NOVA SCOTIA

Fisheries and Aquaculture
1575 Lake Road
Shelburne, Nova Scotia
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APPLICATION POSTED NOTICE

These initial documents have been submitted with respect to a boundary amendment of an existing site held by Kelly Cove Salmon Ltd. The information in these documents is provided as part of the routine disclosure of information by the Department of Fisheries and Aquaculture. Some information may be redacted as business confidential information or personal information.

This application is in the preliminary stages of review by the Department. Please note, the review process may require the applicant to submit additional information to the Department which will be posted to the Department's website.

These documents were provided to the Department by the applicant. The Department is not responsible for the content of these documents, including, buyt not limited to, the accuracy, reliability, or currency of the information contained within.

Boundary Amendment	
Applicant: Kelly Cove Salmon Ltd.	**Species**: Atlantic Salmon, Atlantic halibut, Atlantic cod, Rainbow trout, Blue mussel, Dulse, Kelp (Saccharina latissima, Laminaria digitata, Alaria esculenta)
Location: AQ#1006: Saddle Island, Aspotogan Harbour, Lunenburg County	**Method of Cultivation:** Marine cage cultivation

To learn more about the marine aquaculture lease and license application process, please visit https://novascotia.ca/fish/aquaculture/licensing-leasing/Aqua-Licensing-and-Leasing-Overview.pdf

For information on the Nova Scotia Aquaculture Review Board, please visit https://arb.novascotia.ca/

Received
3 0 OCT. 2016
Fisheries and Aquaculture
Shelburne, NS

Boundary Amendment Application

Boundary Amendment for Site #1006
Saddle Island

Aspotogan Harbour
County of Lunenburg
Province of Nova Scotia

October 24, 2016

Prepared for:
Kelly Cove Salmon Ltd.
P.O. Box 1546
Shelburne, NS
B0T 1W0

Prepared by:
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New Brunswick Newfoundland Nova Scotia

SIMCorp File #SW2016-061

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October 24, 2016

SIMCorp File # SW2016-061

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

Dear Mr. Nickerson:

Reference: **Application for a boundary amendment for aquaculture site #1006, Saddle Island, Nova Scotia**

Please find enclosed the supporting materials for the above mentioned boundary amendment at marine aquaculture site #1006, in Aspotogan Harbour, NS.

If you have any questions or comments on the above noted report, please do not hesitate to contact me at 506-467-9014.

Sincerely,

[redacted] M.Sc.
Sr. Marine Environmental Biologist
Atlantic Region
Sweeney International Marine Corp.
[redacted]@simcorp.ca

cc: [redacted] (SIMCorp)
Brennan Goreham (NSDFA)
Mike Szemerda (KCS)

EXECUTIVE SUMMARY

Project: Application for a boundary amendment of aquaculture site #1006 in Aspotogan Harbour, Nova Scotia

The following report and associated documents have been prepared by Sweeney International Marine Corp. (SIMCorp) for Kelly Cove Salmon Ltd. (KCS) in order to satisfy the criteria of the Nova Scotia Department of Fisheries and Aquaculture (NSDFA) Regulation 347/2015 Schedule A: *Regulations Respecting Aquaculture Licences and Leases*, section 3: Factors to be considered in decisions related to marine aquaculture sites. The purpose of this report is to formally apply for a boundary amendment of marine aquaculture site #1006 in Aspotogan Harbour, in Lunenburg County, Nova Scotia. The following document contains supporting information for a boundary amendment to include a farm consisting of 6, 150-m, circular, plastic cages with 250-ft grid cells in a 1 x 6 configuration. The lease dimensions being applied for are 844 x 358 m, resulting in a farm with an area of 30.22 ha. The proposed site would be initially stocked with 440,000 Atlantic salmon in six cages spring 2018.

SIMCorp has assisted KCS in this application for a boundary amendment of site #1006 through the preparation of this report and other supporting roles. All correspondence should be copied to SIMCorp.

Project Team and Contact Information

The project team, their qualifications, and roles with respect to the preparation of this report are summarised as follows:

Team Member	Affiliation	Role	Qualification
Mike Szemerda	KCS	Corporate Support	Vice President of Salt Water Operations
Jeff Nickerson	KCS	Corporate Support	NS Production Manager
[redacted]	SIMCorp	Sr. Project Manager	Company Owner
[redacted]	SIMCorp	Sr. Marine Environmental Biologist, Atlantic Region	M.Sc.
[redacted]	SIMCorp	Nova Scotia Division Manager	M.Sc.
Stephen Acker	Acker & Doucette Surveying Inc.	Survey Plan Preparation	N.S.L.S.

Contact Information

Proponent:

Company Name: Kelly Cove Salmon Ltd.
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Project Management:

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FACTORS TO BE CONSIDERED IN DECISIONS RELATED TO MARINE AQUACULTURE SITES

a. Optimum Use of Marine Resources

Location Identification and Geographic Description of Site

Aquaculture site Saddle Island (#1006) is owned and operated by Kelly Cove Salmon Ltd. (KCS). The proposed marine farm consists of six, 76-m grid cells in a 1 x 6 configuration. The proposed lease incorporates all aquaculture-related gear, above and below the water line, with lease dimensions of 844 x 358 m, resulting in a farm area of 30.22 ha.

The proposed lease area for the boundary amendment of site #1006 appears on Canadian Hydrographic Service (CHS) Nautical chart #4386 (St. Margaret's Bay) and National Topographic System Map Sector 021A (Chester, Nova Scotia). The coordinates, obtained using DGPS, of the corners of the proposed lease area are located in Table 1.

Site #1006 site is located in Aspotogan Harbour, between the Aspotogan Peninsula and the north side of Saddle Island, Lunenburg County, Nova Scotia (Fig. 1). The site is approximately 15 km east by south of the community of Chester and 14.5 km south of the community of Hubbards. Aspotogan Harbour is positioned between St. Margaret's Bay and Mahone Bay. These areas are notable for their small fishing and tourist-related communities. The harbour provides a number of different resources for humans and animals (Fig. 2). Fishing, specifically lobster, is an important activity contributing to the economic wellbeing of many of the small communities along the peninsula. In addition, this area is habitat for migratory birds, which are supported by the presence of unique microenvironments such as salt marshes, bogs, and fens. The peninsula is limited in terms of tourist destinations. One of the more notable spots, however, is the Bayswater Beach Provincial Park and picnic area where people can enjoy the sandy beaches and the view of the harbour. KCS has implemented policies and procedures to manage their farms and protect wildlife. Aquaculture in Aspotogan Harbour has been able to successfully co-exist with other resources in this area.

Table 1. Coordinates for the Boundary Amendment in Aspotogan Harbour

APPROXIMATE SITE CO-ORDINATES (NAD 83)		
Corner	**Latitude**	**Longitude**
1	44° 30' 20.8"	64° 03' 11.7"
2	44° 30' 28.5"	64° 02' 35.1"
3	44° 30' 17.4"	64° 02' 30.5"
4	44° 30' 03.6"	64° 03' 07.2"
Approximate Site Center	44° 30' 19.1"	64° 02' 51.0"

Figure 1. Proposed Boundary Location for Saddle Island #1006 in Aspotogan Harbour

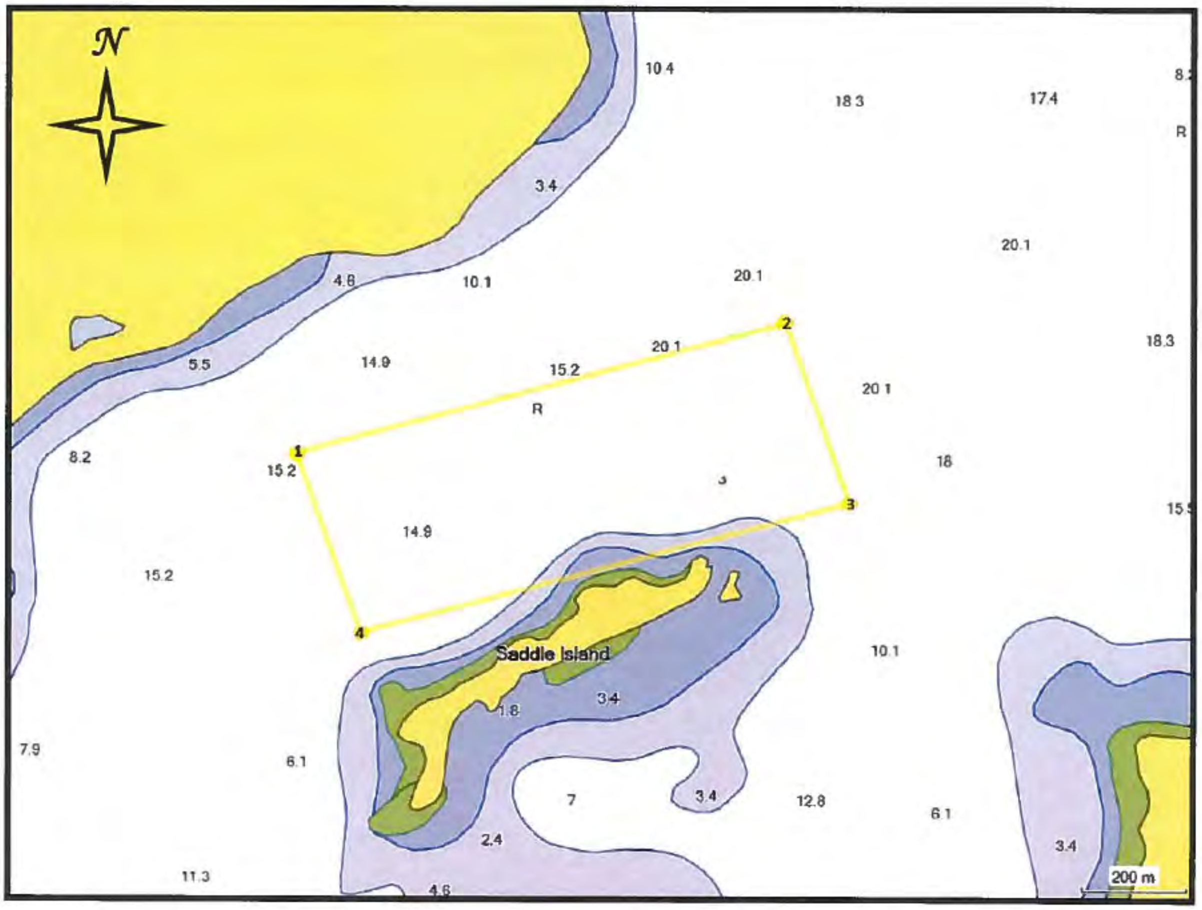
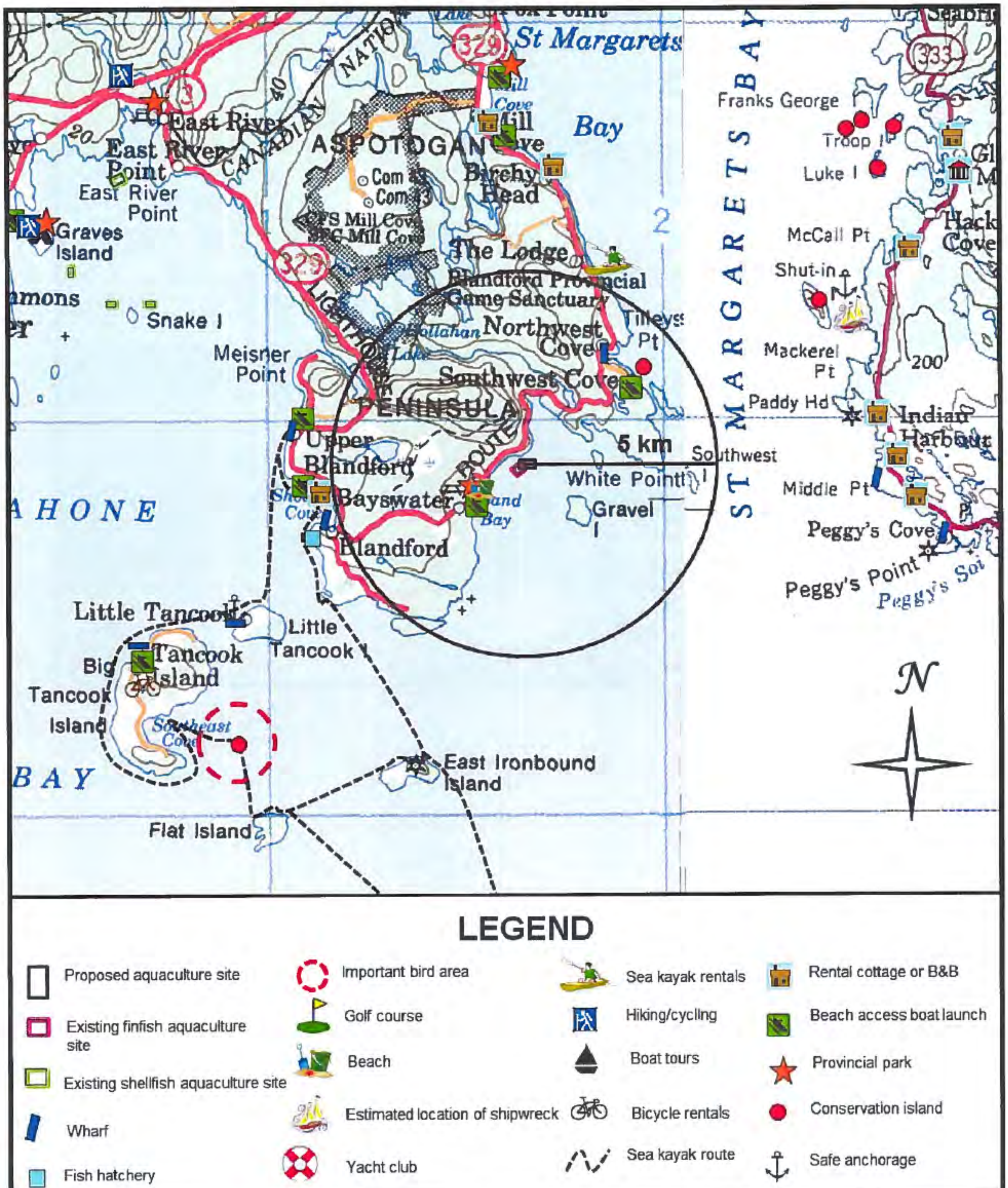


Figure 2. Resource Map of Aspotogan Harbour (Map: National Topographic System Map Sectors 021A and 09P)



b. Community and Provincial Economic Development

The following tables (Tables 2 - 4), obtained from the Statistics Canada website (Statistics Canada 2013), outline employment rates, industries, and occupations relative to Lunenburg County and the province of Nova Scotia as a whole. The data is based on the 2011 census.

Table 2. Labour Force Indicators of Lunenburg County and Nova Scotia

Labour Force Indicators	Lunenburg County			Nova Scotia		
	Total	Male	Female	Total	Male	Female
Total population 15 years and over	40,410	19,670	20,740	768,060	368,640	399,425
In the labour force	23,.505	12,175	11,330	484,585	247,725	236,860
Employed	21,.300	10,980	10,320	435,895	220,810	215,085
Unemployed	2,210	1,200	1,010	48,690	26,910	21,775
Not in the labour force	16,895	7,495	9,405	283,475	120,910	162,560
Participation rate	58.2	61.9	54.6	63.1	67.2	59.3
Employment rate	52.7	55.8	49.8	56.8	59.9	53.8
Unemployment rate	9.4	9.9	8.9	10.0	10.9	9.2

Table 3. Industries of Lunenburg County and Nova Scotia

Industry	Lunenburg County			Nova Scotia		
	Total	Male	Female	Total	Male	Female
Total experienced labour force 15 years and over	23,505	12,180	11,330	484,590	247,725	236,860
Agriculture and other resource-based industries	1,105	885	220	18,340	14,740	3,595
Construction	1,670	1,530	145	32,245	28,835	3,405
Manufacturing	3,040	2,410	635	33,875	25,055	8,830
Wholesale trade	625	490	135	15,380	11,235	4,145
Retail trade	3,160	1,310	1,875	60,900	26,185	34,720
Finance and insurance	570	180	390	15,735	5,375	10,355
Health care and social services	2,745	440	2,305	59,670	10,090	49,575
Educational services	1,720	535	1,185	38,895	12,430	26,470
Other services	1,175	605	575	20,230	9,650	10,575

Table 4. Occupations of Persons in Lunenburg County and Nova Scotia

Occupation	Lunenburg County			Nova Scotia		
	Total	Male	Female	Total	Male	Female
Total experienced labour force 15 years and over	23,510	12,180	11,330	484,585	247,730	236,860
A Management occupations	2,270	1,330	945	48,000	28,825	19,175
B Business, finance and administration occupations	2,980	655	2,325	70,355	18,490	51,870
C Natural and applied sciences and related occupations	985	760	220	28.280	23,065	5,210
D Health occupations	1,405	260	1,150	33,580	6,080	27,500
E Occupations in social science, education, government service and religion	2,555	625	1,930	61,450	21,520	39,930
F Occupations in art, culture, recreation and sport	555	250	305	11,305	5,085	6,225
G Sales and service occupations	5,660	1,975	3,685	116,265	45,190	71,075
H Trades, transport and equipment operators and related occupations	4,140	3,980	155	69,025	65,975	3,050
I Occupations unique to primary industry	1,080	880	190	18,265	15,385	2,875
J Occupations unique to processing, manufacturing and utilities	1,490	1,285	210	18,130	13,150	4,980

The Nova Scotia government has published aquaculture employment statistics from 2013 and 2014 (Table 5; NSDFA 2014). The number of job positions (full time and part time) in finfish aquaculture increased in 2014 from those in 2013. Overall, there was a decrease in job positions in aquaculture, but the decrease was due to a loss of positions in the shellfish industry. On a broader scale, the Atlantic Canada Fish Farmers Association reports that salmon farming employs over 3000 people and directly contributes over $350 million per year to the economy.

Table 5. Nova Scotia Aquaculture Employment Statistics

	Full time		Part time		Total	
	2013	2014	2013	2014	2013	2014
Finfish	159	163	64	72	223	235
Shellfish	112	64	233	237	345	301
Other	20	20	48	50	68	70
Total	**291**	**247**	**345**	**359**	**636**	**606**

According to Statistics Canada, in Nova Scotia approximately 43% of the population lives in rural areas, which is twice the proportion for Canada as a whole (i.e. 20%) (Statistics Canada 2015). In general, Nova Scotia has an increased reliance on natural-based industries, such as the finfish aquaculture industry. In addition to the jobs created directly by the aquaculture sites, there are also jobs created by associated activities such as manufacturing (e.g. cage building and repair, feed manufacturing), transport (e.g. shipping of product to processing plants and to market), processing (e.g. value added products), sales, administration, and sciences (e.g. veterinary services, environmental services). Marine aquaculture has the potential to be an economically sustainable, reliable, and environmentally sustainable industry in Atlantic Canada and to provide needed jobs to Atlantic Canadians. The United Nations Food and Agricultural Organization (FAO) reports that over 75% of the world's marine fish stocks are fully exploited, over exploited, or depleted (FAO 2003). Wild fisheries are therefore unlikely to satisfy the global appetites for seafood. Aquaculture, however, is poised to meet the demand for healthy sources of fish protein.

c. Fisheries Activities

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 seafloor. Various shellfish and seaweeds also support commercial fisheries. In 2014, the top five groundfish and pelagic species landed included herring, haddock, hake, redfish spp., and pollock (Table 6; Fisheries and Oceans 2014a).

Table 6. Atlantic Coast Commercial Landings for 2014
Note: sourced from Fisheries and Oceans Canada (2014a)

2014 ATLANTIC COAST COMMERCIAL LANDINGS, BY REGION (metric tonnes, live weight)	Nova Scotia			
	Maritimes	**Gulf**	**Total**	**Atlantic Total**
Groundfish				
Atlantic Cod	2,348	23	2,371	13,001
Haddock	15,732	0	15,732	16,037
Redfish spp.	6,805	0	6,805	8,948
Halibut (Atlantic)	2,166	34	2,200	3,617
Flatfishes	1,964	151	2,115	10,751
Greenland turbot	44	0	44	14,312
Pollock	2,875	0	2,875	3,204
Hake	8,034	7	8,040	8,451
Cusk	210	0	210	212
Catfish	0	0	0	0
Skate	105	0	105	314
Dogfish	54	0	54	54

Other	2,186	41	2,226	2,363
Total	**42,523**	**256**	**42,779**	**81,263**
Pelagic & other finfish				
Herring	40,013	4,878	44,891	114,610
Mackerel	703	67	770	6,540
Swordfish	1,609	0	1,609	1,609
Tuna	493	78	571	763
Alewife	524	173	697	1,562
Eel	8	23	31	311
Salmon (Atlantic)	0	0	0	0
Smelt	0	0	0	124
Silversides	0	154	154	449
Shark	64	0	64	64
Capelin	0	0	0	28,867
Other	34	0	34	63
Total	**43,448**	**5,374**	**48,822**	**154,964**
GRAND TOTAL (5)	**238,708**	**17,834**	**256,542**	**686,629**

Groundfish

There are a number of commercially harvested species of groundfish off the south shore of Nova Scotia. The most common traditional fisheries included 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 2014b). 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 2015g). 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).

Flatfish are also important commercial groundfish but they are caught mostly on the fishing banks and deeper areas (Fisheries and Oceans Canada 2014b). In NAFO Divisions 4X5Y, these species are halibut, yellowtail flounder, American plaice, winter flounder, and witch flounder (Fisheries and Oceans Canada 2014b). 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).

Figures 3 - 6 show the approximate groundfish landings off the coast of Nova Scotia between 1999 and 2003 (Fisheries and Oceans Canada 2014b).

The Saddle Island site is present in the Maritimes Statistical District 23 which encompasses Black Point, Shad Bay to Lunenburg County Line. An adjacent district, Fisheries Statistical District 25, incorporates all the landings from Halifax County Line to inclusive Oakland and Eastern side of Mahone Bay. A request for fisheries landing data was submitted to the Department of Fisheries and Oceans on September 29, 2016 (Request Number: RQ20161325). Upon receipt of DFO's report, the information on specific landing and value data will be provided.

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*)
- Cusk (*Brosme brosme*), restricted to by-catch only
- Redfish (*Sebastes* sp.)
- Silver hake (*Merluccius bilinearis*)
- White hake (*Urophycis tenuis*), restricted to by-catch only

Figure 3. Commercial Groundfish Landings (1999 – 2003)

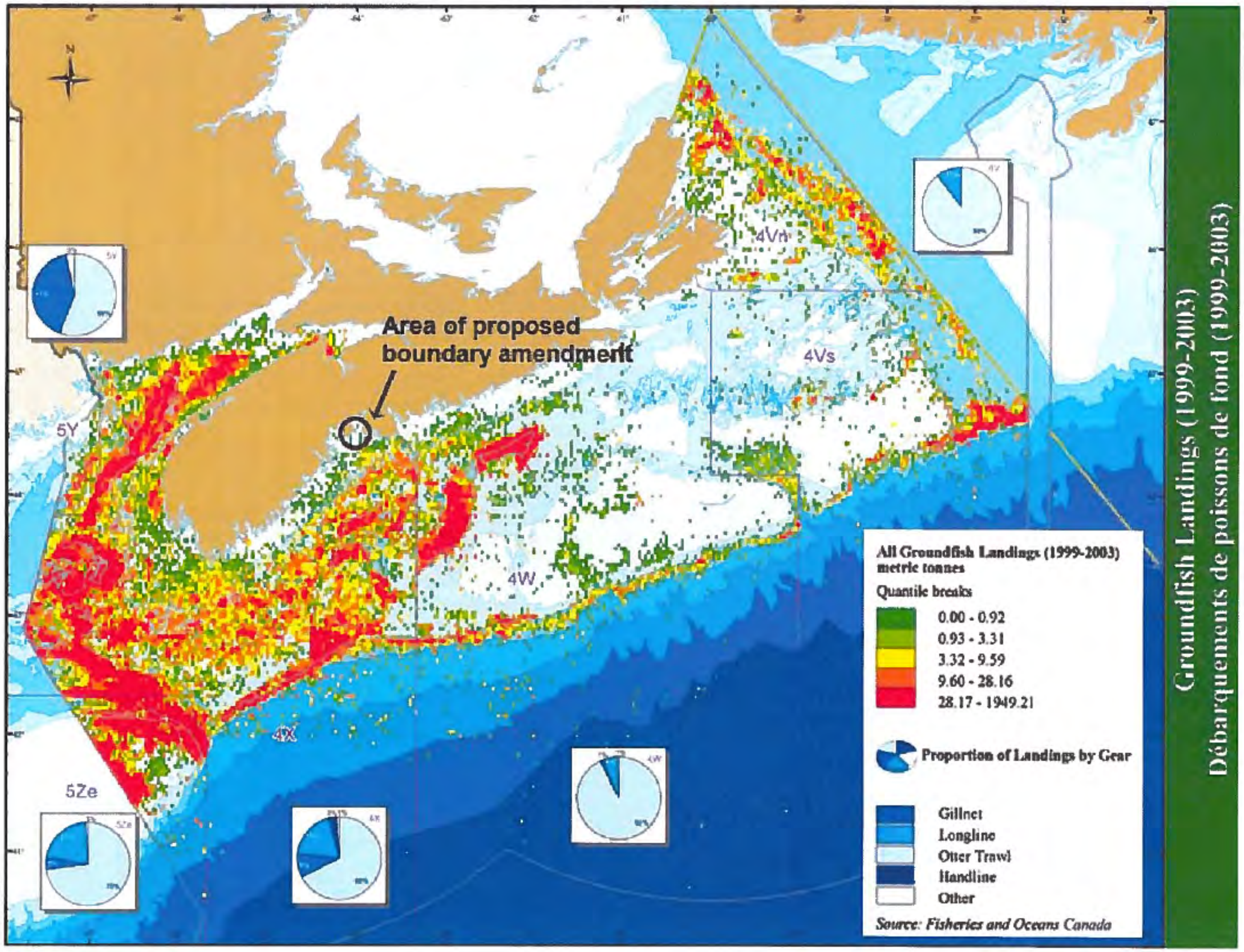


Figure 4. Commercial Cod, Haddock, and Pollock Landings (1999 – 2003)

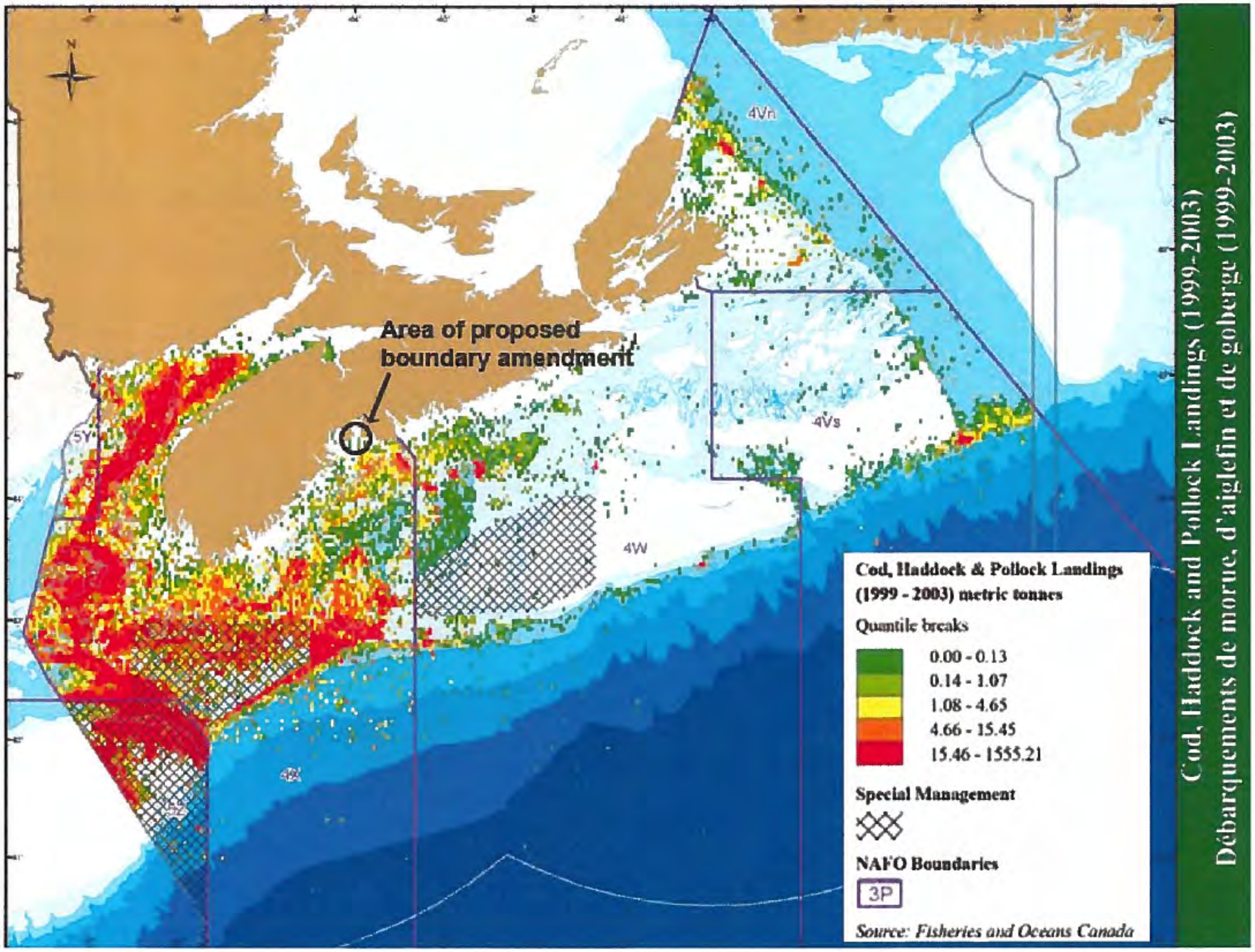


Figure 5. Commercial Flatfish Landings (1999 – 2003)

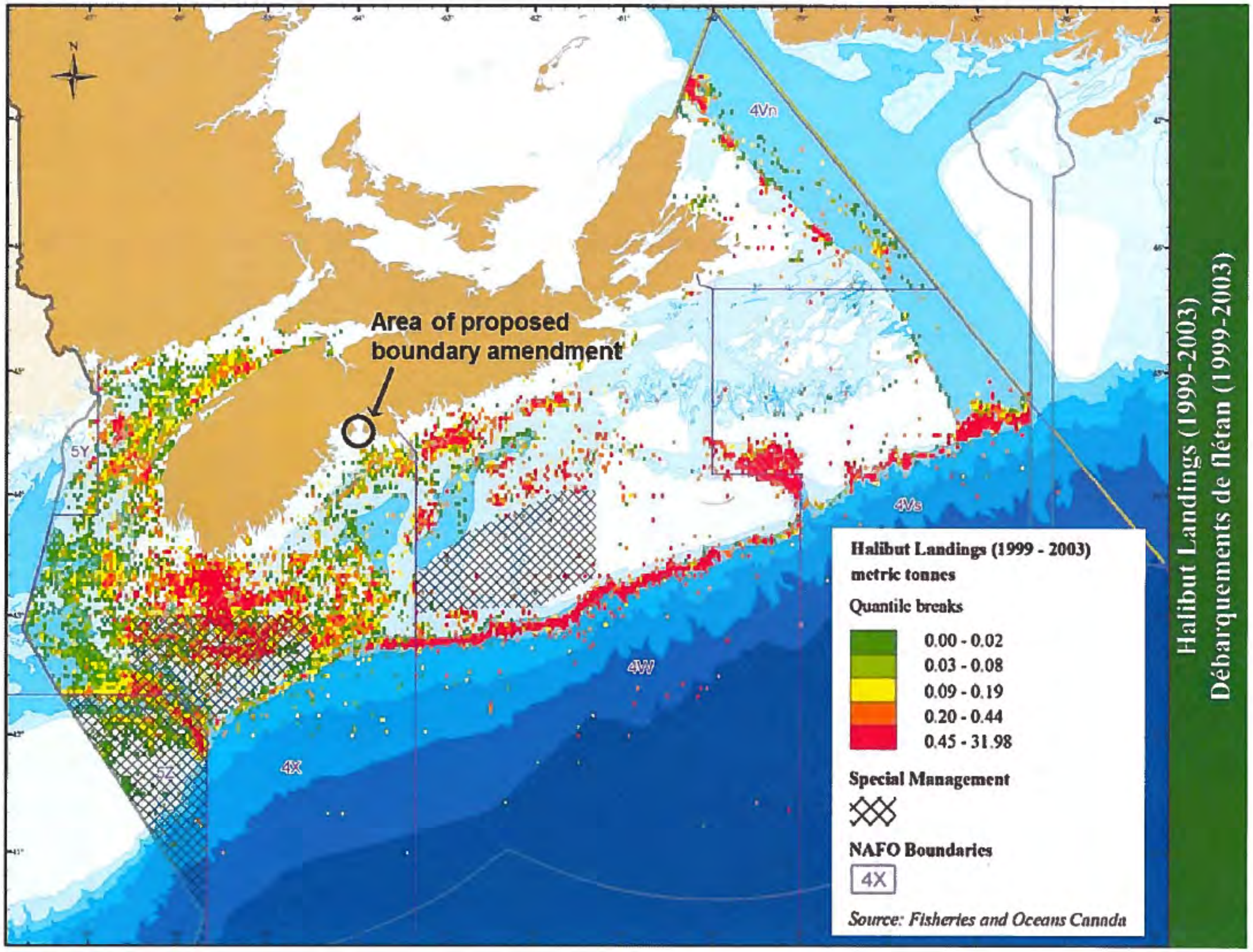
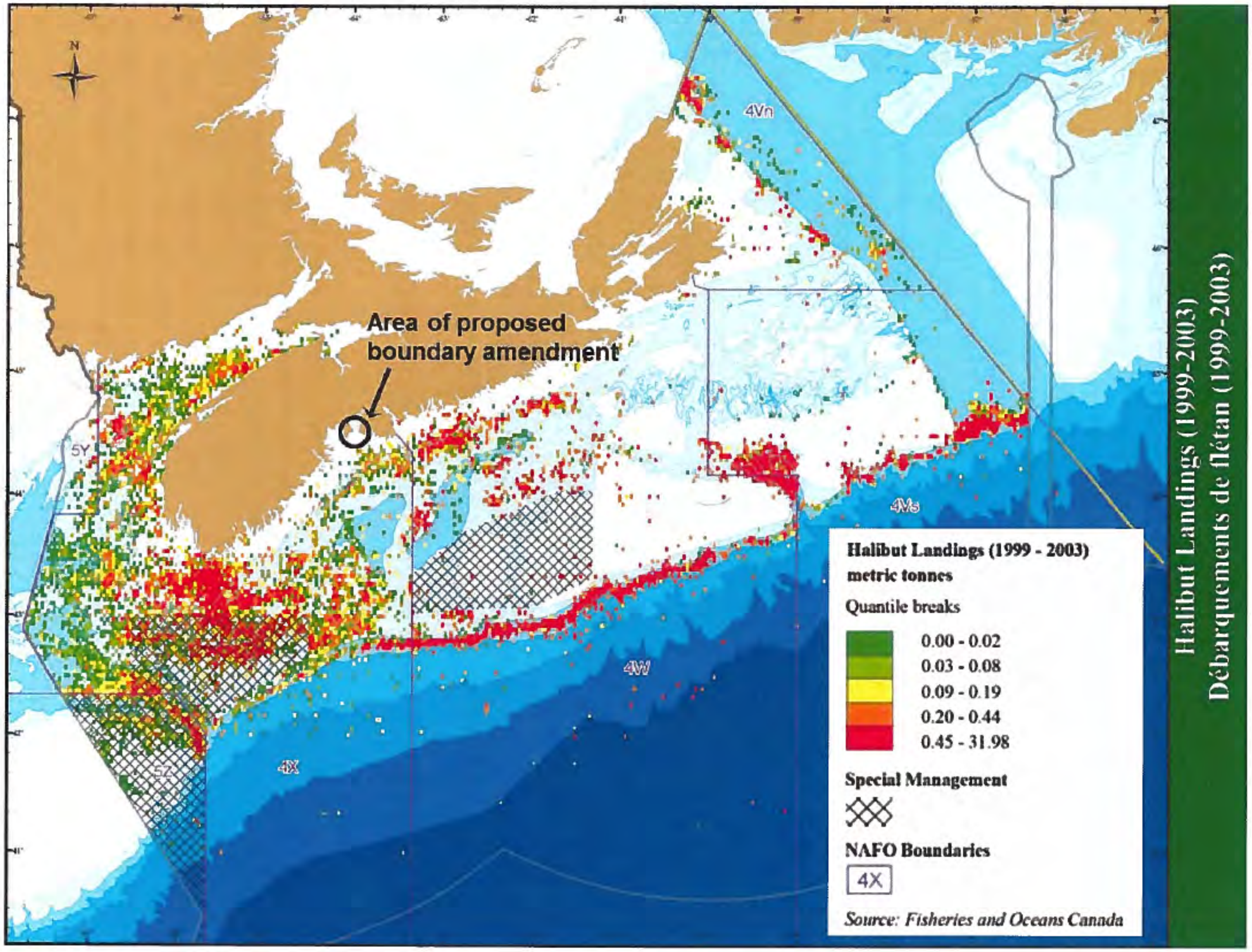


Figure 6. Commercial Halibut Landings (1999 – 2003)



Pelagics

The most common commercial species of pelagic fish off the shore of Nova Scotia include: herring (Fig. 7), mackerel (Fig. 8), tuna, swordfish, and alewife, with herring being the most valuable pelagic in 2014 (Table 6; Fisheries and Oceans Canada 2014a). Herring, *Clupea harengus*, stocks in the 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 2015c). Approximated moving biomass averages for the Southwest Nova Scotia / Bay of Fundy area indicated slight increases each year since 2012 (DFO 2015c). The herring fishery largely takes place on dense summer feeding, overwintering, and spawning locations and is dominated by purse seine, gillnet, and weir (DFO 2015c). Inshore fishing for herring takes place in the general area of the proposed aquaculture site boundary amendment (Fig. 7).

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 2014). The NS mackerel fishery is conducted using purse seine, gillnet, and weir (NSDFA 2014). Trapnet fishing is the method most frequently used in St. Margaret's Bay and Mahone Bay and has an open season from April through November each year (Fisheries and Oceans Canada 2014b). Because of high fishing mortality, mackerel landings of recent years (2011 - 2013) have decreased within the Northwest Atlantic region when compared to numbers from years previous (DFO 2014). Figure 8 illustrates the general distribution of mackerel fishing activities on the Scotian Shelf.

The small pelagic fisheries are Scotia-Fundy wide, meaning that any gillnet licence 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. 9) 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 Shelburne, Cape Sable Island, Sambro, Wood's Harbour, and Clark's Harbour (Fisheries and Oceans Canada 2008). The bluefin tuna (Fig. 10) is the most common tuna found off the Nova Scotia coast and is fished with tended line, rod and reel, harpoon, longline, and trap nets (Fisheries and Oceans Canada 2014b). The trapnet mackerel fishery in St. Margaret's Bay is known to accept bluefin tuna as by-catch, however, several limitations are placed on this and tagging of all fish caught is required (Fisheries and Oceans Canada 2014b). 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 considered to be of a critical status whereas the bigeye and yellowfin tuna stocks are considered healthy (O'Boyle 2012).

A request for fisheries landing data in Maritimes Districts 23 and 25 was submitted to the Department of Fisheries and Oceans on September 29, 2016 (Request Number: RQ20161325). Upon receipt of DFO's report, the information on specific landing and value data will be provided.

Species list

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

Figure 7. Commercial Herring Landings (1999 – 2003)

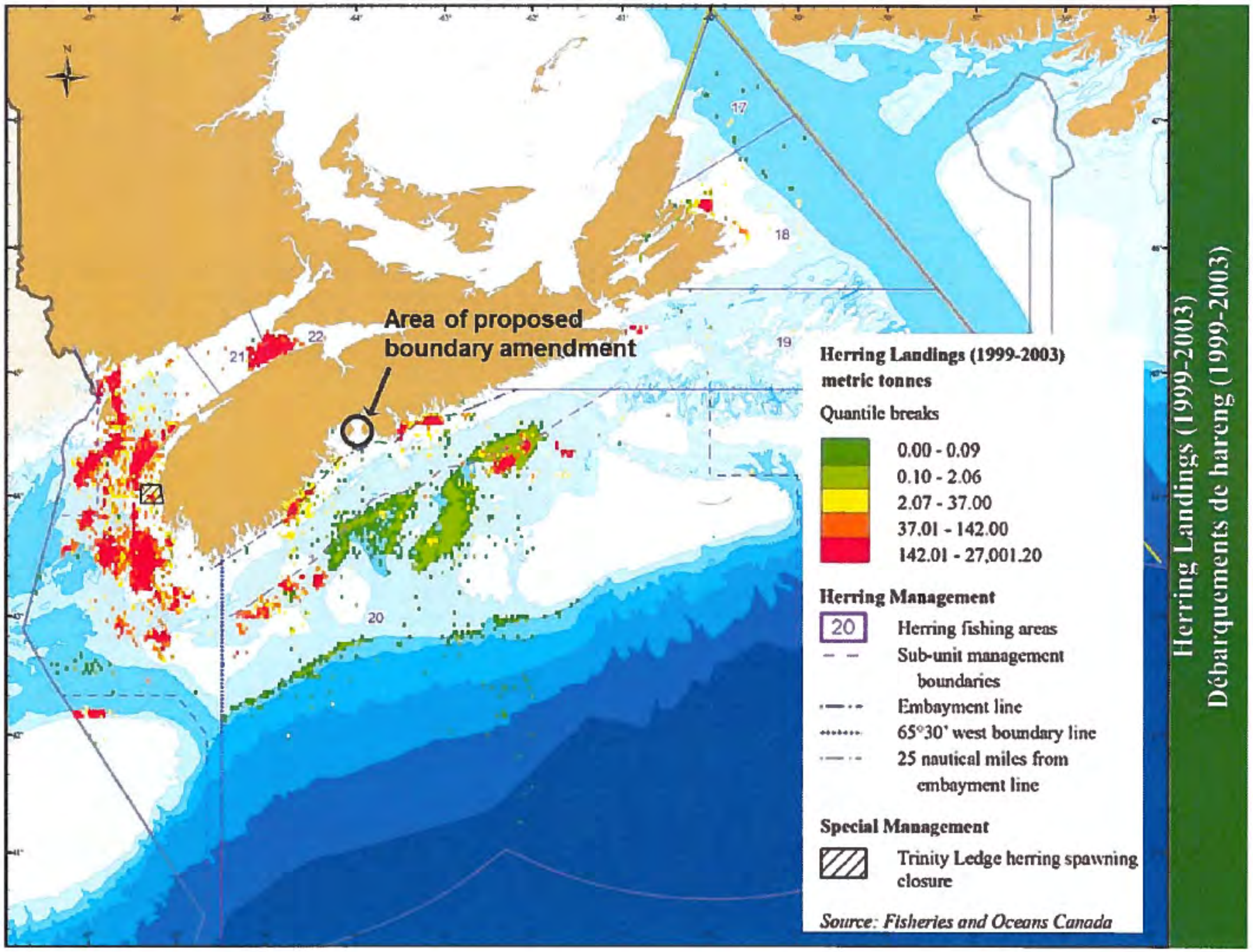


Figure 8. Commercial Mackerel Landings (1999 – 2003)

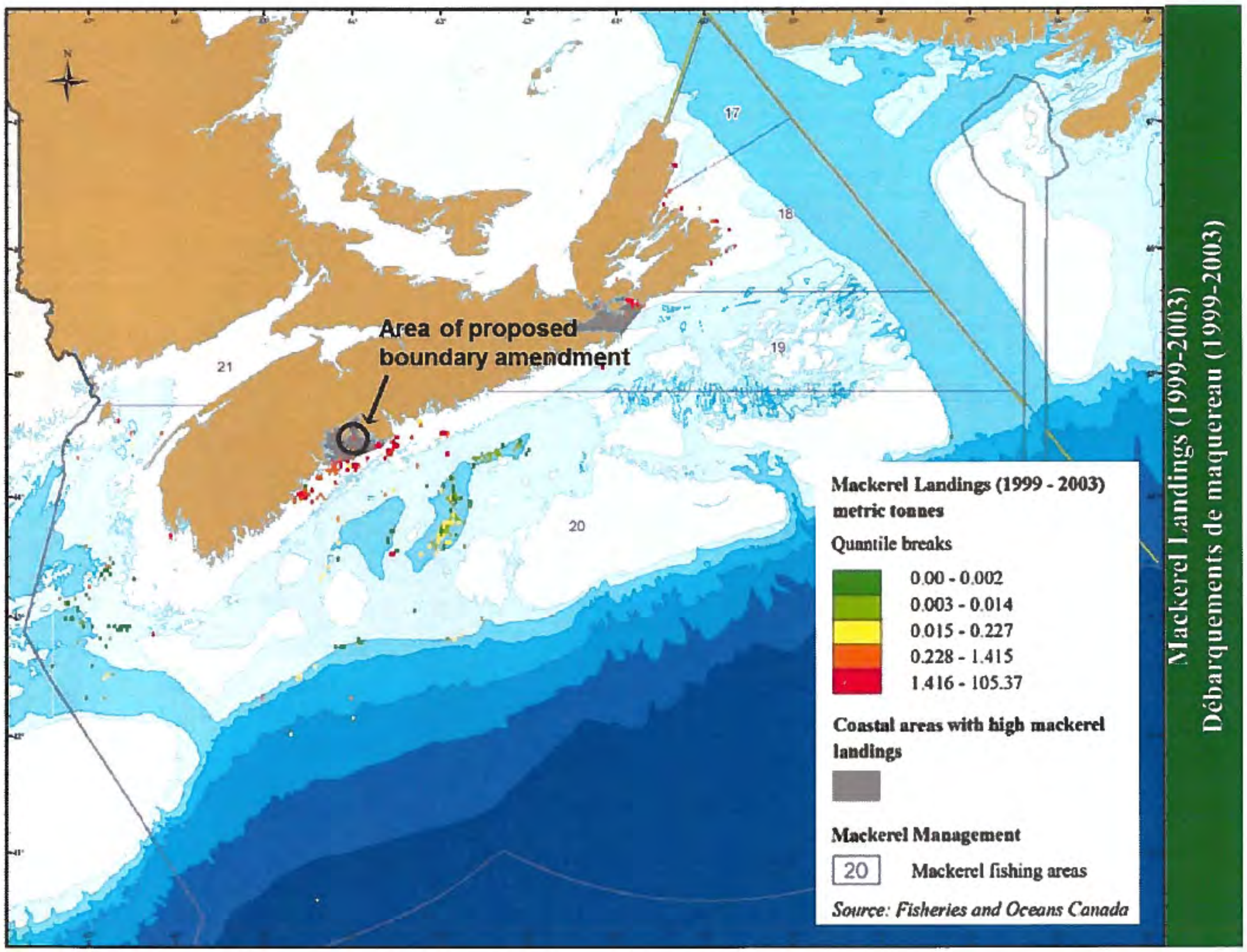


Figure 9. Commercial Large Pelagic Fish Landings, Excluding Bluefin Tuna (1999 – 2003)

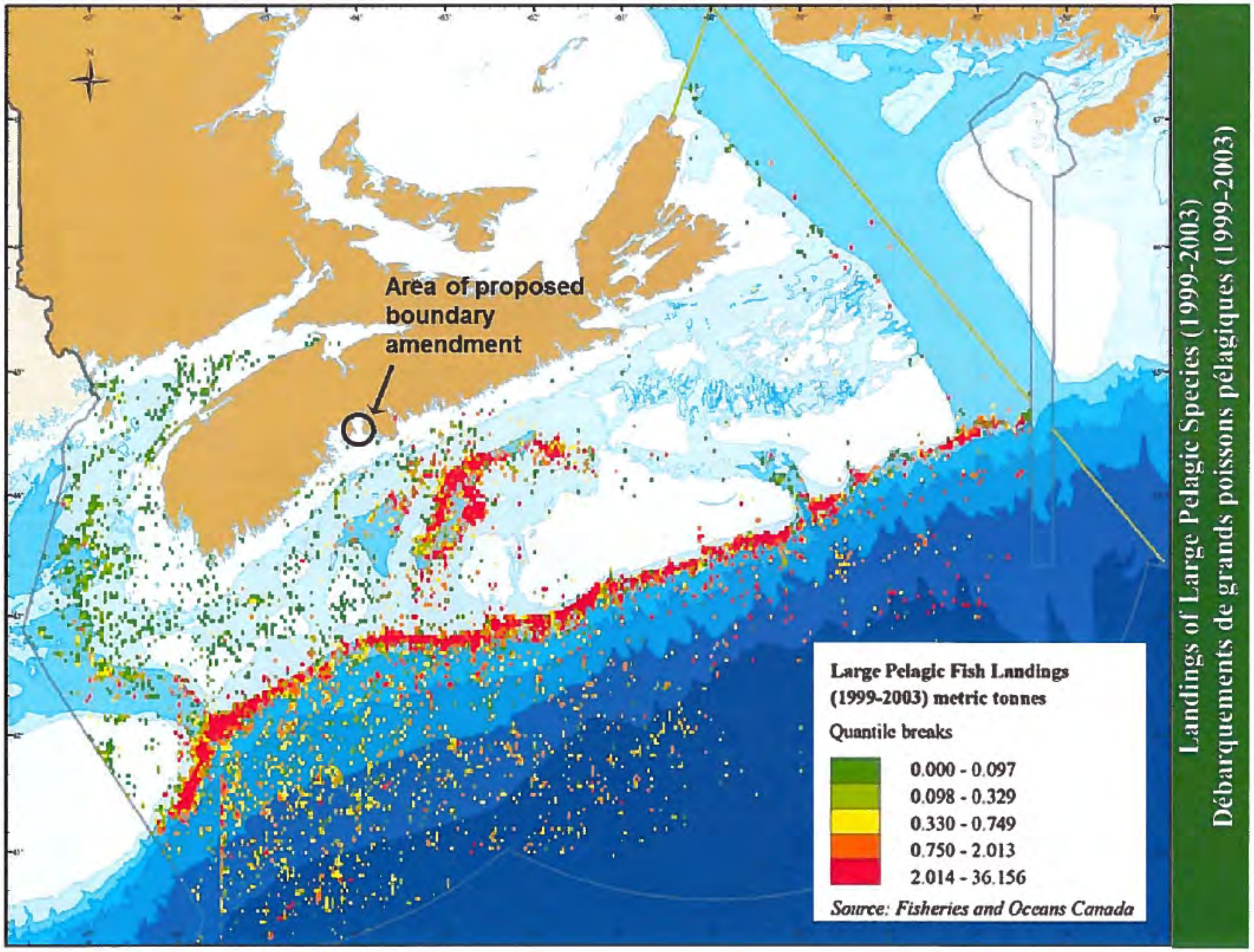
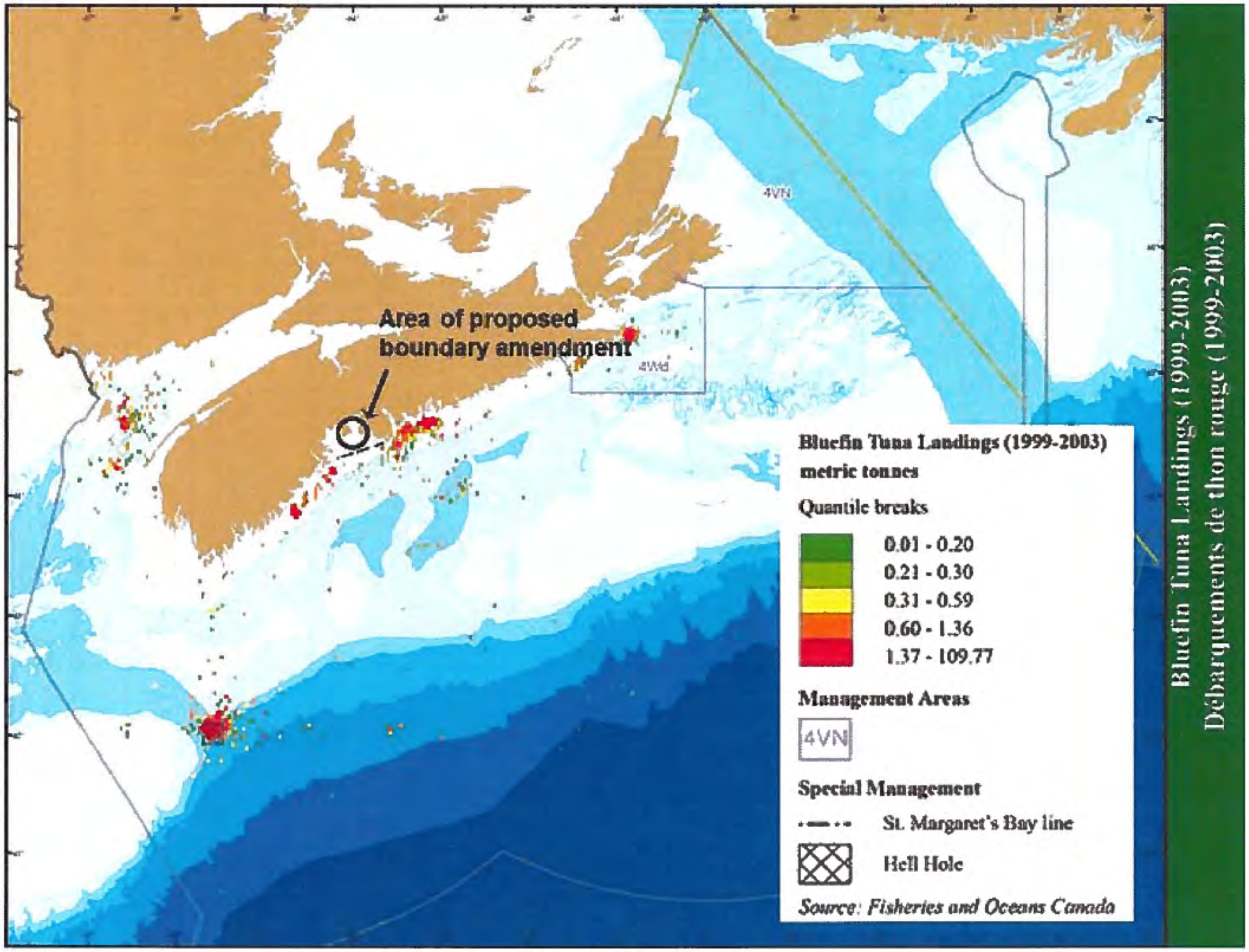


Figure 10. Commercial Bluefin Tuna Landings (1999 – 2003)



Shellfish and Other Invertebrates

There are a number of shellfish species that are harvested off Nova Scotia and included are such commercially important species as scallops, lobsters, shrimp, and crabs (Table 7; Fisheries and Oceans Canada 2014a). Also harvested are sea cucumber, sea urchins, and soft-shell clams.

Table 7. Atlantic Coast Commercial Landings for 2014
Note: source from Fisheries and Oceans Canada (2014a)

2014 ATLANTIC COAST COMMERCIAL LANDINGS, BY REGION
(metric tonnes, live weight)

Species	Nova Scotia			Atlantic
	Maritimes	Gulf	Total	Total
Shellfish				
Clams / quahaug	2,068	3	2,071	26,869
Oyster (1)	2	69	72	1,258
Scallop (2)	63,694	78	63,772	69,745
Squid	22	0	22	22
Mussel (3)	0	2	2	2
Lobster	47,235	4,300	51,534	92,779
Shrimp	24,748	124	24,872	129,658
Crab, Queen	12,142	7,045	19,187	96,103
Crab, Other	426	579	1,005	5,277
Whelks	111	0	111	3,491
Cockles	6	0	6	257
Sea cucumber	1,719	0	1,719	5,379
Sea urchin	270	0	270	2,377
Other	0	0	0	0
Total	**152,443**	**12,200**	**164,643**	**433,218**
Subtotal	**238,414**	**17,830**	**256,245**	**669,445**
Others				
Marine plants	214	4	218	14,360
Lumpfish roe	0	0	0	40
Miscellaneous (4)	80	0	80	2,784
Total	294	4	298	17,184
GRAND TOTAL (5)	**238,708**	**17,834**	**256,542**	**686,629**

(1) Oyster: BC data now reported under Aquaculture. 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 2014a), of which the lobster fishery is the primary component. In 2014, Nova Scotia landed over 51,000 t of lobster valued at $570 million (Fisheries and Oceans Canada 2014a, Fisheries and Oceans Canada 2014c). The inshore lobster fishery accounts for ~ 90% of the lobster landings (Coffen-Smout et al. 2013; Fig. 11), in which the landings have more than doubled in the past 20 years (NSDFA 2014). The proposed farm falls within lobster fishing area (LFA) 33. Typical lobster grounds are characterised by a hard seafloor such as ledge, boulder, or cobble (Lawton 1993) whereas the proposed aquaculture farm is located over mostly sandy conditions (see section **d. Oceanographic and Biophysical Characteristics**). 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.). Landings in LFA 33 over recent years have increased. Landings made in LFA 33 over recent years have been positive, in addition to the population status being deemed healthy in 2014 and the catch per unit effort (CPUE) rates on the rise since 2000 (Fisheries and Oceans Canada 2015b).

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 2014b) (Fig. 12). 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 (Fisheries and Oceans Canada 2014b, DFO 2015d). Commercial snow (queen) crab landings for 2013 and 2014 are illustrated in Figure 14, which indicates that the proposed boundary amendment of Saddle Island 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 2015c).

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. In shrimp fishing area 16, a number of licenses are largely inactive due to low shrimp abundance in this area (Seafish 2015); however, Fisheries and Oceans maintain the stock biomass as being in the healthy zone (Fisheries and Oceans Canada 2015d).

The commercial fishery for scallops is typically offshore, although a smaller inshore fishery does occur along parts of the Atlantic coast (Fig. 16). Historically, the area off Digby, in the Bay of Fundy, has been the most important area for the inshore fishery (Fisheries and Oceans Canada 2014b). While shellfish harvesting is restricted in St. Margaret's Bay, scallop fishing occurs inshore within the boundaries of Scallop Fishing Area 29, which encompasses the south shore of Nova Scotia (Fig. 17).

A request for fisheries landing data in Maritimes Districts 23 and 25 was submitted to the Department of Fisheries and Oceans on September 29, 2016 (Request Number:

RQ20161325). Upon receipt of DFO's report, the information on specific landing and value data will be provided.

The area of the proposed fish farm falls within shellfish harvesting area NS-13-020-003 (Fig. 18) in approved waters. Some nearby prohibited shellfish growing areas are located on the western side of St. Margaret's Bay, in New Harbour, and in Shoal Cove.

<u>Species list</u>

- Lobster (*Homarus americanus*)
- Snow crab (queen crab) (*Chinoecetes opilio*)
- Shrimp (*Pandalus borealis*)
- Rock crab and Jonah crab (*Cancer irroratus* and *C. borealis*)
- Green crab (*Carcinus maenas)*
- Scallop (*Placopecten magellanicus*)
- Soft-shell clam (*Mya arenaria*)

Figure 11. Total Lobster Catch
Note: sourced from Coffen-Smout et al. (2013)

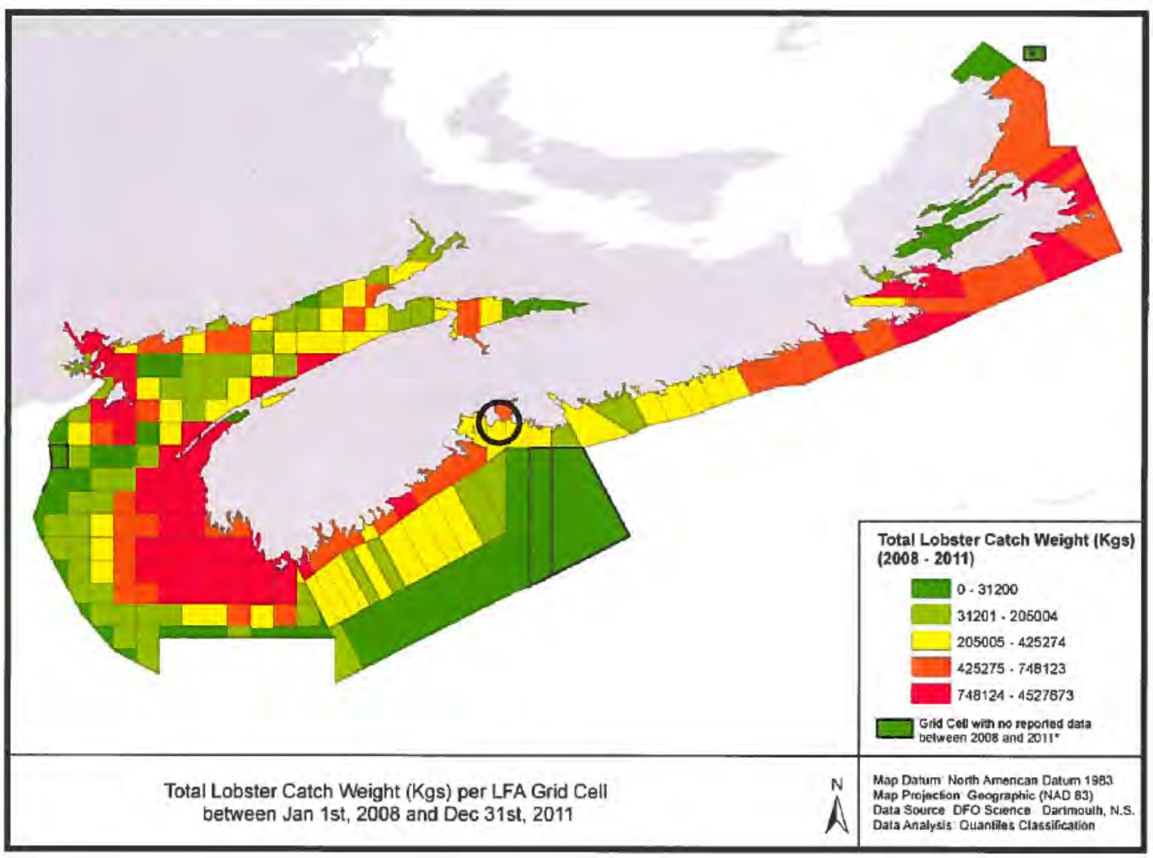


Figure 12. Commercial Crab Landings (1999 – 2003)

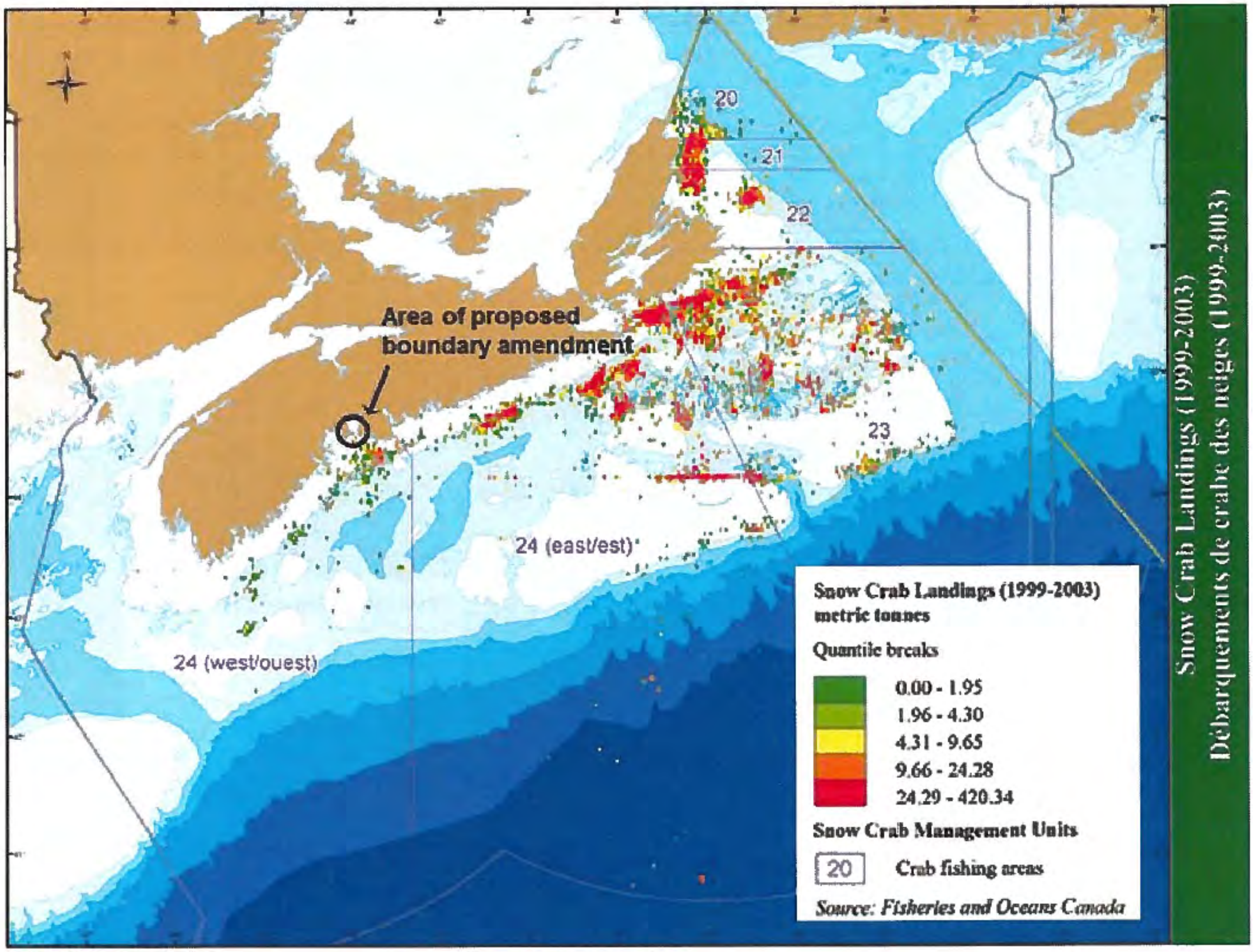


Figure 13. Commercial Snow Crab Landings (1999 – 2003)

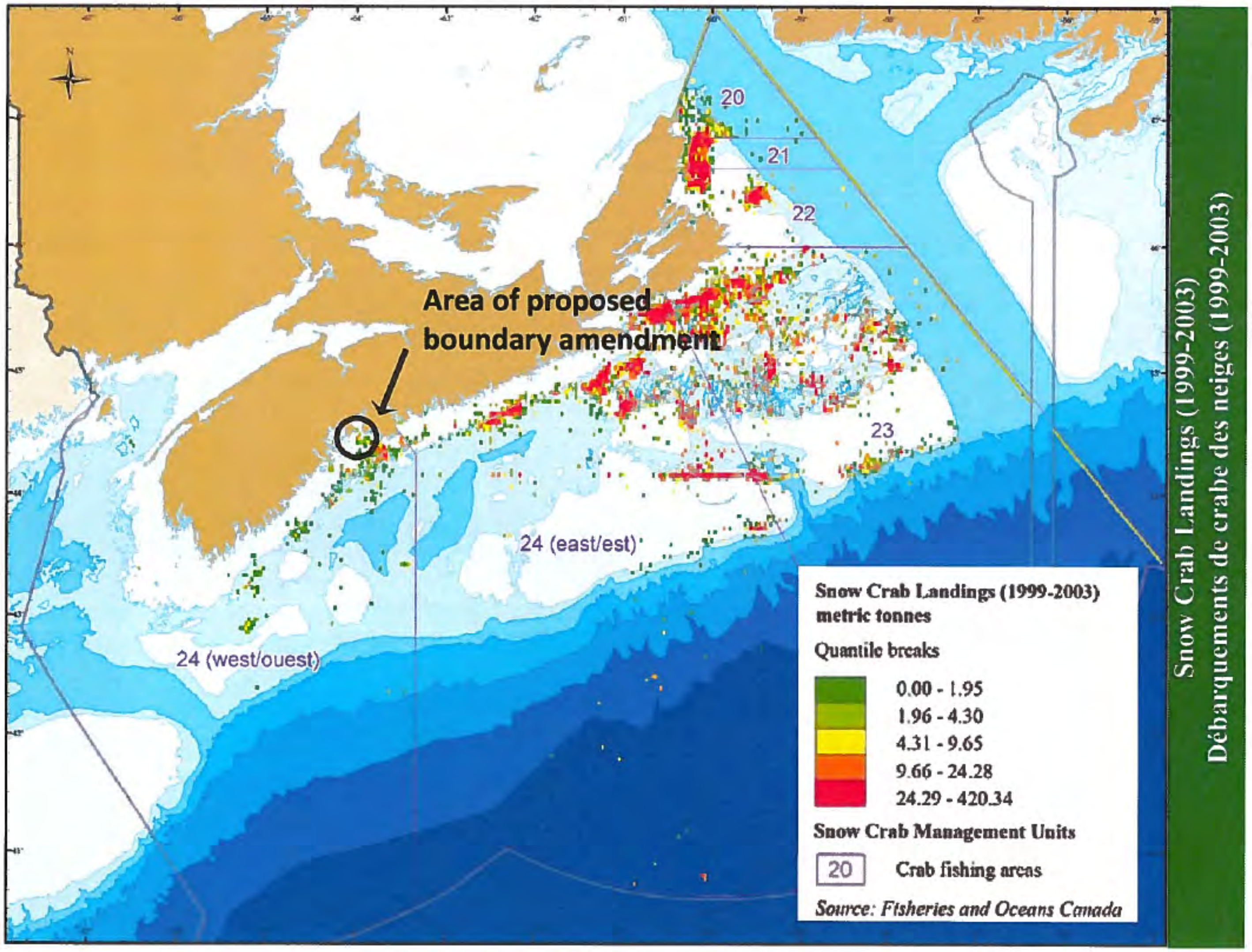


Figure 14. Commercial Snow Crab Landings (DFO 2015d)

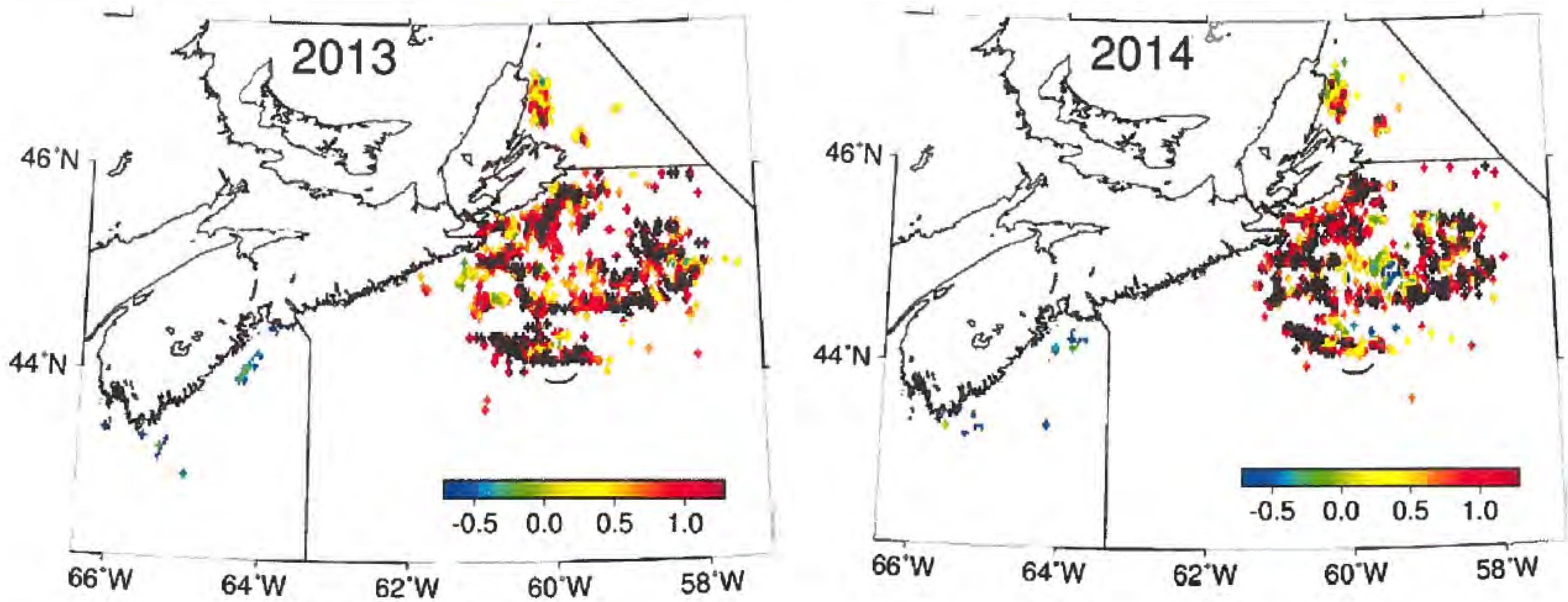


Figure 15. Shrimp Fishing Areas in Atlantic Canada
Note: Sourced from Fisheries and Oceans Canada (2015c)

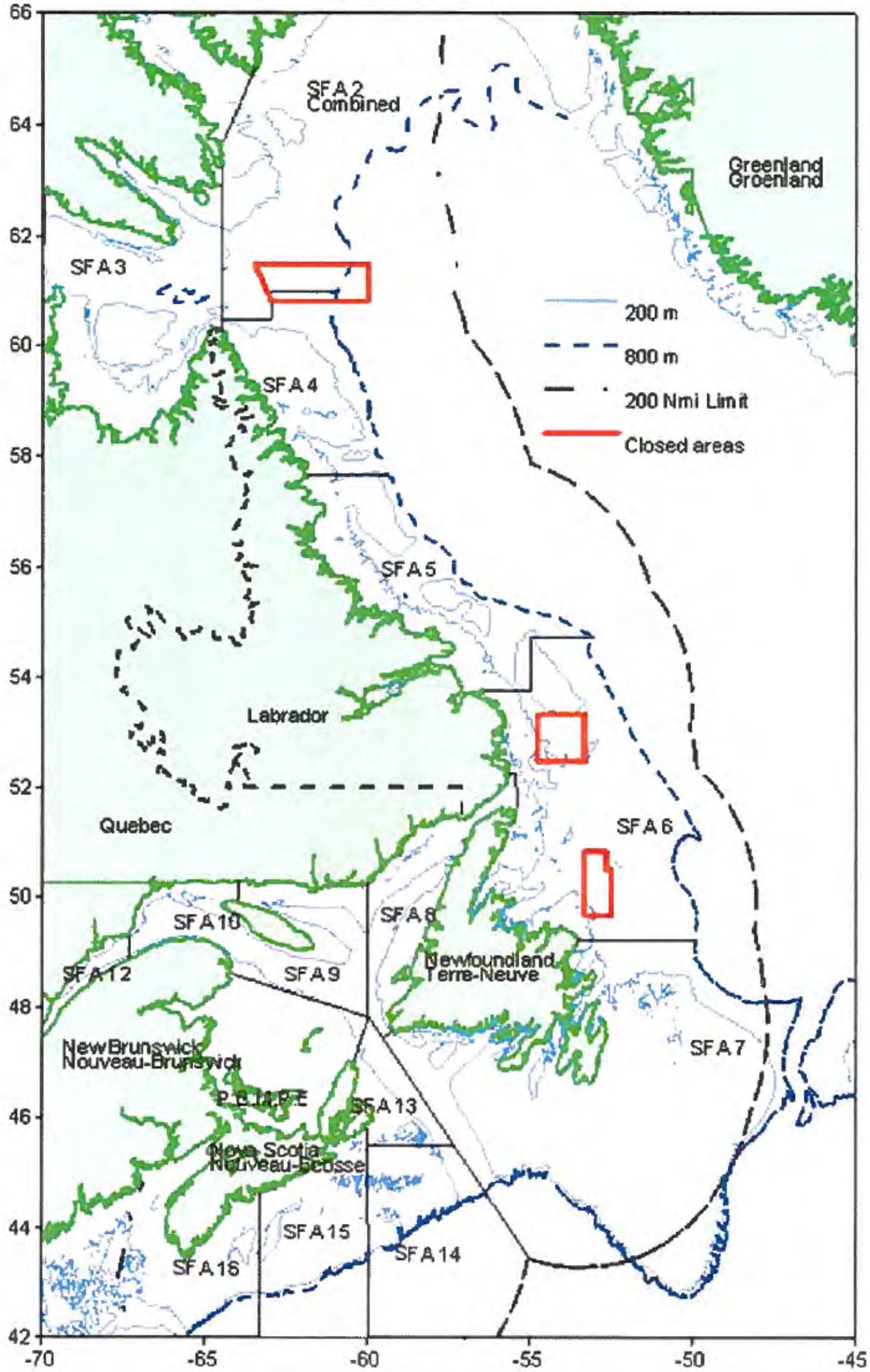
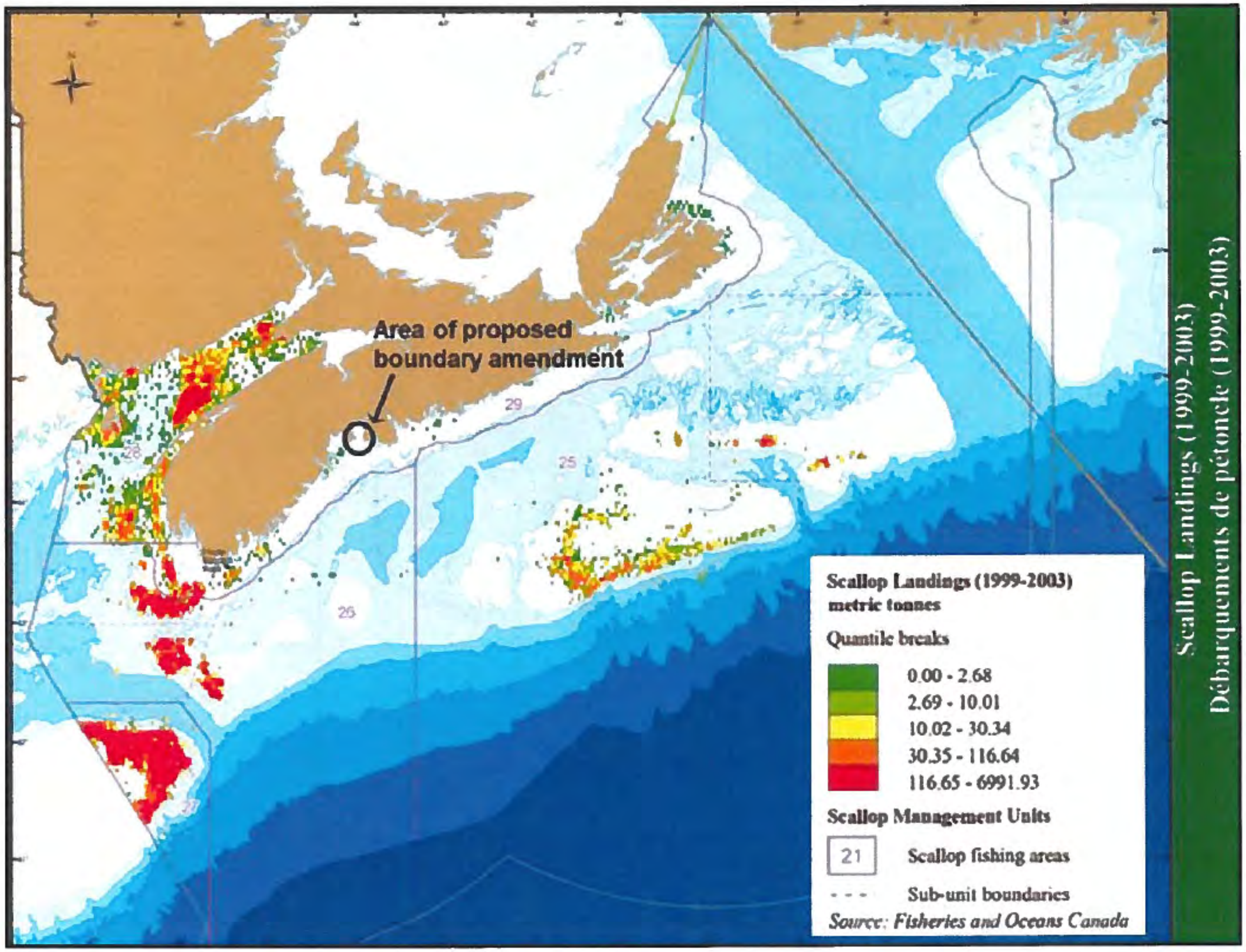


Figure 16. Commercial Scallop Landings (1999 – 2003)



SW2016-061

Figure 17. Scallop Production Areas
Note: sourced from Fisheries and Oceans (2016a)

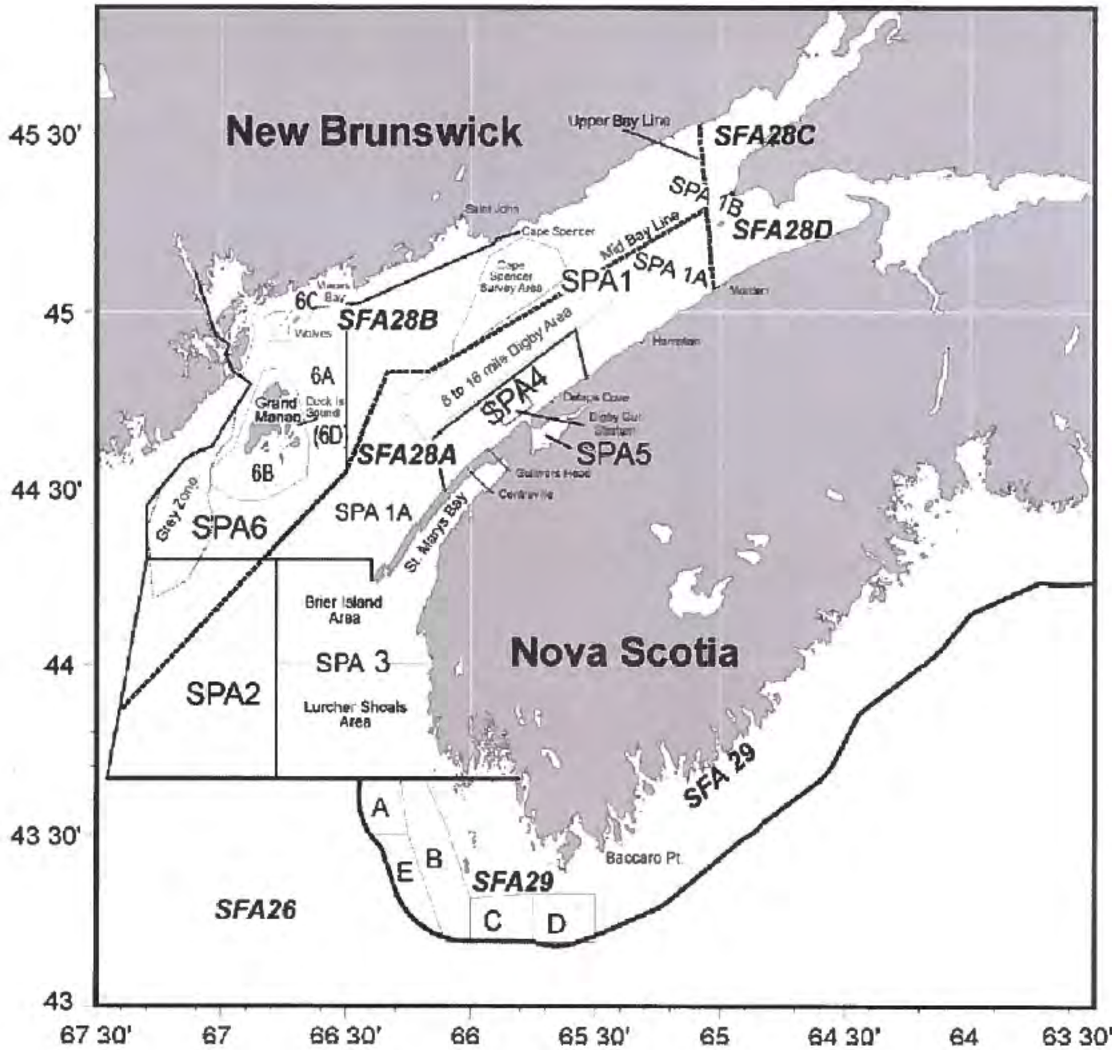
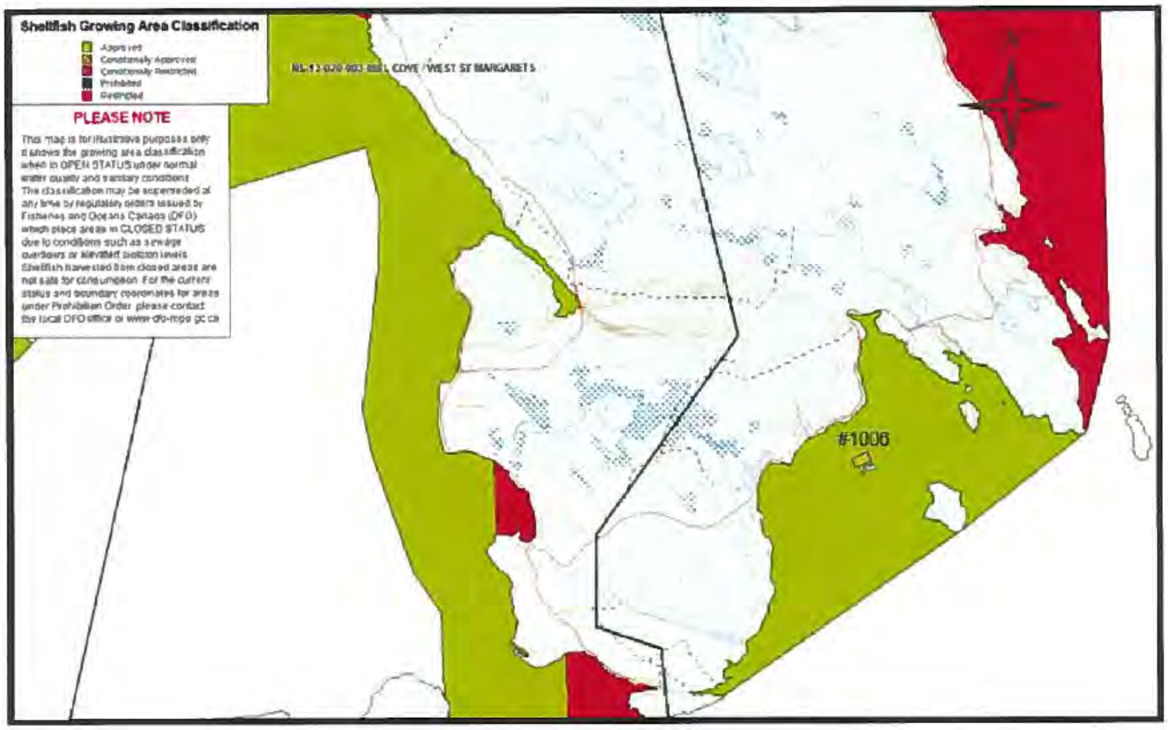


Figure 18. Shellfish Harvesting Classifications of the Aspotogan Harbour Area
Note: DFO is the central CSSP agency with respect to the real time status of shellfish growing area classifications. DFO should be contacted directly for information on shellfish area closures.



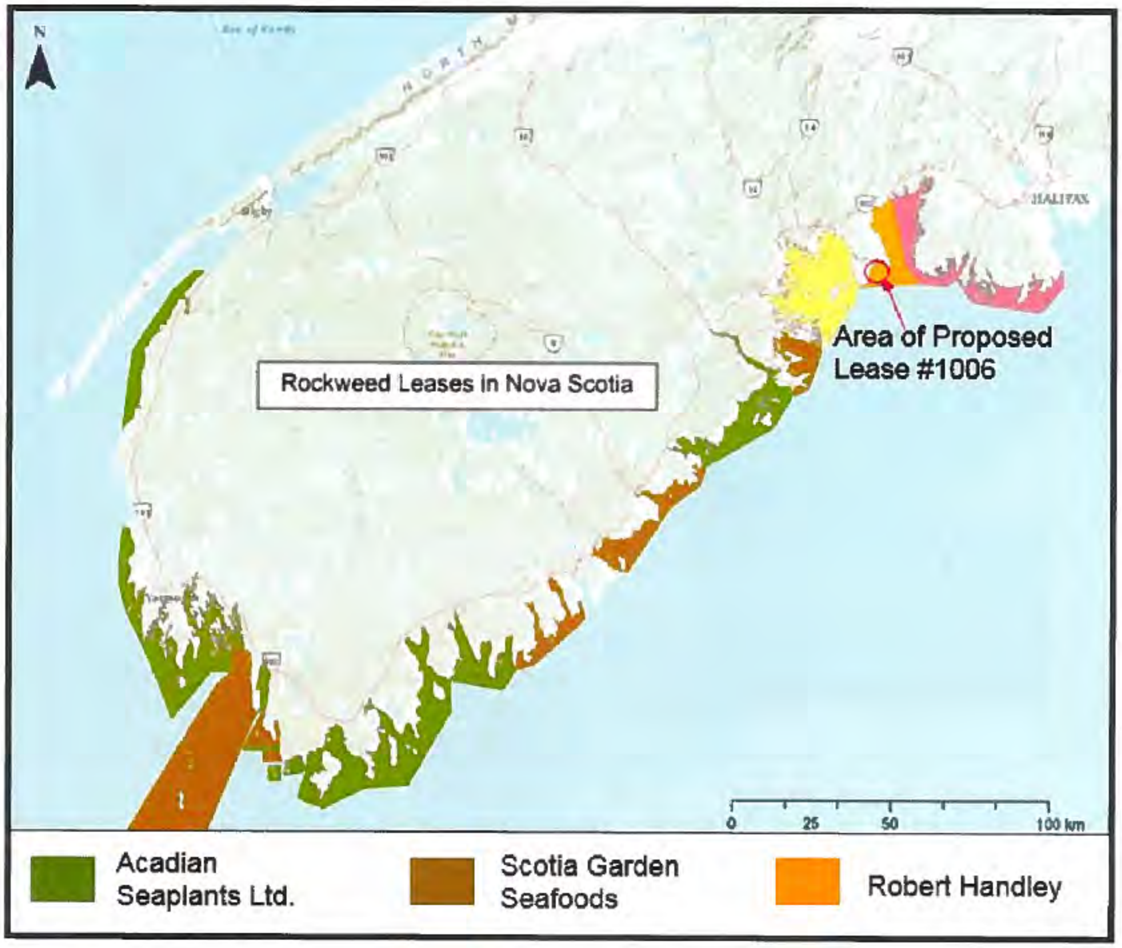
Seaweeds

Marine plants that are 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, fertiliser, and other specialty products. Though the species is not under any immediate threat, Irish moss populations are beginning to experience signs of increase in site-specific harvesting pressure within Nova Scotian stocks, and protection methods are beginning to be recognised (Fisheries and Oceans Canada 2013a). [redacted] own leases in the area surrounding the Saddle Island site – St. Margaret's Bay and Aspotogan Harbour. Details on specific leases such as harvest amounts are unattainable due to privacy laws and commercial confidentiality.

The province of Nova Scotia has jurisdiction over the issuing of rockweed licenses. A provincial representative from the Department of Fisheries and Aquaculture explained that rockweed harvesting can coexist with aquaculture and no conflict is anticipated between the industries (J. Huston, pers. com.). This is due to the fact that 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 also harvested with a hand rake (Fisheries and Oceans Canada 2013a). Harvesting *Ascophyllum* is considered a high risk activity as these plants and other biota can be damaged due to harvest. Therefore mitigation actions such as seasonal closures during peak growth or reproductive effort may be necessary to ensure the population status does not diminish (Fisheries and Oceans Canada 2013a).

Figure 19. Rockweed licences in the Aspotogan Harbour Area



Recreational Fisheries

The recreational fishery in the area of Aspotogan Harbour is varied. Several species are targeted including mackerel, trout, striped bass, clams, and mussels. A federal license is not required for fishing in tidal or saltwater in Nova Scotia; however, Canadian federal fishing seasons and bag limits must be respected.

Aboriginal Fisheries

A request for aboriginal fisheries landing data in Maritimes Districts 23 and 25 was submitted to the Department of Fisheries and Oceans on September 29, 2016 (Request Number: RQ20161325). Upon receipt of DFO's report, the information on specific landing and value data will be provided.

d. Oceanographic and Biophysical Characteristics

Baseline Survey

A baseline survey of the proposed lease area will be conducted in November 2016. The baseline assessment report will be submitted separately from this report.

Physical Oceanography

Wind

The proposed boundary amendment of NS aquaculture site #1006 is located along the southern shore of the Aspotogan Peninsula, near Saddle Island on the south shore of Nova Scotia, along the Atlantic seaboard. The site is sheltered from the southeast around to the east by its proximity to the mainland of Nova Scotia and neighbouring islands. The most significant wind direction for this site is to the southeast, to which the site is exposed to the Atlantic Ocean.

The following wind speed data, including Figures 20 and 21, were sourced 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 speeds of less than 25 knots occur 75.8% of the time on the south shore of Nova Scotia. Storm force winds (i.e. > 45 knots) occur only 1.2% of the time. The most common wind directions are westerly (20.7% occurrence) and southwest (18.5% occurrence) while the least common wind direction is from the southeast (6.1% occurrence). Winds from the direction of greatest exposure (southeast and south) are most often between 10 and 20 knots, very rarely exceed 30 knots and almost never reach storm force winds. Historically, the months with the highest mean wind speeds in the area have been January (22.2 knots) and December (21.6 knots). During these months the most frequent wind direction is from the west. Annual wind statistics for the south shore of Nova Scotia are presented in Figure 20, and summary graphs of average monthly wind speeds are presented in Figure 21.

Hourly wind speed and direction data were also collected from the Lunenburg weather station, located at N44.36003° W64.29614° (Environment Canada 2016). Data collected between January 1, 2010 and December 31, 2014 were used to produce the wind-rose plot of Figure 22. The average wind speed over this time period was 17.80 km/hr, with a maximum recorded wind speed of 122 km/h. Based on this data, the most common winds in the Lunenburg area occur between 195 and 225° (approximately the south-southwest to the southwest), but the strongest winds come from a heading between 265 and 315° (westerly through west-northwest). Most commonly, wind speeds are between 4 and 20 km/h (Fig. 23).

Figure 20. Annual Wind Statistics for the Nova Scotian Shore
Note: sourced from MacLaren Plansearch Ltd. (1991)

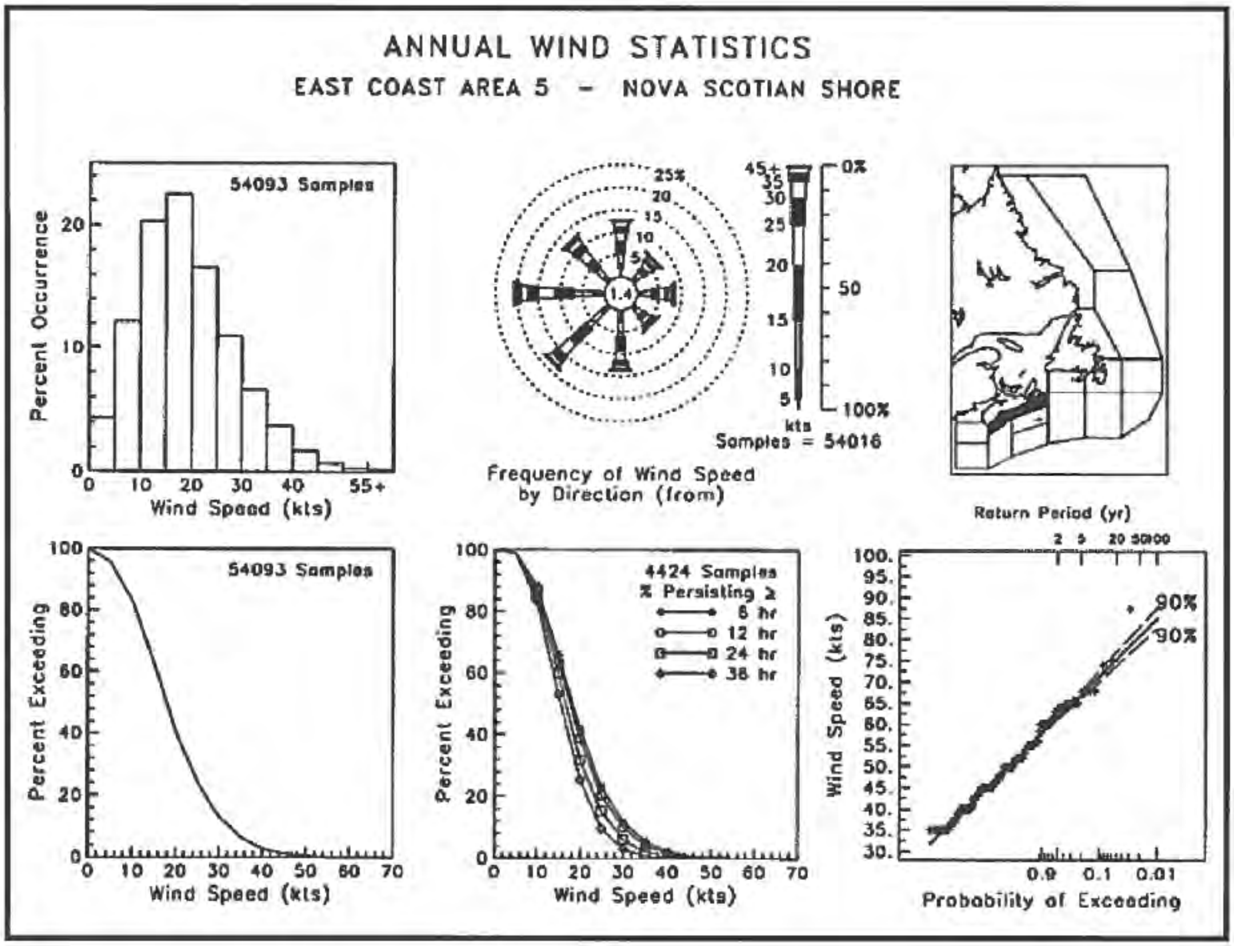


Figure 21. Average Monthly Wind Statistics for the Nova Scotian Shore
Note: sourced from MacLaren Plansearch Ltd. (1991)

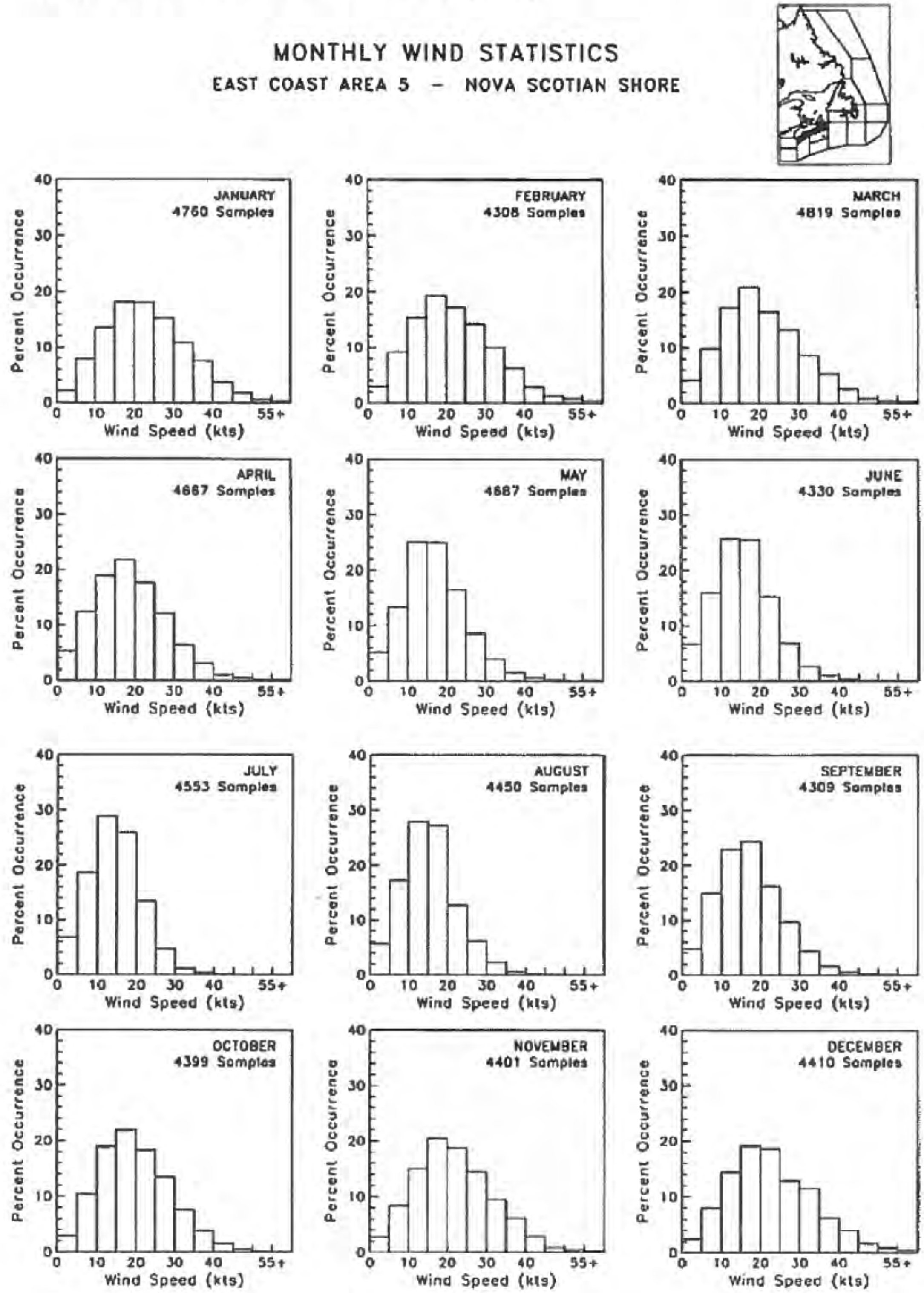


Figure 22. Wind-rose Plot of Lunenburg Weather Station Data Collected Between December 1, 2010 and December 31, 2015

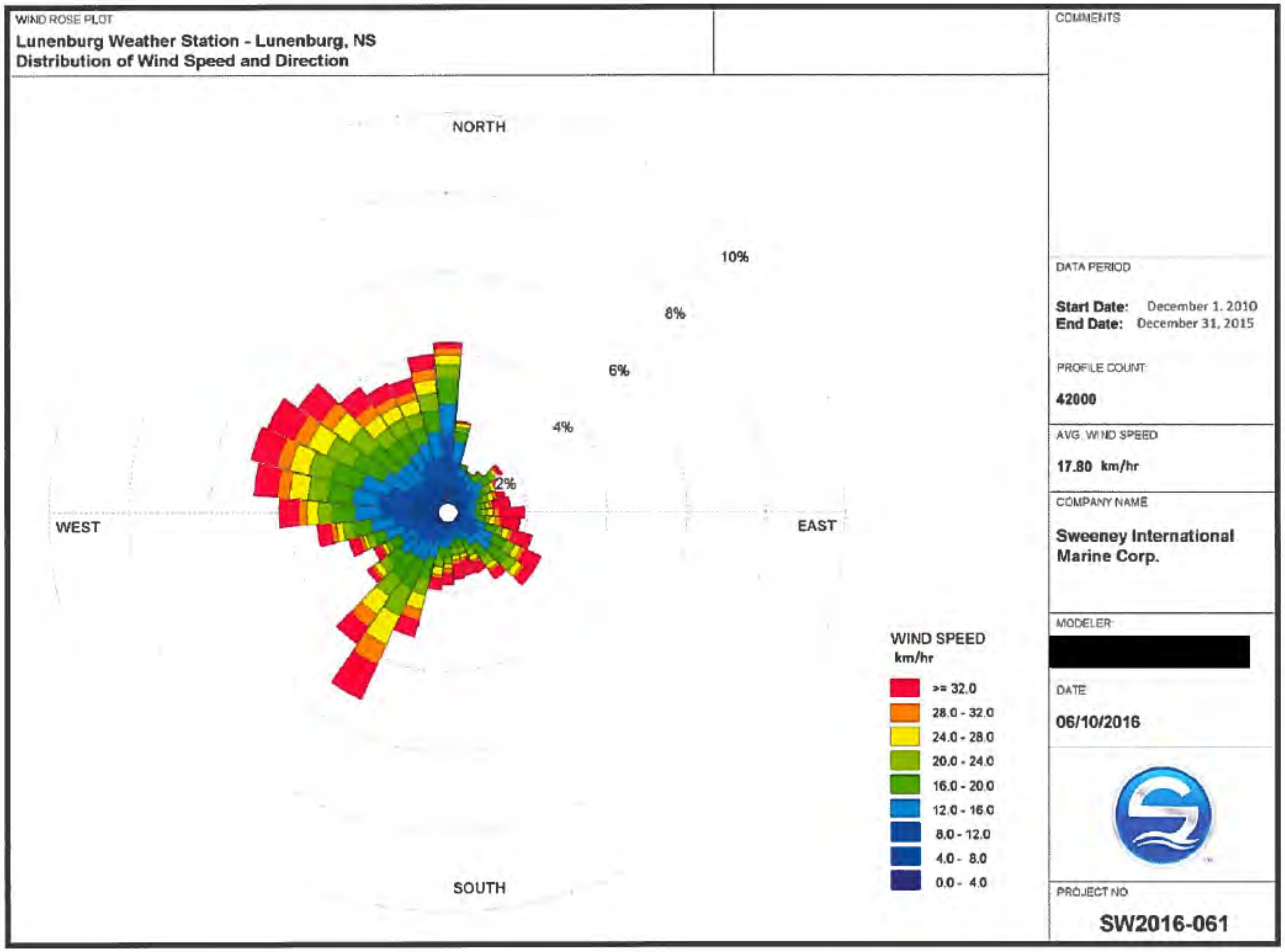
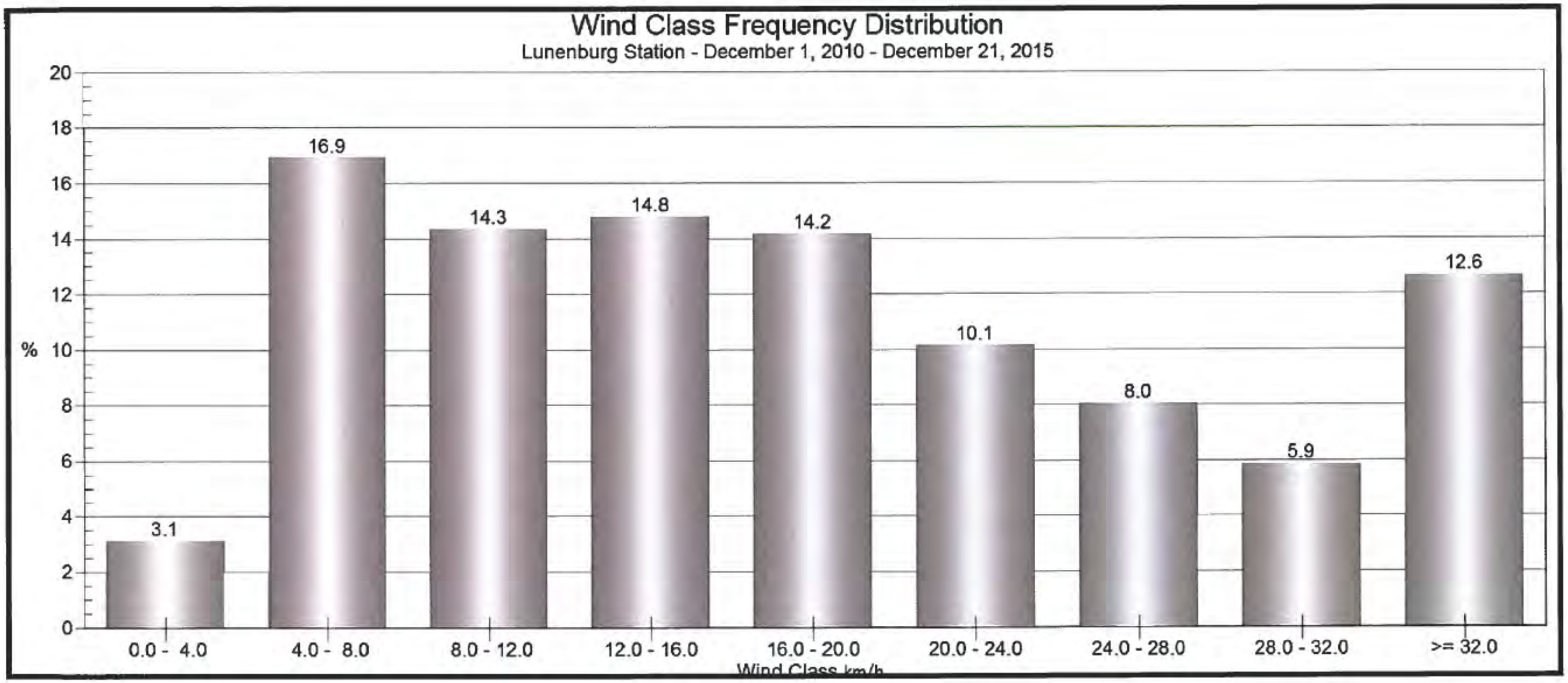


Figure 23. Frequency of Wind Speed Observed at the Lunenburg Weather Station between December 1, 2010 and December 31, 2015
Data sourced from Environment Canada (2016)



<u>Waves</u>

The following wave height data, including Figures 24 and 25, 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 7 m and greater are generally associated with winds speeds of 30 knots or more. Waves of less than 3 m in height were recorded 82.3% of the time while waves greater than 5 m were recorded only 2.1% of the time. Waves reaching the south shore of Nova Scotia most commonly come from the southwest (28.3%) and the west (25.9%). However, the aquaculture site in Aspotogan Harbour is relatively sheltered from these directions. The largest wave heights (i.e. > 5 m) generally come from the northeast, east, south, southwest, or west. Waves coming from the southeast very rarely exceed 4.5 m in height. Waves coming from the south almost never exceed 5.5 m. The greatest monthly average wave height for the Nova Scotian shore is 1.6 m, which occurs in the months of January, February, March, and December (Table 8). Annual wave height statistics for the Nova Scotian shore are presented in Figure 24 and summary graphs of average monthly wave heights are presented in Figure 25.

Wave height data was also obtained from the Northeastern Regional Association of Coastal and Ocean Observing Systems website (NERACOOS 2016) to determine maximum waves. Data presented in Table 8 were collected by the Northeast Channel, NERACOOS N01 buoy, which is located off the southwest coast of Nova Scotia (N42° 19' 35" W65° 54' 29").

Table 8. Wave Height Data from the Northeast Channel Buoy

Date of Maximum Wave of the Year	Wave Height (m)	Wave Period (s)	Sustained Wind Speed (knots)	Gusts (knots)	Wind Direction
February 9, 2016	9.73	16	36.9*	46.7*	NE*
February 3, 2015	9.88	16	32.6	42	NW
February 15, 2014	9.97	10.7	25.3*	33*	W*
March 8, 2013	10.0	16.0	38.3	48.5	NE
January 14, 2012	9.4	10.7	30.7	39.7	WSW
October 30, 2011	8.5	10.7	36.4	43.6	NW
November 5, 2010	10.0	16.0	21.7	27.3	SSE
August 23, 2009	11.9	16	25.0	38.2	NW
March 21, 2008	10.7	10.7	N/A	N/A	NW
November 4, 2007	13.0	16	38.6	51.5	WSW
October 29, 2006	9.9	16	30.1	36.8	WSW
December 20, 2005	10.0	10.7	N/A	N/A	N/A

*Note: data for the Northeast Channel buoy was incomplete on the dates specified. For these dates, sustained wind speed, gusts, and wind direction data were taken from the La Have Bank buoy, station 44150, located at N42.505° W64.018° (NERACOOS 2016).

Figure 24. Annual Wave Height Statistics for the Nova Scotian Shore
Note: sourced from MacLaren Plansearch Ltd. (1991)

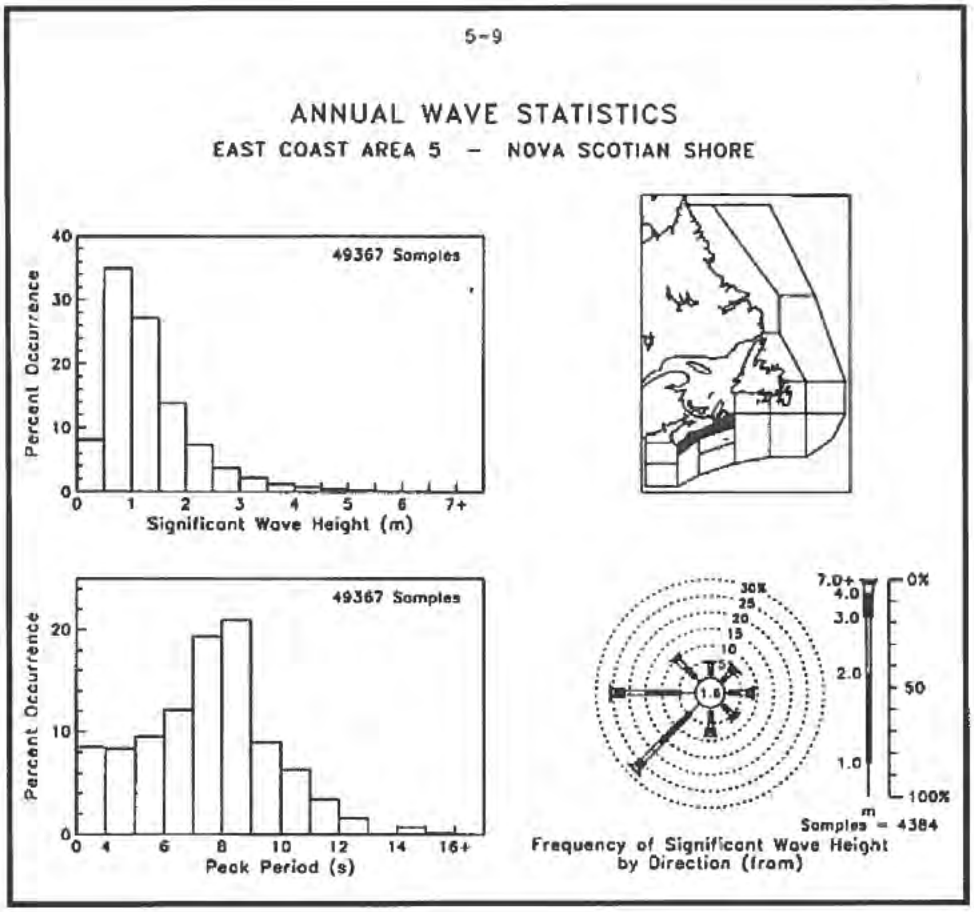
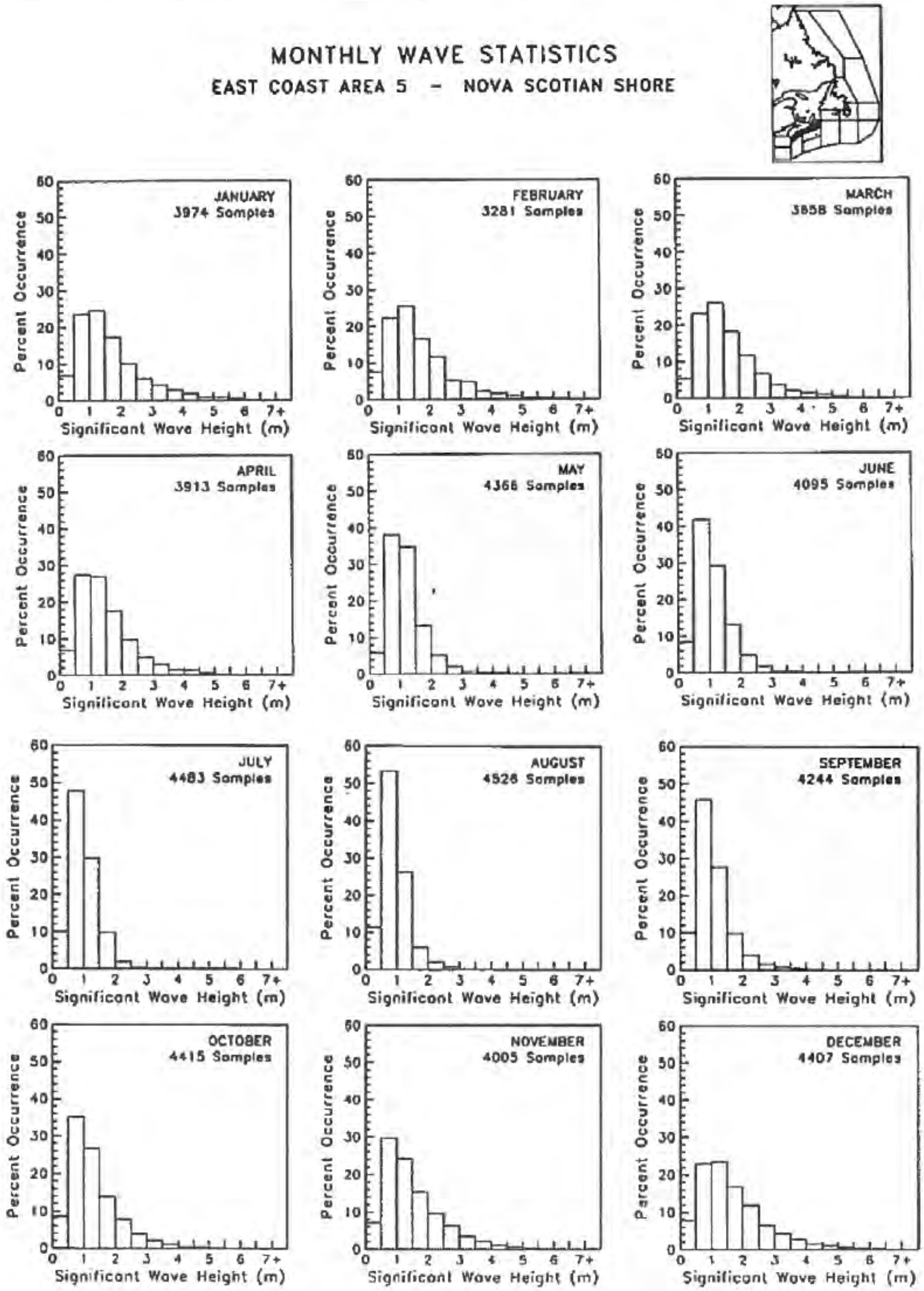


Figure 25. Average Monthly Wave Height Statistics for the Nova Scotian Shore
Note: sourced from MacLaren Plansearch Ltd. (1991)



Extreme Storm Events and Storm Surge

The south shore of 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 on the project caused by weather and climate extremes. KCS has a number of high energy sites in New Brunswick, Nova Scotia, and Newfoundland, which are exposed to strong winds and large waves. The grid and anchoring systems that will be used on the proposed boundary amendment in Aspotogan Basin will have the same technology that has been proven successful at these high energy sites. The plastic circular cages and grid components that are 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 that damage is sustained, repairs will be carried out as necessary. Any significant damage will be reported to NSDFA.

Temperature

Temperatures at the Saddle Island aquaculture site were recorded by KCS between the dates May 2013 and September 2016. The minimum water temperature experienced was approximately -0.6ºC, which occurred in February 2015. The maximum water temperature recorded was approximately 26.0ºC reported in September 2013; however, this outlier is thought to be a data recording error. The next highest temperature occurred in August 2015 with a recording of 21.7ºC. Figure 26 displays the water temperatures collected from the Saddle Island site.

Long term temperature data for the South Shore area (Hydrographic Database Subarea 14) were sourced from climatology data of DFO, Oceanography and Scientific Data, Atlantic Zone Monitoring Program (DFO 2007). Figures 27 and 28 display average, monthly, water-temperature data for the South Shore of NS. Mean water temperatures from this data range between 0.3 and 16.1ºC. The lowest temperatures of the year are normally experienced in February to March and the highest temperatures in August to October. The existing, successful aquaculture site in Aspotogan Harbour would indicate that the temperatures in the area of Aspotogan Harbour are tolerable for Atlantic salmon. However, on occasion the temperatures approach superchill conditions.

Figure 26. Daily Water Temperature Data from the Saddle Island Aquaculture Site #1006

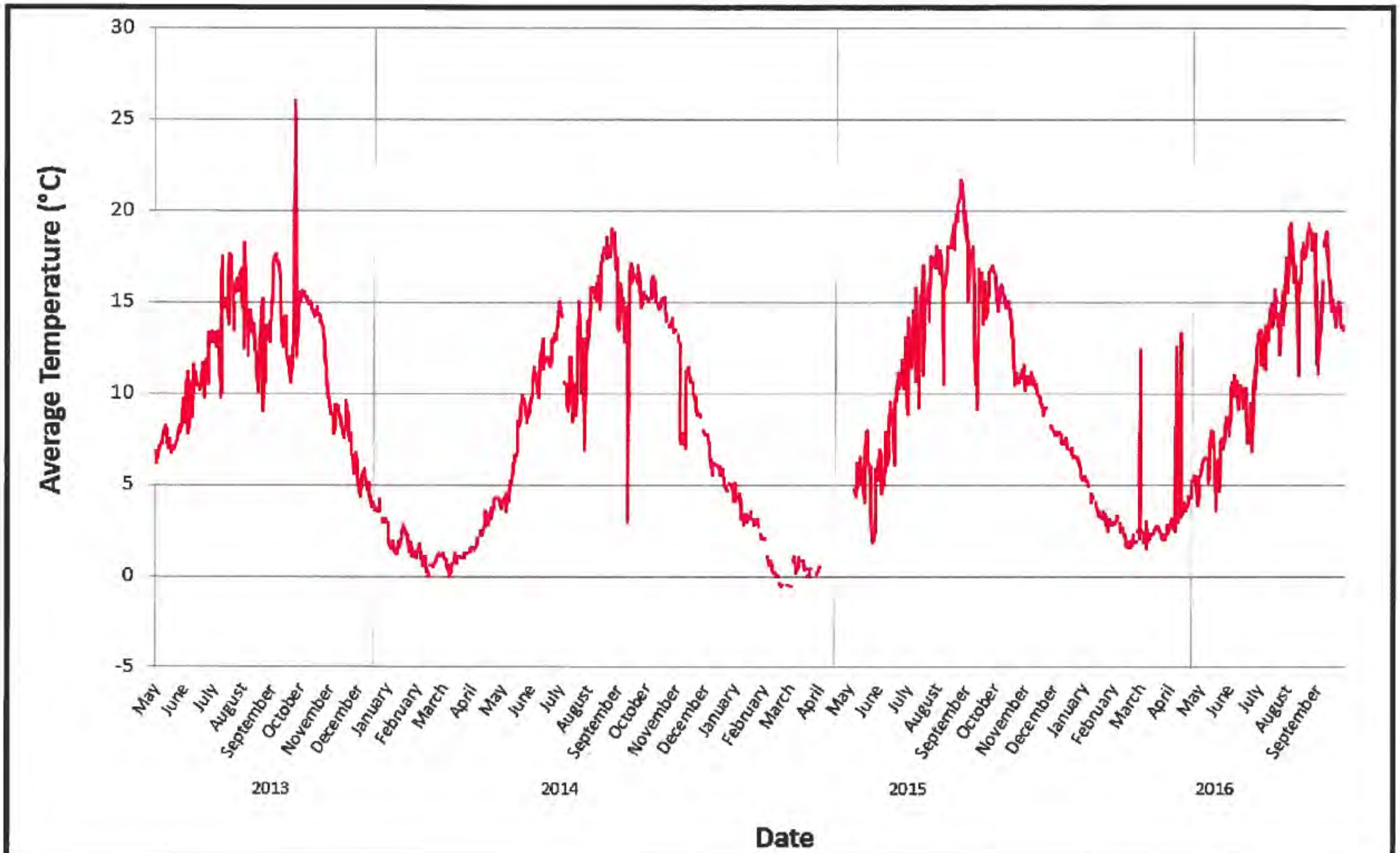


Figure 27. Average Monthly Temperature Data of OES Subarea 14 (South Shore) at 0 to 100 m Deep
Note: Data was obtained from the Oceans and Ecosystem Science website (DFO 2007).

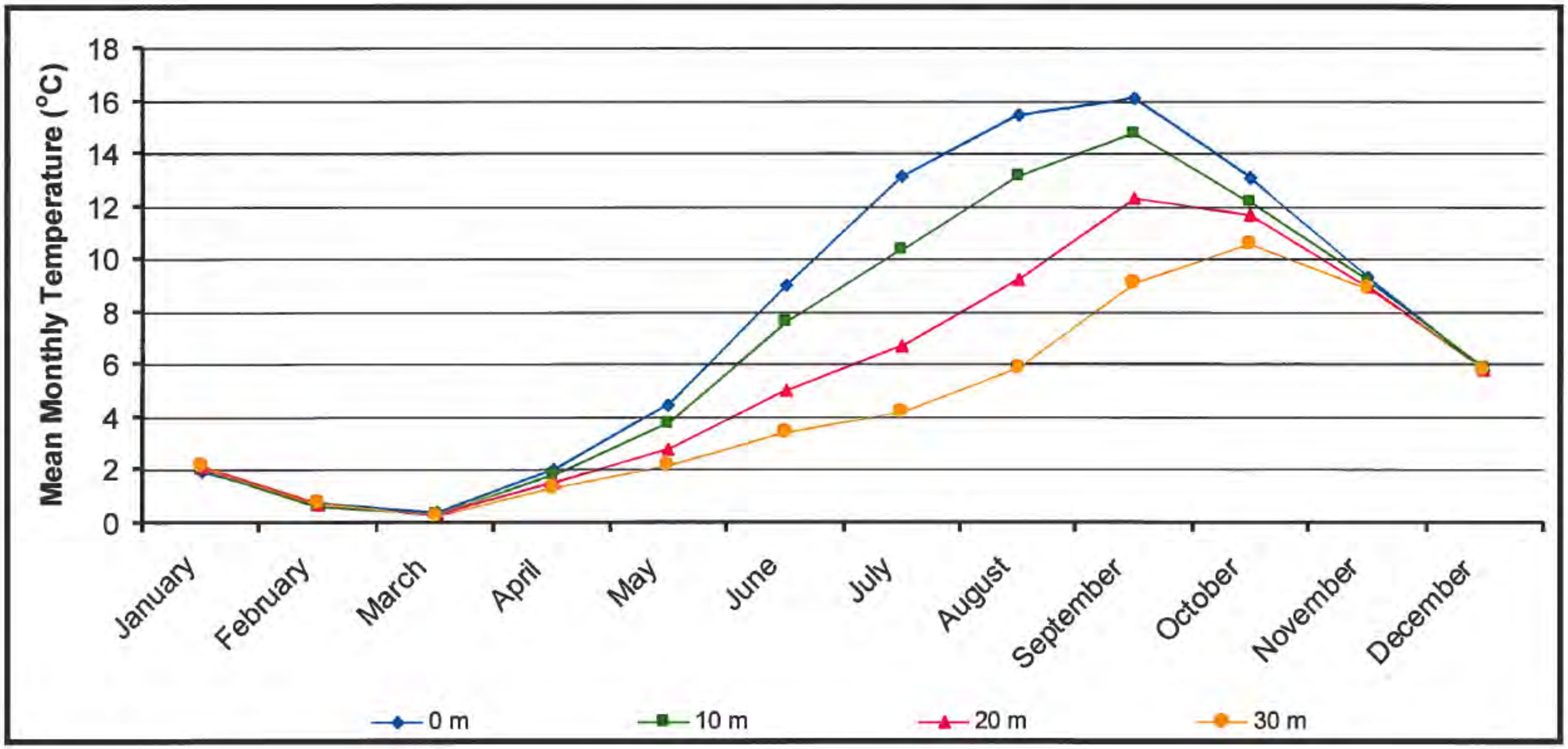
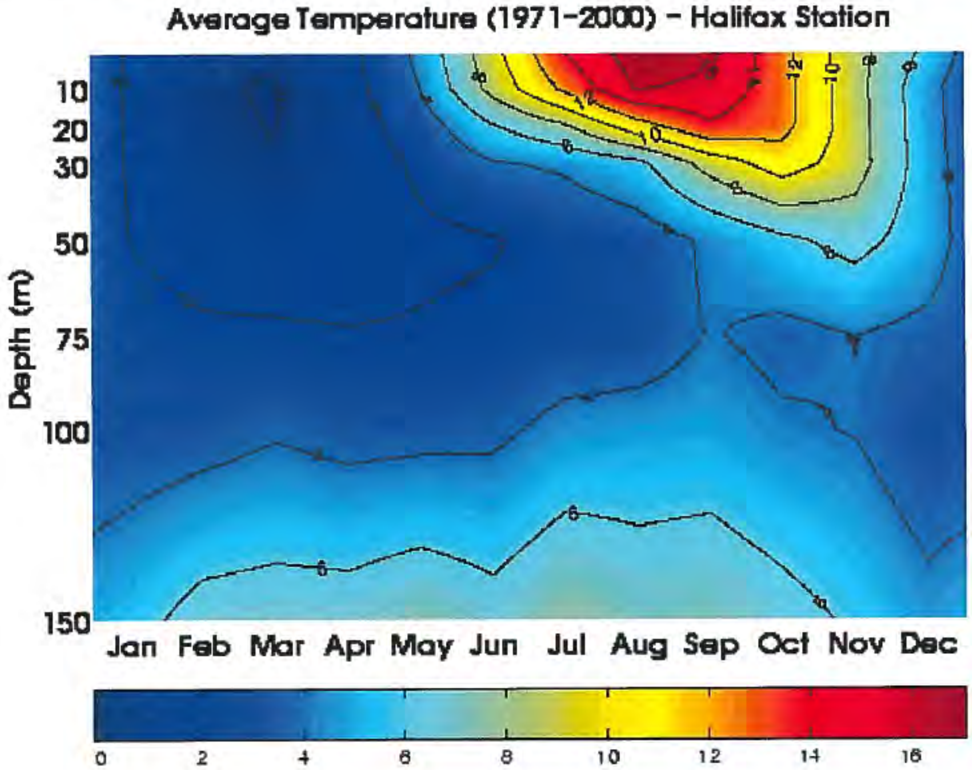


Figure 28. Contour Plot of Average Monthly Temperatures from Station 2 of DFO's Atlantic Zone Monitoring Program
Note: Graph was obtained from Fisheries and Oceans Canada (2016b).



Superchill

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. -0.75ºC). 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

Sea ice is typically not a problem in southern Nova Scotia. The thirty-year frequency of presence of sea ice for the South Shore is 1 – 15% (Fig. 29), and the median of predominant ice type is new ice (Fig. 30). Both Figure 29 and 30 illustrate the thirty-year averages for the week of January 29, the week that appears to have the most sea ice coverage on the South Shore.

KCS has no intentions of deploying equipment such as ice booms near the proposed 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 29. Frequency of presence of sea ice in Atlantic Canada
Note: Figure sourced from Environment Canada, Canadian Ice Service (2010)

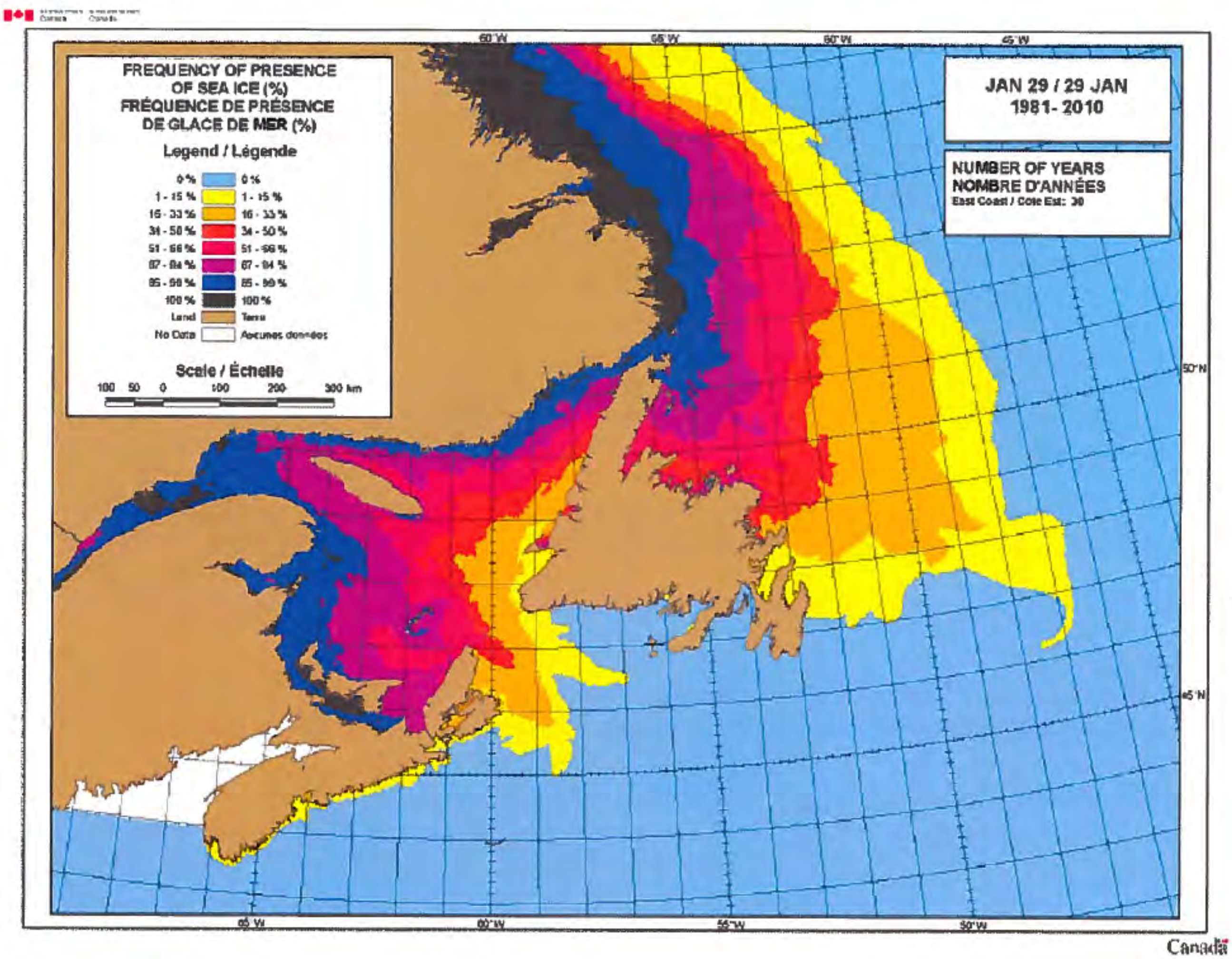
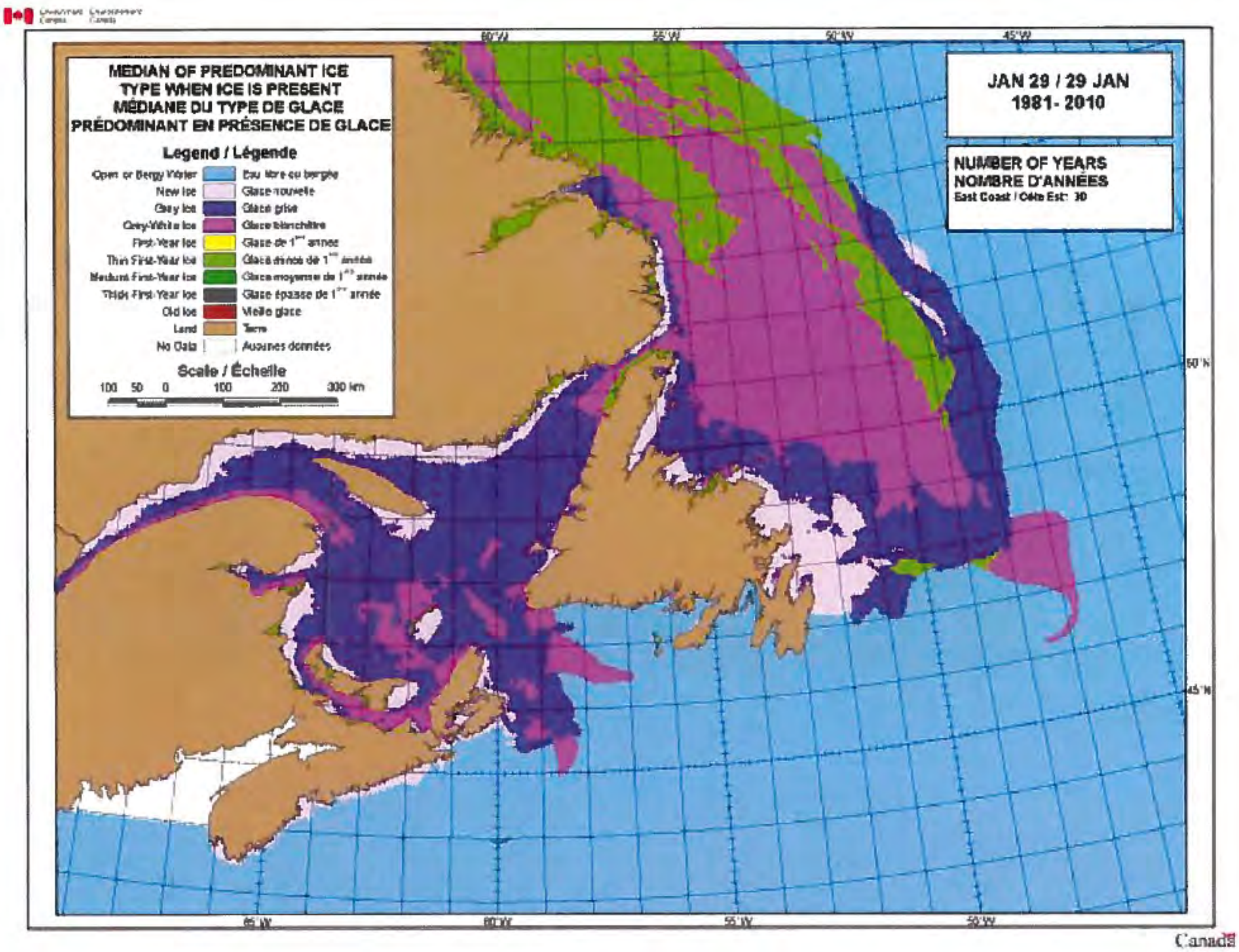


Figure 30. Median of Predominant Ice Type in Atlantic Canada
Note: Figure sourced from Environment Canada, Canadian Ice Service (2010)



Salinity

According to the monthly, average, salinity data gathered from the DFO OSD Atlantic Zone Monitoring Program (DFO 2007) for Subarea 14, South Shore, salinity ranges between 30.7 and 31.9‰, on average, and is generally lowest in September to November and highest in February to April (Fig 31). The existing, successful aquaculture site at Saddle Island indicates that the salinities in the area are tolerable for Atlantic salmon. Monthly average salinity data from Subarea 14 (Fisheries and Oceans Canada 2016b) is shown in Figure 32.

Figure 31. Contour Plot of Average Monthly Salinity of OES Subarea 14 (South Shore)
Note: Graph was obtained from the Oceans and Ecosystem Science website (Fisheries and Oceans Canada 2016b).

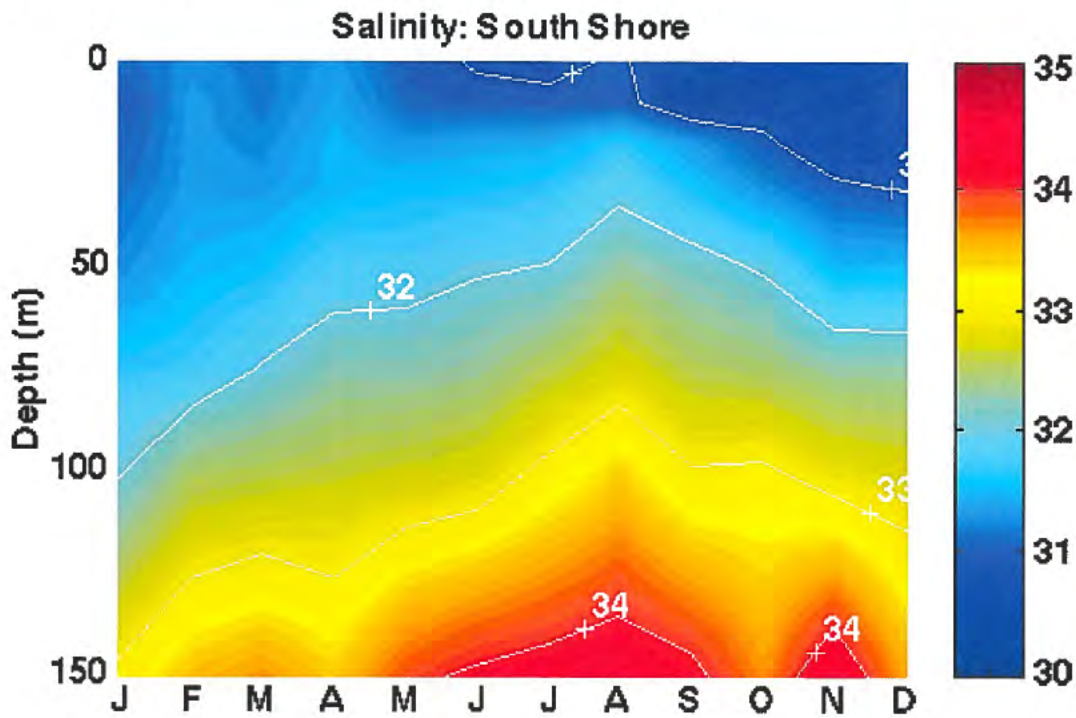
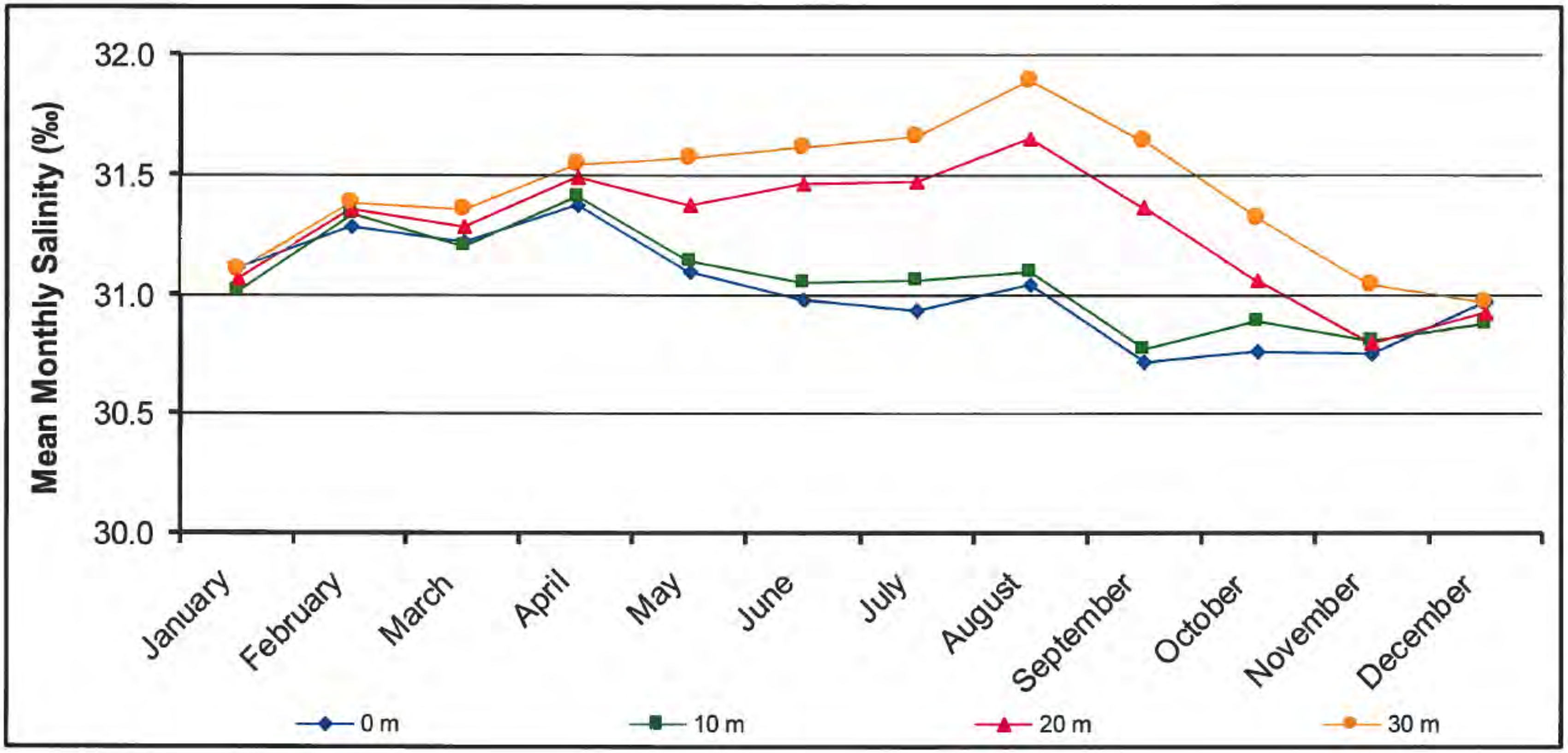


Figure 32. Average Monthly Salinity of OES Subarea 14 (South Shore) at Various Depths
Note: Data was obtained from the Oceans and Ecosystem Science website (DFO 2007).



Tides

Based on Canadian Hydrographic Service (CHS) tide tables for Lunenburg (Station #455), the tidal range is normally between 1 and 2.5 m (Fisheries and Oceans Canada 2016c). The greatest tidal range for 2016 is 2.2 m; however, storm surges, should they co-occur with the highest high water, could result in higher water levels.

Currents

Collection of local current speed and direction throughout the water column was carried out for a period of forty one (41) days from October 7 to November 17, 2015 using a 614-kHz Teledyne RDI Workhorse Sentinel Acoustic Doppler Current Profiler (ADCP) deployed by the Nova Scotia Department of Fisheries and Aquaculture. The unit was deployed in approximately 16 m of water, 195 m west of the present Saddle Island boundaries (N44° 30.181' W64° 03.160').

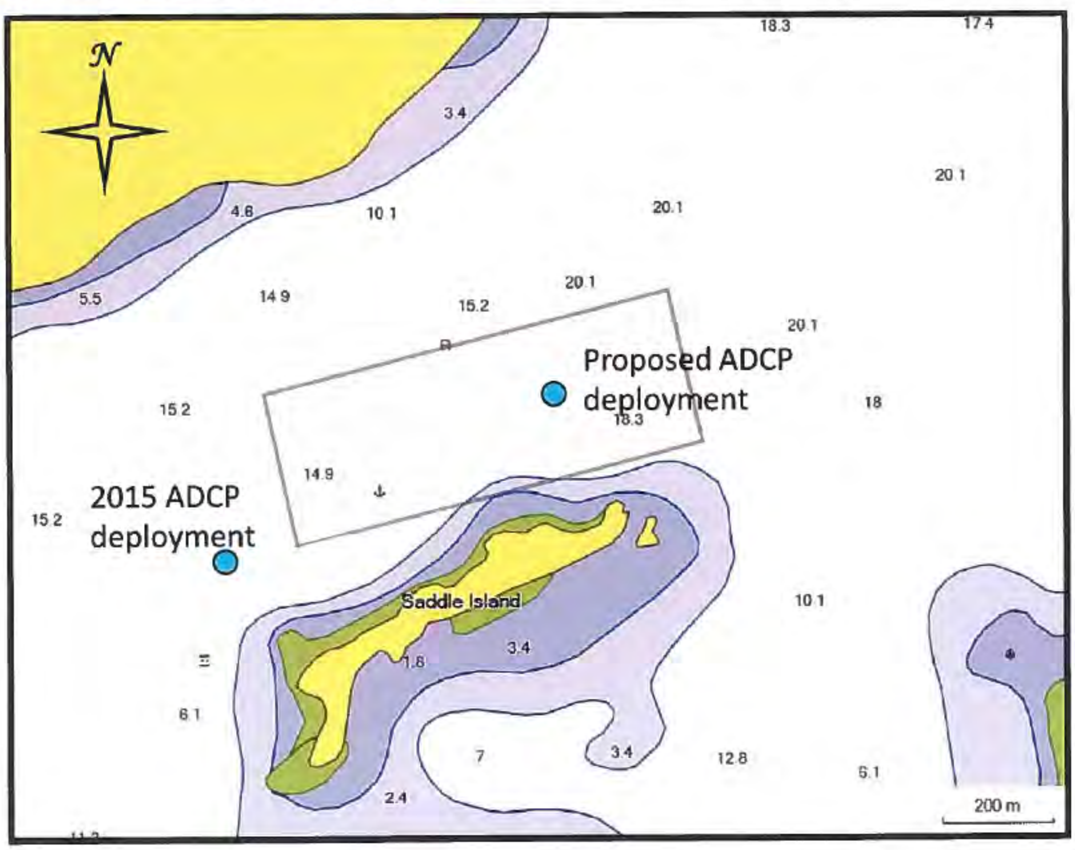
The majority of water currents measured at this site flowed roughly to the west-southwest and southwest, with approximately 32.6% of the depth-averaged currents travelling in these directions. The depth-averaged current speed, which is the average speed of all measured currents, was 4.72 cm/s with the greatest recorded speed of 78.0 cm/s occurring 16 m from bottom (Table 9). The most frequently observed speeds were between 1.5 and 3.0 cm/s (24.6%). While the water flows most frequently towards the west-southwest and the southwest, a reciprocal flow between the west-southwest and east-northeast was recorded in the two cells closest to the seafloor. In the cell closest to the surface, current directions toward the north-northeast are more common and show a reciprocal flow to the west-southwest. Surface currents are influenced by wind conditions. Overall the average current velocities increased steadily with increased distance from the seafloor. Graphs illustrating the current directions and current speed frequency distributions are located in Appendix A.

An additional current meter was deployed on October 7, 2016 by the Department of Nova Scotia Fisheries and Aquaculture. The approximate coordinates are N44° 30.338 W64°02.765 which is north northeast of the current site which will more closely reflect the currents in the area of the proposed boundaries (Fig. 33). Reporting of results will occur early December after the unit has been retrieved and data processed.

Table 9. Current Data Summary Statistics for Saddle Island

Saddle Island Approx. Distrance from Seafloor	Current Speed Statistics						
	Mean	Min	Max	Mode	< 2 cm/s	< 5 cm/s	Directional Modes
(m)	(mm/s)	(mm/s)	(mm/s)	(mm/s)	(%)	(%)	Cardinal or Intercardinal
3	33.7	1	138	21	28.6	79.6	ENE & WSW
4	34.6	0	144	21	28.6	77.1	WSW & ENE
5	37.4	0	150	14	26.6	73.6	WSW & SW
6	39.6	0	162	16	23.9	70.7	WSW & W
7	41.1	0	162	25	22.0	68.2	WSW & W
8	42.8	0	165	25	21.0	65.9	WSW & W
9	43.8	0	191	26	19.8	65.0	WSW & SW
10	44.8	0	197	21	20.1	63.8	WSW & SW
11	45.7	1	206	22	19.0	64.0	WSW & SW
12	46.6	1	212	25	19.0	61.4	WSW & SW
13	48.3	1	226	25	18.8	59.8	WSW & SW
14	51.3	0	249	34	16.7	56.1	WSW & SW
15	54.7	0	296	21	15.1	51.8	WSW & SW
16	98.1	0	780	38	9.2	33.9	NNE & SW
Overall	**47.2**	**0**	**780**	**21**	**20.8**	**63.7**	**WSW & SW**

Figure 33. ADCP Deployment Locations at Saddle Island (#1006)



Bathymetry

Bathymetric profiling of the existing lease area was carried out on October 6, 2016 using a Hummingbird system Helix 5 SI-GPS to record X, Y, and Z coordinates throughout the lease. Scanning of the Saddle Island area began at the northwest corner of the proposed lease. Parallel transects were run the length of the lease area, separated by approximately 50 m. The data gathered during the scanning was then compiled and then used to produce both a three-dimensional, surface map and a two-dimensional, contour diagram of the site. The lease boundary is located over 9 m to 21 m depths. The shallowest depths are located along the southern edge of the site with a steep slope to the northeast (Fig. 34 – 35). The deepest water is located in the northeastern end of the site. 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.

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 were corrected for tidal influences, thus the soundings displayed represent the depths relative to chart datum.

Figure 34. Interpolated 2D bathymetric profiles of site #1006 at Saddle Island

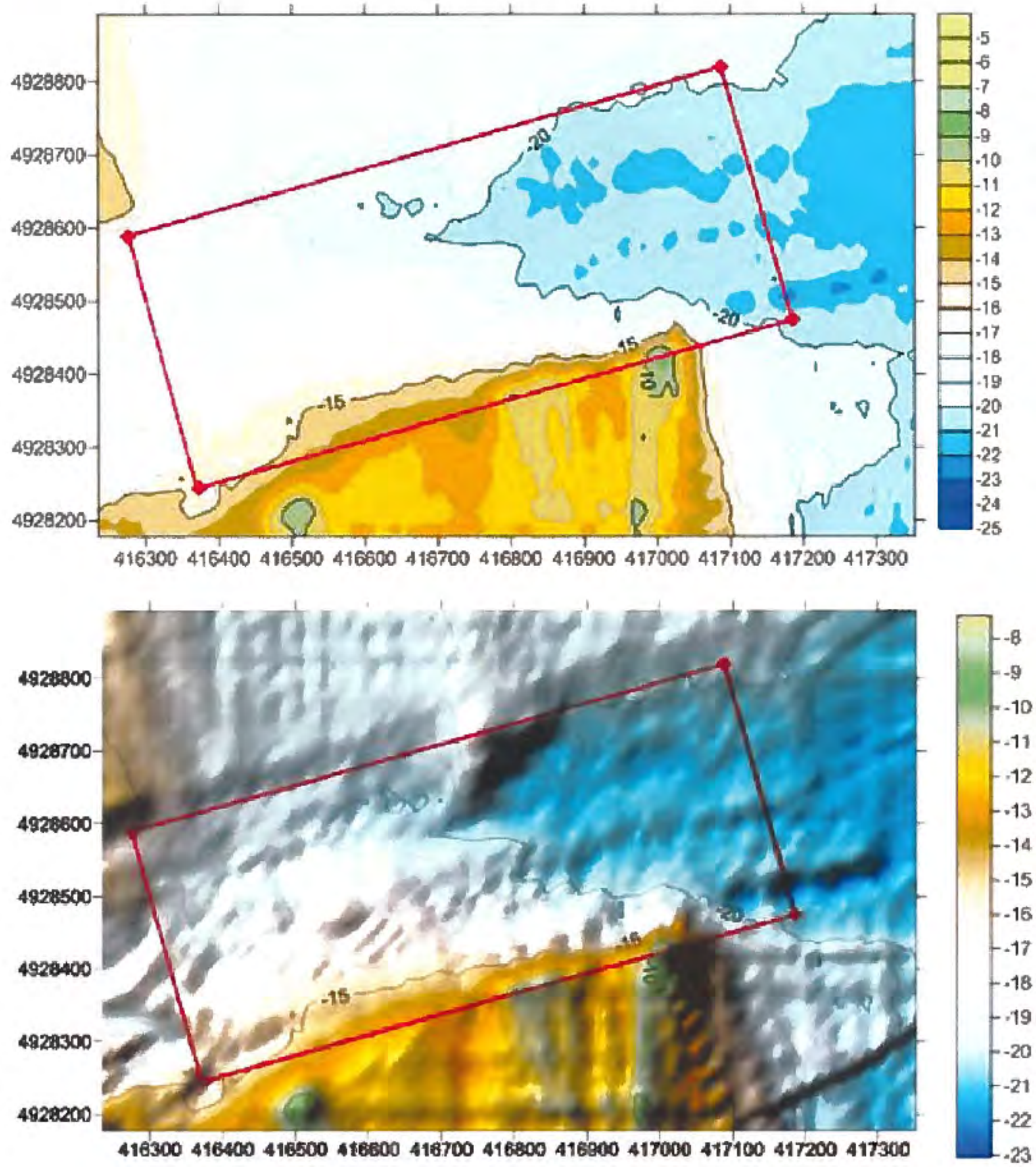
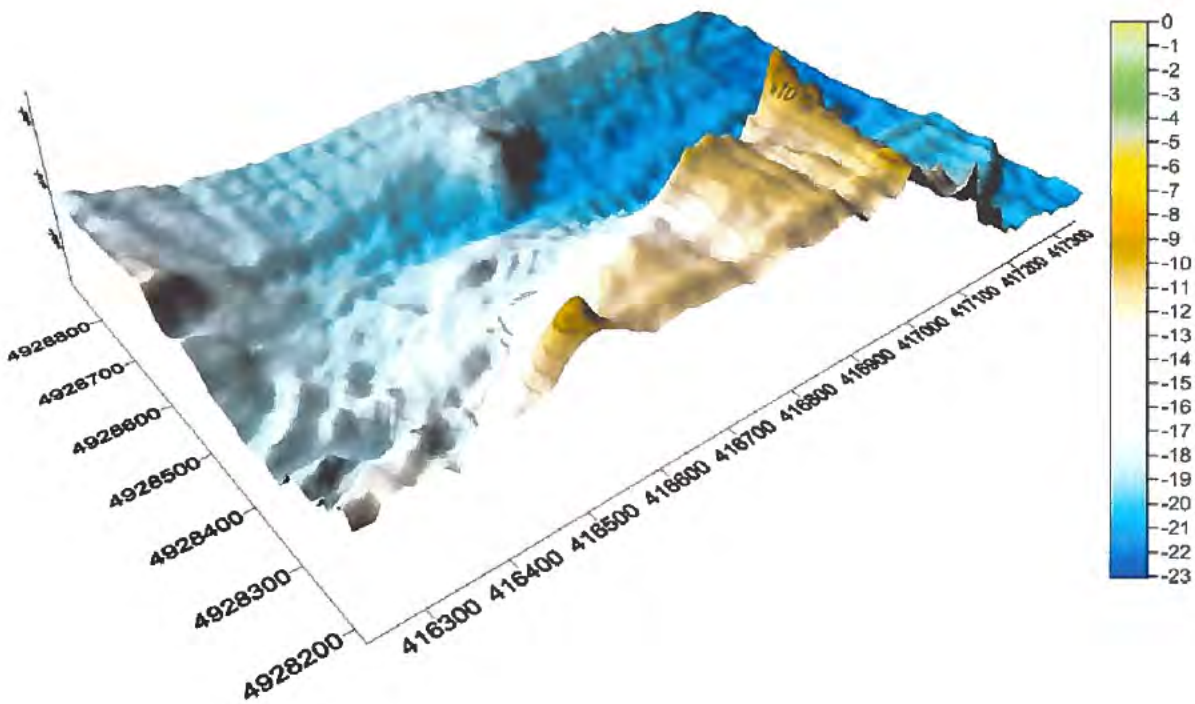


Figure 35. Interpolated 3D surface map of site #1006 at Saddle Island site

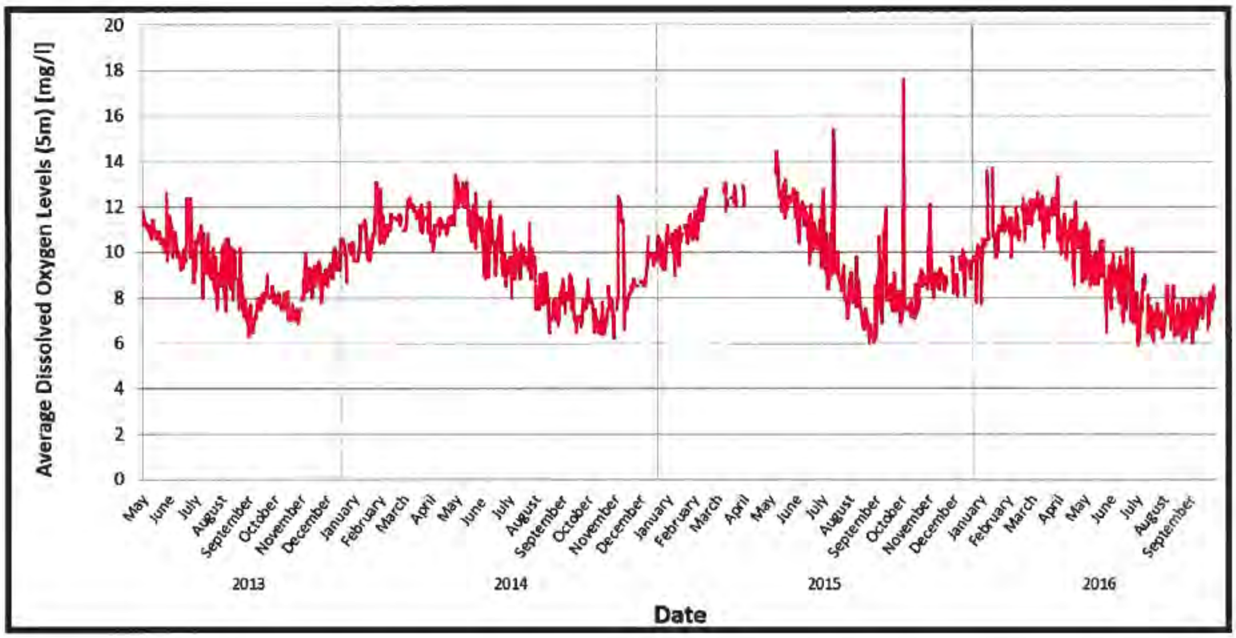


Chemical Oceanography

Oxygen

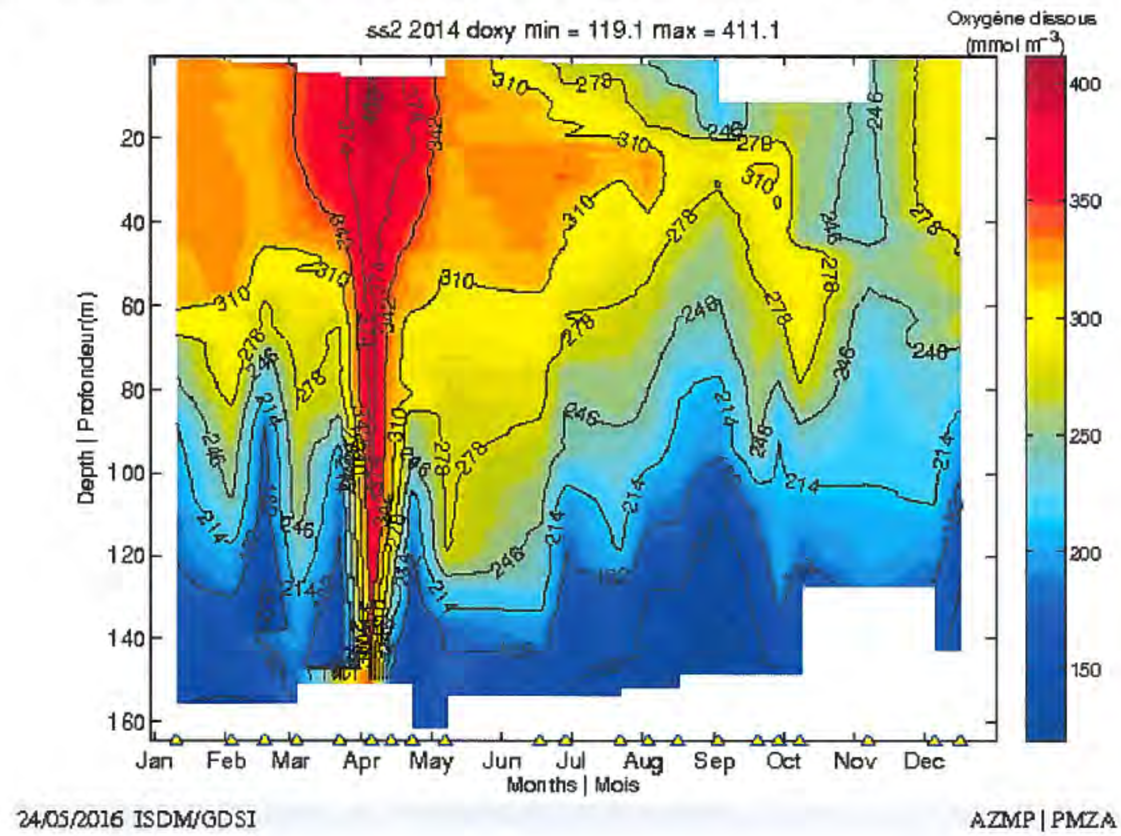
Dissolved oxygen (DO) data measured at the Saddle Island aquaculture site were collected and reported by KCS (KCS) staff during the site operations between May 2013 and September 2016 (Fig. 36). The minimum DO value recorded was 5.9 mg/L in July 2016. For adult Atlantic salmon, the lower limit of DO for optimal growth is generally accepted as 6 mg/L. The Saddle Island site typically displays DO values well above this threshold.

Figure 36. Dissolved Oxygen Levels as Measured at the Saddle Island Aquaculture Site



Long-term, monthly, average, dissolved-oxygen data presented in Figure 37 are from the Halifax Monitoring Station (Station 2) located at 44.27°N 63.23°W (Fisheries and Oceans 2016b). This was the closest monitoring station to the proposed location and was therefore chosen over alternate monitoring stations as a source of oceanographic data. While the Halifax monitoring station is farther offshore than the proposed boundary amendment of site #1006, it should provide a reasonable estimation of dissolved oxygen. From this averaged data, the lowest dissolved oxygen appeared in June - October, while the highest concentrations of dissolved oxygen were present in March - April.

Figure 37. Dissolved Oxygen Concentrations as Measured at the Halifax Monitoring Station 2
Note: Graph was obtained from the Fisheries and Oceans Canada (2016b)



Biological Oceanography

Harmful Algal Blooms

The occurrence of a harmful algal bloom (HAB) is sometimes unpredictable, but the effects on fish farms may be successfully avoided or managed by a variety of means. The Harmful Algae Monitoring Program (HAMP) was established in 1999 in order to cope with the effects of harmful algae throughout the aquaculture industry (Fisheries and Oceans Canada 2013b). Microscopic surveillance of water samples on finfish farms has offered a series of data, aiding in the prediction of algal blooms in the vicinity of the aquaculture cages (Fisheries and Oceans Canada 2013b). Research continues to be conducted on the algal blooms in order to better understand and predict HABs (Fisheries and Oceans Canada 2013b). This research serves to identify the species of algae, cultivate it within a lab environment, and document the trends of the blooms (Fisheries and Oceans Canada 2013b).

There are five general strategies that can intervene with HABs; mechanical, biological, chemical, genetic, and environmental control (NCBI 2009). Mechanical control involves the removal of HAB species by dispersing clay over the water surface (NCBI 2009). The clay and algae aggregate and settle to the seafloor (NCBI 2009). Biological control consists of using various pathogens or species of fauna to destroy or filter the harmful algae out of the surrounding water (NCBI 2009). Although biological control is considered, there are many logistical issues with the release of another species into a foreign area, and it is rarely used (NCBI 2009). Chemical control involves the use of chemicals or minerals toxic to the HAB (NCBI 2009). Although the use of copper sulphate has been used in the past, chemical interventions are generally dismissed as it would require extensive research to identify a chemical or mineral that would actively keep algae out of the finfish cages while not causing a widespread effect on the environment and all other organisms in the area (NCBI 2009). Genetic control involves the genetic engineering of exotic or newly introduced species in order to adjust the environmental tolerances, reproduction rates, or other aspects of a pest within the area of the aquaculture sites (NCBI 2009). Issues with this form of control are similar to those of the biological control, in that the negative impacts of the integrated species may worsen the condition of the aquaculture site (NCBI 2009). For these reasons, the use of genetic control is not likely to gain approval (NCBI 2009). The environmental manipulation of the area in which HAB occurs, involves the modification of either the physical or chemical aspects of the environment (NCBI 2009). This may include the alteration of nutrient levels in the water with the use of pollution control or the alteration of the physical properties in the area such as water circulation (NCBI 2009).

It may be possible to detect the beginning of a HAB event by monitoring fish behaviour. In some cases, fish will reduce or stop feeding, be less energetic, orient themselves peculiarly in the water column (such as swimming near the cage bottom), or exhibit odd swimming behaviour and lack of equilibrium (Rensel and Whyte 2003). Cage site staff will report any odd behaviour of the salmon to KCS management.

Due to the relatively shallow water, mechanical and physical measures of bloom intervention are not feasible at the proposed location. KCS will instead monitor water samples on a regular basis during the months harmful algae may be present (typically mid-April until November). Should concentrations of harmful algal cells become a cause for concern, feeding activities would cease in order to allow the fish to rest and retreat to the depths of the cages away from surface-oriented blooms.

e. Other Users of the Public Waters

Geology

The area of Aspotogan Harbour is a compilation of a number of geological formations. The majority of Aspotogan Peninsula is comprised of plutonic or granitoid rock. The southwest tip of the peninsula is comprised of the Goldenville group which includes the formations: Green Harbour (dominated by grey metasandstone and minor green metasiltstone), Government Point (grey thin metasandstone, greyish-green metasiltstone, and black slate), and Moshers Island (laminated metasiltstone to slate with minor metasandstone beds) (White 2010).

Archaeology

In the past, impacts to paleontological resources were assessed by the Nova Scotia Museum. The 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 Saddle Island, are considered to cause minimal damage to any submerged archaeological resource as the anchors are the only portion of the site in contact with the seafloor.

Shipwrecks

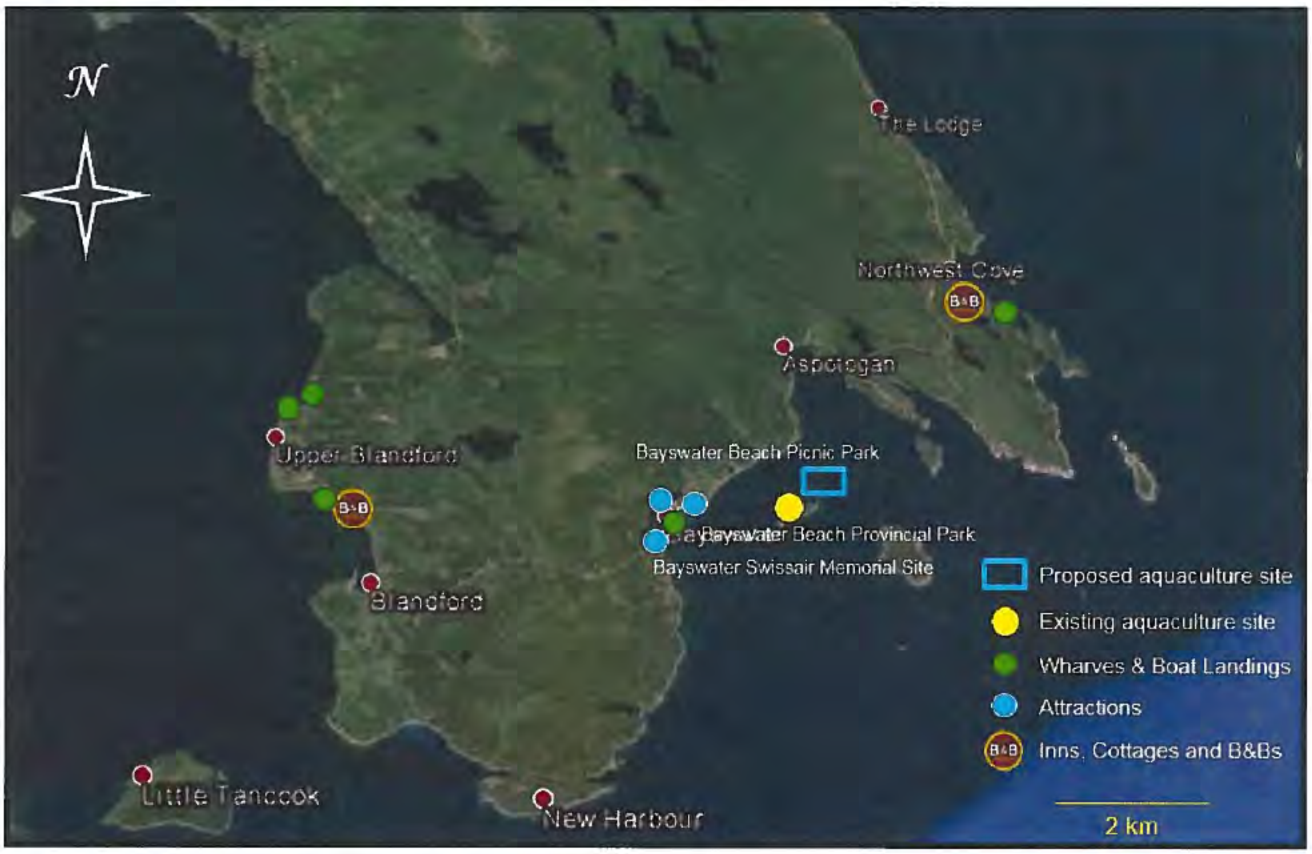
Several shipwrecks may be in the area of the proposed site (Maritime Museum of the Atlantic 2016); however, detailed locations or coordinates are not available. Estimates of some of the wreck locations are shown on Figure 2. A number of shipwrecks have been reported in Mahone Bay and St. Margaret's Bay. These include, but are not limited to, the *Elcy Elvy*, the *Ella D.*, the *Flo F. Mader*, the *Sweat*, the *Tickles*, the *Young Teazer*, the *Atlantic Roamer*, the *Edgewood*, the *Henry*, the *Sailor's Fancy*, and the *Speedwell*.

The *Elcy Elvy* was stranded on Gimlet Reef, Mahone Bay on September 15, 1886 due to stress of weather; this resulted in a total loss. The *Ella D.* burnt in a fire on January 1, 1920 in Chester Basin resulting in a loss. On January 10, 1923 the *Flo F. Mader* was stranded and lost in Mahone Bay Harbour. An American privateer schooner named the *Sweat* had been raiding the South Shore in 1779 until it was deliberately lured onto a ledge by a Liverpool schooner on December 10, 1779 where it was grounded. The ledge, now known as Sweat Ledges, is located near Heckman's Island. The *Young Teazer* had also been involved in several raids before being cornered in Mahone Bay. A crew member subsequently blew the schooner up and she sank in the waters between Mason and Rafuse Islands. The wreckage from this vessel was salvaged and built into a store in Mahone Bay. A fishing vessel named *Tickles* was grounded in Mahone Bay due to an unknown cause on July 17, 1973. The *Atlantic Roamer* was wrecked in St. Margaret's Bay on September 5, 1972 due to a fire in the engine room. On March 26, 1921 the *Edgewood* schooner was stranded in St. Margaret's Bay due to an unknown cause. A brigantine named *Henry* was stranded in the fog on May 15, 1885 at Betty Island Point resulting in a partial loss. The *Sailor's Fancy* was stranded in Shut-In Island when the steering gear broke on October 10, 1891. Cargo accounted for $300 of this total loss.

Recreation and Tourism

The area along the Aspotogan Harbour is reported to have minimal tourist activities. It is limited to the Bayswater Beach Provincial Park with an accompanying picnic area (~1 km from the Saddle Island marine farm) and several wharf and boat launch locations. The Bayswater Swissair Memorial site is located near the provincial park (~2 km from the Saddle Island farm) and was erected in remembrance of the 1998 airplane crash that occurred near the neck of the St. Margaret's Bay and the passengers who lost their lives there. Overall, the Aspotogan Peninsula is characterised as a scenic route for individuals travelling the Lighthouse Route in order to buy from the local fish markets or just take in the sights of the coastline and its small sheltered communities. A number of Bed and Breakfasts are found along the peninsula such as the Century House Bed & Breakfast, near Upper Blandford (~5 km from Saddle Island farm) and Smithhaven Bed & Breakfast, near Northwest Cove (~3.5 km from Saddle Island farm). A short distance off the coast in between Northwest Cove and Southwest Cove is Horse Island (~4 km from Saddle Island farm), an island with pending nature reserve status in St. Margaret's Bay. Even though the area of interest is not overly orientated towards tourism, the harbour is found in between St. Margaret's Bay and Mahone Bay, both locations notable for communities that support a variety of small fishing and tourist-related activities. St. Margaret's Bay and Mahone Bay are outside of the range of interest that would pertain to the present project and are not included in this section. Figure 38 illustrates a number of tourist and recreational attractions in the area of the Saddle Island aquaculture site.

Figure 38. Tourism and Recreation



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, the 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 2016d).

The nearest MPAs to the proposed aquaculture site include the Gully, located 200 km off of 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 the erosional features of glacial ice over thousands of years. Surrounding the Sable Gully is an important and highly functional area, in which a number of 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.

Significance of Proposed Area to SARA

There are a number of species found in New 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 10 - 13 list those species, their status, and their occurrence in the study area.

Table 10. 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 -Protected under the *Species at Risk Act* (Schedule 1) and the *NS Endangered Species Act* -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)
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*
Boreal felt lichen	*Erioderma pedicellatum*	-Last COSEWIC designation (Nov 2014): endangered -Protected under the federal *Species at Risk Act* (Schedule 1) -in Nova Scotia there are 13 individuals at three sites - all in Halifax County.
Eskimo curlew	*Numenius borealis*	-Last COSEWIC status (Nov 2009): endangered -May be extinct -Occasionally staged in the Maritimes; diet included coastal shrimp-like invertebrates -Protected under the *Species at Risk Act* (Schedule 1) and the *Migratory Birds Convention Act*

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 2016a)
Little brown myotis	*Myotis lucifugus*	-Last COSEWIC designation (Nov 2013): endangered -Protected under the federal *Species at Risk Act* (Schedule 1) -Largest threat to the bat is white-nose syndrome, a fungal infection
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
Northern myotis	*Myotis septentrionalis*	-Last COSEWIC designation: (Nov 2013): endangered -Protected under the federal *Species at Risk Act* (Schedule 1) -Largest threat to the bat is white-nose syndrome, a fungal infection
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
Roseate tern	*Sterna dougallii*	-Last COSEWIC designation (Apr 2009): endangered -2 largest colonies are at The Brothers and Country Islands -Protected under the federal *Species at Risk Act* (Schedule 1), the federal *Migratory Birds Convention Act* and the *Nova Scotia Endangered Species Act* -Confirmed sightings in the area approximately 9.0 km southwest of the site on Grassy Island, Mahone Bay and 13.0 km northeast of the site on Wedge Island, St. Margaret's Bay. Both islands serve as nesting grounds (BSC 2014)
Tri-coloured bat	*Perimyotis subflavus*	-Last COSEWIC designation (Nov 2013): endangered -One of the smallest bats in North America -Declines of more than 75% in Eastern Canada, and expected to continue to decline due to fungal infections (COSEWIC 2013a) -Largest threat to the bat is white-nose syndrome, a fungal infection -Protected under the federal *Species a Risk Act* (Schedule 1) and the *Nova Scotia Endangered Species Act*
Vole ears lichen	*Erioderma mollissimum*	-Last COSEWIC designation (Nov 2009): endangered -It inhabits cool, humid, and coastal conifer forests dominated by balsam fir (COSEWIC 2009b) -Protected under the federal *Species at Risk Act* (Schedule 1) and the *Nova Scotia Endangered Species Act*

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 11. 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 (2016)

COMMON NAME	SCIENTIFIC NAME	COMMENTS
Threatened Species		
Canada warbler	*Wilsonia canadensis*	-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), the *Migratory Birds Convention Act, 1994*, and the *Canada National Parks Act* -Possible sightings off of the Aspotogan peninsula (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* -No confirmed sightings in the 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* -No confirmed sighting near Aspotogan Harbour (BSC 2014)
Eastern whip-poor-will	*Caprimulgus vociferus*	-Last COSEWIC designation (Apr 2009): Threatened -Prefers to nest in semi-open forests or patchy forests with clearings, such as barrens or forests that are regenerating following major disturbances -Protected under the federal *Species at Risk Act* (Schedule 1) and the *Migratory Birds Convention Act, 1994* -No known sightings in the vicinity of the proposed project (BSC 2014)
Least bittern	*Ixobrychus exilis*	-Last COSEWIC designation (Apr 2009): threatened -Prefers large marshes with relatively stable water levels throughout the nesting period -Wintering habitat includes emergent marshes, like those used for breeding, and also brackish and saline swamps -Protected by the *Canada National Parks Act*, the federal *Species at Risk Act*, and the *Migratory Birds Convention Act, 1994* -No known sightings in the vicinity of the proposed project (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* -Possible sightings in the vicinity of the proposed project (BSC 2014)

Wood turtle	*Glyptemys insculpta*	-Last COSWIC designation (Nov 2007): Threatened -Associated with rivers and streams with sandy or gravely-sandy bottoms and prefers clear, meandering watercourses with a moderate current -Habitats used less frequently include bogs, marshy pastures, beaver ponds, shrubby cover, meadows, coniferous forests, mixed forests, hay and agricultural fields, and pastures -Protected under the federal *Species at Risk Act* (Schedule 1) and the *Nova Scotia Endangered Species Act* -Protected by the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (Appendix II) -Proximity to the proposed project is unknown

Table 12. 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 (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
Barrow's goldeneye	*Bucephala islandica*	-Last COSEWIC designation (May 2011): special concern -Protected under the *Species at Risk Act* (Schedule 1) and *Migratory Birds Convention Act* -While the Species at Risk Public Registry shows the entire coast of Nova Scotia as Barrow's goldeneye habitat, there have only been possible sightings in the vicinity of the site (BSC 2014)
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 the summer -Protected from certain activities under the Marine Mammal Regulations of the *Fisheries Act* -Protected by *Species at Risk Act* (Schedule 2)
Harlequin duck	*Histrionicus histrionicus*	-Last COSEWIC designation (May 2013): special concern -Inhabits rocky coastal marine areas the majority of the year, moving once a year into fast turbulent rivers -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 sightings in the vicinity of the site
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
Monarch butterfly	*Danaus plexippus*	-Last COSEWIC status (Apr 2010): special concern -Exist primarily wherever milkweed (*Asclepias*) and wildflowers (such as goldenrod, asters, and purple loosestrife) exist -Protected under the federal *Species at Risk Act* (Schedule 1) -Protected by the *Canada National Parks Act*
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 blackbirds winter, albeit sporadically, in the southern part of most Canadian provinces -Protected under the federal *Species at Risk Act* (Schedule 1) -No 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 -Probable sightings near the proposed site (BSC 2014)

Snapping turtle	*Chelydra serpentine*	-Last COSEWIC designation (Nov 2008): Special concern -The species is widespread from Nova Scotia to southeastern Saskatchewan -Observed in shallow water in almost every kind of freshwater habitat; preferred habitat of the species is characterised by slow-moving water with a soft mud bottom and dense aquatic vegetation -Protected under the *Species at Risk Act* (Schedule 1) and the *Canada National Parks Act* -Unlikely to be affected by the proposed project
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 13. 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 (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 water, 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 the 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 Little East River is listed as the closest wild salmon river (ASF 2016b)
Atlantic sturgeon (Maritime Populations)	*Acipenser oxyrinchus*	-Last COSEWIC designation (May 2011): threatened -Occur 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 -May be near the area (BSC 2014)
Barn swallow	*Hirundo rustica*	-Last COSEWIC designation (May 2011): threatened -Protected under the *Migratory Birds Convention Act, 1994* -Bird Studies Canada have confirmed sightings in Aspotogan Harbour (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 2009c)

Blue felt lichen	*Degelia plumbea*	-Last COSEWIC designation (Nov 2010): special concern -Occurs in coastal sub-oceanic areas (COSEWIC 2010a) -Threatened by activities changing relative humidity of forest, airborne pollutants, and poor forestry practices in which precautions have not been made (Nova Scotia Canada 2016)
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) has a possible occurrence of the bird in Aspotogan Harbour
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)
Moose (NS mainland population)	*Alces alces americana*	-Last COSEWIC designation: none -This species is protected under the *Nova Scotia Endangered Species Act* (Nova Scotia Canada 2016)
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 federal *Species at Risk Act* (Schedule 1) and 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 -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 has identified fishing and pelagic long-lining in particular, as being the most significant threat to the shortfin mako; there is no directed fishery for shortfin mako in Atlantic Canada, but it is caught as by-catch in other pelagic fisheries and 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 but is captured as by-catch in fisheries directed towards groundfish (Fisheries and Oceans Canada 2015e) -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 2015e) -Area of abundance along the Scotian Shelf has drastically declined since 1970 (Fisheries and Oceans Canada 2015e)
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 2015f)

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 to 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 2013b)
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 ground fish 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)
Wrinkled shingle lichen	*Pannaria lurida*	-Last COSEWIC designation (Apr 2016): threatened -Proximity to proposed project unknown
Yellow-banded bumble bee	*Bombus terricola*	-Last COSEWIC designation (May 2015): special concern -Has been collected over most of NS (COSEWIC 2015)

Critical Habitat and Mitigation Plans

Atlantic Whitefish

Critical habitat was not identified in the *Recovery Strategy for the Atlantic Whitefish (Coregonus huntsmani) in Canada* (Fisheries and Oceans Canada 2016e). Atlantic whitefish were known to historically occur in the Tusket and Petite Rivers, but they no longer appear to exist outside the Petite Rivière watershed (Fisheries and Oceans Canada 2016e). The Hebb, Milipsigate, and Minamkeak lakes are the only known areas where full, life-cycle closure is achieved. Species survival, and also recovery, is therefore completely dependent on the continued viability of this population whose only area of occupancy is a semi-natural lake habitat.

Critical habitat is described in the 2016 Department of Fisheries and Oceans Amended Recovery Strategy for the Atlantic Whitefish *(Coregonus huntsmani)* in Canada, in which the critical habitat is defined as the substrate within the three Petite Lakes along with any connections between them and the ocean. The total combined area consists of approximately 16 km^2, including the three dams and their structures of Hebb, Milipsigate, and Minamkeak Lakes (Fisheries and Oceans Canada 2016e). The Schedule of Studies provided within the *Species at Risk Act* Action Plan for the Atlantic Whitefish (Coregonus *huntsmani)* in Canada (Fisheries and Oceans Canada 2016e) states that research activities are required to better identify the critical habitats, including a better understanding of currents throughout the three lakes. Should more information be gained, the section regarding the alteration of critical habitat will be replaced within the Recovery Strategy (Fisheries and Oceans Canada 2016e). Under SARA, critical habitat must be legally protected within 180 days after it is identified in a recovery strategy or action plan.

Mitigation Plan for KCS: 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.

Leatherback Sea Turtle

While the state of knowledge on habitat requirements of leatherback turtles in Canadian waters is increasing, it is currently not possible to identify critical habitat for this species (Atlantic Leatherback Turtle Recovery Team 2006).

Mitigation Plan for KCS: 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 without loose, free-floating ends in order to prevent entanglements of marine animals.

North Atlantic Right Whales

North Atlantic right whales have occurred throughout history along the coastal waters of the Atlantic, ranging from lower latitudes throughout the fall and winter for breeding, and higher latitudes for feeding during the spring and summer months (NOAA 2016b). Throughout these migrations, areas of high use include Coastal Florida and Georgia, the Great South Channel, Massachusetts Bay, Cape Cod Bay, the Bay of Fundy, and the Scotian Shelf (NOAA 2016b). Much of these areas were listed as critical habitats for the North Atlantic right whale in 1994 before the critical habitats were updated and expanded in January 2016 (NOAA 2016b).

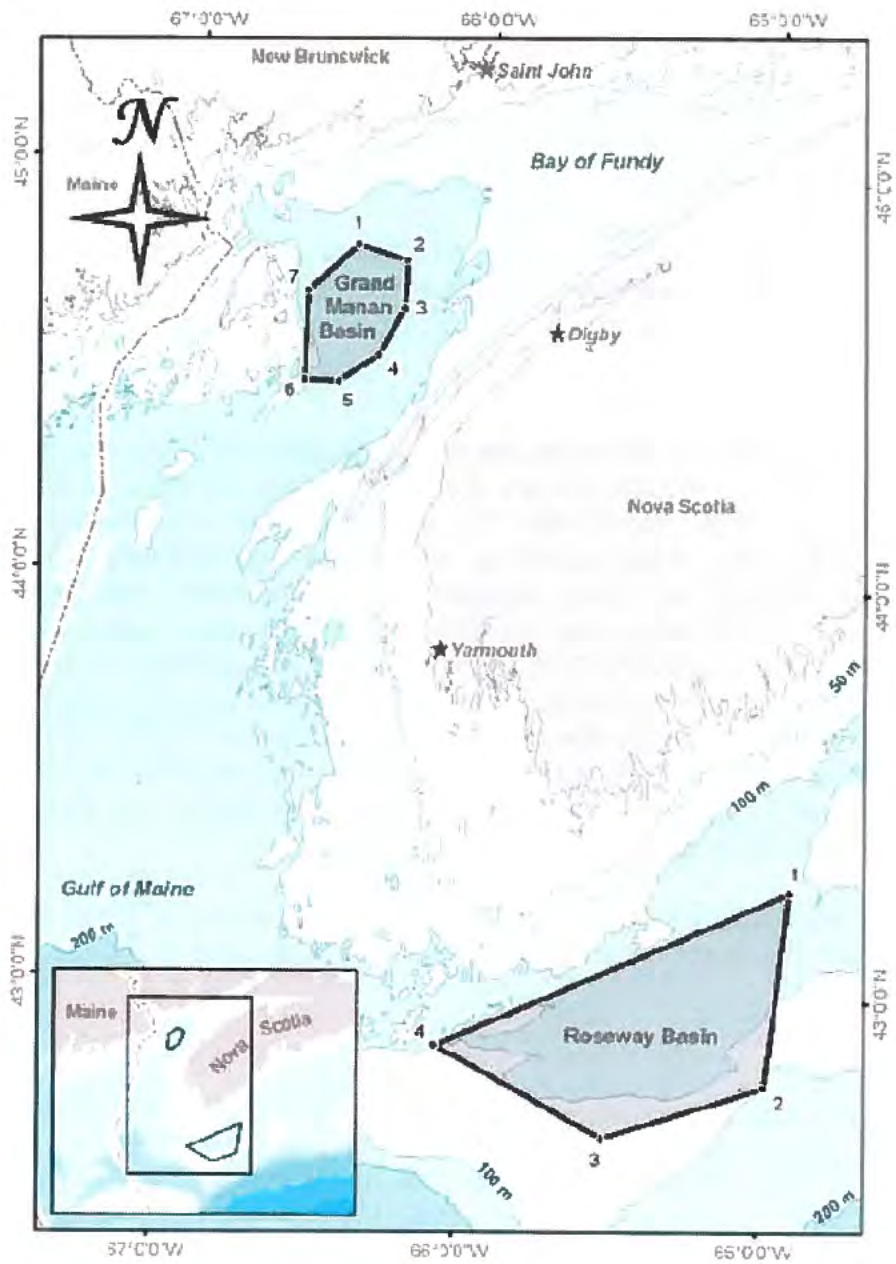
Grand Manan Basin, in the Bay of Fundy, has been identified as critical habitat for right whales (Fisheries and Oceans Canada 2014d). Right whales eat copepods and this area supports the highest concentrations of copepods in the Bay of Fundy (Michaud and Taggart 2011). Roseway Basin, on the southwestern Scotian Shelf, is another important area of right-whale aggregation wherein right whales have been observed feeding and socialising. This area has also been designated as a conservation area for right whales (Fig. 39). Neither of these areas identified as either critical habitat or conservation area for right whales is within 5 km of the proposed aquaculture site. The closest area, Roseway Basin, is greater than 100 km from the proposed aquaculture site.

Despite best efforts, vessel strikes are currently the leading cause of right whale deaths (Fisheries and Oceans Canada 2014e). In an effort to protect the North Atlantic right whales, Fisheries and Oceans Canada have dedicated two habitats as conservational areas for right whales (Fisheries and Oceans 2014e). The Roseway Basin and the lower Bay of Fundy area (Grand Manan Basin) are understood to be seasonally high-use habitats for right whales in Canada (Fisheries and Oceans Canada 2014e). Since 2002, the diversion of vessel traffic in the lower Fundy Bay area has been enforced (Fisheries and Oceans Canada 2014e). The other conservation habitat, Roseway Basin, has no known traffic measures through the area (Fisheries and Oceans Canada 2014e). In 2007, the IMO safety committee proposal was accepted by Transport Canada, and Roseway Basin has been declared an "Area to be Avoided"; all traffic is strongly encouraged to find an alternate route (Fisheries and Oceans Canada 2014e).

Mitigation Plan for KCS: Many 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 whales that are seen during aquaculture activities. Should a 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 given 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).

Figure 39. Boundaries of North Atlantic Right Whale SARA Conservation Areas
Note: Figure produced by Oceans and Coastal Management Division, DFO and copied from the Species at Risk Public Registry (Fisheries and Oceans Canada 2014e)



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 2012). 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 2013c).There is no known piping plover beach near the proposed aquaculture site.

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

Red Knot *rufa*

Breeding critical habitat for *rufa* cannot be identified at this time; however, the known stopover attributes of critical habitat required by *rufa* are muddy, sandy, or rocky coastal marine and estuarine habitats with large intertidal flats [e.g. mouths of bays and estuaries, lagoons, salt marshes, sand spits, islets, shoals, sandbars, rocky (limestone) tidal flats (either covered or not covered) with seaweed (e.g. *Fucus* species), and features often associated with natural inlets] and/or inland saline lake habitat (Environment and Climate Change Canada 2016a). Stopover critical habitat is located at Beaverhill Lake, AB; Quill, Last Mountain, Chaplain, Old Wives, and Reed Lakes, SK; the shore of Hudson Bay in and adjacent to Wapusk National Park, MB; sections of shore along Hudson Bay in ON; shorelines of James Bay in ON and QC; sections of the Parc marin du Saguenay–Saint-Laurent and adjacent shores, QC; the Mingan Archipelago National Park Reserve, QC; and the Magdalen Islands, QC (Environment and Climate Change Canada 2016a).

Mitigation Plan for KCS: None of the listed areas are within 5 km of the proposed project. However, KCS will limit beach clean-up activities to only take place during the fall and winter months.

Roseate Terns

The three islands of the Grassy Island complex within Mahone Bay and St. Margaret's Bay have supported nesting roseate terns at alternate time periods for the last 20 years. These islands have been designated an Important Bird Area (NS026; IBA Canada 2015). The three islands include: Grassy Island, a small islet located between Big Tancook and Flat Island at the mouth of Mahone Bay; Westhaver Island, on the west side of Mahone; and Wedge Island, the east side of St. Margaret's Bay. These islands appear to function as a complex of nesting sites with roseate terns shifting locations depending on local conditions (IBA Canada 2015). Predation by gulls on eggs and young, human disturbance at colonies, and coastal development all pose significant threats to this species (Nova Scotia Canada 2016). Grassy Island and Wedge Island are approximately 9.0 km southwest and 13.0 km northeast of the site, respectively.

Mitigation Plan for KCS: None of the identified areas are within 5 km of the proposed project. However, KCS will limit beach clean-up activities to only take place during the fall and winter months and will be scheduled so as not to interfere with the sensitive breeding, nesting, and fledging times (i.e. mid-April to mid-August).

Blue Whale

Fisheries and Oceans Canada have been conducting studies on marine animal health since 1990. Causes of whale death are investigated to assess any potential threats to whale populations in their habitat.

As of February 2016, the blue whale remains listed under the *Species at Risk Act* as an endangered species throughout the Atlantic Ocean (Fisheries and Oceans 2016f). New recovery, management, and actions plans have not yet been released by the Species at Risk Public Registry, however are expected in the near future (Fisheries and Oceans Canada 2016f). DFO is currently aiding in the recovery of the blue whale by enforcing the legislation. In doing so, DFO also reviews the environmental assessments of offshore petroleum industries to ensure that endangered species are considered (Government of Canada 2016). The *Fisheries Act*, *Species at Risk* Act, *Canadian Environmental Assessment Act*, and *National Energy Board Act* all consider the needs of the blue whale (Government of Canada 2016)

The Marine Animal Response Society (MARS) is working to develop and implement a cetacean sighting network in Nova Scotia and hopes to work with other groups in New Brunswick and Prince Edward Island to implement a Maritime-wide assistance network. The Grand Manan Whale and Seabird Research Station (GMWSRS) is developing a voluntary Code of Conduct for fishermen using fixed fishing gear near large whales in the Bay of Fundy. This will foster stewardship, provide information to prevent entanglement of whales and loss of fishing gear, and will promote education on endangered whales in the coastal communities of New Brunswick and Nova Scotia.

As of 2016, the recovery goal was to have a minimum of 1000 mature individuals within the North Atlantic (Government of Canada 2016). To do so, measures are being taken in order to monitor the population trends within the Atlantic, along with the reduction of noise and activities within the feeding areas, and to gain knowledge of threats to the blue whale's food resources. Also of concern are injuries and mortalities, activities that cause disturbance to the whales, contamination, and other impacts and their effects on populations (Government of Canada 2016).

Mitigation Plan for KCS: 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 given details of the sighting.

The Campobello Whale Rescue Team, located on Campobello Island, New Brunswick specialises in the disentanglement of whales and provides advice through telephone conversations when in need of immediate help (Government of Canada 2016). This team works in close proximity with DFO, offering advice when a distressed or deceased whale is found (Government of Canada 2016). The Whale Release and Stranding Group established in Newfoundland and Labrador report incidents in which whales are injured or deceased (Government of Canada 2016). All documentation and samples are sent to DFO Science in the surrounding area (Government of Canada 2016). As well as reporting and documenting, a response team aids with entanglements and awareness activities (Government of Canada 2016).

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).

White Shark

The white shark occurs in both inshore and offshore waters, from the intertidal to the upper continental slope and mesopelagic zone. Known bathymetric range is from just below the surface to just above the bottom down to a depth of at least 1,280 m (Bigelow and Schroeder 1948). 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 (Compagno 2001). Critical habitat for this species has not been identified in Canada.

Mitigation Plan for KCS: KCS personnel will not attempt to attract, capture, or harass any sharks in any way.

Mainland Moose

Moose are commonly associated with wild boreal and mixed wood habitats, although the species is most often found where its preferred food – twigs, stems, and foliage of young deciduous trees and shrubs – is most abundant. Such preferred habitats include forested landscapes recently disturbed by fire, wind, disease, and timber harvesting. Summer habitats, especially for female and young moose, include an interspersion of wetlands with access to submerged and emergent aquatic vegetation. In winter, moose favour a landscape supporting recently disturbed mixed forests for food and adjacent mature conifer cover for escape and shelter (Parker 2003).

The number of moose on mainland Nova Scotia is continuing to decline and is probably between 1,000 and 1,200 animals (Parker 2003). From 1960 to the present, most moose on the mainland have been restricted to the northern Cobequid Hills and Pictou-Antigonish Highlands, the isolated southwestern interior in and around the Tobeatic Wildlife Management Area, and scattered pockets along the eastern shores of Guysborough, Halifax, Shelburne, Queens, and Yarmouth Counties. NSDNR has identified the Aspotogan Peninsula as a significant habitat for concentration of mainland moose. The mainland moose are fully protected from legal hunting but are subjected to poaching of an uncertain extent. Parasites and unidentified viral infections have increased the population's mortality. Additional threats to local populations includes the loss of older growth conifer habitat to forest harvesting.

Mitigation Plan for KCS: The mainland moose population is protected under the *Nova Scotia Endangered Species Act*. KCS employees of the proposed aquaculture site will not harm or kill any mainland moose.

Lichens

Blandford Nature Reserve and Deep Cove Conservation Lands are protected areas on the Aspotogan Peninsula. These areas are within 5 km of the proposed project, supporting many endangered species of lichens such as boreal felt, blue felt, and vole ears lichen. Deep Cove Conservation Lands are also home to the rare powdered moon lichen and mountain sandwort lichen. Refer to Section **Other Significant or Sensitive Habitats** for additional information.

Mitigation Plan for KCS: The primary threat to lichens is air pollution and acid precipitation which can cause death of individuals and disrupt reproduction. The lichens can also be threatened by tree harvesting, forestry activities, road construction, housing/cottage development, and climate change. KCS employees of the proposed aquaculture site will not disrupt the known habitats of endangered or rare lichens.

Other Significant or Sensitive Habitats

There a few significant habitats within 5 km of the proposed Saddle Island site. Gravel Island is an important area for eiders, gulls, blue heron, and great cormorants. Saddle Island is a habitat supporting species of concern, primarily birds. A marsh is present approximately 1.0 km west of the site. A bog, supporting many lichen species is within 2.2 km of the site on the mainland. The Aspotogan peninsula supports Mainland moose population from Chester to Dartmouth, Nova Scotia (Fig. 40; NSDNR 2016). There are three existing protected areas within 5 km of the site: Blandford Nature Reserve, Deep Cove Conservation Lands, and St. Margaret's Bay Island Nature Reserve. The Blandford Nature Reserve has been extended to incorporate an area of land south of Deep Cove Conservation Lands (Fig. 41 & 42; NS Environment 2016). This area is ecologically important due to the presence of old jack pine forests, rare plants and lichens, wetlands, and a large population of migratory birds. Deep Cove Conservation lands, owned by the Nature Conservancy Canada, are known for biodiversity and ecosystems of jack pain, bogs, and rare lichens. Lichens such as boreal felt and powdered moon lichens are present in this area. The beaches and dunes on St. Margaret's Bay Island Nature Reserve, a group of islands in St. Margaret's Bay with pending status, support nesting habitat for rare birds. The Grassy Island Complex involves three islands (Westhaver, Wedge, and Grassy Islands) in Mahone Bay and St. Margaret's Bay and supports nesting grounds for Roseate terns. These islands are greater than 9 km from the site.

Figure 40. Significant Habitats
Note: Base map was obtained from NSDNR (2016)

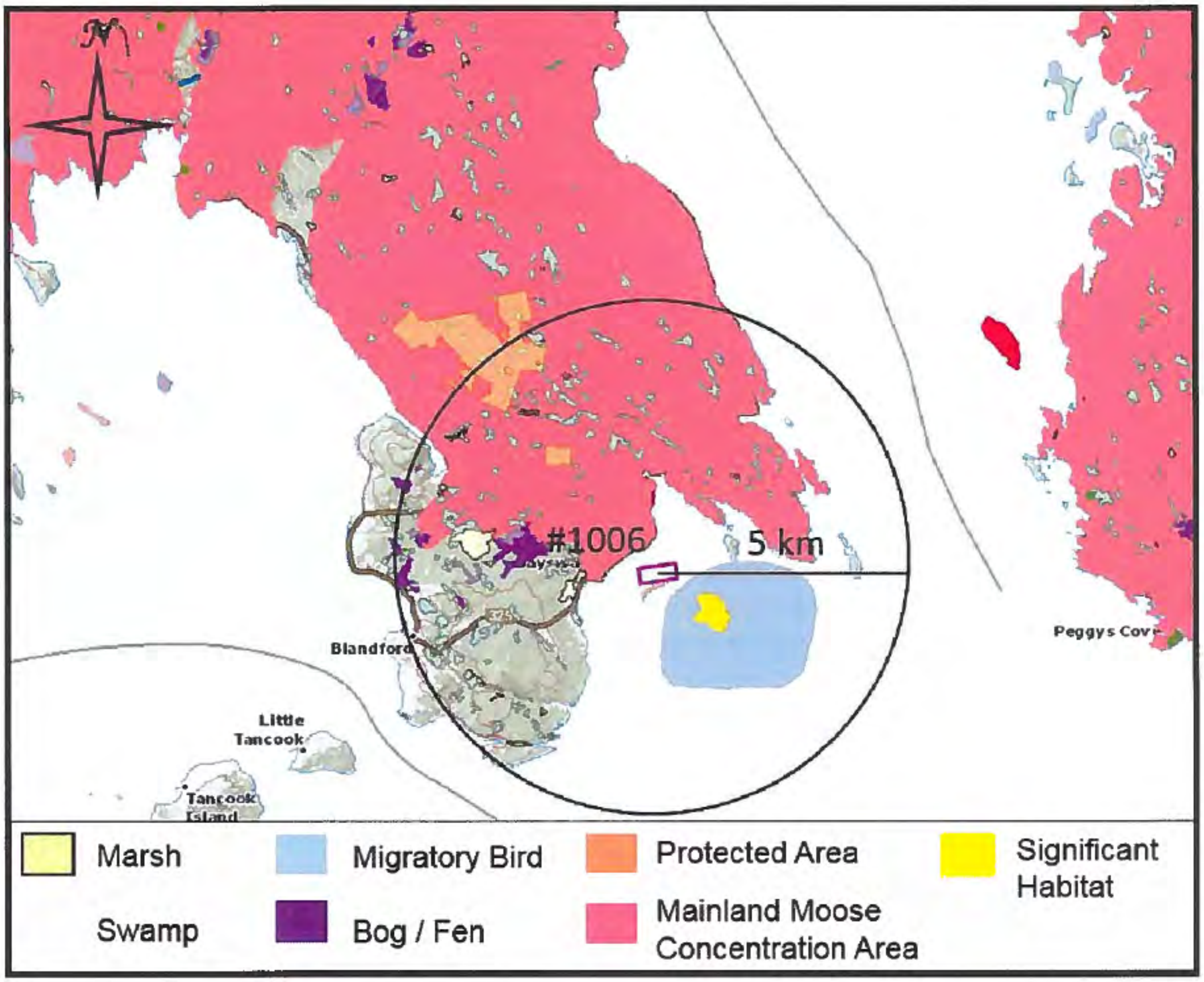


Figure 41. Important Areas for Species of Interest (Map: CHS chart 4386)
Note: Locations were sourced from [1]Maybank (2005), [2]NSDNR (pers. com.), [3]NS Environment (2016), [4]DFO 2016, and [5]IBA Canada (2015)

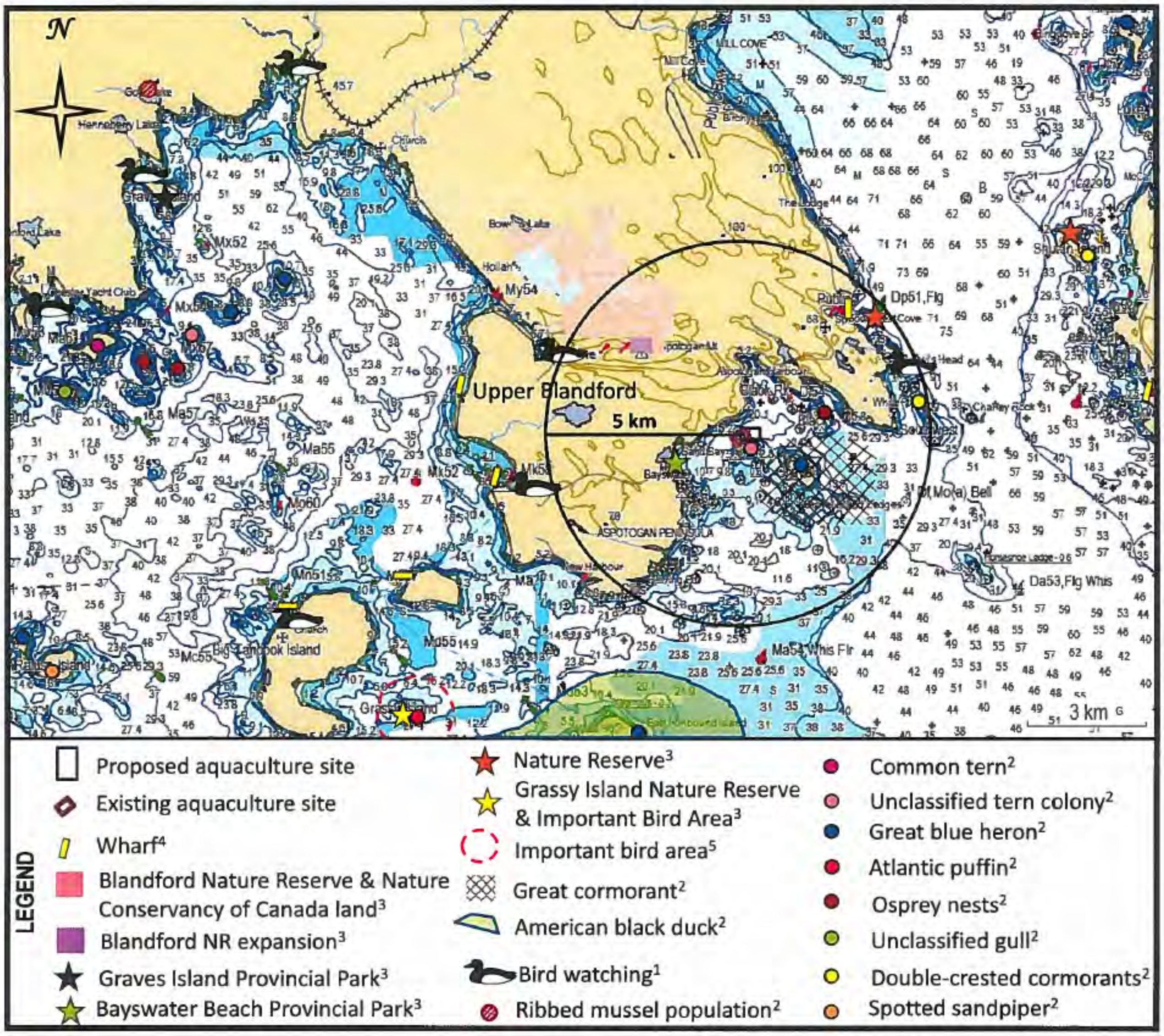
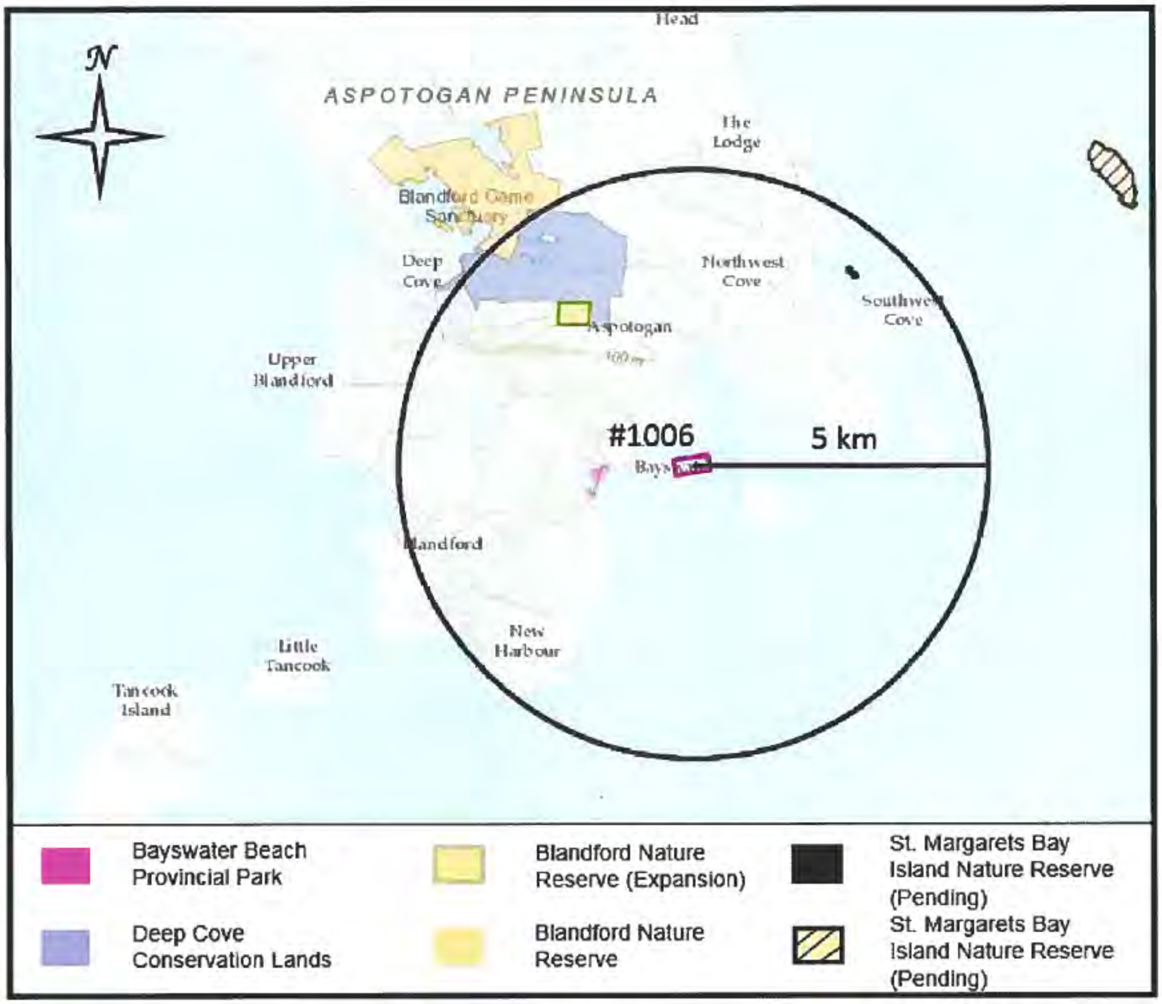


Figure 42. Existing and Pending Protected Areas
Note: Base map was obtained from NS Environment (2016)



Birds

Most of the species of birds in Canada are protected under the *Migratory Birds Convention Act, 1994* (Environment and Climate Change Canada 2016b). A number of 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 landbirds, such as eagles, falcons, and hawks.

The location of the proposed farm falls within block 188 of the Canadian Wildlife Service survey areas (Fig. 43). According to Canadian Wildlife service (CWS) records (A. Hicks, pers. com.), a number of migrating birds inhabit the area off of Bayswater Beach (i.e. bird block 188). Surveys, completed between February 2000 and March 2010 by CWS and NSDNR, have identified several species of waterfowl in this block (Table 14). The common eider was the most common type of bird noted, followed by the long-tailed duck, and unidentified merganser. No Barrow's goldeneye or harlequin ducks were counted in this area over the survey period.

This bird block is not considered an Important Bird Area (IBA) by Important Bird Studies Canada (2016); however, the Province of Nova Scotia (2016b; Fig. 38) recognises the area surrounding Gravel Island, an island east-southeast of Saddle Island, as a significant habitat for migratory birds. The nearest IBA is the Grassy Island complex (NS026) which is composed of Grassy Island, Westhaver Island, and Wedge Island, which are 10.0 km southwest, 24 km west-southwest, and 13.0 km north northeast by north of the site, respectively.

Figure 43. Map of Canadian Wildlife Service Survey Areas Block 188

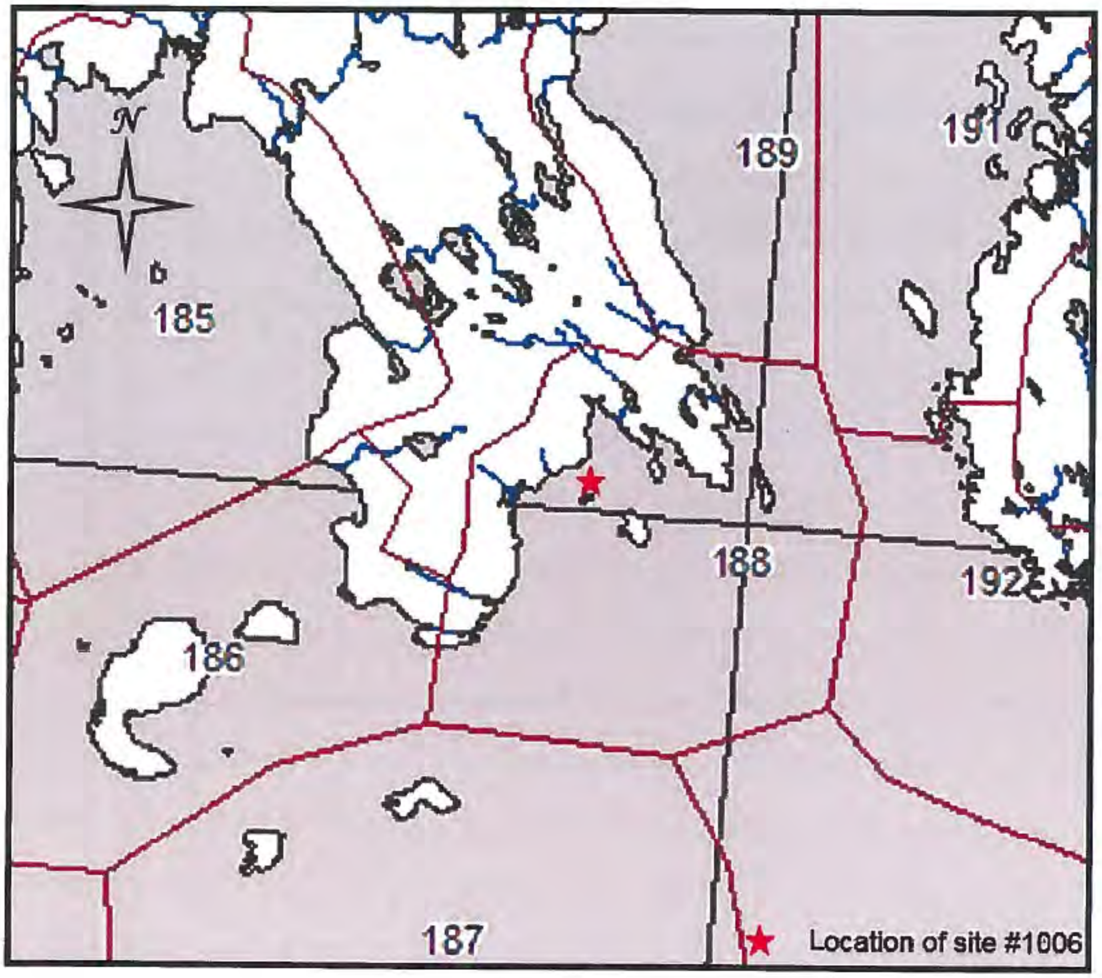


Table 14. Waterfowl Identified in Block 188

	Canadian Wildlife Services – Block 188										
	Numbers of Sightings per Survey										
Bird Names	**02-Feb-00**	**17-May-00**	**21-Mar-01**	**08-Aug-01**	**06-Sep-01**	**13-Aug-02**	**28-Feb-05**	**07-Mar-06**	**12-Mar-07**	**10-Feb-10**	**Grand Total**
American Black Duck	4	0	10	0	0	0	0	30	9	0	53
American Green-winged Teal	0	0	0	0	0	0	0	0	0	0	0
American Wigeon	0	0	0	0	0	0	0	0	0	0	0
Atlantic Brant	0	0	0	0	0	0	0	0	0	0	0
Barrow's Goldeneye	0	0	0	0	0	0	0	0	0	0	0
Black Scoter	0	0	0	0	0	0	0	0	0	0	0
Blue-winged Teal	0	0	0	0	0	0	0	0	0	0	0
Bufflehead	0	0	0	0	0	0	0	0	0	0	0
Canada Goose	0	0	0	0	0	0	0	0	0	0	0
Common Eider	0	227	605	60	0	20	140	172	225	87	1536
Common Goldeneye	0	0	0	0	0	0	3	0	15	20	38
Common Loon	0	0	0	0	0	0	2	5	11	0	18
Common Merganser	0	0	0	0	0	0	0	0	0	0	0
Gadwall	0	0	0	0	0	0	0	0	0	0	0
Greater Scaup	0	0	0	0	0	0	0	0	0	0	0
Harlequin Duck	0	0	0	0	0	0	0	0	0	0	0
Hooded Merganser	0	0	0	0	0	0	0	0	0	0	0
King Eider	0	0	0	0	0	0	0	0	0	0	0
Lesser Scaup	0	0	0	0	0	0	0	0	0	0	0
Long-tailed Duck	21	0	44	0	0	0	139	218	44	0	466
Mallard	0	0	0	0	0	0	0	1	0	0	1
Northern Pintail	0	0	0	0	0	0	0	0	0	0	0
Northern Shoveler	0	0	0	0	0	0	0	0	0	0	0
Red-breasted Merganser	19	0	0	0	0	0	0	0	0	0	19
Ring-necked Duck	0	0	0	0	0	0	0	0	0	0	0
Seal	0	0	0	0	0	0	0	51	0	0	51
Snow Goose	0	0	0	0	0	0	0	0	0	0	0
Surf Scoter	0	0	0	0	0	0	0	0	0	0	0
Unidentified Cormorant	0	0	9	0	0	5	0	0	0	0	14
Unidentified Diving Duck	0	0	0	0	0	0	0	0	0	0	0
Unidentified Duck	0	0	0	0	0	0	0	0	0	0	0
Unidentified Goldeneye	6	0	4	0	0	0	0	0	0	0	10
Unidentified Loon	0	0	16	0	0	0	0	0	0	0	16
Unidentified Merganser	0	0	9	0	0	0	11	82	156	2	260
Unidentified Scaup	0	0	0	0	0	0	0	0	0	0	0
Unidentified Scoter	0	0	0	0	0	0	0	0	0	0	0
Unidentified Teal	0	0	0	0	0	0	0	0	0	0	0
White-winged Scoter	0	0	0	0	0	0	0	0	0	0	0
Wood Duck	0	0	0	0	0	0	0	0	0	0	0
Grand Total	**50**	**227**	**697**	**60**	**0**	**25**	**295**	**559**	**460**	**109**	**2482**

f. Public Right of Navigation

The following figures provide information regarding navigation routes that are used by KCS while servicing the aquaculture site in Aspotogan Harbour (Fig. 44) and the layout of on-site equipment (Figs. 45 - 49).

Figure 44. Marine Chart Showing KCS Vessel Route from Saddle Island to Kelly Cove Salmon Wharf

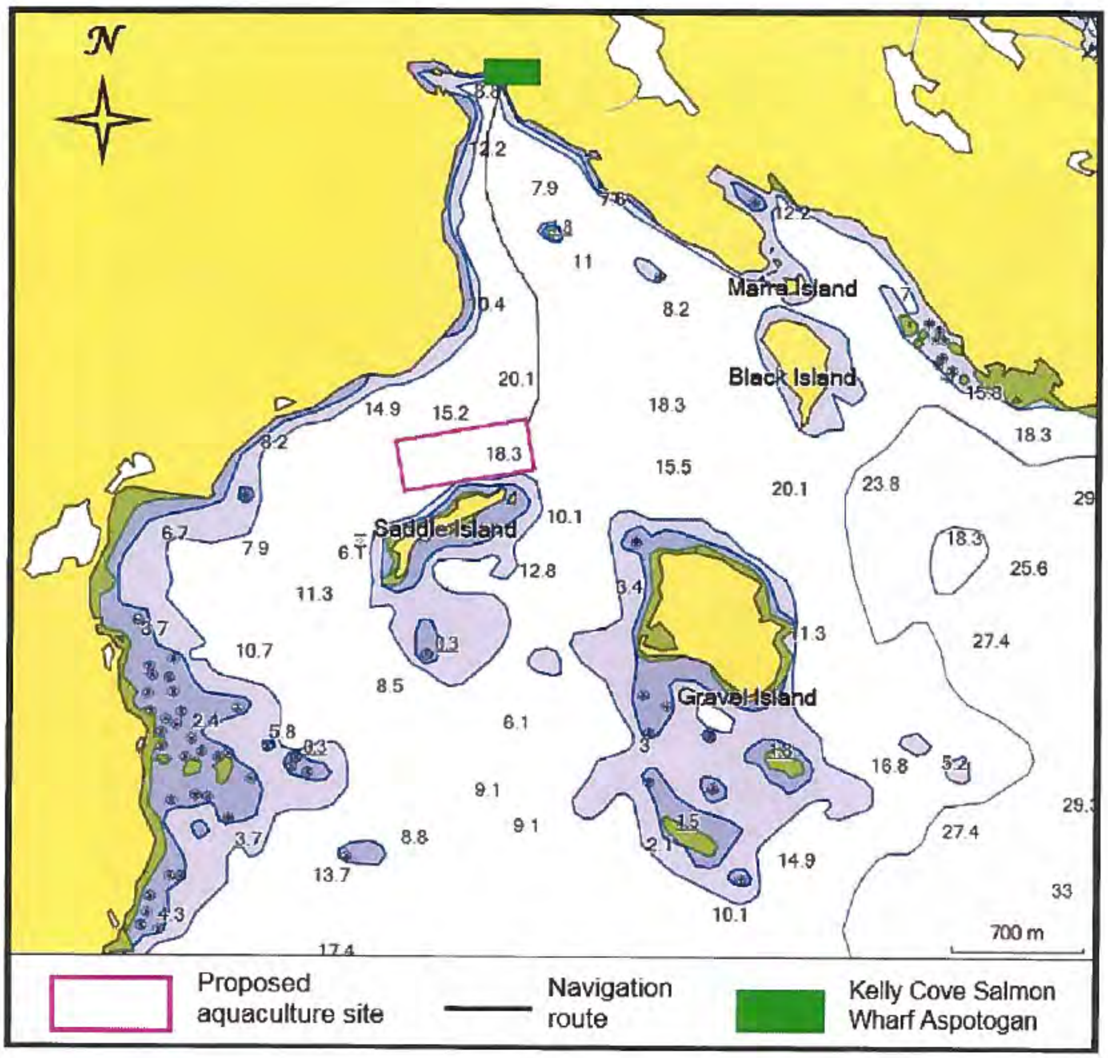


Figure 45. Plan View of the Proposed Boundary Amendment of the Saddle Island Aquaculture Site Showing Nearby Property Owners

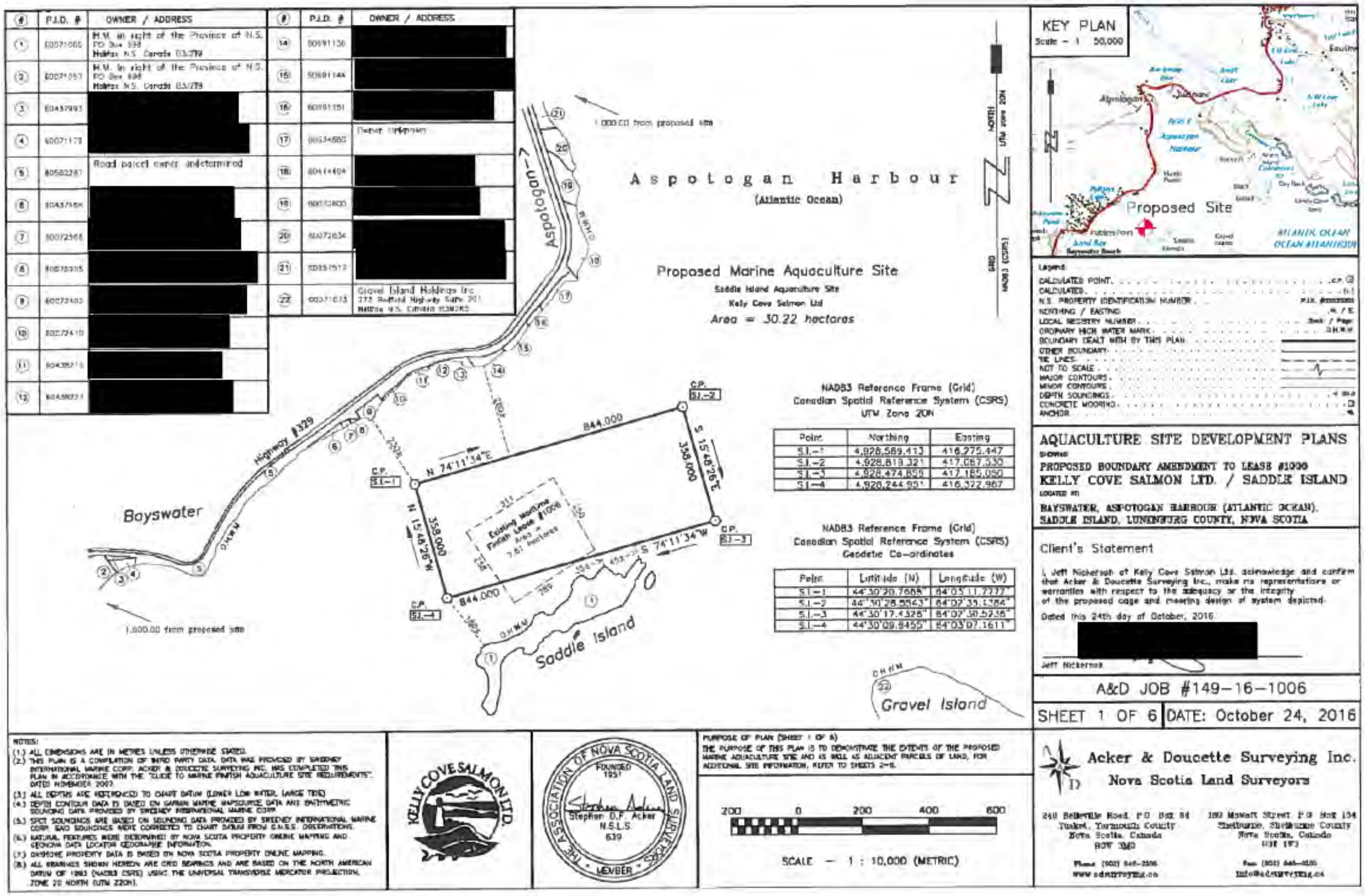
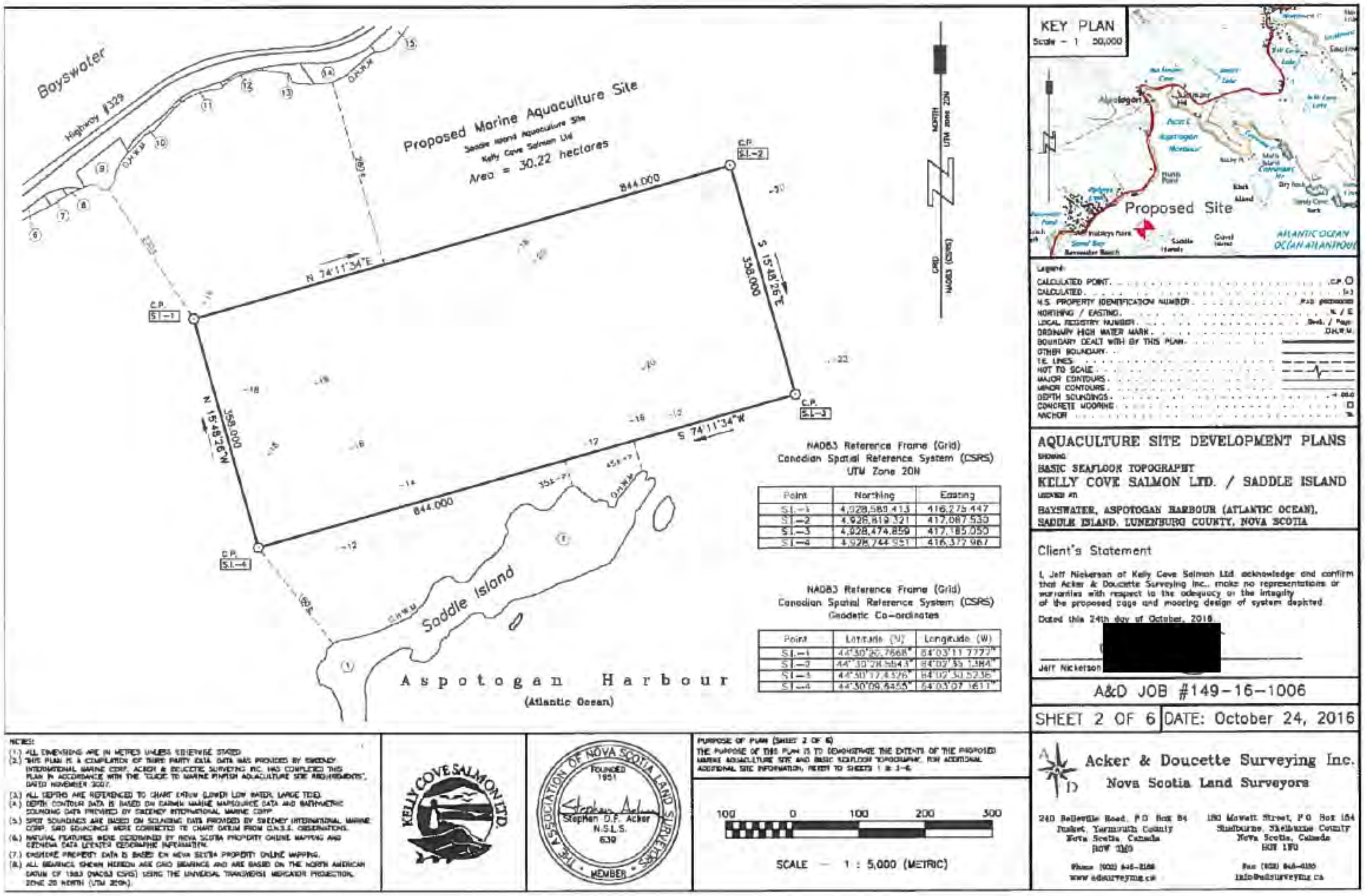


Figure 46. Saddle Island Site Development Plan Showing Basic Seafloor Topography



Point	Northing	Easting
S1-1	4,928,589.413	416,275.447
S1-2	4,928,819.321	417,087.530
S1-3	4,928,474.859	417,185.050
S1-4	4,928,244.951	416,372.967

Point	Latitude (N)	Longitude (W)
S1-1	44°30'20.7668"	64°03'11.7772"
S1-2	44°30'28.5643"	64°02'35.1384"
S1-3	44°30'17.4326"	64°02'30.5236"
S1-4	44°30'09.6455"	64°03'07.1611"

Figure 47. Saddle Island Site Development Plan Showing Cage Configuration

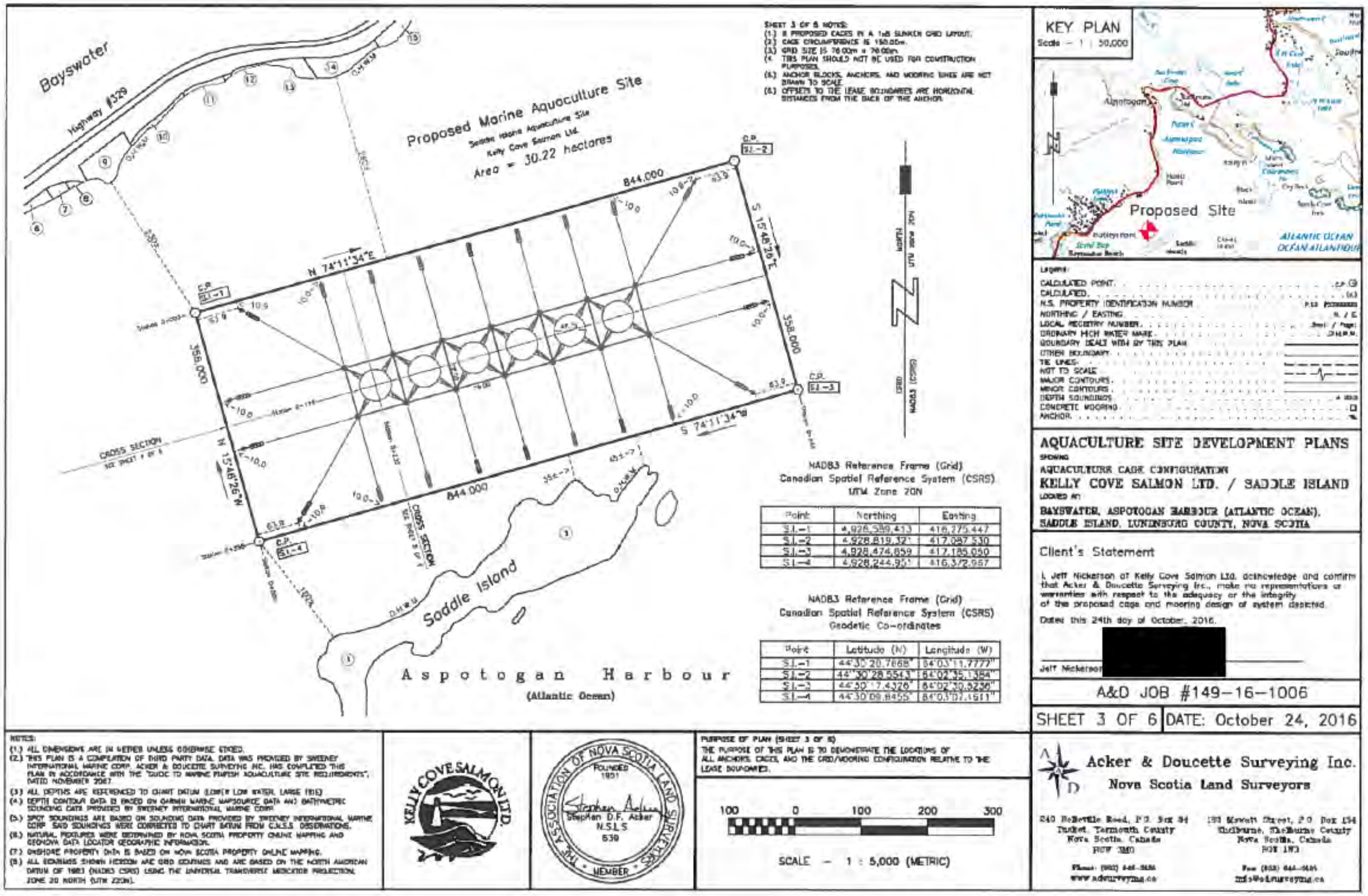


Figure 48. Saddle Island Cross-sectional Plan A

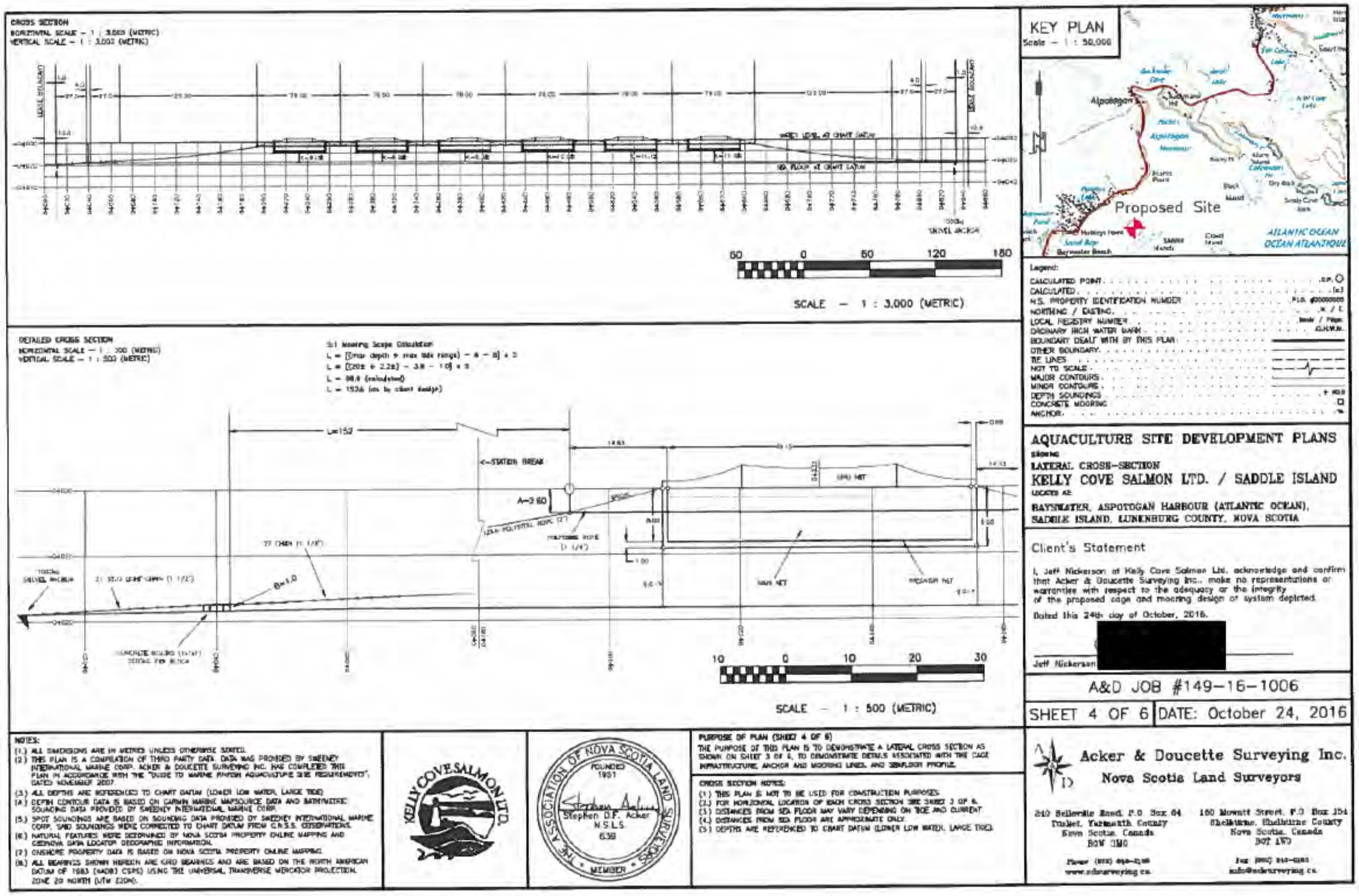
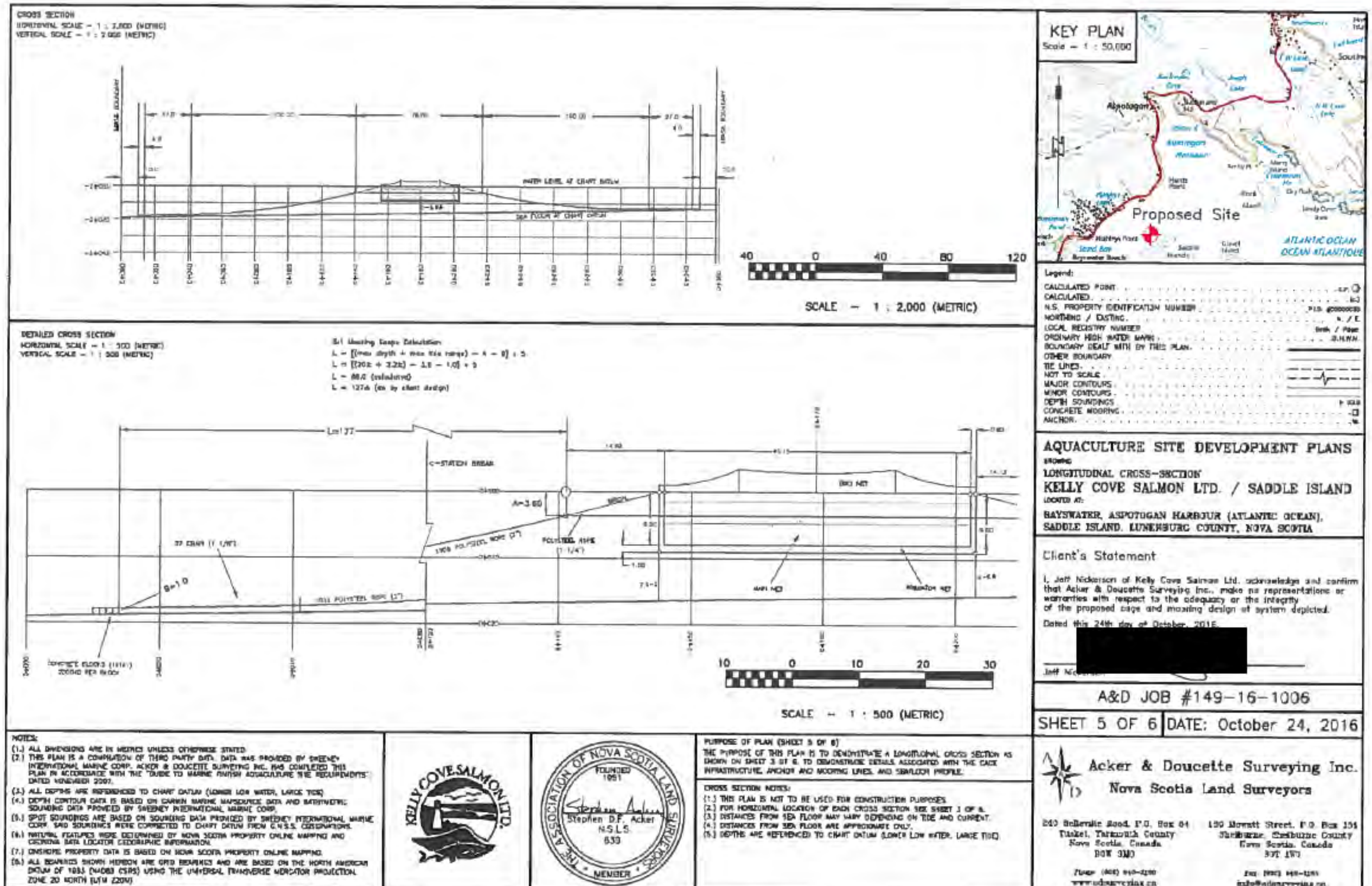


Figure 49. Saddle Island Cross-sectional Plan B



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. The notice of works form will be completed and submitted separately from this document.

g. Sustainability of Wild Salmon

The Saddle Island 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: SFA20, SFA 21, and part of SFA 22 (Fig. 50). The marine aquaculture site in Aspotogan Harbour is located in SFA 21. 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%) (DFO 2011a). 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, DFO 2011b). River acidification is recognised as a major factor in the survival of Atlantic salmon in Nova Scotia.

All Atlantic salmon index populations within DFO's 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 depositions ranging between 2 and 4% of conservation (egg) requirements in 2014 (Fisheries and Oceans Canada 2015f). In November 2010, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the Outer 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". There are a number of rivers in the upper Bay of Fundy and the Minas Basin which COSEWIC has listed as endangered or possibly extirpated for Atlantic salmon. These rivers are all over 100 km away from the proposed aquaculture site (ASF 2016b).

The Salmon Atlas (Fig. 51) and the Atlantic Salmon Federation (Fig. 52) illustrate four salmon rivers near the Saddle Island site – Gold River, Middle River, East River and Little East River (ASF 2016b). The aquaculture site under boundary amendment is located approximately 10, 12.5, 19.5, and 21.5 km from the mouth of the Little East, East, Middle and Gold Rivers, respectively.

Figure 50. Atlantic Salmon Fishing Areas of Atlantic Canada
Note: Figure was sourced from the Fisheries and Oceans Canada (2015e). White, numbered circles identify designated Salmon Fishing Areas.

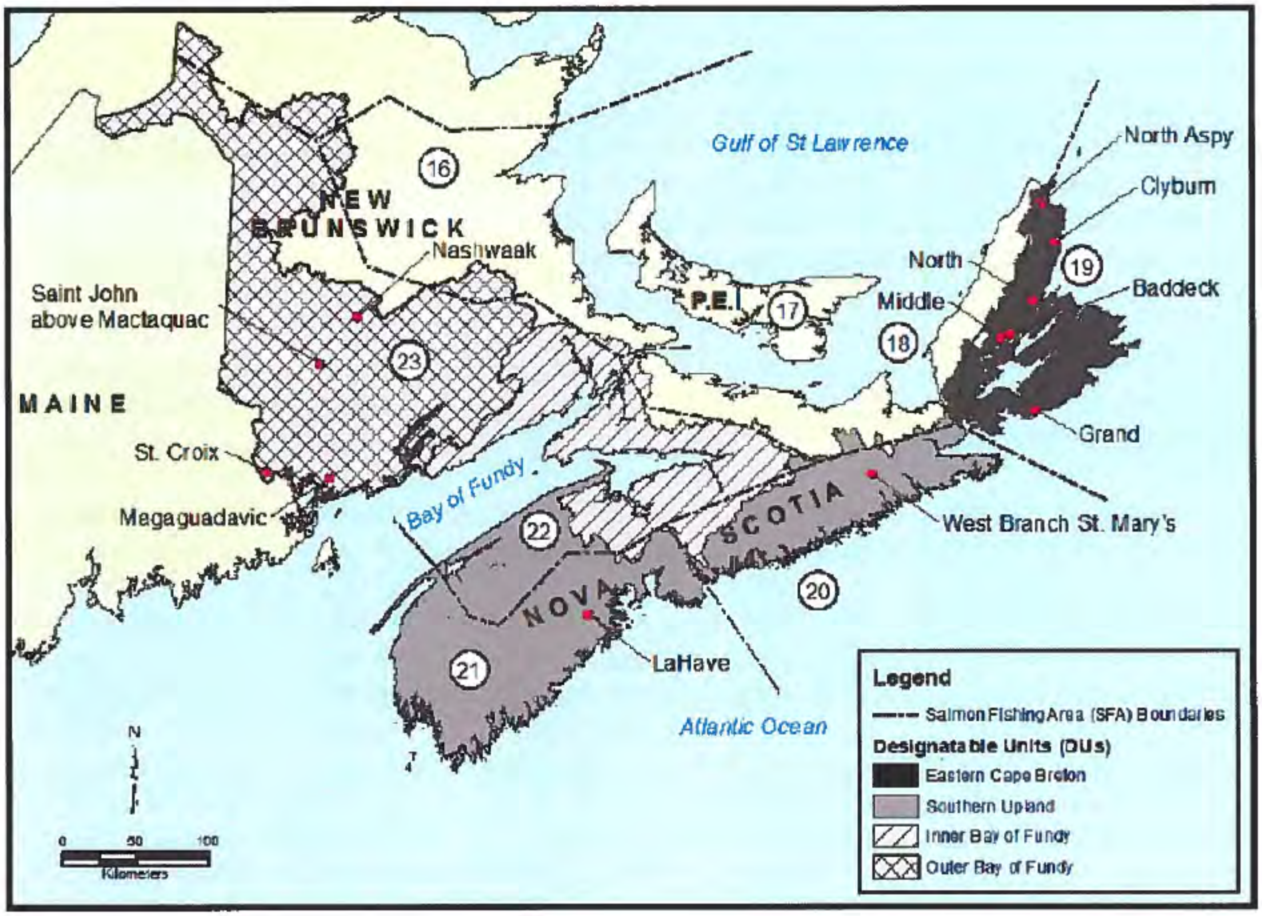


Figure 51. Atlantic Salmon Rivers of Nova Scotia According to The Salmon Atlas
Note: Figure was sourced from The Salmon Atlas (http://www.salmonatlas.com/atlanticsalmon/canada-east/nova-scotia/mapnovascotia.html)

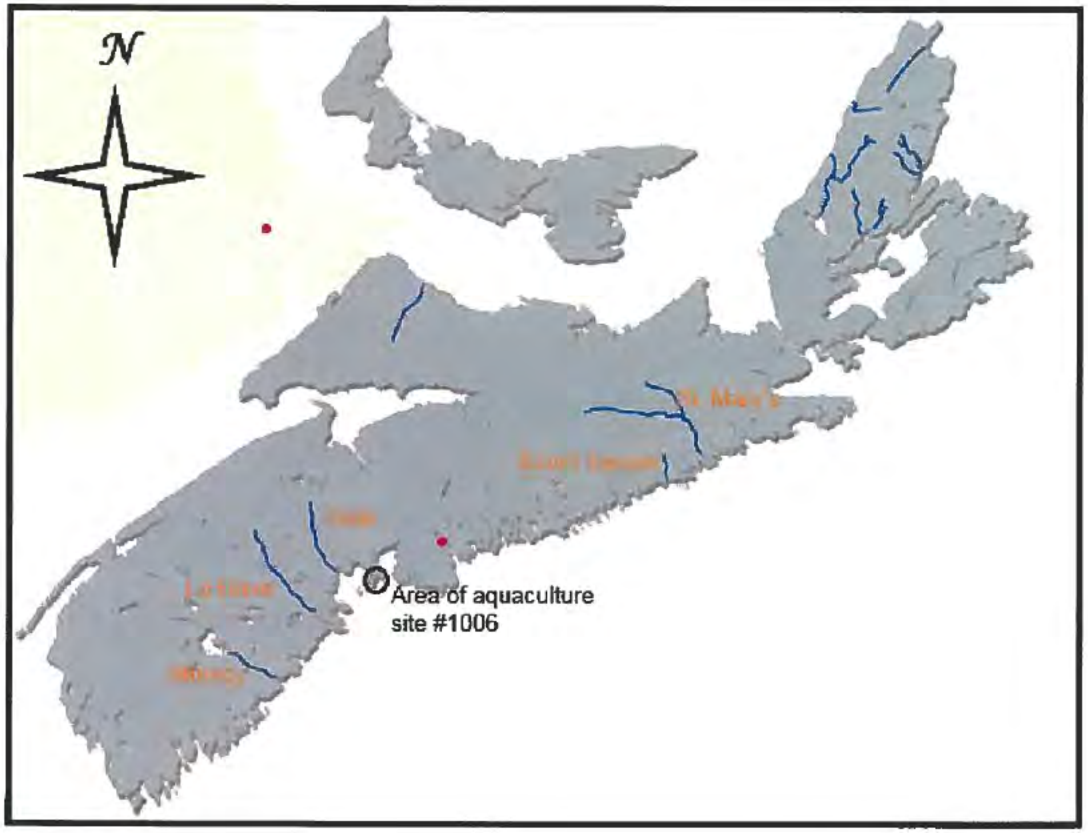
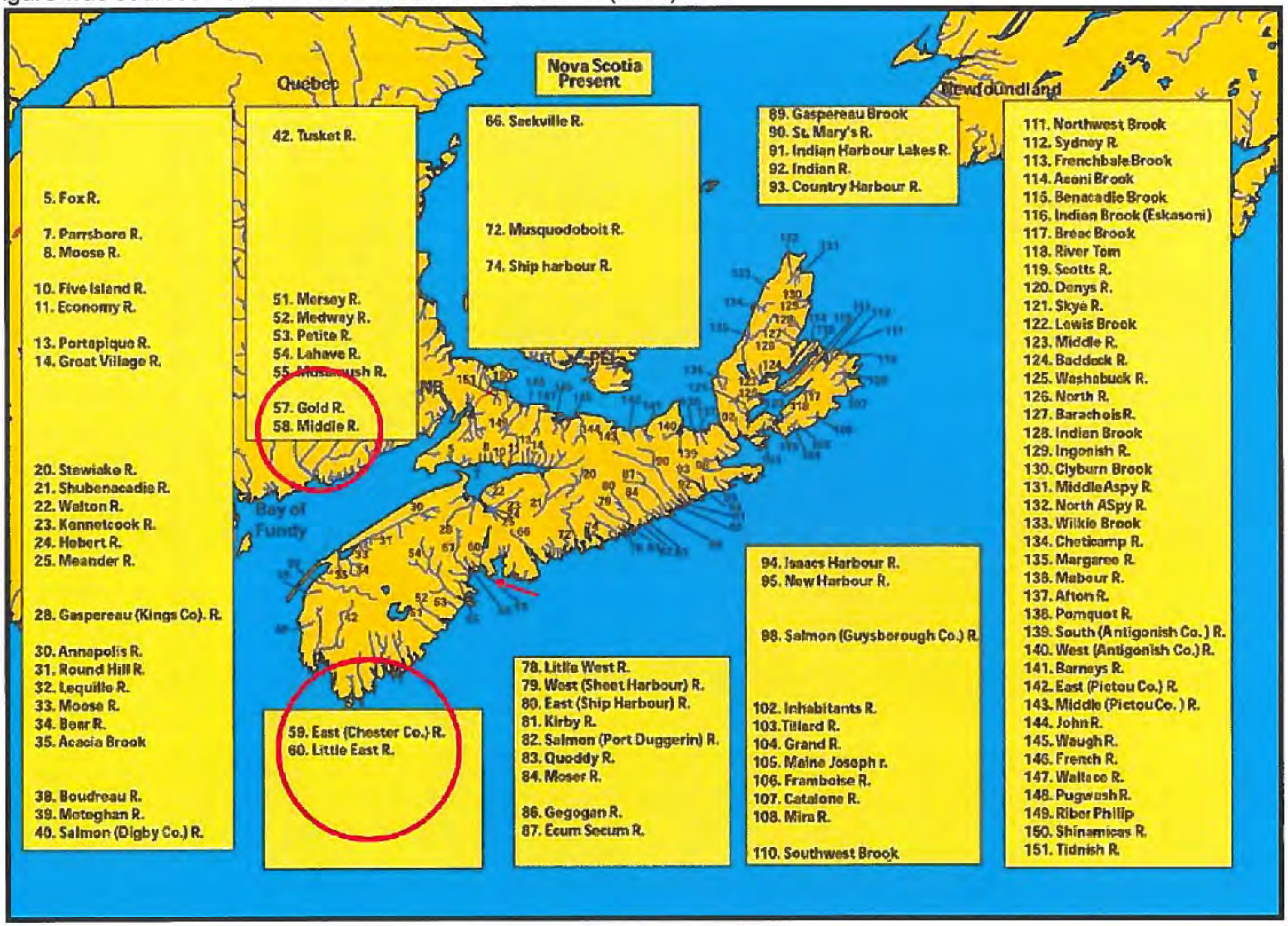


Figure 52. Present Atlantic Salmon Rivers of Nova Scotia
Note: Figure was sourced from the Atlantic Salmon Federation (2016)



A number of 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) and updated by Amiro et al. (2008). 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

KCS has in place plans and codes of practice that address points 1, 2, 4, and 6 above. Points 3, 5, and 7 are beyond the control of KCS.

KCS' plans for containment include checking net integrity after every severe weather event and carrying out repairs as necessary. Net changes are conducted in such a manner as to prevent escapes and salmon losses. KCS will also follow the *Code of Containment for Culture of Atlantic Salmon in Marine Net Pens in New Brunswick* (2008), published by the New Brunswick Salmon Growers Association – now the Atlantic Canada Fish Farmers Association. In the unlikely event that there is an accidental release, the Site Manager will contact the Production Manager, who will then contact NSDFA to report the losses.

KCS follows their fish health management plan. A copy of this plan will become part of the Farm Management Plan, as required by NSDFA. As part of the fish health management, veterinarians regularly visit the marine sites to inspect fish and collect samples. Any diseases that are discovered are treated accordingly and any federally reportable aquatic animal diseases identified will be reported to CFIA.

All KCS farm site workers involved in transferring or moving fish (e.g. introductions, harvests, net changes, etc.) receive training in proper techniques.

Currently, all of the KCS broodstock are of the Saint John River strain, a local, Maritime Canada strain of Atlantic salmon. Broodstock from other countries are not used.

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

There are five (5), aquaculture sites less than 15 km from the Saddle Island site (Fig. 53). The nearest, owned by Sea Farming Industries, is a hatchery for European oyster, bar/surf clam, American oyster, Bay scallop, and quahog. The other farms are licenced for multiple shellfish species including: European oyster, American oyster, sea scallops, bay scallop, quahog, and blue mussels. One site (#0164) has an approval to harvest dulse. The nearest finfish farm is Liverpool (#1205) located approximately 70 km southwest of Saddle Island. This site is owned and operated by KCS.

Production information for KCS Atlantic salmon is privileged and confidential. Inquiries may be directed to KCS for this information as it is not intended for public dissemination.

Figure 53. Marine Chart Showing Other Aquaculture Operations
Note: Figure was sourced from the Department of Fisheries and Aquaculture (2016)

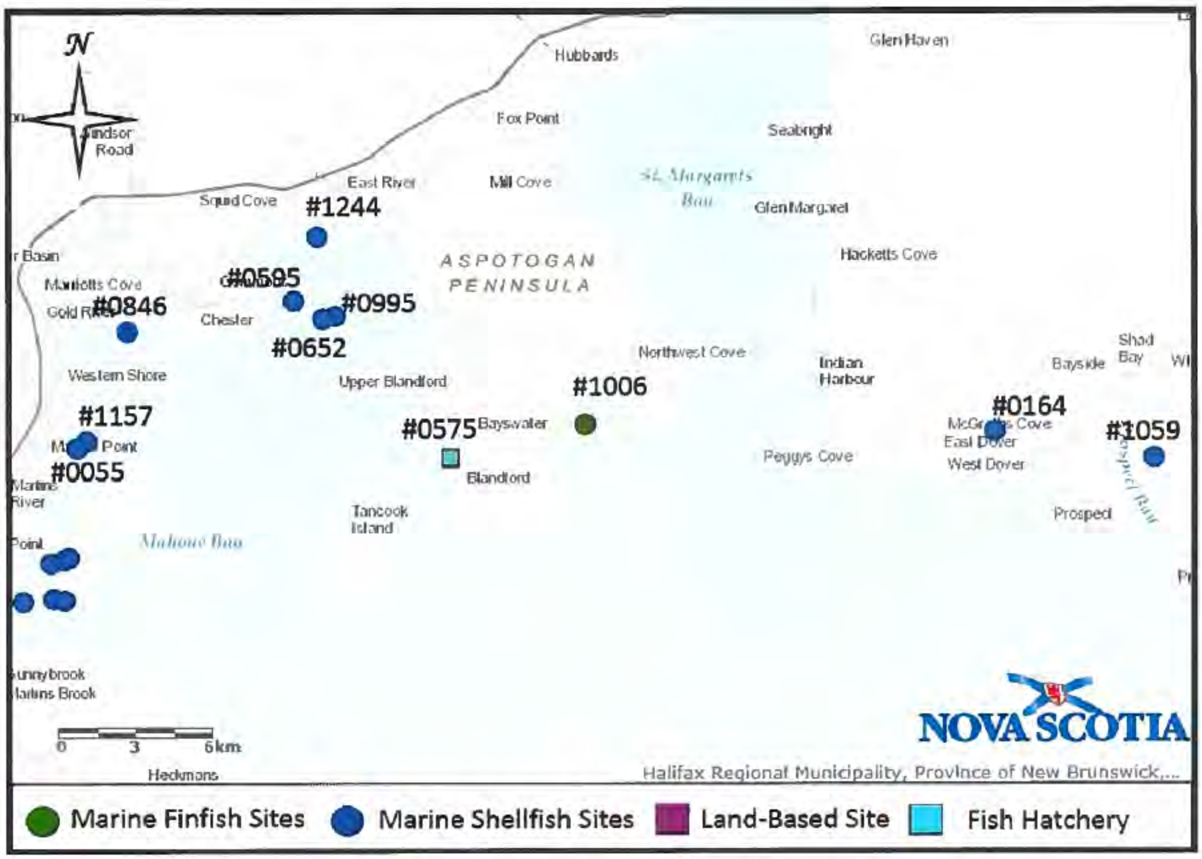


Table 15. Distance from Saddle Island #1006 to nearby finfish and shellfish aquaculture sites

Site #	Distance to Saddle Island (km)	Species	Owner
0575	5.5	European oyster, bar or surf clam, American oyster, bay scallop, quahog	Sea Farming Industries B.V.
0995	10.7	blue mussels, sea scallops	Bay Tender Shellfish Ltd.
0652	11.2	blue mussels, sea scallops, European oyster	Blaine E. Bond
0595	12.5	blue mussels, bay scallops, sea scallops, American oyster	Paul-Aime Joncas
1244	13.0	blue mussel	Blaine E. Bond
0164	16.1	blue mussel, sea scallop, European oyster, dulse	Kiely Cove marine Enterprise
0846	18.5	blue mussel, European oyster, American oyster, sea scallop	Long Reef Shellfish
1157	19.5	blue mussel, bay scallop, European oyster, sea scallop	Wayne Turple
0055	19.8	blue mussel, bay scallop, European oyster, sea scallop	Wayne Turple

List of Contacts

Table 16. Contacts

Contact Name	Affiliation	E-mail	Phone	Date of Contact	Reason for Contact
Andrew Hicks	Environment Canada	Andrew.Hicks@ec.gc.ca	(506) 364-5138	Oct 4, 2016	Bird Surveys
Justin Huston	NSDFA	hustonje@gov.ns.ca	(902) 424-2996	May 11, 2007	Rockweed harvesting
Benjamin Lawrence	NSDNR	benjamlk@gov.ns.ca		Jan 31, 2012	Significant habitats
Carl MacDonald	DFO	Carl.MacDonald@dfo-mpo.gc.ca	(902) 426-1488	Sep 28, 2011	Fisheries
Colin O'Neil	DFO – Policy & Economics	Colin.ONeil@dfo-mpo.gc.ca	(902) 426-6296	Oct 18, 2016	Fisheries
Sean Weseloh McKeane	Communities, Culture and Heritage	Sean.WeselohMcKeane@novascotia.ca	(902) 424-6475	Jun 12, 2016	Archaeological resources

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APPENDIX A
Current Meter Report

Current Profile Report

Aquaculture Site #1006
Saddle Island

Aspotogan Harbour
Lunenburg County
Province of Nova Scotia

April 12, 2016

Prepared for:

Kelly Cove Salmon Ltd
P.O. Box 1546
Shelburne, NS
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Prepared by:

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SIMCorp File #SW2016-002

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April 12, 2016

SIMCorp File # SW2016-002

Jeff Nickerson
P.O. Box 1546
Shelburne, NS
B0T 1W0

Dear Mr. Nickerson

Re: <u>Saddle Island Site #1006 Current Meter Deployment</u>

Please find enclosed the supporting materials for the above mentioned current meter deployment at aquaculture site #1006 Saddle Island, in Aspotogan Harbour, Lunenburg County, NS.

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

Sincerely,

[redacted]

[redacted] B.Sc., MTM
Sr. Marine Environmental Biologist, Newfoundland
SIMCorp Marine Environmental Inc.
[redacted]@simcorp.ca

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1.0 INTRODUCTION

The following report was prepared by Sweeney International Marine Corp. (SIMCorp) for Kelly Cove Salmon Ltd. in order to summarize the results of the current meter profiling of marine aquaculture site #1006, Saddle Island, located in Aspotogan Harbour, Lunenburg County, Nova Scotia. Current speed and direction data presented in this document were collected with the use of a bottom-mounted, 614-kHz Teledyne RDI Workhorse Sentinel Acoustic Doppler Current Profiler (ADCP) deployed by the Nova Scotia Department of Fisheries and Aquaculture for a period of forty one (41) days from October 7 to November 17, 2015.

2.0 CONTACT INFORMATION

Proponent:

Company Name:	Kelly Cove Salmon Ltd.
Principal Contact:	Mr. Jeff Nickerson
Mailing Address:	P.O. Box 1546 Shelburne, NS, B0T 1W0
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Project Management:

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Cellular:	
Facsimile:	
E-mail:	[redacted]@simcorp.ca

3.0 PHYSICAL LOCATION AND DEPLOYMENT

3.1 Physical Location & Site Conditions

The Saddle Island aquaculture site is located on the north side of Saddle Island, approximately 1.7 km south of the community of Aspotogan, NS (Fig. 1). Maximum exposure at this location is from the east southeast and south southwest, where the site is open to St. Margaret's Bay. The site is sheltered from the north, west and southeast by land.

3.2 ADCP Deployment

On October 7, 2015, a 614-kHz Teledyne RDI Workhorse Sentinel ADCP was deployed by the Nova Scotia Department of Fisheries and Aquaculture, Aquaculture Division staff. The unit was deployed approximately 195 m west of the Saddle Island boundaries and was placed in approximately 16 m of water. The approximate coordinates of this deployment were N44° 30.181' W64° 03.160' (Fig. 2, Table 1).

The ADCP was programmed to record the current speed and direction of the entire water column in 1-m bins, collecting data which was averaged over fifteen-minute intervals for a period of 41 days. Each profile determined the average velocity and direction of water flow in the 1-m cells throughout the water column. The frequency distribution of both current speed and direction for every second recorded cell (*i.e.* 3, 5, 7, 9, 11, 13 and 15 m from bottom), as well as the closest, reliable cell to the surface (*i.e.* 16 m) are presented and discussed in Section 4.

Calibration of the unit's compass was performed as per the manufacturer's instructions immediately prior to deployment.

Figure 1. Physical location of site #1006 Saddle Island in Aspotogan Harbour, NS

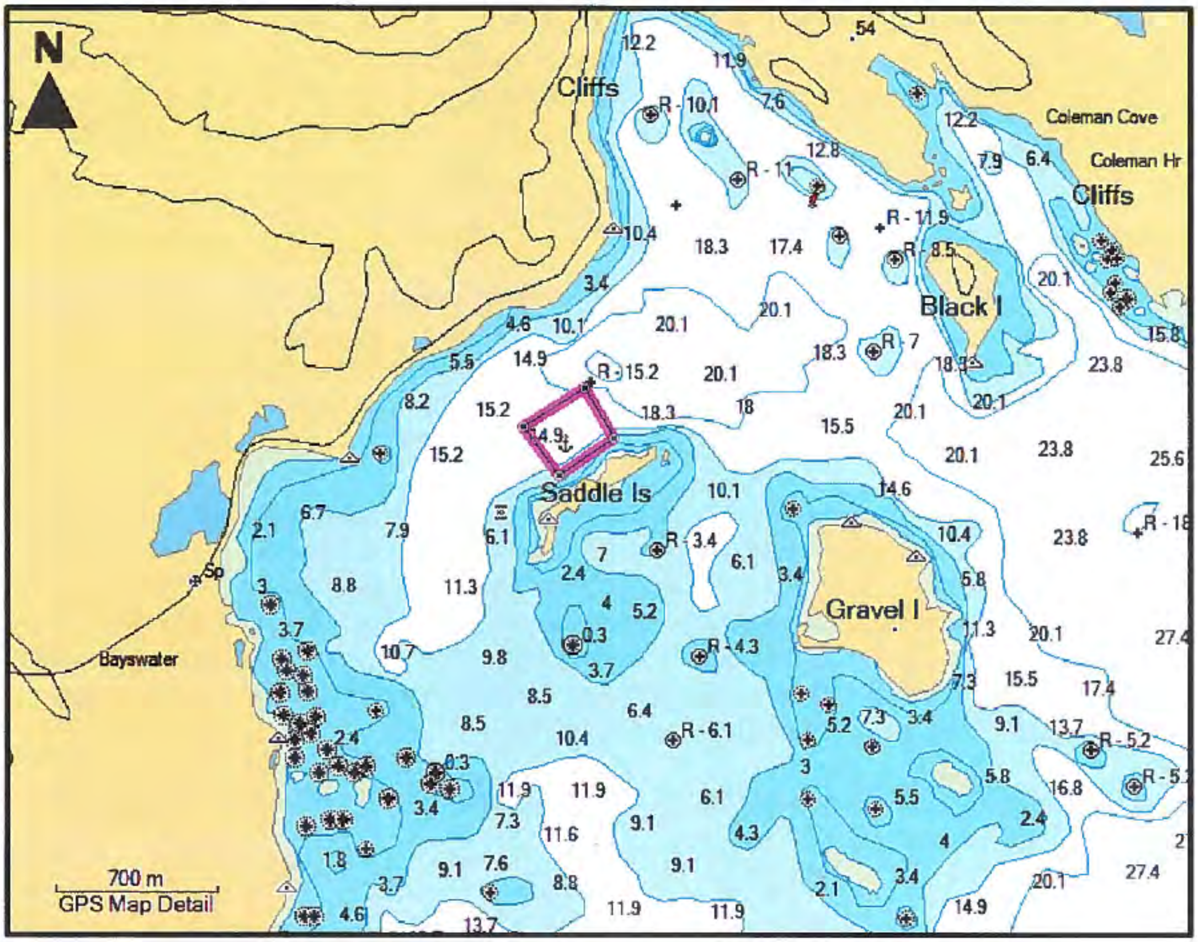


Table 1. Coordinates of lease corners and ADCP deployment at site #1006

Station	Latitude	Longitude
Corner 1	N44° 30.242'	W64° 02.785'
Corner 2	N44° 30.154'	W64° 02.965'
Corner 3	N44° 30.359'	W64° 02.880'
Corner 4	N44° 30.268'	W64° 03.077'
ADCP	N44° 30.181'	W64° 03.160'

Figure 2. Deployment location of the ADCP at site #1006, Saddle Island

4.0 RESULTS AND DISCUSSION

4.1 Deployment Results

Figure 3. Overall average current speed and direction at site #1006

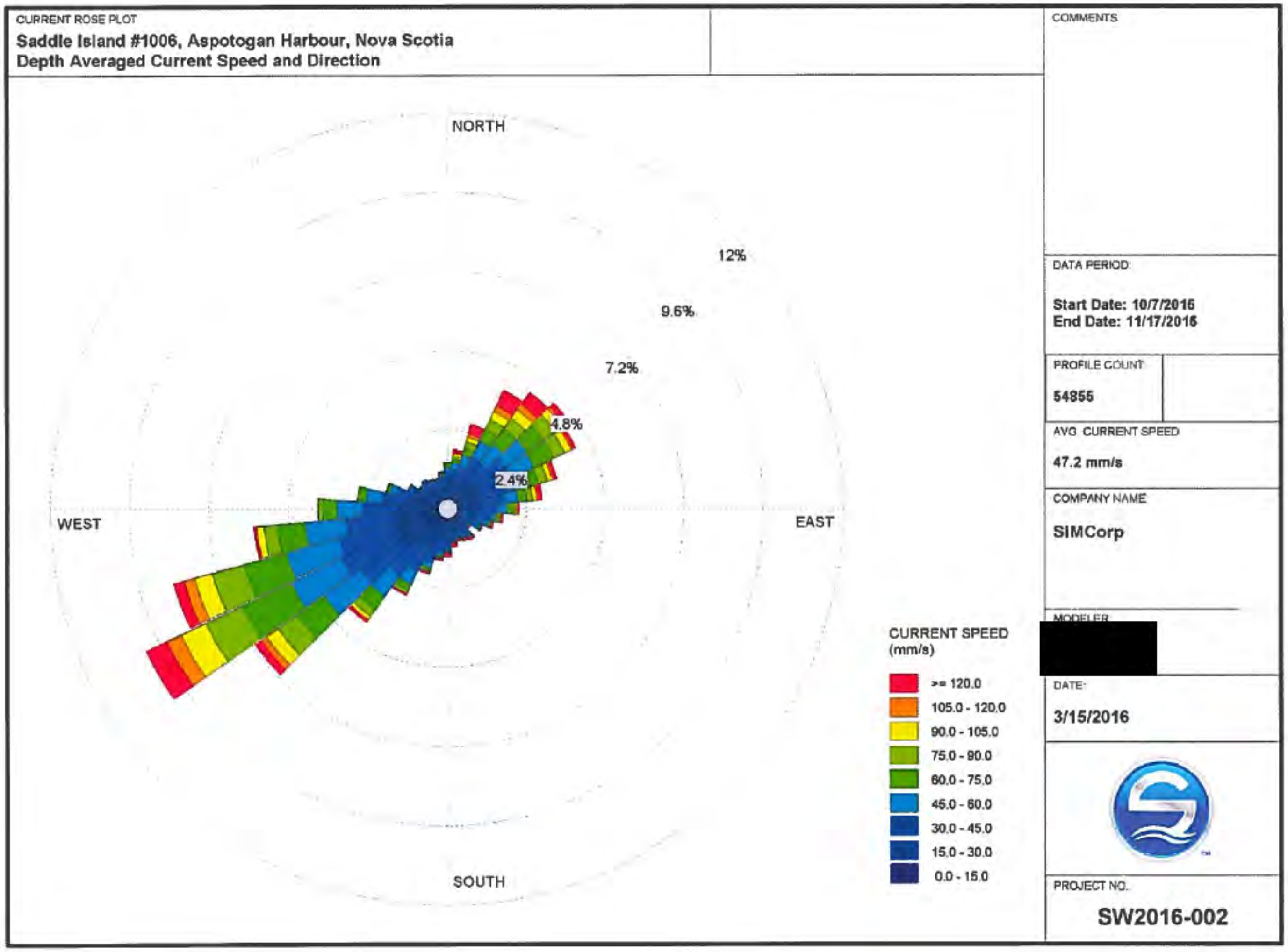


Figure 4. Overall average frequency distribution of current speed classes at site #1006

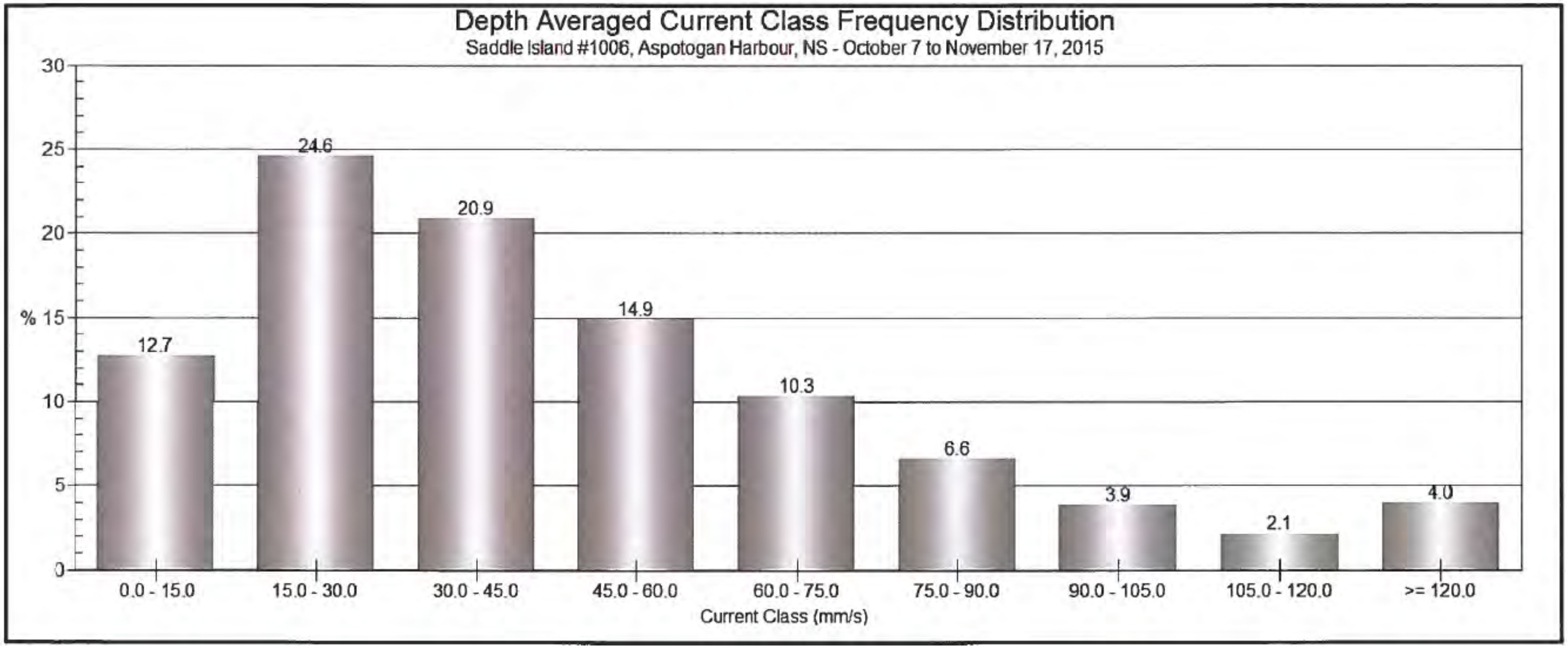


Figure 5. Frequency distribution of current speed and direction 3 m above the seafloor at site #1006

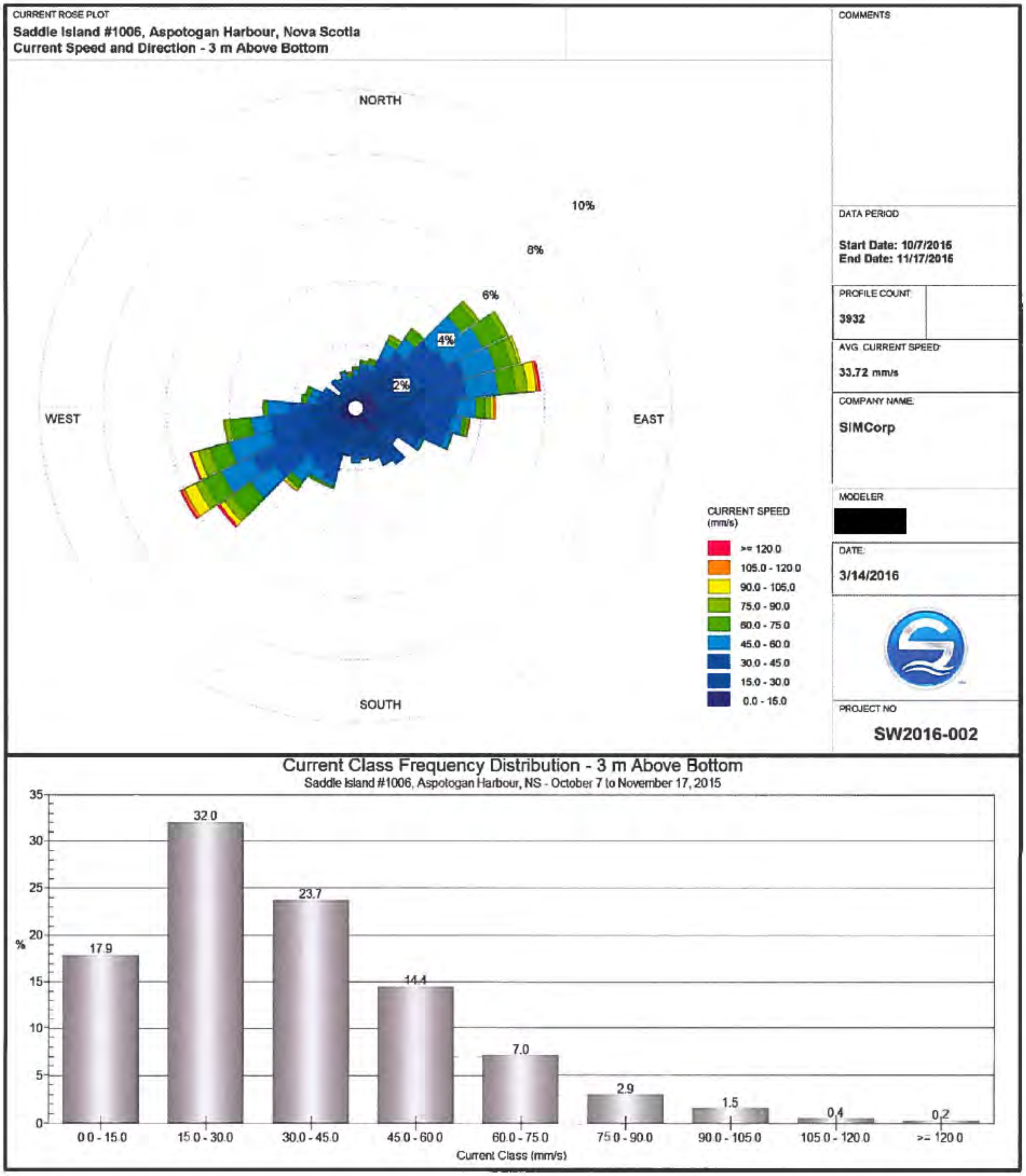


Figure 6. Frequency distribution of current speed and direction 5 m above the seafloor at site #1006

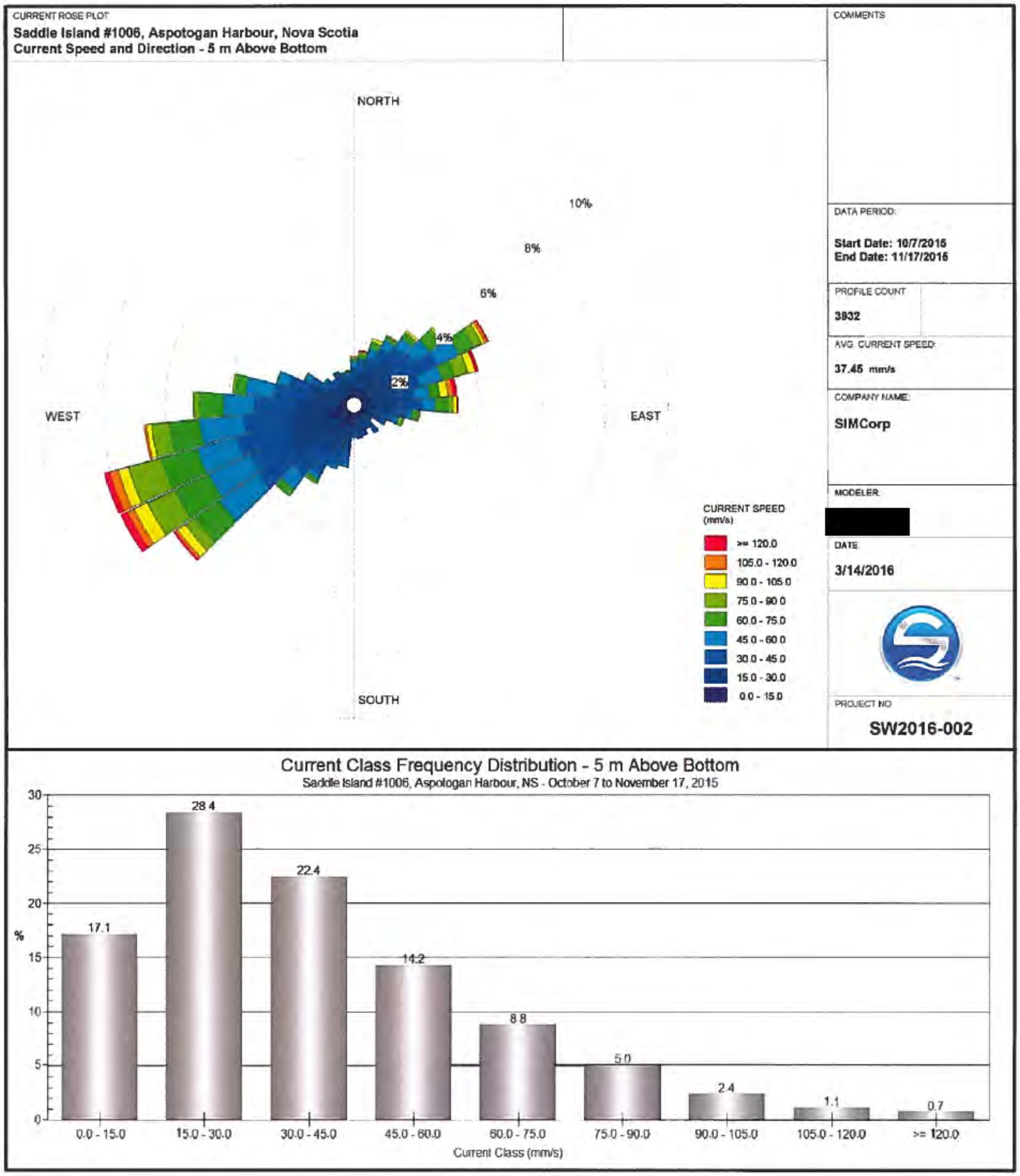


Figure 7. Frequency distribution of current speed and direction 7 m above the seafloor at site #1006

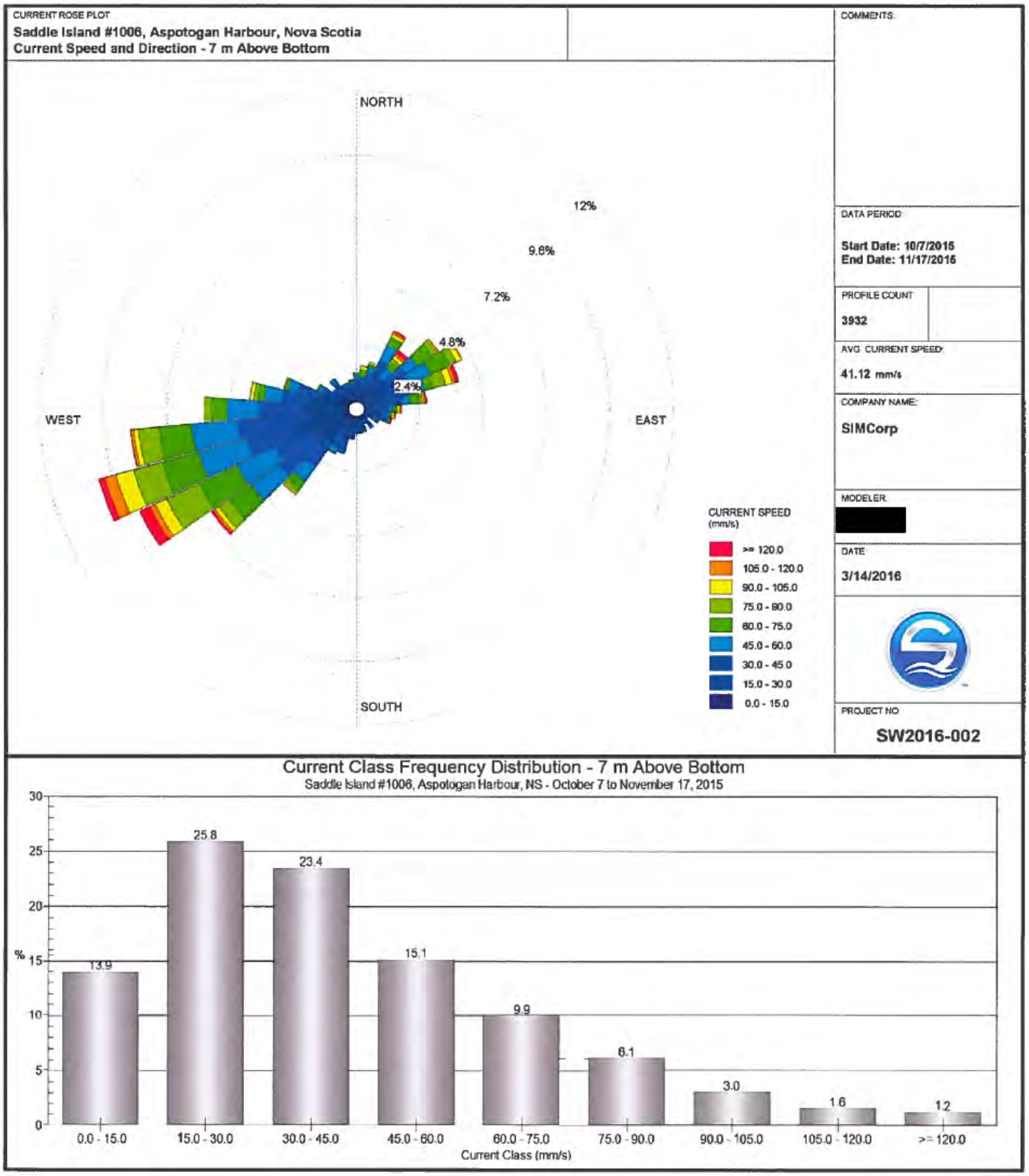


Figure 8. Frequency distribution of current speed and direction 9 m above the seafloor at site #1006

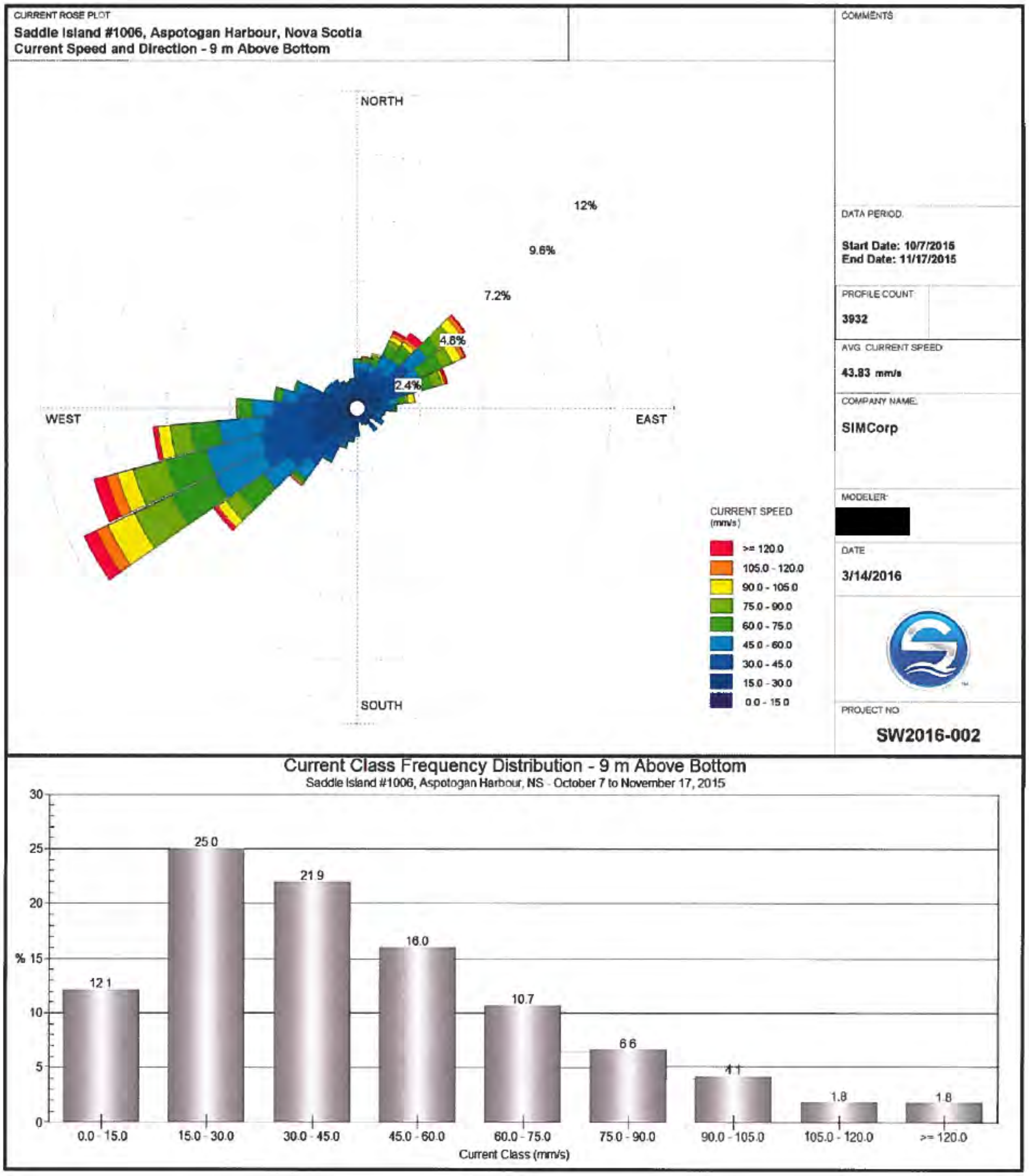


Figure 9. Frequency distribution of current speed and direction 11 m above the seafloor at site #1006

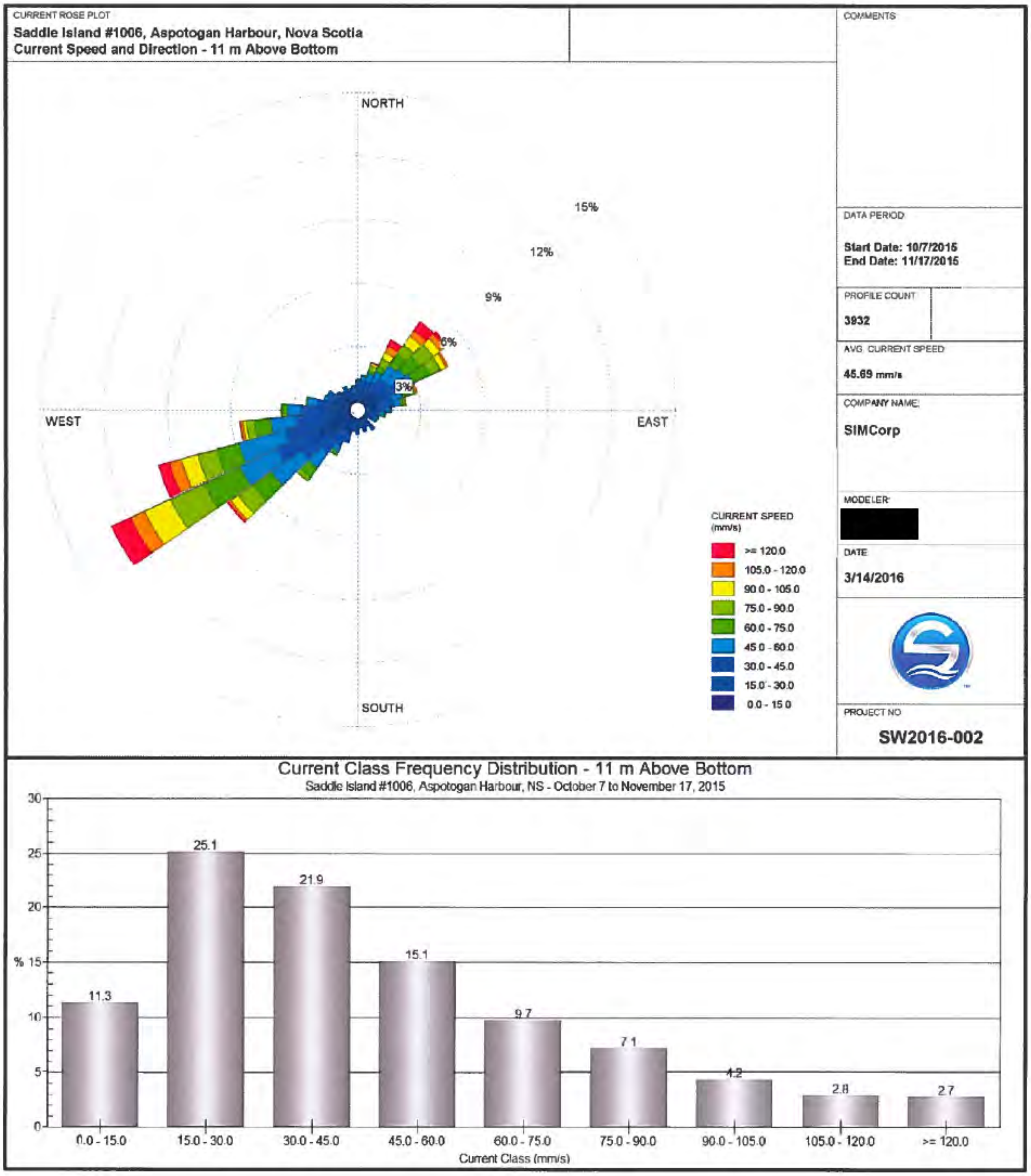


Figure 10. Frequency distribution of current speed and direction 13 m above the seafloor at site #1006

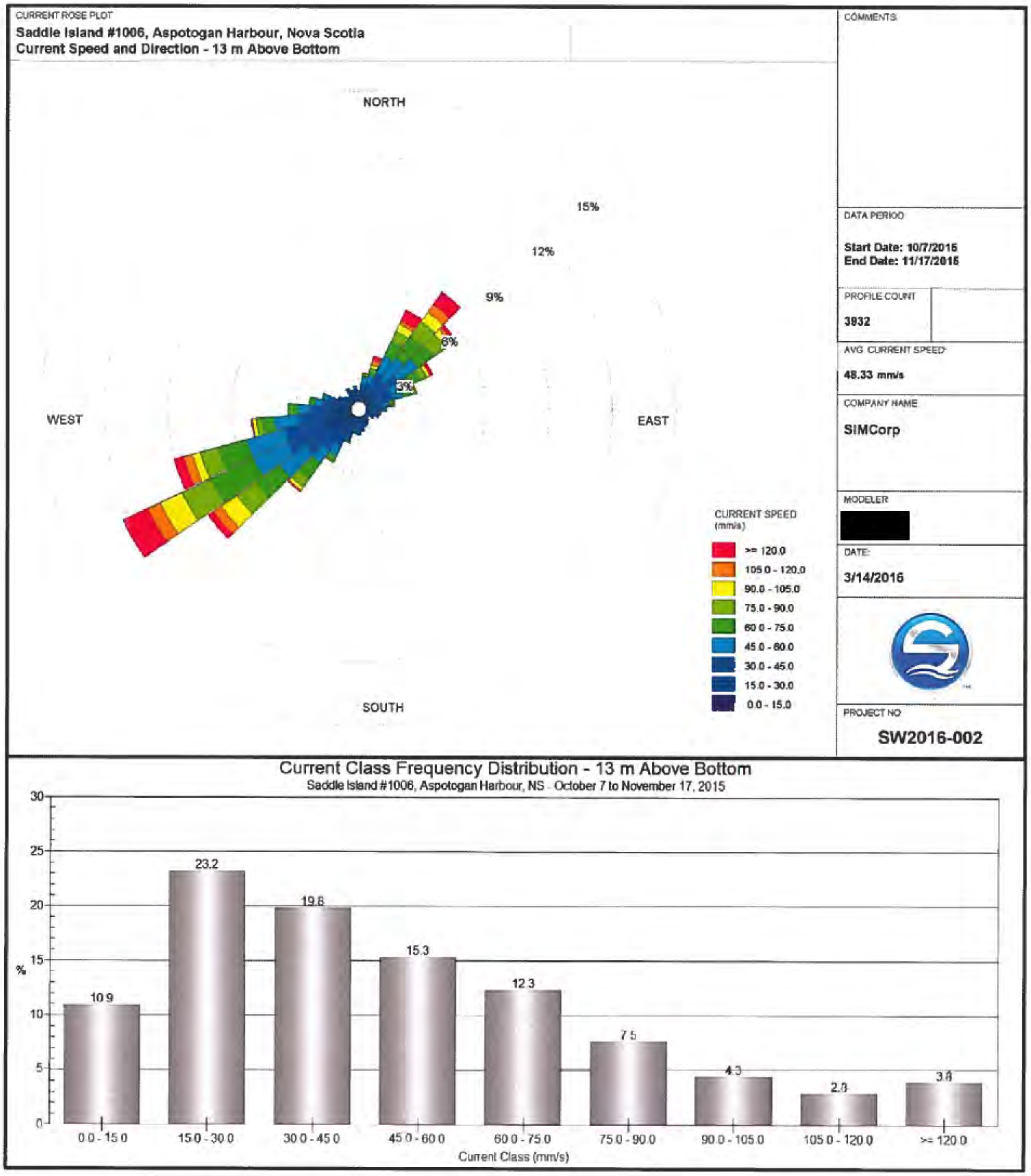


Figure 11. Frequency distribution of current speed and direction 15 m above the seafloor at site #1006

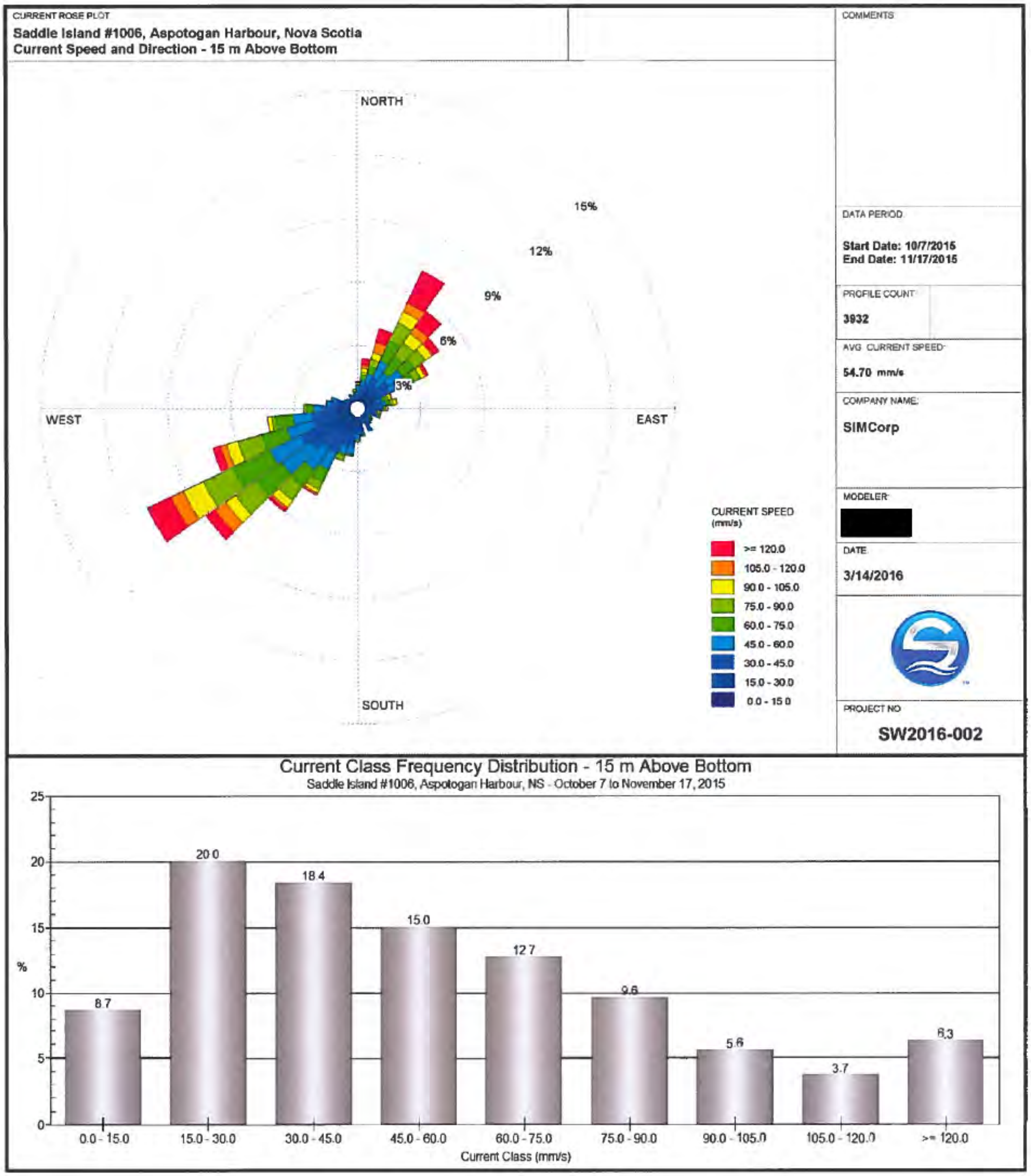


Figure 12. Frequency distribution of current speed and direction 16 m above the seafloor at site #1006

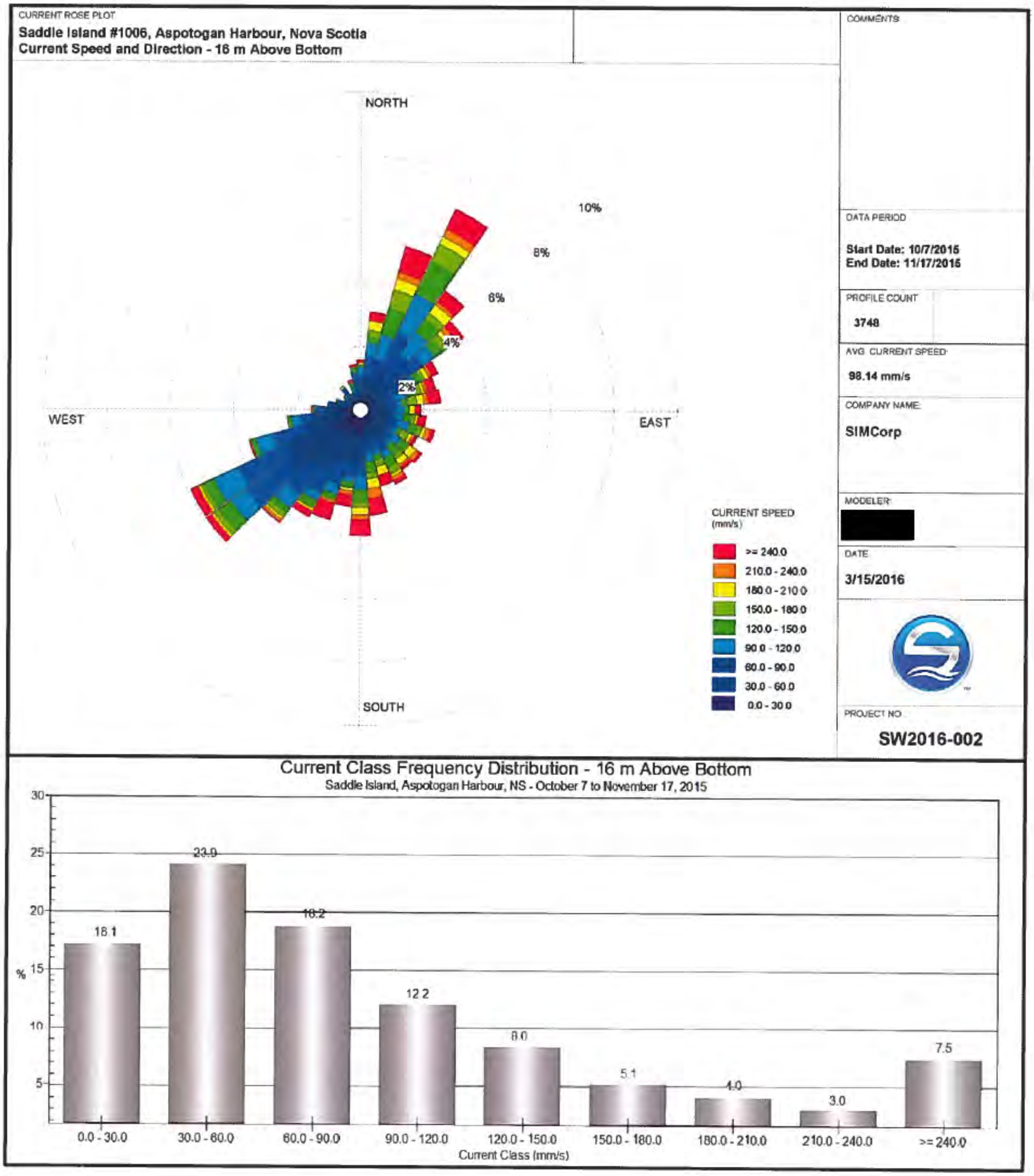
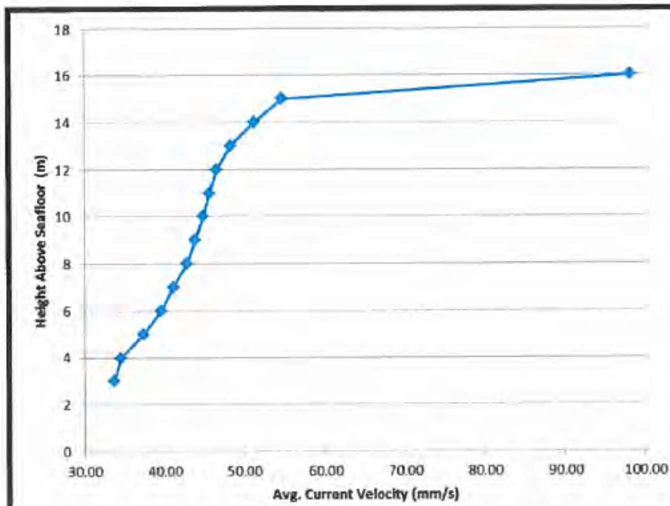
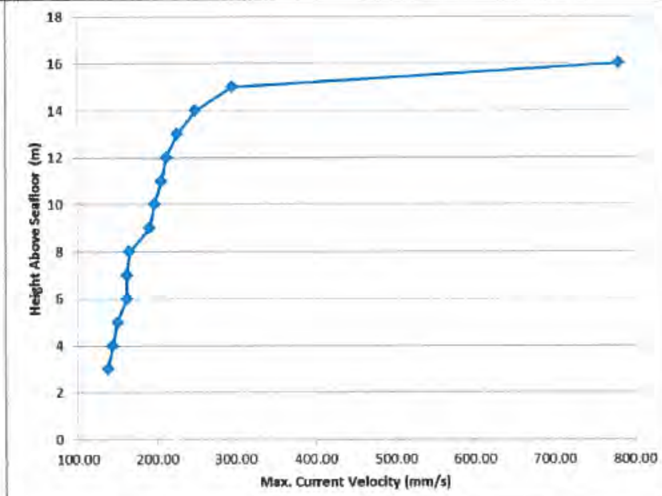


Figure 13. Summary of current velocity and direction data collected at Saddle Island #1006





Saddle Island	Current Speed Statistics							
Approx. Distance from Seafloor	Mean	Min	Max	Mode	< 2 cm/s	< 5 cm/s	Directional Modes	
(m)	(mm/s)	(mm/s)	(mm/s)	(mm/s)	(%)	(%)	Cardinal or Intercardinal	% of Occurrence
3	33.7	1	138	21	28.6	79.6	ENE & WSW	12.7 & 12.6
4	34.6	0	144	21	28.6	77.1	WSW & ENE	15.7 & 11.8
5	37.4	0	150	14	26.6	73.6	WSW & SW	18.5 & 11.7
6	39.6	0	162	16	23.9	70.7	WSW & W	21.4 & 12.1
7	41.1	0	162	25	22.0	68.2	WSW & W	22.4 & 12.7
8	42.8	0	165	25	21.0	65.9	WSW & W	24.2 & 11.7
9	43.8	0	191	26	19.8	65.0	WSW & SW	24.3 & 12.0
10	44.8	0	197	21	20.1	63.8	WSW & SW	24.8 & 12.0
11	45.7	1	206	22	19.0	64.0	WSW & SW	24.1 & 13.5
12	46.6	1	212	25	19.0	61.4	WSW & SW	22.6 & 14.5
13	48.3	1	226	25	18.8	59.8	WSW & SW	22.2 & 15.5
14	51.3	0	249	34	16.7	56.1	WSW & SW	20.4 & 16.8
15	54.7	0	296	21	15.1	51.8	WSW & SW	19.1 & 16.4
16	98.1	0	780	38	9.2	33.9	NNE & SW	13.0 & 11.6
Overall	47.2	0	780	21	20.8	63.7	WSW & SW	19.8 & 12.8

4.2 Deployment Summary

The petals on the current rose diagrams indicate current direction. For example if the broad ends of the petals are pointing to the east, then the current flowed to the east. Analysis of the depth-averaged current speed and direction for site #1006 Saddle Island (Fig. 3 and 4) illustrates the majority of water currents measured at this site flowed roughly to the west southwest and southwest, with approximately 32.6% of the depth averaged currents travelling in these directions. The depth-averaged current speed, which is the average speed of all currents in the presented cells, was 47.2 mm/s with the greatest recorded speed of 780 mm/s occurring 16 m from bottom. The most frequently observed speeds were between 15 and 30 mm/s (24.6%).

General trends in the profile of the water column at site #1006 are illustrated in Figures 5 through 12 and are further summarized in Figure 13. These figures, illustrate that, overall, water moves most frequently towards the west southwest and the southwest, but a reciprocal flow between the west southwest and east northeast was recorded in the two cells closest to the seafloor. In the cell closest to the surface, current directions toward the north northeast are more common (Fig. 12) and show a reciprocal flow to the west southwest. Surface currents are influenced by wind conditions, which is likely the case in Aspotogan Harbour. The average current velocities increased steadily with increased distance from the seafloor (Fig. 13), ranging from 33.7 mm/s at 3 m above the seafloor to 98.1 mm/s at 16 m above the seafloor. Maximum recorded current speeds also increased with distance from seafloor and ranged between 138 mm/s near the ocean floor and 708 mm/s near the surface. Again, wind conditions likely influence the current near the surface.

Figure 5 illustrates the distribution of current speed and direction at the deepest recorded cell of this deployment, with measurements made at approximately 3 m above the seafloor. At this depth, the primary current flow is to the east northeast and west southwest directions, which is a reciprocal flow. The most frequently observed current speeds fell between 15 to 30 mm/s (32.0%). The average velocity of currents observed at this depth was 33.7 mm/s, the lowest average of all depth profiles analyzed.

The data presented in Figure 12 represent the cell nearest to the surface of the water column that contained sufficient dependable readings for analysis (16 m above the seafloor). A different pattern was detected at this depth, with the most common current flowing towards the north northeast. The most frequently observed current speeds fell between 30 to 60 mm/s (24.1 %), while 7.4% of analyzed current data were greater than 240 mm/s. The average velocity of currents observed at this depth was 98.1 mm/s, which was the fastest average current speed of all cells analyzed.

5.0 DISCUSSION

Overall, the current profile at Saddle Island #1006 can be classified as low energy, with average current velocities ranging from 3.37 – 9.81 cm/s throughout the water column and a maximum observed current speed of 78.0 cm/s. Beveridge (1987) reported that current speeds between 10 and 60 cm/s are optimal for marine fish farming, and Pennell (1992) reported that near surface currents of less than 2 cm/s would be considered poor. While the majority of the currents at this site fell below the optimal range, the maximum current speeds observed were within the 10 to 60 cm/s range with slightly higher speeds at the surface. On average, current speeds fell below the minimum recommended speed of 2 cm/s (20 mm/s) 20.8% of the time, with surface currents only falling below 2 cm/s 9.2% of the time. None of the mean current speeds throughout the water column fell below 2 cm/s (20 mm/s).

High current velocities can be advantageous in many respects as they result in good flushing and dilution of organic and nitrogenous wastes. However, at the Saddle Island site, high current speeds were not common and only occurred at the surface of the water column. These higher speeds were likely the influence of winds and waves.

6.0 REFERENCES

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SIMCorp Marine Environmental Inc.

Baseline Assessment Report

Site #1006
Saddle Island

Aspotogan Harbour
Lunenburg County
Province of Nova Scotia

May 16, 2017

Prepared for:
Kelly Cove Salmon Ltd.
P.O. Box 33
Bridgewater, NS
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May 16, 2017

SIMCorp File #SW2016-061

Mr. Jeff Nickerson
Kelly Cove Salmon Ltd.
P.O. Box 33
Bridgewater, NS
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Dear Mr. Nickerson,

Reference: **Saddle Island (#1006) Baseline Report**

Please find enclosed the above noted report and attached video footage for the proposed boundary amendment of site #1006 at Aspotogan Harbour, N.S.

If you have any questions or comments on the above noted report please do not hesitate to contact me at [redacted]

Sincerely,

[redacted]

[redacted] B.Sc.
Marine Environmental Biologist
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[redacted]@simcorp.ca

cc: [redacted] (SIMCorp)
Michael Szemerda (KCS)
[redacted] (KCS)
Kate Richardson (NS DFA)

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APPENDICES

1.0 INTRODUCTION

The following baseline report and attached video have been prepared by SIMCorp for Kelly Cove Salmon Ltd. to summarise the findings of the formal baseline environmental survey required by the Nova Scotia Department of Fisheries and Aquaculture (NS DFA) and required under the *Aquaculture Activities Regulations* for the application for boundary amendment of the Saddle Island marine aquaculture site (#1006). Marine aquaculture site #1006 is located in Aspotogan Harbour, between the Aspotogan Peninsula and the north side of Saddle Island, Lunenburg County, Nova Scotia (Fig. 1). The area is shown on CHS chart #4386. The current lease has dimensions of approximately 310 X 250 X 290 X 260 m with an area of approximately 7.61 ha (Table 1).

Table 1. Current boundary and center coordinates of Saddle Island (#1006)

SITE COORDINATES (NAD 83)		
Corner	**Latitude**	**Longitude**
1	44° 30' 16.08"	64° 03' 04.62"
2	44° 30' 21.54"	64° 02' 52.80"
3	44° 30' 14.52"	64° 02' 47.10"
4	44° 30' 09.24"	64° 02' 57.90"
Site Center	44° 30' 15.06"	64° 02' 55.32"

The boundary amendment, as it was proposed at the time of the NS DFA baseline survey (April 11, 2017), would extend the lease boundaries to accommodate all below-surface gear and alter the cage layout to a 1 x 6 cage configuration. The dimensions of the proposed lease were approximately 844 X 358 m with an area of approximately 30.22 ha (Fig. 1, Table 2).

Table 2. Proposed corner and center coordinates of Saddle Island (#1006)

SITE COORDINATES (NAD 83)		
Corner	**Latitude**	**Longitude**
1	44° 30' 20.8"	64° 03' 11.7"
2	44° 30' 28.5"	64° 02' 35.1"
3	44° 30' 17.4"	64° 02' 30.5"
4	44° 30' 09.6"	64° 03' 07.2"
Approximate Site Center	44° 30' 19.1"	64° 02' 51.0"

Figure 1. Current location of site #1006, proposed boundaries, ADCP deployment and baseline stations

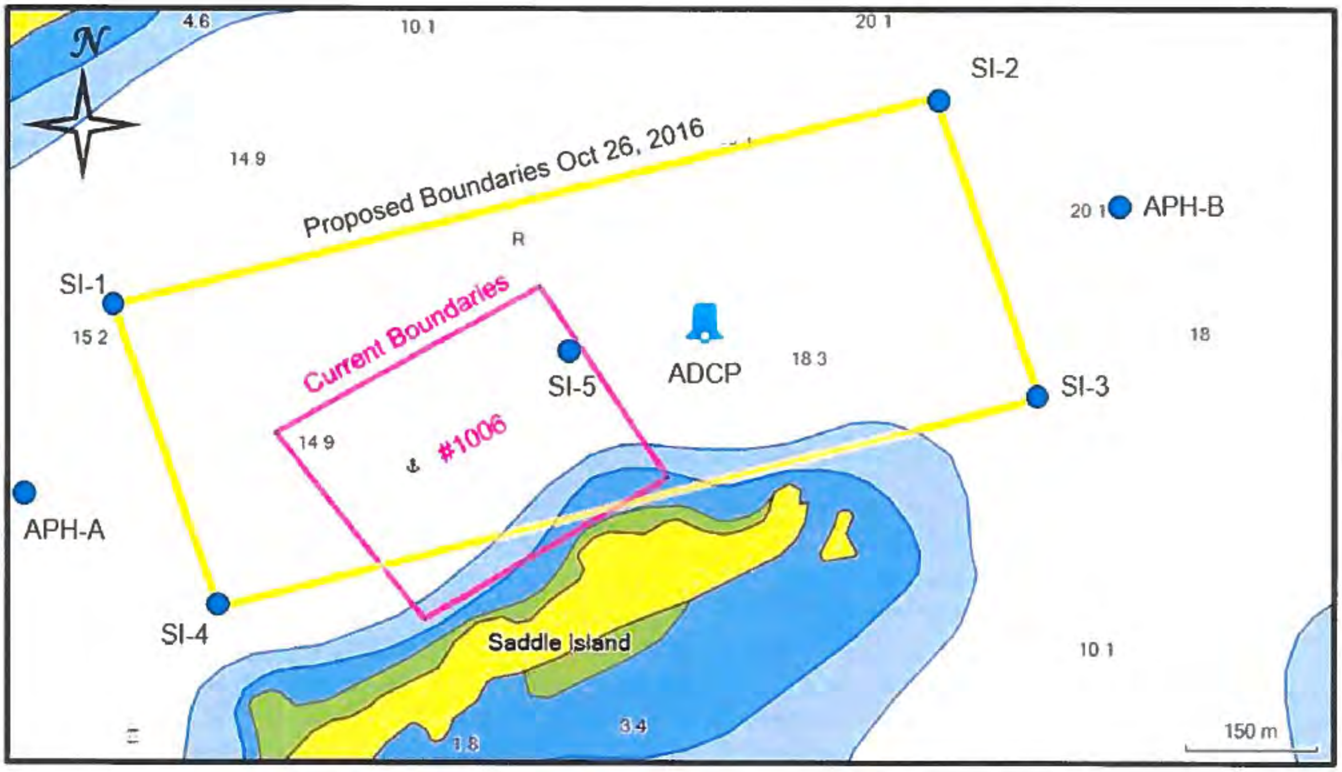

Table 3. Summary of proposed changes to site #1006

Brier Island	Dimensions (m)	Area (ha)	Cages	Grid Size (m)	Production (# fish)
Current boundaries	310 x 250 x 290 x 260	7.61	6 steel 2 circular	N/A	390,000
Proposed boundaries	844 x 358	30.22	1 x 6 Plastic circles	76	440,000

1.1 Completeness of Baseline Information

Due to outstanding circumstances, the baseline survey report was not complete at the time of the *Boundary Amendment Application – Boundary Amendment for Site #1006 Saddle Island*, submitted to NS DFA on October 24th, 2016.

2.0 CONTACT INFORMATION

Proponent:
Company Name: Kelly Cove Salmon Ltd.
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3.0 DEPOSITIONAL MODELLING

3.1 Flow Data Summary Statistics

Measurements of the current speed and direction were collected using a 600-kHz Teledyne RDI Workhorse Sentinel ADCP unit deployed by the Nova Scotia Department of Fisheries and Aquaculture (NS DFA) at coordinates N44° 30' 20.3" W64° 02' 45.9" in 20.7 m of water from October 7 to November 24, 2016 (Fig. 1). 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 by NS DFA staff and analysed, and processed by SIMCorp staff. Graphs and figures demonstrating the frequency distribution of both current speed and direction are presented in Appendix I.

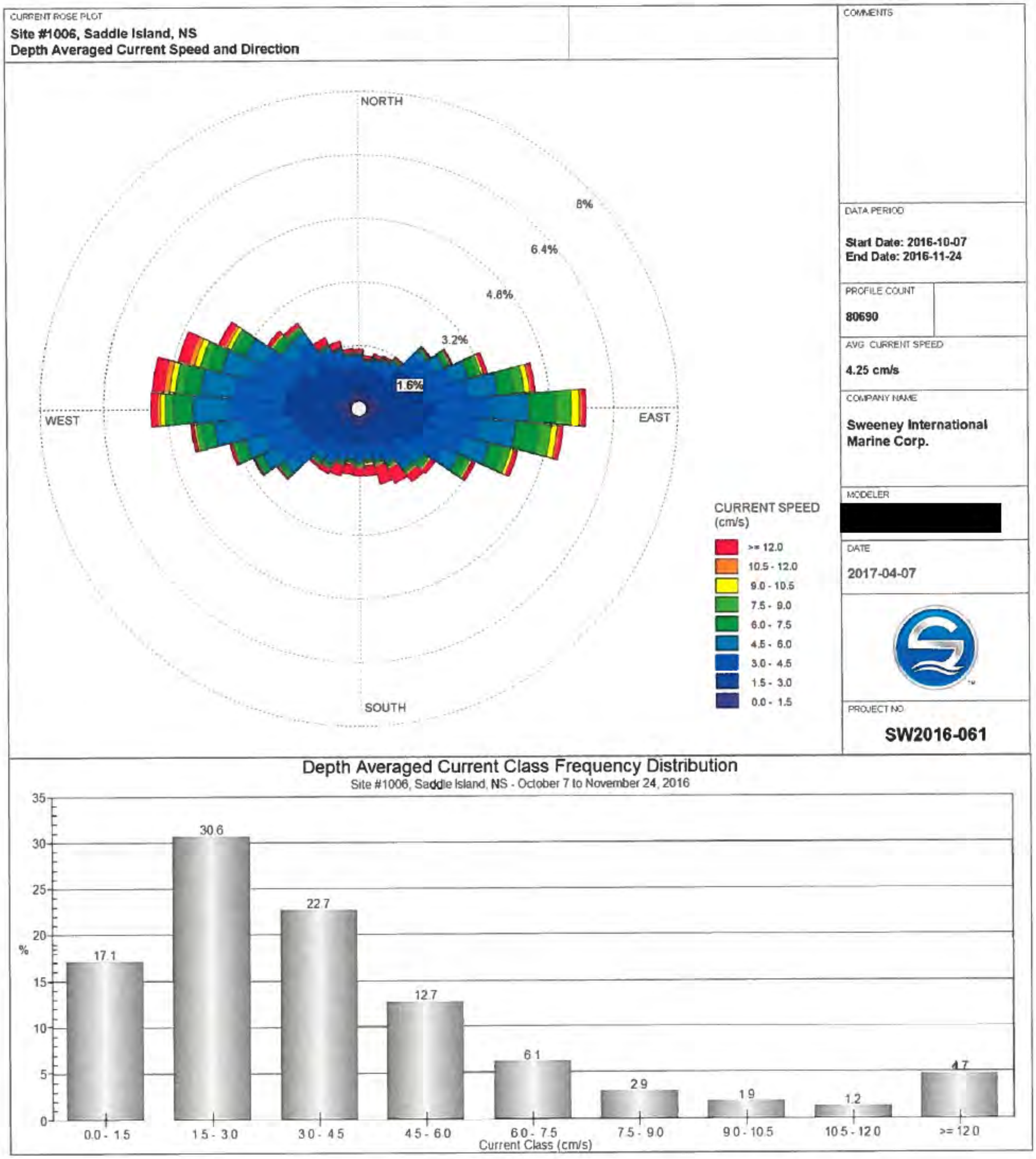
At depths 3 – 15 m above the seafloor, the predominant current directions centered around the WNW and ESE (Table 5). Between 16 and 18 m above the seafloor, the current shifted a little more to the west. At 19 and 20 m above the seafloor, SSE currents were the most common. The currents in the upper water column were most likely influenced by wind direction.

The maximum current speed observed was 140.4 cm/s while the minimum was 0 cm/s (Table 5). The overall mean current speed was 4.25 cm/s (Fig. 2) but currents in the uppermost cell presented (*i.e.* 20 m above the seafloor) were considerably faster at 13.3 cm/s. Again, this was likely due to the influence of wind. Overall, current speeds < 5 cm/s occurred 75.5% of the time. Graphs illustrating the current directions and current speed frequency distributions can are located in Appendix I.

Table 4. Flow data summary statistics

Saddle Island	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	2.68	0	13.3	1.6	45.8	86.7	WNW & ESE
4	3.2	0	19.0	1.6	33.5	82.7	WNW & ESE
5	3.44	0	18.7	1.9	28.8	79.2	WNW & ESE
6	3.51	0	20.5	1.6	27.5	78.4	WNW & ESE
7	3.5	0	18.6	2.5	27.2	79.5	WNW & ESE
8	3.51	0	20.8	2.1	27.0	79.5	WNW & ESE
9	3.52	0	20.8	2.5	26.9	79.9	WNW & ESE
10	3.52	0	19.6	2.4	26.8	79.3	WNW & ESE
11	3.53	0	18.1	2.1	26.8	79.3	WNW & ESE
12	3.49	0	17.7	1.6	27.9	79.6	WNW & ESE
13	3.47	0.1	17.7	2.5	28.8	79.9	WNW & ESE
14	3.46	0	19.3	2.0	28.6	79.9	WNW & ESE
15	3.47	0.1	18.0	2.5	28.8	80.1	WNW & ESE
16	3.46	0	18.5	3.0	28.7	80.2	W & ESE
17	3.6	0	24.0	1.6	27.1	78.8	WNW & ESE
18	4.44	0	57.6	1.7	24.5	72.0	W & WNW
19	9.41	0.1	140.4	2.1	15.1	47.3	SSE
20	13.3	0.1	121.1	5.1	6.2	25.2	SSE
Overall	**4.25**	**0**	**140.4**	**2.1**	**27.3**	**75.5**	**WNW & ESE**

Figure 2. Average current speed and direction recorded at site #1006 within 3 – 20 m above the seafloor



3.2 Model Predictions

Depositional modelling has not been completed for the Saddle Island site at the time of this report. An affordable modelling program that has been tested for accuracy is not yet available. After the release of NewDEPOMOD, model outputs will be generated and submitted when available.

4.0 FISH HABITAT SURVEY

4.1 Methodology

The methods employed to conduct the NS DFA baseline survey were adapted, in consultation with NS DFA 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.

Video images and associated data were collected by SIMCorp Field Supervisor and Marine Environmental Biologist [redacted] B.Sc., Marine Environmental Biologist [redacted] B.Sc., and Technician [redacted] on April 11, 2017. Boat operators [redacted] and [redacted] were contracted from Blandford Auto and Marine. High tide was at 09:37 (1.8 m) and low tide at 16:07 (0.4 m).

Seafloor observations from past environmental monitoring program (EMP) reports and the seafloor observations from the 2017 NS DFA baseline survey were compiled in pictorial form to produce a map of the seafloor characteristics (Fig. 3). EMP observations were made within the area of the grid array.

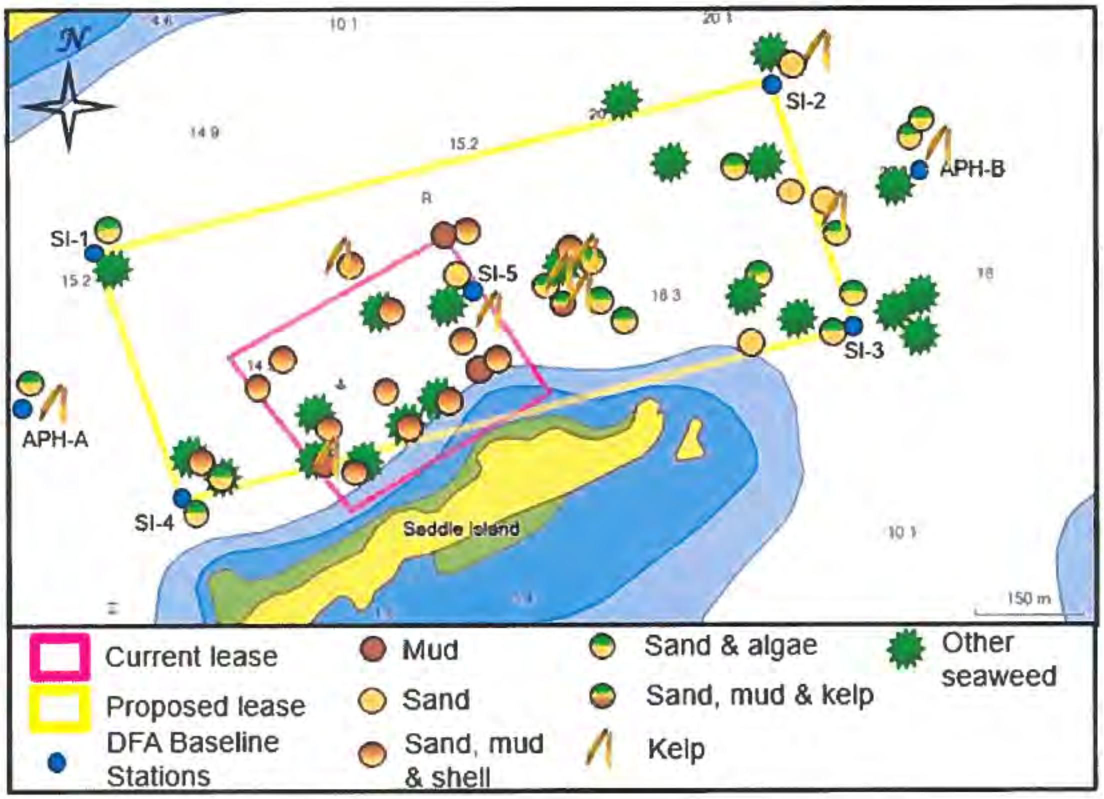
4.2 Sampling Locations

A total of seven stations were investigated for the purpose of the DFA baseline survey (Fig. 1). At the time of the survey, there was gear on site; therefore, only the four corners of the proposed boundaries, site center, and two reference stations were surveyed. The station coordinates are presented in Table 6. To provide information of the seafloor characteristics within the grid array, observations from previous EMP reports were included. The grid array is expected to cover, at least in part, the depositional area characterised by at least 1 g C m^{-2} d^{-1} reaching the seafloor.

Table 5. Baseline sampling coordinates at site #1006 Aspotogan Harbour

SITE COORDINATES (NAD 83)			
Station	**Location**	**Latitude**	**Longitude**
SI1	NW Corner	44° 30' 20.8"	64° 03' 11.8"
SI2	NE Corner	44° 30' 28.5"	64° 02' 34.9"
SI3	SE Corner	44° 30' 18.0"	64° 02' 30.1"
SI4	SW Corner	44° 30' 09.5"	64° 03' 07.3"
SI5	Site Center	44° 30' 19.0"	64° 02' 51.2"
APH-A	Downstream Reference	44° 30' 13.9"	64° 03' 15.6"
APH-B	Upstream Reference	44° 30' 24.5"	64° 02' 26.9"

Figure 3. Benthic habitat characterization at Saddle Island (#1006)



4.3 Video Surveillance

Video footage for the NS DFA baseline was recorded using a Falkjar Underwater Camera System, which was mounted perpendicular to 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 JW 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 clipboard showing collection location information and followed with 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 a minimum of 5-m^2 of seafloor over a minimum duration of two minutes. Screen shots of the seafloor for each sample location are available in Appendix F. 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 7 – 14 and Figure 3. Ratings of video quality are on a scale of 1 to 4. A value of 1 indicates poor video quality with no recognition of sediment surface indicators. A video rated as 2 results in better visual identification; however, determination of sediment condition is poor. A rating of 3 shows improved video quality, but the smaller items may be indistinguishable; and a rating of 4 signifies a high quality video with easy identification of animals and substrate conditions.

4.4 Results and Observations

Tables 7 – 13 include benthic observations from the baseline sampling stations as required by NS DFA for proposed marine aquaculture lease #1006. Station observations are presented in the order they were sampled and a summary of benthic observations is presented in Table 14. An Irish moss bed was present at the southeast corner of the proposed lease with kelp and other macroalgae present. All corners were characterised by hard-packed sand, a light layer of silt, shell debris, and macroalgae. Flora and fauna observed in the video footage and in grab samples included kelp, Irish moss, cumacea, shrimp, sea urchin, and other macroalgae.

Examination of benthic conditions reported during Environmental Monitoring Program (EMP) surveys indicated that the majority of the seafloor below the grid array consisted primarily of mud with sand. Kelp and other macroalgae were commonly observed within the grid area. Benthic habitat characterized during the baseline and past EMP surveys is depicted in Figure 3.

Table 6. SI-5 benthic log

Sampling Date:	April 11th, 2017
Water Body:	Aspotogan Harbour
Lease Name and Number:	Saddle Island #1006
Water Temperature (°C)	4.2 °C
Wind Direction and Speed:	Calm
Wave Action:	Calm
Current Direction & Speed:	Calm
Tide Schedule:	High @ 9:37 (1.8m) Low @ 16:07 (0.4m)
Vessel:	Boston Whaler

Lease # or Reference Site:	Corner
Video Start Time:	10:21 AM
Recorder Name(s):	[redacted]
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Samples:** [redacted]
Sampling Station ID:	SI-5
Dist. and Dir. from Waypoint:	5 m @ 247°
Sampling Coordinates:	N44 30.3173 W64 02.8534
Station Depth (m):	23.2
Video (Y/N):	Y
Number of Collection Attempts:	4

Station Comments:

Video Notes:
Moderately packed brown sand and silt, shrimp, detritus, macroalgae, kelp, trace *Beggiatoa*,

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.

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	SI-5 (1)	Brown sand, mud	None	6	Cumacea, sea lettuce, shell debris
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.29	Y	SI-5 (2)	Brown sand, mud	Moderate	8	Worm tubes, amphipods, cumacea
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.31	Y	SI-5 (3)	Brown sand, mud	Slight	7	Shell debris, worm tubes, cumacea, amphipods

Table 7. SI-2 benthic log

Lease # or Reference Site:	Comer						**Station Comments:**
Video Start Time:	11:09 AM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Samples:** [redacted]						**Video Notes:**
Sampling Station ID:	SI-2						Hard packed brown sand, shell debris, detritus, macroalgae, shells
Dist. and Dir. from Waypoint:	6 m @ 117°						
Sampling Coordinates:	N44 30.4745 W64 02.5820						**Benthic Descriptor Key:**
Station Depth (m):	22.6						[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. 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	0.26	Y	SI-2 (1)	Brown sand, mud	None	7	Ribbon worm
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.26	Y	SI-2 (2)	Brown sand, mud	None	6.5	Cumacea, kelp
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.2	Y	SI-2 (3)	Brown sand, mud	None	6	Cumacea, shell debris

Table 8. APH-B benthic log

Lease # or Reference Site:	Reference						**Station Comments:** Could not achieve grab samples due to large amounts of kelp, irish moss and other macro algae
Video Start Time:	11:43 AM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Samples:** [redacted]						**Video Notes:** Red algae bed, kelp, macroalgae, finger sponges, light layer of silt over macroalgae beds.
Sampling Station ID:	APH-B						
Dist. and Dir. from Waypoint:	2 m @ 24°						
Sampling Coordinates:	N44 30.4079 W64 02.4479						**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):	25						
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		N					
Benthic Replicate 2 (10 mL) Standard Ponar Grab		N					
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 9. SI-3 benthic log

Lease # or Reference Site:	Comer						**Station Comments:** Could not get 3 acceptable sediment samples. The original coordinates were accidentally written before the boat was on mark. The video starts 2 m @ 61° from the target coordinate.
Video Start Time:	12:17 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Samples:** [redacted]						**Video Notes:** Hard packed brown sand and silt, shell debris, sea lettuce, macroalgae, detritus, shrimp
Sampling Station ID:	SI-3						
Dist. and Dir. from Waypoint:	23 m @ 26° (See station comments)						
Sampling Coordinates:	N44 30.3007 W64 02.5010						**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):	25.3						
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	0.33	Y	SI-3 (1)	Brown sand, mud	None	5	
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.34	Y	SI-3 (2)	Brown sand, mud	None	7.5	Cumacea, shell debris, macro algae
Benthic Replicate 3 (10 mL) Standard Ponar Grab		N					

Table 10. SI-4 benthic log

Lease # or Reference Site:	Comer						**Station Comments:**
Video Start Time:	1:01 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted]			**Syringe Samples:** [redacted]			**Video Notes:** Hard packed brown sand, shell debris, macroalgae, shells, kelp, collander
Sampling Station ID:	SI-4						
Dist. and Dir. from Waypoint:	2 m @ 211°						
Sampling Coordinates:	N44 30.1589 W64 03.1209						**Benthic Descriptor Key:**
Station Depth (m):	18.3						[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. 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	0.34	Y	SI-4 (1)	Brown sand	None	7	Macro algae, shell debris
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.35	Y	SI-4 (2)	Brown sand	None	6	Shell debris, kelp
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.35	Y	SI-4 (3)	Brown sand	None	5	Mussel, kelp

Table 11. APH-A benthic log

Lease # or Reference Site:	Reference						**Station Comments:**
Video Start Time:	1:42 PM						
Recorder Name(s):	[redacted]						
Sample Collector's Name(s)	**Sediment Sampler:** [redacted]			**Syringe Samples:** [redacted]			**Video Notes:**
Sampling Station ID:	APH-A						Hard packed brown sand and silt, shell debris, detritus, macroalgae,
Dist. and Dir. from Waypoint:	1 m @ 36°						mussel, trace amounts of kelp
Sampling Coordinates:	N44 30.2321 W64 03.2599						**Benthic Descriptor Key:**
Station Depth (m):	19.8						[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	0.35	Y	APH-A (1)	Brown sand	None	5	Cumacea, shell debris, irish moss
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.34	Y	APH-A (2)	Brown sand	None	5	Cumacea, shell debris, irish moss
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.35	Y	APH-A (3)	Brown sand	None	5	Cumacea, shell debris

Table 12. SI-1 benthic log

Lease # or Reference Site:	Comer	**Station Comments:**
Video Start Time:	2:07 PM	
Recorder Name(s):	[redacted]	
Sample Collector's Name(s)	**Sediment Sampler:** [redacted] **Syringe Samples:** [redacted]	**Video Notes:** Hard packed brown sand and silt, detritus, macroalgae, shell debris, sea urchin, scallop shells
Sampling Station ID:	SI-1	
Dist. and Dir. from Waypoint:	1 m @ 33°	
Sampling Coordinates:	N44 30.3464 W64 03.1963	**Benthic Descriptor Key:**
Station Depth (m):	19.8	[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. 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	0.37	Y	SI-1 (1)	Brown sand	None	8	Shrimp, shell debris, worm tubes
Benthic Replicate 2 (10 mL) Standard Ponar Grab	0.35	Y	SI-2 (2)	Brown sand	None	7	Shell debris
Benthic Replicate 3 (10 mL) Standard Ponar Grab	0.34	Y	SI-3 (3)	Brown sand	None	7	Shell debris

Table 13. Baseline video observation tables from April 11, 2017 survey

Station	Latitude	Longitude	Depth (m)	Time	Video Quality	Substrate											Comments
						Primary	Descriptors										
						> 50% (hard/soft)	Rockwall	Bedrock	Boulders	Rubble	Cobble	Gravel/Sand	Silt/Mud	Organic	Floc		
SI-5	N44 30.3173	W64 02.8534	23.2	10:21	3	Soft						85%	15%				
SI-2	N44 30.4745	W64 02.5820	22.6	11:09	3	Hard						95%	5%				
APH-B	N44 30.4079	W64 02.4479	25.0	11:43	4	Hard							5%				Red algae bed
SI-3	N44 30.3007	W64 02.5010	25.3	12:17	4	Hard						95%	5%				
SI-4	N44 30.1589	W64 03.1209	18.3	13:01	4	Hard						100%					
APH-A	N44 30.2321	W64 03.2599	19.8	13:42	3	Hard						95%	5%				
SI-1	N44 30.3464	W64 03.1963	19.8	14:07	4	Hard						95%	5%				

Note: It is important to clarify that hard bottom is indicated in the video observations when the camera frame is observed to hit or impact the substrate which is indicative of bedrock, boulder, rubble, cobble, gravel or hard packed finer substrate consisting of mud, sand or silt. Soft bottom is indicated in the video observations when the camera frame is observed to sink in the substrate which is indicative of a softer, more loosely packed mud, sand or silt. Substrate Descriptions are visual estimations of surface coverage.

Station	Latitude	Longitude	Depth (m)	Time	Video Quality	Benthic Indicators					Other Benthic Observations (P/A)				Sed. Colour	Flora (%)		Fauna (Abundance)		Other Flora and Fauna Comments
						Beggiatoa		OPC		Barren (P/A)	Off Gas	Feed	Shell Debris	Mussel Shells						
						P/A	%	P/A	%							Crust. Algae	Kelp	Fish	Crabs	
SI-5	N44 30.3173	W64 02.8534	23.2	10:21	3	A	Trace	A	0%	A	A	A	A	A	Brown	0%	5%	0	0	Shrimp (multiple); detritus; macroalgae
SI-2	N44 30.4745	W64 02.5820	22.6	11:09	3	A	0%	A	0%	A	A	A	P	A	Brown	0%	0%	0	0	Detritus; macroalgae; shells
APH-B	N44 30.4079	W64 02.4479	25.0	11:43	4	A	0%	A	0%	A	A	A	A	A	Brown	0%	25%	0	0	Red algae bed; macroalgae; finger sponge
SI-3	N44 30.3007	W64 02.5010	25.3	12:17	4	A	0%	A	0%	A	A	A	P	A	Brown	0%	0%	0	0	Sea lettuce; macroalgae; shrimp (multiple)
SI-4	N44 30.1589	W64 03.1209	18.3	13:01	4	A	0%	A	0%	A	A	A	P	A	Brown	0%	5%	0	0	Macroalgae; shells
APH-A	N44 30.2321	W64 03.2599	19.8	13:42	3	A	0%	A	0%	A	A	A	P	P	Brown	0%	Trace	0	0	Detritus; macroalgae; mussel (1)
SI-1	N44 30.3464	W64 03.1963	19.8	14:07	4	A	0%	A	0%	A	A	A	P	A	Brown	0%	0%	0	0	Detritus; macroalgae; sea urchin (1); scallop shells (2)

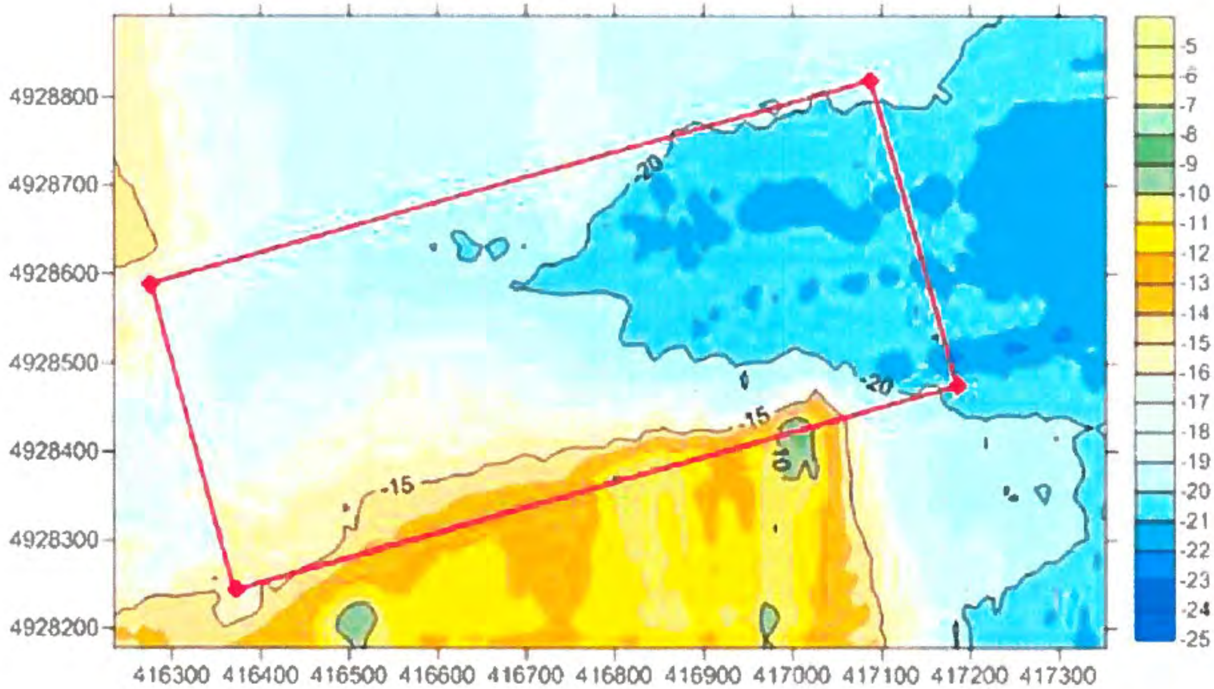
Note: It is important to clarify that observations may be made outside of the (50 cm)² quadrat, and that *Beggiatoa*-like species and Other Benthic Observations of Flora are visual estimations of surface coverage.
Benthic Indicators: A or "Absence" represents < 5 % coverage for OPC or Beggiatoa. P or "Presence" represents ≥ 5 % coverage for OPC or Beggiatoa

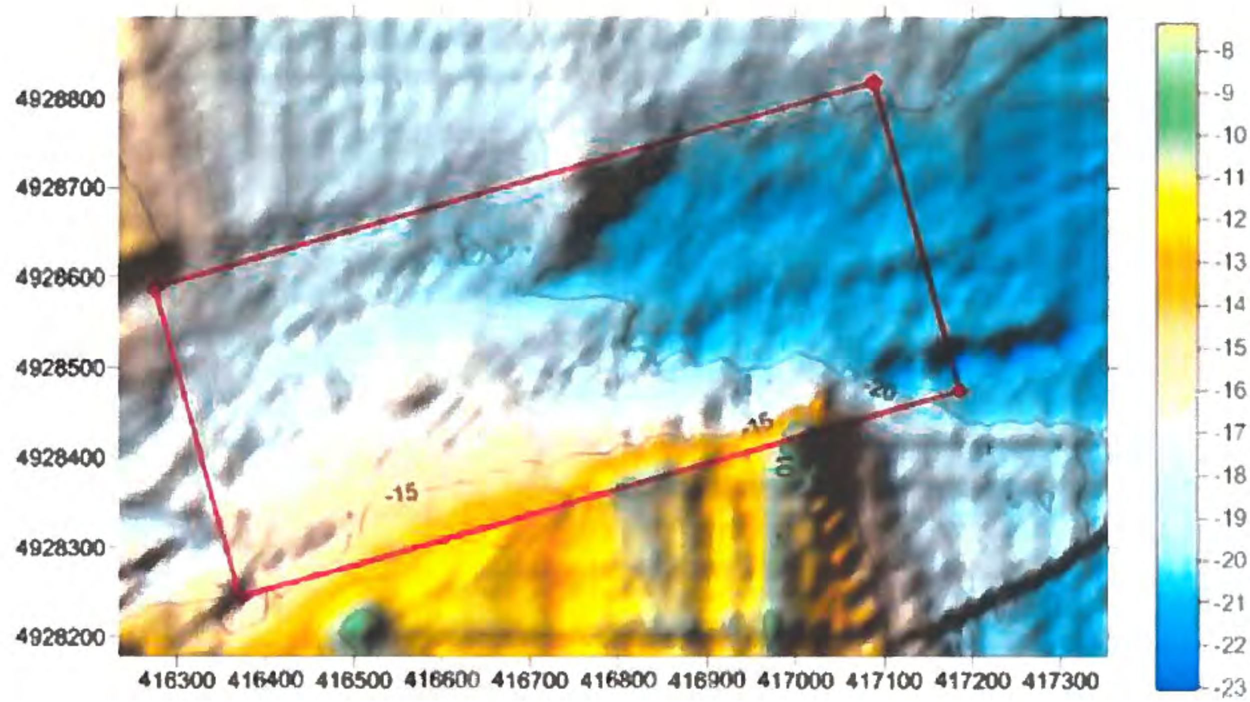
5.0 BATHYMETRY

Side-scan-based depth profiling of lease #1006 was carried out on October 7, 2016 and the data gathered used to produce both a three-dimensional surface map and a two-dimensional contour diagram of the site. Scanning of the Saddle Island area began at the northwest corner of the proposed lease. Parallel transects were run the length of the lease area, separated by approximately 50 m. The data gathered during the scanning was then compiled and then used to produce both a three-dimensional, surface map and a two-dimensional, contour diagram of the site. The lease boundary is located over 9 m to 21 m depths. The shallowest depths are located along the southern edge of the site with a steep slope to the northeast (Fig. 4). The deepest water is located in the northeastern end of the site. 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.

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 were corrected for tidal influences, thus the soundings displayed represent the depths relative to chart datum.

Figure 4. Interpolated 2D bathymetric profiles of site #1006 at Saddle Island





6.0 COMPOSITION OF THE SEABED

6.1 Methodology

The methods employed to conduct the seafloor survey were adapted, in consultation with NS DFA 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* (SOPs) dated June 2016.

Sediment samples and associated data were collected by SIMCorp on April 11, 2017 as stated in Section 4.1 Fish Habitat Survey - Methodology.

6.2 Sampling Locations

A total of seven stations were investigated for the purpose of the NS DFA baseline survey (Fig. 3). At the time of the survey, there was gear on site; therefore, only the four corners of the proposed boundaries, site center, and two reference stations were surveyed. The station coordinates are presented in Table 6.

6.3 Sample Collection

A standard Ponar grab was used in an attempt to collect sediment samples from all of the baseline stations. After deployment, the grab was pulled aboard and placed on the boat deck. When present, the overlying water in the grab was removed via siphon and a picture was taken of the contents (Appendix E). 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 (POM). The remaining top 2-cm of sediment were 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 G.

All reasonable efforts were made to conform to the SOPs, maintain storage temperatures of samples, to collect samples that were as undisturbed as possible and to preserve the integrity of the samples until analysed. However, sediment at station APH-B could not be collected at site #1006 as it is located on beds of kelp, Irish moss and other macro algae and only 2 replicates were able to be collected at corner station SI-3 due to hard packed sediment (Appendix H).

6.4 Sediment Sample Analysis

6.4.1 Sediment Sample Analysis

All sediment samples were analysed within 25 hours of collection for redox potential and sulphide ion concentration (Table 15, Figure 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 (Table 16). A copy of the laboratory data sheet for the redox and sulphide is available in Appendix B.

Sediment samples from each station were sent to the SIMCorp Marine Benthic Sediments Laboratory for analysis of porosity, percent organic matter, grain size, and pH. The results of these analyses are presented in Table 17, Appendix C, and Appendix D.

6.4.2 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 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 calibrations took place in accordance with SOP protocols at 09:00 and 10:30 on April 12, 2017. Two probes were calibrated and used to analyse the samples. The calibration events resulted in a final slope range between -27 and -33 mV (-31.6 & -31.0 mV for probes 1 and 2 respectively). The calibration curve for probe 1 was between -25 to -30 mV [500 to 5000 µM read: -28.9 mV, 1000 to 10000 µM read: -27.8 mV]. The calibration curve for probe 2 was between -25 to -30 mV [500 to 5000 µM read: -28.9 mV, 1000 to 10000 µM read: -27.5 mV]. The results of the five-point factor calibrations are located in Appendix A. The calibration temperatures were 22.2 and 21.8°C for probes 1 and 2 respectively.

6.5 Results and Observations

Review of the video footage collected from the proposed lease area in Aspotogan Harbour revealed no evidence of waste feed, salmon faeces, or other organic deposits. The substrate at site #1006 consisted mainly of hard-packed brown sand with some silt and shell debris. Grain-size analysis results are presented in Appendix C and further support these observations.

Analysis of the sulphide concentration and redox potential indicate oxic conditions at every survey station where sediment could be collected. Sediment could not be collected at station APH-B due to macroalgae beds.

Table 14. Redox potential and sulphide concentration of sediment samples collected at proposed marine aquaculture lease #1006

Site #1006 – Saddle Island

Sample Collection: April 11, 2017 10:00 – 14:40
Sample Analysis: Redox: April 12, 2017 09:05 - 10:40
Sulphides: April 12, 2017 09:05 - 10:45

Sample I.D.		Core Sample Temp	Redox	Redox	Sulphide	
Station	ID#	°C	mV	mVNHE	µM	mV
APH-A	1	9.9	386.2	600.3	31	-840.5
	2	11.5	340.3	552.8	42	-844.5
	3	10.3	307.4	521.1	33	-840.8
Means		10.6	344.6	**558.1**	**36**	-841.9
APH-B	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS
Means		NS	NS	**NS**	**NS**	NS
SI-1	1	9.2	296.8	511.6	156	-863.9
	2	9.5	101.2	315.7	168	-865.3
	3	10.8	23.2	236.4	408	-877.3
Means		9.8	140.4	**354.6**	**244**	-868.8
SI-2	1	7.4	136.4	353.0	231	-869.6
	2	10.4	136.8	350.4	178	-866.0
	3	10.3	140.9	354.6	112	-859.9
Means		9.4	138.0	**352.7**	**174**	-865.2
SI-3	1	6.8	52.7	269.9	704	-884.6
	2	9.9	-9.8	204.3	268	-871.6
	3	NS	NS	NS	NS	NS
Means		8.4	21.5	**237.1**	**486**	-878.1
SI-4	1	10.6	154.1	367.5	164	-864.9
	2	8.6	129.4	344.8	156	-864.2
	3	10.1	94.3	308.2	385	-876.8
Means		9.8	125.9	**340.2**	**235**	-868.6
SI-5	1	10.1	68.6	282.5	321	-874.1
	2	10.7	68.3	281.6	277	-872.0
	3	11.5	47.5	260.0	627	-882.8
Means		10.8	61.5	**274.7**	**408**	-876.3

Redox Test Solution (for probes 1 & 2, respectively)

Prior to analysis: 222.1 mV & 222.3 mV @ 25°C
Post analysis: 221.9 mV & 222.6 mV @ 25°C

Sulphide Probe Calibration Temperatures: 22.2 & 21.8°C

Sulphide Probe 1 Calibration:

Standard	mV
100	-858.3
500	-880.5
1000	-889.4
5000	-909.4
10000	-917.2

Sulphide Probe 2 Calibration:

Standard	mV
100	-856.1
500	-877.8
1000	-887
5000	-906.7
10000	-914.5

Sample met all grab quality criteria
Sample did not meet all quality criteria
Reference station

Figure 5. Graph of mean redox and sulphide values for baseline sampling at site #1006

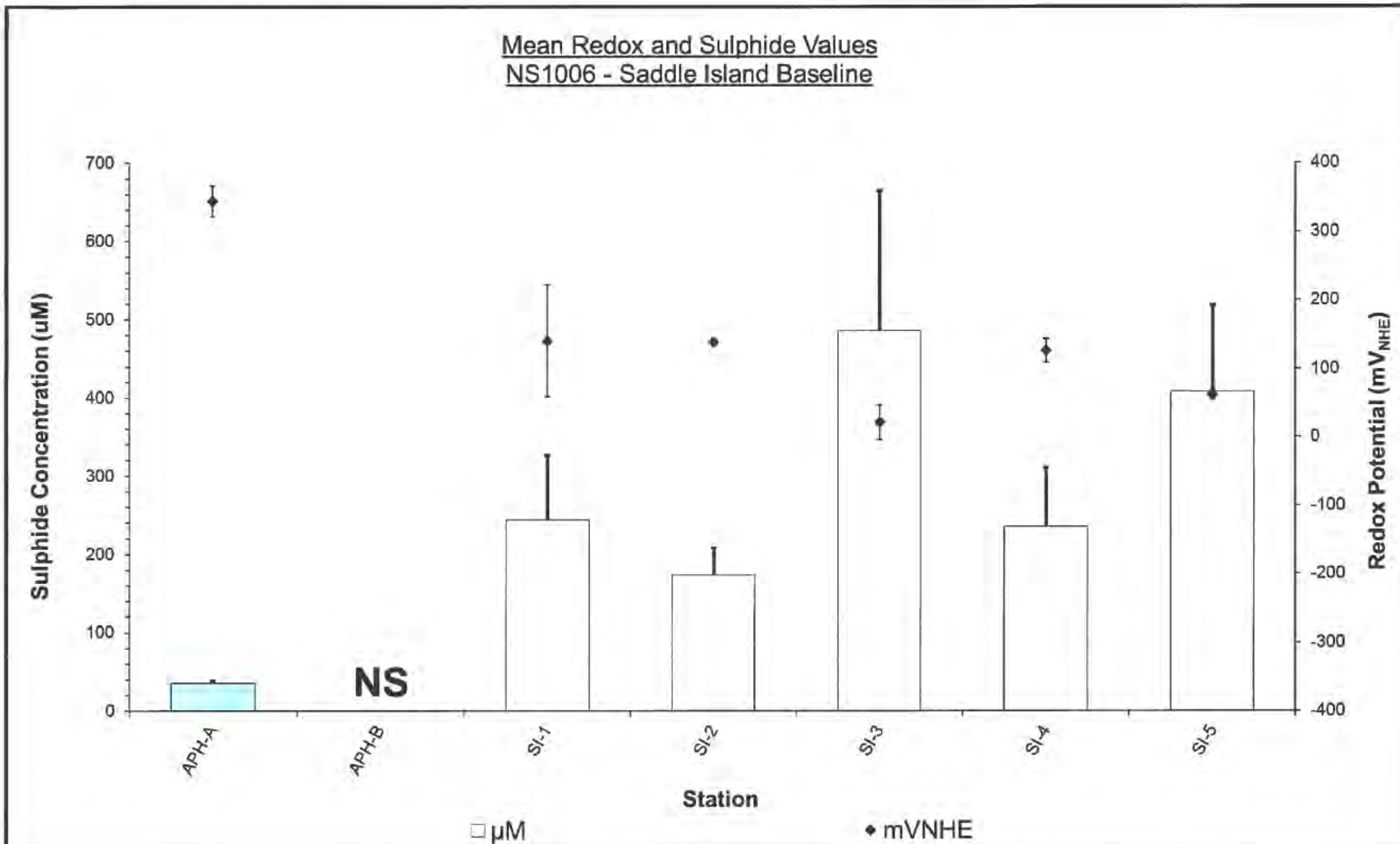


Table 15. Environmental quality definitions for Nova Scotia marine aquaculture monitoring

Measurement	Sediment Classification 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
Sulphide (µM)	< 750 (A) 750 to 1499 (B)	1500 to 2999 (A) 3000 to 5999 (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 ref.
Porosity (%)	≤ reference*	1 to 10X ref.	> 10X ref.

Table 16. 2017 baseline porosity and percent organic matter data for site #1006

Station	Sample #	Porosity Value (%)	% Organic Matter
APH-A	1	24.24	1.38
APH-A	2	25.61	1.52
APH-A	3	26.76	1.53
APH-B	1	N/S	N/S
APH-B	2	N/S	N/S
APH-B	3	N/S	N/S
SI-1	1	37.17	2.96
SI-1	2	32.05	2.85
SI-1	3	46.89	5.21
SI-2	1	29.11	2.01
SI-2	2	30.34	2.11
SI-2	3	27.69	1.93
SI-3	1	42.70	4.34
SI-3	2	40.81	4.39
SI-3	3	N/S	N/S
SI-4	1	25.31	1.74
SI-4	2	27.77	2.19
SI-4	3	54.73	7.70
SI-5	1	28.27	2.49
SI-5	2	66.35	10.29
SI-5	3	29.66	2.81

Note: samples in turquoise are from reference station

6.6 Side Scan Mosaics

Sonar technology emits an acoustic signal, which is sent from a transducer through the water column and bounces back when the signal is interrupted. This creates a shadow or image from which structures within the water column or on the seafloor can be identified. Side-imaging sonar was used to scan the water column and seafloor of site #1006, in Aspotogan Harbour, NS. Side-scan images were recorded using a Humminbird Helix 5 SI-GPS, Internal Side Imaging / GPS Combo on October 6, 2016. The side-imaging sonar uses a razor-thin beam to scan the area up to 240 feet to the left and right of the transducer. Transects were scanned at 40- to 50-m intervals within the boundaries of the site. The scans are overlaid onto a google earth image of the site (Fig. 5). Side-scan images can show features on the seafloor, such as anchor blocks, rock outcroppings, or other objects projecting above the seafloor.

Figure 6. Side scan mosaic of Saddle Island site #1006

7.0 ESTABLISHING REFERENCE STATIONS

Relocating the site will place the current reference stations (APH-61 and APH-67) within the proposed lease boundaries, therefore new reference stations have been established and proposed to NS DFA (Figure 6; Table 17). APH-A and APH-B are located approximately 140 m west southwest and 135 m north northeast, respectively, from the proposed lease boundary. The proposed reference stations were sampled for sediment chemistry and video analysis during the fish habitat and seafloor characteristic survey.

Figure 7. Proposed change in reference station locations for Saddle Island (#1006)

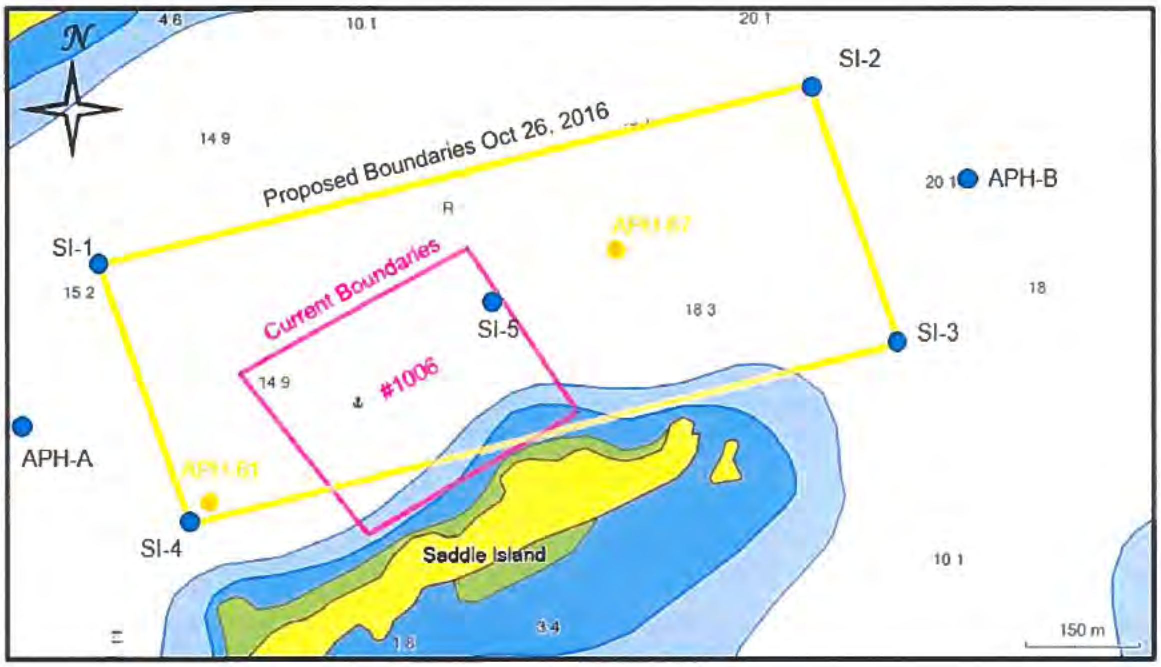


Table 17. Reference station coordinates for Saddle Island (#1006)

REFERENCE STATION COORDINATES (NAD 83)		
Station	**Latitude**	**Longitude**
APH-61	44° 30' 10.7"	64° 03' 06.2"
APH-67	44° 30' 20.7"	64° 02' 44.8"
APH-A	44° 30' 13.9"	64° 03' 15.6"
APH-B	44° 30' 24.4"	64° 02' 26.9"

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:	12-Apr-17
Meter:	2173509
Sulfide Probe ID:	SS1-15402

Project: SW2016-061 Saddle Island (#1006)

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

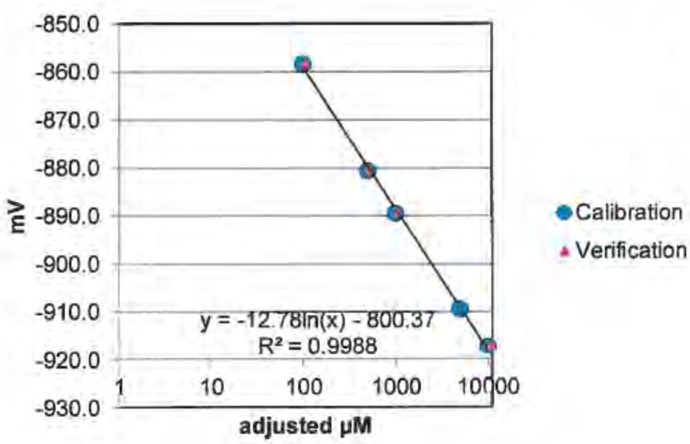
Date calibration performed:	12-Apr-17		
Time calibration completed:	9:00am	**Expiration time:**	12:00pm
Calibration performed by:	[redacted]		

Calibration Temperture: 22.2°C

Calibration -

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

10 µM (really 100 µM)	set at	-858.3 mV	read at	10.7 µM at	-858.9 mV
50 µM (really 500 µM)	set at	-880.5 mV	read at	51.8 µM at	-880.7 mV
100 µM (really 1000 µM)	set at	-889.4 mV	read at	108 µM at	-890.1 mV
500 µM (really 5 000 µM)	set at	-909.4 mV	read at	5025 µM at	-909.9 mV
1 000 µM (really 10 000 µM)	set at	-917.2 mV	read at	1090 µM at	-917.2 mV



Final slope (meter) = -31.6 mV

10 fold slope (validation)

500 to 5 000 µM: -28.9 mV
1000 to 10 000 µM: -27.8 mV

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

Signed off by:

[redacted]

[redacted] M.Sc.
Senior Laboratory Manager

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: 12-Apr-17
Meter: 2116118
Sulfide Probe ID: TQ1-13493

Project: SW2016-061 Saddle Island (#1006)

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

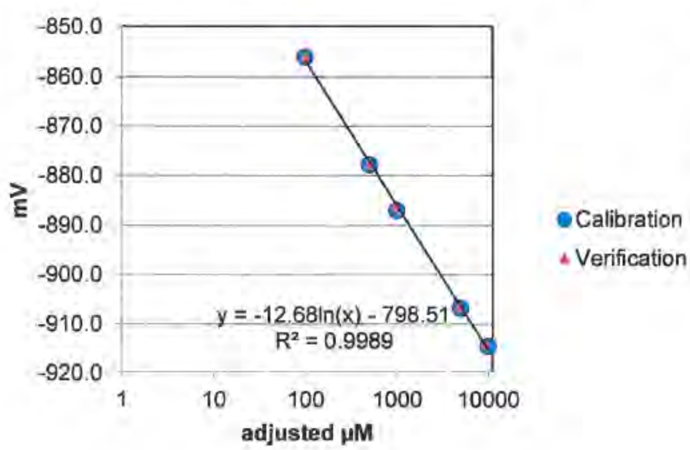
Date calibration performed: 12-Apr-17
Time calibration completed: 10:30am **Expiration time:** 1:30pm
Calibration performed by: [redacted]

Calibration Temperature: 21.8°C

Calibration -

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

10 μM (really 100 μM)	set at	-856.1 mV	read at	9.99 μM at	-856.2 mV
50 μM (really 500 μM)	set at	-877.8 mV	read at	50.6 μM at	-877.7 mV
100 μM (really 1000 μM)	set at	-887 mV	read at	96.3 μM at	-886.2 mV
500 μM (really 5 000 μM)	set at	-906.7 mV	read at	490 μM at	-906.5 mV
1 000 μM (really 10 000 μM)	set at	-914.5 mV	read at	930 μM at	-914.0 mV



Final slope (meter) = -31.0 mV

10 fold slope (validation)

500 to 5 000 μM:	-28.9 mV
1000 to 10 000 μM:	-27.5 mV

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

Signed off by:

[redacted]

[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 #: Saddle Island (#1006) **Sample Collection:** 11-Apr-17
Redox Start: 9:05am on 12-Apr-17 **Redox Stop:** 9:45am on 12-Apr-17
Sulphide Start: 9:05am on 12-Apr-17 **Sulphide Stop:** 9:55am on 12-Apr-17

Sample I.D.		Temp	Redox	Sulphide		
Station	ID #	°C	mV	unadjusted µM	mV	adjusted µM
SI-1	1	9.2	296.8	15.6	-863.9	156
	2	9.5	101.2	16.8	-865.3	168
	3	10.8	23.2	40.8	-877.3	408
SI-2	1	7.4	136.4	23.1	-869.6	231
	2	10.4	136.8	17.8	-866.0	178
	3	10.3	140.9	11.2	-859.9	112
SI-3	1	6.8	52.7	70.4	-884.6	704
	2	9.9	-9.8	26.8	-871.6	268
	3	NS	NS	NS	NS	NS
SI-4	1	10.6	154.1	16.4	-864.9	164
	2	8.6	129.4	15.6	-864.2	156
	3	10.1	94.3	38.5	-876.8	385
SI-5	1	10.1	68.6	32.1	-874.1	321
	2	10.7	68.3	27.7	-872.0	277
	3	11.5	47.5	62.7	-882.8	627

Field Crew: [redacted]

Analysis Crew:

Redox Check (mV):
Prior to analysis: 222.1 mV @ 25°C
Post analysis: 221.9 mV @ 25°C

Sulphide Temp: 22.2°C

Redox reading at 2 minutes

Equipment:

Sulphide Analysis
Probe kit: NSLAB008
Sulphide probe: SS1-15402
Temperature probe: T014

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

SAOB + L-AA mixture

Addition: 9:01am **Expiration:** 12:01pm

Signed off by:

[redacted] M.Sc.
Senior Laboratory Manager

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

Site #: Saddle Island (#1006)
Redox Start: 10:30am on 12-Apr-17
Sulphide Start: 10:35am on 12-Apr-17
Sample Collection: 11-Apr-17
Redox Stop: 10:40am on 12-Apr-17
Sulphide Stop: 10:45am on 12-Apr-17

Sample I.D.		Temp	Redox	Sulphide		
Station	ID #	°C	mV	unadjusted µM	mV	adjusted µM
APH-A	1	9.9	386.2	3.12	-840.6	31.2
	2	11.5	340.3	4.23	-844.5	42.3
	3	10.3	307.4	3.31	-840.8	33.1
APH-B	1	NS	NS	NS	NS	NS
	2	NS	NS	NS	NS	NS
	3	NS	NS	NS	NS	NS

Field Crew: [redacted]

Analysis Crew:

Redox Check (mV):
Prior to analysis: 222.3 mV @ 25°C
Post analysis: 222.6 mV @ 25°C

Sulphide Temp: 21.8°C

Redox reading at 2 minutes (yellow)
Sulphide reading below reporting limit (red)

Equipment:

Sulphide Analysis
Probe kit: NSLAB003
Sulphide probe: TQ1-13493
Temperature probe: T014

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

SAOB + L-AA mixture

Addition: 10:31am

Expiration: 1:31pm

Signed off by:

[redacted]

[redacted] M.Sc.
Senior Laboratory Manager

APPENDIX C
Sediment Grain Size Analysis

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

Date: 26-Apr-17
File No.: SW2016-114
Site Name/#: Saddle Island #1006
Province: Nova Scotia

Grain Size Analysis

			% Fraction			
		mm	SI-1 Rep 1	SI-1 Rep 2	SI-1 Rep 3	Station Average
Gravel	Pebble	>4	0.51	0.03	0.00	0.18
	Granule	2-4	0.21	0.02	0.05	0.09
Sand	Very Coarse	1-2	0.17	0.03	0.10	0.10
	Coarse	0.5-1	0.98	0.40	1.15	0.84
	Medium	0.25-0.5	2.25	1.00	2.18	1.81
	Fine	0.125-0.25	23.04	18.72	20.58	20.78
	Very Fine	0.063-0.125	61.00	65.40	57.63	61.34
Mud	Silt	0.040 - 0.063	5.79	7.73	9.17	7.56
	Clay	0.004 - 0.040	6.06	6.68	9.13	7.29
% Gravel			0.72	0.04	0.05	0.27
% Sand			87.44	85.54	81.64	84.88
% Mud			11.84	14.41	18.30	14.85

NRC-IMB Research Facilities
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Suite 367-368
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Tel: (902) 492-7865
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Fax: (902) 492-7734
www.simcorp.ca

Date: 26-Apr-17
File No.: SW2016-114
Site Name/#: Saddle Island #1006
Province: Nova Scotia

Grain Size Analysis

			% Fraction			
		mm	SI-2 Rep 1	SI-2 Rep 2	SI-2 Rep 3	Station Average
Gravel	Pebble	>4	0.01	0.03	0.01	0.02
	Granule	2-4	0.03	0.05	0.11	0.06
Sand	Very Coarse	1-2	0.08	0.06	0.12	0.09
	Coarse	0.5-1	0.47	0.51	0.70	0.56
	Medium	0.25-0.5	1.50	1.79	1.57	1.62
	Fine	0.125-0.25	19.55	17.21	18.67	18.48
	Very Fine	0.063-0.125	68.00	66.66	69.62	68.09
Mud	Silt	0.040 - 0.063	5.06	6.85	4.35	5.42
	Clay	0.004 - 0.040	5.31	6.84	4.84	5.66
% Gravel			0.04	0.07	0.13	0.08
% Sand			89.59	86.23	90.69	88.84
% Mud			10.37	13.69	9.19	11.08

NRC-IMB Research Facilities
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B3H 3Z1
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(902) 492-0359
Fax: (902) 492-7734
www.simcorp.ca

Date: 26-Apr-17
File No.: SW2016-114
Site Name/#: Saddle Island #1006
Province: Nova Scotia

Grain Size Analysis

			% Fraction			
		mm	SI-3 Rep 1	SI-3 Rep 2	SI-3 Rep 3	Station Average
Gravel	Pebble	>4	0.26	0.02		0.14
	Granule	2-4	0.62	0.07		0.35
Sand	Very Coarse	1-2	1.78	0.23		1.01
	Coarse	0.5-1	5.59	1.79		3.69
	Medium	0.25-0.5	11.64	5.81		8.73
	Fine	0.125-0.25	38.68	37.92		38.30
	Very Fine	0.063-0.125	30.34	40.80		35.57
Mud	Silt	0.040 - 0.063	3.82	7.51		5.66
	Clay	0.004 - 0.040	7.26	5.85		6.56
% Gravel			0.88	0.09		0.48
% Sand			88.04	86.55		87.29
% Mud			11.08	13.36		12.22

NRC-IMB Research Facilities
1411 Oxford Street
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Tel: (902) 492-7865
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Fax: (902) 492-7734
www.simcorp.ca

Date: 26-Apr-17
File No.: SW2016-114
Site Name/#: Saddle Island #1006
Province: Nova Scotia

Grain Size Analysis

			% Fraction			
		mm	**SI-4 Rep 1**	**SI-4 Rep 2**	**SI-4 Rep 3**	**Station Average**
Gravel	Pebble	>4	0.24	0.41	0.57	0.41
	Granule	2-4	0.91	0.62	0.54	0.69
Sand	Very Coarse	1-2	1.35	0.46	0.82	0.87
	Coarse	0.5-1	3.36	1.98	2.51	2.62
	Medium	0.25-0.5	20.34	18.24	15.28	17.95
	Fine	0.125-0.25	41.89	45.87	43.21	43.66
	Very Fine	0.063-0.125	28.88	27.60	30.22	28.90
Mud	Silt	0.040 - 0.063	2.30	1.81	3.55	2.55
	Clay	0.004 - 0.040	0.73	3.01	3.30	2.35
% Gravel			1.15	1.03	1.12	1.10
% Sand			95.81	94.15	92.04	94.00
% Mud			3.03	4.82	6.84	4.90

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Date: 26-Apr-17
File No.: SW2016-114
Site Name/#: Saddle Island #1006
Province: Nova Scotia

Grain Size Analysis

			% Fraction			
		mm	SI-5 Rep 1	SI-5 Rep 2	SI-5 Rep 3	Station Average
Gravel	Pebble	>4	0.36	0.64	0.13	0.38
	Granule	2-4	0.12	0.55	0.10	0.25
Sand	Very Coarse	1-2	0.30	0.72	0.23	0.42
	Coarse	0.5-1	0.72	4.25	0.78	1.92
	Medium	0.25-0.5	2.95	6.19	3.36	4.17
	Fine	0.125-0.25	22.20	19.38	21.19	20.93
	Very Fine	0.063-0.125	61.94	50.04	62.68	58.22
Mud	Silt	0.040 - 0.063	6.23	6.25	5.52	6.00
	Clay	0.004 - 0.040	5.19	11.97	6.02	7.73
% Gravel			0.47	1.19	0.23	0.63
% Sand			88.11	80.59	88.24	85.64
% Mud			11.42	18.22	11.54	13.73

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Date: 26-Apr-17
File No.: SW2016-114
Site Name/#: Saddle Island #1006
Province: Nova Scotia

Grain Size Analysis

			% Fraction			
		mm	SI-A Rep 1	SI-A Rep 2	SI-A Rep 3	Station Average
Gravel	Pebble	>4	0.08	0.01	0.01	0.03
	Granule	2-4	0.19	0.03	0.02	0.08
Sand	Very Coarse	1-2	0.15	0.09	0.06	0.10
	Coarse	0.5-1	0.54	0.61	0.36	0.51
	Medium	0.25-0.5	1.49	1.88	0.94	1.44
	Fine	0.125-0.25	40.21	37.25	33.56	37.01
	Very Fine	0.063-0.125	51.18	52.41	55.94	53.17
Mud	Silt	0.040 - 0.063	2.42	3.25	4.08	3.25
	Clay	0.004 - 0.040	3.74	4.48	5.03	4.42
% Gravel			0.26	0.05	0.03	0.11
% Sand			93.57	92.23	90.86	92.22
% Mud			6.16	7.73	9.11	7.67

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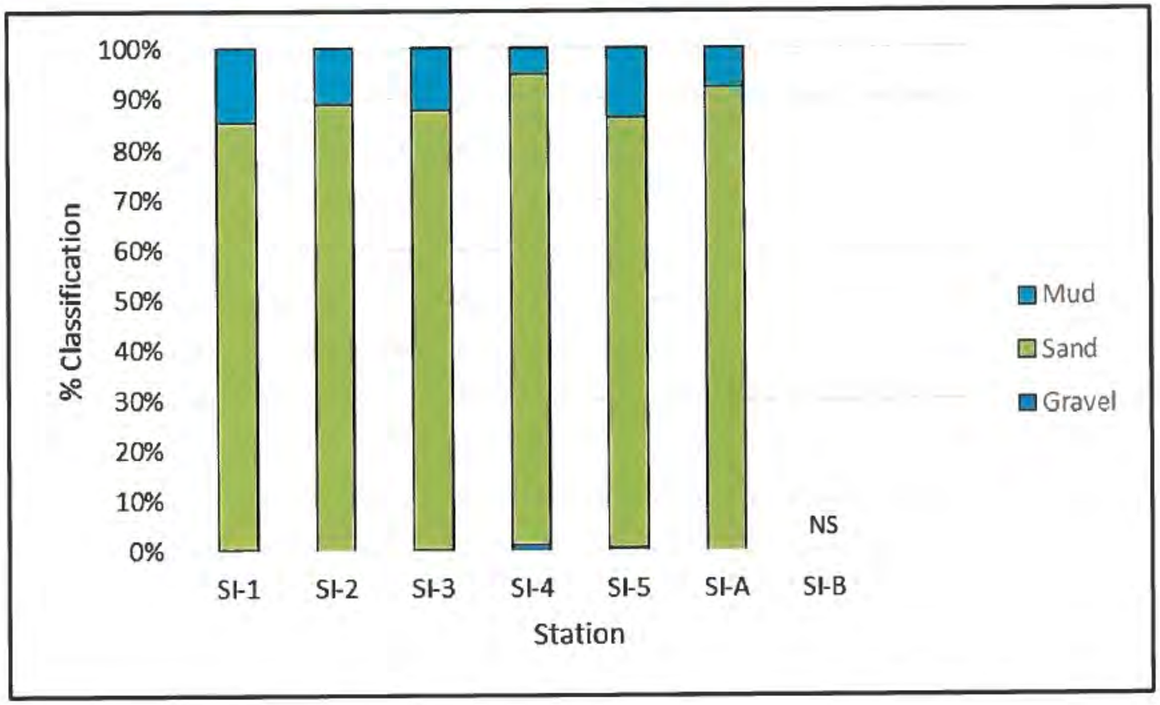


Signed off by:

[redacted]

[redacted] M.Sc.
Senior Laboratory Manager

APPENDIX D
pH Analysis

Station	Replicate	pH
SI-1	1	7
	2	7
	3	7.5
SI-2	1	7
	2	7
	3	7
SI-3	1	7.5
	2	7.5
	3	N/S
SI-4	1	7
	2	7
	3	7
SI-5	1	7
	2	7.5
	3	7
SI-A	1	7
	2	7
	3	7
SI-B	1	N/S
	2	N/S
	3	N/S

APPENDIX E
Grab Photos

SI-5

Pre-siphon

Post-siphon

Pre-siphon **Post-siphon**

APH-B

Grabs were not sampled

SI-3

Pre-siphon **Post-siphon**

Grabs that were not sampled

SI-3

Grabs that were not sampled

Pre-siphon

Post-siphon

APH-A

Pre-siphon

Post-siphon

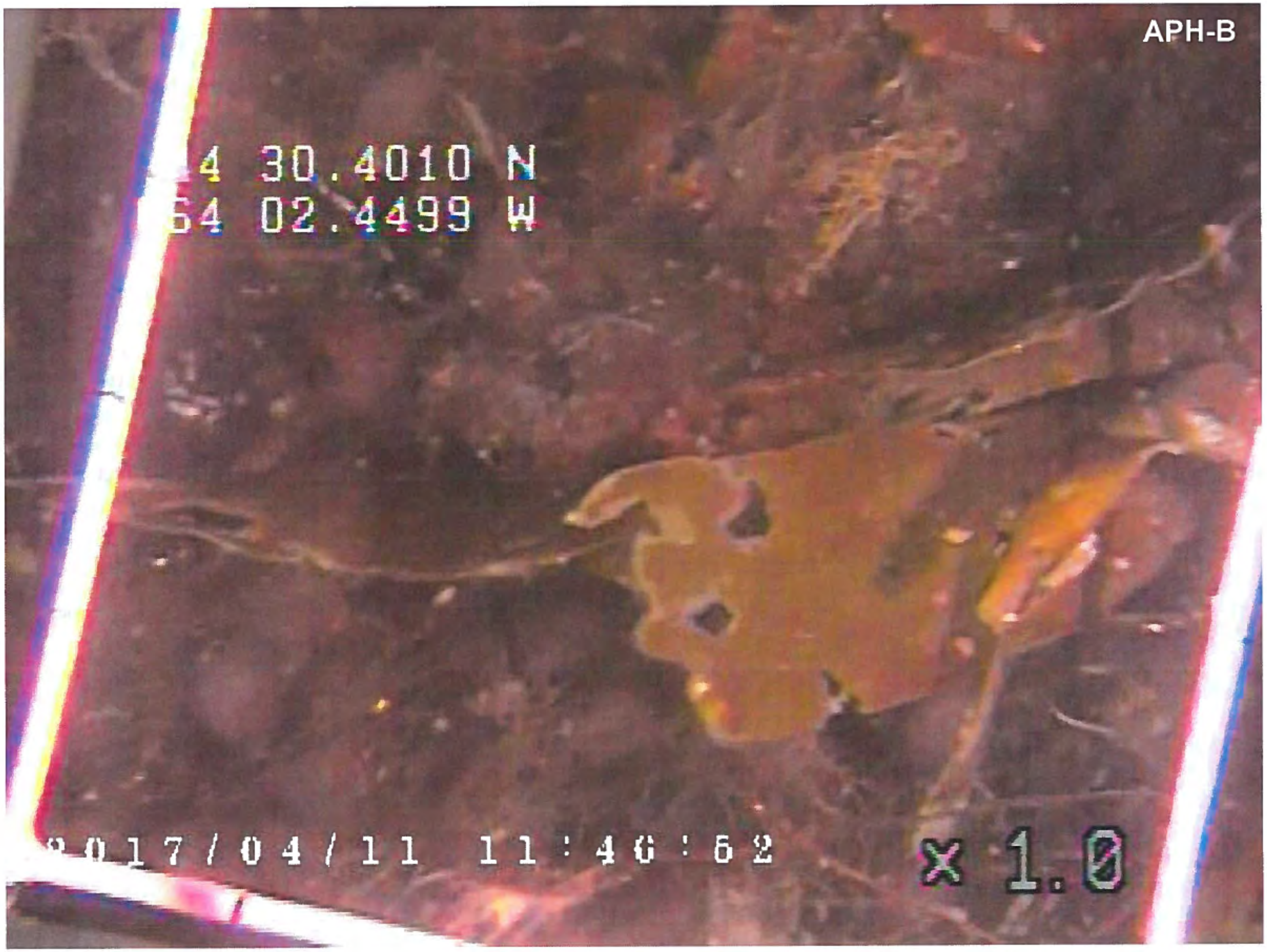
SI-1

Pre-siphon **Post-siphon**

APPENDIX F
Screen Shots of the Seafloor


SI-5
44 30.3137 N
64 02.8636 W
2017/04/11 10:25:50
x 1.0


SI-2
4 30.4739 N
64 02.5795 W
2017/04/11 11:12:16
x 1.0


APH-B
4 30.4010 N
64 02.4499 W
017/04/11 11:46:52
x 1.0

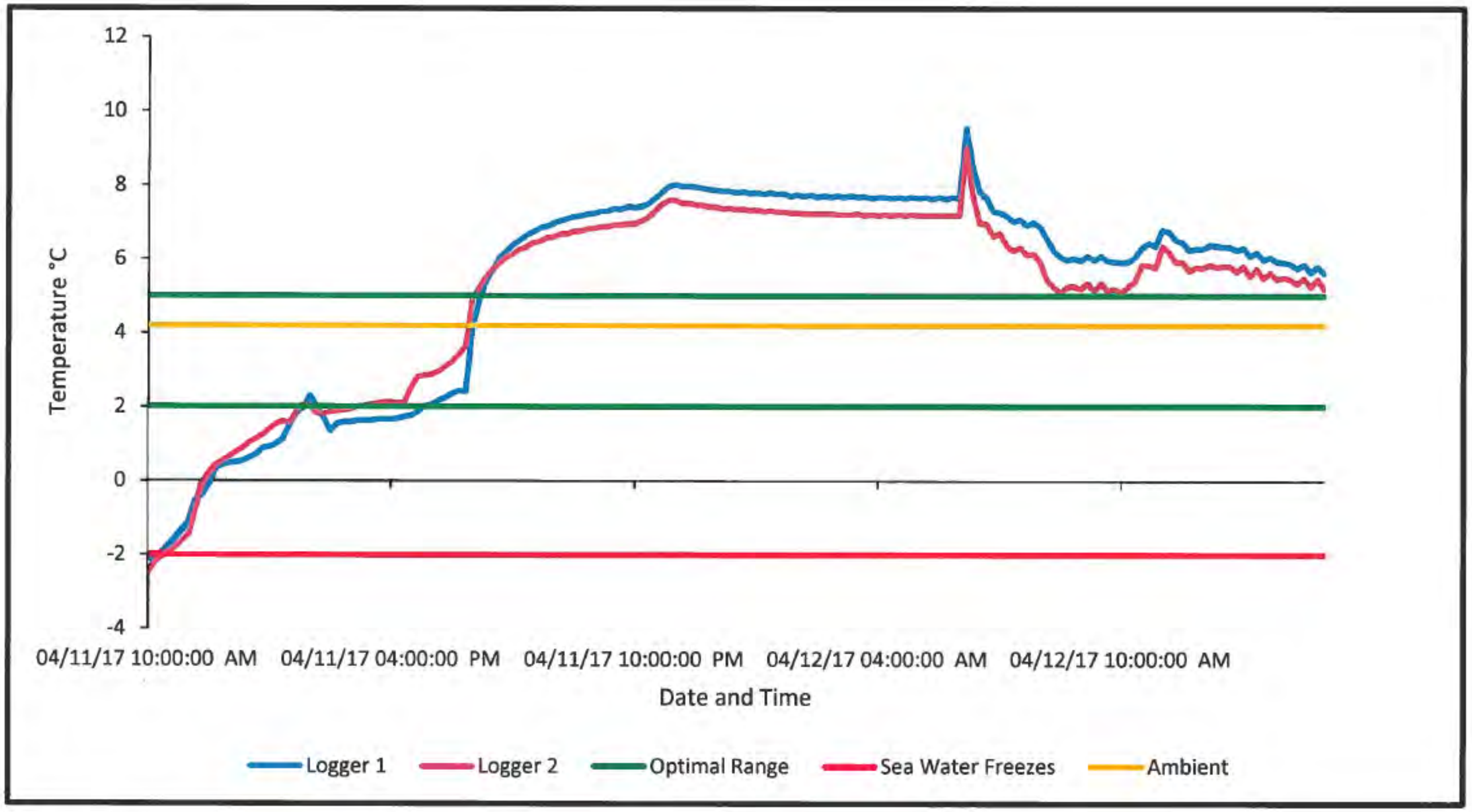

SI-3
4 30.2907 N
02.5077 W
17/04/11 12:20:29
x 1.0


SI-4
44 30.1591 N
64 03.1218 W
2017/04/11 13:05:03
x 1.0


APH-A
44 30.2324 N
064 03.2606 W
2017/04/11 13:46:02
x 1.0


SI-1
44 30.3466 N
064 03.1958 W
2017/04/11 14:10:24
x 1.0

APPENDIX G
Sample Storage Temperature


12
10
8
6
4
2
0
-2
-4
Temperature °C
04/11/17 10:00:00 AM
04/11/17 04:00:00 PM
04/11/17 10:00:00 PM
04/12/17 04:00:00 AM
04/12/17 10:00:00 AM
Date and Time
Logger 1
Logger 2
Optimal Range
Sea Water Freezes
Ambient

APPENDIX H
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
SI-5	4	1, 3, 4	28, 29, 31	Down	6, 8, 7	2 - Very watery sediment	No
SI-2	3	1, 2, 3	26, 26, 20	Down	6, 6.5, 6	N/A	No
APH-B	5	N/A	N/A	N/A	N/A	1 - No sediment 2 - No sediment 3 - No sediment 4 - No sediment 5 - No sediment	N/A
SI-3	5	2, 4	33, 34	Down	5, 7.5	1 - <5 cm sediment depth 3 - <5 cm sediment depth 5 - <5 cm sediment depth	No, yes
SI-4	5	2, 4, 5	34, 35, 35	Down	7, 6, 5	1 - No sediment 3 - Grab Leaked	No, yes, yes
APH-A	3	1, 2, 3	35, 34, 35	1 up, down, down	5, 5, 5	N/A	No
SI-1	3	1, 2, 3	37, 35, 34	Down	8, 7, 7	N/A	No

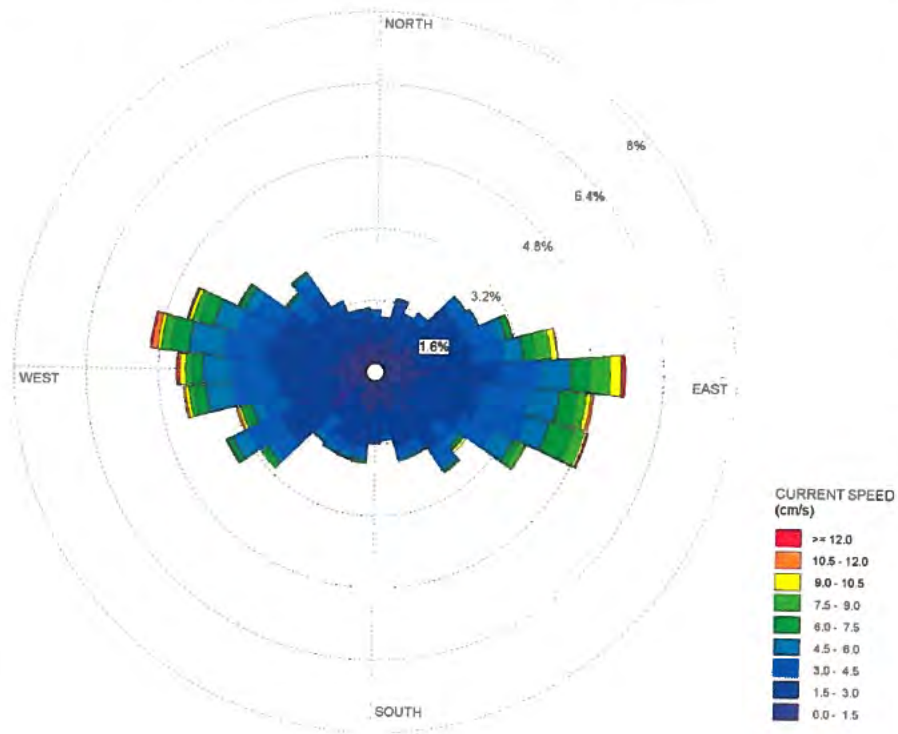
Station	Grab Attempt				
	Grab 1	Grab 2	Grab 3	Grab 4	Grab 5
APH-A	SP	SP	SP	-	-
APH-B	SP	SP	SP	SP	SP
SI-1	SP	SP	SP	-	-
SI-2	SP	SP	SP	-	-
SI-3	SP	SP	SP	SP	SP
SI-4	SP	SP	SP	SP	SP
SI-5	SP	SP	SP	SP	-

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

APPENDIX I
ADCP Data

CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 3m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

2.68 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

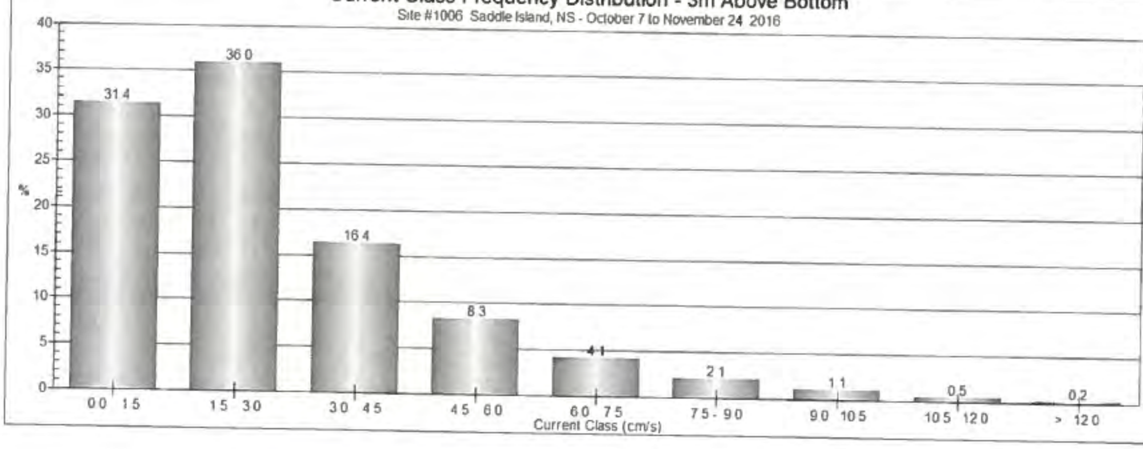
2017-04-07

PROJECT NO.

SW2016-061

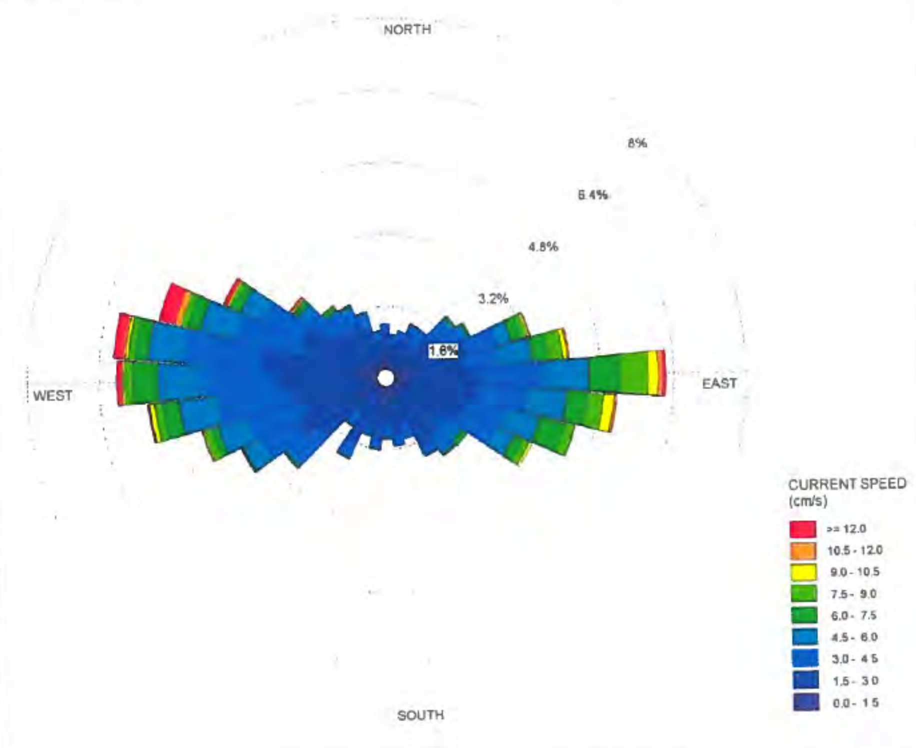
Current Class Frequency Distribution - 3m Above Bottom

Site #1006 Saddle Island, NS - October 7 to November 24 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 4m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.20 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

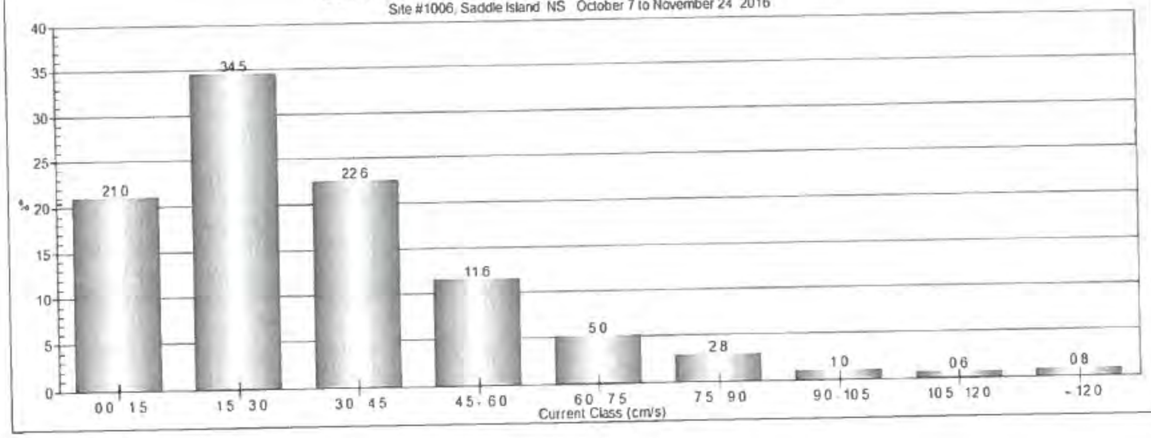
DATE

2017-04-07

SW2016-061

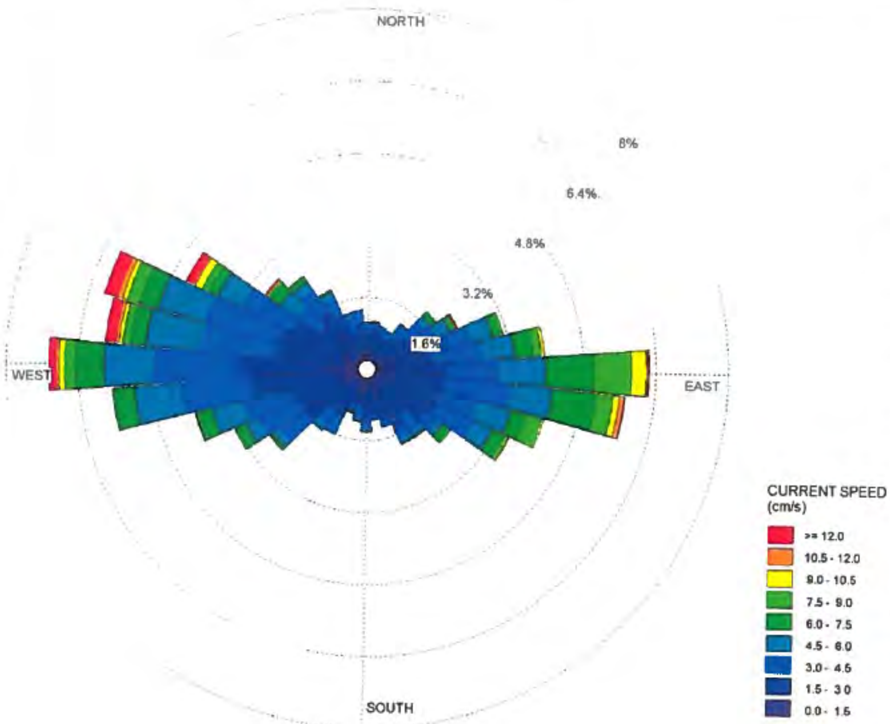
Current Class Frequency Distribution - 4m Above Bottom

Site #1006, Saddle Island NS October 7 to November 24 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 5m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.44 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

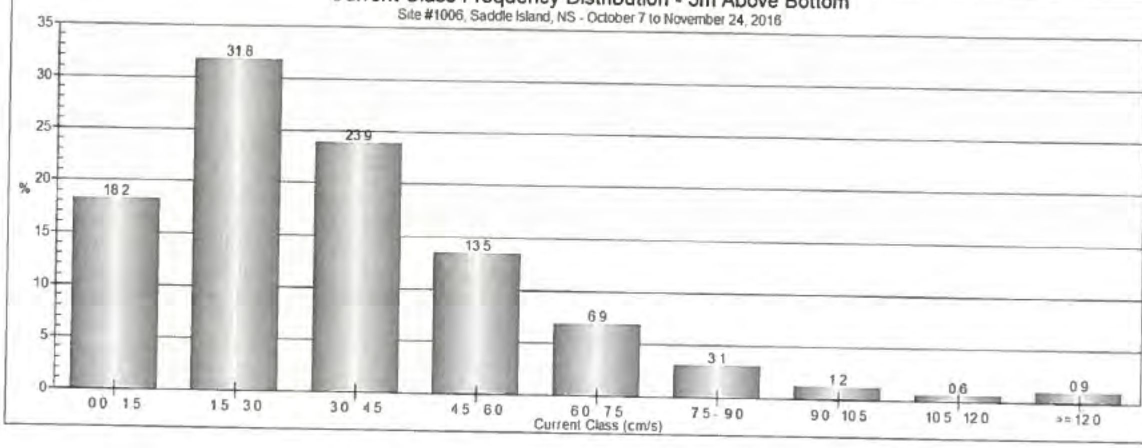
2017-04-07

PROJECT NO.

SW2016-061

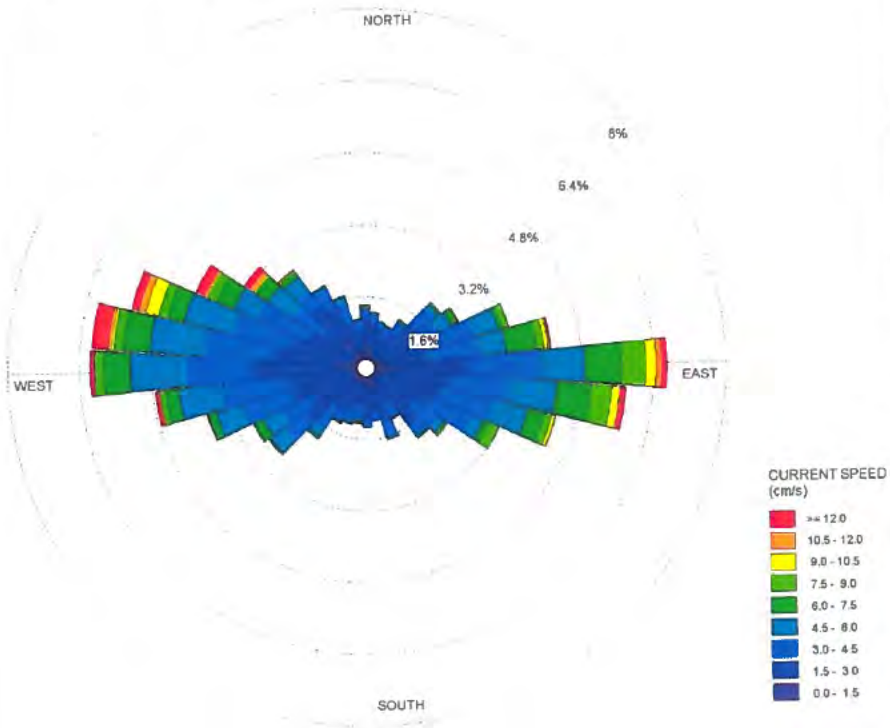
Current Class Frequency Distribution - 5m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 6m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.51 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

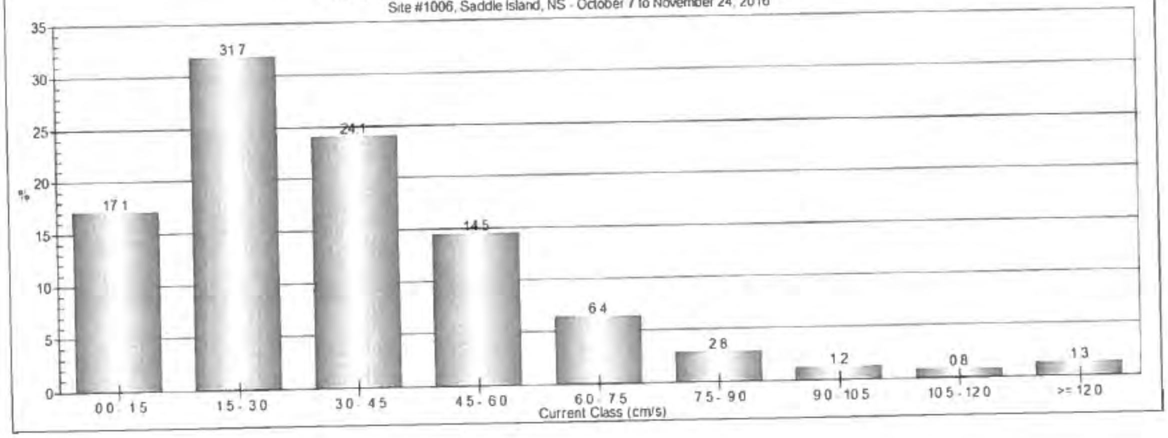
2017-04-07

PROJECT NO.

SW2016-061

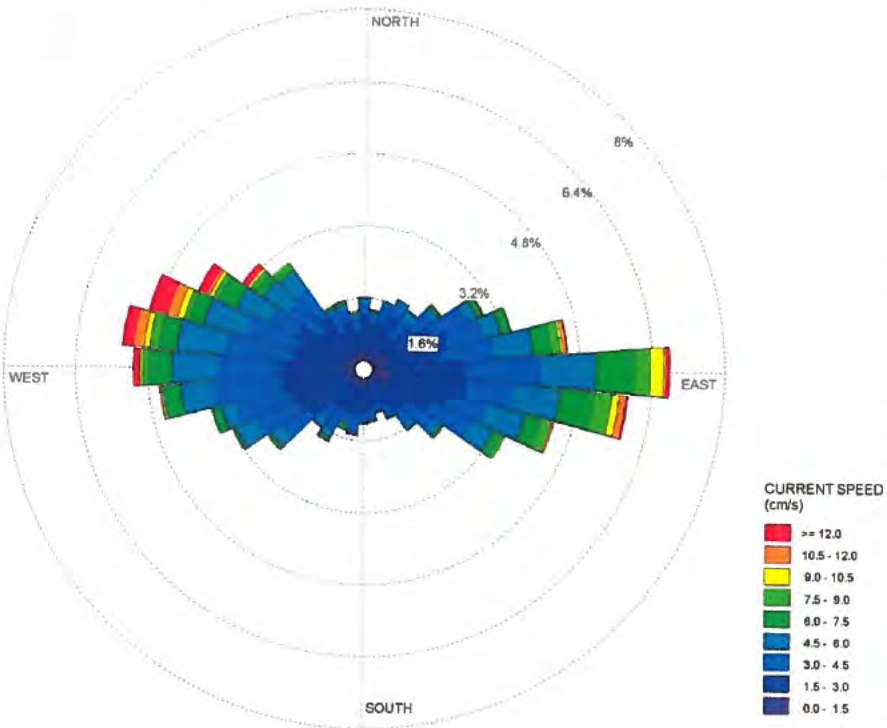
Current Class Frequency Distribution - 6m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 7m Above Bottom



COMMENTS:

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.50 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

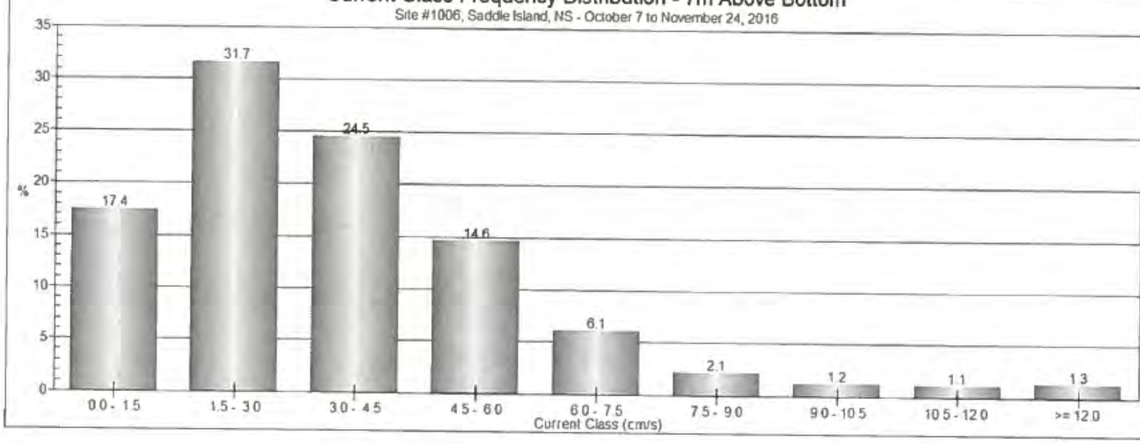
2017-04-07

PROJECT NO.

SW2016-061

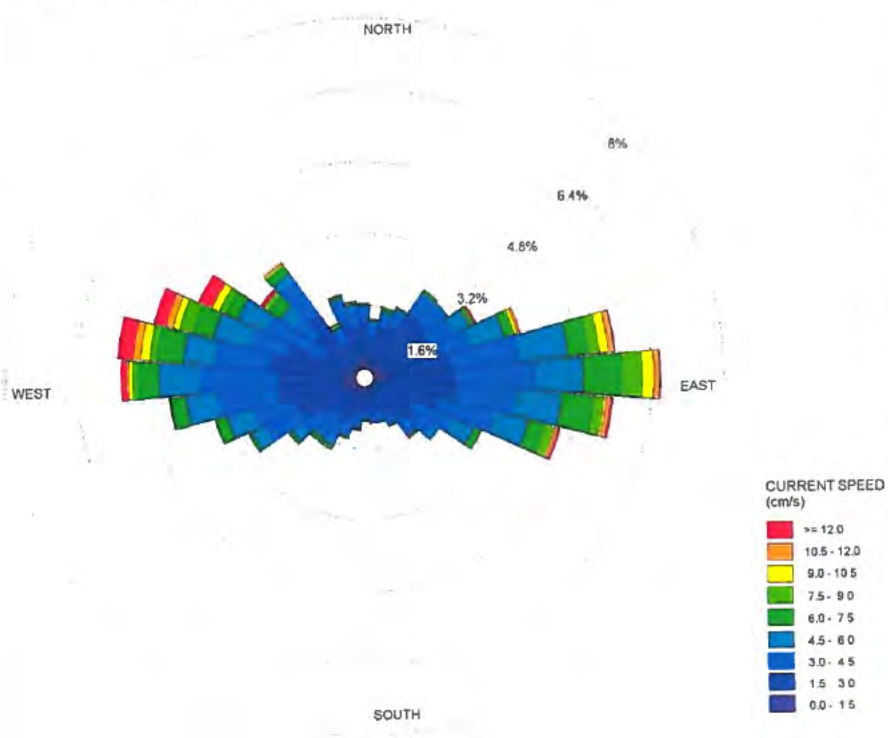
Current Class Frequency Distribution - 7m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 8m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.51 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

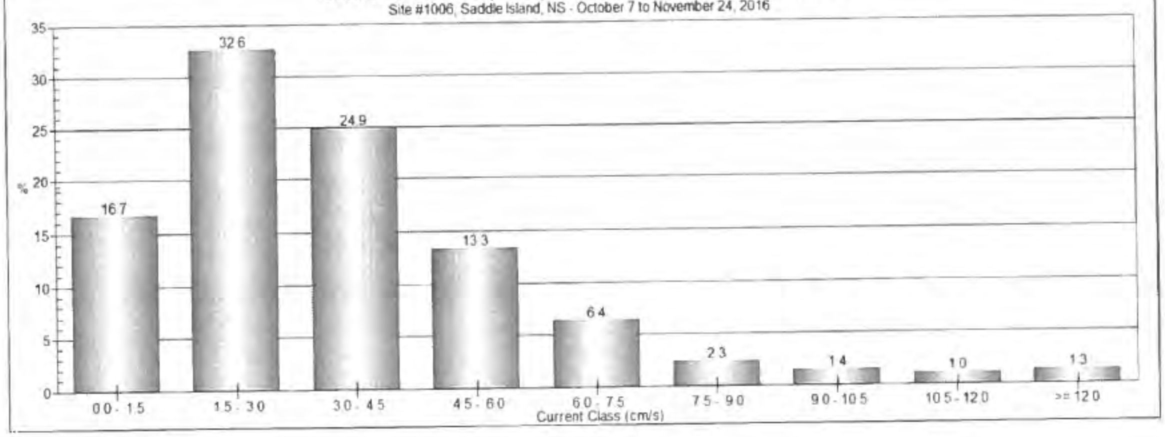
2017-04-07

PROJECT NO.

SW2016-061

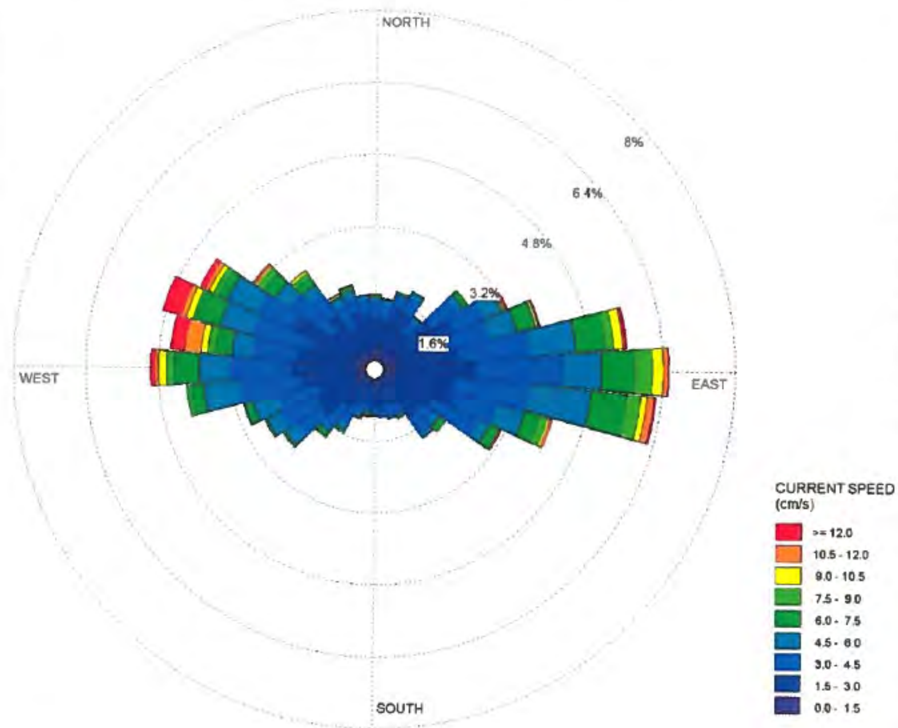
Current Class Frequency Distribution - 8m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 9m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.52 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

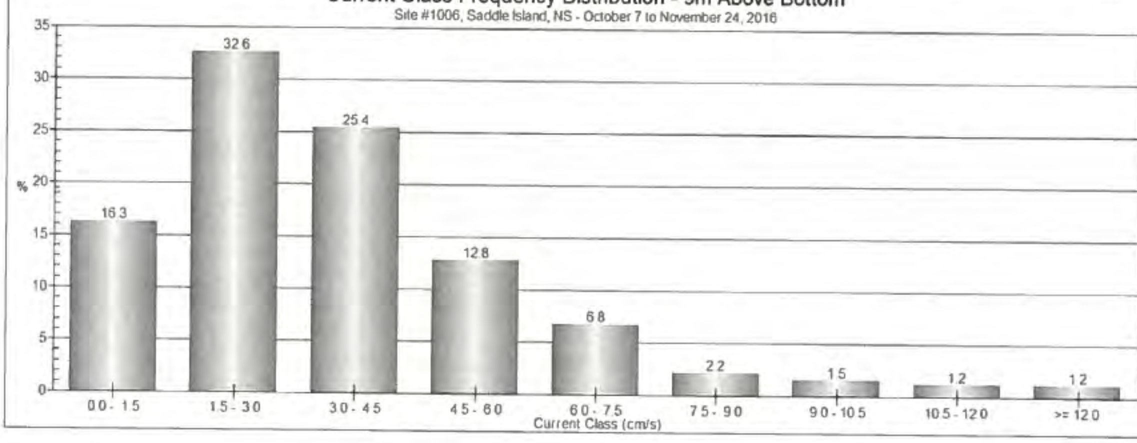
2017-04-07

PROJECT NO.

SW2016-061

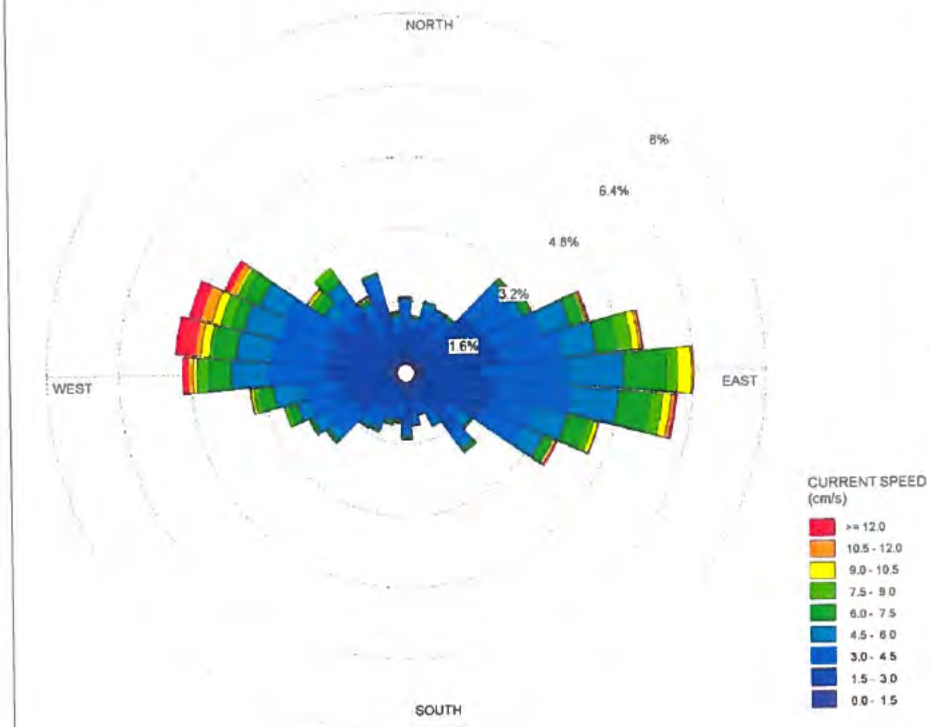
Current Class Frequency Distribution - 9m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 10m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.52 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

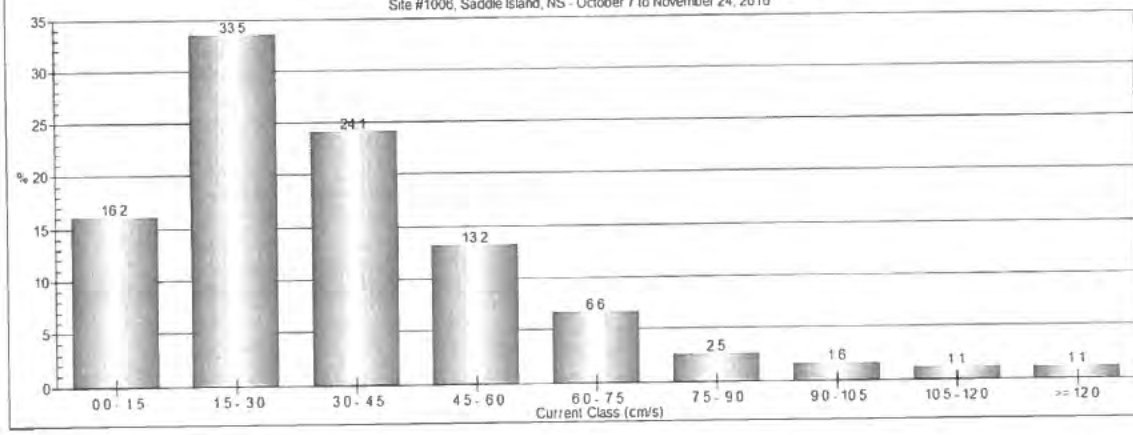
2017-04-07

PROJECT NO.

SW2016-061

Current Class Frequency Distribution - 10m Above Bottom

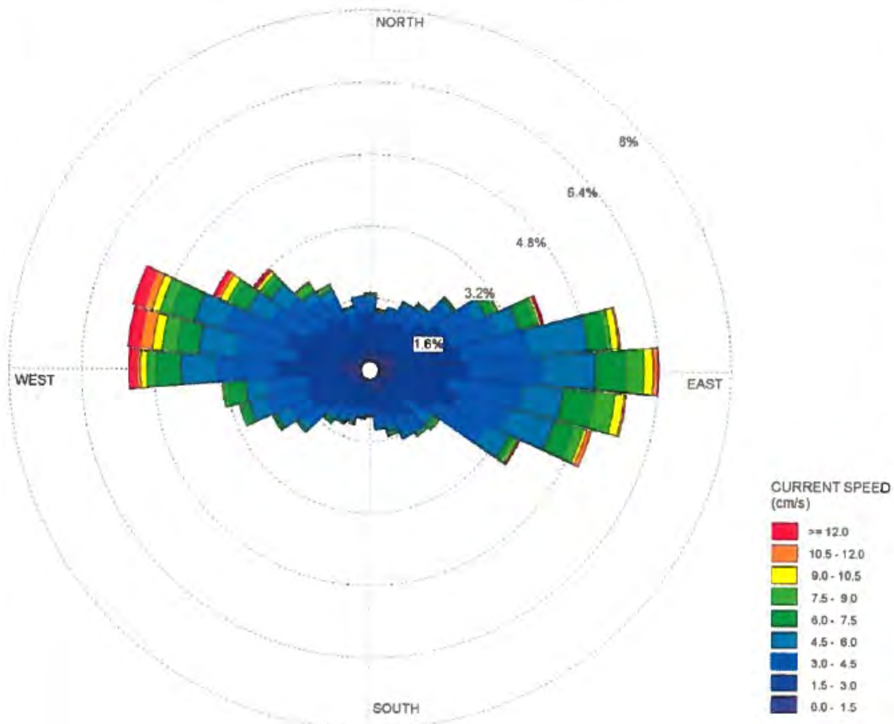
Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS

Current Speed and Direction - 11m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.53 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

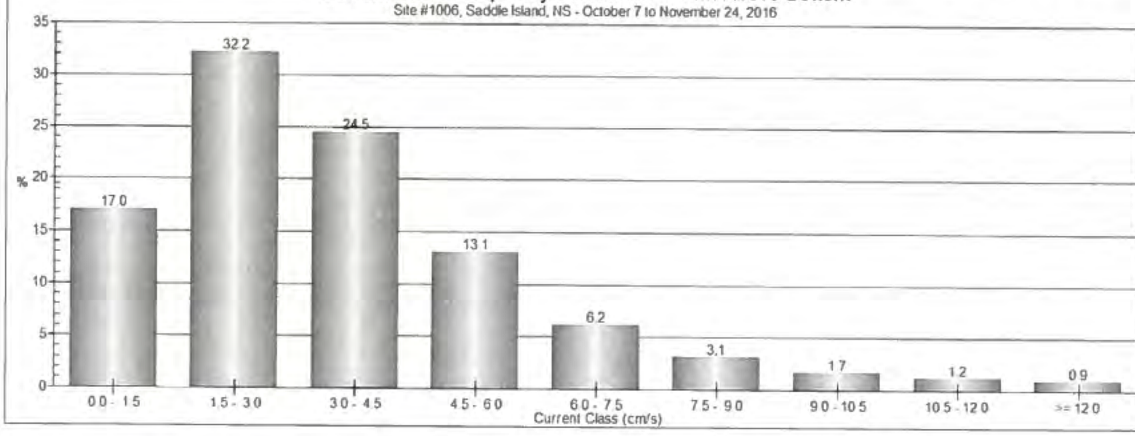
2017-04-07

PROJECT NO.

SW2016-061

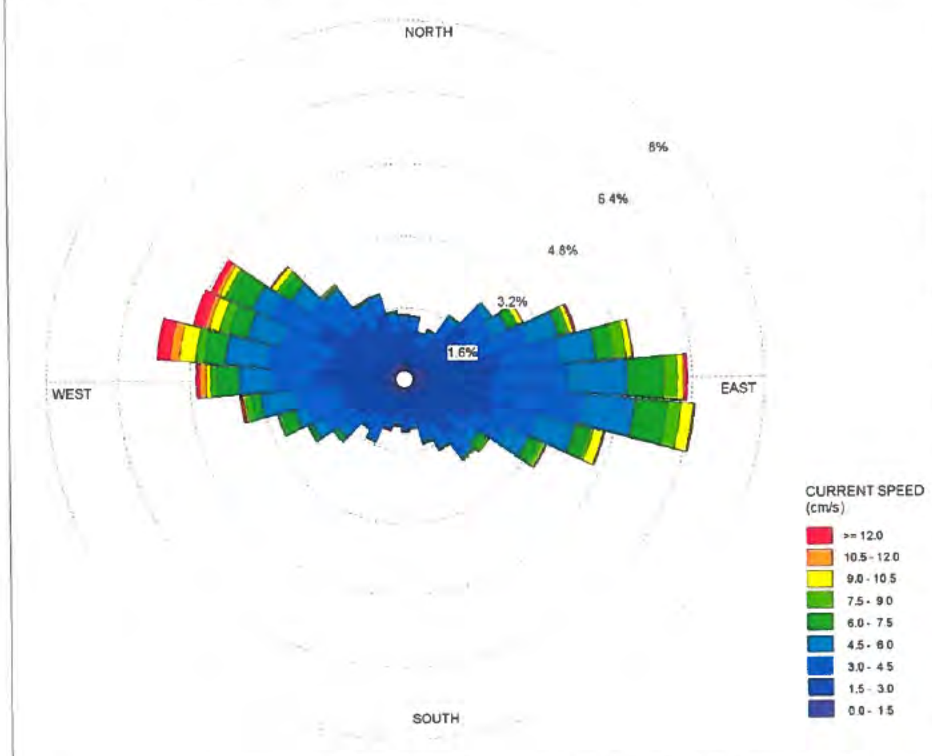
Current Class Frequency Distribution - 11m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 12m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.49 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

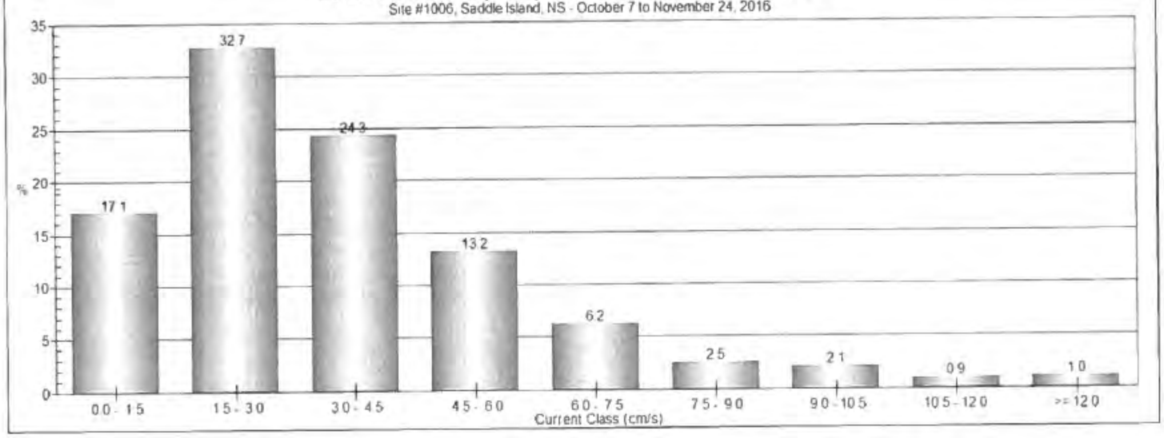
2017-04-07

PROJECT NO.

SW2016-061

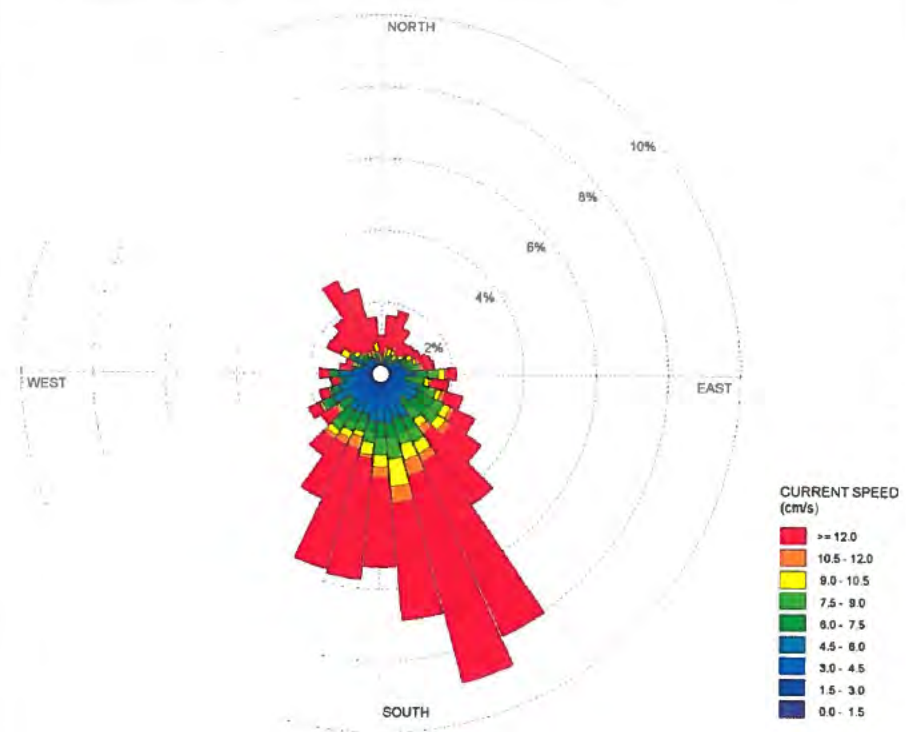
Current Class Frequency Distribution - 12m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 20m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4482

AVG. CURRENT SPEED

13.34 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

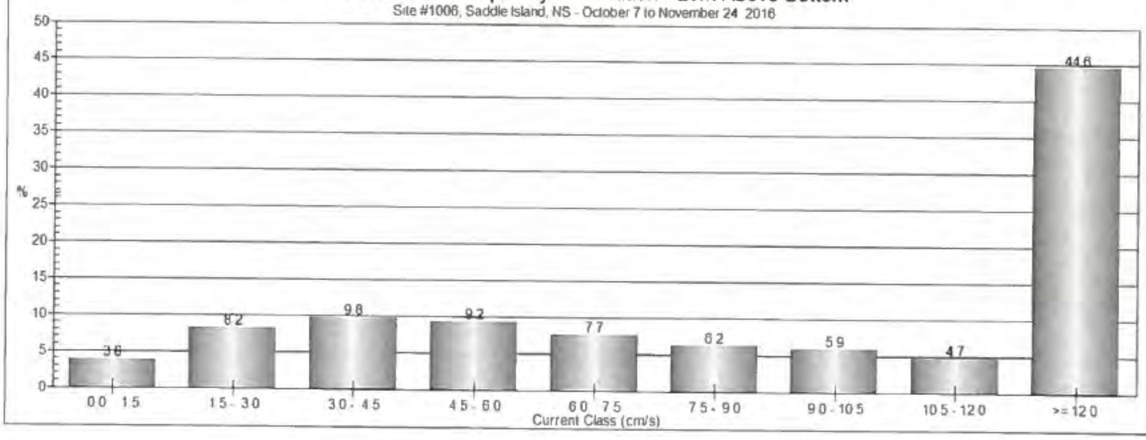
2017-04-07

PROJECT NO

SW2016-061

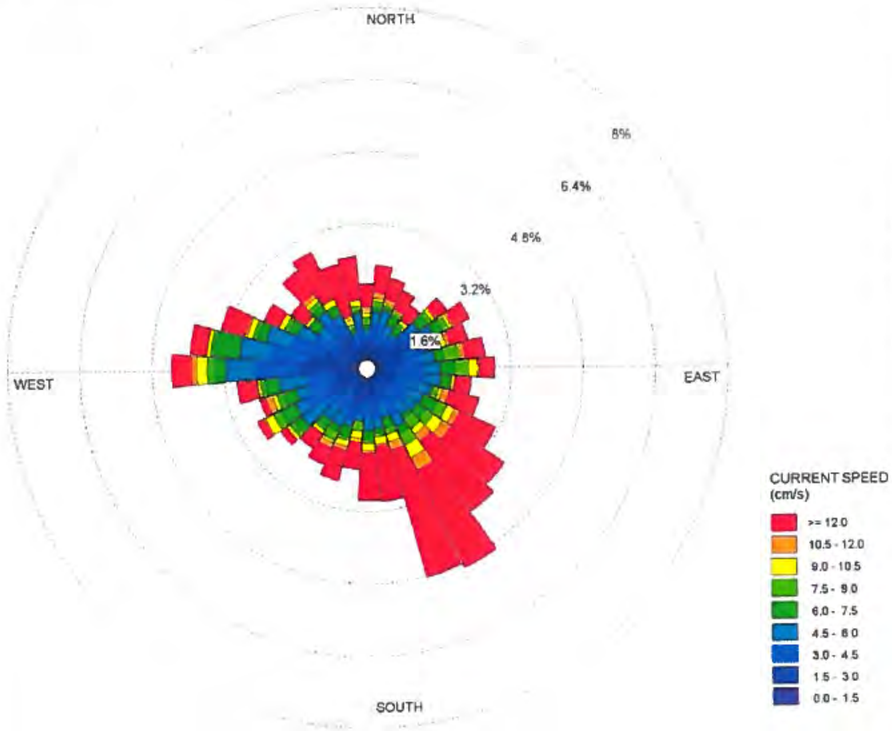
Current Class Frequency Distribution - 20m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 19m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

3014

AVG. CURRENT SPEED

9.41 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

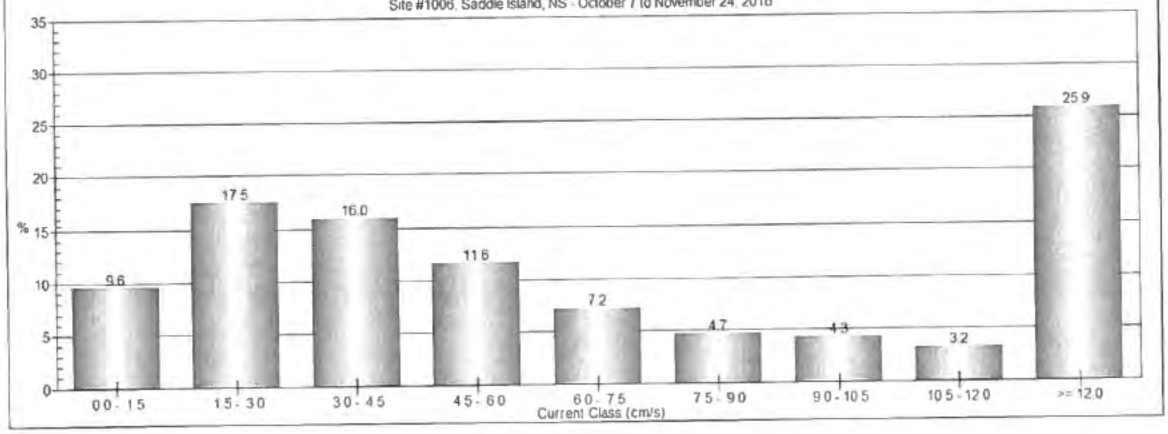
DATE

2017-04-07

PROJECT NO.

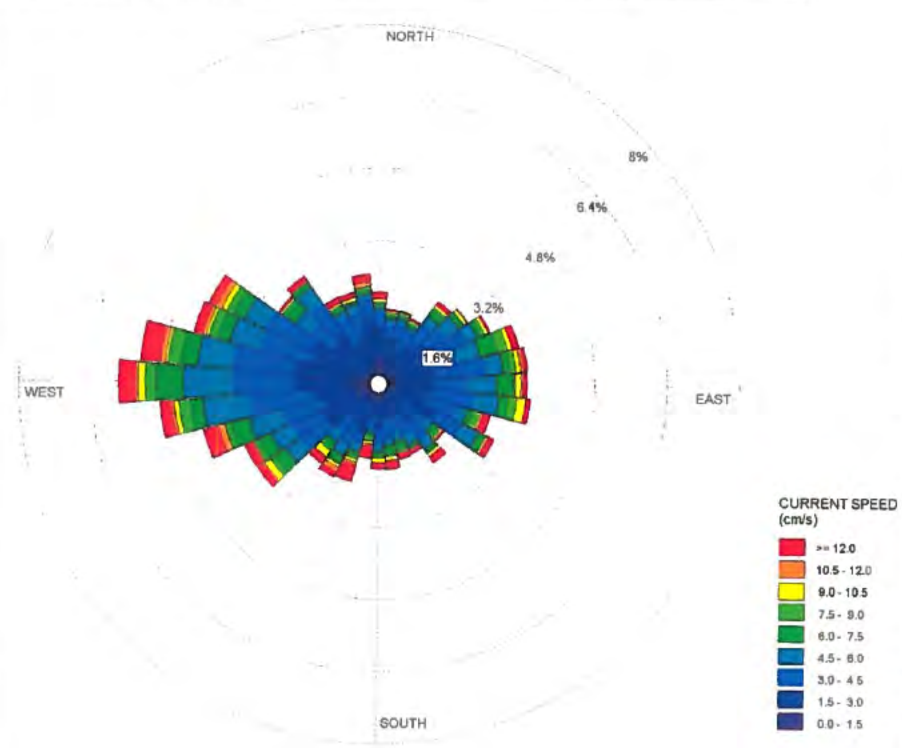
SW2016-061

Current Class Frequency Distribution - 19m Above Bottom
Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 18m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4119

AVG. CURRENT SPEED

4.44 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

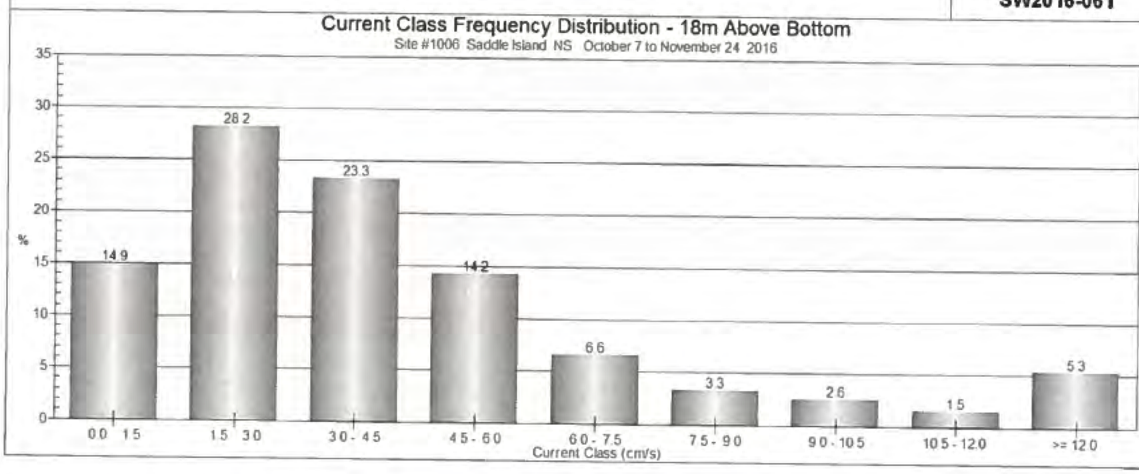
[redacted]

DATE

2017-04-07

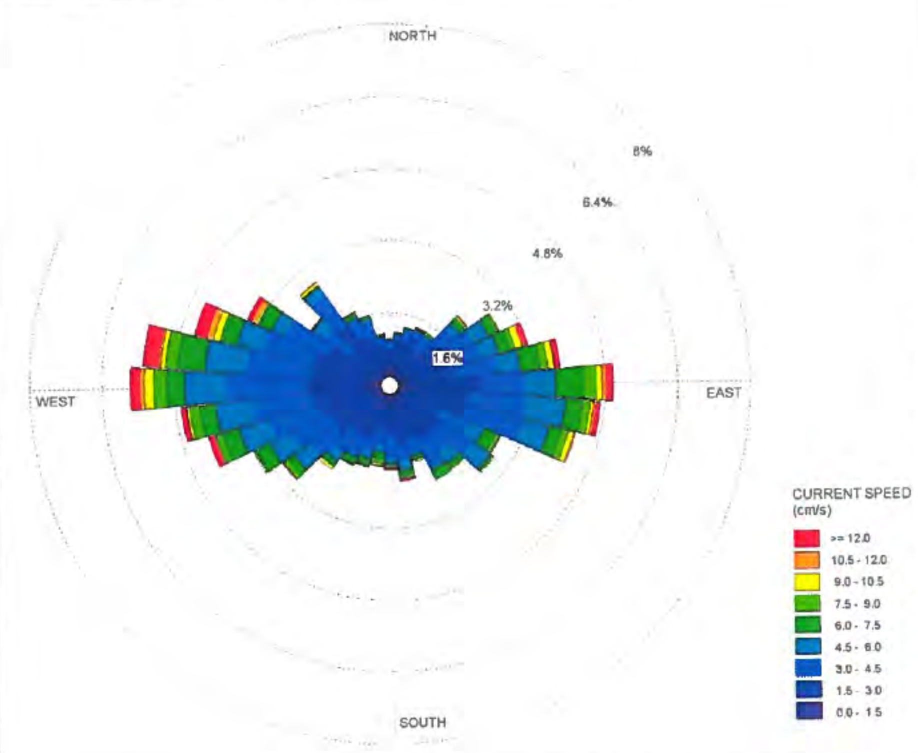
PROJECT #

SW2016-061



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 17m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.60 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

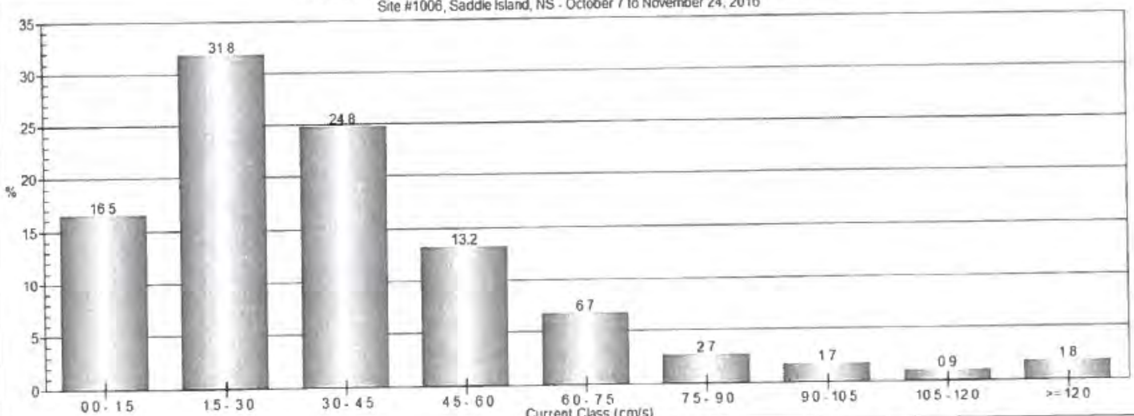
2017-04-07

PROJECT NO

SW2016-061

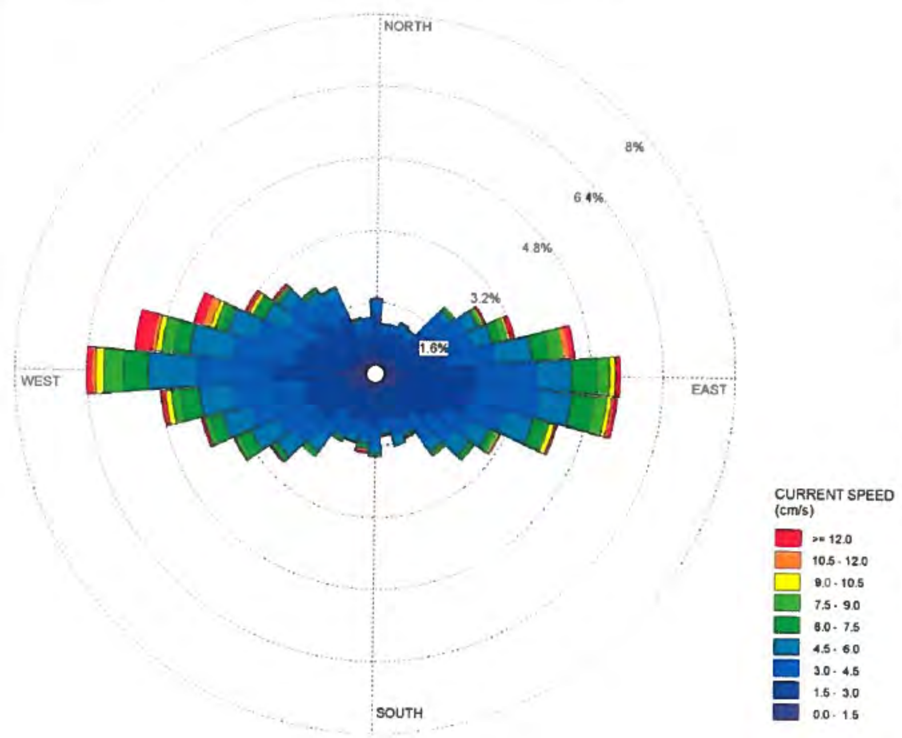
Current Class Frequency Distribution - 17m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 16m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4805

AVG. CURRENT SPEED

3.46 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

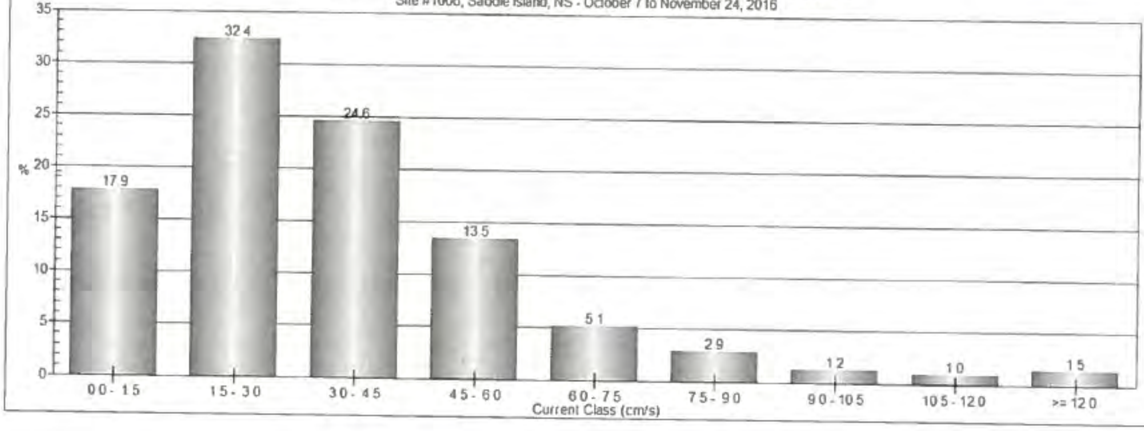
2017-04-07

PROJECT NO

SW2016-061

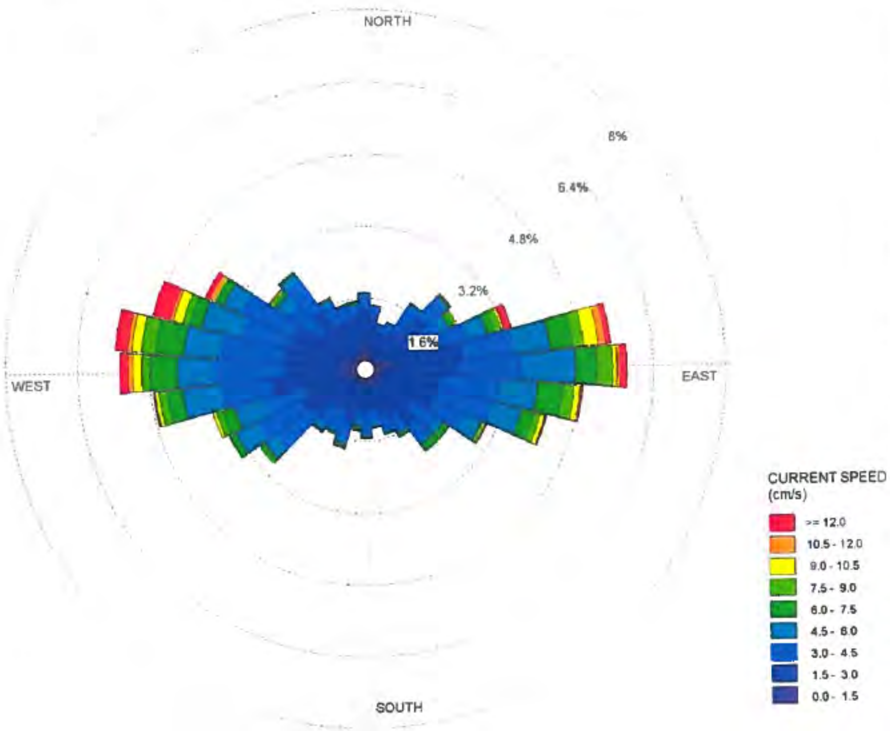
Current Class Frequency Distribution - 16m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 15m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.47 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

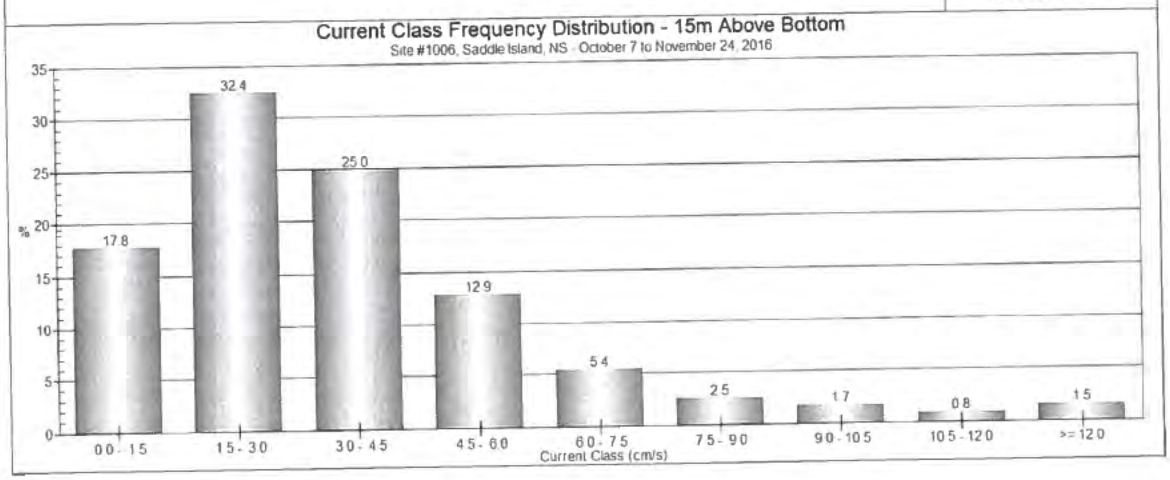
[redacted]

DATE

2017-04-07

PROJECT NO.

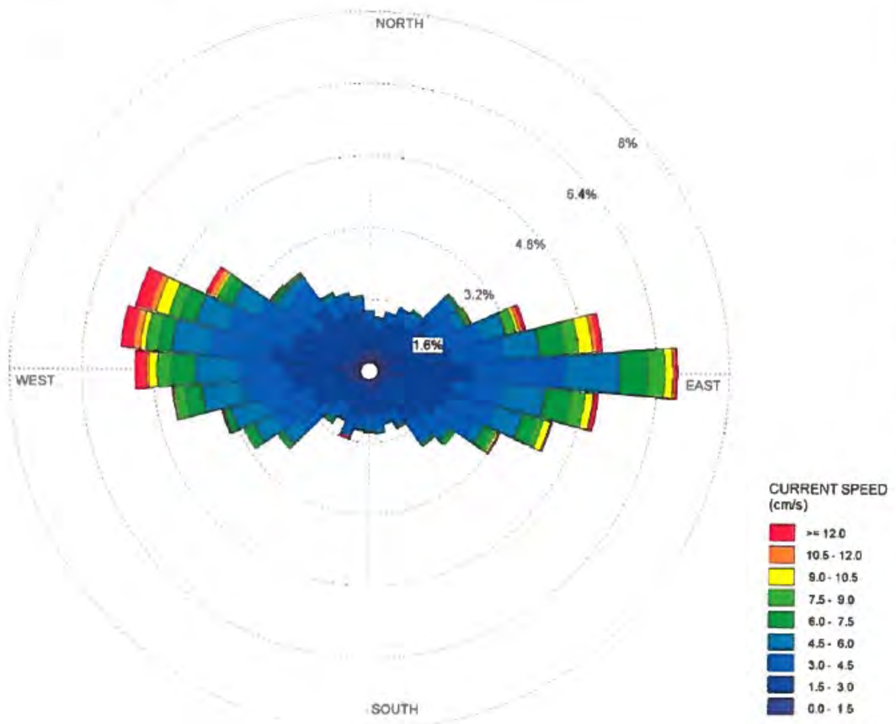
SW2016-061



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS

Current Speed and Direction - 14m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.46 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

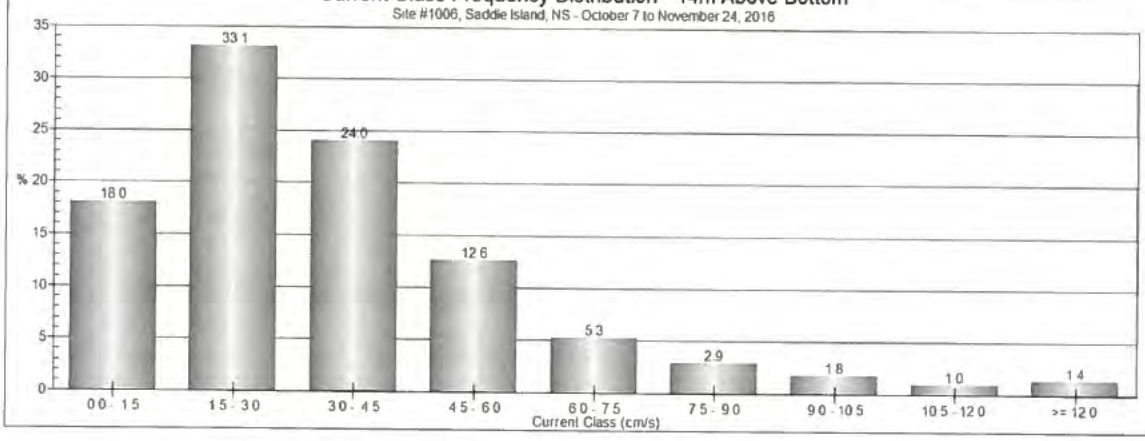
2017-04-07

PROJECT NO

SW2016-061

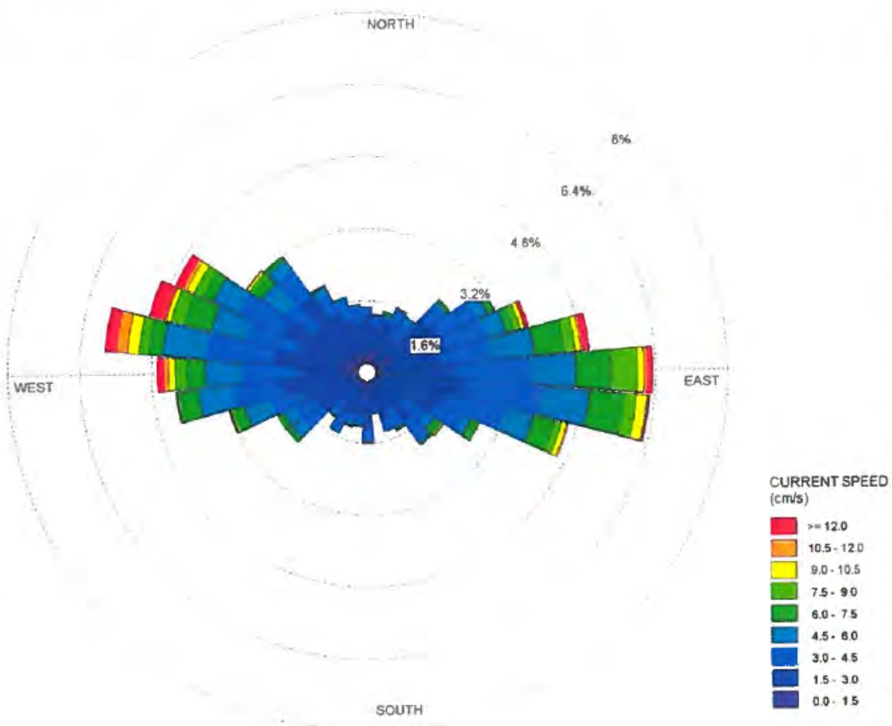
Current Class Frequency Distribution - 14m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



CURRENT ROSE PLOT

Site #1006, Saddle Island, NS
Current Speed and Direction - 13m Above Bottom



COMMENTS

DATA PERIOD

Start Date: 2016-10-07
End Date: 2016-11-24

PROFILE COUNT

4605

AVG. CURRENT SPEED

3.47 cm/s

COMPANY NAME

Sweeney International Marine Corp.

MODELER

[redacted]

DATE

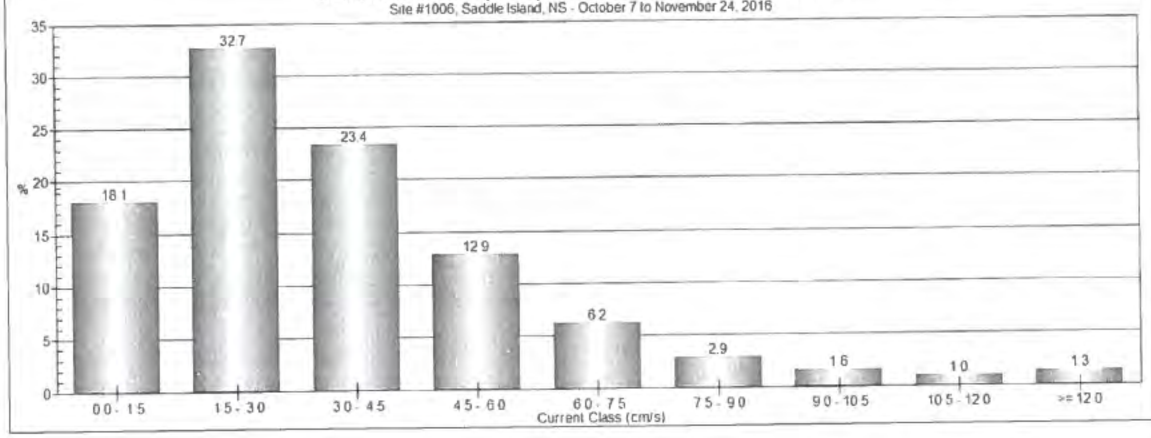
2017-04-07

PROJECT NO.

SW2016-061

Current Class Frequency Distribution - 13m Above Bottom

Site #1006, Saddle Island, NS - October 7 to November 24, 2016



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