

	<b>Total</b>	<b>14,645</b>	<b>53,536</b>
2013	Crab, Snow	4,316	21,790
	Groundfish	1,159	3,367
	Lobster	1,354	13,204
	Mollusc and Crustacean, Other	2,204	1,267
	Pelagic and Estuarial	56	821
	Shrimp	2,234	4,032
	<b>Total</b>	<b>11,324</b>	<b>44,481</b>
2014	Crab, Snow	4,693	26,455
	Groundfish	903	5,065
	Lobster	1,520	15,859
	Mollusc and Crustacean, Other	2,576	1,467
	Pelagic and Estuarial	272	1,277
	Shrimp	3,217	8,379
	<b>Total</b>	<b>13,180</b>	<b>58,502</b>

The distribution of pelagic and estuarial species is shown in Figure 4-25. The density of the points indicates the potential for effort for the species or species group within the 6-minute grid square over the most recent four years of data. Bluefin tuna, fished primarily by set hook and line, is the most important pelagic species fished in the area.

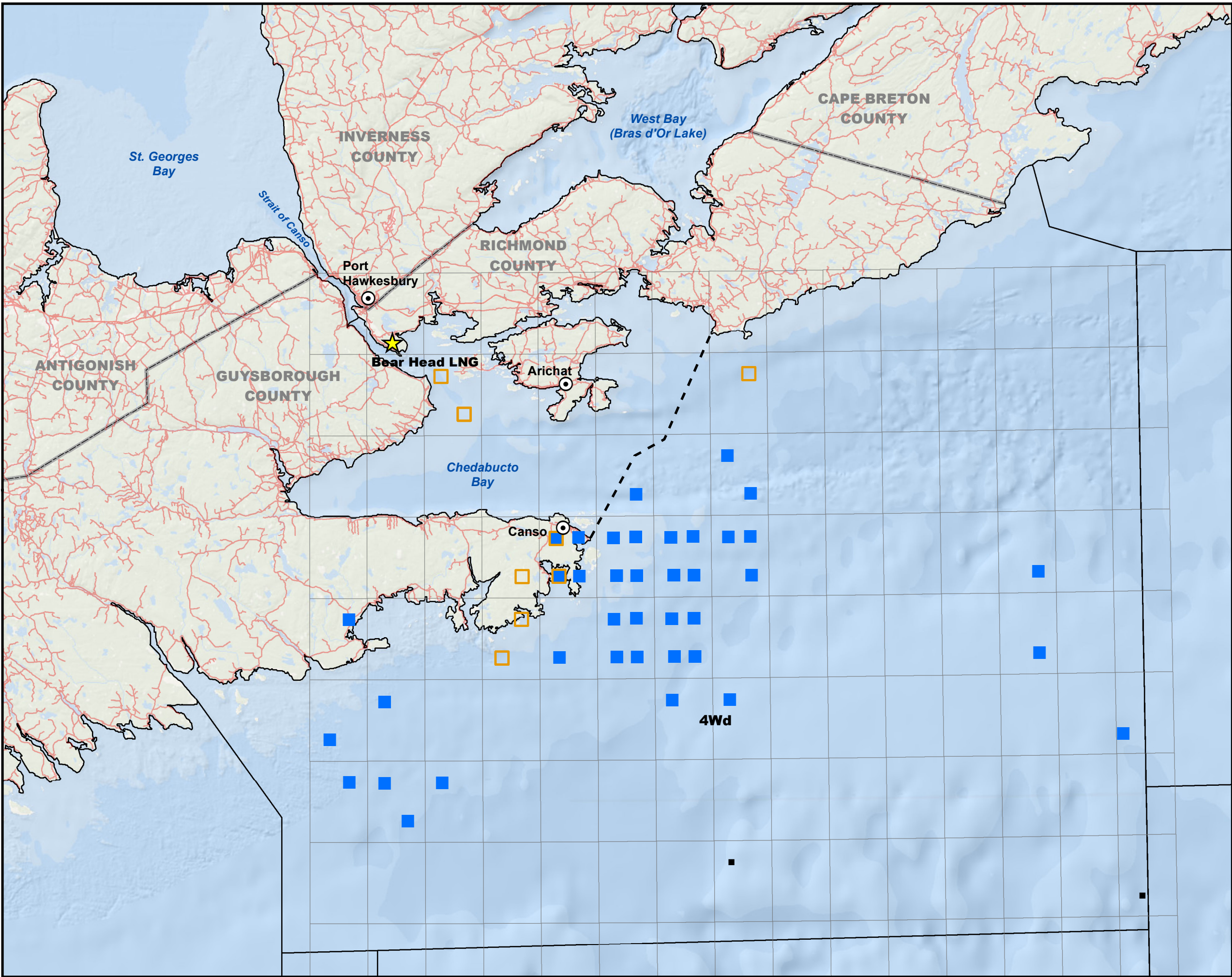
#### *Herring*

A large population of southern Nova Scotia herring (*Clupea harengus*) over-winter in Chedabucto Bay. The current management plan allows for large seiners to fish these over-wintering fish (DFO, 2014), but the existing market allow the seiners to catch their quota during other parts of the year in the Bay of Fundy and off southern Nova Scotia (Dick Stewart, pers. Comm., Atlantic Herring Co-op). These seiners could, however, in future years, be found in the Chedabucto Bay area between November to March.

#### *Bluefin Tuna*

Atlantic bluefin tuna (*Thunnus thynnus*) migrate seasonally to the Scotian Shelf and into the Gulf of St. Lawrence between July and December. Bluefin are large, with the all-tackle angling record of 679 kg taken off Aulds Cove, Nova Scotia in 1979 (DFO 2011). The Canadian fishery, primarily hook and line, takes place largely in the Southern Gulf of St. Lawrence and along the coast of mainland Nova Scotia, into the Bay of Fundy (Figure 4-26). A large fishery exists off Chedabucto Bay in the approaches to the Strait.



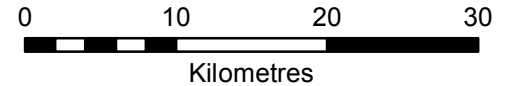
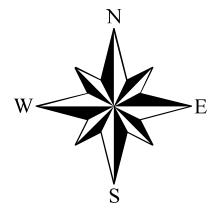


**Figure 4-25**  
**Pelagic and Estuarine**  
**Catches**  
**2010-2013**

**Approximate Pelagic/Estuarine Catch Locations**

- Mackerel
- Tuna
- Other Pelagic/Estuarial Species

- ⊙ Major Ports
- County Boundaries
- DFO Unit Area
- 6 Minute Catchment Grid

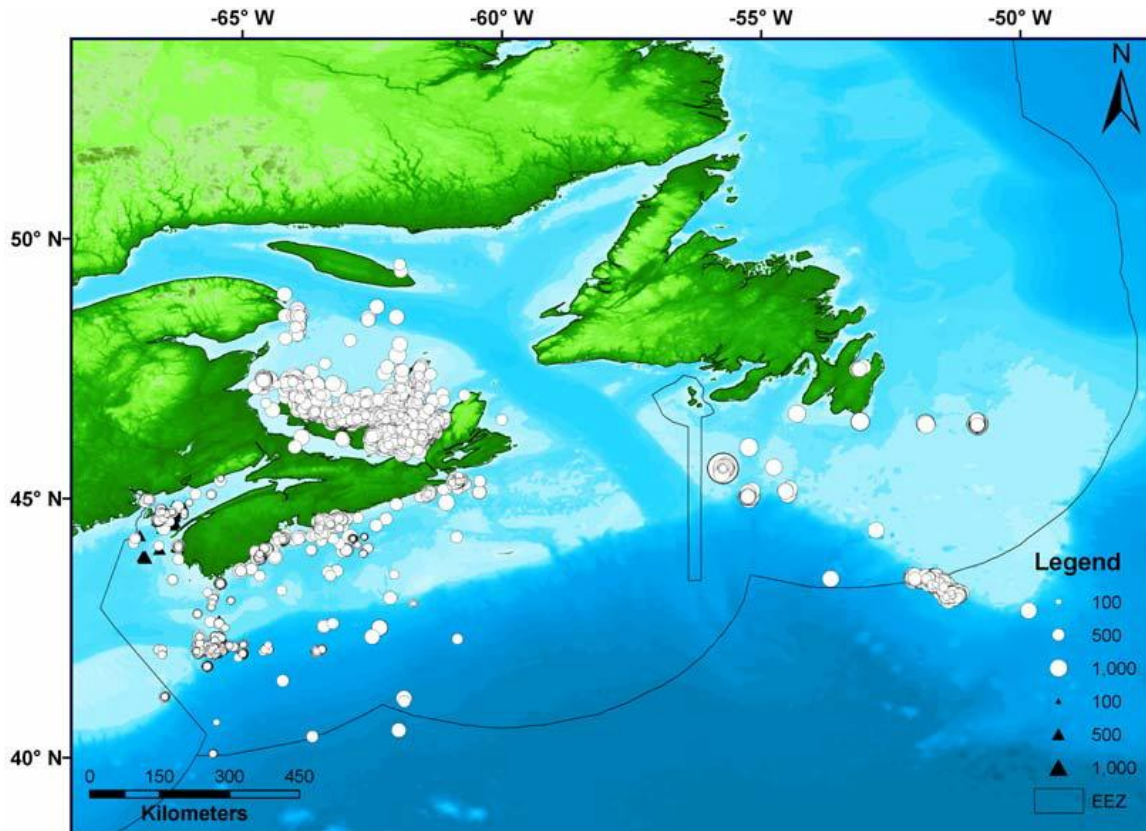


Map Parameters  
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 Datum: NAD83  
 Zone: 20  
 Scale: 1:500,000  
 Project Numer: 622560  
 Date: April 1, 2015

Data Source:  
 -Canvec (2013) Digital National Topographic System (NTS) topographic dataset  
 -Department of Fisheries and Oceans







*\*White circles are hook and line, black triangles are electric harpoon, and symbol size is proportion to the weight in pounds*

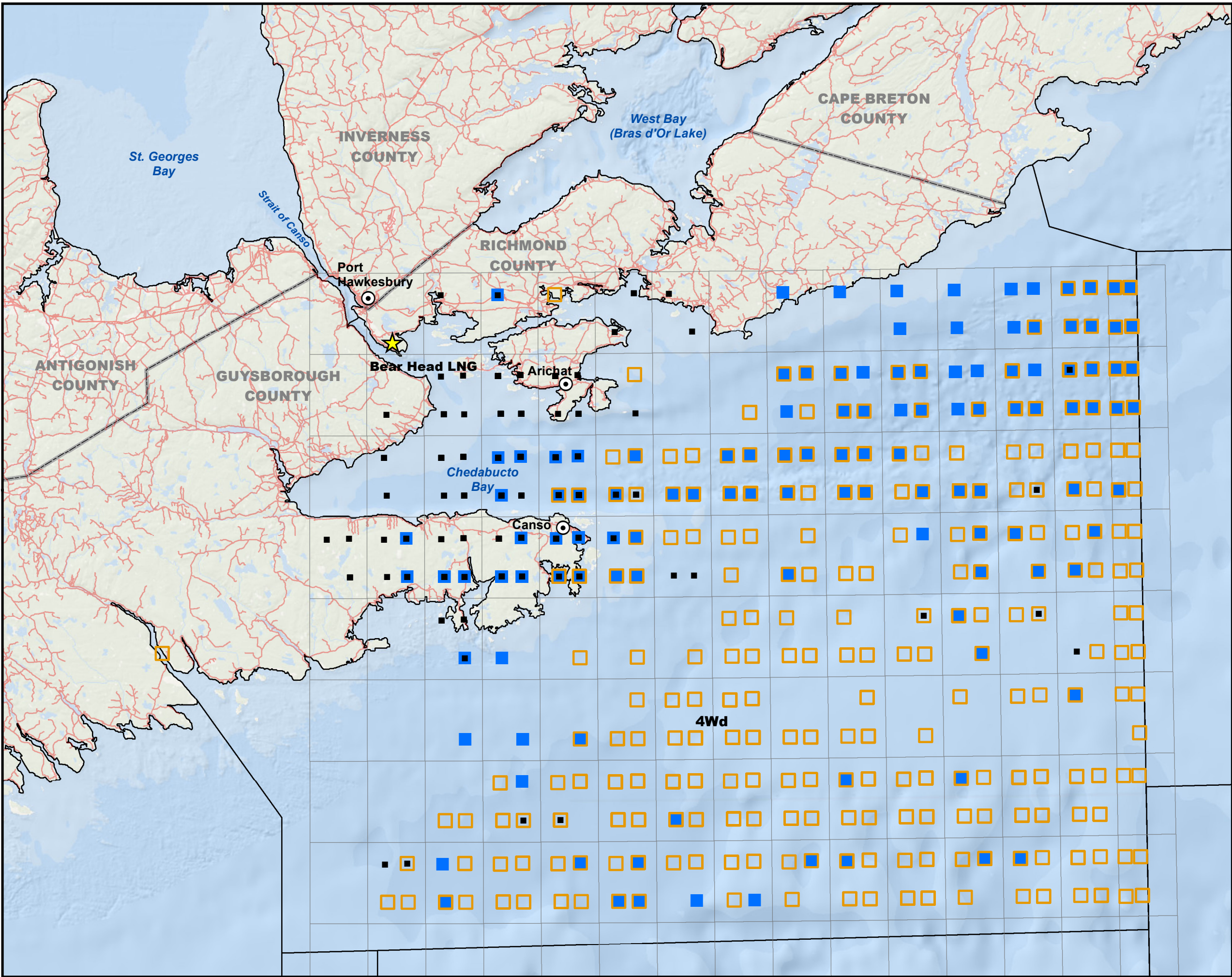
**Figure 4-26: Location of Bluefin Tuna Catches from logbook records, 2000-2009\***

*Shellfish*

Shellfish species landed in the area include, crabs, scallop, oyster, sea urchin, shrimp, cock crab, whelk and soft-shelled clam (Jacques Whitford 2004). Snow crab is the most common and valued species caught and landed in the area, but rock crab is also caught in inshore areas and stone crab in deeper waters. Scallops are fished in various inshore grounds, but fishing areas tend to move from year to year because populations need time to replenish. Oyster, sea urchin and soft-shelled clam are fished in specific inshore habitats, usually by small boat.

The distribution of shellfish is shown in Figure 4-27. The density of the points indicates the potential for effort for the species or species group within the 6-minute grid square over the most recent four years of data. In contrast to the fishing effort for other species groups, effort for shellfish, particularly snow crab, takes place throughout the navigation lanes used by large vessels.



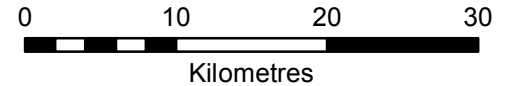
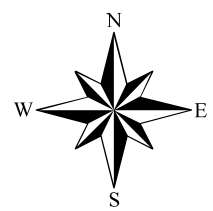


**Figure 4-27**  
**Shellfish Catches**  
**2010-2013**

**Approximate Shellfish Catch Locations**

- Shrimp (Prawn)
- Snow Crabs
- Other Shellfish

- Major Ports
- County Boundaries
- DFO Unit Area
- 6 Minute Catchment Grid



Map Parameters  
 Projection: Universal Transverse Mercator (UTM)  
 Datum: NAD83  
 Zone: 20  
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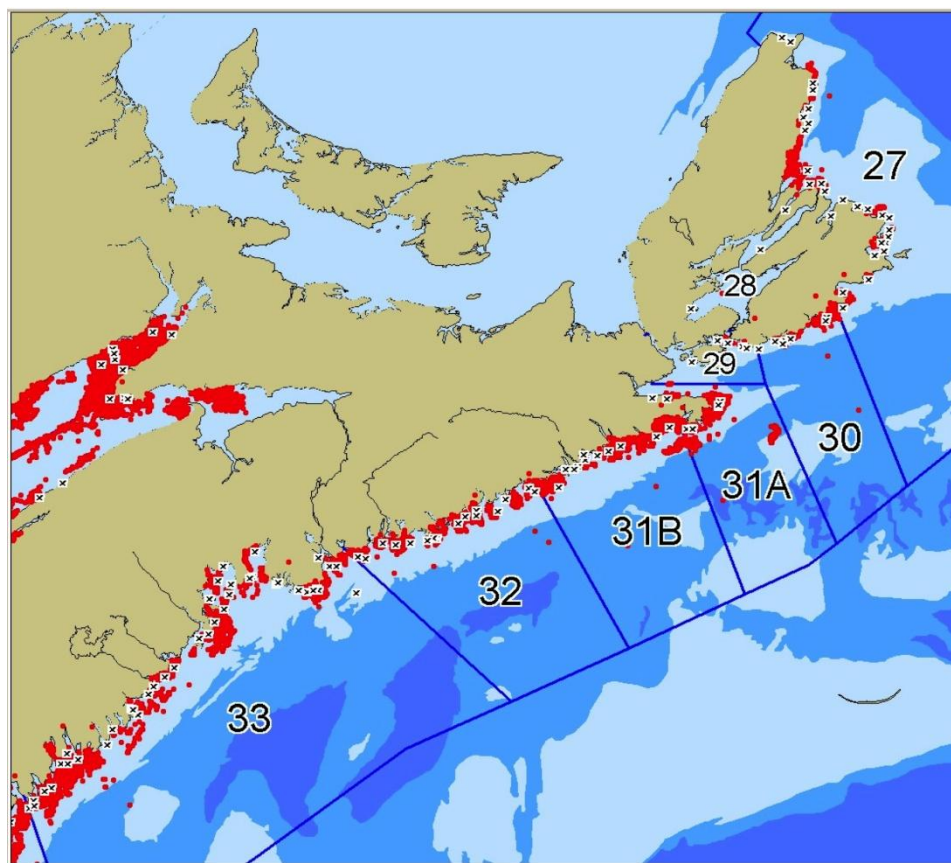




## Lobster

Lobster (*Homarus americanus*) is one of the most valuable commercial species fished in the area. Recently Nova Scotia has been successful at opening new markets in China, which may further increase sales and value. Lobsters are fished mostly in coastal waters at depths less than 70 m. The steep bathymetry of the Strait of Canso results in a relatively narrow band of lobster habitat and thus a restricted fishing area compared to nearby areas, such as Isle Madame. The fishery is regulated by the number of traps allowed per fisher and fishing season. The Strait and approaches are divided into the three lobster fishing areas 29, 30, and 31a (Figure 4-28) with the following seasons:

- ◆ Area 29: May 10 - July 10
- ◆ Area 30: May 19 - July 20
- ◆ Area 31a: April 29 - June 30

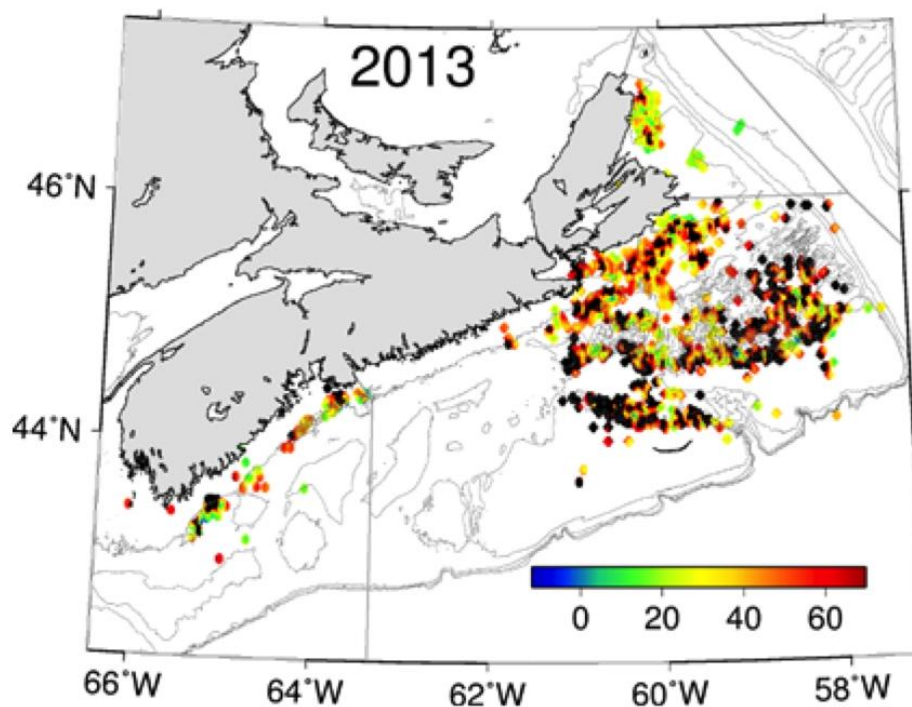


**Figure 4-28: Lobster Fishing Areas and Sampling Areas for Research Studies (Tremblay et al. 2012)**



### *Snow Crab*

Snow crab (*Chionoecetes opilio*) is one of the dominant macro-invertebrates on the Scotian Shelf, common over muddy bottom and in water temperatures less than 6°C at depths to near 300 m (DFO, 2014c). Snow crab contributes almost half of the value of the fisheries within the study area, i.e., close to \$25 million annually. In 2005, former Crab Fishing Areas 20-22 were merged into a single division N-ENS. The approaches to the Strait of Canso are near the dividing line between snow crab divisions N-ENS and S-ENS. As can be seen in Figure 4-29, the fishing effort is relatively heavy throughout the approaches to the Strait. The fishing season is from April 2 to September 30, although somewhat shorter in division N-ENS to the north (Cook, 2014). Overall the fishery is stable and prospects are good.



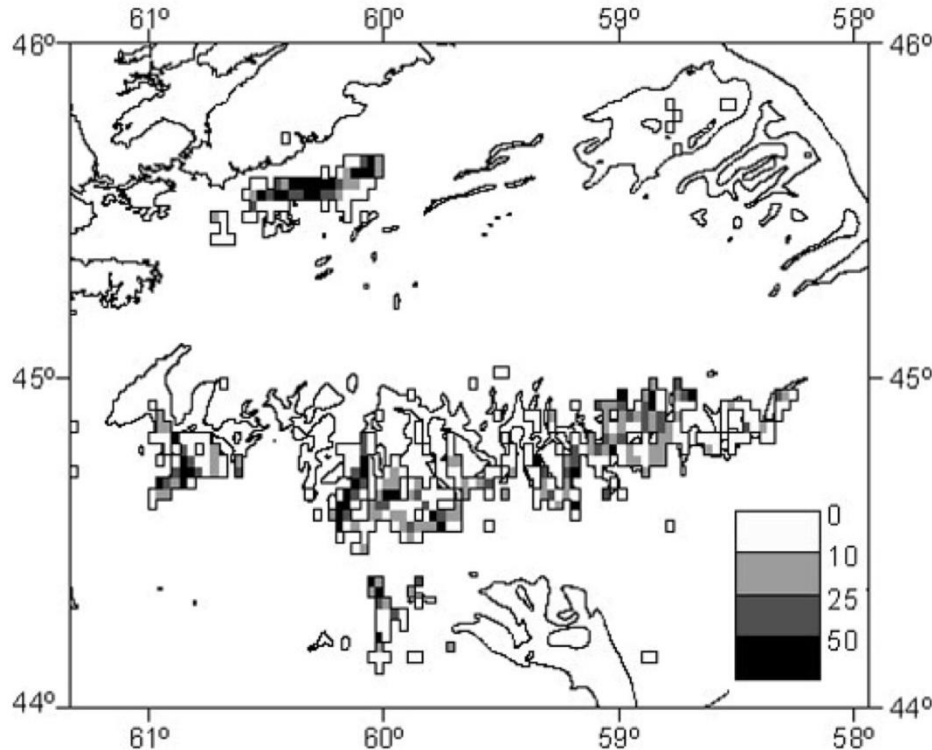
**Figure 4-29: Fishing Effort (Number of traps hauls per 1 minute grid) for Snow Crab from Logbooks in 2013**

### *Shrimp*

Northern shrimp (*Pandalus borealis*) is one of the major shellfish fisheries in the Strait of Canso area. Catches from 1995 to 2011 have averaged almost 4,000 tonnes (Hardie et al. 2013). The fishery is divided into two distinct components: a trap fishery within Chedabucto Bay; and a bottom trawling fishery operating near shore southern Cape Breton Island and in a number of larger deeper 'holes' further offshore, such as Louisbourg Hole, Misaine Hole and Canso Hole. Trawlers are prohibited from



fishing for shrimp within Chedabucto Bay from spring to fall by an 'inshore line'. Shrimp is primarily landed in the ports of Canso, Arichat and Louisbourg. The trap fishery in Chedabucto Bay has been successful in recent years at finding a higher price market in Japan, which is positive for the Canso area. Fishing effort is generally outside of areas frequented by major shipping from the Strait (Figure 4-30).



**Figure 4-30: Annual Effort ('000 hours) Fishing for Shrimp in 2012**

#### 4.5.4.3 Fishing Effort

The number of fishing vessels was not accessible by Statistical District to ensure confidentiality of information, nor was it available for 2010 and 2011. Table 4-37 provides the number of vessels by size class for 2012 to 2014.



**Table 4-37: Number of Licensed Fishing Vessels Registered with Statistical District 9, 14 and 15 by Size Class**

Year	Less than 65'	Greater than 65'	Total
2012	201	10	211
2013	199	11	210
2014	203	10	213

### *Navigation and Risk*

Fishing vessels are equipped with standard aids to navigation, including radar, radar reflectors, lights and fog horns, and are subject to the standard marine rules for navigation, including the training of crew. Navigation rules generally require fishing vessels to give right of way to large vessels like LNG tankers, but fishing vessels towing nets are less mobile and are given right of way if running lights indicate they are towing gear. Navigation lanes are established where marine traffic is higher to avoid encounters between fishing vessels and other marine traffic. Accidents between fishing vessels and other marine traffic are a rare event. One of the issues to be considered is to determine if mobile gear is potentially active in an area where project traffic could increase risk.

With regards to fixed gear, minimizing potential interactions and adverse effects is typically an issue of risk management and effective communications. If a buoy marking a trap is lost, the gear may not be able to be recovered. While careful watch is kept, under conditions of poor visibility, gear loss can occur.

### *Seasonality of Fishing*

Table 4-38 illustrates the fishing effort within the study area (4Wd) based on fishing logs and landing information. Effort was approximated based on the number of data points associated with catch data and interpreted in relation to relevance to the project. The effort shown is considered to be indicative of the period when major interactions between fishing operations and LNG vessel traffic could potentially occur.

**Table 4-38: Fishing Effort by Month and Major Species for Management Area 4Wd**

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Cod		Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Yellow	Yellow	Yellow	
Haddock					Yellow	Yellow	Yellow	Yellow	Yellow			
Halibut	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Yellow	Yellow	Yellow	Yellow
Turbot			Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow		Yellow
Cusk					Yellow	Yellow	Yellow	Yellow				
Monkfish							Yellow					
Herring								Yellow				
Mackerel					Yellow	Yellow	Yellow		Yellow	Yellow	Yellow	
Tuna, Bluefin									Orange	Orange	Orange	
Alewife					Yellow	Yellow				Yellow	Yellow	Yellow
Am, Eel				Yellow		Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	
Smelt	Yellow	Yellow								Yellow	Yellow	Yellow
Blue Shark												
Soft Shell Clams				Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow		
Scallop	Yellow	Yellow	Orange	Orange				Yellow	Orange	Orange	Red	Orange
Lobster	Yellow			Yellow	Yellow	Yellow	Yellow				Yellow	Yellow
Shrimp	Yellow	Orange	Orange	Red	Red	Red	Orange	Yellow	Orange	Orange	Red	Red
Jonah Crab				Yellow	Yellow	Yellow						
Rock Crab				Yellow	Yellow	Yellow	Yellow	Yellow				
Snow Crab				Red	Red	Red	Red	Red	Orange	Orange		Yellow
<b>Legend</b>	Yellow	1-3 data points per month			Orange	4-9 data points per month			Red	>9 data points per month		



#### 4.5.4.4 Recreational Fishery

As identified in the previous Environmental Assessment (JWEL, 2004a), there are reports of diving for scallops in the Strait area and sport fishing for trout and salmon. Recreational fishing for mackerel may take place close to the Project site, however, it mostly occurs off the Causeway, local wharves and piers around Port Hawkesbury, as well as the southeast tip of Bear Head.

The dirt road around the Project site is used by recreational fishers and anglers to launch their boats from the beach at the southern end of Bear Head. August, September and October are the months when the majority of recreational fishing takes place. Recreational fishing in the streams located around the Project area is not known to occur. The southeastern point of Bear Head contains a pond regularly harvested for mussels by recreational harvesters.

#### 4.5.4.5 Aquaculture

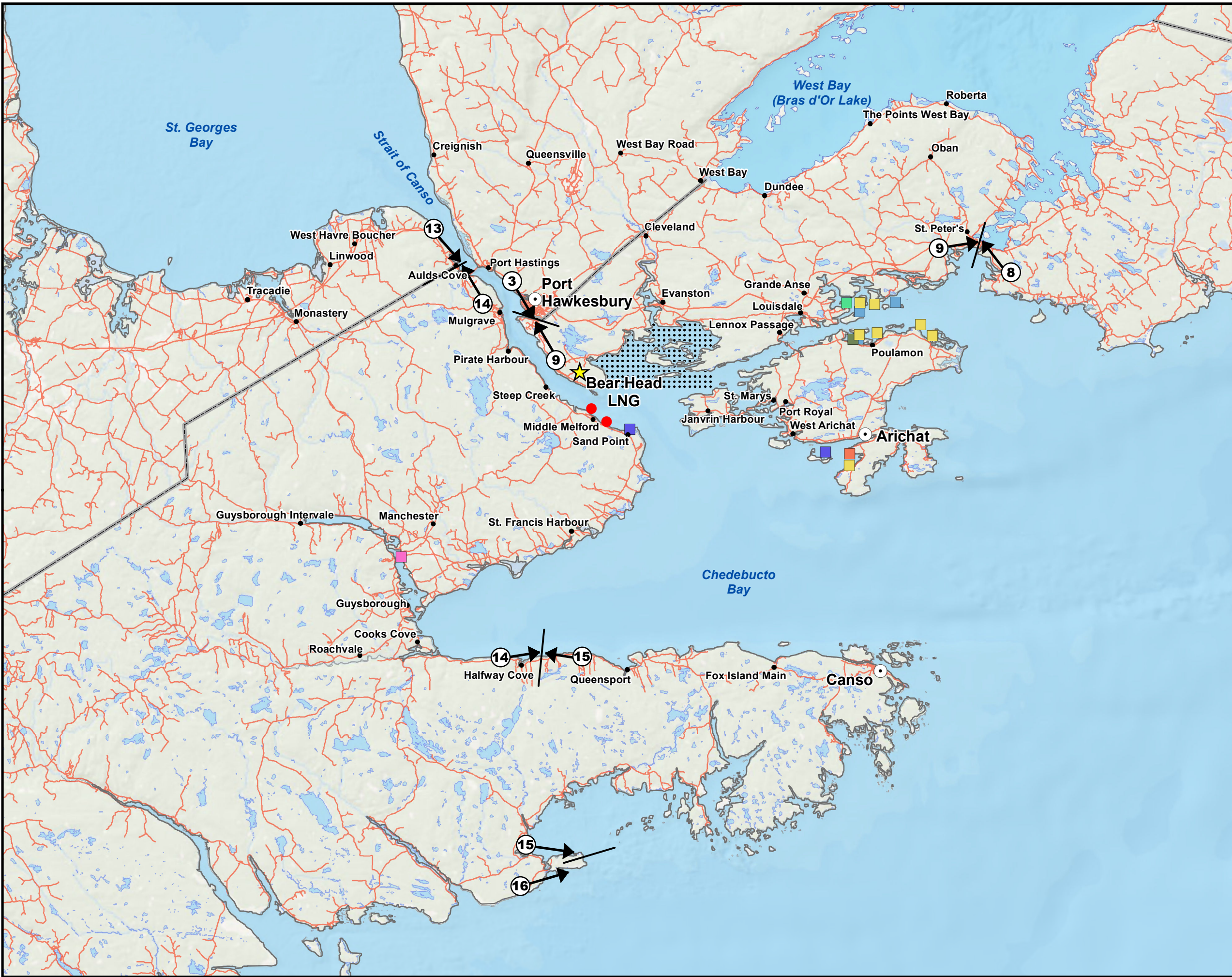
Aquaculture sites near the main navigation route for the LNG tankers are described in Table 4-39. It should be noted that there are approximately 11 shellfish sites near Louisedale, to the north of Isle Madame, and approximately 9 shellfish sites near Whitehead Harbour to the south of Cape Canso.

**Table 4-39: Major Aquaculture Sites in Chedabucto Bay, Nova Scotia**

Lease Holders	Species	Size (ha)	Latitude (N)	Longitude (W)
St. Peters Fish Hatchery Ltd.	A. salmon, rainbow trout	22.98	45° 30' 3.271"	61° 02' 35.430"
Steven Grady	A. salmon, rainbow trout	4.2	45° 31' 17.347"	61° 15' 14.452"
Little Harbour Hatchery Ltd.	Brook trout, A. salmon, brown trout, rainbow trout	1.84	45° 25' 41.491"	61° 30' 13.5"
Premium Seafoods Ltd.	American oyster, blue mussel, sea scallop	8.22	45° 29' 56.045"	61° 01' 01.825"
Ronald Boudreau	Blue mussel, sea scallop	8.03	45° 29' 24.881"	61° 01' 04.619"

The location of aquaculture sites are illustrated in Figure 4-31. Note this figure also illustrates the boundaries of Statistical Districts, major ports, and the location of some near shore fishing areas for mackerel and sea scallop.

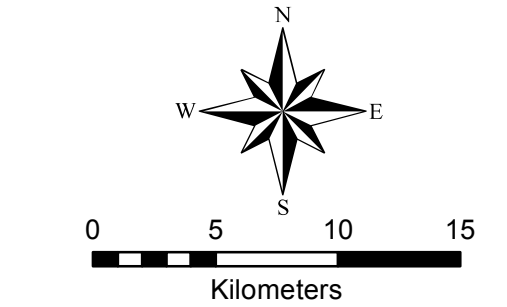




**Figure 4-31  
 Aquaculture Leases**

- Mackerel Trap Locations
- American Oyster; Blue Mussel; Sea Scallop
- Atlantic Salmon; Rainbow Trout
- Bay Quahaug; Sea Scallop; Blue Mussel; American Oyster
- Blue Mussel
- Blue Mussel; Sea Scallop
- Brook Trout; Atlantic Salmon; Brown Trout; Rainbow Trout
- Sea Scallop; Blue Mussel
- Major Ports
- # Fisheries Statistical District
- County Boundaries
- ⋯ Scallop Fishing Area

Note: Lobster fishing occurs near shore to a depth of 70m in some areas.



Map Parameters  
 Projection: Universal Transverse Mercator (UTM)  
 Datum: NAD83  
 Zone: 20  
 Scale: 1:300,000  
 Project Number: 622560  
 Date: April 1, 2015

Data Source:  
 -Canvec (2013) Digital National Topographic System (NTS) topographic dataset for Port Hawkesbury (011F11)  
 -Nova Scotia Department of Fisheries and Aquaculture



#### 4.5.5 First Nations Land and Resource Use

A MEKS was undertaken by Mainland Mi'kmaq Developments Inc. to update the MEKS completed in 2004 with the intent of supporting the integration of Mi'kmaq knowledge relating to use and occupation of the Mi'kma'ki into the Environmental Assessment process. An interim MEKS was completed for this assessment, pending field studies to be completed in June of 2015. The interim updated MEKS is provided in Appendix F. Further conclusions and recommendations may be made once the final MEKS is completed.

#### 4.5.6 Archaeological and Heritage Resources

An integral part of the environmental assessment (JWEL, 2004a) was the execution of a study to determine the archaeological importance of the project site and surrounding lands and waters. This work drew upon the archaeological site records at the Nova Scotia Museum of Natural History, historical literature and archival resources; an archaeological survey of the proposed Project area was undertaken to assess the heritage resource potential (JWEL, 2004a).

Archaeological research was performed using the previously accepted Bear Head LNG environmental assessment in combination with additional historical research at the Public Archives of Nova Scotia. Using a map created by A.F. Church for Richmond County published between 1883 and 1887, dwellings in and around the Bear Head LNG site were identified (Church, 1883-1887). These dwellings may have been related to mining or ship building activities, which were prevalent in the area during the 19<sup>th</sup> century. All dwellings within the Bear Head LNG site were digitized as part of the 2004 work. These files can be found in Appendix F. Although more names were shown on the A.F. Church map in the Point Tupper area, after digitizing the map and adding geo-referenced points, seven dwellings were identified as having once existed in the vicinity of the Project site<sup>7</sup>; these dwellings are located on Figure 4-32.

No other archaeological sites were identified on the site. Information in the previous environmental assessment is important to this section as major development occurred following the accepted 2004 Bear Head LNG environmental assessment. Also reported on the 2004 Bear Head LNG Environmental Assessment was communication with a representative of Nova Scotia Museum's Archaeological Sites Inventory Database stating that there were no additional archaeological sites identified in the Bear Head LNG site area (JWEL, 2004a).

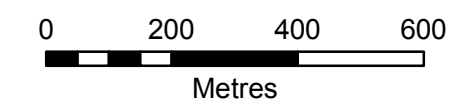
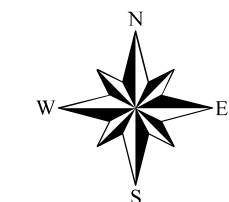
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<sup>7</sup> These dwellings were identified under the following names: J. Mackie, P Mackie, A McPherson, T. Mitchell, J. Morash, D. O'Brien and G. Wright.

**Figure 4-32**  
**Archaeological Sites**



- Archaeological Sites
- Bear Head LNG Site Features
- Elevation
- Rivers and Streams
- Roads
- Waterbodies



Map Parameters  
 Projection: Universal Transverse Mercator (UTM)  
 Datum: NAD83  
 Zone: 20  
 Scale: 1:20,000  
 Project Numer: 622560  
 Date: April 1, 2015

Data Source:  
 -Canvec (2013) Digital National Topographic System (NTS) topographic dataset for Port Hawkesbury (011F11)  
 -Archeological Impact Assessment (A2003NS55)  
 -Site Preparation As-builts, J & T Van Zutphen for Bear Head LNG Corp., April 7, 2006, PN 6143  
 -Plot Plan, LNG International Limited, March 5, 2015, BH-DG-00-002 Rev C1



#### 4.5.6.1 Archaeological Potential – Pre-Contact

Pre-contact sites refer to areas of pre-European archaeology, such as aboriginal burial sites (Saskatchewan Archaeological Society, 2015). Three facts lead to the observation that Bear Head LNG site is unlikely to be the location of site of pre-contact archaeological importance: few necessary resources for survival, extreme exposure and lack of scholarly reporting of the area. Better resources, including proximity to fresh water, a food supply and transportation is found inland from the site. Also, the Bear Head location is subject to extreme climatic conditions, including winds from the Strait of Canso and Chedabucto Bay. These two facts combined with the lack of published or documented scholarly material make the Bear Head LNG site an unlikely location for pre-contact archaeology (JWEL, 2004a).

#### 4.5.6.2 Archaeological Potential – Historic

As described in the 2004 Bear Head LNG Environmental Assessment and noted in additional research at the Public Archives of Nova Scotia, the oldest information found pertaining to the Bear Head LNG site is on the A.F. Church map from the late 19th century. No earlier historical information was located.

#### 4.5.6.3 Field Survey

An archaeological field survey was undertaken between September 15 and 19, 2004. The survey was performed over the Bear Head LNG site, and surrounding areas, with focus on the coast line. The potential for Aboriginal, or pre- contact archaeology, was considered during planning and throughout the survey. An attempt was made to view all locations within the site that were identified on the A.F. Church map. Using GPS, a search for remnant dwelling features was performed. All features located were photographed and entered on a Maritime Archaeological Resource Inventory Site Survey Form. Information and details from the survey can be found in Appendix H.

As described in the field survey notes of Appendix H, components of the physiography were described, including terrain, plants, and surface rocks. No definitive archaeological sites were found on the beach except for a spoil heap of rocks, possibly from mining activities. Further research did not determine this to be a significant feature. There was no evidence of Aboriginal occupation on the beach (JWEL, 2004a).

Of the dwellings shown on the A.F. Church map, three could not be located. Using the GPS and including a 50 m buffer capacity, surveyors could not locate any settlement features (cellars) for the A. McPherson, J. Morash, or G. Wright dwellings. All details found pertaining to the other noted dwellings are described in the full report in Appendix H. The observed features included stone foundations, a stone well, and some landscaping. An error on the A.F. Church map location for the T. Mitchell dwelling was assumed. Surveyors found features east of the originally defined area, which are presumed to be part of the Mitchell dwelling. The four foundations that were found during the survey are outside the Project area and were not disturbed by the existing development. The previously performed survey did not suggest a need for further archaeological exploration in the area.