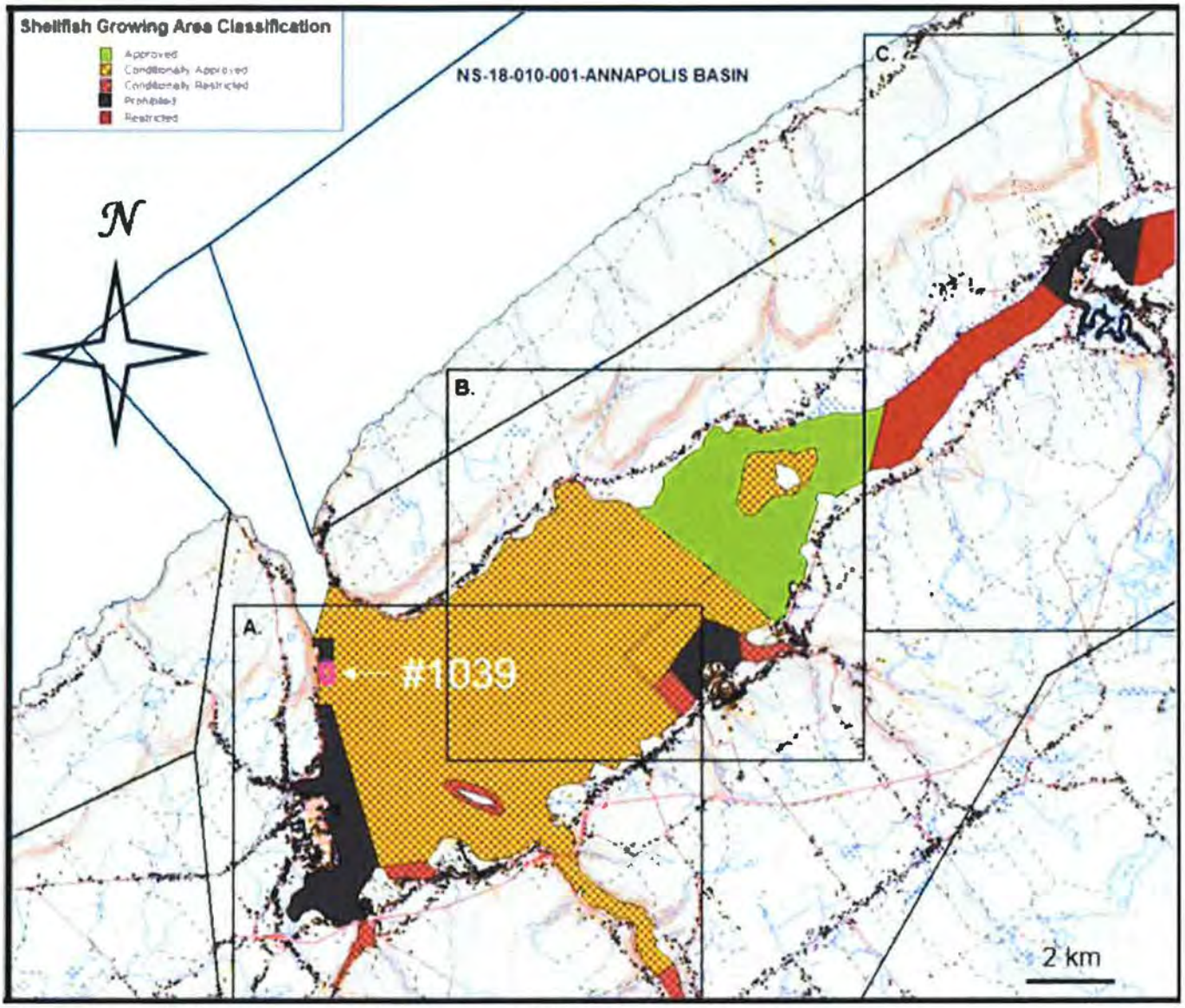

Figure 17. Shellfish Harvesting Classifications of the Annapolis Basin Area
Note: DFO is the central CSSP agency with respect to the real-time status of shellfish growing area classifications. DFO should be contacted directly for information on shellfish area closures.

Seaweeds

Marine plants harvested commercially in Nova Scotia include rockweed (*Ascophyllum nodosum*), Irish moss (*Chrondus Chrispus*), dulse (*Palmaria palmata*), and kelp (*Saccharina latissima, S. groenlandica* and *Laminaria digitata*). In 2013, approximately 332 t of marine plants were landed in Nova Scotia at a value of nearly $107,560 (NSDFA 2013).

In Nova Scotia, *Ascophyllum* is harvested for animal fodder, fertilizer, and other specialty products. Irish moss is commonly harvested for carrageenan, which is used in the food industry for its thickening and stabilizing properties. Though the species is not under any immediate threat, Nova Scotian Irish moss populations are beginning to experience signs of increase in site-specific harvesting pressure, and protection methods are beginning to be recognized (Fisheries and Oceans Canada 2013). Harvest rates of rockweed in Annapolis Basin have remained high over the past 30 years; however, these rates indicate that the habitat value of these beds is significantly altered and takes years to recover. Reassessment of long-term impacts on habitat and the ecosystem are important in determining future harvest rates.

The province of Nova Scotia has jurisdiction over the issuing of rockweed licenses. A provincial representative from NSDFA explained that rockweed harvesting can coexist with aquaculture and no conflict is anticipated between the industries (J. Huston, pers. com.). This is because rockweed harvesting takes place in shallow, intertidal water but aquaculture farms require deeper water. Irish moss also occurs low in the intertidal and into the shallow subtidal and is harvested with a hand rake (Fisheries and Oceans Canada 2013). Harvesting *Ascophyllum* is considered a high-risk activity as these plants and other biota can be damaged due to harvest. Annapolis Basin has a history of overharvest impacts; one full closure of the basin resulted when harvest rates were greater than 50%. Therefore, mitigation actions such as seasonal closures during peak growth or reproductive effort may be necessary to ensure population status (Fisheries and Oceans Canada 2013). There are currently no rockweed leases in place for Annapolis Basin; however, two (2) applications have been received for this area and are currently being processed by the Province of Nova Scotia (W. Vissers, pers. com.; Fig.18).

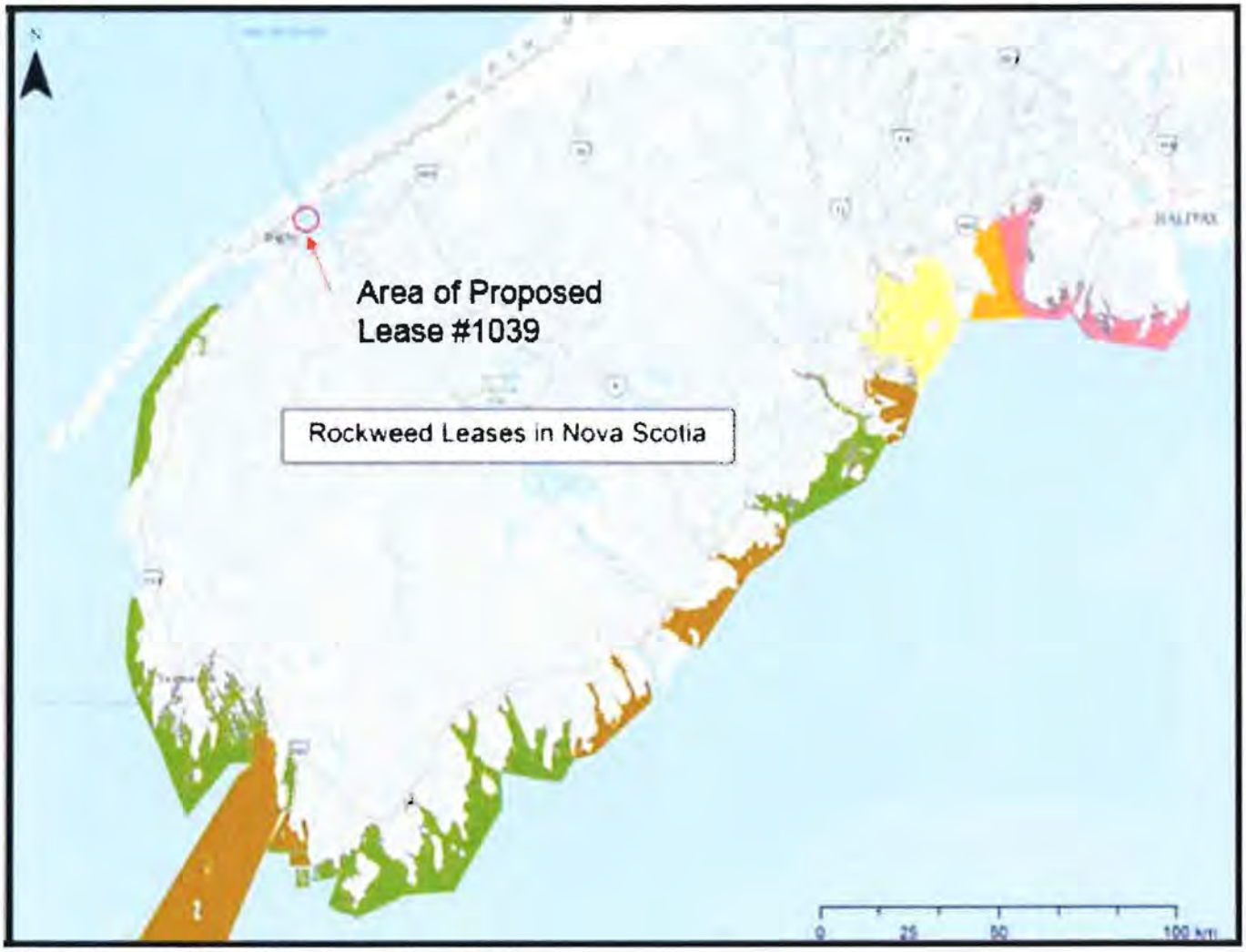

Figure 18. Rockweed Licences in Nova Scotia
Note: sourced from Nova Scotia Department of Fisheries and Aquaculture

3.1.2 Recreational Fisheries

Department of Fisheries and Oceans Canada was contacted for recreational fishing landings; however, this data is not available through their database (C. O'Neil, pers. com.). Local angling associations, such as the Nova Scotia Association of Anglers and Hunters, have been contacted but they do not record landing numbers.

Nova Scotia is divided into six recreational fishing areas (RFA's) to all for regional management. The Annapolis Basin is surrounded by two counties – Annapolis and Digby. The recreational fishing Area 4 encompasses Digby, Queens, Shelburne and Yarmouth while Area 5 is comprised of Annapolis, Kings and Hants. There were approximately 80,000 anglers in 2014 (NSDFA 2017). The most common freshwater species being fished in Areas 4 and 5 include: trout (rainbow, speckled and brook), small mouth bass, chain pickerel and shad are the most common freshwater species being fished by

recreational fishermen. The season for smallmouth bass, all species of trout, and chain pickerel is April 1 to October 31. There is no closed season for tidal waters, however in non-tidal water the season runs from April 1 to October 31. The bag limit is 5 fish for shad, bass and trout species and 25 fish for those fishing chain pickerel. NSDFA encourages anglers to visit their website on a regular basis, to ensure they are knowledgeable about current laws and regulation.

Table 6 provides a list of number of recreational fishing guides in Areas 4 and 5 and species fished (NSDFA 2017).

Table 6. Recreation Fishing Guides in Areas 4 &5

Company	Name of Guide	Contact Information	Area	Species
NS Wilderness Guide Service		@bellaliant.net	5	-Speckled, rainbow & brown trout -smallmouth bass -other freshwater and saltwater species
N/A			5	-speckled & brown trout -rainbow trout -Atlantic salmon
N/A			5	-Speckled & brown trout -small mouth bass -Shad; chain Pickerel -Atlantic salmon
Natures Point of View		Naturespointofview@yahoo.ca	4	-bass -trout
N/A			4	-speckled trout -smallmouth bass
N/A		@eastlink.ca	4	-saltwater species
N/A		@yahoo.ca	4	-trout -smallmouth bass -chain pickerel -mackerel
Munro's Mountain Maple		@ns.sympatico.ca	5	-speckled & brown trout -small mouth bass
Hurricane Harvesting		@raydesign.org	5	-speckled, brown, & rainbow trout -smallmouth bass -chain pickerel
N/A			5	-speckled trout -smallmouth bass -chain pickerel
Dave's Guiding Service			5	-speckled and rainbow trout -smallmouth bass -Atlantic salmon -chain pickerel
N/A		@eawstlink.ca	5	-salmon -trout -striped bass -shad

Tight Lines Guide Service	[redacted]	[redacted]@tightlines.ca [redacted]	5	-speckled, brown & rainbow trout -chain pickerel -smallmouth bass

Salmon angling seasons in all salmon fishing areas (SFA) in the Maritimes Region (SFA – 23) are closed due to conservation concerns with the exception of three rivers in SFA 19 (Cape Breton East; Fisheries and Oceans 2015e).

Department of Fisheries and Oceans Canada was contacted for recreational fishing landings; however this data is not available through their database (C. O'Neil, pers. com.). In addition,

Nova Scotia Federation of Anglers & Hunters (NSFAH) was contacted to obtain information regarding recreational fishing efforts in the Digby and Annapolis Counties. [redacted], the chair of the fish committee for the NSFAH, indicated the species fished in the area can be obtained on the NSDFA website which is summarized in Table 8 (NSDFA 2017). He was unable to provide number of fishermen or specific information regarding landings.

3.1.3 Aboriginal Fisheries

Aboriginal landings were reported in Maritimes Statistical Districts 38 & 39 however the landing data, species fished, value and fishing effort was not provided by the Department of Fisheries and Oceans Canada (C. O'Neil, pers. com.).

The DFO Area Director for Acadia, Annapolis Valley and Bear River DFO was contacted for information on Aboriginal fisheries, but at the time of this report, an answer had not been received (pending communications with F. Quinn).

Relative fishing efforts cannot be reported as the information is unavailable.

The Bear River First Nation was contacted multiple times with no response.

3.2 Impact on Fisheries Activities

The Environmental Monitoring Program Framework for Marine Aquaculture in Nova Scotia -June 2017 (NS EMP Framework 2017) lays out a series of principles and criteria to guide the management process and to determine levels of monitoring and mitigation for each aquaculture site. The document Standard Operating Procedures for the Environmental Monitoring of Marine Aquaculture in Nova Scotia -June 2017 (NS EMP SOP 2017) describes the procedures that support the application of the framework.

The NS EMP Framework 2017 focuses on benthic marine habitat in the immediate vicinity of the aquaculture site. Although sediment sulfide concentration is the key indicator for this environmental monitoring program, a suite of sediment variables are used to validate sulfide. In addition, benthic video collected at each monitoring station is required.

Benthic monitoring allows the assessment of organic loading beneath and around areas of aquaculture production, one of the primary concerns regarding aquaculture impacts on the environment. KCS adheres to the NS EMP Framework 2017 in Nova Scotia.

The monitoring strategy for this KCS sites follows the guidelines and procedures outlined in NS EMP Framework and NS EMP SOP 2017. An annual EMP monitoring event will occur during July 1st to October 31st of each year.

The site follows standard best management practices for rearing fish in a marine environment. These practices have controls in place to mitigate potential environmental effects. However, the site must also have a selection of additional mitigation strategies to apply if an environmental compliance threshold is exceeded.

In the event poor environmental performance is determined through monitoring, the site must implement mitigation. Furthermore, the site must update their mitigation plan to address the poor environmental performance and submit the updated plan to NSDFA.

These mitigation strategies must be based on best management practices and a hazard analysis of Environmental Impacts. For the Environmental Impact mitigation plan, this must be followed by an examination of each hazard to determine which process steps have the most significant hazards and therefore could have additional controls to reduce environmental impact.

Each site has a different risks of algae blooms and therefore algae monitoring requirements should be determined on a site by site basis, according to history and best available knowledge.

Algae monitoring will take place at the site on a weekly basis from May to October. Water samples will be collected by the Site Manager at the surface of the water near the center of the farm; once the sample is collected it may be stored on ice – depending on time until samples are delivered. Samples are sent to the office in Bridgewater where they are analyzed by trained staff and recorded.

Due to natural cycles and processes such as seasons, thermoclines, weather, haloclines, algal blooms, etc., it is of utmost importance to monitor water quality. Monitoring specific water parameters will aid the farmer in preparedness for dealing with health issues, assist with feeding regimes, and allow mitigative actions to be taken when conditions are less than optimum.

KCS provides detailed maps and diagrams of their sites when requested. These maps and diagrams show the location of all above and underwater infrastructure, thus aiding in fishing efforts. KCS reports harmful algal blooms to the province of Nova Scotia which can benefit invertebrate fishing activities within the Annapolis Basin.

A healthy marine environment is paramount to the site's operation. If the marine environment is poor enough to affect fisheries activities, it would also be detrimental to the site's production.

Section 4: Oceanographic and Biophysical Characteristics of the Public Waters

4.1 Oceanographic Environment

4.1.1 Wind

The proposed boundary amendment of NS aquaculture site #1039 is located near the channel at the entrance to Annapolis Basin, on the Fundy shore of Nova Scotia. The site is sheltered from the south around to the northwest due to its proximity to the mainland of Nova Scotia. The most significant wind directions for this site are from the east-northeast around to the south-southeast, to which the site is exposed to the greatest fetches.

The following wind speed data, including Figures 19 and 20, were collected from the Wind and Wave Climate Atlas – Volume I: The East Coast of Canada, for the Nova Scotian Shore, prepared by MacLaren Plansearch Ltd. (1991). Winds speed of less than 25 knots occur 90.9% of the time on the south shore of Nova Scotia. Storm force winds (i.e. > 45 knots) occur only 0.2% of the time. The most common wind directions are southwest (~20% occurrence) and west (~17.5% occurrence) while the least common wind directions are from the northeast (~7.5% occurrence), east (~6% occurrence), and southeast (~5.5% occurrence). Historically, the months with the highest mean wind speeds in the area have been January and December. During these months, the most frequent wind directions are from the northwest, north, and west, respectively. Annual wind statistics for the Fundy shore of Nova Scotia are presented in Figure 19 and summary graphs of average monthly wind speeds are presented in Figure 20.

Wind speed and direction data were also collected from the Brier Island weather station (Environment Canada 2017a) at Digby Neck, located at N44° 17' 09.000" W66° 20' 48.000". Data collected between April 1, 2011 and August 31, 2018 were used to produce the wind-rose plot of Figure 21. Based on this data, the most common and strongest winds in the Annapolis Basin area occur between 145 and 175°(coming from approximately the south-southeast through the southwest). Most commonly, wind speeds are between 2 and 8 km/h (Fig. 22). Maximum wind speed and direction recorded at the Brier Island weather station is presented in Table 6.

Table 7. Maximum Wind Speed and Direction Measured at the Brier Island Weather Station

Date of Maximum Wind of the Year	Wind Speed (km/hr)	Wind Direction
February 13, 2017	91	N
February 16, 2016	92	SE
February 15, 2015	95	NNW
March 26, 2014	107	NNW
February 17, 2013 March 26, 2013	95	NW
December 30, 2012	91	NNW
October 10, 2011 December 8, 2011	83	NW

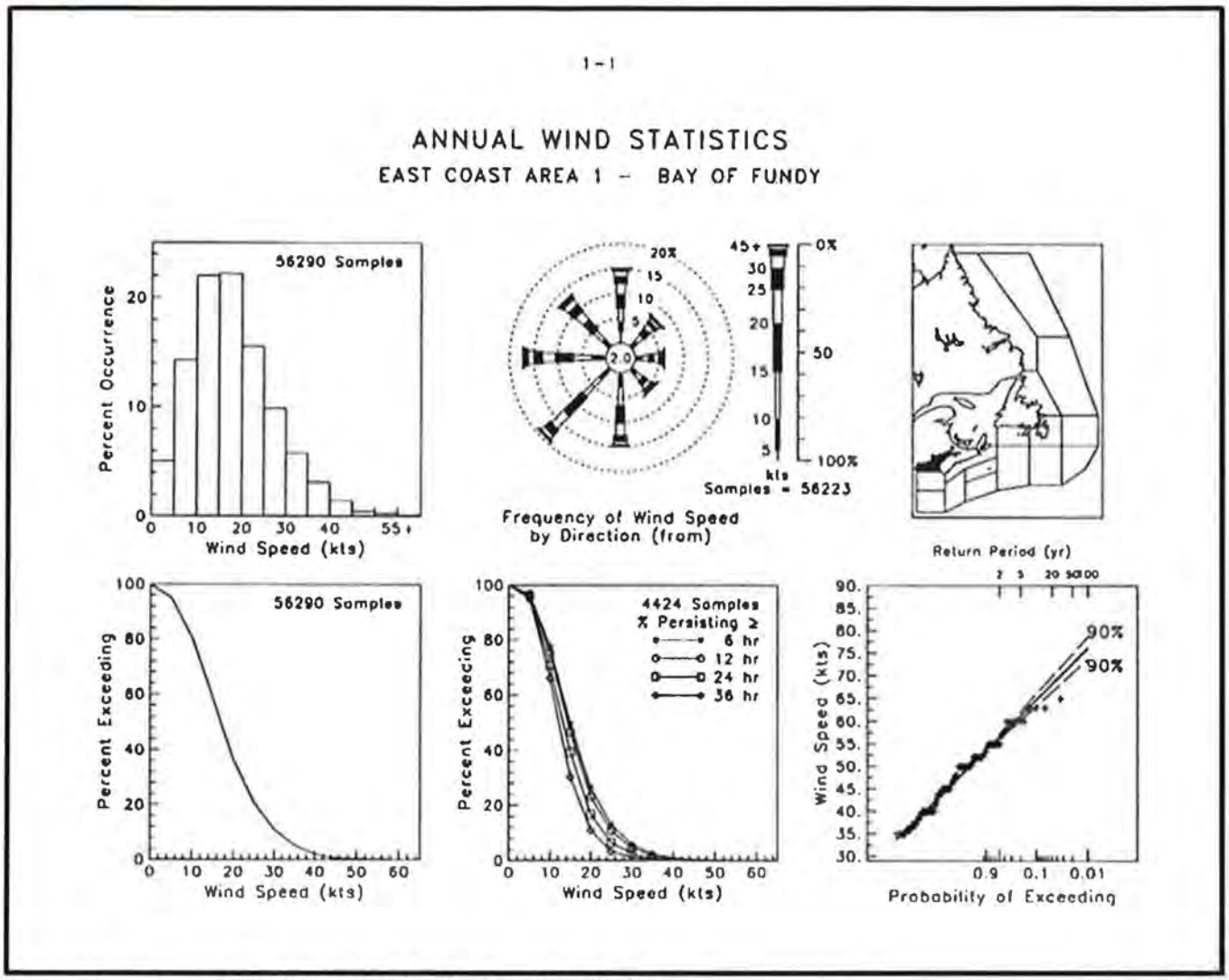

Figure 19. Annual Wind Statistics for the Bay of Fundy Shore
Note: sourced from MacLaren Plansearch Ltd. (1991)

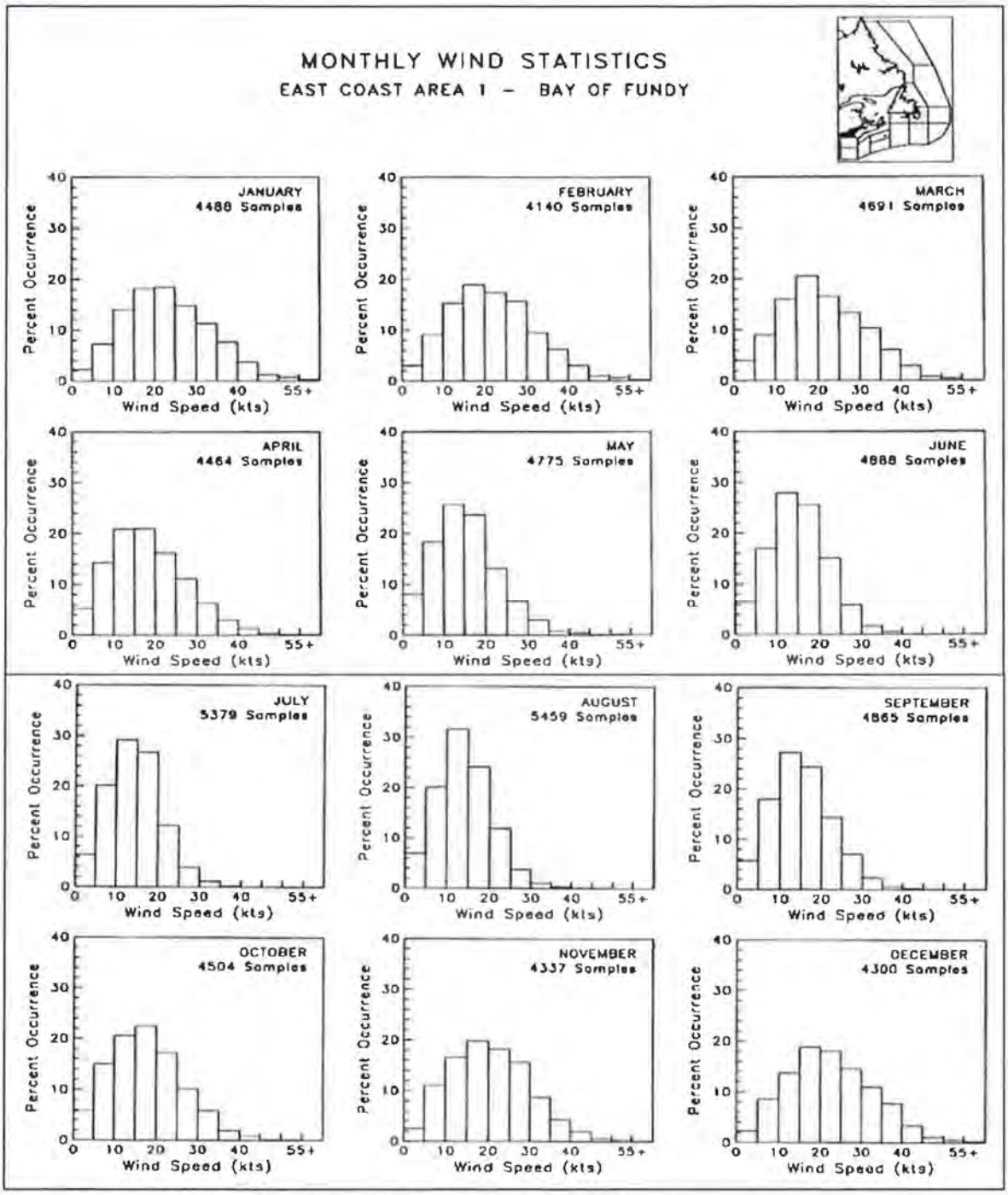

Figure 20. Average Monthly Wind Statistics for the Bay of Fundy Shore
Note: sourced from MacLaren Plansearch Ltd. (1991)

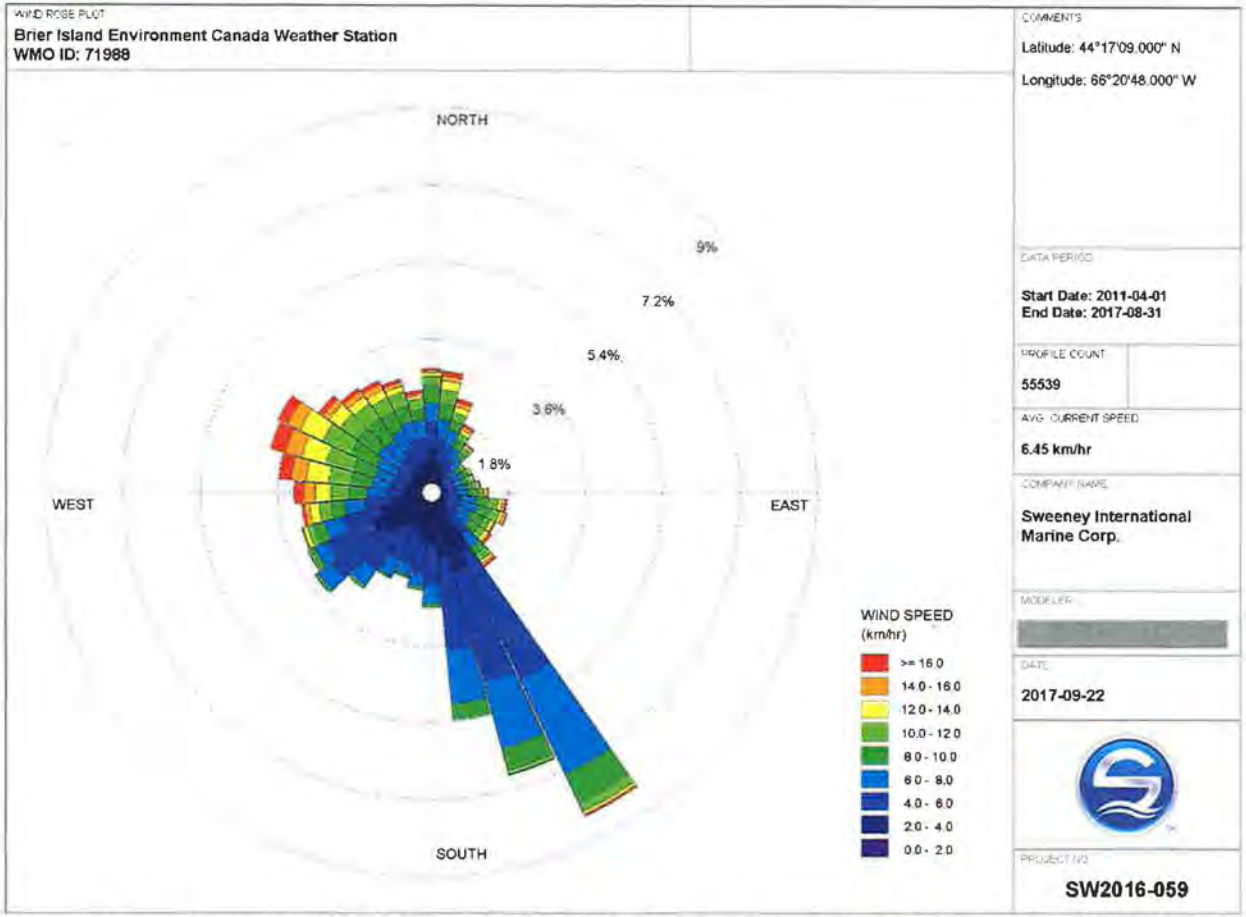

Figure 21. Wind-rose Plot of Brier Island Weather Station Data Collected Between April 1, 2011 and August 31, 2017
Note: the bars on the plot indicate the direction the wind was coming from
Data sourced from Environment Canada (2017a)

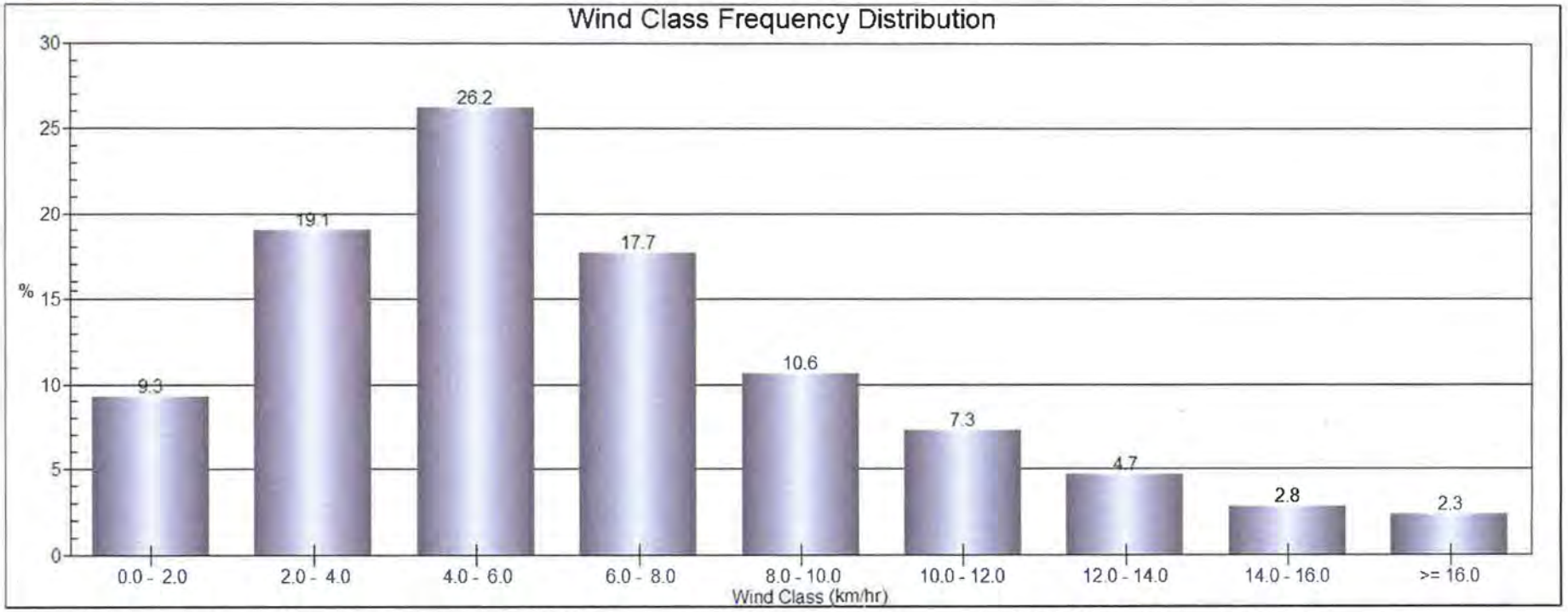

Figure 22. Frequency of Wind Speed Observed at the Brier Island Weather Station between April 1, 2011 and August 31, 2017
Data sourced from Environment Canada (2017a)

4.1.2 Waves

The following wave height data, including Figures 23 and 24, were collected from the Wind and Wave Climate Atlas – Volume I: The East Coast of Canada, prepared by MacLaren Plansearch Ltd. (1991).

Wave heights of 6 m and greater are generally associated with winds speeds of 30 knots or more. Waves of less than 3 m in height were recorded 89.9% of the time while waves greater than 5 m were recorded only 1.0% of the time. Waves reaching the Fundy shore of Nova Scotia most commonly come from the southwest (24.7%) and west (18.9%). The aquaculture site at Rattling Beach is sheltered by land for these directions. The largest wave heights (i.e. > 5 m) generally come from the east. Waves coming from west, southwest, northwest, northeast, and southeast very rarely exceed 3.5 m in height. The greatest monthly average wave height for the Nova Scotian shore is 1.1 m, which occurs in the months of January, and December. Annual wave height statistics for the Nova Scotia shore are presented in Figure 23 and summary graphs of the average monthly wave heights are presented in Figure 24

Wave height data was also obtained from the National Data Buoy Center (NOAA 2017) to determine maximum waves. Data presented in Table 7 were collected by the Jonesport, Maine station 44027 buoy, which is located 20 nautical miles southeast of Jonesport (N44° 17' 13" W67° 18' 27"). The Jonesport, Maine buoy is the nearest buoy to the Rattling Beach site for which wave data is available.

Table 8. Wave Height Data from Buoy 44027 near Jonesport Maine

Date of Maximum Wave of the Year	Wave Height (m)	Mean Wave Direction	Wave Period (s)	Sustained Wind Speed (knots)	Gusts (knots)	Wind Direction
March 15, 2017	5.78	SSE	7.16	28.2	35.6	N/A
December 30, 2016	5.78	SSW	6.3	38.9	48.6	N/A
January 27, 2015	8.43	N/A	9.09	38.9	48.2	N
February 15, 2014	6.12	N/A	12.12	33.2	42.6	WNW
November 27, 2013	6.55	N/A	10.0	15.6	45.1	SSE
January 14, 2012	7.18	N/A	11.43	35.0	42.0	WSW
November 23, 2011	4.8	N/A	8.33	15.0	43.3	NNE
January 26, 2010	6.07	N/A	9.09	33.6	41.8	SSE
December 10, 2009	6.29	N/A	10.0	N/A	N/A	N/A
January 8, 2009	5.66	N/A	11.43	30.5	38.9	WSW
October 29, 2008	8.08	N/A	11.43	33.0	39.7	SSW
February 15, 2007	6.88	N/A	10.81	34.8	42.6	SE
October 29, 2006	7.81	N/A	11.43	36.0	43.9	SW
November 23, 2005	6.82	N/A	12.12	23.9	30.3	SSW

SIGNIFICANT WAVE HEIGHT STATISTICS

EAST COAST AREA 1 - BAY OF FUNDY

PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION

Annual
ODGP

	Direction - coming from									
	N	NE	E	SE	S	SW	W	NW	Total	Num Obs
0.0 - < 0.5 m	0.5	0.7	0.5	0.5	0.6	2.0	1.6	1.0	7.2	313
0.5 - < 1.0 m	2.0	1.8	1.8	2.1	2.5	6.6	5.1	3.1	24.7	1078
1.0 - < 1.5 m	2.3	1.7	2.3	1.0	1.7	7.0	5.0	4.0	24.8	1084
1.5 - < 2.0 m	1.7	1.5	2.0	0.8	1.1	4.0	3.3	2.7	16.8	735
2.0 - < 2.5 m	0.9	1.4	1.2	0.6	1.0	2.4	1.7	1.5	10.7	467
2.5 - < 3.0 m	0.4	0.8	0.7	0.4	0.6	1.4	1.0	1.1	6.1	265
3.0 - < 3.5 m	0.1	0.5	0.6	0.5	0.7	0.7	0.6	0.7	4.7	205
3.5 - < 4.0 m	0.1	0.3	0.5	0.3	0.2	0.2	0.2	0.3	2.1	91
4.0 - < 4.5 m	-	0.2	0.2	0.1	0.1	0.1	0.1	0.1	1.0	43
4.5 - < 5.0 m	-	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.7	31
5.0 - < 5.5 m	-	0.0	0.1	0.1	0.0	0.0	0.1	-	0.3	15
5.5 - < 6.0 m	-	0.0	0.1	0.0	0.0	0.0	0.0	-	0.3	11
6.0 - < 6.5 m	-	0.0	0.1	0.0	-	-	-	-	0.2	10
6.5 - < 7.0 m	-	-	0.0	-	-	0.0	0.0	-	0.1	4
7.0 - + m	-	-	-	-	0.0	0.0	0.0	-	0.1	4
Total	8.0	8.7	10.3	6.2	8.7	24.7	18.9	14.6	100.0	4356

MONTHLY DATA STATISTICS

Waverider

	Mean m	Std Dev m	Med m	Max m	Min m	Upper 95% Lim m	Lower 95% Lim m	Most Freq Dir from	Num Obs
January	1.1	0.7	1.0	4.5	0.1	2.4	0.2	—	901
February	0.8	0.7	0.7	6.8	0.1	2.0	0.2	—	980
March	0.8	0.8	0.7	4.5	0.1	2.0	0.2	—	1177
April	0.7	0.4	0.5	2.8	0.1	1.4	0.1	—	844
May	0.6	0.4	0.4	2.8	0.0	1.2	0.1	—	1007
June	0.5	0.3	0.3	2.8	0.0	1.0	0.0	—	814
July	0.4	0.3	0.3	2.7	0.0	0.9	0.0	—	1140
August	0.4	0.2	0.3	1.7	0.0	0.8	0.0	—	1086
September	0.5	0.4	0.4	2.7	0.0	1.2	0.0	—	1189
October	0.7	0.5	0.5	3.7	0.0	1.7	0.1	—	1261
November	0.9	0.7	0.8	3.7	0.0	2.3	0.1	—	1072
December	1.1	0.7	0.9	3.8	0.1	2.5	0.2	—	849
Annual	0.7	0.6	0.5	6.8	0.0	1.8	0.1	—	12300

Figure 23. Significant Wave Height Statistics for the Fundy Shore
Note: sourced from MacLaren Plansearch Ltd. (1991)

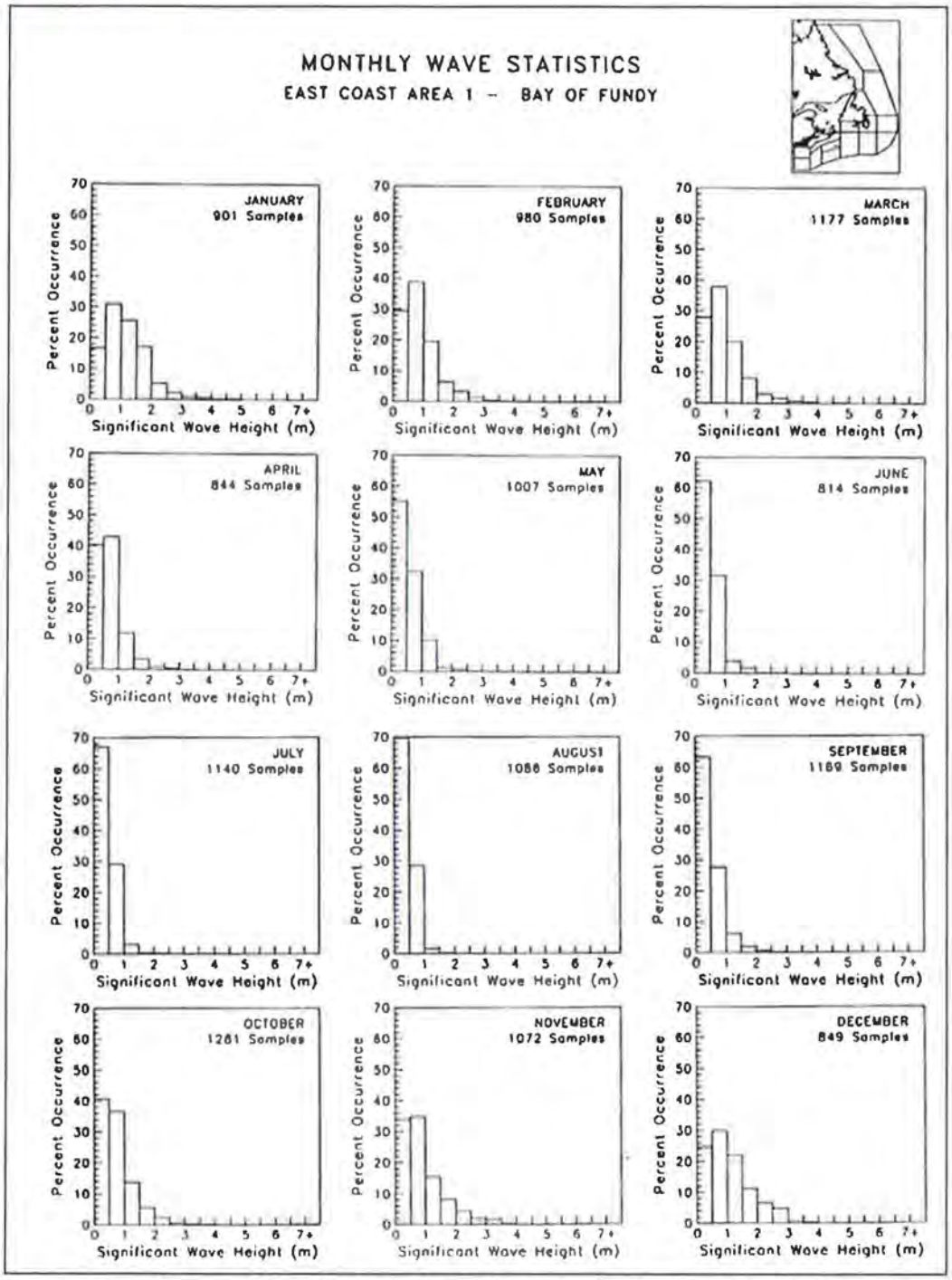

Figure 24. Average Monthly Wave Height Statistics for the Bay of FundyShore
Note: sourced from MacLaren Plansearch Ltd. (1991)

4.1.3 Extreme Storm Events and Storm Surge

Nova Scotia is sometimes subject to extreme weather conditions. Wind and wave damage caused by storms, and ice damage during extremely low temperatures, are environmental hazards that could cause unwanted changes to the project. However, employing proper gear and using the most recent technologies for cage design and construction, as well as routine inspection and maintenance, will help prevent any unfavourable effects to the project caused by weather and climate extremes. KCS has several high energy sites in New Brunswick, Nova Scotia, and Newfoundland, which are exposed to strong winds and large waves. The grid and anchoring systems used at Rattling Beach have been proven successful at these high energy sites. The plastic, circular cages and grid components employed by KCS have been tested and shown to withstand wave heights of 8 m. During extreme weather conditions, personnel will not be working on the cage site. Once the extreme weather has passed, crews will be dispatched to examine the cage system and fish stock for damage. In the event damage is sustained, repairs will be carried out as necessary. Any significant damage will be reported to NSDFA.

4.1.4 Tides

Based on Canadian Hydrographic Service Tide Tables (Fisheries and Oceans Canada 2017f) for Digby (Station #325), the predicted highest high tide for 2017 is 9.2 m and the lowest low tide is -0.3 m, giving a maximum tidal range of 9.5 m. Typically, the tidal range is between 6 and 9 m. In 2016, the highest high tide was 9.4 m and the lowest low tide was -0.4 m, giving a tidal range of 9.8 m. However, storm surges, should they co-occur with the highest high water, could result in higher water levels.

4.1.5 Currents

Collection of local current speed and direction data throughout the water column was carried out between June 29 and August 4, 2016 using a 600-kHz Acoustic Doppler Current Profiler (ADCP) deployed by NSDFA. The current meter could not be deployed at the center of the proposed lease due to the presence of gear and fish. The current meter was located ~ 100 m to the southeast of the original lease boundaries (N44° 39' 03.3" W65° 45' 14.8").

At depths 3 – 10 m above the seafloor, most water flowed towards the NNE, with approximately 39% of all recorded currents travelling between 5 and 25 degrees. The depth-averaged current speed of all recorded profiles at this site was 22.65 cm/s. In depth profiles 3 – 10 m above the seafloor, the maximum recorded speed was 81.0 cm/s occurring 10 m from the bottom. The most frequently observed speeds were between 18 and 24 cm/s near the seafloor (25.3% at 3 m) and 24 and 36 cm/s within the mid water column (18.3% at 10 m). Data obtained from the upper water column did not yield reliable data with less than 75% of the data present; therefore, it was omitted from the analysis. Average current speeds significantly varied with depth, with the cell nearest to the surface having the highest occurrence of currents greater than 80 cm/s.

The maximum current speed observed was 81.0 cm/s while the minimum was 0.2 cm/s (Table 3). The overall mean current speed was 23.9 cm/s but currents in the uppermost cell presented (i.e. 10 m above the seafloor) were considerably faster at 32.8 cm/s. This may have been due to the influence of the wind. Overall, current speeds < 5 cm/s occurred 1.94% of the time. Graphs illustrating the current directions and current speed frequency distributions are located in Section 4.2 – Baseline Environmental Monitoring.

Table 9. Current Data Summary Statistics for Rattling Beach

Rattling Beach	Current Speed Statistics						
Depth from Seafloor (m)	Mean (cm/s)	Min (cm/s)	Max (cm/s)	Mode (cm/s)	< 2 cm/s (%)	< 5 cm/s (%)	Directional Modes (Cardinal or Intercardinal)
3	19.8	2.4	51.6	18.3	0	0.83	NNE
4	21.3	0.4	55.9	19.1	0	1.04	NNE
5	22.5	0.4	60.1	20.3	0	1.71	NNE
6	23.2	0.4	64.4	11.7	0	2.14	NNE
7	24	0.2	67.5	17.1	0	2.3	NNE
8	26.3	0.3	71.5	29.5	0	2.01	NNE
9	29.2	0.9	75.1	40.7	0	3.56	NNE
10	32.7	0.7	81	33.1	0	1.94	NNE
Overall	**24.9**	**1**	**66**	**24**	**0**	**1.94**	**NNE**

4.1.6 Salinity

KCS reported salinities for Rattling Beach site between 30 and 32‰. According to the monthly, average, salinity data gathered from the DFO OSD Atlantic Zone Monitoring Program, (Fisheries and Oceans Canada 2017g; Fig. 25) for Prince 5, Bay of Fundy, salinity ranges between 30.9 and 32.9‰. In general, salinity is lowest in April to June and highest between the months of August to December. The existing, successful, aquaculture site at Rattling Beach would indicate that the salinities in the area are tolerable for Atlantic salmon. Monthly, average, salinity data from Subarea 55 are presented in Figure 26 (Fisheries and Oceans Canada 2007).

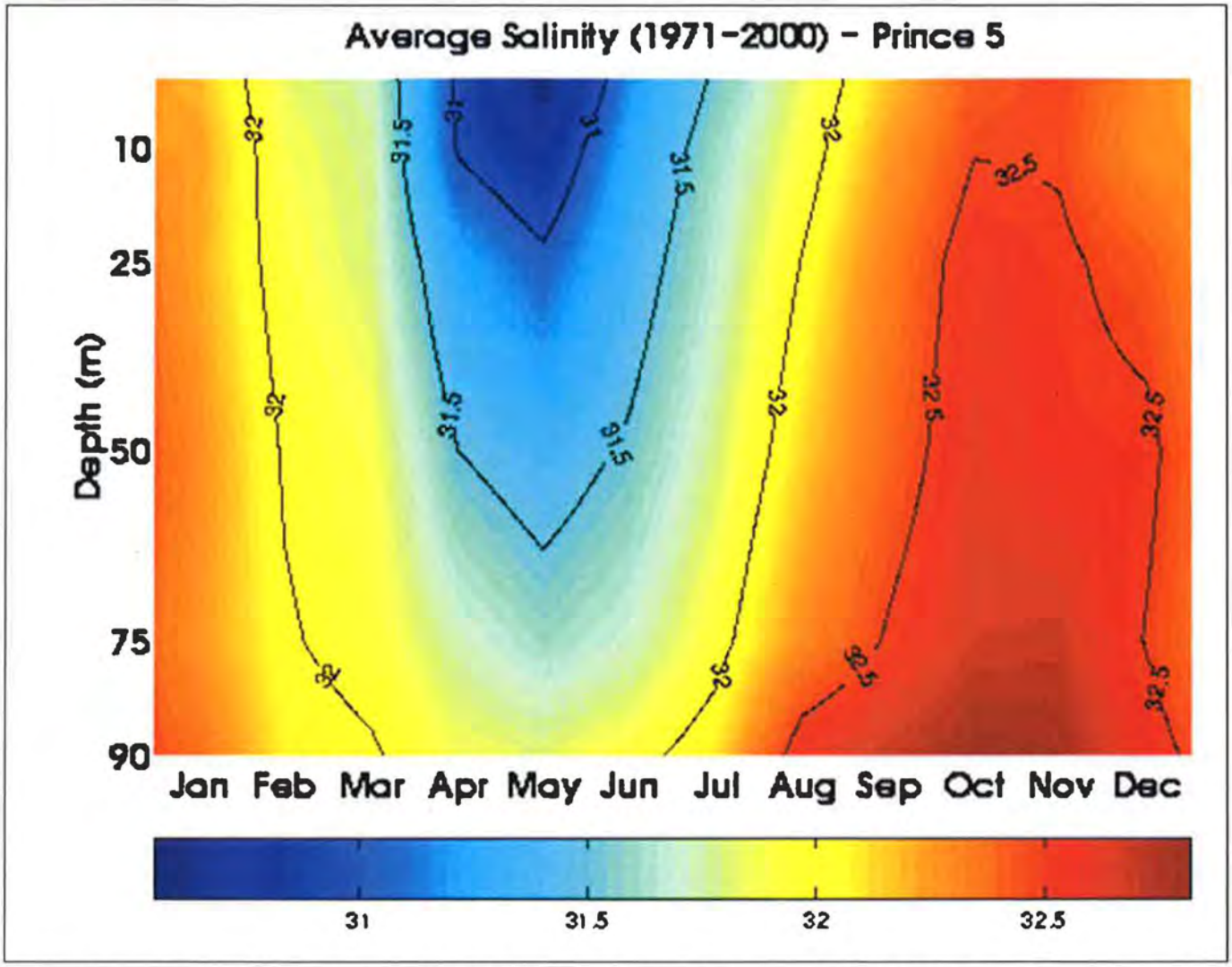

Figure 25. Contour Plot of Average Monthly Salinity of Prince 5 Station of DFO's Atlantic Zone Monitoring Program
Note: Graph was obtained from the Fisheries and Oceans Canada (2017g), Marine Environmental Data Services website

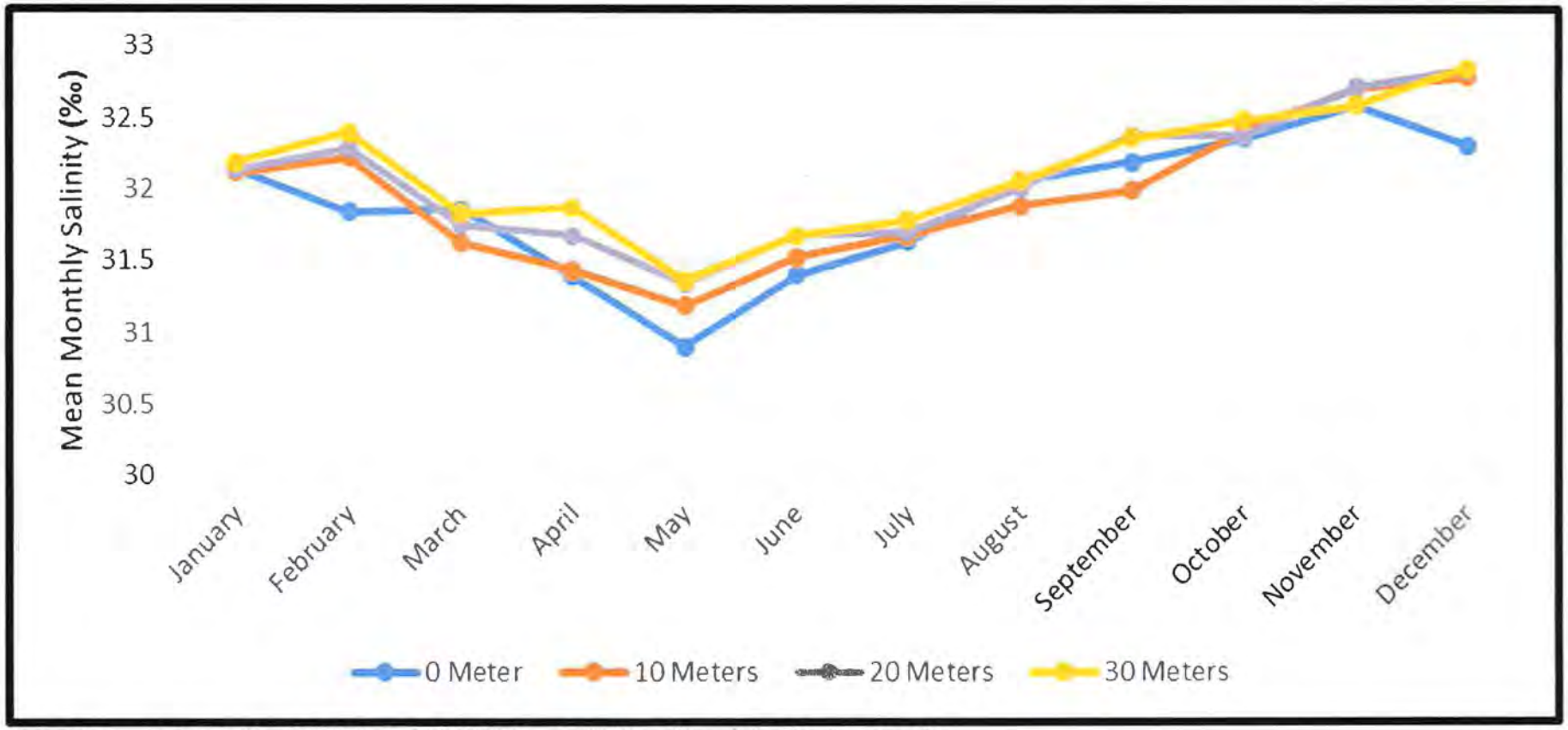

Figure 26. Average Monthly Salinity of OES Subarea 55 (Bay of Fundy) at Various Depths
Note: Data was obtained from the Oceans and Ecosystem Science website (Department of Fisheries 2007)

4.1.7 Temperature

Temperatures at the Rattling Beach aquaculture site were recorded and collected by KCS staff during site operations. The minimum water temperature was recorded in February 2015 and was approximately 0°C. The maximum water temperature was recorded in August 2016 and was approximately 16.6°C. Figure 27 displays the historical water temperature trends from the Rattling Beach site.

Long-term temperature data for the Fundy shore area (Prince 5) were sourced from the DFO OSD Atlantic Zone Monitoring Program and are presented in Fig. 29 (Fisheries and Oceans Canada 2017g). Monthly, average, temperature data provided in Fig. 28 were derived from climatology data of the DFO Maritime Oceans and Ecosystem Science (OES) project, Hydrographic Database, Subarea 55 (Fisheries and Oceans Canada 2007). Figures 28 and 29 display average and monthly water temperature data for the Fundy shore of Nova Scotia. Mean water temperatures from this data range between 1.8 and 12.7°C. The lowest temperatures of the year are normally experienced in February to March and the highest temperatures in August. The existing, successful, aquaculture site at Rattling Beach would indicate that the temperatures in the area are tolerable for Atlantic salmon.

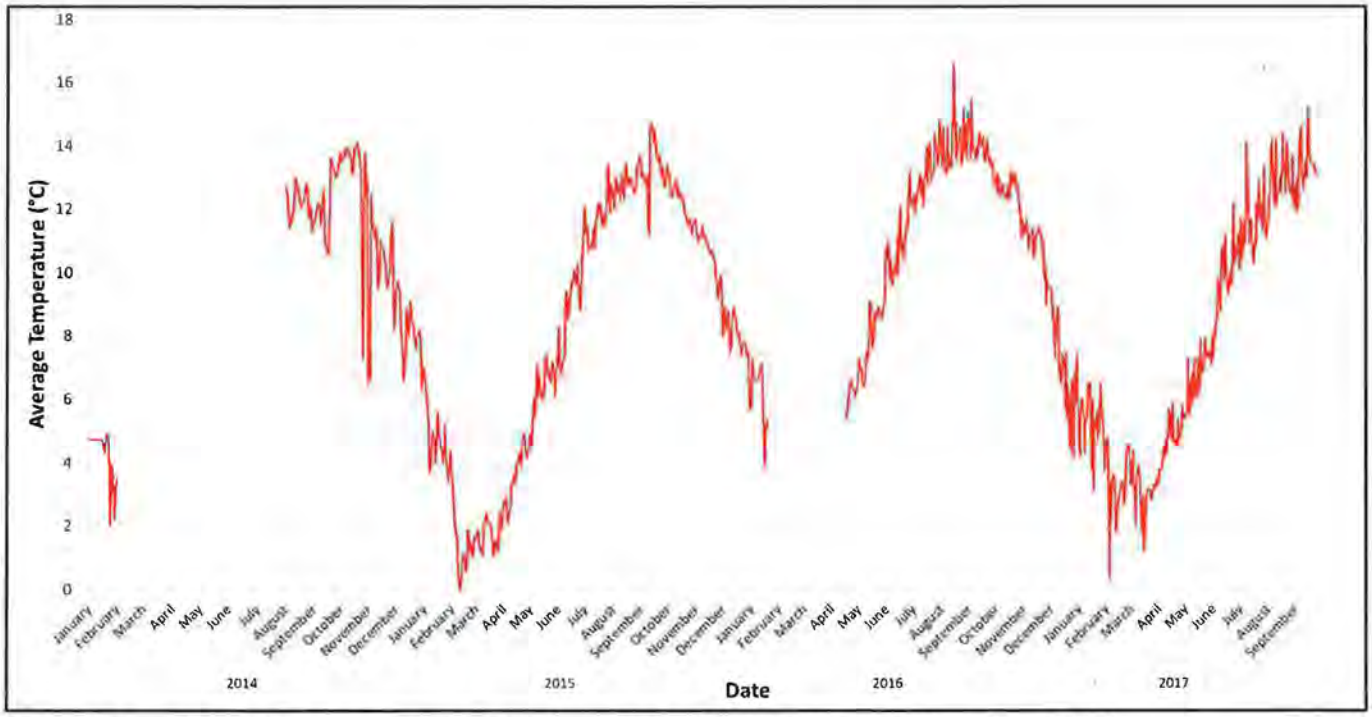

Figure 27. Daily Water Temperature Data from the Rattling Beach Aquaculture Site #1039

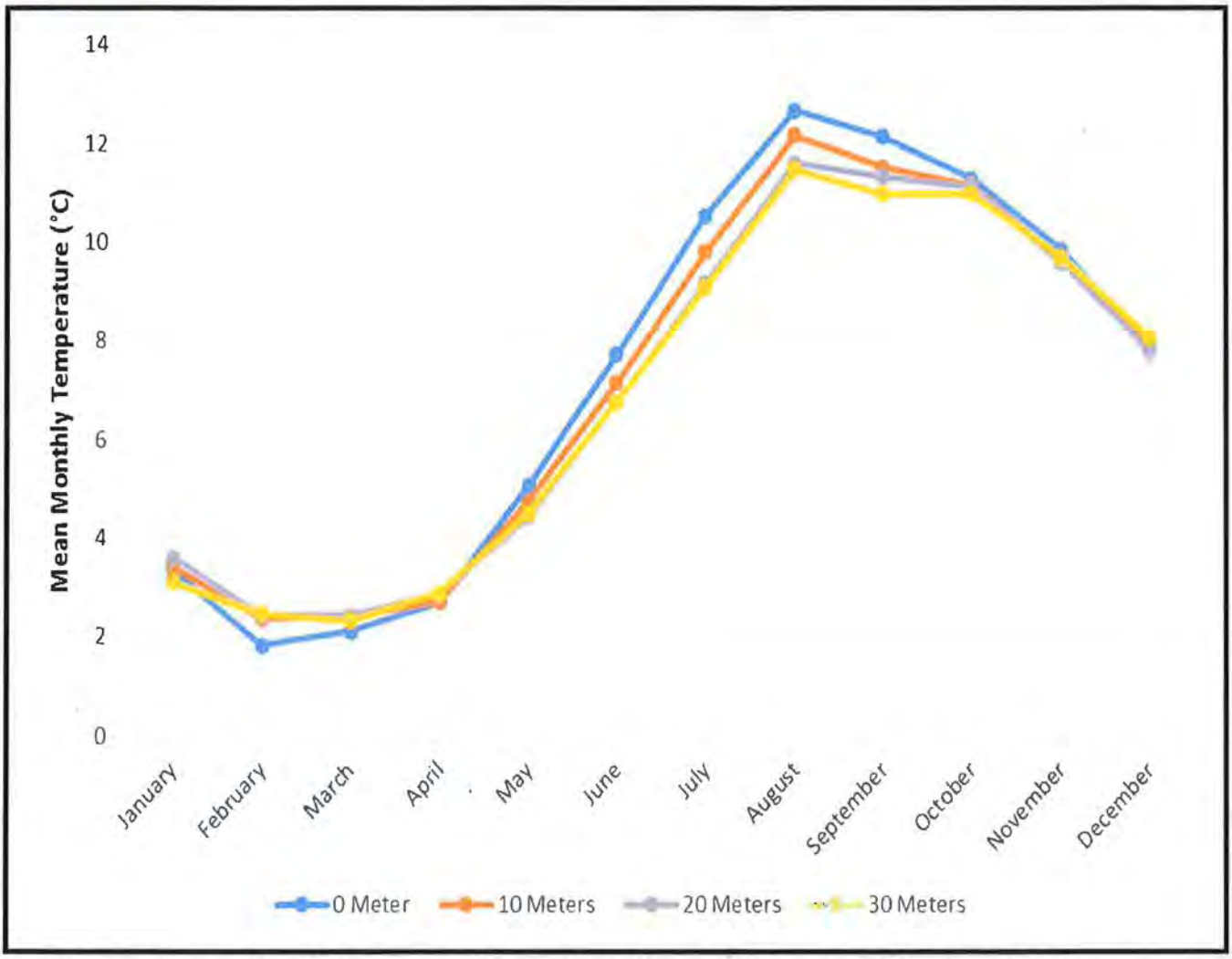

Figure 28. Average Monthly Temperature Data of OES Subarea 55 (Bay of Fundy) at 0 to 30 m Deep
Note: Data was obtained from the Oceans and Ecosystem Science website (Fisheries and Oceans 2007).

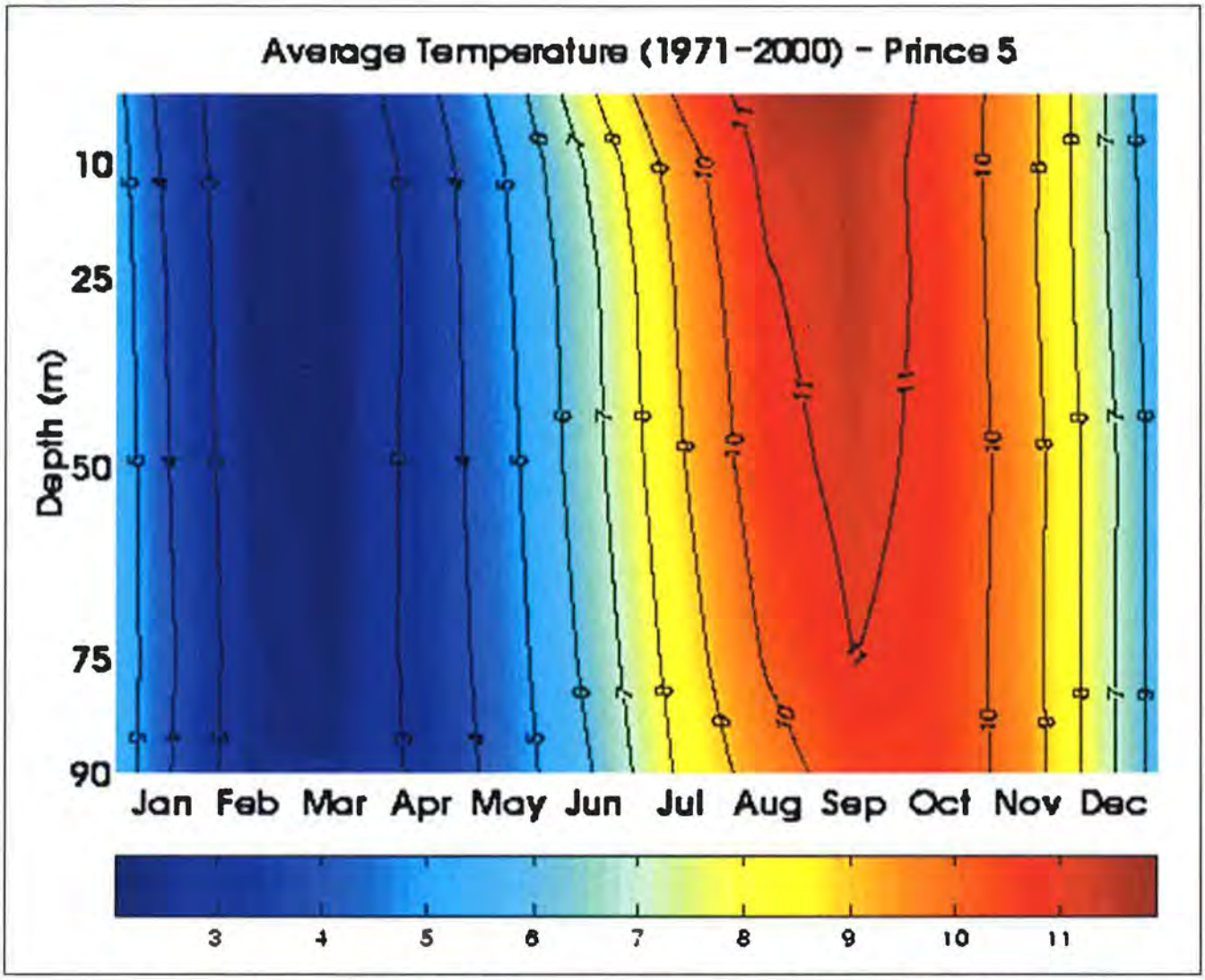

Figure 29. Contour Plot of Average Monthly Temperatures from Prince 5 Station of DFO's Atlantic Zone Monitoring Program
Note: Graph was obtained from Fisheries and Oceans Canada (2017g).

The effects of superchill can be detrimental to fish health and may result in high mortalities. Superchill is a phenomenon caused by the cooling of seawater below the lethal temperature for Atlantic salmon (i.e. -0.75˚C). Although cold temperatures cannot be entirely avoided in a northern climate, the effects of superchill may be diminished by fitting the cages with deep nets and locating cage systems in deep enough water that the fish may avoid the surface water layer which, in winter, tends to be colder than deeper water. Other mitigation strategies include avoiding stress in the fish by ceasing feeding and other activities at the cage site. These activities excite the fish and bring them up to the surface where the water is colder. KCS does not approach their cage sites or feed stock during time periods when superchill is a potential threat.

Sea ice is typically not a problem in Annapolis Basin. The thirty-year frequency of presence of sea ice (Fig. 30) and predominant ice type (Fig. 31) for the Bay of Fundy and Annapolis Basin are unknown. Both Figures 30 and 31 illustrate the thirty-year averages for the week of January 29, the week that appears to have the most sea ice coverage in Nova Scotia. KCS has no intentions of deploying equipment such as ice booms near the site. KCS does, however, continuously monitor for sea ice during winter months and will take necessary precautions, if needed. Freezing spray may occasionally build up on cage structures during extreme winter conditions. When ice build-up is a concern, it can be removed by site crews.

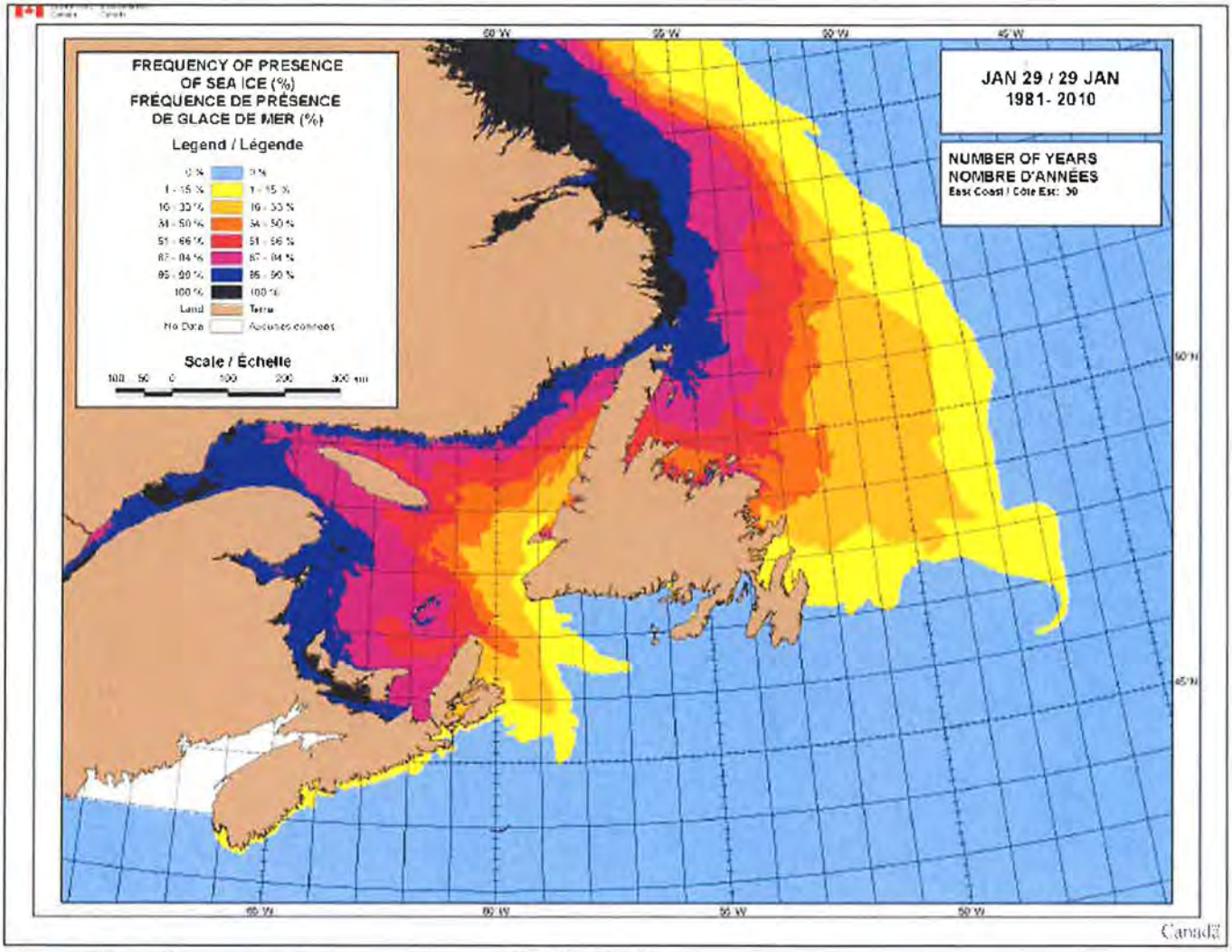

Figure 30. Frequency of presence of sea ice in Atlantic Canada
Note: Figure sourced from Environment Canada, Canadian Ice Service (2010)

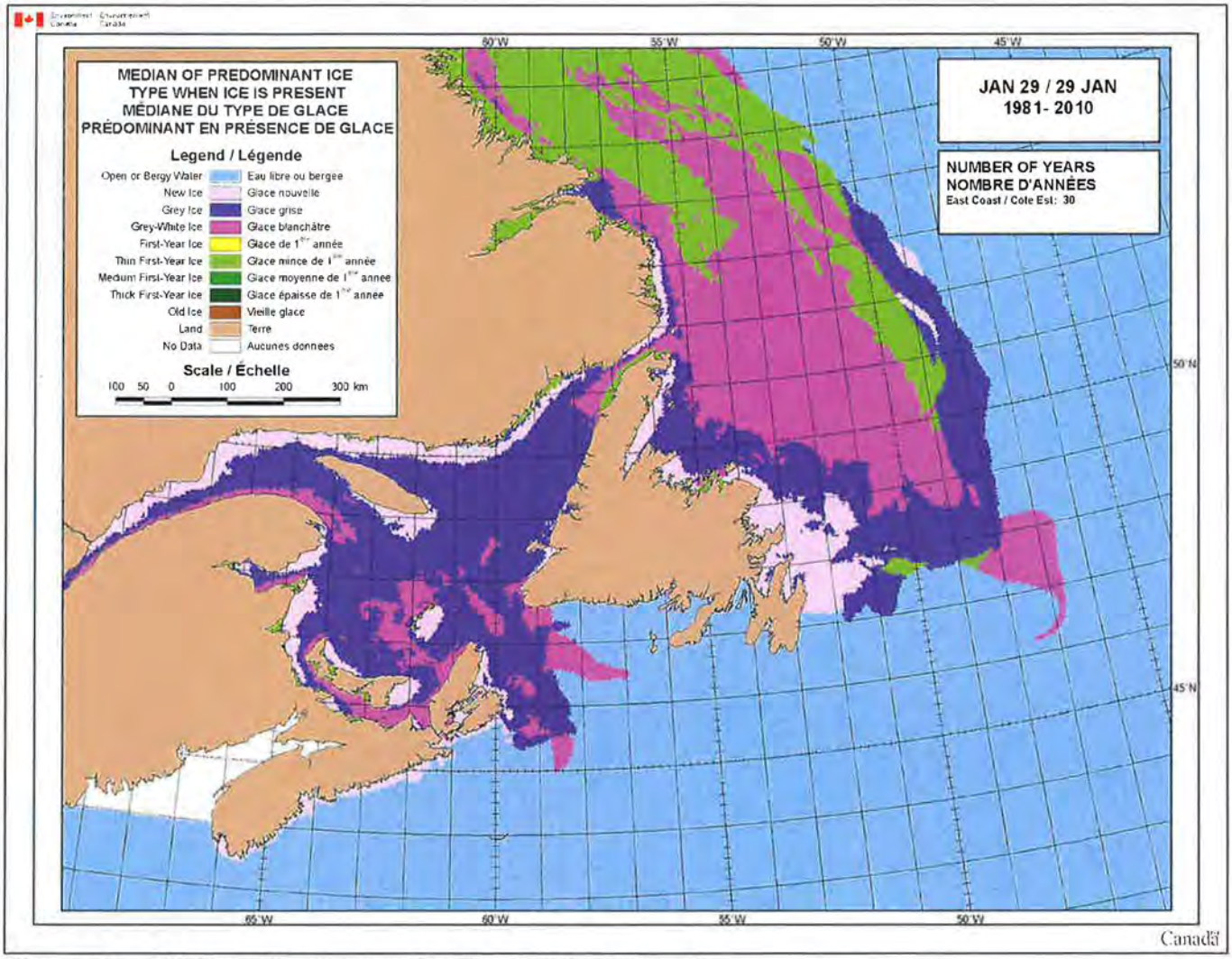

Figure 31. Median of Predominant Ice Type in Atlantic Canada
Note: Figure sourced from Environment Canada, Canadian Ice Service (2010)

4.1.8 Oxygen

Long-term, monthly, average, dissolved-oxygen data presented in Figure 32 are from the Fundy Prince 5 Station located at 44.93°N 66.85°W (Fisheries and Oceans 2017g). This was the closest monitoring station to the proposed location and was therefore chosen over alternate monitoring stations as a source of oceanographic data. From this averaged data, the lowest dissolved oxygen appeared in September - November, while the highest concentrations of dissolved oxygen were present in March - May.

Dissolved oxygen concentrations at the Rattling Beach aquaculture site were collected and reported by KCS staff during the site operations. The minimum DO value recorded was approximately 0 mg/L; however, an equipment malfunction is suspected for this date making the lowest, reliable concentration 6.98 mg/L. The maximum concentration recorded was

approximately 13.4 mg/L. For adult salmon, the lower limit of DO for optimal growth is generally accepted as 6 mg/L. The Rattling site typically displays DO values well above this threshold. Figure 33 illustrates the historical, DO trends from the Rattling Beach site.

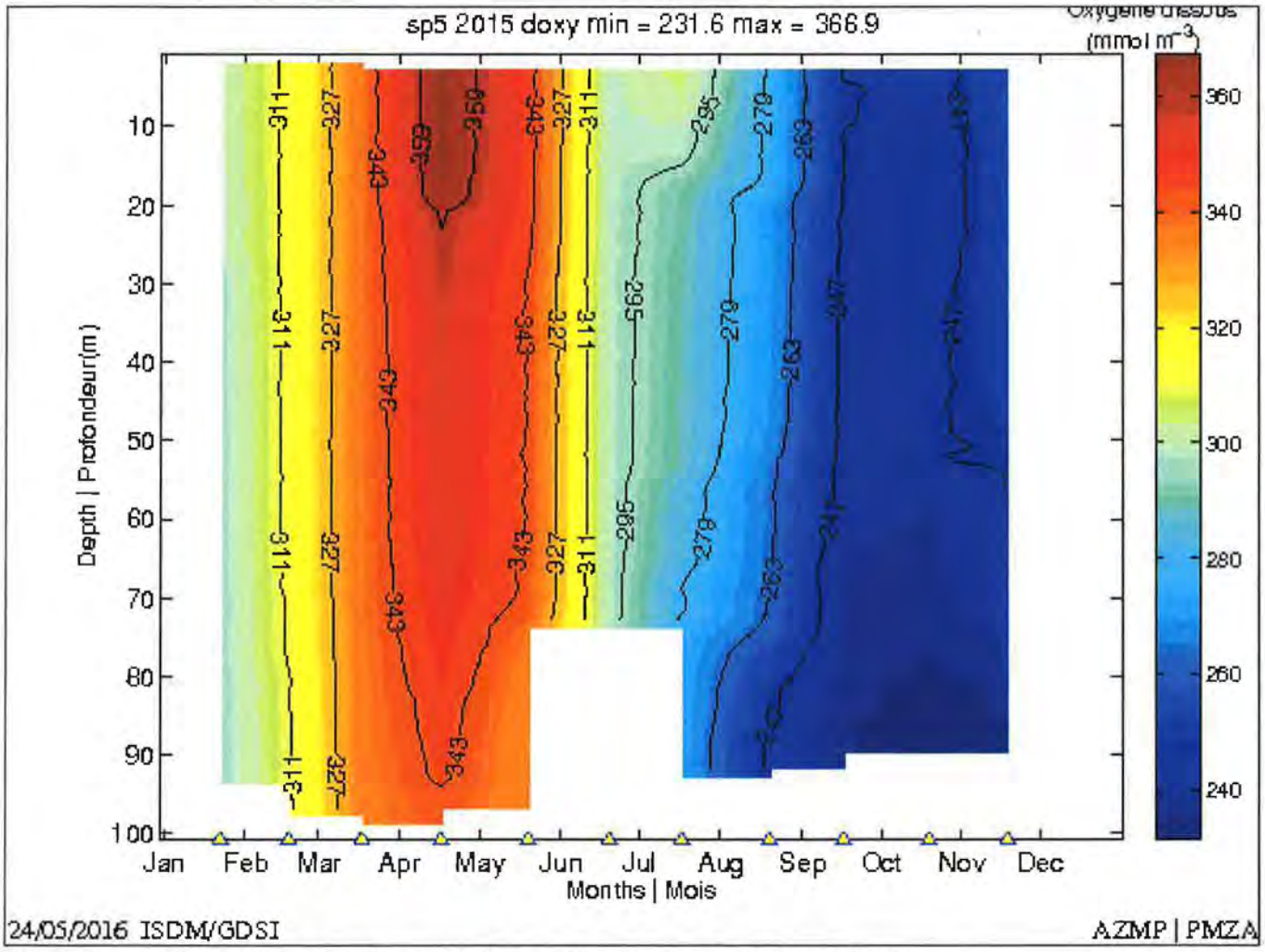

Figure 32. Dissolved Oxygen Concentrations as Measured at the Prince 5 Station
Note: Graph was obtained from the Fisheries and Oceans Canada (2017g), Marine Environmental Data Services Website

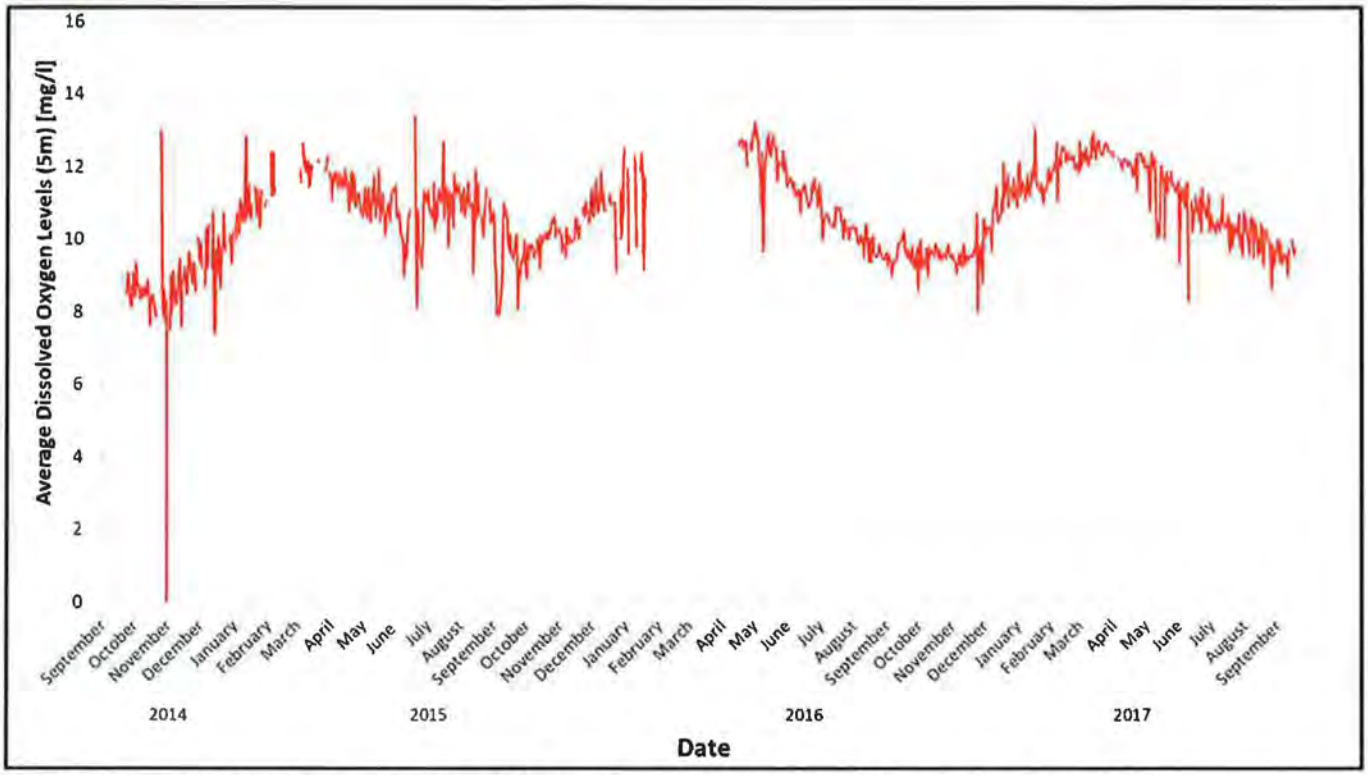

Figure 33. Dissolved Oxygen Levels as Measured at the Rattling Beach Aquaculture Site #1039

4.1.9 Bathymetry

Basic seafloor topography around the Rattling Beach aquaculture site is present in Figure 34. Section 4.2 – Baseline Environmental Monitoring provides additional information.

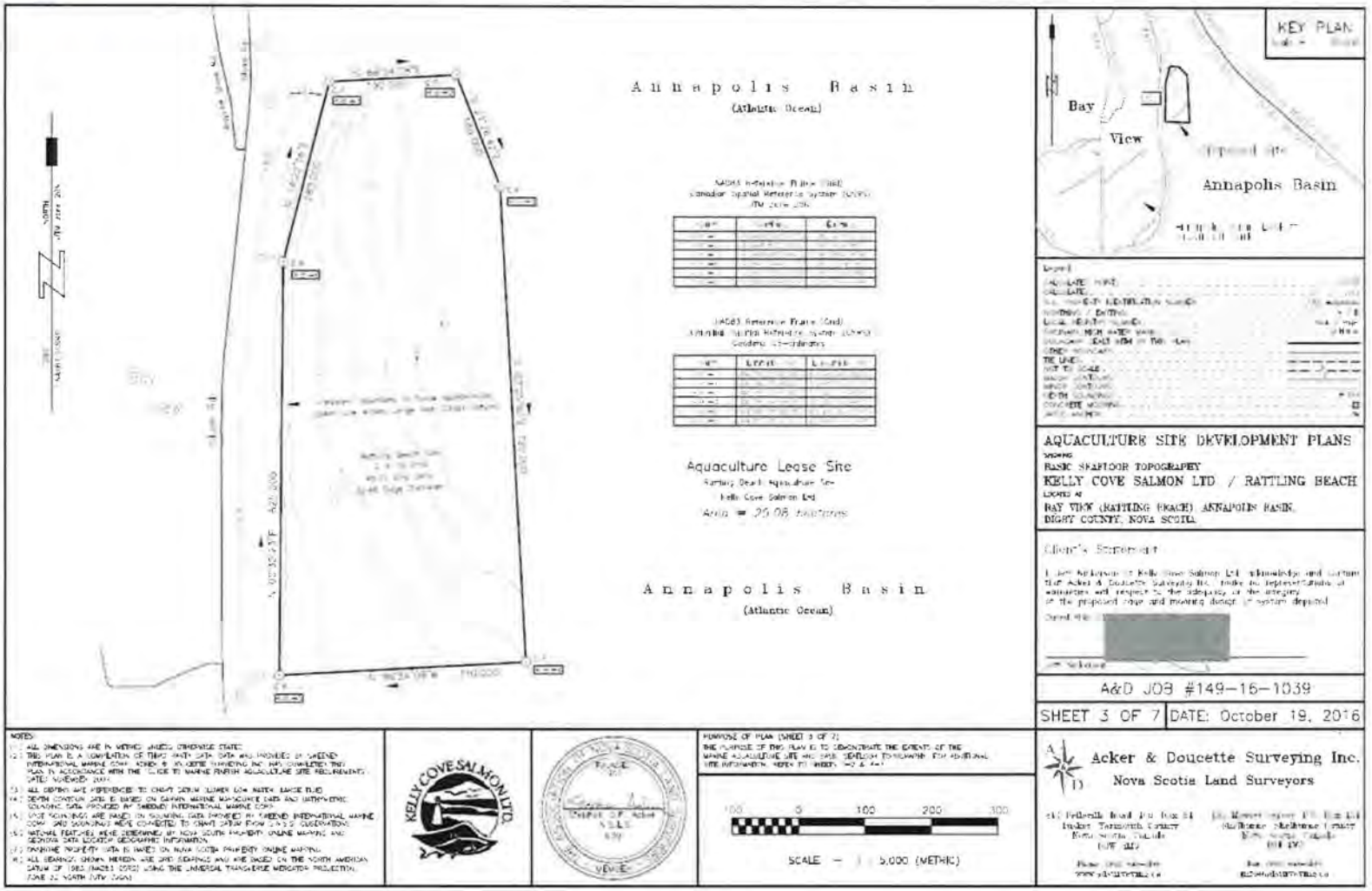

Figure 34. Basic Seafloor Topography

4.2 Baseline Monitoring

A baseline survey of the proposed lease area was conducted on July 20, 2016. The baseline survey report is entitled Baseline Assessment Site #1039 Rattling Beach and dated October 20, 2016 (Appendix A).

4.3 Site Design

The design of the Rattling beach site is a direct result of the known local bathymetry, oceanographic and benthic environment information. Additional information has been gathered in the baseline survey. This information is contained in Sections 4.1 & 4.2, and the baseline survey is included in Appendix A.

Section 5: The Other Users of the Public Waters Surrounding the Proposed Aquacultural Operations

5.1 Description of Other Users

5.1.1 Adjacent Property Owners

In October 2016, Acker & Doucette Surveying produced aquaculture site development plans which were submitted as a package with the signed notice of works to Transport Canada. In the development plans, adjacent property owners within 1,000-m were identified to the North (Figure 35) and South (Figure 36) of the proposed aquaculture lease for Rattling Beach #1039.

The proposed amendment will not adversely impact adjacent property owners or their access to the water.

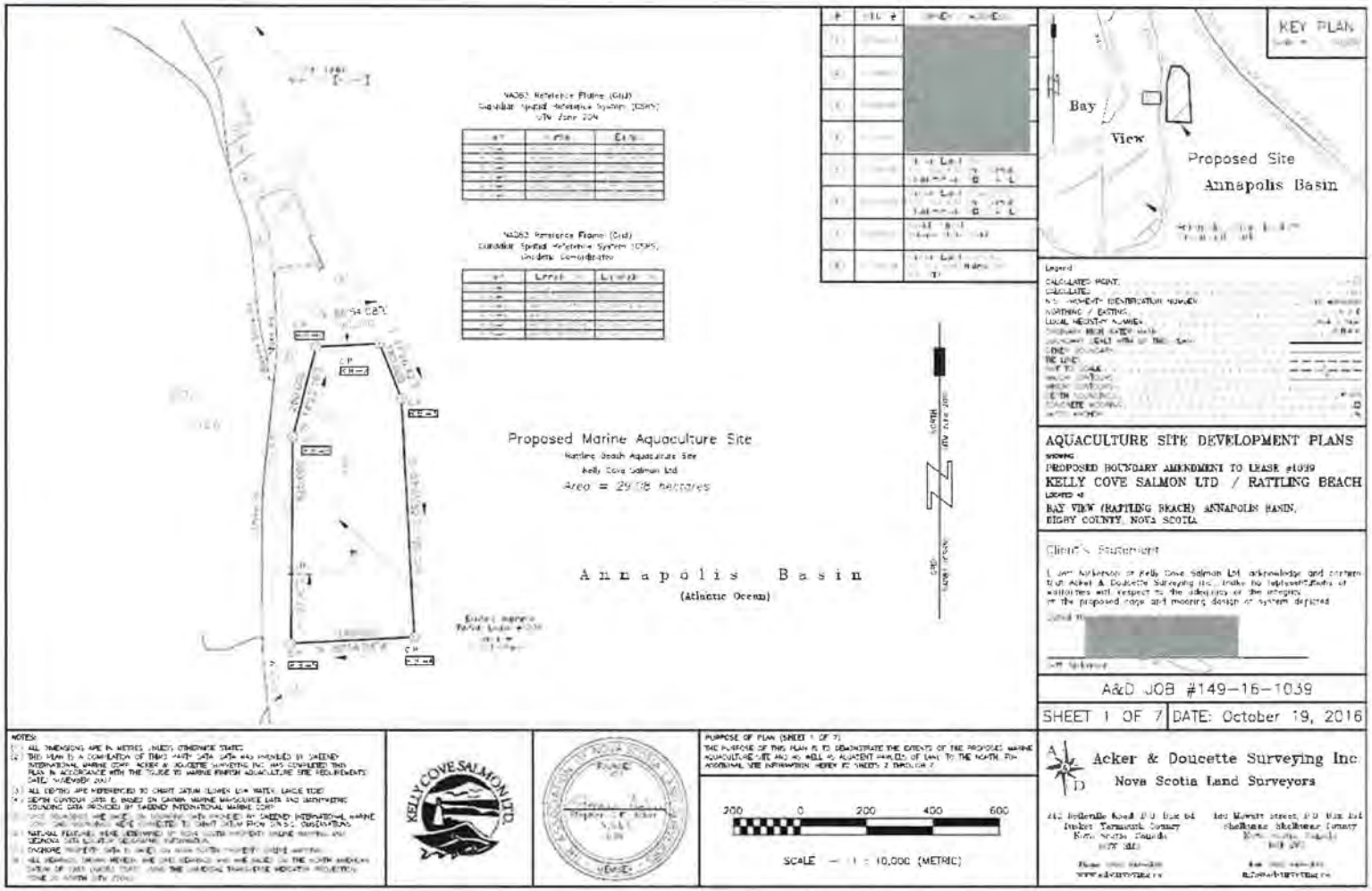

Figure 35. Plan View of the Proposed Boundary Amendment of the Rattling Beach Aquaculture Site Showing Nearby Property Owners

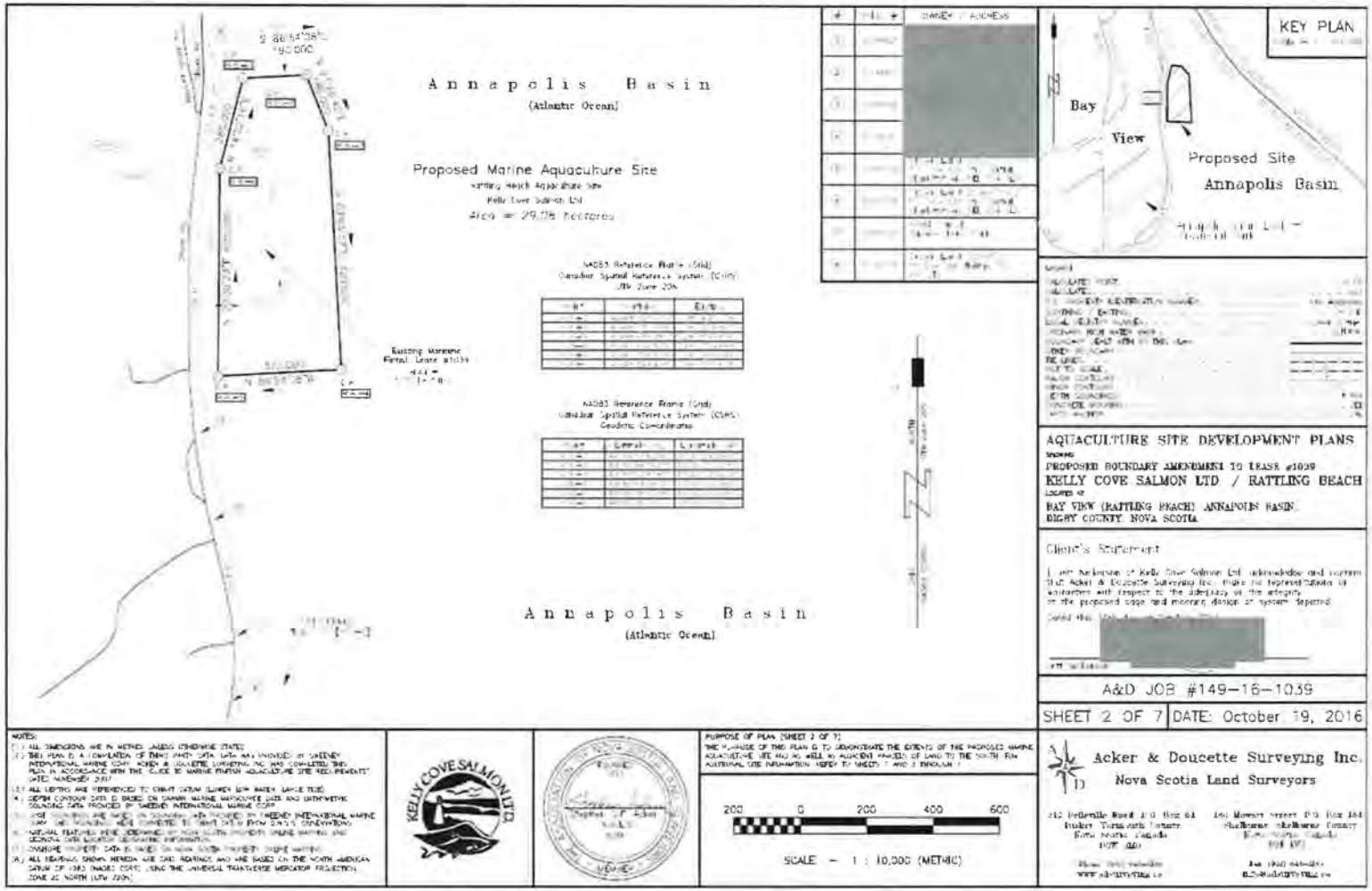

Figure 36. Plan View of the Proposed Boundary Amendment of the Rattling Beach Aquaculture Site Showing Nearby Property Owners

5.1.2 Pleasure Craft and Commercial Vessels

Within 10-km of the Rattling Beach site, four (4) active wharves and/or boat landings are present (Figure 3). Culloden wharf is a community fishing wharf, Battery Point (Victoria Beach) is used for small crafts but mostly consists of fishing boats, Royal Western Nova Scotia Yacht Club (RWNSYC) for pleasure craft and The Port of Digby which accommodates community vessels including fishing vessels as well as Kelly Cove Salmon Ltd's working vessels for Victoria Beach (#1040) and Rattling Beach (#1039). Historic wharves in the area: Clementsport, Port Wade and Deep Cove Wharf (Coastal Communities Network 2005).

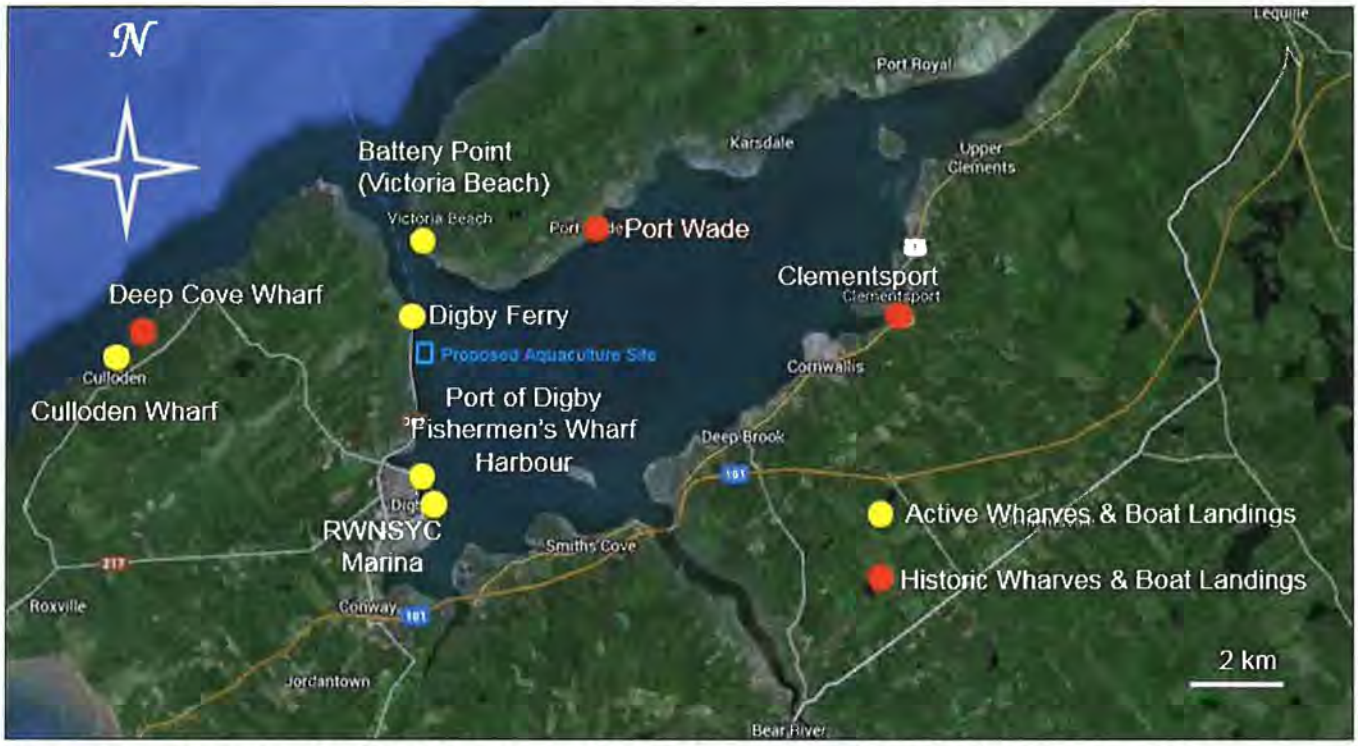

Figure 37. Current and Historic Wharves and Boat Landings near Rattling Beach Aquaculture Site

The Digby Ferry is located north of the site. The Fundy Rose ferry travels between Saint John, New Brunswick and Digby, Nova Scotia, once or twice daily depending on the time of year. The ferry route is outlined in Figure 38 (Bay Ferries 2017).

All pleasure crafts and commercial vessels must abide by the navigation buoys and markers present within the basin. The general route to enter and exit the basin is present in Figure 39. The Port of Digby has published a detailed map of Annapolis Basin, outlining anchorage areas and navigation buoys (Figure 40; i-Boating 2017).

Figure 38. Bay Ferries ferry route between Digby and Saint John

Figure 39. Pleasure Craft and Commercial Boat Traffic in Annapolis Basin

Figure 40. Navigational Buoys and Anchorage Areas in the Annapolis Basin
Note: Figure was sourced from i-Boating (2017)

5.1.3 Fish & Seafood Processors

Fish and seafood processors within the area of the proposed Rattling Beach site were identified using Nova Scotia Fisheries Sector Council as a resource (Figure 41). The nearest processors are O'Neil Fisheries Ltd. and Casey Fisheries Ltd, at approximately 2.6-km from the proposed boundaries of the Rattling Beach site. O'Neil Fisheries Ltd. is located at 144 Water St. Digby. O'Neil Fisheries Ltd. primarily process scallop and haddock, however their multispecies groundfish vessels also land pollock, redfish, winter flounder, witch flounder and Atlantic halibut. Casey Fisheries Ltd. is located at 146 Water Str. Digby. The company specializes in Digby scallops, clams, cod, haddock, Pollock, flounder, lobster and rock crab. Other products include sea urchin roe, periwinkles and dulse.

Other processors include Mosher Longmire Fisheries Ltd. which is located at 11 1st Ave. Digby, approximately 4.0-km from the proposed boundaries of the Rattling Beach site. This company provides fresh or frozen fish and seafood. Broad Cove Fisheries is located at 1631 Culloden Road, approximately 7-km from the proposed Rattling Beach boundaries. Products include groundfish, live lobster, periwinkle and Mako shark.

While the processors are in relatively close proximity to the proposed Rattling Beach boundaries, no negative interactions have been documented.

Figure 41. Fish and Seafood Processors in Digby County

5.1.4 Recreation and Tourism

The Annapolis Basin area offers an extensive list of recreational and tourism activities. Perhaps the most well-known tourist attraction in the area of Annapolis Basin is whale watching tours. Opportunities are offered by Brier Island Whale Watching and Seabird Cruises, Ocean Explorations, Mariner Cruises Whale Watching and Seabird Tour, Gael Tours, Dockside Whale Watching & Charters, and Fundy Adventures.

The area of Annapolis Basin is also known to have tourism activities such as yachting out of the Royal Western Nova Scotia Yacht Club & Marina, located in Digby (~2.7 km from proposed site). Many different provincial and historic parks are around Annapolis Basin. Provincial Parks in the area include the Central Grove Provincial Park located on Digby neck and the Annapolis Basin Look Off in Digby (~1.2 km from proposed site). Historic sites include the Port Royal Habitation and National Historic Site, the Forte Anne Historic Site, and the Annapolis Royal Historic Gardens. Kayaking and canoeing rentals and routes for the Annapolis River, Bear River, and other rivers in the area are offered by Canoe Annapolis County. Private kayak tours are also offered throughout Annapolis Basin by Kayak Annapolis Royal and Dockside Kayak Rentals.

There are several lighthouses in the areas of Annapolis and Digby county, including the Prim Point Lighthouse in Victoria Park (~ 4.5 km from proposed site), the Bear River Lighthouse in Smiths Cove (~ 6.2 km from proposed site), and the lighthouse located in Gilberts Cove. Camping areas within Annapolis and Digby Counties are provided by Digby Campground and Fun Park, Fundy Trail Campground and Cottages in Delaps Cove, and Jaggers Point Ocean Front Campground in Smiths Cove.

Public beaches in the general vicinity of the Annapolis Basin include Sandy Cove Beach, a well-known tourist destination, and Smiths Cove, where clam digging is offered by the team of Fundy Adventures (~ 6.5 km from proposed site). Walking trails can be found in the Historical Association of Annapolis Royal's Historic Walking Trails. Hiking opportunities are also available on a large trail extending from the tail of Bear River in Smiths Cove to Harbourview (~ 6.6 km from proposed site). Many tourists come to enjoy freshly caught local seafood, which is offered at a number of restaurants around Annapolis Basin. Some of the more famous restaurants include Restaurant Composé, in Annapolis Royal, and Shore Road Seafood, in Hillsburn.

Annapolis Royal offers various places to stay the night, including Digby Pines Gold Resort and Spa, Coastal Inn Digby, Bayside Inn Bed and Breakfast, Seawinds Motel, Croft House Bed and Breakfast, The Garrison House, the Hillside House Inn, the Annapolis Royal Inn, At the Turret Bed & Breakfast, The Bailey House, and The Queen Anne Inn. Other Bed and Breakfasts in the area of Annapolis Basin include the Seafaring Maiden near Granville Ferry, the Harbour View Inn in Smiths Cove, Headley House by the Sea in Smiths Cove, and Ocean Hillside Bed and Breakfast in Digby. Figures 42 & 43 illustrates a number of tourist and recreational attractions, as well as other resources, in the area of the Rattling Beach aquaculture site.

Digby's tourism is an important economic sector. Specific events, such as the Wharf Rat Rally and Scallop Days, attract many visitors specifically in the summer time (Municipality of Digby, 2017a).

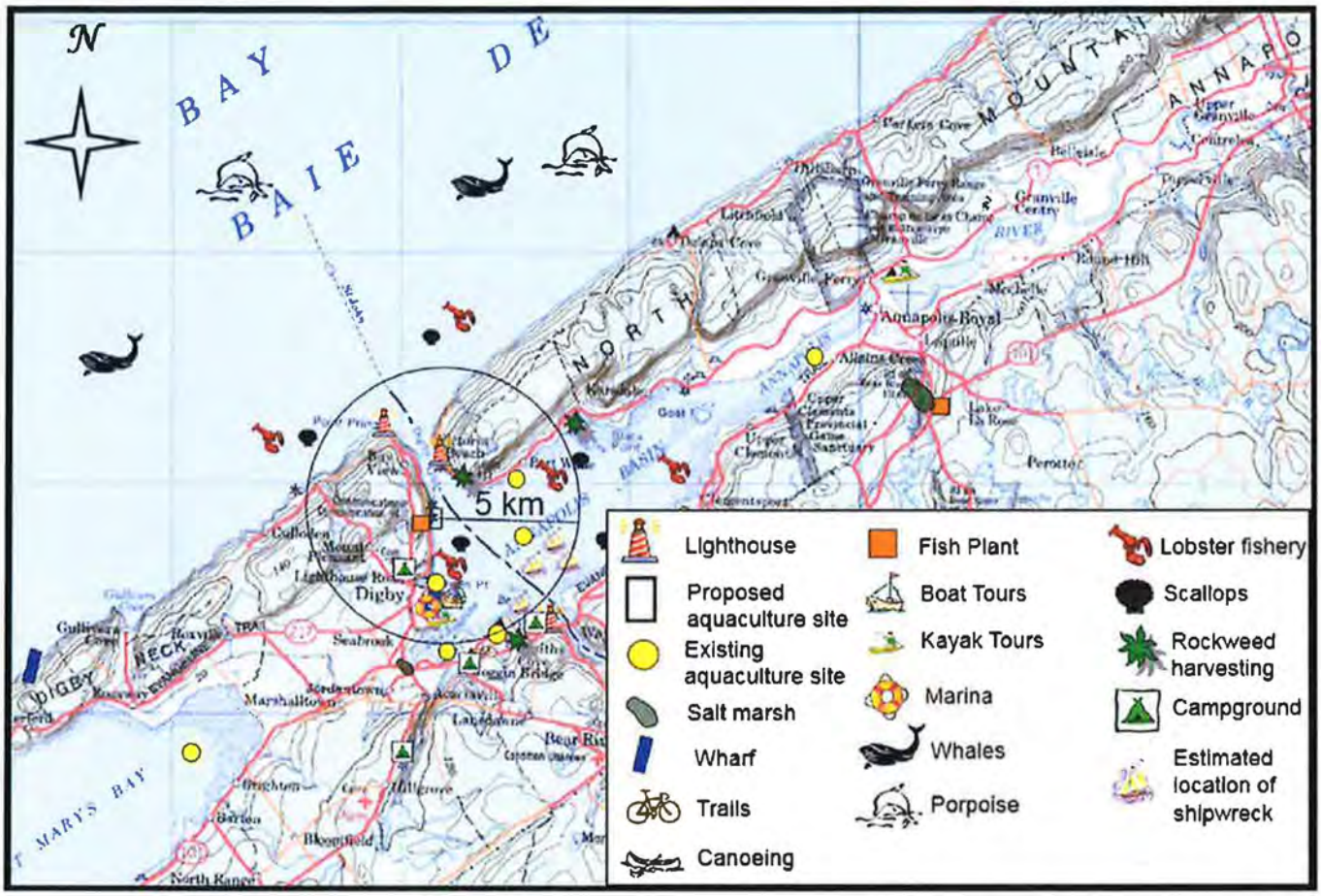

Figure 42. Resource Map of Annapolis Basin (Map: National Topographic System Map Sector 021A and Sector 020P)

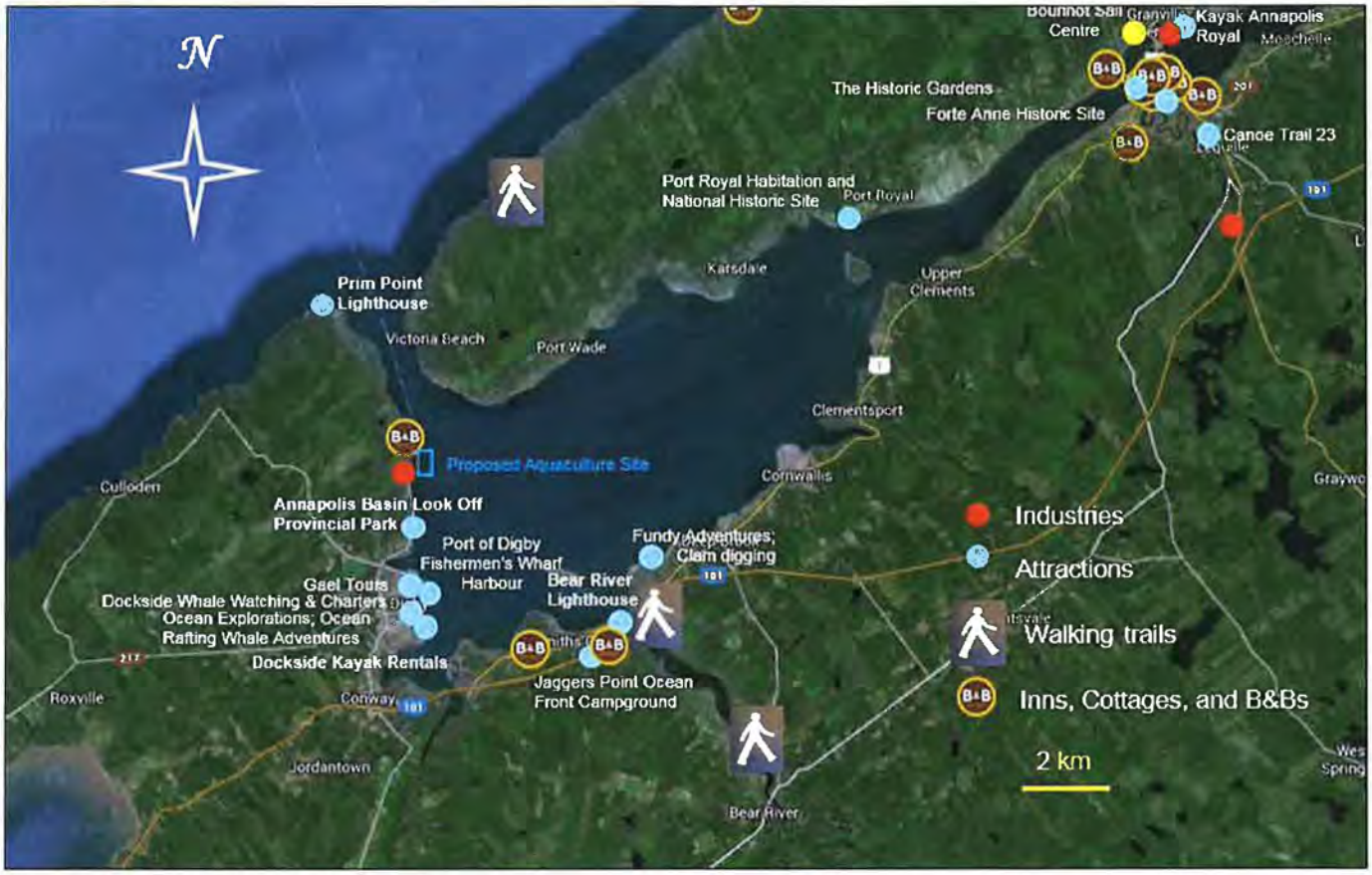

Figure 43. Tourism and Recreation

5.1.5 Communities and Lodging

The Rattling Beach site is located approximately 2.5-km north of Digby, Nova Scotia. The population of the town of Digby is 2,060, however 17,323 people live in the county of Digby (Statistics Canada 2017a).

In Digby county, a number of cottages and campgrounds are available for use throughout the year. Table 9 lists lodging options within 10-km of the proposed Rattling Beach boundaries. Refer to Section 5.1.4 Recreation and Tourism for details regarding inns, bed and breakfasts and hotels.

Table 10. Cottages and Campgrounds near Rattling Beach #1039.

Type of Lodging	Lodging	Distance and Location in Relation to the Site	General Location
Cottages	Birch Village	4.9 km – south	Smiths Cove
	The Villages of Mountain Gap Resort	5.5 km – south	Near Big Joggins overlooking Annapolis Basin
	Still Point Lodge	6.2 km – south southeast	Bear River
Campgrounds	Fundy Spray Camp Ground	5.3 km - south	Near Joggins Bridge
	Jaggars Point Oceanfront Campground	5.4 km– south southeast	Smiths Cove
	Digby Campground and Fun Park	2.5 km – west southwest	North of the town of Digby
	Red Roof Campground	4.5 km – west southwest	Inland off of Scenic Dr.
	Wild Coast Tents	7.5 km – east southeast	Bear River
	Bear River Millyard Recreation Campground and Camp Cottages	10.8 km – east southeast	Bear River

5.1.6 Municipal, Industrial and Agriculture

5.1.6.1 Municipal

Residents and businesses have access to proper disposal of any residential, commercial, and industrial waste in this area. Waste removal which includes green bin, recycling, and garbage is available throughout the town of Digby and Digby County. Collection days is dependent upon location within this area. Alternatively, a public drop off and transfer station is located in Seabrook as well as a full collection site at Conway Workshop Association (Digby) for residential eWaste and waste from the industrial-commercial-institutional (ICI) sector. Bottle exchanges are also accessible in the area.

One of the largest sources of pollution, by volume, originates from municipal wastewater (Environment Canada 2012a). The Government of Canada manages the risks associated with effluent discharge under the Canadian Environmental Protection Act 1999 (CEPA 1999). Municipal wastewater treatment plants operate in accordance to the Wastewater Systems Effluent Regulations which have been established under the Fisheries Act, which state minimum quality standards. A waste treatment plant located in Smith's Cove, 4.7-km south southeast of the aquaculture boundaries, services the town of Digby and the county of Digby. The plant was being upgraded in 2013 to transfer Digby's waste directly to the Smith's plant so that the town's sewage treatment plant at the south end could be closed (Digby Courier

2013). As stated on the Municipality of Digby website, Digby "...takes pride in being a green, clean, active, secure, accessible, and healthy place to live, work and visit" (Municipality of Digby 2017b).

5.1.6.2 Industrial

According to the Municipality of Digby, fishing has been the main contributor to Digby's economy. While traditional fishing, food processing and manufacturing remain important, Digby has become a destination for tourists (Municipality of Digby 2017a). Refer to Sections 5.1.3 Fish and Seafood Processors and 5.1.4 Recreation and Tourism for additional details.

5.1.6.3 Agriculture

In 2010, diverse agricultural activities in Digby County accounted for approximately $63.1 million in farm receipts. Animal production, greenhouse, nursery/floriculture, and agri-tourism such as wineries, U-picks, and farmers markets are the predominant activities within this area. Table 10 indicates the number of farms in the town of Digby and Digby County (Statistics Canada 2017b). In general, "other" animal production is the principal farm type mostly comprised of mink farming (Nova Scotia Federation of Agriculture 2014).

Table 11. Total Number of Farms in Digby and Digby County
Note: Table recreated from Statistics Canada Census of Agriculture (Statistics Canada 2017b)

	Digby	Digby County
Cattle ranching/farming	6	14
Poultry and egg production	1	2
Pig/hog farming	2	2
Sheep and goat farming	1	2
Other animal production	39	68
Oilseed and grain farming	0	1
Vegetable/melon farming	5	7
Fruit/tree nut farming	9	21
Greenhouse, nursery and floriculture	5	10
Other crop farming	8	10
Total Farms	76	137

No known interactions between municipal, industrial or agriculture with the Rattling Beach site.

5.1.7 First Nations Territories/Reserves

The closest First Nations communities to the proposed project aquaculture site are the Bear River First Nations reserve from the Confederacy of Mainland Mi'kmaq, five Acadia First Nations reserves (Gold River 21, Medway River 11, Ponhook Lake 10, Wildcat 12, and Yarmouth 33) and Annapolis Valley First Nations Reserve. Statistics Canada reports that the Bear River reserve had a population of 102 individuals and a total private dwelling count of 44 (Statistics Canada 2013a). Statistics Canada reports that the Acadia First Nation reserves had a population of 157 individuals and a total private dwelling count of 62 in Yarmouth 33 Reserve (Statistics Canada, 2013b) and a population of 77 individuals and a total private dwelling count of 27 in Gold River 21 Reserve (Statistics Canada, 2013c). The other three Acadian First Nation reserves are inhabited with less than 33 individuals with no available labour force activity or occupation statistics. The Annapolis Valley First Nation Reserves had a population of 145 individuals. From the National Household Survey, the only reported reserve relying on natural-based resources was the Yarmouth 33.

Bear River First Nation has launched a project to re-establish traditional canoe routes for ecotourism named "7 Paddles". At present time, the community is focusing their efforts inward to build the foundation for the project, such as building of canoes and a cookhouse.

5.1.8 Geology and Archaeology

In the area of Annapolis Basin, the bedrock geology consists of alluvial and lacustrine clastic sedimentary rocks and local basalt, granite, syenite, gabbro, and minor felsic volcanic rocks of the Newark Supergroup (Hibbard et al. 2006). Closest to the Rattling Beach marine site are the

North Mountain (basalt) and Blomidon (lacustrine playa, sandflat, and deltaic clastic rocks, minor aeolian sandstone and conglomaerate) formations (Keppie 2000).

In the past, impacts to paleontological resources were assessed by the Nova Scotia Museum. An internal provincial review of new and existing aquaculture sites will be examined by Nova Scotia Communities, Culture, and Heritage (CCH) (S. Weseloh-McKeane, pers. com.). In general, most cage-based aquaculture sites, like Rattling Beach, cause minimal damage to submerged archaeological resources as the anchors are the only portion of the site in contact with the seafloor.

5.1.9 Shipwrecks

Several shipwrecks may be in the area of the proposed site (Maritime Museum of the Atlantic 2016); however, detailed locations or coordinates are not available. Estimates of some of the wreck locations are shown on Figure 43. Several shipwrecks reported in the Annapolis and Digby areas took place within Annapolis Basin. These include, but are not limited to, the Clarence A Shafner, the James Muir, the Lizzie Wharton, the Lorne B. Snow, the Marie Delphin, the Martha D. Mclain, the Meldon G., the Ora, the Ronald Eugene, the Robert Leonard, the Singer, and the Wanda Elaine.

The Clarence A. Shafner was stranded in Annapolis basin due to broken moorings in 1902 while on a voyage to Cuba. The schooner was considered a partial loss. In 1874, a barque, known as the James Muir, was stranded in Pond Cove of Bear Island in Annapolis Basin due to stress of weather; the ship was declared a partial loss, with approximately $4500 of cargo lost. The schooner, Lizzie Warton, was in Annapolis Basin when it caught fire in 1901. The disaster resulted in the total loss of the ship along with $800 worth of cargo. While out on a fishing voyage in 1914, the Lorne B. Snow was stranded in Annapolis Basin by unknown causes. The event led to the partial loss of the schooner. Similarly, the Marie Delphin was stranded at Hardy's Point in Annapolis Basin in 1894 for unknown reasons. The event led to the total loss of the schooner. The wreck of the Martha D Mclain at Sulis Point of Annapolis Basin was induced by stress of weather in 1899; the schooner was on a fishing voyage when it suffered a total loss. In 1968, the Meldon G. foundered in Annapolis Basin resulting in the total loss of the ship. The brigantine, Ora, was wrecked in 1902 in Annapolis Basin due to stress of weather; the result was a partial loss. The Ronald Eugene was stranded at Man O' War Rock in Annapolis Basin in 1948 due to unknown causes resulting in the total loss of the ship. Also due to unknown causes, the Robert Leonard was stranded in Annapolis Basin in 1879; the event was deemed a partial loss. The fishing vessel, Singer, was lost due to heavy seas and stress of weather when it smashed ashore in Annapolis Basin in 1972. Also in 1972, the engine room of the Wanda Elaine caught fire while the ship was in Annapolis Basin, resulting in the wreckage and total loss of the fishing vessel.

5.1.10 Important Habitats and Conservation Areas

There are a few significant habitats within 5-km of the Rattling Beach site. The whole of Annapolis Basin (9,273.2 ha) has been designated as significant habitat for migratory birds. This area is part of an important migratory route called the Atlantic Flyway which follows the Atlantic Coast of North America and the Appalachians Mountains with end points at the Eastern Artic Islands/the coast of Greenland and the Gulf of Mexico. A salt marsh is present approximately 2.2 km south-

southeast of the Rattling Beach site and a number of marshes, bogs/fens, and swamps surround the basin (Fig. 44; NSDNR 2016). The only existing protected area within 5 km of the site is the Annapolis Basin Look-Off Provincial Park, which offers exceptional views of the whole basin on a clear day (Fig. 45).

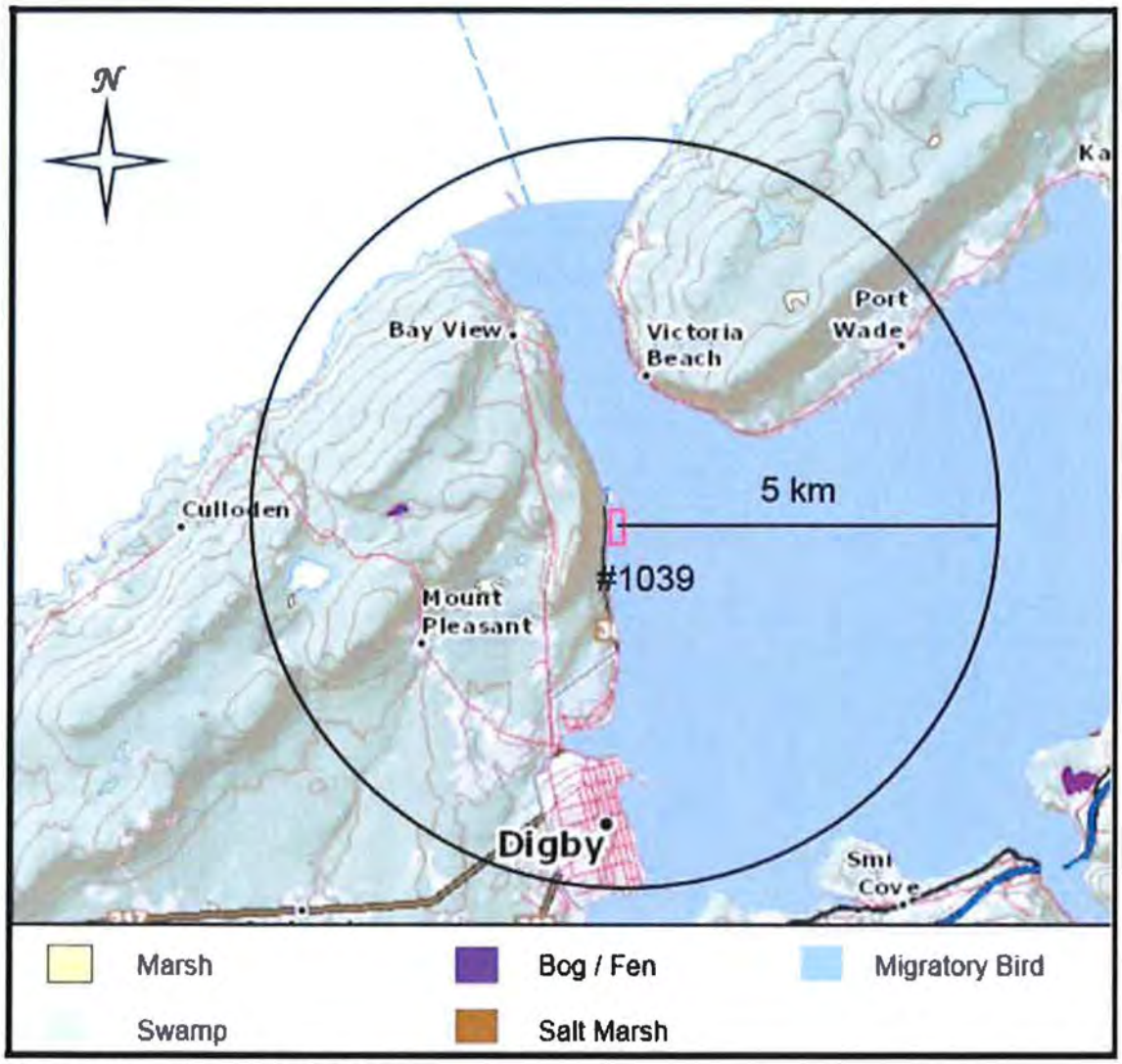

Figure 44. Significant Habitats
Note: Base map was obtained from NSDNR (2016)

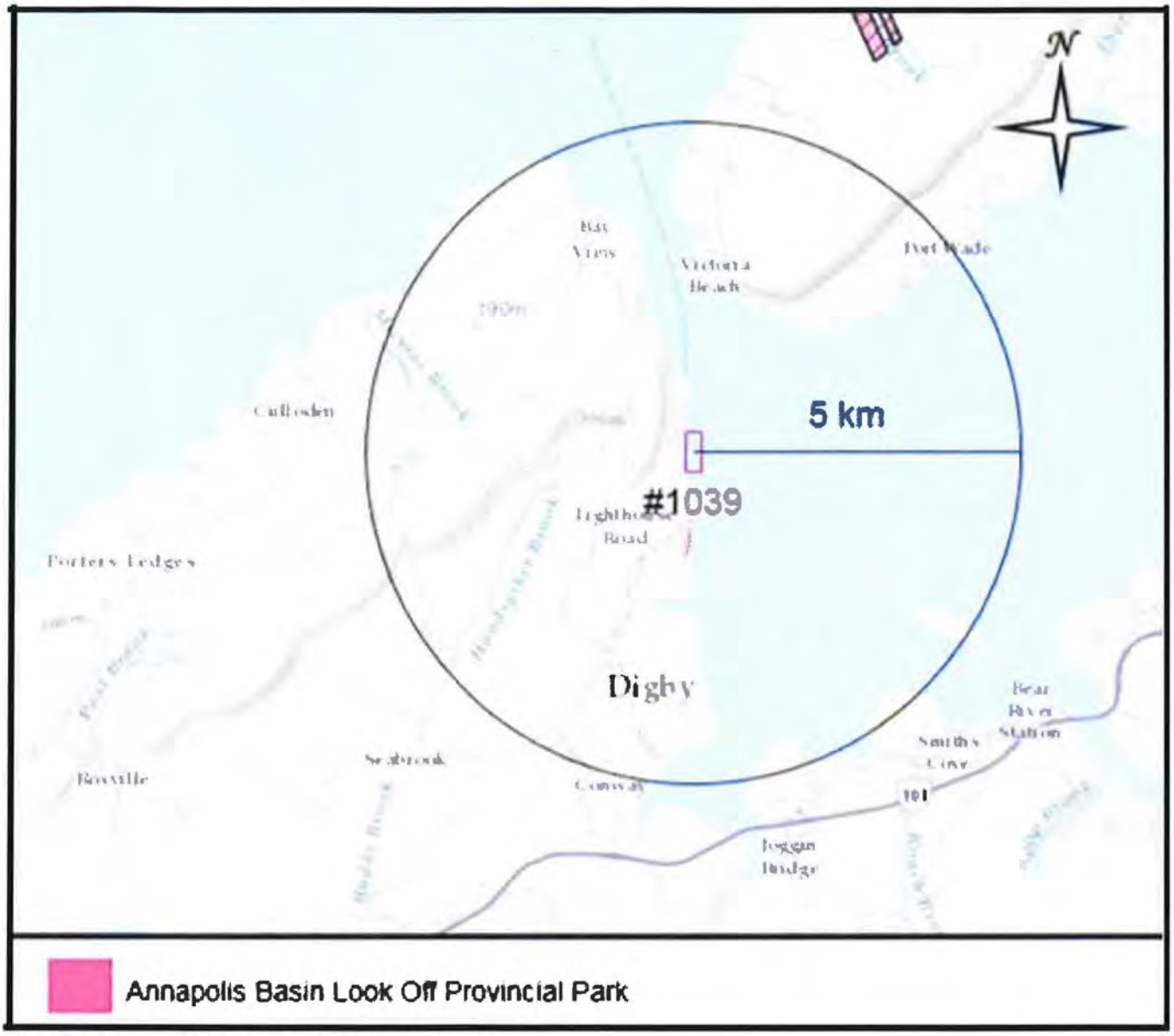

Figure 45. Existing and Pending Protected Areas
Note: Base map was obtained from NS Environment (2016)

5.2 Significance of Proposed Area to Wildlife

5.2.1 National Wildlife Area

Currently, there are 54 designated National Wildlife Areas (NWA) in Canada. A total of six (6) NWAs are present in the province of Nova Scotia, however none of the NWAs are within 50-km of the proposed aquaculture site (Environment Canada 2017b).

5.2.2 Wetlands

In Canada, 37 sites have been designated as Wetlands of International Importance. Three (3) are in Nova Scotia however none of the wetlands are within 50-km of the proposed aquaculture site (Ramsar 2017).

5.2.3 Marine Protected Areas

As defined by DFO, marine protected areas (MPAs) are geographic areas dedicated to and managed for the long-term conservation of nature. Fisheries and Oceans Canada establishes and manages MPAs under the Oceans Act in order to conserve numerous aspects of the areas. The aspects include, but are not limited to, commercial and non-commercial fishery resources, endangered or threatened marine species, unique habitats and other marine resources, or habitats necessary to fulfill the Minister's mandate of scientific research (Fisheries and Oceans Canada 2016c).

The nearest MPAs to the proposed aquaculture site include the Gully, located 200 km off Nova Scotia and east of Sable Island, and the Musquash Estuary, located just 20 km southwest of Saint John, New Brunswick.

The Sable Gully is a submarine canyon formed by glacial ice erosion over thousands of years. Surrounding the Sable Gully is an important and highly functional area, in which several commercial fisheries are supported, and it is of great importance to the oil and gas industry. The MPA is a crucial habitat to a number of endangered or threatened species inhabiting the Scotian Shelf. Some of these species live in the Sable Gully year-round, including the Northern Bottlenose whale. Many endangered or threatened species such as various species of sharks, tuna, marlin, and seabirds are drawn to the area due to it copious amounts of plankton. The slopes and floor of the Sable Gully are known to have various crab species, sea pens, anemones, brittle stars, and a large variety of cold-water coral. Conservational efforts are in place as the area is used for continuous research and monitoring. The conservation efforts of DFO include the collection and analysis of data, regulatory monitoring of the shipping, fishing, research, tourism, and oil-and-gas activities in the surrounding area, development of regulation and industry codes, provision of educational activities at the Bedford Institute of Oceanography, and the evaluation and reporting required to produce a MPA management plan.

The Musquash Estuary is conserved by DFO, with the help of the management and owners of the surrounding area including Ducks Unlimited Canada, the Eastern Habitat Joint Venture, the Nature Conservancy of Canada, the Province of New Brunswick, and the Government of Canada. Conservational efforts for the area include the production of a management plan to maintain the productivity and biodiversity and reduce any human-caused modification to the habitat.

5.2.4 Significant Habitat for Birds

Most of the species of birds in Canada are protected under the Migratory Birds Convention Act (Environment and Climate Change Canada 2016a). Many migratory marine birds, shorebirds, gulls, and waterfowl inhabit the waterways and shores

of coastal Nova Scotia. Migratory birds protected by the Migratory Birds Convention Act and associated regulations generally include all seabirds except cormorants and pelicans, all waterfowl, all shorebirds, and most land birds, such as eagles, falcons, and hawks.

The Western Hemisphere Shorebird Reserve Network (WHSRN) has designated the upper beaches of the Bay of Fundy, to include Chignecto Bay in New Brunswick and Cumberland Basin and Minas Basin in Nova Scotia as WHSRN sites. Both areas are greater than 100-km in distance from the proposed aquaculture site (WHSRN, 2017).

The location of the proposed farm falls within block 113 of the Canadian Wildlife Service survey areas (Fig. 46). This bird block is not considered an Important Bird Area (IBA) by Bird Studies Canada (2014); however, the Province of Nova Scotia (NSDNR 2016; Fig. 46) recognizes Annapolis Basin as a significant habitat for migratory birds. Surveys, completed between February 2000 and March 2010 by the Canadian Wildlife Service (CWS) and Nova Scotia's Department of Natural Resources, identified several species of birds in blocks 113 (Table 11). Due to funding deficiencies, few surveys have been performed since March 2010 and no additional data are available for this block (A. Hicks, pers. comm.). The long-tailed duck was the most common bird noted followed by the merganser and scaup.

Kelly Cove Salmon operates with a Wildlife Interaction Plan in place. The WIP outlines all control measures and special requirements as they relate wildlife encounters at the site. Birds are specifically addressed in the WIP.

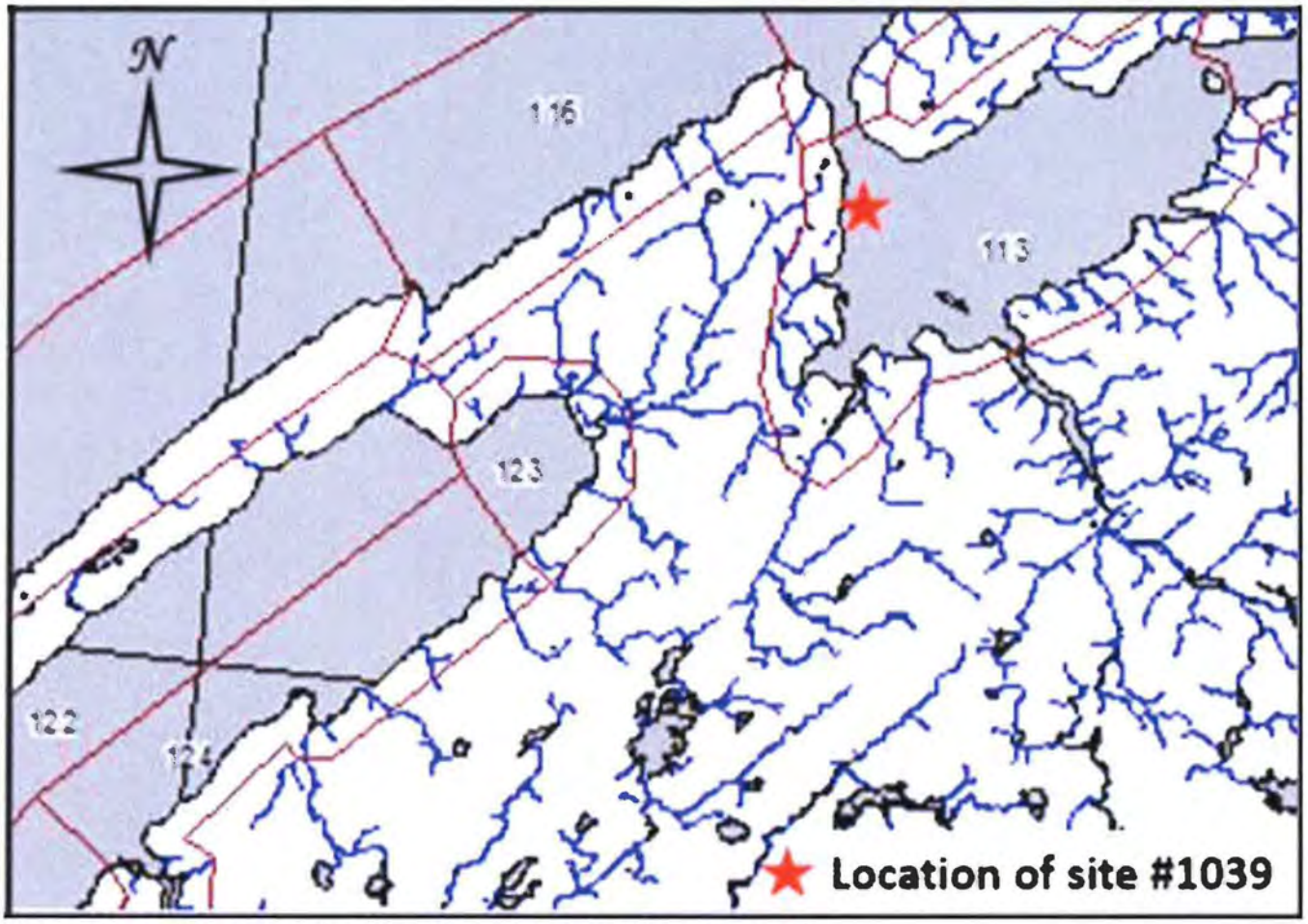

Figure 46. Map of Canadian Wildlife Service Survey Area Block 113

Table 12. Waterfowl Identified in Block 113

Canadian Wildlife Service – Block 113							
	Numbers of Sightings per Survey						
Bird Name	**02-Feb-00**	**16-May-00**	**04-Mar-04**	**26-Feb-07**	**18-Feb-09**	**22-Jan-10**	**Grand Total**
American Black Duck		0	81	98	424	312	**915**
American Green-winged Teal	0	0	0	0	0	0	**0**
American Wigeon	0	0	0	0	0	0	**0**
Atlantic Brant	0	0	0	0	0	0	**0**
Barrow's Goldeneye	0	0	0	0	0	0	**0**
Black Scoter	0	0	0	75	61	137	**273**
Blue-winged Teal	0	0	0	0	0	0	**0**
Bufflehead	130	0	44	0	37	0	**211**
Canada Goose	44	0	0	0	0	0	**44**
Common Eider	0	0	5	47	18	0	**70**
Common Goldeneye	0	0	48	9	111	22	**190**
Common Loon	0	0	9	9	21	2	**41**
Common Merganser	11	0	0	0	0	0	**11**
Female Common Eider	2	0	0	0	0	0	**2**
Gadwall	0	0	0	0	0	0	**0**
Greater Scaup	0	0	0	0	0	0	**0**
Harlequin Duck	0	0	0	0	0	0	**0**
Hooded Merganser	0	0	0	0	0	2	**2**
King Eider	0	0	0	0	0	0	**0**
Lesser Scaup	0	0	0	0	0	0	**0**
Long-tailed Duck	0	0	306	224	88	0	**618**
Male Common Eider	2	0	0	0	0	0	**2**
Mallard	0	0	0	0	0	0	**0**
Northern Pintail	0	0	0	0	0	0	**0**
Northern Shoveler	0	0	0	0	0	0	**0**
Red-breasted Merganser	0	0	0	0	11	0	**11**
Ring-necked Duck	0	0	0	0	0	0	**0**
Snow Goose	0	0	0	0	0	0	**0**
Surf Scoter	0	0	0	0	8	0	**8**
Unidentified Cormorant	0	0	0	1	2	0	**3**
Unidentified Diving Duck	0	0	0	0	0	0	**0**
Unidentified Duck	0	0	0	0	0	0	**0**
Unidentified Goldeneye	5	0	0	0	0	0	**5**
Unidentified Merganser	0	0	91	317	139	1	**548**
Unidentified Scaup	62	0	52	192	33	0	**339**
Unidentified Scoter	0	0	2	85	0	0	**87**
Unidentified Teal	0	0	0	0	0	0	**0**
White-winged Scoter	1	0	0	0	0	0	**1**
Wood Duck	0	0	0	0	0	0	**0**
Grand Total	**257**	**0**	**639**	**1057**	**953**	**476**	**3382**

5.2.5 Significance of Proposed Area to SARA

The Species at Risk Act (SARA) prevents species from becoming threatened, endangered, or extirpated by preventing destruction of their habitat and prohibit harassment, capture or harming/killing of listed species. There are several species found in Nova Scotia and the Atlantic Ocean that are listed by COSEWIC, the Government of Canada Species at Risk Act, or the Nova Scotia Endangered Species Act as either endangered, threatened, or of special concern/vulnerable. Tables 12 - 15 list those species, their status, and their occurrence in the area of interest.

Table 13. Endangered Species in Nova Scotia and the Atlantic Ocean
Note: Unless otherwise specified, the information in the following table was derived from the Species at Risk Public Registry (Nova Scotia Canada 2016)

COMMON NAME	SCIENTIFIC NAME	COMMENTS
Endangered Species		
Atlantic whitefish	*Coregonus huntsmani*	-Last COSEWIC designation (Nov 2010): endangered -Historically found only in the Tusket and Petite Rivière watersheds, and their adjacent estuaries and bays, but was extirpated from the Tusket River system sometime after 1982 (Fisheries and Oceans Canada 2006) -Poor damming practices and insufficient fish ladders have led to declines (Fisheries and Oceans Canada 2010) -Protected under the Species at Risk Act (Schedule 1) -Not known to frequent the study area
Blue whale	*Balaenoptera musculus*	-Last COSEWIC designation (May 2012): endangered -Blue whales range widely, inhabiting both coastal waters and the open ocean. Individuals belonging to the Atlantic population are frequently observed in estuaries and shallow coastal zones where the mixing of waters ensures high productivity of krill -Protected under the federal *Species at Risk Act* (Schedule 1) and the Marine Mammals Regulations, which fall under the *Fisheries Act* -Not known to frequent the study area
Leatherback sea Turtle (Atlantic population)	*Dermochelys coriacea*	-Last COSEWIC designation (May 2012): endangered -Is the most common sea turtle recorded in Nova Scotian coastal waters (NS Museum 2016) -Atlantic Canada supports one of the largest seasonal foraging populations of leatherbacks in the Atlantic (NOAA 2016b)

North Atlantic right whale	*Eubalaena glacialis*	Last COSEWIC designation (Nov 2013): endangered -Summer and fall occurrences in the offshore area called Grand Manan Basin -Protected under the federal *Species at Risk Act* (Schedule 1) and under the Marine Mammal Regulations under the *Fisheries Act* -Not known to frequent the study area
Piping plover	*Charadrius melodus*	-Last COSEWIC designation (Nov 2013): endangered -Nests above high-water mark on exposed gravel or sandy beaches -On the Atlantic coast, they often nest in association with small cobble and other small beach debris on ocean beaches, sand spits or barrier beaches; they also forage for food on these beaches -Protected under the federal Species at Risk Act (Schedule 1), the federal Migratory Birds Convention Act and the Nova Scotia Endangered Species Act -No known beaches in the vicinity of the site (BSC 2014)
Red knot rufa	*Calidris canutus rufa*	-Last COSEWIC designation (Apr 2007): endangered -Migratory stopovers are vast coastal zones swept by tides twice a day, usually sandflats but sometimes mudflats. In these areas, the birds feed on molluscs, crustaceans, and other invertebrates. The species also frequents peat- rich banks, salt marshes, brackish lagoons, mangrove areas, and mussel beds -Protected under the federal Species at Risk Act (Schedule 1) and the Nova Scotia Endangered Species Act -Proximity to the study area is unknown
White shark	*Carcharodon carcharias*	-Last COSEWIC designation (Apr 2006): endangered -Occurs in both inshore and offshore waters; ranges in depth from just below the surface to just above the bottom, down to a depth of at least 1,280 m -It occurs in the breakers off sandy beaches, off rocky shores, and readily enters enclosed bays, lagoons, harbours, and estuaries, but does not penetrate brackish or fresh waters to any extent -No federal or provincial laws explicitly protect white sharks in Canadian waters; however, it is given SARA Schedule 1 status

Table 14. Threatened Species in Nova Scotia and the Atlantic Ocean
Note: Unless otherwise specified, the information in the following table was derived from the Species at Risk Public Registry (Nova Scotia Canada 2016)

COMMON NAME	SCIENTIFIC NAME	COMMENTS
Threatened Species		
Canada warbler	*Wilsonia anadensis*	-Last COSEWIC designation (Apr 2008): threatened -Found in a variety of forest types, but it is most abundant in wet, mixed deciduous-coniferous forest with a well-developed shrub layer -Protected under the *Species at Risk Act* (Schedule 1) and the *Migratory Birds Convention Act, 1994* -Protected under *Canada National Parks* Act -Confirmed sightings throughout the Annapolis Basin area (BSC 2014)
Chimney swift	*Chaetura pelagica*	-Last COSEWIC status (Apr 2007): threatened -The species breeds in Nova Scotia -Roosts in chimneys, crevices, caves, and hollow trees -Protected under the *Species at Risk Act* (Schedule 1), the *Migratory Birds Convention Act, 1994* and the *Nova Scotia Endangered Species Act* Confirmed sightings throughout the Annapolis Basin area (BSC 2014)
Common nighthawk	*Chordeiles minor*	-Last COSEWIC designation (Apr 2007): threatened -Nests in a wide range of open, vegetation-free habitats including dunes, beaches, recently harvested forests, burnt-over areas, logged areas, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores, and river banks; also inhabits mixed and coniferous forests -Protected under the *Species at Risk Act* (Schedule 1), the *Migratory Birds Convention Act, 1994* and the *Nova Scotia Endangered Species Act* -Confirmed sightings ~ 4 km south of the site (BSC 2014)

Olive-sided flycatcher	*Contopus cooperi*	-Last COSEWIC designation (Nov 2007): threatened -Breeds in scattered locations throughout most of forested Canada -Most often associated with open areas containing tall, live trees or snags for perching -Protected under the federal Species at Risk Act (Schedule 1) and the Migratory Birds Convention Act, 1994 -Confirmed sightings ~ 4 km south of the site (BSC 2014)

Table 15. Species of Special Concern in Nova Scotia and the Atlantic Ocean
Note: Unless otherwise specified, the information in the following table was derived from the Species at Risk Public Registry (Nova Scotia Canada 2016)

COMMON NAME	SCIENTIFIC NAME	COMMENTS
Species of Special Concern		
Atlantic wolffish	*Anarhichas lupus*	-Last COSEWIC designation (Nov 2012): special concern -Primarily inhabits the cold, deep waters of the continental shelf; prefers rocky or hard clay bottoms and uses areas with sandy or muddy bottoms only occasionally -Protected under the federal *Species at Risk Act* (Schedule 1) -May be present in the study area
Fin whale	*Balaenoptera physalus*	-Last COSEWIC designation (May 2005): special concern -Associated with low surface temperatures and oceanic fronts during summer months; found from close inshore to well beyond the shelf break -Protected under the federal Species at Risk Act (Schedule 1)
Harbour porpoise	*Phocoena phocoena*	-Last COSEWIC designation (Apr 2006): Special concern -Sometimes frequents bays and harbours, particularly during summer -Protected from certain activities under the Marine Mammal Regulations of the Fisheries Act -Protected by Species at Risk Act Schedule 2
Humpback whale	*Megaptera novaeangliae*	-Last COSEWIC designation (May 2003): not at risk -Humpback whales form distinct populations and live close to coastlines -SARA schedule 3

Rusty blackbird	*Euphagus carolinus*	-Last COSEWIC status (Apr 2006): Special concern -The breeding range of the rusty blackbird includes a vast portion of Canada; a very small number of rusty blackbird's winter, albeit sporadically, in the southern part of most Canadian provinces -Protected under the federal Species at Risk Act (Schedule 1) -Confirmed sightings near the aquaculture site (BSC 2014)
Short-eared owl	*Asio flammeus*	-Last COSEWIC designation (Apr 2008): Special concern -Breeds sporadically in arctic areas, coastal marshes, and interior grasslands where voles and other small rodents proliferate -Occasionally seen in coastal areas of Atlantic Canada -Confirmed sightings ~ 4 km south of the proposed site
Sowerby's beaked whale	*Mesoplodon bidens*	Last COSEWIC designation (Nov 2006): special concern-This species is most often sighted in deep water, along the continental shelf edge and slope; only rarely seen in coastal waters -Protected under the Marine Mammal Regulations of the Fisheries Act

Table 16. Species with no SARA Status but with COSEWIC Designation in Nova Scotia and the Atlantic Ocean
Note: Unless otherwise specified, the information in the following table was derived from the Species at Risk Public Registry (Nova Scotia Canada 2016)

COMMON NAME	SCIENTIFIC NAME	COMMENTS
Species with no SARA status		
American eel	*Anguilla rostrate*	-Last COSEWIC designation (May 2012): threatened -Canadian range includes all fresh, estuarine, and coastal marine waters that are accessible to the Atlantic Ocean -Blockage of migratory streams is a major threat to the species
American plaice	*Hippoglossoides platessoides*	-Last COSEWIC designation (Apr 2009b): threatened
Atlantic bluefin tuna	*Thunnus thynnus*	-Last COSEWIC designation (May 2011): endangered -Occurs in the western Atlantic from Newfoundland to the Caribbean Sea; actively fished in Canadian waters from July through December over the Scotian Shelf (COSEWIC 2011a)
Atlantic cod (Southern Population)	*Gadus morhua*	-Last COSEWIC designation (Apr 2010): endangered -Atlantic cod inhabit all waters overlying the continental shelves of the Northwest and the Northeast Atlantic Ocean -Commercial fishing is ongoing and contributes to decline; there is evidence of an unexplained increase in natural mortality in the 4X portion of the designatable unit
Atlantic salmon (Nova Scotia Southern Upland population)	*Salmo salar*	-Last COSEWIC designation (Nov 2010): endangered -Acidification of freshwater habitats by acid rain is a major threat as is poor marine survival related to incompletely understood changes to the marine ecosystem (ASF 2016a) -The Annapolis, Round Hill, Moose, Bear, and Acacia Brook Rivers are listed as present salmon rivers and the Lequille as extirpated (ASF 2016b)

Atlantic sturgeon (Maritime Populations)	*Acipenser oxyrinchus*	-Last COSEWIC designation (May 2011): threatened -Occurs in rivers, estuaries, near-shore marine environments, and shelf regions to at least 50 m depth along the Atlantic coast of North America (COSEWIC 2011b)
Bank swallow	*Riparia riparia*	-Last COSEWIC designation (May 2013): threatened -In the Maritimes, it is most common and widespread on Prince Edward Island and the Northumberland Coast of New Brunswick and Nova Scotia -Bird Studies Canada records indicate bank swallows have been observed around Annapolis Basin (BSC 2014)
Barn swallow	*Hirundo rustica*	-Last COSEWIC designation (May 2011): threatened -Protected under the *Migratory Birds Convention Act, 1994* -Bird Studies Canada records indicate confirmed occurrences of barn swallows on the shore nearest the aquaculture site (BSC 2014)
Basking Shark (Atlantic population)	*Cetorhinus maximus*	-Last COSEWIC designation (Nov 2009): special concern -Uses coastal, temperate waters (COSEWIC 2009c) -Mortality caused by fishing by-catch and boat strikes are cited as the major threats to the species (COSEWIC 2009b
Blue shark	*Prionace glauca*	-Last COSEWIC designation (Apr 2006): special concern -In Atlantic Canada, they are regularly found in almost all waters but are most often encountered offshore; fishing by-catch is the largest threat (COSEWIC 2006)
Eastern wood peewee	*Contopus virens*	Last COSEWIC designation (Nov 2012): special concern Bird Studies Canada (2014) considers occurrences of the bird in the area to be possible
Killer whale (Northwest Atlantic population)	*Orcinus orca*	-Last COSEWIC designation (Nov 2008): special concern -Northwest Atlantic distribution includes Nova Scotian waters (COSEWIC 2008)

Loggerhead sea turtle	*Caretta caretta*	-Last COSEWIC designation (Apr 2010): endangered -Routinely found in Atlantic Canadian waters; usually associated with the warmer offshore waters of the Gulf Stream (COSEWIC 2010b)
Peregrine Falcon (anatum subspecies)	*Falco peregrinus anatum*	-Last COSEWIC designation (Apr 2007): non-active -Prefer open habitats, such as sea coasts, for hunting -Protected under the Nova Scotia Endangered Species Act -Protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Appendix I)
Porbeagle shark	*Lamna nasus*	-Last COSEWIC designation (May 2014): Endangered -Can be found from the coast to the open sea migrating annually to further inshore; seasonally ranging from the Scotian shelf and Bay of Fundy to Newfoundland on the continental shelf occasionally close to shore -Is protected by the Oceans Act and by the Fisheries Act under the terms of the Atlantic Fishery Regulations, 1985 -Target fishing and by-catch of longline fisheries has resulted in the population decline, and still continues -Currently no fisheries management measures for this species
Shortfin mako (Atlantic population)	*Isurus oxyrinchus*	-Last COSEWIC designation (Apr 2006): threatened -Found in both inshore and offshore waters -COSEWIC identified fishing, pelagic long-lining in particular, as being the most significant threat to the species; no directed fishery for shortfin mako in Atlantic Canada, but it is caught as by-catch in other pelagic fisheries and is sought after for sport fishing -Managed under the Canadian Atlantic Pelagic Shark Integrated Fisheries Management Plan which allows for an unrestricted by-catch along with 100% dockside monitoring

Smooth skate (Lauranian-Scotian population)	*Malacoraja senta*	-Last COSEWIC designation (May 2012): special concern -One of the smallest species of skate endemic to the western North Atlantic (Natanson et al. 2007) -By-catch mortality contributes to population decline (Natanson et al. 2007) -No direct fisheries for this species, however captured as by-catch in fisheries directed towards groundfish (Fisheries and Oceans Canada 2015d) -Population of the Laurentian-Scotian has accounted for 90% of the smooth skates in Canada, while covering 70% of the Canadian smooth skate range (Fisheries and Oceans Canada 2015d) -Area of abundance along the Scotian Shelf has drastically declined since 1970 (Fisheries and Oceans Canada 2015d)
Spiny dogfish	*Squalus acanthias*	-Last COSEWIC designation (Apr 2010): special concern -Inhabits Canadian waters ranging from Newfoundland to the Scotian Shelf, approximately 10 to 20% of those on the Scotian Shelf migrate south in the fall, returning in the spring (BIO 2015a) -Widely distributed in temperate regions of the world's oceans and appears to be a habitat generalist; subject to both targeted and by-catch fishing mortality (COSEWIC 2010c) -Target of direct fisheries in Atlantic Canada (Fisheries and Oceans Canada 2015)
Thorny skate	*Amblyraja radiata*	-Last COSEWIC designation (May 2012): special concern -One of the most common skates in the Northwest Atlantic (BIO 2015b) -Both a target of directed fisheries and caught as by-catch, although directed fisheries along the Scotian Shelf stopped in 2005 (BIO 2015b) -Regarded as over fished and landing of this species is prohibited throughout the Gulf of Maine (BIO 2015b)
White hake	*Urophycis tenuis*	-Last COSEWIC designation (Nov 2013): threatened -Adjust their depth distribution to find temperatures in the range of 4 - 8°C (COSEWIC 2013a)

Winter skate (Georges Bank- Western Scotian Shelf-Bay of Fundy populations)	*Leucoraja ocellata*	-Last COSEWIC designation (May 2015): special concern -Estimated to have declined by 90% since 1970, now at a historic low (IUCN 2009) -Caught as by-catch in groundfish targeting fisheries (IUCN 2009) -Bottom-dwelling species usually found on sand and gravel and at depths less than 111 m (COSEWIC 2005) -Landings under quota control on the Scotian Shelf (IUCN 2009)

5.3 Impacts to Other Users Including Wildlife

5.3.1 Critical Habitat and Mitigation Plans for Wildlife

Atlantic Whitefish

Atlantic whitefish are protected under the federal Species at Risk Act (Schedule 1). The Nova Scotia Fishery Regulations under the Fisheries Act prohibit the taking of Atlantic whitefish from all provincial waters by any method at any time of the year. This species is also protected under the Nova Scotia Endangered Species Act. Under this Act, it is prohibited to kill, harm or collect this species. While the Mersey River is not listed as habitat for the Atlantic whitefish, there are reports of Atlantic whitefish moving along the shores of Liverpool Bay towards the Mersey River (C. Reynolds, pers. com.). Neither KCS nor any of its employees will attempt to harm or capture Atlantic whitefish.

Leatherback Sea Turtle

The leatherback sea turtle is protected under the Species at Risk Act, which makes it an offense to kill, harm, harass, capture or take any individuals of a listed species. KCS will comply by these rules. If a leatherback sea turtle is spotted by any of the crew working on the aquaculture site, the Marine Animal Response Society (MARS) will be contacted at 1.866.567.6277 and given details of the sighting.

In 2006, the Atlantic Leatherback Turtle Recovery Team published a recovery strategy for the turtles in Atlantic Canadian waters. The recovery strategy document listed entanglement in commercial fishing gear, vessel collision from recreational boating and other ship traffic, marine pollution and oil and gas exploration and development as potential threats contributing to mortality. A summary of the gear types thought to be the highest risk for entanglement included longline, gillnet, traps and pots. Aquaculture gear was not mentioned in the document, but it stands to reason that aquaculture equipment, including all lines, should be kept in good working order.

Migratory Birds

Most species of birds in Canada are protected under the Migratory Birds Convention Act, 1994. Under the Migratory Birds Regulations (C.R.C., c. 1035), it is an offense to disturb, destroy or take a nest, egg, or shelter of a migratory bird, or possess a live migratory bird, or the carcass, skin, nest or egg of a migratory bird except under the authority of a permit. KCS personnel will abide by the Migratory Birds Convention Act and the associated regulations.

Piping Plover

Suitable piping-plover habitat can be approximated as a beach with the following attributes: a gently sloping foredune, wide stretches of beach that afford protection from flooding during high water, sand and/or gravel and/or cobble substrate, and a lack of vegetation (Environment Canada 2012b). A number of sites in Nova Scotia have been identified as meeting these criteria. Distribution often fluctuates due to changes in habitat. These changes may include, but are not limited to, beach width, composition of substrate, feeding areas, vegetation coverage, and human disturbance (COSEWIC 2013b). There is no known piping-plover beach near the proposed aquaculture site.

The piping plover is protected under the Species at Risk Act and the federal Migratory Birds Convention Act. KCS employees of the proposed aquaculture site will not kill, harm, or collect adults, young, or eggs of the piping plover.

Sharks

No federal or provincial laws explicitly protect white sharks in Canadian waters (COSEWIC 2006). In Atlantic Canada, there are only three directed shark fisheries. One is a recreational fishery for the blue shark which is primarily in the form of annual derbies; the others are commercial fisheries aimed at the porbeagle shark and spiny dogfish (Canadian Shark Research Laboratory 2012). The practice of finning, removing, and retaining the fins and discarding the remainder of the shark at sea, was banned in Canadian waters in 1994 (Fisheries and Oceans 2002). KCS personnel will not attempt to attract, capture or harass any sharks in any way.

Whales

Blue whales are protected under the Marine Mammals Regulations of the Fisheries Act. KCS will comply with these regulations and will not attempt to harvest, kill, or harass any blue whales (or any other whales, such as right whales) that are seen during aquaculture activities. Should any whale in distress be noted by any of the crew members at the aquaculture sites, the Marine Animal Response Society (MARS) will be contacted at 1.866.567.6277 and provided with details of the sighting. Vessels servicing the site will travel at a maximum speed of 9 knots in order to prevent damaging collisions between whales and aquaculture service vessels. This is below the recommended speed set by NOAA Fisheries Service for ships travelling through known whale areas (i.e. 9.9 knots).

5.3.2 Impacts to Other Users

5.3.2.1 Right to Navigation

The following figures provide information regarding navigation routes that are used by KCS while servicing the Rattling Beach aquaculture site (Figure 47). The layout of on-site equipment is provided in Figures 48-50.

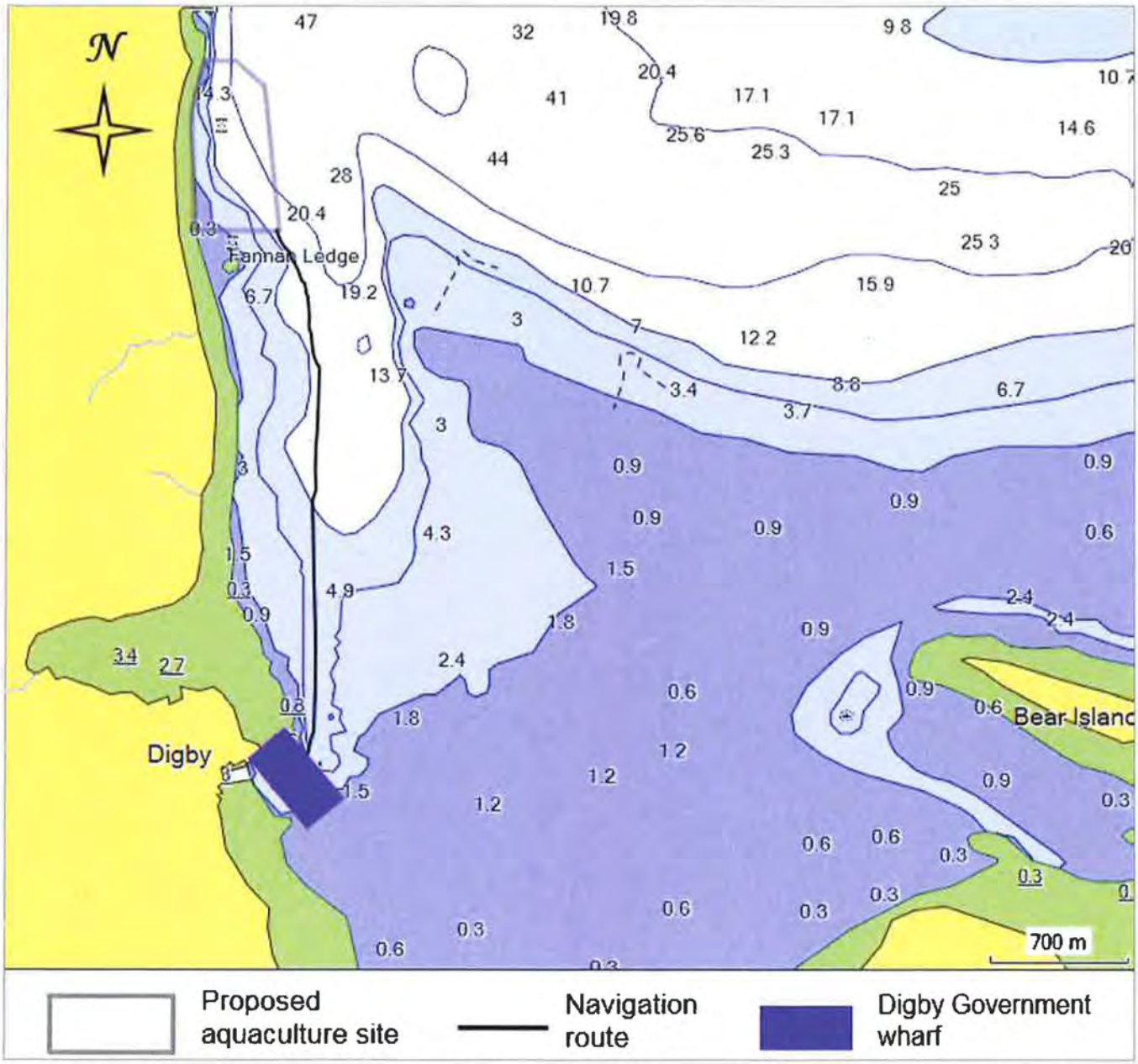

Figure 47. Marine chart showing KCS vessel route from Rattling Beach to the Digby Government Wharf.

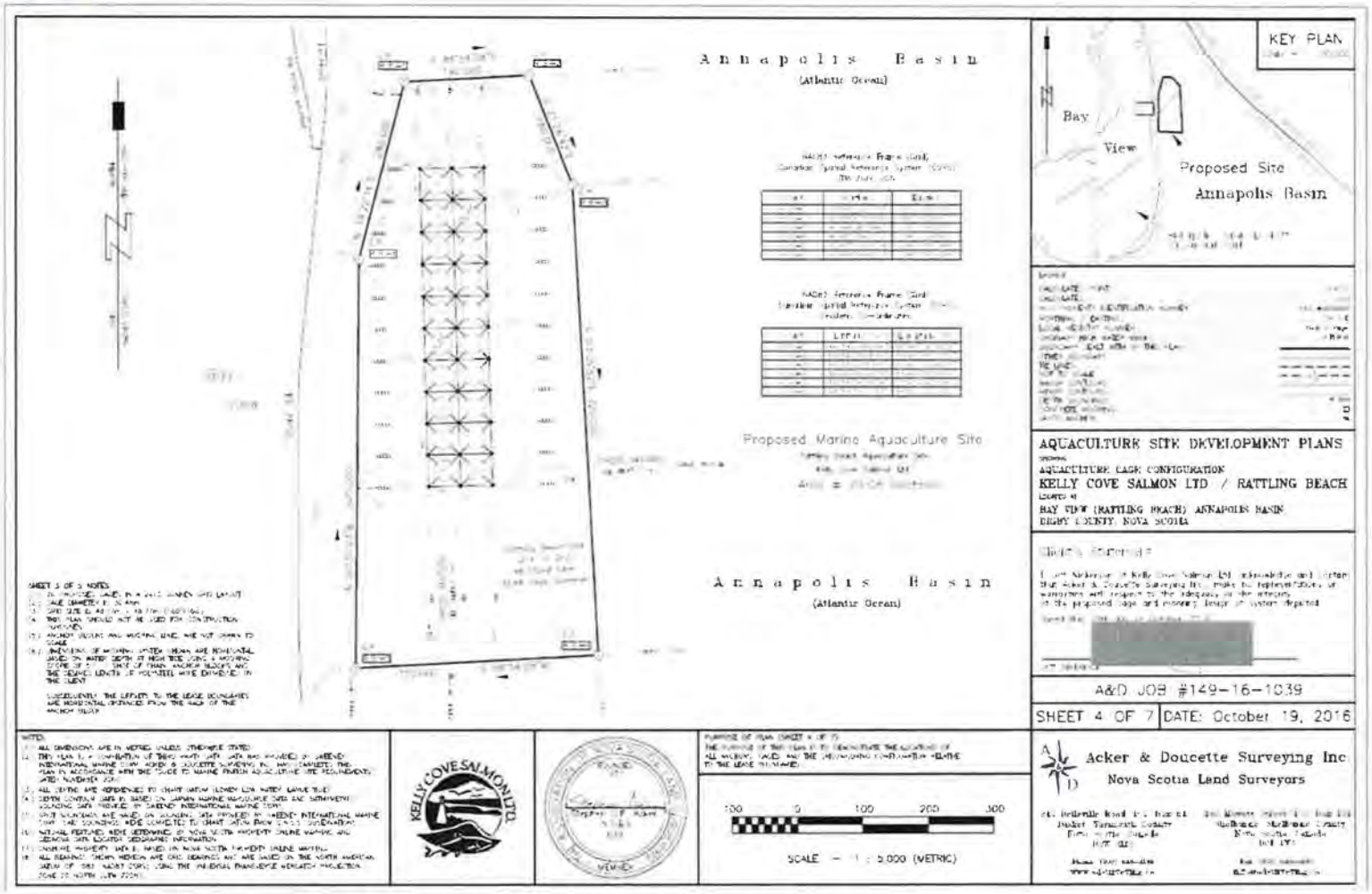

Figure 48. Rattling Beach site development plan showing cage configuration.

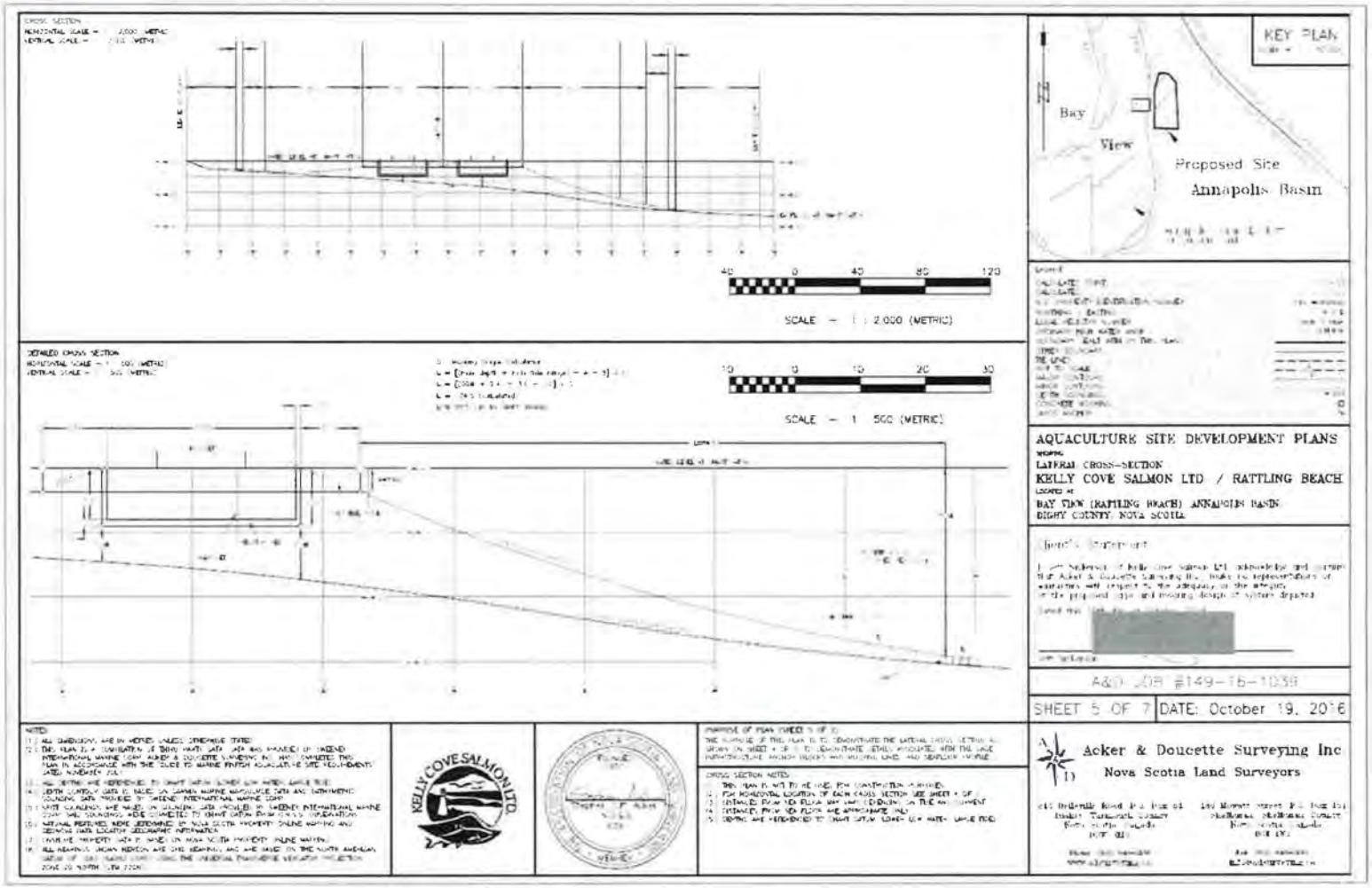

Figure 49. Rattling Beach cross-sectional plan A.

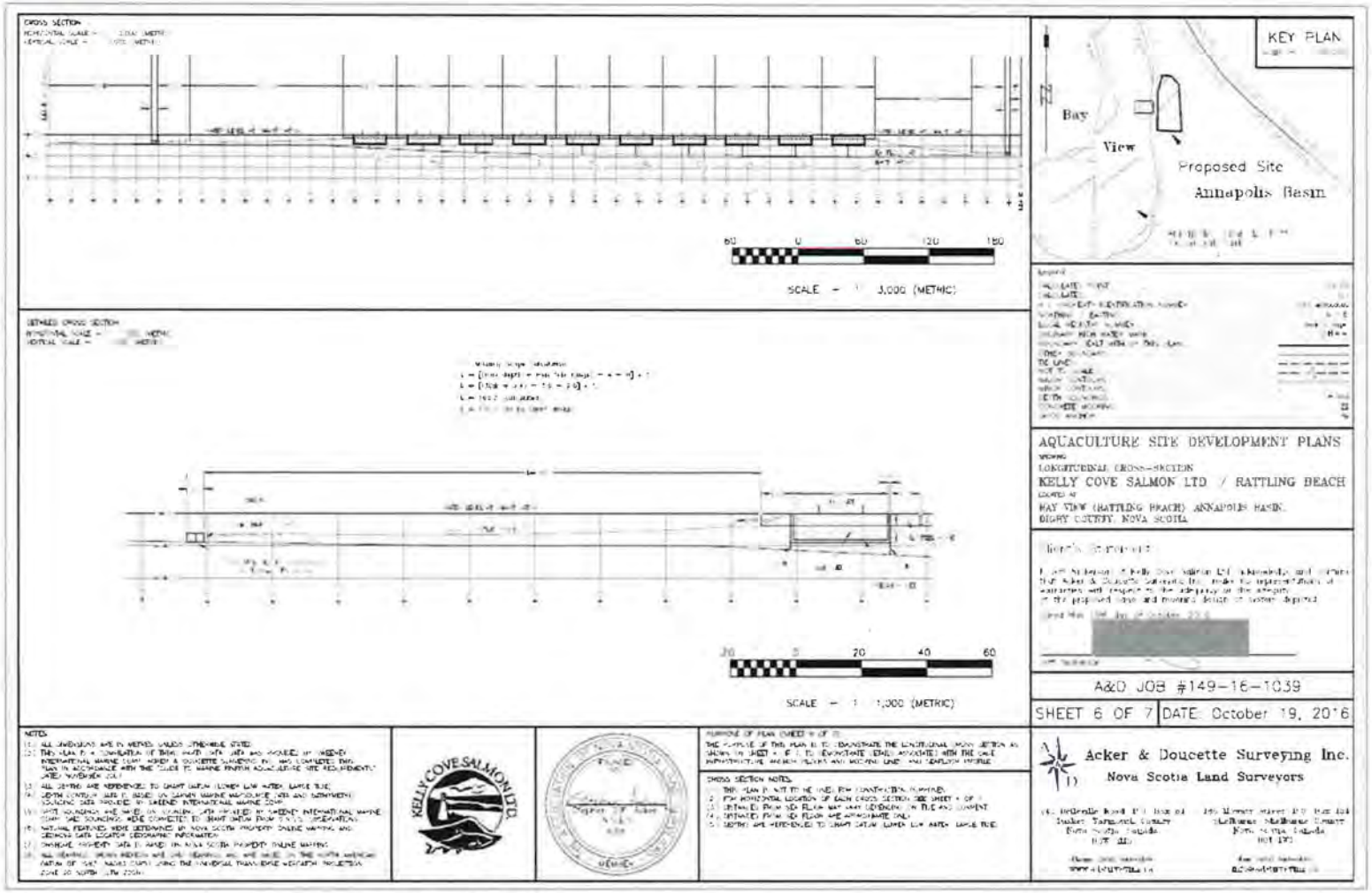

Figure 50. Rattling Beach cross-sectional plan B.

5.3.2.2 Esthetics

Rattling beach site is an existing site. The requested boundary amendment does not affect the visual appearance of the site.

5.3.2.3 Bird Activity

Any activity on the water, which includes fishing and aquaculture, can result in an increased number of opportunistic birds such as seagulls. These birds can become a nuisance for adjacent property owners and tourists travelling in and around the basin. The site will continue to discourage deterring birds by using bird nets over the cages as well as maintaining the feed in closed containers.

5.4 Impacts by Other Users Including Wildlife

5.4.1 Wildlife

Due to the environment in which KCS operates, wildlife interactions will be unavoidable – both positive or neutral and negative (predator). Positive or neutral interactions may require management notification if the species is listed on a Species At Risk list or other similar document.

Negative or predator interactions should be noted to determine if there is an increase or decrease in activity. If a predator is persistent or there is the potential for endangerment of employees, deterrence methods may be required. Any interaction, whether intentional or accidental, must be reported. Interactions with birds and predators at a marine finfish site are to be avoided. Unwanted attention from birds and predators, such as seals, endangers the wildlife themselves, can present a nuisance to workers, may stress the fish, and may pose biosecurity and fish health risks.

Predator deterrence is a key to containment management. Predator exclusion using netting include predator netting, bird nets, shark guards, and containment nets. Site mortalities are to be contained in secure, closed containers and removed promptly from the site. The containers are to be checked daily to ensure mortality containment integrity. Feed is to be stored inside, or if outside, covered with tarps or stored inside a tub with a securely fastened lid. Routine and daily examinations of dead and live fish are conducted to inspect for signs of predator attack, and any are noted. Divers are called in when deemed necessary to verify net integrity below water if predator problems are detected.

To deter birds and to mitigate against interactions, each cage containing fish are equipment with a bird stand and net for the duration of the grow-out. These stands and nets remain in place during the production schedule but may be temporarily lifted during activities such as mortality dives, net washing, fish transfers or treatments.

Measures taken to protect fish from predators are always carried out in a manner that considers predator welfare and does not endanger the predator population; however, if a predator cannot be deterred and is threatening the security of the containment, it may be dispatched in accordance with Government Policy and Saltwater Management consent.

The Wild Life Interaction Plan contains prevention and control measures for wildlife (Appendix E.)

5.4.2 People Interaction

Interaction with people outside of KCS for the marine site is inevitable. Use of the Digby Government Wharf and the proximity of the site to Digby contribute to this. Interactions with people and organizations outside of KCS can raise biosecurity concerns, pollution concerns and potential safety concerns for site staff.

Biosecurity is a key component to managing the risk of pathogen spread. Biosecurity helps mitigate outbreaks of disease through the control of personnel, traffic, vehicles, biologics, and equipment. Biosecurity standard operating procedures must be developed and utilized to mitigate risk and to manage activities in such a way to reduce stress of animals and to reduce the potential for pathogen spread. Biosecurity must be considered within all procedures and must be addressed within procedural descriptions. All sites have a wharf usage biosecurity procedure which considers other users of the wharf.

Also, the potential for pollution from other industries within the Annapolis Basin exists. Bay Ferries operate a ferry terminal near the site and a fish processing plant is located nearby.

Water quality is monitored based on the uncertainty of natural cycles and processes such as seasons, thermoclines, weather, haloclines, algal blooms, etc., but also provides information on water quality as it relates to man-made factors. Monitoring specific water parameters will aid the farmer in preparedness for dealing with health issues, assist with feeding regimes, and allow mitigative actions to be taken when conditions are less than optimum. Aquaculture license holders will be responsible for monitoring oxygen and temperature on a daily unless weather conditions do not permit water quality monitoring.

Although environmental parameters such as low oxygen and high or low temperatures and algae levels cannot be controlled in a marine finfish operation, a site must have emergency plans in place to respond to such environmental parameters when they reach levels that may affect fish health and welfare. To better understand oxygen and temperature levels at the site, VEMCO temperature and oxygen sensors will be deployed at the farm - these will provide staff with real-time data 24 hours per day.

Mitigation plans are in place for the possibility of water quality issues related to oxygen, temperature, and algae.

Visitors to the Rattling Beach site are welcomed and are expected to follow basic biosecurity and health and safety (H&S) rules. This aids in ensuring that all parties on the site remain safe. The Site Manager should confirm with the Area Manager that a visitor(s) has approval to be on site if the Site Manager was not previously informed. All visitors must sign the log book. Visitors must change their footwear prior to stepping on site, rubber boots will be provided from the office. All visitors must wear a PFD provided by the office to the site and while on site and the use of footbaths and proper hygiene is mandatory. By adhering to strict biosecurity, H&S, and visitor protocols, KCS provides a safe working environment for employees, visitors, and the fish on site.

KCS operates under a detailed Safety Management System (SMS). The SMS contains procedures for dealing with Emergency Preparedness and Transportation. An emergency is classified as any situation that has the potential to cause harm to any employee, visitor or infrastructure on site.

Section 6: The Public Right of Navigation

6.1 Navigation Protection Act Approval

6.1.1 Notice of Works

Transport Canada requires a notice of works form in order to notify the Navigation Protection Program (NPP) regarding a proposed or existing work in navigable water. A completed and signed notice of works form with supporting documentation was submitted to Transport Canada on October 20th, 2016 under NWP File # 8200-94-3045. Acker & Doucette Surveying Inc. produced the aquaculture site development plans submitted with the signed notice of works. The plans include:

a. Proposed navigation aid limits to demonstrate the extent of the marine aquaculture site as well as adjacent parcels of land to the north and south of the lease. Property identification number (P.I.D. #) with corresponding owner names and addresses are also outlined in the plans;
b. Depiction of the basic seafloor topography within the proposed lease boundaries;
c. Demonstration of anchors, cages, and grid/mooring configuration location within the proposed lease boundaries;
d. Lateral and longitudinal cross sections demonstrating cage infrastructure, anchor blocks, mooring lines and seafloor profile.

Each plan indicates the exact location of the proposed lease, legal lease site number and position of the lease. See Appendix C for the complete Notice of Works Package.

6.1.2 Transport Canada Approval Package

Transport Canada granted Kelly Cove Salmon Ltd. approval for Rattling Beach #1039 under the Navigation Protection Act on January 11th, 2017. The Minister of Transport approved the placement of the aquaculture facility as per the submitted development plans. Within the approval, Transport Canada outlined standard terms and conditions whereby all anchorage systems, gear and associated work must remain within the site boundaries, specific buoy markers are to be installed and maintained, and should any material/equipment drift from the boundaries, it must be immediately marked with a cautionary light and radar reflector and promptly removed or returned to maintain right of navigation.

See Appendix D for complete Transport Canada Approval package.

6.1.3 Project Description

The proposed lease incorporates all aquaculture-related gear, above and below the water line, therefore alterations to the grid are not required. Installation of specific buoy markers outlining the lease area is complete as per Transport Canada's approval package (Section 6.1.2).

Section 7: The Sustainability of Wild Salmon

7.1 Identification of Local Salmon Populations

The Rattling Beach marine aquaculture site is located in the range of the Nova Scotia Southern Upland Population of Atlantic salmon. The Southern Upland region of Nova Scotia is divided into three salmon fishing areas: SFA 20, SFA 21, and part of SFA 22 (Fig. 51). The marine aquaculture site in Annapolis Basin is located in SFA 22.

The abundance of Atlantic salmon in the Maritimes Region has been in decline for over 20 years leaving populations in many rivers to become extirpated or listed endangered under the Species at Risk Act (SARA). A region-wide electrofishing survey conducted in 2000 found salmon in 28 of 52 rivers surveyed (54%) whereas a similar survey conducted in 2008 and 2009 found salmon in only 21 of 54 rivers surveyed (39%) (Fisheries and Oceans 2011). The pH of water samples collected in the 1980s and 1990s indicated that several rivers in Nova Scotia were partially to heavily acidified (Lacroix and Knox 2005, Gibson et al. 2009, Fisheries and Oceans 2011). River acidification is recognized as a major factor in the survival of Atlantic salmon in Nova Scotia.

All Atlantic salmon index populations within Department of Fisheries and Oceans (DFO) Maritimes Region were assessed to be well below conservation (egg) requirements in 2014. Southern Upland (SU) and Outer Bay of Fundy (OBoF) Atlantic-salmon populations remain critically low; adult salmon returns to the LaHave River (SU), the Saint John River upriver of Mactaquac Dam, and the Nashwaak River (OBoF) remain among the lowest returns on record with estimated egg deposits ranging between 2 and 4% of conservation requirements in 2014 (Fisheries and Oceans Canada 2015e). In 2016, assessment of the index population for SFA 21– Lahave River Salmon population above Morgan Falls, indicate that the egg deposition and parr densities were below conservation requirements (DFO 2017c).

In November 2010, COSEWIC designated the Outer Bay of Fundy, Inner Bay of Fundy, Nova Scotia Southern Upland, and Eastern Cape Breton population assemblages as endangered (Fisheries and Oceans Canada 2011). However, the SARA status is "no status, no schedule". Within SFA 19 to 23, all rivers have been closed to recreational fishing as of 2010 (DFO 2017c). These rivers are all over 100 km away from the proposed aquaculture site (ASF 2016b).

The Salmon Atlas and the Atlantic Salmon Federation (Figs. 52-53) count five salmon rivers feeding into the Annapolis Basin: Annapolis River, Round Hill River, Moose River, Bear River, and Acacia Brook; the Lequille River is considered extirpated (ASF 2016b). Other nearby rivers that flow into Saint Mary's Bay include the Boudreau and Meteghan rivers, which both also have wild salmon (ASF 2016b). The aquaculture site under boundary amendment application is located approximately 4 and 6 km from the mouths of Acacia Brook and Bear Rivers, respectively, the nearest identified wild salmon rivers.

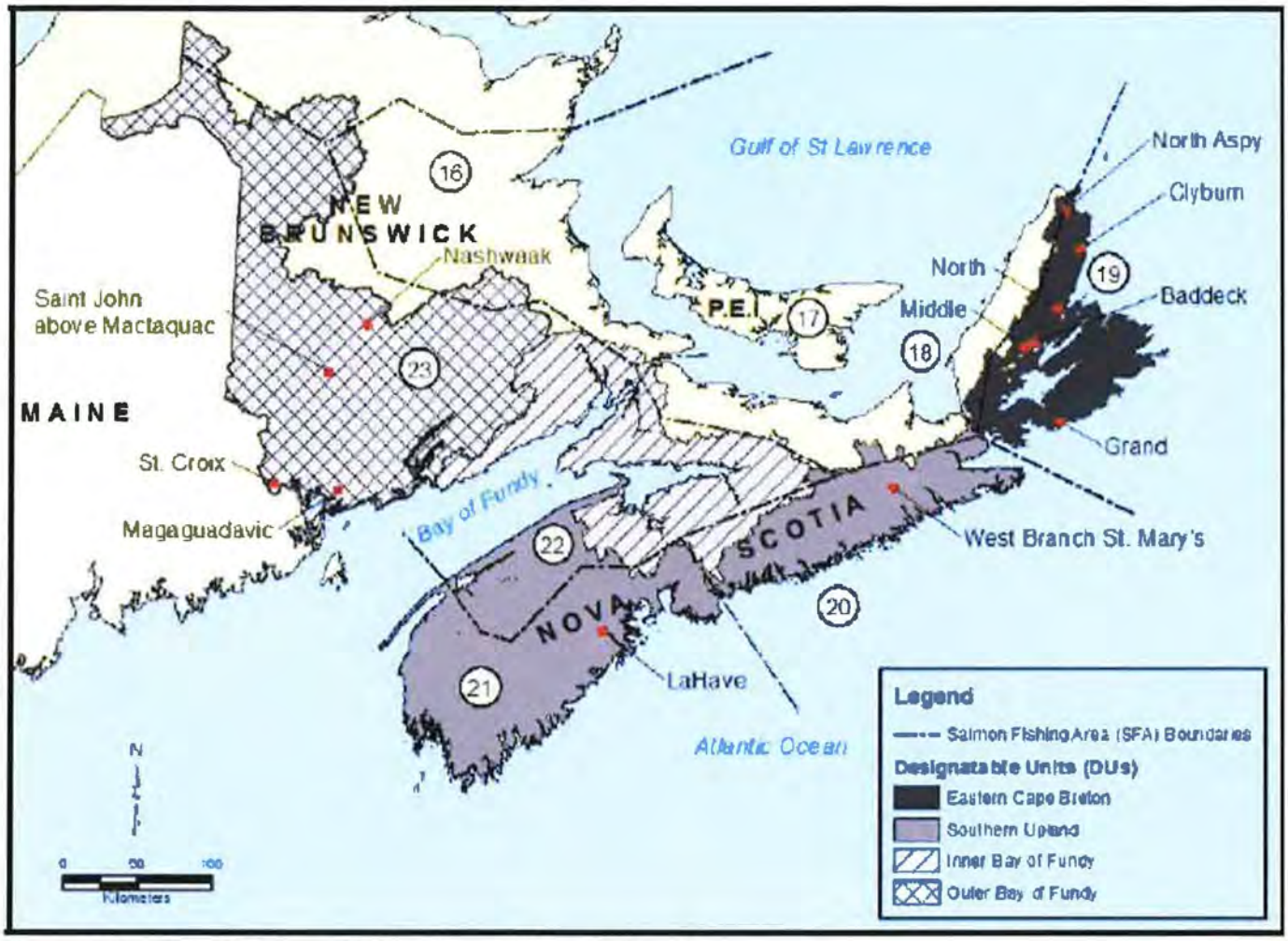

Figure 51. Atlantic Salmon Fishing Areas of Atlantic Canada
Note: Figure was sourced from the Fisheries and Oceans (2015e). White, numbered circles identify designated Salmon Fishing Areas.

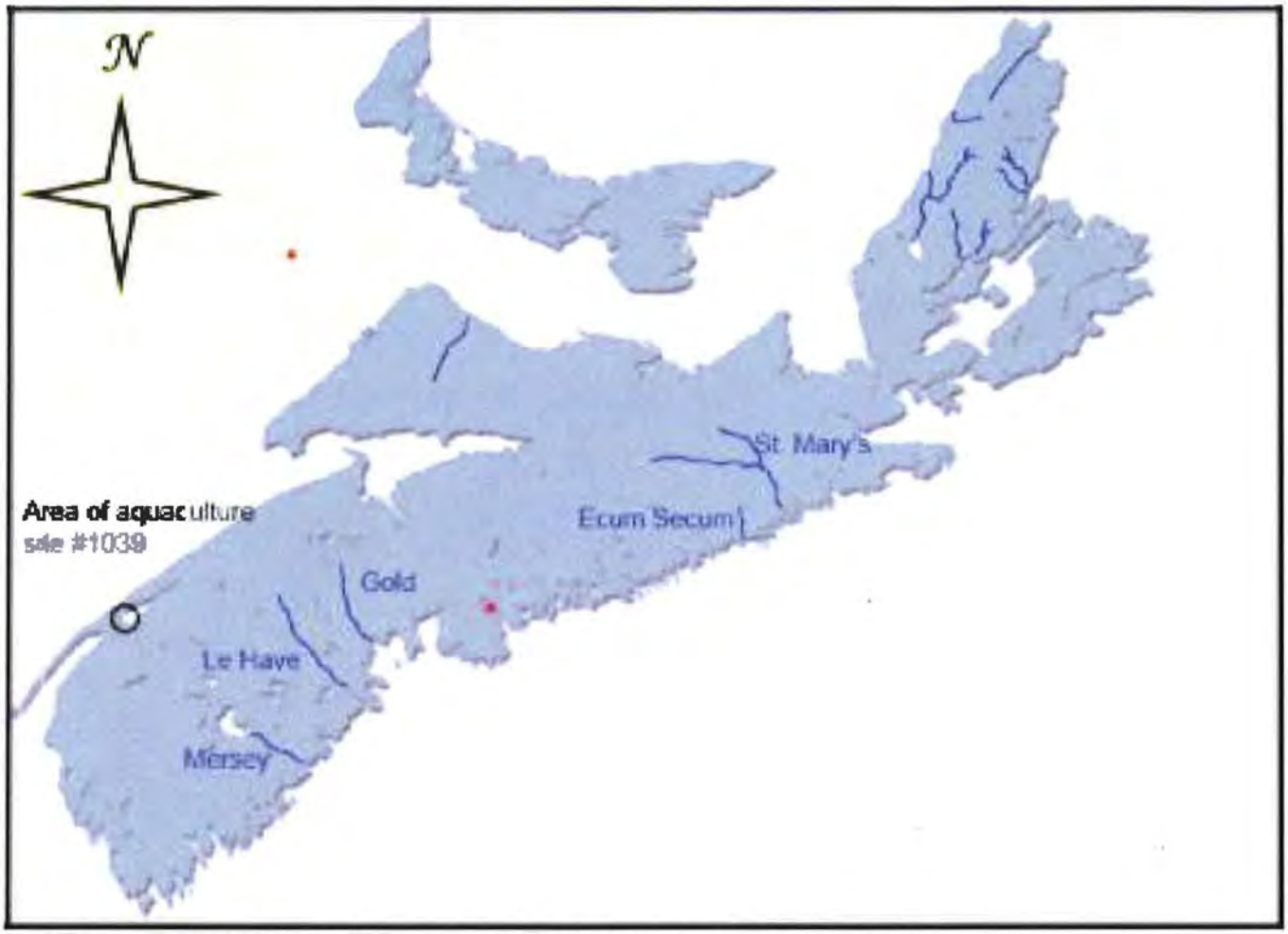

Figure 52. Atlantic Salmon Rivers of Nova Scotia According to The Salmon Atlas
Note: Figure was sourced from The Salmon Atlas (2016).

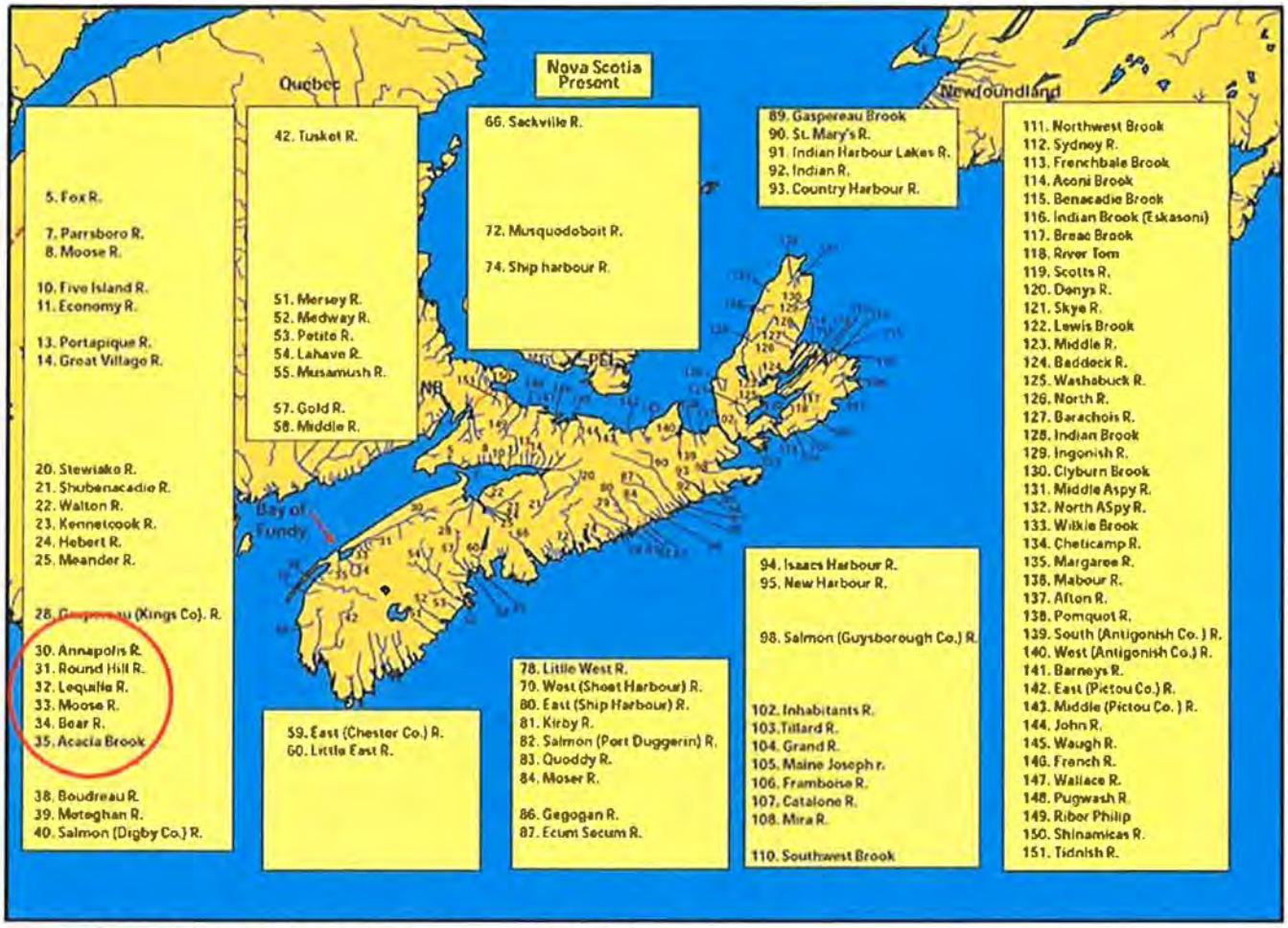

Figure 53. Present Atlantic Salmon Rivers of Nova Scotia
Note: Figure was sourced from the Atlantic Salmon Federation (2016a)

7.2 Support of the Sustainability of Wild Salmon

7.2.1 Potential Impacts to the Wild Salmon Population

To reduce potential impacts to the wild salmon population, the Atlantic Salmon Federation (ASF) recommends placement of marine cages away from the mouths of Atlantic salmon rivers, emphasis on sustainable aquaculture with minimal environmental effects and disease transfer, as well as increased containment protocols.

ASF's review on marine cage aquaculture states escapes are inevitable due to "equipment failure due to accidents, predators, storms and high wave action, or vandalism" which has resulted in identification of farmed salmon in rivers within Maine and Newfoundland (ASF 2013). The main concerns regarding escapees include interbreeding with wild stock which can reduce fitness of the wild population as well as competition for freshwater habitat. ASF stresses the need for transparency regarding escapee events. Government and industry should communicate pertinent information immediately to the public and local community groups.

ASF outlines concern for wild salmon migrating in the area of a marine aquaculture facility, due to increased risk of disease transfer to wild populations, specifically Infectious Salmon Anemia (ISA) and sea lice. To reduce the risk of disease transfer, ASF suggests immediate industry response is required to reduce disease transfer. However, the use of chemicals such as SLICE and hydrogen peroxide to treat sea lice outbreaks continues to be a point of contention due to the potential release into the marine waters and impacts on the health of crustaceans (ASF 2013).

Refer to Section 7.2.3 – Mitigation Efforts and Regulatory Requirements for information regarding containment protocols, disease management and environmental monitoring which support the sustainability of wild salmon.

7.2.2 Restoration Efforts

NSLC Adopt a Stream program (2017) has engaged over 35 Nova Scotia community-based groups to participate in restoration of steam habitats. Supports include remediation of culverts, re-establishing fish passage ways and planting streamside trees to prevent erosion. Adopt a Stream program indicates two (2) restoration efforts near the Annapolis Basin. The first is the L'sitkuk watershed (the Bear River) which is scheduled to undergo restoration to support aquatic connectivity and spawning pools through updating digger logs, liming, repair damage to culverts, and collect water quality data. The community group involved with this project is the Bear River First Nation group. The other restoration effort is currently underway within the Annapolis River Watershed. Restoration of fish passageways and habitat enhancement is being guided by the Clean Annapolis River Project (CARP) group in collaboration with members of the Bear River First Nation. This project will install digger logs and deflectors to enhance the habitat quality as well as remove debris, install tailwater control/baffles, barriers and chutes. Restoration efforts will benefit a variety of species including salmon, trout, striped bass and eel.

The aquaculture site, Rattling Beach #1039, will have no foreseeable impact on the restoration efforts in the Annapolis Basin and Digby area.

KCS is actively searching for wild salmon restoration collaborations in Nova Scotia.

7.2.3 Mitigation Efforts and Regulatory Requirements

Several mitigation measures can be employed to reduce the potential impacts of salmon aquaculture on wild salmon populations. A list of priority objectives to reduce the risk of interactions between wild and farmed salmon was provided by DFO (1999). They are as follows:

1) Improved containment, including the development and implementation of Code of Practice, contingency plans, and a reporting system for escapees
2) Improved fish health management, including completion and implementation of provincial Codes of Practice, including contingency plans and a reporting system for specified diseases
3) Upgrading policy for introductions and transfers of fishes and improving related enforcement
4) Enhancing education and training of aquaculture workers, particularly relative to containment and farm/hatchery management
5) Ensuring the maintenance of wild stocks at or above their conservation requirements

6) Continuing the use of local stocks as donors, where possible, for currently practiced aquaculture, or using other strains if rendered sterile or properly contained, and

7) Continue incorporating risk analysis into the review process for the location of hatcheries and salmon farms.

Aquaculture license holders of marine finfish must operate to comply with the Aquaculture Management Regulations for Nova Scotia (Schedule A – Regulations Respecting Aquaculture Management made by the Governor in Council under Section 4 Chapter 25 of the Acts of 1996, the Fisheries and Coastal Resources Act). A detailed Farm Management Plan (FMP) is required to outline the company's policies for fish health management, containment management, farm operations and environmental monitoring. The FMP is reviewed by Nova Scotia's Department of Fisheries and Aquaculture to ensure compliance to the Aquaculture Management Regulations. KCS policies outlined in the FMP address priority objectives 1, 2, 4, and 6, as listed above, to reduce the potential impacts of salmon aquaculture on wild salmon populations. Points 3, 5, and 7 are beyond the control of KCS. The FMP, in part or in whole, will be made available upon request by DFA or other parties.

Section 8. The Number and Productivity of Other Aquaculture Sites in the Public Waters Surrounding the Proposed Aquacultural Operation

8.1 Identification of Other Aquaculture Sites

There are nine (9), aquaculture sites less than 15 km from the Rattling Beach site; two are marine finfish (Atlantic salmon), one is licensed for halibut (#1302), one for quahog (#1228), five for soft-shell clam (#1343, 1338, 1342, 1339, 1340) and one is for mixed species of sea/bay scallop, American Oyster, and European Oyster (#1042; Fig. 49, Table 15). The Atlantic salmon farms nearest to the site are both owned by KCS; however, only one (#1040) is operational.

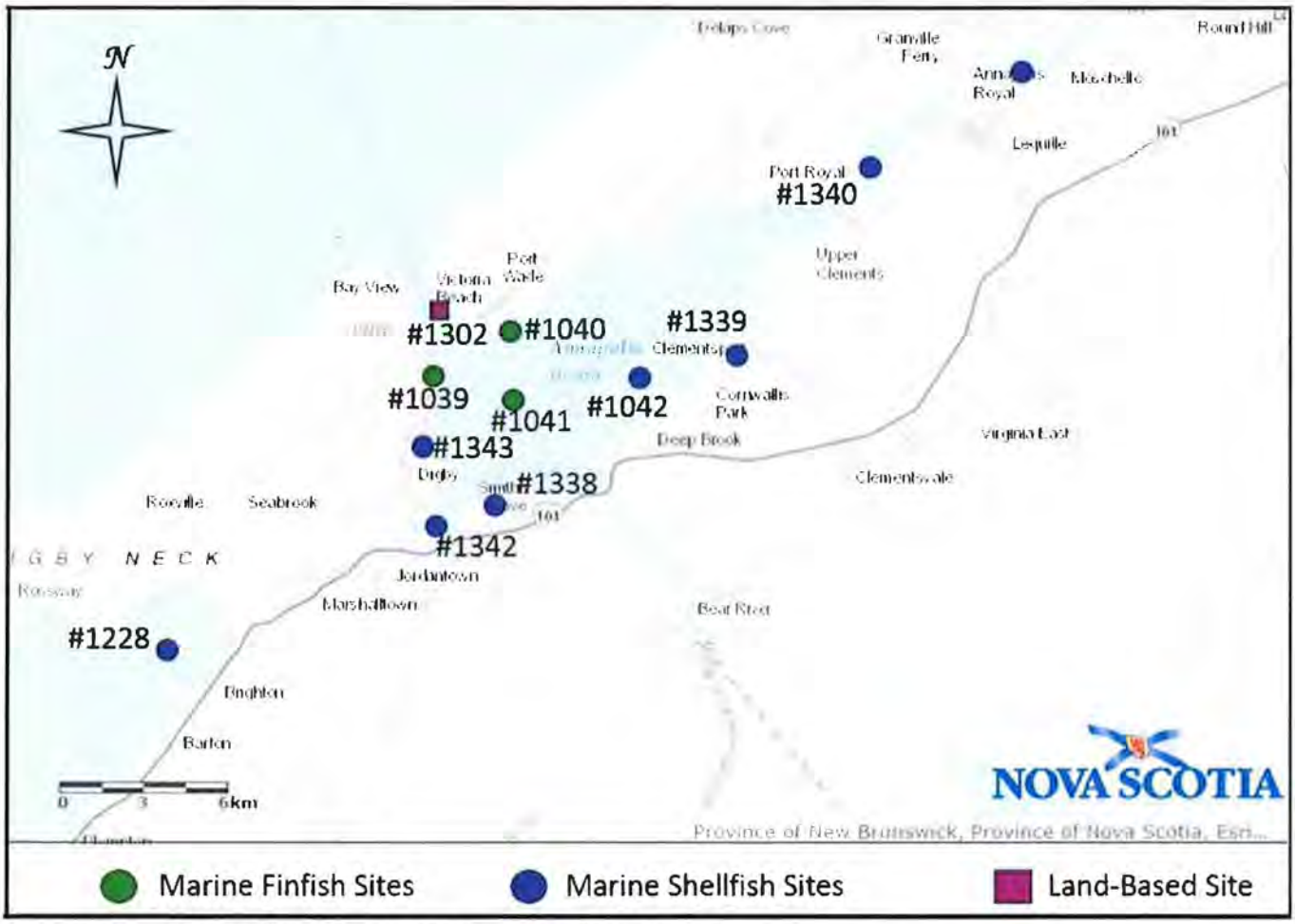

Figure 54. Marine Chart Showing Other Aquaculture Operations
Note: Figure was sourced from the Department of Fisheries and Aquaculture (2016)

Table 17. Distance from Rattling Beach #1039 to nearby finfish and shellfish aquaculture sites

Site #	Distance to Rattling Beach (km)	Species	Owner
1302	2.2	Halibut	Pronet Micro Systems Inc.
1343	2.2	Soft-shelled clam	Innovative Fisheries Products
1041	2.7	Atlantic salmon	Kelly Cove Salmon
1040	2.8	Atlantic salmon	Kelly Cove Salmon
1042	3.9	Sea scallop, bay scallop; American oyster; European oyster	Innovative Fisheries Products
1338	5.9	Soft-shell clam	Innovative Fisheries Products
1342	6.6	Soft-shell clam	Innovative Fisheries Products
1339	7.5	Soft-shell clam	Innovative Fisheries Products
1340	11.1	Soft-shell clam	Innovative Fisheries Products
1228	14.2	Quahog	Innovative Fisheries Products

8.2 Interactions with Other Aquaculture Operations

This site is not part of an Aquaculture Management Area (AMA) for the purpose of managing the health of aquatic animals in the area as we are the sole Atlantic salmon producer in the Production Area.

We do however, operate a company managed stocking/harvesting plan that follows similar principles to an AMA.

8.2.1 Environmental Conditions

The water within Annapolis Basin is continually circulated and flushed as a result of a significant tidal range. Based on Canadian Hydrographic Service Tide Tables (Fisheries and Oceans Canada 2017f) for Digby (Station #325), the predicted highest high tide for 2017 is 9.4 m and the lowest low tide is -0.4 m, giving a maximum tidal range of 9.8 m. Typically, the tidal range is between 6 and 9 m.

Collection of local current speed and direction data throughout the water column was carried out between June 29 and August 4, 2016 using a 600-kHz Acoustic Doppler Current Profiler (ADCP) deployed by NSDFA. Most of the water flowed towards the NNE. Recorded current speeds demonstrated 18 to 24 cm/s near the seafloor, 24 to 36 cm/s mid-water

column and the greatest currents at the surface. With significant currents and flow directed towards the mouth of the basin, a significant interaction with other aquaculture operations as a result of onsite activity, is unlikely.

Annual environmental monitoring of Rattling Beach is conducted in accordance to the Department of Fisheries and Aquaculture's Standard Operating Procedures for Environmental Monitoring of marine Aquaculture Sites in Nova Scotia. Rattling Beach has returned Oxic classifications for the last two production cycles, indicating this site is stocked and managed sustainably.

8.2.2 Boat Traffic and Wharves

Site #1039 is located on the western side of the Annapolis Basin, near the mouth of the Digby Gut channel. All the aquaculture operations in Annapolis Basin, including Rattling Beach, are situated near the shore. Farm gear and structures, when marked in accordance to NPP approval, do not pose a navigation risk or impedance.

The Port of Digby Fishermen's Wharf accommodates community vessels including fishing vessels as well as working vessels Kelly Cove Salmon Ltd. sites, Victoria Beach (#1040) and Rattling Beach (#1039) (Figure 55).

Within the production cycle, disease, including parasites are spread by the movement of live fish, both farmed and wild, the movement of dead fish, human or animal movement between farms, equipment transfers and those naturally occurring in the water column are minimized through the following good management biosecurity practices. Footbaths are to be used upon entering and exiting the site vessel. All equipment will be disinfected prior to being introduced to the Rattling Beach site. Site crew are aware of internal biosecurity protocols regarding staff and equipment movement from site to site and from public locations to the site.

Visitors to the Rattling Beach site are welcomed and are expected to follow basic biosecurity and health and safety rules. The Site Manager should confirm with the Area Manager that a visitor(s) has approval to be on site if the Site was not previously informed. If a certain site has a fish health concern, visitors will not be allowed to visit the site – unless granted permission by Saltwater Management or the Fish Health Manager. All visitors must sign the log book. Surprise visitors such as Government inspectors should also be reported to Management. Visitors must change their footwear prior to stepping on site, rubber boots will be provided from the office. Special exemptions may be given in the instances of surprise inspections or large group tours or if the visitor(s) are low risk and will not be handling fish or involved in farming operations. All visitors must wear a PFD provided by the office to the site and while on site and the use of footbaths and proper hygiene is mandatory.

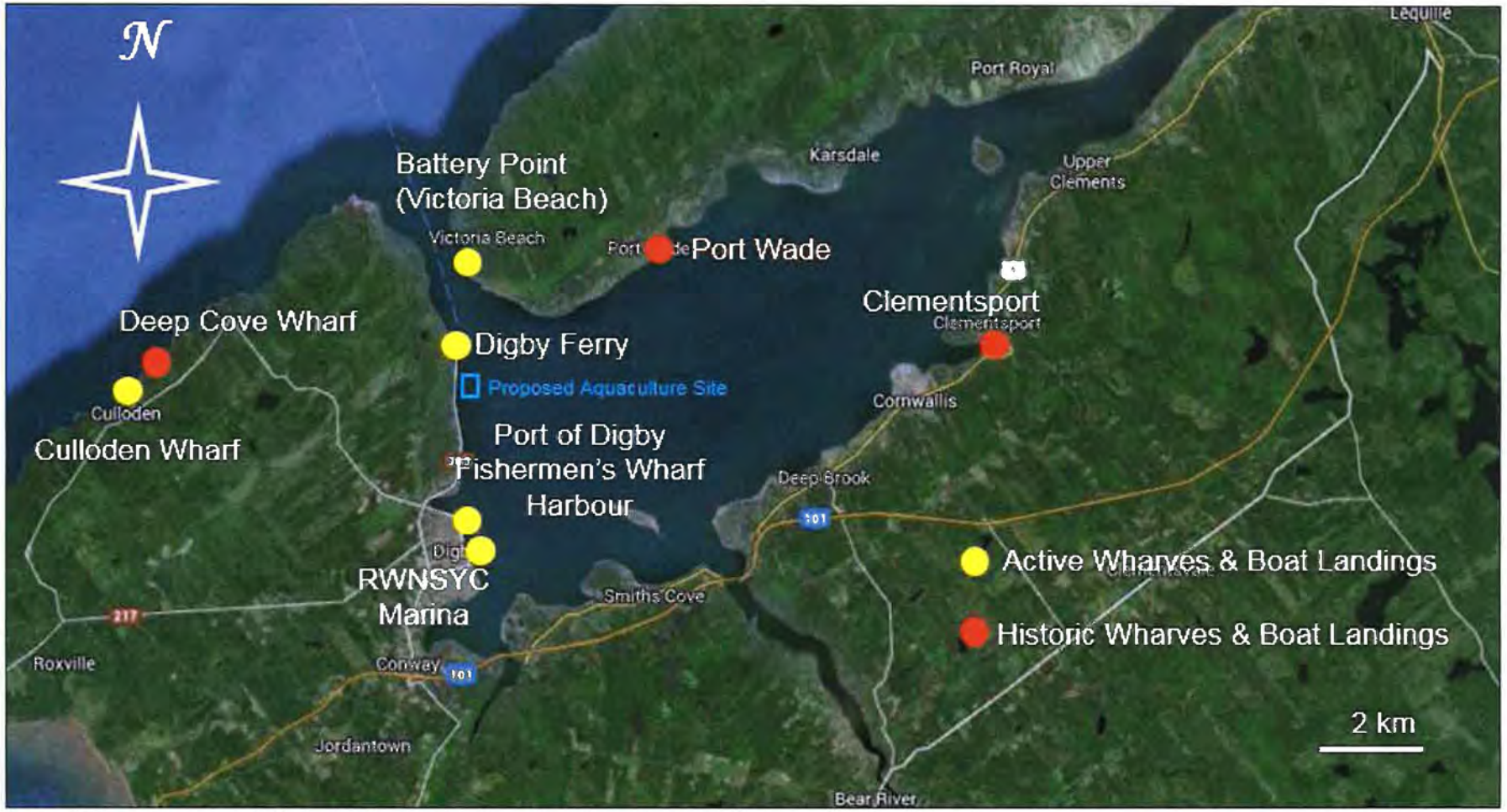

Figure 55. Current and Historic Wharves and Boat Landings Near Rattling Beach Aquaculture Site

8.2.3 Shellfish and Atlantic Salmon Aquaculture

A total of seven (7) shellfish and two (2) active Atlantic salmon net pen aquaculture sites are present in the Annapolis Basin (Figure 1). There are no direct interactions between shellfish and Atlantic salmon aquaculture, specifically related to disease transfer.

List of Contacts

Contact Name	Affiliation	E-mail	Phone	Date of Contact	Reason for Contact
Justin Huston	NSDFA	hustonje@gov.ns.ca	(902) 424-2996	May 11, 2007	Rockweed harvesting
David MacArthur	Environment Canada	David.MacArthur@eg.gc.ca	(902) 426-6296	Jul 5, 2016	Shellfish Areas
Carl MacDonald	DFO	Carl.MacDonald@dfo-mpo.gc.ca	(902) 426-1488	Sep 28, 2011	Fisheries
[redacted]	Nova Scotia Federation of Anglers & Hunters	http://www.nsfah.ca/contact/	[redacted]	Oct 11, 2017	Recreational Fisheries
Colin O'Neil	DFO – Policy & Economics	Colin.ONeil@dfo-mpo.gc.ca	(902) 426-6296	Oct 18, 2016	Fisheries
Frank Quinn	DFO – Area Director	Frank.Quinn@dfo-mpo.gc.ca	(867) 393-6719	Oct 10, 2017	Aboriginal Fisheries
Wendy Vissers	NSDFA	Wendy.Vissers@novascotia.ca	(902) 526-3617	Oct 4, 2016	Rockweed licences
Sean Weseloh McKeane	Communities, Culture and Heritage	Sean.WeselohMcKeane@novascotia.ca	(902) 424-6475	Jun 12, 2016	Archaeological resources

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Appendices

November 2017

Appendix A – Baseline Report

Baseline Assessment Report

Site #1039
Rattling Beach

Annapolis Basin
Digby County
Nova Scotia

October 20, 2016

Prepared for:
Kelly Cove Salmon Ltd.
P.O. Box 1546
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October 20, 2016

SIMCorp File #SW2016-059

Mr. Jeff Nickerson
Kelly Cove Salmon Ltd.
P.O. Box 1546
Shelburne, NS
B0T 1W0

Dear Mr. Nickerson,

Reference: **Rattling Beach (#1039) Baseline Report**

Please find enclosed the above noted report and attached video footage for the proposed boundary amendment of site #1039 at Annapolis Basin, N.S.

If you have any questions or comments on the above noted report please do not hesitate to contact me at 902-492-7865.

Sincerely,

[redacted]

Marine Environmental Biologist
Sweeney International Marine Corp.

cc: Jessica Feindel (NSDFA)
[redacted] (KCS)
[redacted] (SIMCorp)

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1.0 INTRODUCTION

The following baseline report and attached video have been prepared by SIMCorp for Kelly Cove Salmon Ltd. to summarize the findings of the formal baseline environmental survey required as part of the application for a boundary amendment of Rattling Beach (#1039). Marine aquaculture site #1039 is located on the western shore of the Annapolis Basin, near the mouth of Digby Gut channel in Digby County (Fig. 1). This area is shown on CHS chart #4396. The current lease has dimensions of approximately 160 x 460 x 210 x 460 m with an area of approximately 8.74 ha (Table 1).

Figure 1 – Current Rattling Beach (#1039) location in Annapolis Basin

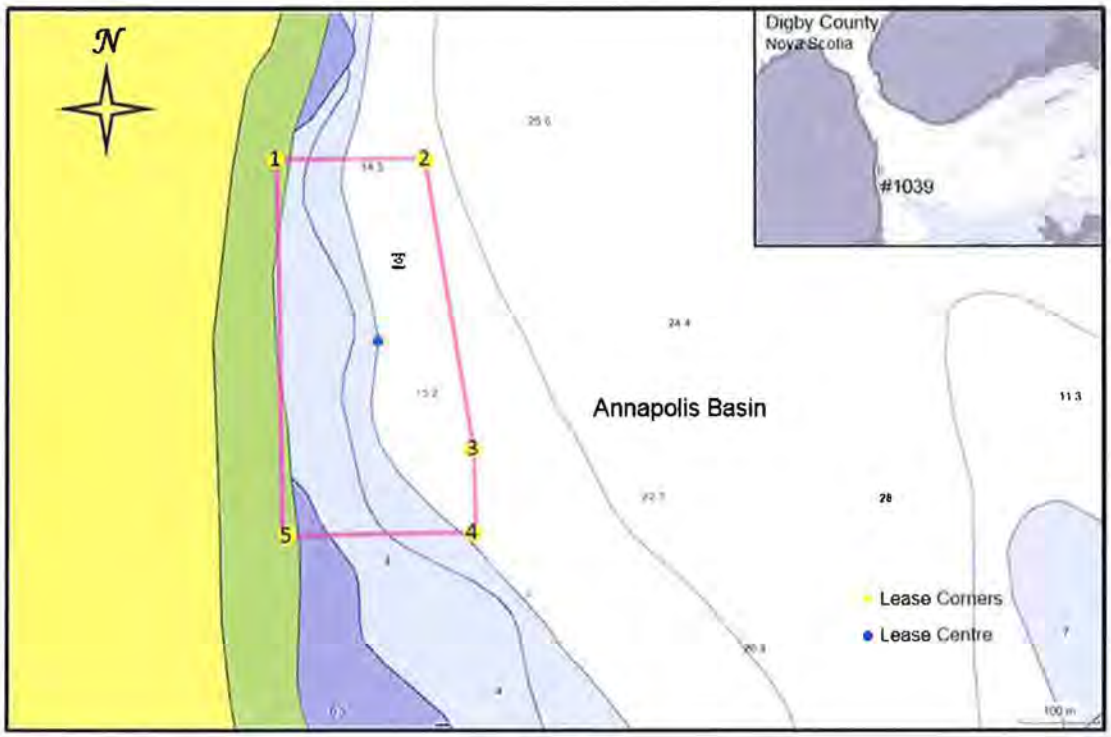

Table 1 – Current boundary and center coordinates of Rattling Beach (#1039)

SITE COORDINATES (NAD 83)		
Corner	**Latitude**	**Longitude**
1	44° 39' 20.34"	65° 45' 27.36"
2	44° 39' 20.40"	65° 45' 20.10"
3	44° 39' 08.76"	65° 45' 17.64"
4	44° 39' 05.52"	65° 45' 17.58"
5	44° 39' 05.40"	65° 45' 27.06"
Site Centre	44° 39' 12.68"	65° 45' 22.68"

The proposed boundary amendment extends the lease boundaries to accommodate all below surface gear. The dimensions of the proposed lease are approximately 140 x 180 x 725 x 590 x 260 m with an area of approximately 24.01 ha (Fig. 2, Table 2).

Figure 2 – Proposed boundary location for Rattling Beach (#1039)

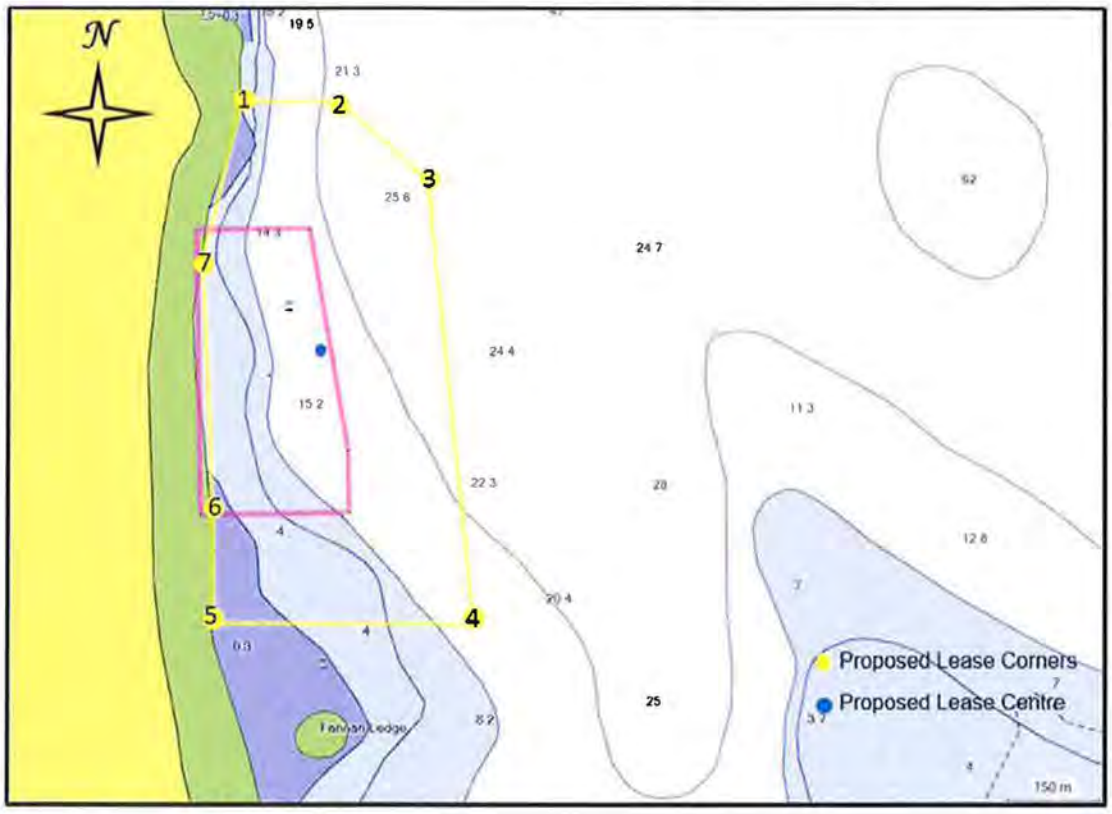

Table 2 – Proposed boundary and center coordinates of Rattling Beach (#1039)

SITE COORDINATES (NAD 83)		
Corner	**Latitude**	**Longitude**
1	44° 39' 27.0"	65° 45' 24.5"
2	44° 39' 27.0"	65° 45' 18.2"
3	44° 39' 22.9"	65° 45' 12.6"
4	44° 38' 59.6"	65° 45' 09.7"
5	44° 38' 59.7"	65° 45' 26.3"
6	44° 39' 05.8"	65° 45' 26.3"
7	44° 39' 18.8"	65° 45' 27.0"
Approximate Site Center	44° 39' 13.8"	65° 45' 19.2"

Benthic field data contained within this report were collected by SIMCorp Field Supervisor and Marine Environmental Biologist [redacted], B.Sc. and Marine Environmental Biologists [redacted] B.Sc. and [redacted] B.Sc., and Technician [redacted] on July 20, 2016. High tides were at 12:40 (7.7 m), low tides were at 18:49 (1.2 m).

Current speed and direction data presented in this document were collected with the use of an Acoustic Doppler Current Profiler (ADCP), deployed by Nova Scotia Department of Fisheries and Aquaculture (NSDFA) at site #1039 from June 29 to August 4, 2016 (37 days).

2.0 CONTACT INFORMATION

Proponent:

Company Name:	Kelly Cove Salmon Ltd.
Principal Contact:	Mr. Jeff Nickerson
Mailing Address:	P.O. Box 1546 Shelburne, Nova Scotia B0T 1W0
E-mail:	jnickerson@cookeaqua.com

Project Management:

Company Name:	Sweeney International Marine Corp.
Principal Contact:	[redacted]
Mailing Address:	46 Milltown Blvd. St. Stephen, New Brunswick E3L 1G3
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Cellular:	[redacted]
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3.0 METHODOLOGY

The methods employed to conduct the seafloor sediment condition analyses were adapted, in consultation with Nova Scotia's Department of Fisheries and Aquaculture (NSDFA) officials, from a combination of Appendix 2 of the New Brunswick Department of Agriculture, Aquaculture and Fisheries (NB DAAF) *Bay of Fundy Marine Aquaculture Site Allocation Application Guide* (SOPs) and Appendix B of the Nova Scotia Department of Fisheries and Aquaculture draft *Standard Operating Procedures for the Environmental Monitoring of Marine Aquaculture in Nova Scotia* dated June 2016.

3.1 Sampling Locations

A total of nine stations were investigated for the purpose of this baseline survey (Fig. 3). Currently, the site is stocked, therefore only the seven corners of the proposed boundaries and two reference stations were sampled. The sampling station coordinates

are present in Table 3; sampling at the approximate site center was omitted because gear is present on site.

Reference stations previously sampled for the site (ANB-01 and ANB-05) are approximately 374 and 100 m from the current lease boundaries (Table 4). Extending the lease boundaries to incorporate all aquaculture site specific gear, above and below the waterline, will decrease the distance of the reference station ANB-01 to 155 m. ANB-05 will be within the proposed boundary; therefore, a new reference station is required. It is proposed ANB-A be located at N44° 38' 56.5" W65 45' 13.5", which is approximately 105 m south of the lease boundary. The recommended locations of the reference stations to accommodate the proposed boundaries are illustrated in Figure 3 and Figure 4.

An ADCP was deployed by Nova Scotia's Department of Fisheries and Aquaculture at the coordinate N44° 39' 03.3" W65° 45' 14.8" in approximately 14 m of water on June 29 to August 4. The current meter could not be deployed at the center of the proposed site due to the presence of gear and fish. Therefore, the location between the current and proposed site boundaries was chosen which is greater than 100 m from the nearest aquaculture site gear to avoid distortion of data (Fig. 4).

Figure 3 – Baseline sampling stations at Rattling Beach (#1039)

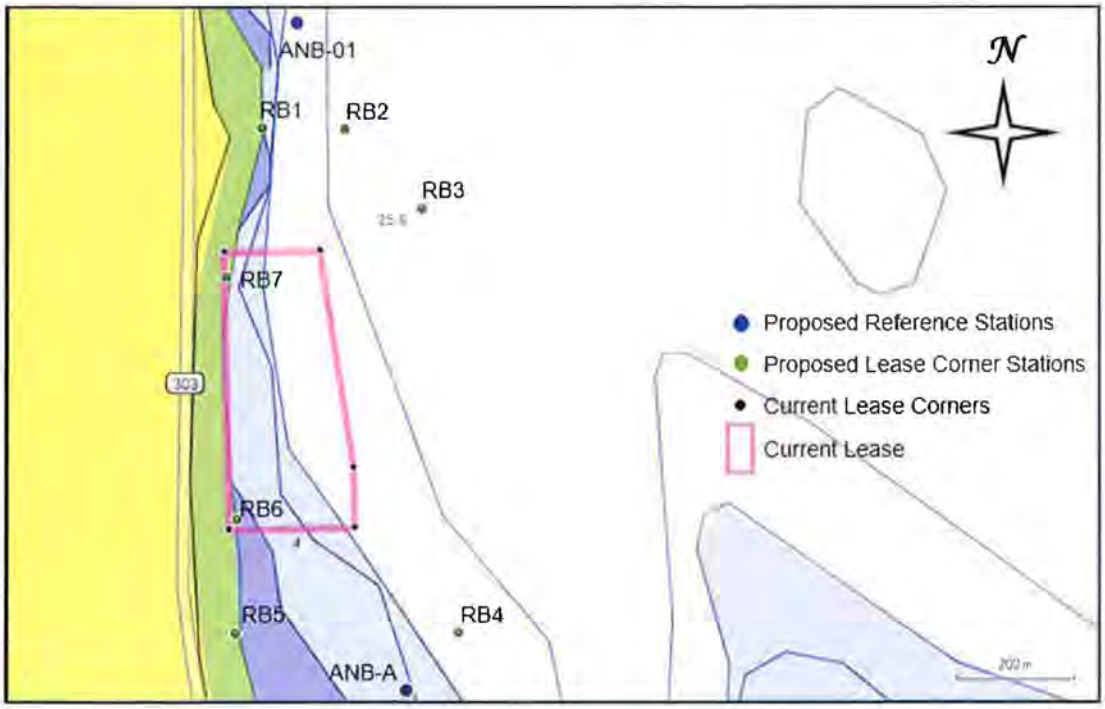


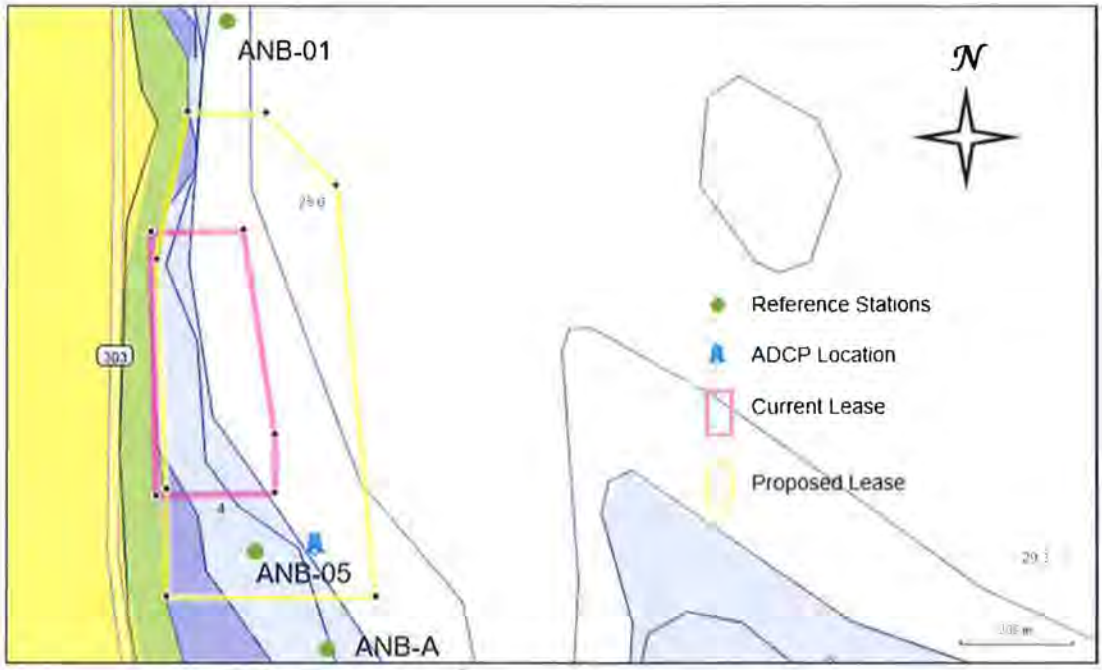
Table 3 - Baseline Sampling Coordinates at Site #1039, Annapolis Basin for Boundary Amendments

SITE COORDINATES (NAD 83)			
Station	**Location**	**Latitude**	**Longitude**
RB1	NW corner	44° 39' 27.0"	65° 45' 24.5"
RB2	NE corner	44° 39' 27.0"	65° 45' 24.5"
RB3	ENE corner	44° 39' 27.0"	65° 45' 18.2"
RB4	SE corner	44° 39' 22.9"	65° 45' 12.6"
RB5	ESE corner	44° 38' 59.6"	65° 45' 09.7"
RB6	SE corner	44° 38' 59.7"	65° 45' 26.3"
RB7	SSE corner	44° 39' 05.8"	65° 45' 26.3"
ANB-01	Upstream Reference	44° 39' 18.8"	65° 45' 27.0"
ANB-A	Downstream Reference	44° 39' 13.8"	65° 45' 19.2"

Table 4 – Reference station coordinates for current and proposed lease boundaries at Rattling Beach (#1039)

REFERENCE STATION COORDINATES (NAD 83)			
Station	**Latitude**	**Longitude**	**Lease Boundary**
ANB-01	44° 39' 32.5"	65° 45' 21.2"	Current and Proposed
ANB-05	44° 39' 02.3"	65° 45' 19.7"	Current
ANB - A	44° 39' 56.5"	65° 45' 13.5"	Proposed

Figure 4 – Proposed reference station locations for new lease boundaries and ADCP deployment location at Rattling Beach (#1039)



3.2 Sample Collection

A standard Ponar grab was used to collect sediment samples from all of the baseline stations; however, many of the samples could not be collected as the stations were located on hard bottom. After deployment, the grab was pulled aboard and placed on the deck. When present, the overlying water in the grab was removed via siphon and a picture was taken of the contents (Appendix D). Notes were taken on time, location, sediment type, colour, depth, odour, flora and fauna, etc. Sediment subsamples were collected from the top 2-cm of the grab samples with 10-mL syringes that were sealed with Parafilm M® and capped to form an airtight seal until analysed. Syringes were labelled and placed in a plastic cooler with ice. Samples were kept cool until analysed for redox, sulphide, porosity, and percent organic matter. The remaining top 2-cm of sediment was placed in 2-oz Whirl-Paks for use in grain size analysis.

Sample temperatures were recorded using HOBO ProV2 temperature loggers. Temperatures recorded from inside the sample cooler are presented graphically in Appendix F.

All reasonable efforts were made to conform to the SOPs, maintain storage temperature of samples, to collect samples that were as undisturbed as possible and to preserve the

integrity of the samples until analysed. However, site #1039 is characterized by coarse sediments, mainly of cobble stones, pebbles, and moderately packed medium-to-fine sand, gravel, and mud. Retrieving three undisturbed, soft sediment samples with minimal leakage from the grab and at least 5 cm sediment depth was not possible from at any of the stations. Samples were collected from both of the reference stations (ANB -01 and A) as well as three corner stations (Corners #2, 3, & 4) for redox, sulphide, porosity, percent organic matter, and grain size analyses. These samples came from grabs which failed to meet one or more of the criteria; achieving 5 cm of sediment penetration was not always possible and grabs were often leaking due to catching rocks and shells (Appendix G).

3.3 Video Surveillance

Video footage was recorded using a Seaviewer Underwater Camera System, which was mounted perpendicular with the seafloor in an aluminum frame; i-Torches were used for light. A 0.25-m^2 quadrat was visible in the field of view as a size reference. The video camera frame includes a scale bar demarcated with 5-cm segments. Live video footage from the underwater camera was recorded using a J.W. Fishers digital video recorder (DVR) built into a VRM-1 video recorder and monitor system with a GPS interface, which allowed coordinate positions to be overlaid onto the video. ,Video recording of each sampling station started at the surface with the viewing of a "whiteboard" showing collection location information, followed by a 360° pan of the area at the sampling station and then the underwater footage. The recording continued uninterrupted for the duration of the underwater surveillance and was concluded only after the camera was returned to the vessel at the surface. Footage coverage included the camera's descent, impact with the sediment surface, and minimum of 5-m^2 of seafloor over a minimum duration of two minutes. Screen shots of the seafloor for each sample location were taken and are presented in Appendix E. All on-site visual assessments have been recorded in the field notes and video assessments supplement the field data included in this report. Seafloor characteristics for each station are presented in Tables 6 - 14.

3.4 Bathymetric Profiling

Bathymetric profiling of the existing lease area was carried out on October 5, 2016 using a Hummingbird system Helix 5 SI-GPS to record X, Y, and Z coordinates throughout the lease. The data gathered during the scanning was then compiled and a three dimensional surface map and a two dimensional contour diagram produced by interpolation. Scanning of the Rattling Beach area began at the northern boundary of the proposed lease. Parallel transects were run the length of the lease area, separated by approximately 50 m. The maps illustrate the basic bathymetry of the scanned area and can serve to aid in the planning and placement of marine farm infrastructure such as grid anchors and other moorings.

4.0 SEDIMENT SAMPLE ANALYSIS AND DATA COLLECTION

4.1 Sediment Sample Analysis

All sediment samples were analysed within 72 hours of collection for redox potential and sulphide ion concentration (Table 15, Fig. 5). Temperatures were taken for each sample. Redox readings in mV were adjusted for temperature to produce mV readings relative to the normal hydrogen electrode (mV_{NHE}). Sulphide samples were brought to the same temperature at which the sulphide probe was calibrated before a reading was taken. Redox and sulphide measurements were made on the 0- to 2-cm deep portion of the grab samples. These results can be related to the Environmental Quality Definitions for Nova Scotia Marine Aquaculture Monitoring seen in Table 5. A copy of the laboratory data sheet for the redox and sulphide is presented in Appendix B.

Sediment samples from each station were sent to the SIMCorp Marine Benthic Sediments Laboratory for analysis of porosity, total organic content and grain size. The results of these analyses are presented in Table 16 and Appendix C.

Table 5 – Environmental Quality Definitions for Nova Scotia Marine Aquaculture Monitoring

	Sediment Classification		
Measurement	**Oxic**	**Hypoxic**	**Anoxic**
Sediment colour	Tan to depth > 0.5 cm	Tan to < 0.5 cm with some black sediments at surface	Surface sediments black
Microbial presence	No sulphur bacteria present	Patchy sulphur bacteria	Widespread bacterial mats
Macrofaunal Assemblage	Wide array of infauna and epifauna	Mixed group of mostly small infauna	Small infauna only
Sulfide, µM	**< 750 (A) 750 to 1500 (B)**	**1500 to 3000 (A) 3000 to 6000 (B)**	> 6000
Redox (Eh), mV	> 100 (A) 100 to -50 (B)	-50 to -100 (A) -100 to -150 (B)	< -150
Organic matter, %	<= reference*	1.5 to 2X ref.	> 2X reference
Porosity, %	<= reference*	1 to 10X ref.	> 10X reference

4.2 Equipment and Calibrations

Redox measurements were taken using a combination meter (Fisher Accumet AP125) and probe (Orion Epoxy Sure-Flow Combination Redox/ORP Electrode), which was checked for electrical function just prior to and after use. Readings were taken according to the SOP protocols. Sulphide measurements were taken using a calibrated combination meter (Fisher Accumet AP125) and probe (Orion 96-16 Sure-Flow Combination Silver/Sulphide Electrode). Meter and sulphide probe calibration took place in accordance with SOP protocols at 09:55 on July 21, 2016. One probe was calibrated and used to analyse the samples. The calibration event resulted in a final slope range between -27 and -33 mV (-30.0 mV) the calibration curve was between -25 to -30 mV [500 to 5000 µM read: -25.6 mV, 1000 to 10000 µM read: -25.1 mV]. The results of the five-point, factor-calibration are located in Appendix A. The calibration temperature was 20.8°C.

4.3 ADCP Deployment

Measurements of the current speed and direction were collected at Rattling Beach using a 600 kHz Teledyne RDI Workhorse Sentinel ADCP unit deployed by the Nova Scotia Department of Fisheries and Aquaculture (Fig. 4). The current meter could not be deployed at the center of the proposed site due to the presence of gear and fish. Therefore, a location between the current and proposed site boundaries was chosen, greater than 100 m from the nearest aquaculture site gear to avoid distortion of data. This meter was deployed at site #1039 for a period of approximately 37 days between June 29 and August 4, 2016. The ADCP was configured to record the current speed and direction of the water column in one (1) meter bins, collecting a profile every fifteen (15) minutes. Once the unit was recovered, the data were downloaded and analysed by NSDFA and processed by SIMCorp Marine Environmental Biologist [redacted]. Graphs and figures illustrating the frequency distribution of both current speed and direction are presented in Appendix H and raw current speed and direction data is included in the supplementary material attached to this report (*RattlingBeach.xls*).

5.0 RESULTS AND OBSERVATIONS

The following are baseline sampling station benthic characteristics at proposed marine aquaculture lease #1039 in the order they were sampled.

Table 6 – ANB-A Benthic Log

Sampling Date:	July 20th, 2016
Water Body:	Annapolis Basin
Lease Name and Number:	Rattling Beach #1039
Water Temperature (°C)	14.4 °C
Wind Direction and Speed:	NW 15 knots shifting to SW 15-20 knots
Wave Action:	calm
Current Direction & Speed:	Strong SW->NE with the wind
Tide Schedule:	High: 12:40 Low: 18:49
Vessel:	Carolina Skiff

Lease # or Reference Site:	Reference	**Station Comments:**
Video Start Time:	10:36 AM	
Recorder Name(s):	[redacted]	
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]	**Video Notes:** Moderately easily disturbed, fine, brown sand & pebbles; scallop shells; rock crabs; macroalgae
Sampling Station ID:	ANB-A	
Dist. and Dir. from Waypoint:	8 m @ 330°	
Sampling Coordinates:	N44 38.946 W65 45.228	Benthic Descriptor Key:
Station Depth (m):	11	[1] e.g. Gas bubbles, feed, faeces, sediment colour, type, and consistency
Video (Y/N):	Y	[2] e.g. Strong, slight, none
Number of Collection Attempts:	6	[3] e.g. Eelgrass, kelp, lobster, starfish, Beggiatoa, polychaetes, etc.

Sample/Collection method	Ascension Speed (m/s)	Sample (Y/N)	Sample ID	Sediment Description[1]	Odour[2]	Sediment Sample Depth (cm)	Flora/Fauna[3]
Benthic Replicate 1 (10 mL) Standard Ponar Grab	0.28	Y	ANB - A (1)	Brown mud, sand, gravel	None	4	Scallop shell
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.23	Y	ANB - A (2)	Brown mud, sand, gravel	None	1	Scallop shell
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.28	Y	ANB - A (3)	Brown mud, sand, gravel	None	1	Whelks, fish bone

Table 7 – Corner #4 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:**
Video Start Time:	11:28 AM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:**
Sampling Station ID:	Corner #4						Moderately easily disturbed, brown sand, mud, pebbles, boulders & shell hash; rock crabs; scallop shells; macroalgae
Dist. and Dir. from Waypoint:	8 m @ 3.2 °						
Sampling Coordinates:	N44 38. 9977 W65 45.1614						**Benthic Descriptor Key:**
Station Depth (m):	20						[1] e.g. Gas bubbles, feces, faeces, sediment colour, type, and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	3						[3] e.g. Eelgrass, kelp, lobster, starfish, *Beggiatoa*, polychaetes, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab	0.28	Y	RB4 (1)	Brown mud, sand, pebbles, shell hash	None	2	Shell, whelk, barnacles
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.28	Y	RB4 (2)	Brown mud, sand, pebbles, shell hash	None	5	Whelks
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.27	Y	RB4 (3)	Brown mud, sand, pebbles, shell hash	None	3	Whelks, barnacles

Table 8 – Corner #5 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** No sediment samples were able to be collected
Video Start Time:	12:10 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						Video Notes:
Sampling Station ID:	Corner #5						Moderately easily disturbed, brown mud, sand & boulders; kelp; algae; macroalgae; barnacles; rock crabs; other crab species (possibly green crabs)
Dist. and Dir. from Waypoint:	7 m @ 310°						
Sampling Coordinates:	N44 38.9975 W64 45.4425						Benthic Descriptor Key:
Station Depth (m):	7.4						[1] e.g. Gas bubbles, feed, faeces, sediment colour, type, and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	5						[3] e.g. Eelgrass, kelp, lobster, starfish, *Beggiatoa*, polycheates, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 9 – Corner #6 Benthic Log

Lease # or Reference Site:	Corner	**Station Comments:** No sediment samples were able to be collected.
Video Start Time:	12:31 PM	
Recorder Name(s):	[redacted]	
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]	Video Notes:
Sampling Station ID:	Corner #6	Moderately easily disturbed, light-brown sand, silt & boulders; kelp; red algae; periwinkles; sea star
Dist. and Dir. from Waypoint:	6 m @ 336°	
Sampling Coordinates:	N44 39.0996 W65 45.4401	Benthic Descriptor Key:
Station Depth (m):	7	[1] e.g. Gas bubbles, fecal casts, sediment colour, type, and consistency
Video (Y/N):	Y	[2] e.g. Strong, slight, none
Number of Collection Attempts:	5	[3] e.g. Eelgrass, kelp, lobster, starfish, Beggiatoa, polycheates, etc.

Sample/Collection method	Ascension Speed (m/s)	Sample (Y/N)	Sample ID	Sediment Description[1]	Odour[2]	Sediment Sample Depth (cm)	Flora/Fauna[3]
Benthic Replicate 1 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 10 – Corner #7 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** No sediment samples were able to be collected
Video Start Time:	12:54 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:** Mostly boulders covered in barnacles and crustose algae; small patches of brown sand and mud; rockweed, green crab
Sampling Station ID:	Corner #7						
Dist. and Dir. from Waypoint:	5 m @ 335						
Sampling Coordinates:	N44 39.316 W65 45.452						Benthic Descriptor Key:
Station Depth (m):	6						
Video (Y/N):	Y						(e.g. Gas bubbles, feed faeces, sediment colour, type, and consistency)
Number of Collection Attempts:	5						(e.g. Strong, slight, none)
							(e.g. Eelgrass, kelp, lobster, starfish, *Beggiatoa*, polycheates, etc.)
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 11 – Corner #1 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** No sediment samples were able to be collected
Video Start Time:	1:11 PM						
Recorder Name(s):							
Sample Collector's Name(s)	**Sediment Sampler:** **Syringe Sampler:**						**Video Notes:**
Sampling Station ID:	Corner #1						Mostly boulders covered in barnacles; some light brown mud with sand patches; red algae and kelp
Dist. and Dir. from Waypoint:	4 m @ 128°						
Sampling Coordinates:	N44 39.4502 W65 45.4058						Benthic Descriptor Key:
Station Depth (m):	6.7						[1] e.g. Gas bubbles, feed tastes, sediment colour, type and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	5						[3] e.g. Eelgrass, kelp, lobster, starfish, *Beggiatoa*, polychaetes, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 12 – ANB-01 Benthic Log

Table 13 – Corner #2 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:**
Video Start Time:	2:10 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:** Moderately to easily disturbed brown mud, sand & cobble; lots of shell debris and scallop shells; some *Flustra*
Sampling Station ID:	Corner #2						
Dist. and Dir. from Waypoint:	4 m @ 153°						
Sampling Coordinates:	N44 39.4480 W65 45.3020						Benthic Descriptor Key:
Station Depth (m):	27						[1] e.g. Gas bubbles, feed, faeces, sediment colour, type, and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	5						[3] e.g. Eelgrass, kelp, lobster, starfish, *Beggiatoa*, polycheates, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab	0.3	Y	RB2 (1)	Brown mud, sand, rocks	Moderate	4.5	Rockweed, *Flustra*, quahog, whelk
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.28	Y	RB2 (2)	Brown mud, sand, pebbles, cobble, gravel	None	3	Quahog, scallop shell, amphipods
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.29	Y	RB2 (3)	Brown mud, sand, pebbles, rocks	None	1	Shells, whelks, worm tubes, barnacles

Table 14 – Corner #3 Benthic Log

Lease # or Reference Site:	Corner						**Station Comments:** 1st video was scrapped due to the camera shifting in the frame. Lots of strong current affecting this station at the time of sampling.
Video Start Time:	2:59 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Sampler:** [redacted]						**Video Notes:** Moderately easily disturbed mud, sand & cobble; shell debris; scallop shells; *Flustra*; rock crab; hermit crab
Sampling Station ID:	Corner #3						
Dist. and Dir. from Waypoint:	12 m @ 145°						
Sampling Coordinates:	N44 39.3764 W65 45.2049						Benthic Descriptor Key:
Station Depth (m):	31						[1] e.g. Gas bubbles, feed, faeces, sediment colour, type, and consistency
Video (Y/N):	Y						[2] e.g. Strong, slight, none
Number of Collection Attempts:	3						[3] e.g. Eel grass, kelp, lobster, starfish, *Beggiatoa*, polychaetes, etc.
Sample/Collection method	**Ascension Speed (m/s)**	**Sample (Y/N)**	**Sample ID**	**Sediment Description[1]**	**Odour[2]**	**Sediment Sample Depth (cm)**	**Flora/Fauna[3]**
Benthic Replicate 1 (10 mL) Standard Ponar Grab	0.27	Y	RB3 (1)	Brown mud, sand	None	1	Shells, whelks
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.28	Y	RB3 (2)	Brown mud, sand, shell debris, rocks	None	5	Whelks
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.29	Y	RB3 (3)	Brown mud, sand, gravel, shell debris	None	2	Whelks

Table 15 – Redox potential and sulphide ion concentration for samples collected at proposed marine aquaculture lease #1039

Site #1039 – Rattling Beach

Sample Collection: July 20, 2016 10:20 - 15:30
Sample Analysis: Redox: July 21 2016 10:05 - 10:55
Sulphides: July 21, 2016 10:10 - 10:55

Sample I.D.		Core Sample Temp	Redox	Redox	Sulphide	
Station	ID#	°C	mV	mVNHE	µM	mV
ANB-01	1	8.9	11.6	226.7	313	-869.9
	2	10.5	-209.0	4.5	193	-864.2
	3	10.5	-75.8	137.7	467	-875.1
Means		10.0	-91.1	123.0	324	-869.7
ANB-A	1	8.2	-15.8	200.0	25	-837.1
	2	7.5	70.0	286.5	58	-848.1
	3	10.8	55.0	268.2	55	-847.2
Means		8.8	36.4	251.6	46	-844.1
Corner #1	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		N/A	N/A	N/A	N/A	N/A
Corner #2	1	8.8	-35.8	179.4	343	-871.0
	2	12.0	-36.5	175.5	382	-872.4
	3	10.4	-119.6	94.0	292	-869.2
Means		10.4	-64.0	149.6	339	-870.9
Corner #3	1	8.2	-109.7	106.1	34	-840.8
	2	8.2	-66.9	148.9	19	-833.2
	3	9.9	-11.2	202.9	51	-846.2
Means		8.8	-62.6	152.6	35	-840.1
Corner #4	1	10.0	-125.4	88.6	29	-838.9
	2	8.0	-112.1	103.9	117	-857.0
	3	10.2	46.3	260.1	23	-835.5
Means		9.4	-63.7	150.9	56	-843.8
Corner #5	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		N/A	N/A	N/A	N/A	N/A
Corner #6	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		N/A	N/A	N/A	N/A	N/A
Corner #7	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		N/A	N/A	N/A	N/A	N/A

Redox Test Solution
Prior to analysis: 220.8 mV @ 25°C
Post analysis: 220.8 mV @ 25°C

Sulphide Probe 1 Calibration:

Standard	mV
100	-855.3
500	-876.3
1000	-884.6
5000	-901.9
10000	-909.7

Sulphide Probe Calibration Temperatures: 20.8°C

Sample met all grab quality criteria
Sample did not meet all quality criteria
Reference Station
NS = No Sample

Figure 5 – Mean redox potential and sulphide ion concentration at proposed marine aquaculture lease #1039

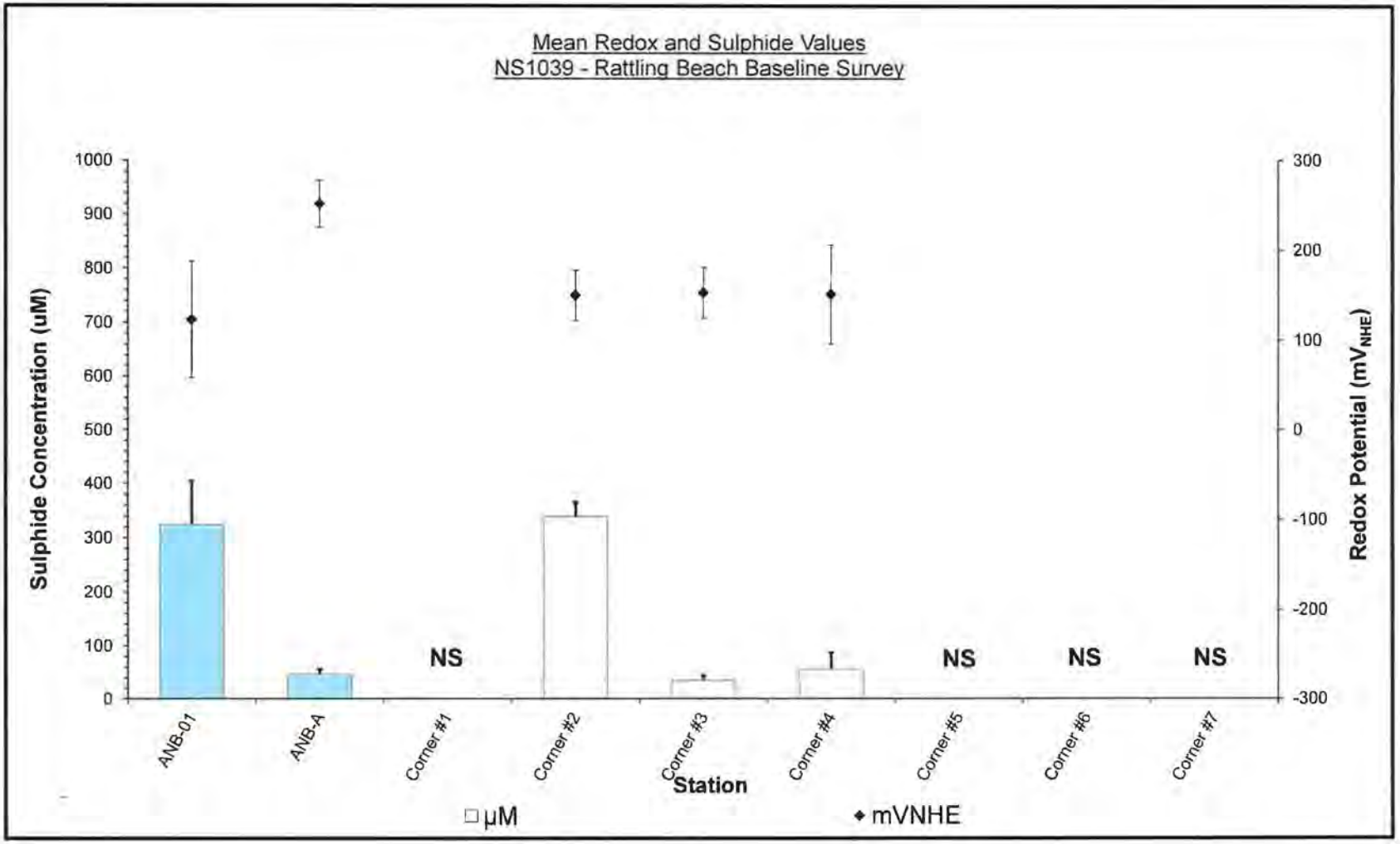


Table 16 – 2016 Baseline porosity and percent organic matter data for site #1039

Station	Sample #	Porosity Value (%)	% Organic Matter
ANB-01	1	30.16	2.29
ANB-01	2	25.83	1.99
ANB-01	3	44.22	4.34
ANB-A	1	21.40	1.65
ANB-A	2	20.01	1.27
ANB-A	3	17.84	1.55
Corner #1	1	NS	NS
Corner #1	2	NS	NS
Corner #1	3	NS	NS
Corner #2	1	17.61	1.39
Corner #2	2	15.59	1.94
Corner #2	3	19.18	1.45
Corner #3	1	12.61	0.77
Corner #3	2	21.22	1.36
Corner #3	3	18.67	1.16
Corner #4	1	18.16	1.31
Corner #4	2	25.01	1.78
Corner #4	3	26.12	1.88
Corner #5	1	NS	NS
Corner #5	2	NS	NS
Corner #5	3	NS	NS
Corner #6	1	NS	NS
Corner #6	2	NS	NS
Corner #6	3	NS	NS
Corner #7	1	NS	NS
Corner #7	2	NS	NS
Corner #7	3	NS	NS

Note: samples in turquoise are from reference stations

6.0 DISCUSSION

6.1 Benthic Observation and Analysis

Review of the video footage and grab observations collected from the proposed lease area in the Annapolis Basin reveal no evidence of waste feed, salmon faeces, or other organic deposits. The substrate beneath site #1039 consisted mainly of cobble stones and pebbles at the western most stations closer to shore where sediment was not retrievable by surface-deployed grab. The remaining stations, where sediment was obtained, consisted mostly of medium to fine sand, gravel, and mud that was moderately packed. Shell hash and scallop shells were also very common due to scallop shucking that occurs in the area. Grain size analysis results are presented in Appendix C and further support these observations.

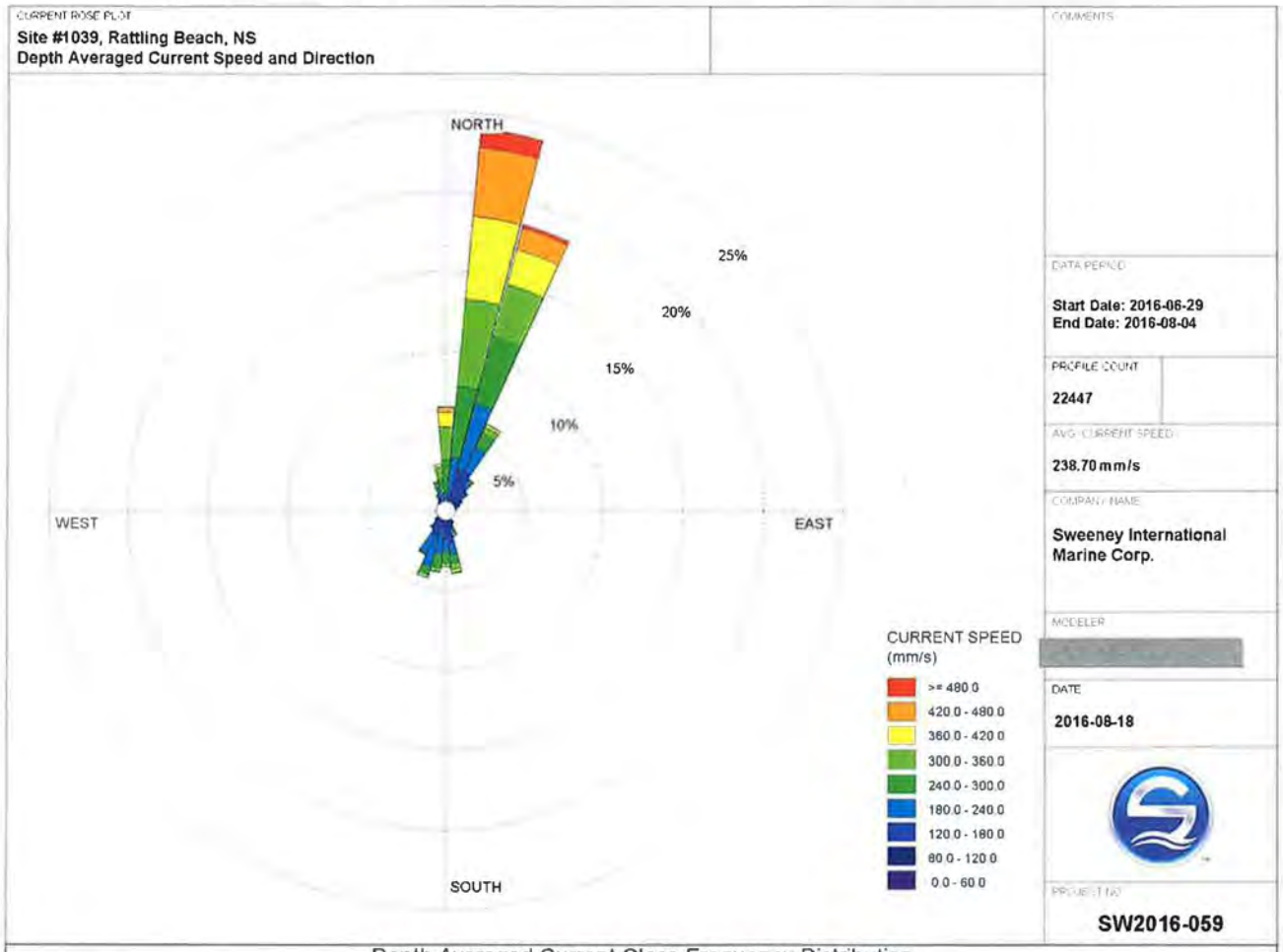
Flora and fauna observed in the video footage and in collected grab samples included rock crabs, green crabs, hermit crabs, whelks, barnacles, kelp, rockweed, sea stars, *Flustra,* periwinkles, and quahogs.

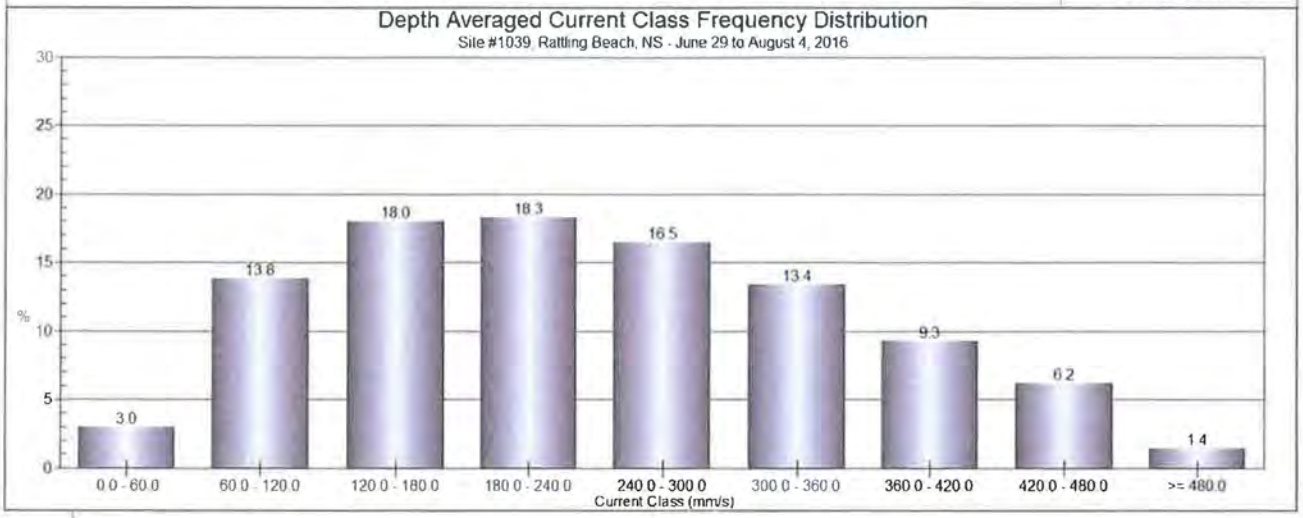
Analysis of the sulphide concentration and redox potential of the collected sediments revealed oxic conditions at every station where sediment could be collected. It should be noted that none of the grabs that yielded sediment met all of the necessary grab criteria; however, samples were collected when possible. The highest mean sulphide concentration obtained during this baseline assessment was 339 µM at the station located at corner #2 of the proposed lease.

6.2 Current Speed and Direction

The petals on the current rose diagrams indicate the direction in which the current was flowing (*i.e.* if the broad ends of the petals are pointing to the east, then the current was flowing to the east). Analysis of the depth averaged current speed and direction at site #1039 shows that the majority of water flow experienced at this location flowed towards the north northeast, with approximately 42% of all recorded currents travelling between 5 and 25 degrees (NNE). The depth averaged current speed of all recorded profiles at this site was 23.87 cm/s (Fig. 6). In the depth profiles analysed, 3 – 10 m above the ocean bottom, the maximum recorded speed was 81.0 cm/s occurring 10 m from the bottom. The most frequently observed speeds were between 18 and 24 cm/s near the seafloor (25.3% at 3 m) and between 36 and 42 cm/s within the upper water column (22.2% at 10 m). The figures in Appendix H illustrate some of the trends in current flow throughout the water column at Rattling Beach. The direction of current flow remains relatively consistent throughout the water column, but the upper-most cell had a nearly unidirectional flow travelling between about 5 and 25 degrees. Data obtained from cells higher in the water column did not yield reliable data. Less than 75% of the data was present and was omitted from analysis. Average current speeds significantly varied with depth, with the cell nearest to the surface having the highest occurrence of currents greater than 80 cm/s.

Figure 6 – Average current speed and direction recorded at site #1039 within 3 – 10 m above the seafloor





6.3 Bathymetry

Side scan-based, depth profiling of lease #1039 was carried out on October 5, 2016 and the data gathered used to produce both a three-dimensional, surface map and a two-dimensional, contour diagram of the site. Figures 7 - 8 show the water depth within the survey area at the time of scanning, which ranged from approximately 2m at the northwest and southwest corners. The eastern side of site is in deeper water ranging from 20 m in the southeast corner to 36 m in the northeast corner.

It should be noted that the Z axis of the 3D surface map is not displayed at the same scale as that of the X and Y axes. This exaggerates relatively small and gradual depth changes over a large geographical area allowing for a more easily understood bathymetric profile. Depths in both the 2D and 3D contour diagrams have not been corrected for tidal influences, thus the soundings displayed represent the depths at the time of recording and not depth relative to chart datum.

Figure 7 – Interpolated 2D bathymetric profiles of site #1039 at Rattling Beach

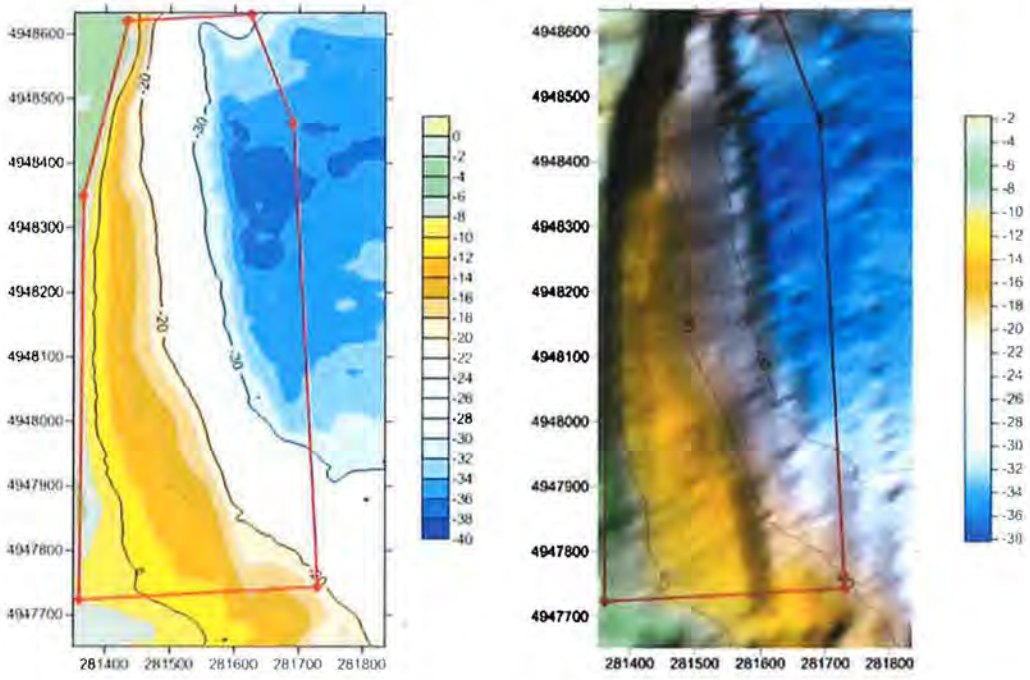
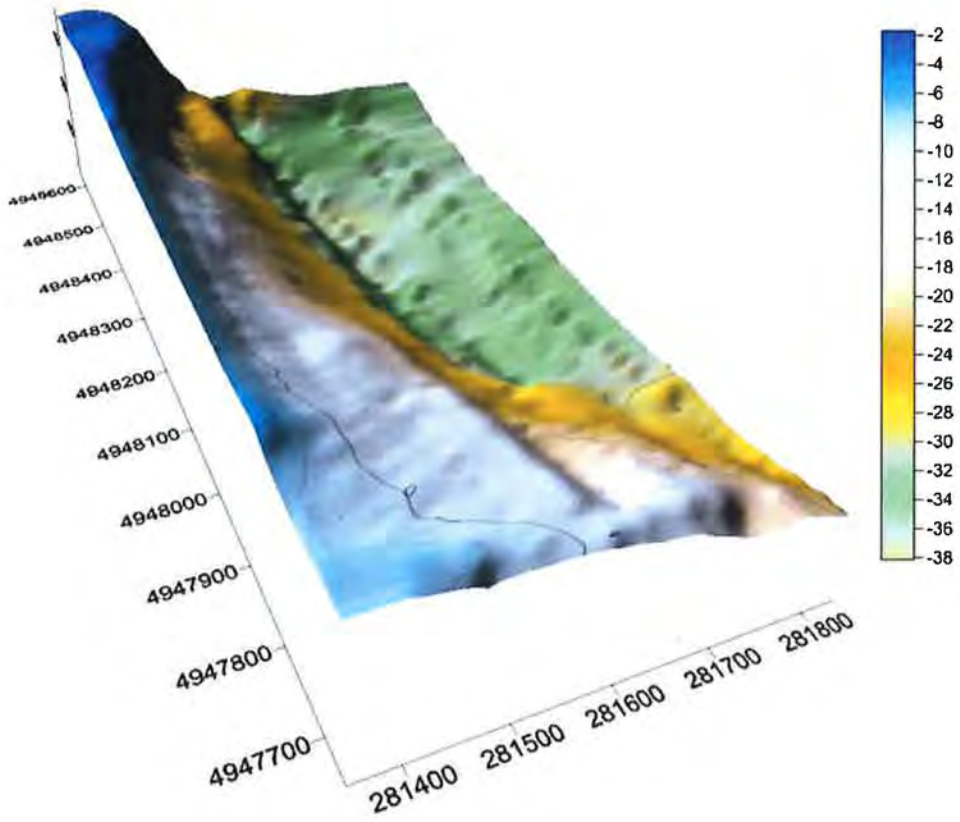


Figure 8 – Interpolated 3D surface map of site #1039 at Rattling Beach site



APPENDIX A
Sulphide Probe Calibration Certificate

NRC-IMB Research Facilities
1411 Oxford Street
Suite 367-368
Halifax, NS
B3H 3Z1
Tel: (902) 492-7865
(902) 492-0359
Fax: (902) 492-7734

Date: 21-Jul-16
Meter: 2007891
Sulfide Probe ID: RS1-12416

Project: SW2016-059 Rattling Beach (#1039)

5-point calibration using 100, 500, 1000, 5 000 and 10 000 µM sulphide standards.

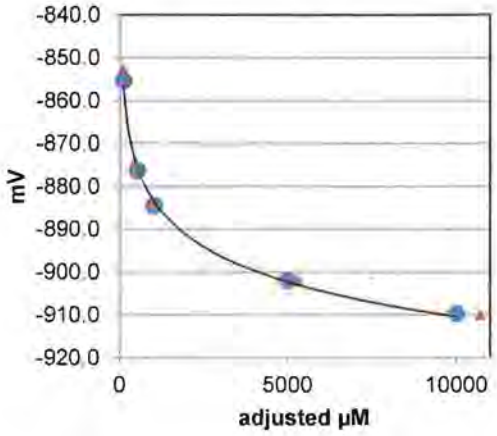
Date calibration performed: 21-Jul-16
Time calibration completed: 9:55am 20(1) **Expiration time:** 12:55pm
Calibration performed by: [redacted]

Temperature calibration performed at: 20.8°C

Calibration -

After calibration the standards were re-measured to verify calibration.

10 µM (really 100 µM)	set at	-855.3 mV	read at	8.19 µM at	-852.6 mV
50 µM (really 500 µM)	set at	-876.3 mV	read at	44.2 µM at	-874.2 mV
100 µM (really 1000 µM)	set at	-884.6 mV	read at	94.3 µM at	-883.7 mV
500 µM (really 5 000 µM)	set at	-901.9 mV	read at	532 µM at	-902.1 mV
1 000 µM (really 10 000 µM)	set at	-909.7 mV	read at	1070 µM at	-910.0 mV



Final slope (meter) = -30.0 mV

10 fold slope (validation)

500 to 5 000 µM: -25.6 mV
1000 to 10 000 µM: -25.1 mV

Calibration meets final slope range of -27 to -33 mV and 10-fold slope of -25 to -30 mV.

Signed off by:

[redacted], M.Sc.
Senior Laboratory Manager

APPENDIX B
Redox and Sulphide Data Sheet

NRC-IMB Research Facilities
1411 Oxford Street
Suite 367-368
Halifax, NS
B3H 3Z1
Tel: (902) 492-7865
(902) 492-0359
Fax: (902) 492-7734
www.simcorp.ca

Site #: Rattling Beach (#1039) **Sample Collection:** 20-Jul-16
Redox Start: 10:05am on 21-Jul-16 **Redox Stop:** 10:55am on 21-Jul-16
Sulphide Start: 10:10am on 21-Jul-16 **Sulphide Stop:** 10:55am on 21-Jul-16

Sample I.D.		Temp	Redox	Sulphide		
Station	ID #	°C	mV	unadjusted µM	mV	adjusted µM
ANB-01	1	8.9	11.6	31.3	-869.9	313
	2	10.5	-209.0	19.3	-864.2	193
	3	10.5	-75.8	46.7	-875.1	467
ANB-A	1	8.2	-15.8	2.48	-837.1	24.8
	2	7.5	70.0	5.80	-848.1	58.0
	3	10.8	55.0	5.52	-847.2	55.2
Corner #1	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Corner #2	1	8.8	-35.8	34.3	-871.0	343
	2	12.0	-36.5	38.2	-872.4	382
	3	10.4	-199.6	29.2	-869.2	292
Corner #3	1	8.2	-109.7	3.42	-840.8	34.2
	2	8.2	-66.9	1.86	-833.2	18.6
	3	9.9	-11.2	5.13	-846.2	51.3
Corner #4	1	10.0	-125.4	2.89	-838.9	28.9
	2	8.0	-112.1	11.7	-857.0	117
	3	10.2	46.3	2.31	-835.5	23.1
Corner #5	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Corner #6	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Corner #7	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-

Field Crew: [redacted]

Analysis Crew: [redacted]

Redox Check (mV):
Prior to analysis 220.8 mV @ 25°C
Post analysis: 220.8 mV @ 25°C

Sulphide Temp: 20.8°C

Redox reading at 2 minutes

Equipment:

Sulphide Analysis	
Probe kit:	NSLAB004
Sulphide probe:	RS1-12416
Temperature probe:	T012

Redox Analysis	
Meter number:	487142
Redox probe:	R002
Temperature probe:	T007

SAOB + L-AA mixture

Addition: 10:00am **Expiration:** 1:00pm

Signed off by:

[redacted], M.Sc.
Senior Laboratory Manager

APPENDIX C
Sediment Grain Size Analysis

NRC-IMB Research
Facilities
1411 Oxford Street
Suite 367-368
Halifax, NS
B3H 3Z1
Tel: (902) 492-7865
(902) 492-0359
Fax: (902) 492-7734

Date: 02-Aug-16
File No.: SW2016-114
Site Name/#: Rattling Beach (#1039)
Province: Nova Scotia

Grain Size Analysis

			% Fraction								
		mm	Corner #1	Corner #2	Corner #3	Corner #4	Corner #5	Corner #6	Corner #7	ANB-01	ANB-A
Gravel	Pebble	>4	NS	40.745	22.918	22.694	NS	NS	NS	13.406	24.511
	Granule	2-4	NS	6.308	4.643	5.258	NS	NS	NS	2.759	4.891
Sand	Very Coarse	1-2	NS	4.365	2.687	4.147	NS	NS	NS	2.086	7.075
	Coarse	0.5-1	NS	5.592	8.040	6.531	NS	NS	NS	6.765	13.920
	Medium	0.25-0.5	NS	11.257	14.015	10.581	NS	NS	NS	32.562	19.261
	Fine	0.125-0.25	NS	12.377	22.035	17.301	NS	NS	NS	16.193	7.386
	Very Fine	0.063-0.125	NS	15.261	15.278	19.990	NS	NS	NS	13.742	12.561
Mud	Silt	0.004 - 0.063	NS	4.094	10.383	13.497	NS	NS	NS	12.486	10.396
% Gravel			NS	47.054	27.561	27.952	NS	NS	NS	16.165	29.402
% Sand			NS	48.852	62.055	58.551	NS	NS	NS	71.349	60.202
% Mud			NS	4.094	10.383	13.497	NS	NS	NS	12.486	10.396

Note: NS - No Sample Collected

[redacted], M.Sc.
Senior Laboratory Manager

APPENDIX D
Grab Photos

ANB-A

Pre-siphon **Post-siphon**

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Corner #4

Pre-siphon

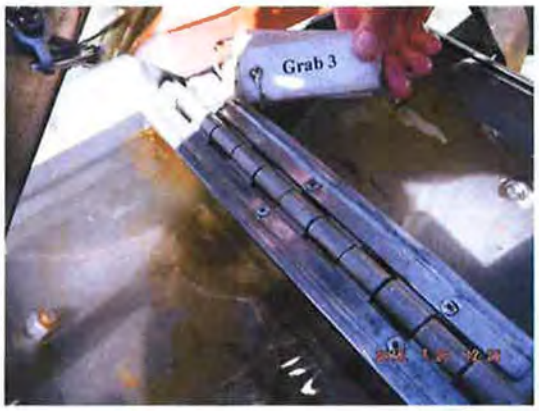
Post-siphon

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Corner #5

Grabs were not sampled



Corner #6

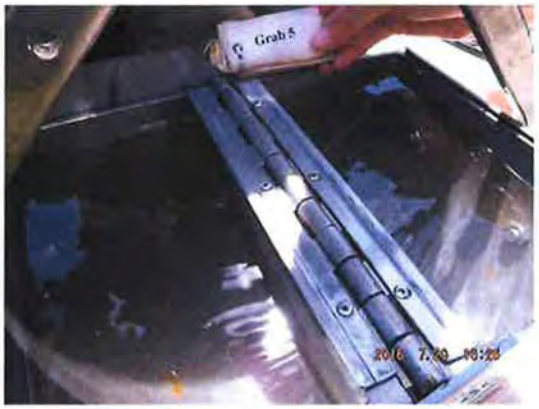
Grabs were not sampled

Corner #7

Grabs were not sampled

Corner #1

Grabs were not sampled



ANB-01

Pre-siphon

Post-siphon

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Corner #2

Pre-siphon **Post-siphon**

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Corner #3

Pre-siphon

Post-siphon

Grab leaked and was not siphoned

Grab leaked and was not siphoned

Grab leaked and was not siphoned

APPENDIX E
Screen Captures of the Seafloor


ANB-A
44 38.9476 N
065 45.2351 W
2016/07/20 10:41:49


Corner #4
44 29.0016 N
065 45.1475 W
2016/07/20 11:33:37


Corner #5
44 38.9954 N
065 45.4358 W
2016/07/20 12:12:16


Corner #6
44 39.0980 N
065 45.4412 W
2016/07/20 12:36:28


Corner #7
44 39.3135 N
065 45.4520 W
2016/07/20 12:66:60


Corner #1
44 39.4482 N
065 45.4057 W
2016/07/20 13:14:29


ANB-01
44 39.5493 N
065 45.3614 W
2016/07/20 13:34:63


Corner #2
144 38.4607 N
065 45.9053 W
2016/07/20 14:12:22


Corner #3
44 39.3845 N
065 45.2038 W
2016/07/20 16:02:22