4 EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS ASSESSMENT

The original EA Report (March 2014) and subsequent EA Addenda and Amendment provided a detailed overview of the existing (baseline) environment within and around the GrandSPAN Project and Study Areas, including relevant aspects of the existing physical, biological and socioeconomic environments, and an assessment of the potential environmental effects of the Project.

This Chapter of the 2018 EA Update provides an updated overview of the existing environmental setting for the Project. This includes a description of any new or additional information for the EA Study Area that has become available since the original EA documentation was completed, with a particular focus (where possible and relevant) on the planned 2018 survey area. It also provides an analysis of any implications of this new information and the specific nature and scale of the planned 2018 Project activities for the EA's predicted environmental effects, the mitigation measures that have been identified and proposed by GXT for the Project, and thus for the overall findings and conclusions of the original EA documents referenced above. This discussion is focussed on and structured according to the various Valued Environmental Components (VECs) that were considered and addressed in the original EA Report, namely:

1) Marine Fish and Fish Habitat;
2) Marine Fisheries and Other Activities;
3) Marine / Migratory Birds;
4) Marine Mammals and Sea Turtles;
5) Species at Risk; and
6) Protected and Sensitive Areas

In the interests of efficiency and brevity it does not repeat all of the detailed environmental information and analysis provided in the original EA documentation, which should therefore also be referred to as required and relevant.

4.1 Marine Fish and Fish Habitat (Including Species at Risk)

Marine ecosystems comprise both biological and physical elements that interact to form complex and variable patterns across a seascape. Biological ecosystem elements span primary producers such as phytoplankton to consumers such as zooplankton, benthic invertebrates and fish. In the Study Area many of these species are of ecological, cultural, commercial and/or of conservation importance and may rely on specific habitats to fulfil parts of their life cycle. The EA Report presented a detailed overview of marine fish and fish habitat within the Study Area, including plankton, algae, benthic invertebrates and fish (Section 4.2.1), based on existing and applicable information that was available at the time of writing, with additional information provided as available in the EA Addenda and 2015 EA Amendment.

4.1.1 Existing Environment

For the most part, the information and datasets that were used in the original EA documentation represent the most recent and relevant information on marine fish and fish habitat in the overall Study Area. In some instances, new information has become available on particular fish species within the region, which include commercial species and species that have been identified as being of

conservation concern. Key data sources used in this EA Update are presented in Table 4.1, which are summarized in the subsections that follow.

Table 4.1 Marine Fish and Fish Habitat: Additional or Updated Data Sources Used in the EA Update

Environmental Component	Additional or Updated Data Sources Used in the EA Update
Assemblages	Murillo et al (2016a), Nogueira et al (2014, 2016, 2017, 2018)
Plankton	Melle et al (2014); Pepin et al (2015)
Plants and Macroalgae	Hernandez-Kantun et al (2017)
Benthic Invertebrates	Kenchington et al (2014); Barrio Froján et al (2015); Beazley and Kenchington (2015); Beazley et al (2015), Greenan et al (2016), Guijarro et al (2016), Howell et al (2016); Mullowney et al (2017); Murillo et al (2016a, 2016b); Buhl-Mortensen (2017); Kenchington et al (2017)
Marine Fish	Curtis et al (2014); Nogueira et al (2014, 2015, 2017,2018); Parzanini et al (2017); Vaudo et al (2017)
Species at Risk	COSEWIC (2016); Simpson et al (2016)

4.1.1.1 Assemblages and Taxonomic Groups

Flora and fauna distribute themselves across the GrandSPAN Study Area in a manner that mirrors environmental and habitat preferences, as well as inter- and intra-species interactions including competition and predation. When species overlap consistently in time and space, they form assemblages (Haedrich and Merritt 1990, Amec 2014). These assemblages are often associated with particular habitats resulting from a combination of environmental parameters including depth, temperature, pressure, light levels, oceanographic processes, productivity, and substrate type (Gomes et al 1992; Mahon et al 1998; Murillo et al 2016a; Nogueira et al 2017). Assemblages across much of the Study Area, as detailed in the EA Report and by Amec (2014), remain relevant. However, since the original EA documents were completed and submitted there have been updated descriptions of fish (Nogueira et al 2014, 2015, 2017, 2018) and invertebrate (Murillo et al 2016a) depth assemblages across the Study Area that are summarized in their respective sections below.

4.1.1.2 Plankton, Plants and Macroalgae

Plankton are small, free-floating organisms that include microscopic marine plants (phytoplankton), invertebrates (zooplankton), vertebrate eggs and larvae (ichthyoplankton), bacteria, fungi and viruses. These organisms make up the dominant group in the ocean, both in terms of diversity and biomass, and consequently, they play an important role as the base layers of most food webs (primary and secondary production).

Recent studies indicate that bathymetry is a dominant factor that influences zooplankton community distribution, with a shift in community composition from the continental shelf to the shelf edge (Pepin et al 2015). In Atlantic Canada waters, zooplankton communities in shallow shelf areas are dominated by *Pseudocalanus spp, Temora longicornis*, and larvaceans, whereas deeper waters are dominated by *Oithona atlantica, Microcalanus spp, Calanus finmarchicus* and Ostracods (Pepin et al 2015). *Calanus finmarchicus* is, for example, considered one of the most important copepods in the North Atlantic due to its abundance and role in food webs (Melle et al 2014). A review of environmental factors that influence this species indicated that *C. finmarchicus* recruitment in the western North Atlantic was

delayed relative to the timing of phytoplankton bloom (Melle et al 2014). Low temperatures in the western North Atlantic were suggested to cause a mismatch in copepod recruitment and the phytoplankton bloom (Melle et al 2014).

Macroalgae (e.g. *Laminaria, Agarum clathratum*) and sea grasses (*Zostera marina*) create important habitat and nursery areas for marine fish and invertebrates (Amec 2014). Their distribution is typically limited, however, to depths less than 50 m as they are reliant on sunlight for photosynthesis (Dayton 1985; Gregory and Anderson 1997; Anderson et al 2002). In Newfoundland waters, the depth boundary where various species will not grow is approximately 75 m (Mathieson and Dawes 2017). Recent reviews of distributions of red coralline algae in the North Atlantic indicate that they may occupy habitats from intertidal zones to 60 m depths (Hernandez-Kantun et al 2017). *Lithothamnion glaciale* and *Lithothamnion tophiforme*, are the primary species distributed in Newfoundland and Labrador waters with *L. glaciale* generally occupying intertidal to moderately deep waters (less than 25 m) and *L. tophiforme* occurring in deeper areas (25-39 m) (Hernandez-Kantun et al 2017).

4.1.1.3 Marine Invertebrates

Benthic Invertebrates

Benthic invertebrates represent a very broad group of animals that associate with the seafloor for at least part of their life cycle. These taxa play a variety of ecological and socioeconomic roles in the ecosystem, and collectively form an important part of the food chain (Templeman 2010), generate habitat heterogeneity (Hasemann and Soltwedel 2011), are part of important commercial fisheries (Dawe et al 2012). Their limited mobility and sensitivity to anthropogenic disturbance makes benthic communities particularly relevant to assessing potential effects related to offshore developments (DeBlois et al 2014; Barrio Frojàn et al 2015; Bell et al 2015; Cordes et al 2016; Clark et al 2016; Murillo et al 2016a, 2016b). An overview of the biology, ecology, and distribution of key benthic and pelagic invertebrate species in the Study Area were detailed in the EA Report (Section 4.2.1.5).

Updated and additional information on benthic invertebrates in the overall Study Area come mainly from surveys on the Flemish Cap and the tail of the Grand Banks (Murillo et al 2016a), Flemish Pass (Barrio Frojàn et al 2015, Beazley et al 2015), and the Orphan Basin (Carter et al 1979, d'Entremont et al 2008). Murillo et al (2016a) recently assessed the composition and distribution of benthic assemblages on the tail of the Grand Bank and the Flemish Cap. Assemblages on continental shelf of the tail of the Grand Bank were associated with coarse sediments and freshwater associated with the Labrador Current. These areas were typically dominated by orange footed sea cucumber (*Cucumaria frondosa*) and sand dollars (*Echinarachnius parma*). On the upper slope of the Grand Bank (650-700 m depth), benthic invertebrate assemblages were dominated by sponges that had a wide bathymetric and geographic range.

Invertebrate assemblages on the Flemish Cap at depths less than 500 m typically included the sponge *Lophon piceum*, and crustacean *Sabinea sarsii*. Echinoderms (*Ceramaster granularis, Ponaster tenuispinus, Ctenodiscus crispatus, Brisaster fragilis*) and sea anemones (*Hormathia digitata*) were characteristic species on the Flemish Cap from 200-500 m and were associated with silt, sand and gravel bottoms (Murillo et al 2016a). Within the 500-900 m depth range on the Flemish Cap, on primarily sandy-silt bottoms, deep-sea coral assemblages were observed that were characterized by a variety of coral species (black corals, cup corals, soft corals, sea pens, gorgonian corals). Deepwater invertebrate assemblages (700-1,400 m) were similar among the tail of the Grand Bank and the Flemish Cap with

the macrofauna assemblages become increasingly characterized by various species of sea pens, sponges and echinoderms (sea urchins and seastars) (Murillo et al 2016a).

In the Flemish Pass and western Flemish Cap, some 527 epifaunal species / morphotypes were identified from 400-1,400 m depths (Beazley et al 2015, Greenan et al 2016). Sponges and cnidarians represented the highest number of taxa, followed by arthropods echinoderms and molluscs (Beazley et al 2015). Infaunal assemblages in the Flemish Pass are characterized by polychaetes, nematodes, brittle stars, sponges, and hydrozoans (Barrio Frojàn et al 2015).

The Orphan Basin lies in the northern part of the overall Study Area and is an area that exhibits relatively little habitat complexity in deep areas (from 2,000 m to over 3,000 m). The area is dominated by species that can thrive in silt habitats including polychaetes, molluscs, sand dollars, brittlestars and brachiopods (Carter et al 1979). Sponges are also distributed in deep areas of the Orphan Basin. In preliminary surveys of the Orphan Basin, unidentified hydroids, sponges, anemones, brittlestars, sea urchins, and crabs were observed (d'Entremont et al 2008).

Snow crab was identified as a commercially important benthic invertebrate species in the EA Report. Mullowney et al (2017) used survey and tagging data to further characterize the inshore and offshore movements of snow crab. This species migrates to deeper waters as they transition to adults with average movements ranging from 54-72 km for male and female crab (Mullowney et al 2017). These movements down-slope are associated with temperature as the juveniles search for warmer waters. Seasonal migrations where crab move towards shallow waters for mating and molting range from 43-46 km on the Grand Bank and 25 km in an inshore bay (Notre Dame Bay) (Mullowney et al 2017). Overall, this recent study indicates that individual snow crab demonstrate high levels of mobility in the Study Area.

Corals and Sponges

Deep-sea corals, sea pens and sponges (Figures 4.1 to 4.4) are a subset of benthic invertebrates that are of particular conservation interest due to their habitat-forming capacity and their relative sensitivity to certain types of anthropogenic stressors (Murillo et al 2011; Beazley et al 2013). There are at least 57 species of corals and sea pens distributed within and around the Study Area on the Flemish Cap, Flemish Pass and the Grand Banks based on bottom trawling and video surveys (Gilkinson and Edinger 2009; Wareham 2009; Murillo et al 2012; Beazley et al 2013, Vàzquez et al 2013; Baillon et al 2014a, 2014b; Kenchington et al 2014, Beazley and Kenchington 2015). Along shelf and slope areas, depth along with other associated environmental parameters is considered the greatest predictor for coral presence as determined by distribution models (Guijarro et al 2016). This supports the association of coral species to specific depth ranges, particularly on shelf slopes.

In the Study Area, soft corals are mainly distributed on shelf areas, whereas black wire corals, gorgonian corals and stony cup corals are distributed on the shelf slopes (Figures 4.1 and 4.2). Sea pens and stony cup corals are also well distributed along the northern margin of the Laurentian Channel. *Lophelia pertusa* has recently been observed at the shelf break in the mouth of the Laurentian Channel inside the Project Area (Buhl-Mortensen 2017). *Lophelia pertusa* corals are a long-lived, reef building cold water corals that are sensitive to damage from bottom-contacting fishing gear (Buhl-Mortensen 2017).

Figure 4.1 Coral Distributions based on Canadian (2005-2015) RV Surveys

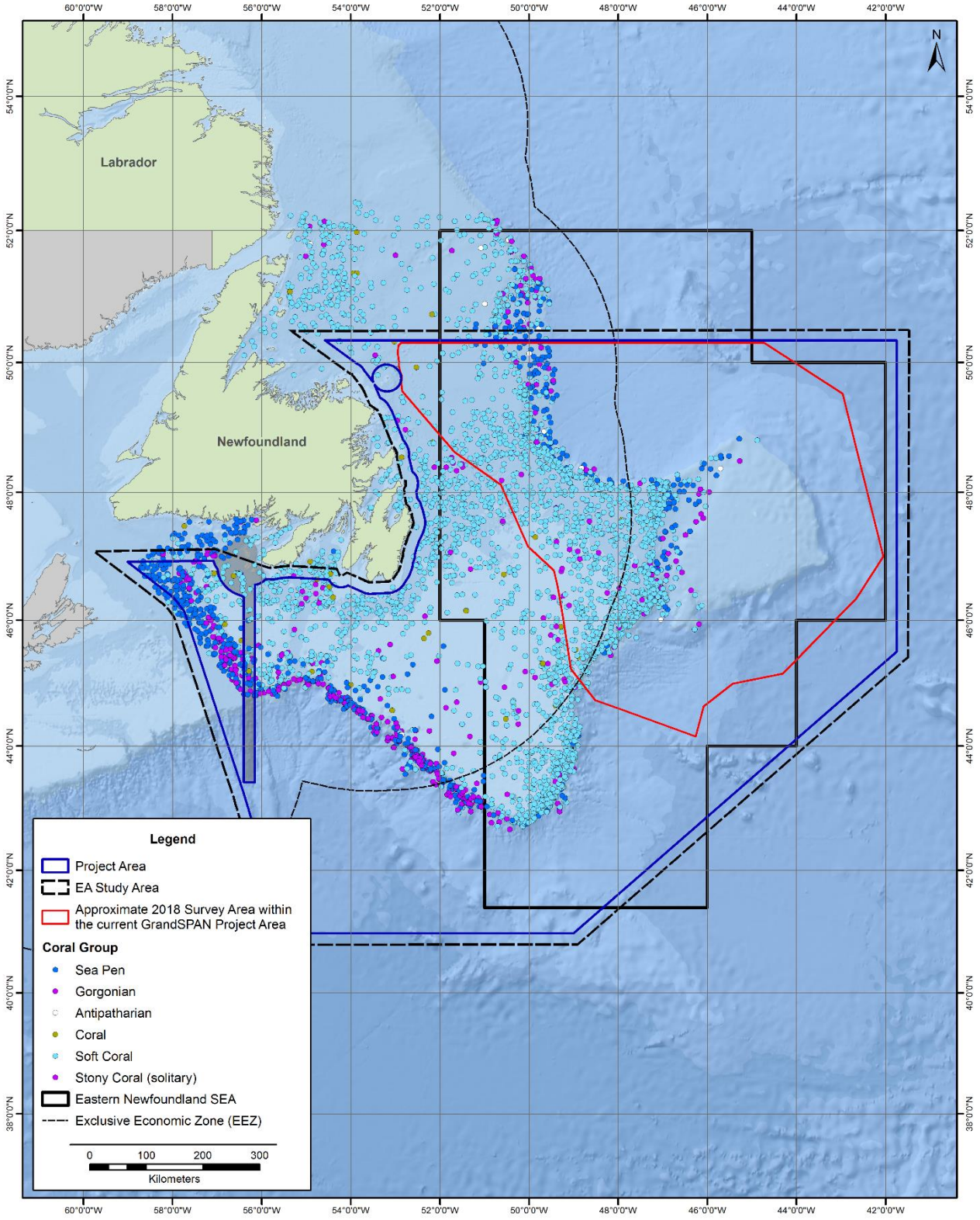


Figure 4.2 Coral Distributions based European Union-Spanish (2004-2013) RV Surveys

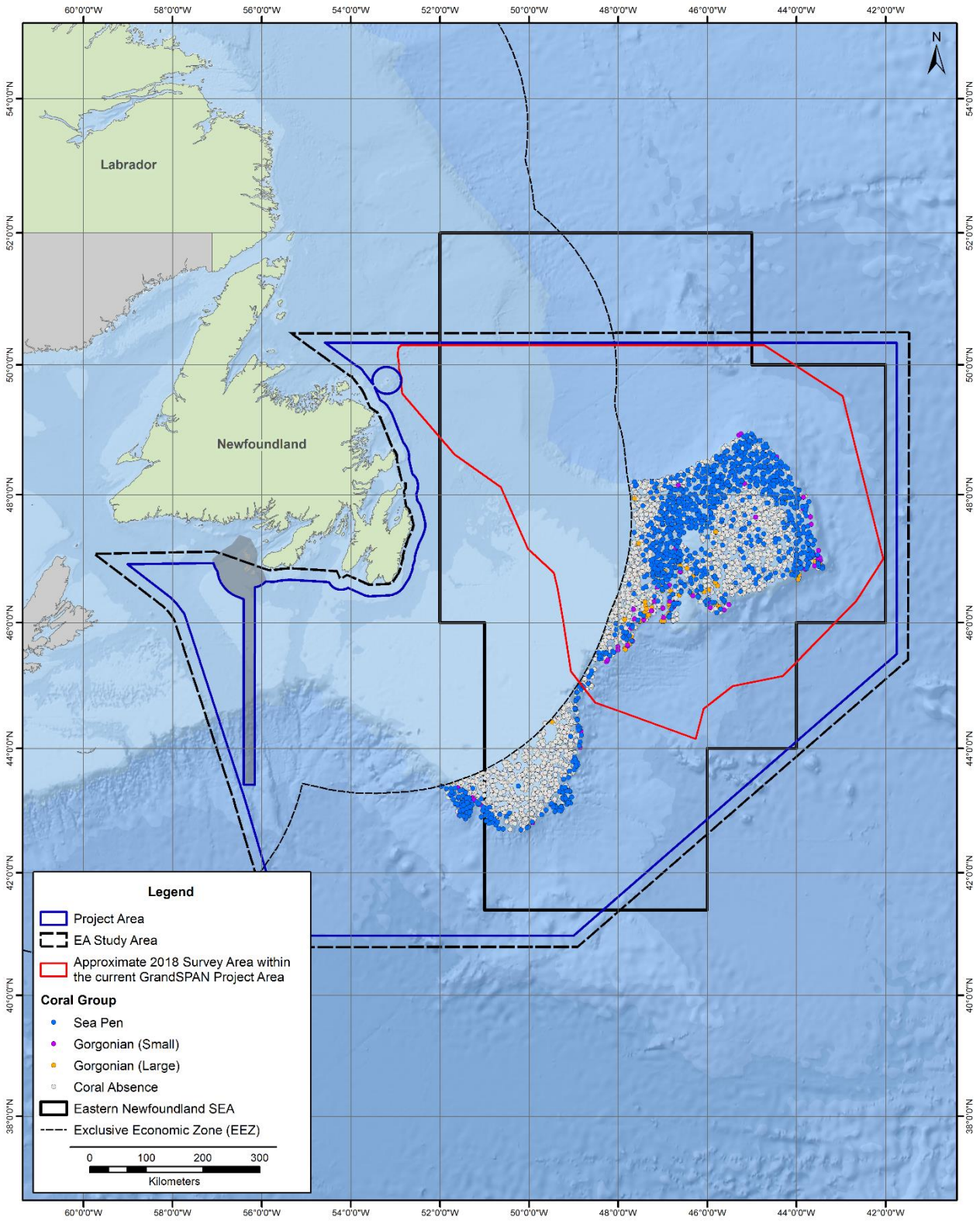


Figure 4.3 Sponge Distributions based on Canadian (2005-2015) RV Surveys

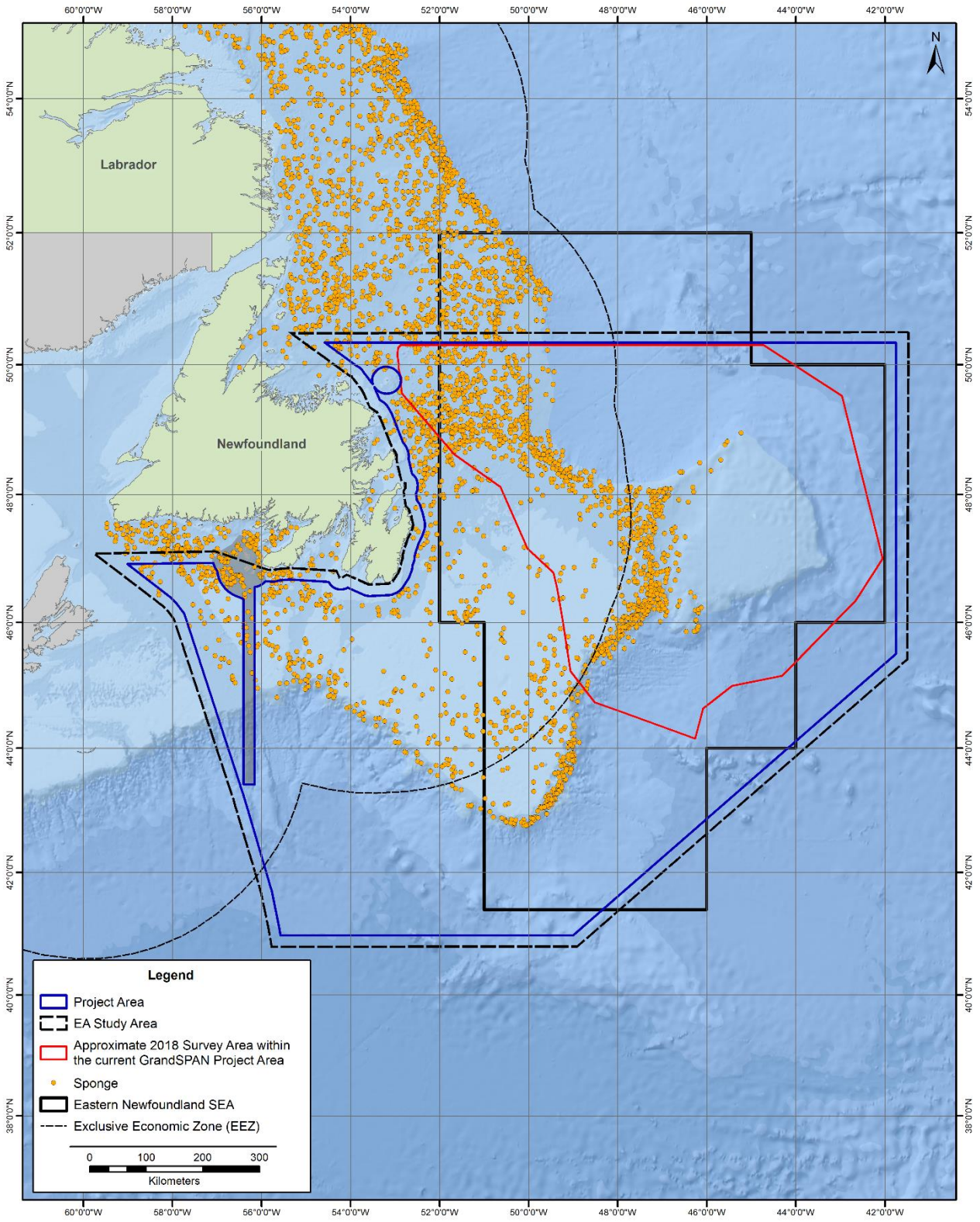
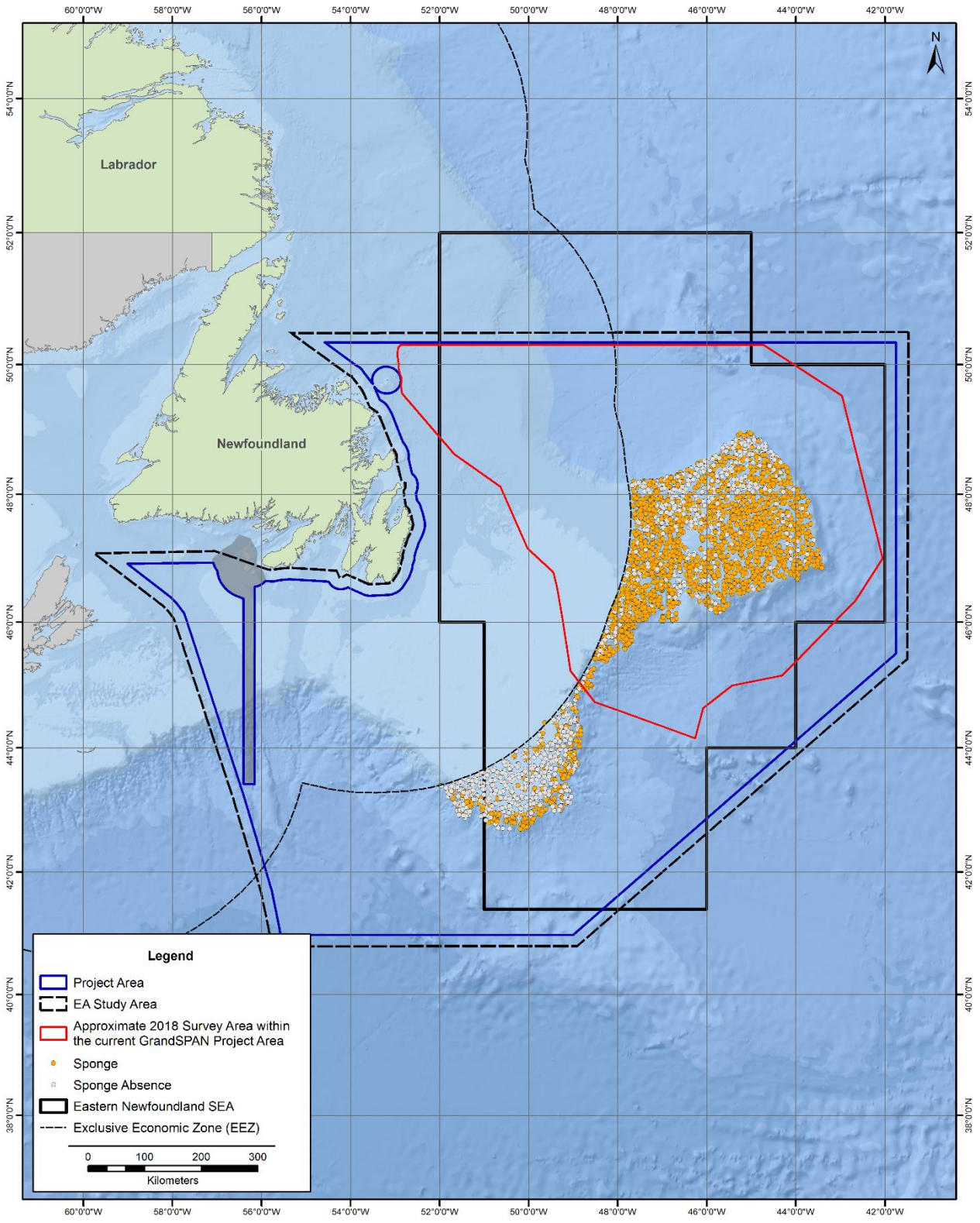


Figure 4.4 Sponge Distributions based on European Union-Spanish (2004-2013) RV Surveys



There are also at least 60 sponge species found within the Study Area (Figures 4.3 and 4.4; Murillo et al 2012; Beazley et al 2013; Knudby et al 2013; Beazley and Kenchington 2015; Beazley et al 2015, Murillo et al 2016b). Due to their fragile nature, sponges are not always identifiable to species from such surveys, and therefore sponge diversity may be under represented in published reports (Knudby et al 2013). Sponges exhibit a wide depth range (100-1,500 m) with the higher sponge biomass being located on the Flemish Cap, followed by the Flemish Pass and the tail of the Grand Banks. Sponges are well distributed on shelf areas east of Newfoundland with lower distributions on the southern Grand Banks (Guijarro et al 2016). Murillo et al (2016b), for example, identified deep areas of the Flemish Cap and the Grand Bank as areas of high biomass for *Geodia sp*. Distribution modelling indicates that summer primary production minimum, silicate concentration, temperature, depth and particular organic carbon availability were the primary parameters in predicting sponge distribution (Guijarro et al 2016, Howell et al 2016).

Pelagic Invertebrates

Pelagic macroinvertebrates include animals that live exclusively in the pelagic environment or swim up from the benthos to feed. A review of trawl data on the Flemish Cap (Vázquez et al 2013) indicated that squid (e.g., *Illex illecebrosus, Histoteuthis sp., Gonatus sp*.), octopus (*Bathypolypus arcticus*), shrimp (e.g., *Pandalus borealis. Acanthephyra pelagica, Pasiphaea tarda*) were commonly captured. *Gonatus sp.* squid are suggested to be particularly abundant along the slopes of the Newfoundland Shelf in the Study Area (NAFO areas 3LMNO) due to their prevalence in the stomachs of Greenland halibut, and are considered an important prey species (CBD 2014).

4.1.1.4 Marine Fish

Marine fish are found throughout the Study Area and, of the 188 species known to occur in Newfoundland and Labrador waters (Templeman 2010), many are of ecological, commercial, conservation and/or cultural importance. These species collectively reflect a diversity of morphologies, life histories, habitat requirements and their presence within the Study Area varies according to environmental conditions, habitat, and life history stage. The overlap in fish presence based on their environmental requirements and preferences again results in distinct assemblages of fish species. An overview of the biology, ecology, and distribution of key demersal and pelagic fish species in the Study Area is detailed in the original EA Report (Section 4.2.1.6).

Demersal Fish

Since the completion of the original EA documentation for the Project, key groundfish assemblages in the Study Area have been further characterized with European Union Research Vessel (RV) data for the Flemish Cap and the tail of the Grand Banks (Nogueira et al 2014, 2015, 2017, 2018) (Table 4.2). Groundfish assemblages have been observed to associate with depth, but this may be a proxy for other associated environmental parameters including temperature, productivity, oceanographic processes and oxygen levels (Nogueira et al 2017). In groundfish assemblages, biomass and abundance was observed to decline with depth and diversity was observed to increase with depth (Nogueira et al 2015, 2017). Therefore, at shallower depths the areas are often dominated by a few species with high abundance, whereas deeper water fish assemblages are dominated by several species with low abundance. Across areas, Atlantic cod, American plaice, and Atlantic wolffish were characteristic species in the shelf assemblages, transitioning to redfish species, Arctic eelpout, longfin hake, and wolffish species in the upper-slope assemblage. The lower medium assemblage was characterized by

a variety of species including Greenland halibut, blue hake, grenadier species and black dogfish (Nogueira et al 2014, 2015, 2017, 2018).

Table 4.2 Generalized Fish Assemblages According to Depth for the Tail of the Grand Banks and Flemish Cap

Tail of the Grand Banks	Flemish Cap
Shelf Assemblage (38-300 m)	**Shelf Assemblage (129-250 m)**
• Yellowtail flounder, *Limanda ferruginea* • American plaice, *Hippoglossoides platessoides* • Northern sand lance, *Ammodytes dubius* • Moustache sculpin, *Triglops murrayi* • Capelin, *Mallotus villosus* • Atlantic cod, *Gadus morhua* • Sea raven, *Hemitripterus americanus* • Atlantic wolffish, *Anarhichas lupus* • Thorny skate, *Ambylaraja radiata* • Monkfish, *Lophius americanus*	• American plaice, *Hippoglossoides platessoides* • Witch flounder, *Glyptocephalus cynoglossus* • Atlantic cod, *Gadus morhua* • Atlantic wolffish, *Anarhichas lupus* • Golden redfish, *Sebastes norvegicus* • Spotted wolffish, *Anarhichas minor*
Upper slope assemblage (301-600 m)	**Upper slope assemblage (251-600 m)**
• Redfish, *Sebastes* spp. • Spotted wolffish, *Anarhichas minor* • Arctic eelpout, *Lycodes reticulatus* • Northern wolffish, *Anarhichas denticulatus* • Witch flounder, *Glyptocephalus cynoglossus* • Longfin hake, *Phycis chesteri*	• Acadian redfish, *Sebastes fasciatus* • Deepwater redfish, *Sebastes mentella* • Arctic eelpout, *Lycodes reticulatus* • Thorny skate, *Amblyraja radiata* • Longfin hake, *Phycis chesteri* • Spinytail skate, *Bathyraja spinicauda* • Northern wolffish, *Anarhichas denticulatus*
Lower-medium Assemblage (601-1,460 m)	**Lower-medium Assemblage (601-1,460 m)**
• Greenland halibut, *Reinhardtius hippoglossoides* • Blue hake, *Antimora rostrata* • Roughhead grenadier, *Macrourus berglax* • Marlin-spike, *Nezumia bairdii* • Black dogfish, *Centroscyllium fabricii* • Roundnose grenadier, *Coryphaenoides rupestris* • Northern cutthroat eel, *Synaphobranchus kaupii* • Arctic skate, *Amblyraja hyperborea* • Snubnosed spiny eel, *Notacanthus chemnitzii* • Spinytail skate, *Bathyraja spinicauda* • Longnose chimera, *Harriotta raleighana*	• Greenland halibut, *Reinhardtius hippoglossoides* • Blue hake, *Antimora rostrata* • Roughhead grenadier, *Macrourus berglax* • Marlin-spike, *Nezumia bairdii* • Black dogfish, *Centroscyllium fabricii* • Roundnose grenadier, *Coryphaenoides rupestris* • Northern cutthroat eel, *Synaphobranchus kaupii* • Arctic skate, *Amblyraja hyperborea* • Snubnosed spiny eel, *Notacanthus chemnitzii* • Sloane's viperfish, *Chauliodus sloani* • Vahl's eelpout, *Lycodes vahlii* • Scaly dragonfish, *Stomias boa* • Bean's sawtoothed eel, *Serrivomer beanii* • Threadfin rockling, *Gaidropsarus ensis* • Demon catshark, *Apristurus* sp. • Lanternfish, *Lampanyctus* sp.
Source: Adapted from Nogueira et al (2014, 2015, 2017, 2018).	

Pelagic Fish

Pelagic fish species in the Study Area undertake extensive seasonal migrations to spawning, nursery and foraging areas (Trenkel et al 2014). This includes seasonal spawning migrations between freshwater and marine habitats (e.g. Atlantic salmon, American eel), summer feeding migrations from

southerly latitudes by migratory warm water pelagic fishes (e.g., tunas, swordfish, sharks), and seasonal inshore offshore migrations (e.g., Atlantic cod, capelin) as detailed in the original EA Report. Temperature is considered a key environmental parameter for controlling distributions of various small to medium pelagic species (e.g., herring, mackerel, capelin) (Trenkel et al 2014). In large pelagic species such as tuna and swordfish, temperature, oxygen levels, population density, and oceanographic processes are important for determining spatial distributions (Trenkel et al 2014).

Recent tagging and fishing surveys focussed on sharks have further characterized their habitat utilization and distribution in Canadian waters. Early, juvenile and adult life stages of porbeagle sharks are abundant on or near the continental shelf in Canadian waters and are rarely captured at the surface or at depths greater than 200 m (COSEWIC 2014). Conversely, shortfin mako migration routes are mainly in offshore areas outside the continental shelf, including the Newfoundland Shelf and Flemish Cap in summer to winter seasons (Vaudo et al 2017). White sharks have seasonal distribution ranges, where in winter months they frequent areas off the southeastern United States and in spring to summer months expand to northern parts of their range (Curtis et al 2014), as evidenced by female white sharks that have been tracked to the southern Newfoundland shelf and slopes and to the Flemish Cap (Ocearch 2018).

4.1.1.5 Species at Risk

There are a number of fish species that have been designated as being at risk, or which have otherwise been identified as being of special conservation concern, that are known or likely to occur in the Study Area, including several that are designated and formally protected under the federal *Species at Risk* Act (SARA) and/or the Newfoundland and Labrador *Endangered Species Act* (NL ESA) (Table 4.3). Since the EA Report and Amendment were completed and submitted there have been changes in species at risk designations for several species, as follows (see shaded rows in Table 4.3):

- Blue shark (*Prionace glauca):* Designation was changed during the November 2016 COSEWIC assessment from “Special Concern” to “Not at Risk” (COSEWIC 2016, SARA 2018);

- Shortfin mako (*Isurus oxyrinchus):* Designation was changed during the April 2017 COSEWIC assessment from “Threatened” to “Special concern” (COSEWIC 2017a); and

- Common lumpfish (*Cyclopterus lumpus):* Designated as “Threatened” during the November 2017 COSEWIC assessment (Simpson et al 2016, SARA 2018).

Table 4.3 Fish Species at Risk or Otherwise of Special Conservation Concern

Species		Status / Designation [1,2]				Relevant Population (Where Applicable)
Common Name	Scientific Name	*NL ESA*	*SARA*	COSEWIC	IUCN	
Atlantic wolffish	*Anarhichas lupus*		SC	SC		
Northern wolffish	*Anarhichas denticulatus*		T	T		
Spotted wolffish	*Anarhichas minor*		T	T		
American eel	*Anguilla rostrata*	V		T	E	Global (IUCN)

Species		Status / Designation [1,2]				Relevant Population (Where Applicable)
Common Name	**Scientific Name**	***NL ESA***	***SARA***	**COSEWIC**	**IUCN**	
Blue shark	*Prionace glauca*			NR	NT	Atlantic (COSEWIC); Global (IUCN)
Basking shark	*Cetorhinus maximus*			SC	V	Atlantic (COSEWIC); Global (IUCN)
Common lumpfish	*Cyclopterus lumpus*			T		Atlantic (COSEWIC)
Alewife	*Alosa pseudoharengus*				LC	Global (IUCN)
Black dogfish	*Centroscyllium fabricii*				LC	Global (IUCN)
Atlantic cod	*Gadus morhua*			E	V	Newfoundland and Labrador (COSEWIC); Global (IUCN)
Cusk	*Brosme brosme*			E		
Haddock	*Melanogrammus aeglefinus*				V	Global (IUCN)
White hake	*Urophycis tenuis*			T		Atlantic and Northern Gulf of St. Lawrence (COSEWIC)
Porbeagle	*Lamna nasus*			E	V	Global (IUCN)
Shortfin mako	*Isurus oxyrinchus*			SC	V	Atlantic (COSEWIC); Global (IUCN)
White shark	*Carcharodon carcharias*		E	E	V	Atlantic (COSEWIC/SARA); Global (IUCN)
Roughhead grenadier	*Macrourus berglax*			SC		
Roundnose grenadier	*Coryphaenoides rupestris*			E		
Lanternfish	Myctophidae				LC	Global (IUCN)
Atlantic hagfish	*Myxine glutinosa*				LC	Global (IUCN)
American plaice	*Hippoglossoides platessoides*			T		Newfoundland and Labrador (COSEWIC)
Atlantic halibut	*Hippoglossus hippoglossus*			NR	E	Global (IUCN)
Barndoor skate	*Dipturus laevis*				E	Global (IUCN)
Smooth skate	*Malacoraja senta*			E	E	Funk Island Deep (COSEWIC); Global (IUCN)
Spinytail skate	*Bathyraja spinicauda*				NT, V	Global, Northwest Atlantic (IUCN)
Thorny skate	*Amblyraja radiata*			SC	V	Canada, Global (IUCN)
Winter skate	*Leucoraja ocellata*			E	E	Eastern Scotian Shelf – Newfoundland (COSEWIC); Global (IUCN)
Atlantic salmon	*Salmo salar*			NR, T, SC, E	LC	South Newfoundland, Gaspe-Southern Gulf of St. Lawrence, Eastern Cape Breton, Nova Scotia Southern Upland (COSEWIC); Global (IUCN)

Species		Status / Designation [1,2]				Relevant Population (Where Applicable)
Common Name	**Scientific Name**	***NL ESA***	***SARA***	**COSEWIC**	**IUCN**	
Albacore tuna	*Thunnus alalunga*				NT	Global (IUCN)
Atlantic bluefin tuna	*Thunnus thynnus*			E	E	Global (IUCN)
Bigeye tuna	*Thunnus obesus*				V	Global (IUCN)
Acadian redfish	*Sebastes fasciatus*			T	E	Atlantic (COSEWIC); Global (IUCN)
Deepwater redfish	*Sebastes mentella*			T	LC	Northern (COSEWIC); Global (IUCN)
Greenland shark	*Somniosus microcephalus*				NT	Global (IUCN)
Spiny dogfish	*Squalus acanthias*			SC	V	Atlantic (COSEWIC); Global (IUCN)

[1] Not at Risk (NR), Least Concern (LC), Vulnerable (V), Near Threatened (NT), Special Concern (SC), Threatened (T), Endangered (E)
[2] Multiple designations refer to multiple populations or sub-populations

With particlar reference to the recent COSEWIC designation of common lumpfish, Canadian RV spring and fall surveys indicate that this species is distributed mainly on shelf areas off Newfoundland to the south (NAFO area 3Ps) and east (NAFO areas 3KLO). This semi-pelagic species occupies shallow coastal waters at depths less than 20 m to areas over 300 m (Simpson et al 2016). In Newfoundland waters, common lumpfish spawn in subtidal waters between May-June and move to deeper waters in late summer and early fall (Simpson et al 2016). Common lumpfish hatch from male guarded nests and occupy coastal nursery areas with sea grasses and macroalgae (Simpson et al 2016). Adult lumpfish feed on pelagic and benthic prey, including fish eggs, larvae, ctenophores, crustaceans, small fish, polychaetes and molluscs (Simpson et al 2016). Current threats to this species are to include changes in water temperature and salinity, destruction and pollution of spawning and nesting habitat, and directed and bycatch fishing adults. Although no critical habitats have been established for this species to date, shallow coastal spawning and nursery areas around Newfoundland are important aspects of this species life history.

There have been no new management plans for species recovery for any at risk marine fishes in the Study Area since the EA Report and Amendment were completed (Government of Canada 2018).

4.1.2 Environmental Effects Assessment

As illustrated previously in Section 2.2 of this EA Update, the 2018 survey activities that will be undertaken as part of the GrandSPAN Project are in keeping with the nature and scope of those described and assessed in the original GrandSPAN EA reviews, and will occur within the previously defined and considered EA Study Area.

While the particular marine areas that will be the subject of the 2018 surveys would be expected to contain specific fish species and habitats that are characteristic of the particular environmental conditions present at these locations, and their relative location within the overall EA Study Area, the updated information presented in the preceding section does not suggest that the 2018 survey areas

are likely to contain new or different species, habitats - and thus, potential environmental issues or interactions – that were not considered and addressed in the original EA. The offshore survey activities that will be undertaken as part of this Project - including those planned for 2018 - will not result in any direct contact with the seabed, and will therefore not physically disturb sensitive benthic habitats such as corals and sponges. There are therefore no likely increases or other changes in the Project's potential to interact with, or have negative effects upon, key or particularly sensitive species (including any that are designated as being species at risk) or habitats. All of the mitigation measures and commitments outlined in the original EA Report (with further details on some measures in the subsequent EA Addendum and Amendment) would remain applicable and will continue to be implemented and adhered to by GXT in planning and conducting this Project.

The nature and scale of the planned 2018 activities and the updated baseline information provided above therefore do not change the results of the original environmental effects assessment for this VEC, and the Project is still not likely to result in significant adverse environmental effects on marine fish and fish habitat.

4.2 Marine Fisheries and Other Activities

4.2.1 Existing Environment

The EA Report, Addenda and Amendment provided an overview of the existing socioeconomic environment of the Study Area, including marine fisheries and other anthropogenic components and activities that occur in the region and which may potentially interact with the Project.

4.2.1.1 Commercial Fisheries

Fisheries were a key area of focus of the EA review for the Project, and on-going Project planning and implementation will continue to place a high degree of emphasis on addressing the potential for interactions with commercial fishing activity within and near the Study Area, a priority that was repeated during the 2018 consultations, as described above (Chapter 3.0).

As described in the original EA Report (Section 4.3.1), there are several regulatory jurisdictions associated with marine fisheries within the Study Area. The Government of Canada has jurisdiction over fish stocks and fishing activities within the 200 nautical mile limit (EEZ) and for benthic invertebrates across the continental shelf. Beyond that 200 mile limit, the North Atlantic Fisheries Organization (NAFO) manages groundfish and other resources and activities. For administrative purposes, the Northwest Atlantic is divided into a series of NAFO Divisions, Subdivisions and Unit Areas, and although fish harvesting activities and fisheries management responsibilities do extend across these areas and their boundaries, they are frequently used to regulate and manage fishing activity.

The Study Area overlaps with at least a part of nine NAFO Divisions and Subdivisions, and many Unit Areas, which are listed below, and are used in this section to describe fishing activity in and around the region:

- *NAFO Division 3k*: Unit Areas 3Ka, 3Kd, 3Ke, 3Kf, 3Kg, 3Kh, 3Kj, 3Kk
- *NAFO Division 3L*: Unit Areas 3La, 3Lb, 3Lc, 3Ld, 3Le, 3Lf, 3Lg, 3Lh, 3Li, 3Lj, 3Lq, 3Lr, 3Ls, 3Lt

- *NAFO Division 3M*: Unit Areas 3Ma, 3Mb, 3Mc, 3Md, 3Mm
- *NAFO Division 3N*: Unit Areas 3Na, 3Nb, 3Nc, 3Nd, 3Ne, 3Nf, 3Nn
- *NAFO Division 3O*: Unit Areas 3Oa, 3Ob, 3Oc, 3Od, 3Oe, 3Of
- *NAFO Subdivision 3PN*: Unit Area 3PNa
- *NAFO Subdivision 3PS*: Unit Areas 3PSa, 3PSb, 3PSc, 3PSd, 3PSe, 3PSf, 3PSg, 3PSh
- *NAFO Subdivision 4VS*: Unit Areas 4VSb, 4VSc, 4VSe, 4VSv
- *NAFO Subdivision 4VN*

Commercial fisheries data are provided by Fisheries and Oceans Canada (DFO) Statistical Services, including mapping information on the location of recorded fishing activity. The mapping information is currently provided by DFO as an aggregated data set which gives a general indication of fishing areas (by species, gear types, fleet and other pre-determined categories and data classes) for individual grid "cells" that are approximately 6 x 4 nautical miles in size. The DFO datasets record and report domestic and foreign fish harvests that are landed in Canada. The original EA Report, Addenda and EA Amendment included a detailed description of commercial fisheries in the Study Area, based on existing data sources and other information that was available as of the time of their preparation and submission. This included fisheries landings statistics and associated geospatial data up to 2013. The following sections provide an updated overview of commercial fishing activity in the Study Area (and particularly, for the NAFO Unit Areas described previously), as reflected in the available fisheries data sets covering the period 2014 to 2016, as available. The 2015 fisheries data (landings statistics) were the most current available from DFO as of the time of writing of this 2018 EA Update (J. Hosein, DFO, pers. comm). On April 4, 2018, DFO provided 2010-2016 fisheries geospatial data, but requests for the associated landings statistics (weight and value) for 2016 are still pending[1].

The sections (and associated tables, graphs and figures) that follow are therefore based on the following data to provide an updated overview of commercial fisheries in the Study Area:

1) The DFO provided 2014 and 2015 fisheries data (landings statistics) are used to provide an updated summary of commercial fisheries in the various NAFO Unit Areas that overlap the approximate 2018 GrandSPAN survey area (Figure 4.5);

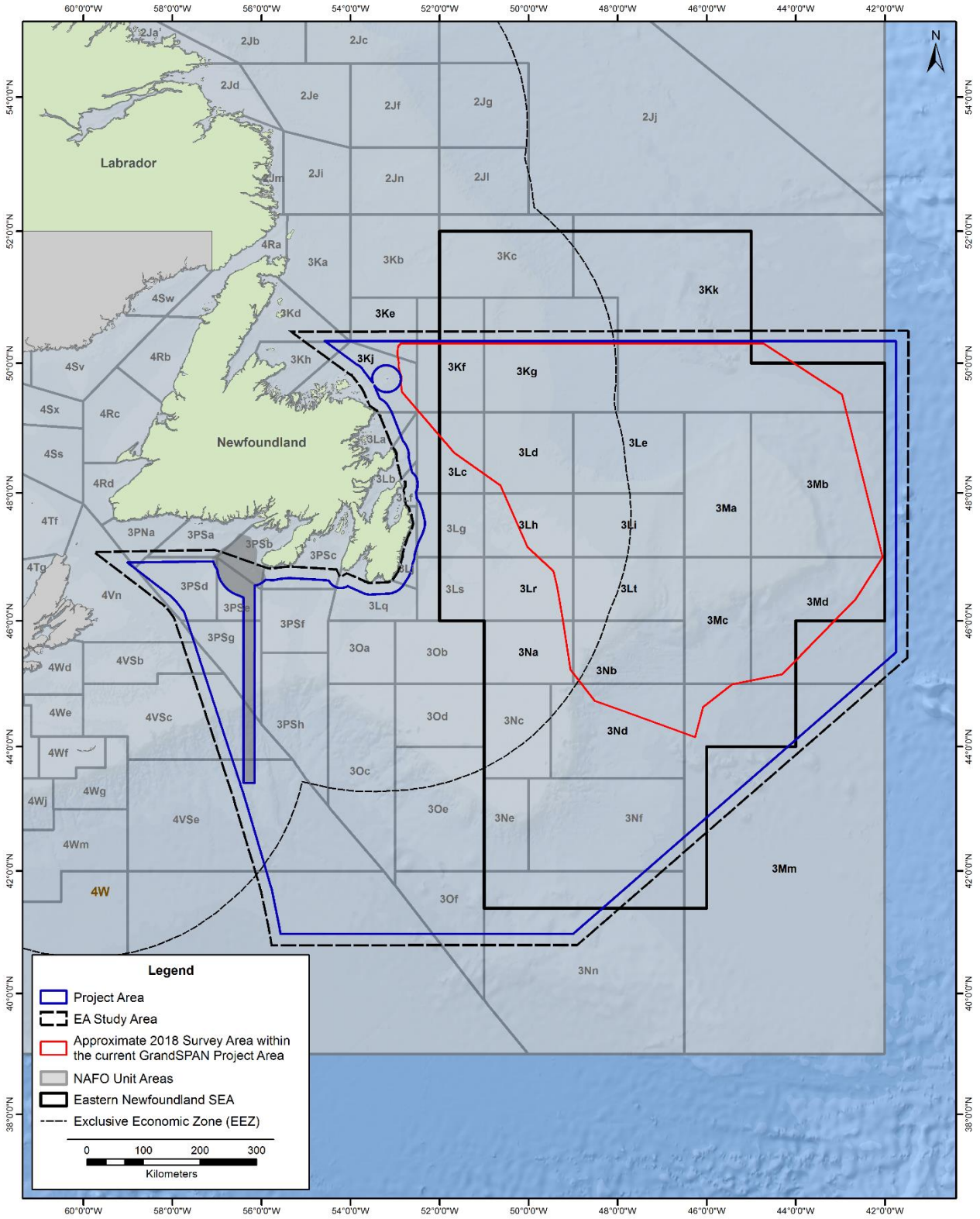
2) NAFO Data Extraction Tool (Statlant 21A, last update 2017-12-11) data are available for the 2014 to 2016 period, and are used to provide an updated summary of commercial fish landings in the various NAFO Divisions and Subdivisions that overlap the GrandSPAN Study Area as a whole; and

3) The DFO provided 2014 – 2016 fisheries geospatial data are used to provide updated mapping of commercial fisheries in the various NAFO Unit Areas that overlap the GrandSPAN Study Area as a whole, including the approximate 2018 GrandSPAN survey area.

Fisheries catch statistics and mapping for the period 2008-2013 are provided in the original EA Report (Section 4.3.1) and EA Amendment and are not repeated here

[1] It should also be noted that data provided for the most recent years have been substantially redacted by DFO for confidentiality reasons. They are therefore not able to fully describe some important fisheries, nor to provide accurate and complete totals or facilitate direct comparison with similar fisheries data between years.

Figure 4.5 NAFO Unit Areas Within and Adjacent to the Study Area (Bold Text Indicates Those Overlapping with the Approximate 2018 Survey Area)



Domestic Commercial Fish Harvests: Overall Landings (Weight and Value)

The available DFO data indicate that the average annual commercial fish harvest (finfish and shellfish) within the Study Area (and specifically, within the various NAFO Unit Areas that overlap the planned 2018 survey area) for the 2014 – 2015 period totalled approximately 29,000 tonnes and had a landed value of over $131 million (Tables 4.4 and 4.5). This reflects a change from the 2009-2013 landings data provided in the original EA Report and EA Amendment, which is partly the result of the increasingly redacted harvest data (such as the absent data in several Unit Areas), but also reflects the closure of the shrimp fishery in some areas as described further below.

Table 4.4 Fish Harvests by Weight and Value (2014-2015)

Year	Weight (kg)	Value ($)
2014	29,470,777	120,781,719
2015	28,927,275	141,669,371
Total	**58,398,052**	**262,451,090**
Average	**29,199,026**	**131,225,545**

Table 4.5 Fish Harvests (All Species) by Weight and Value by NAFO Unit Area (2014-2015)

Unit Area	2014 Weight (kg)	2014 Value ($)	2015 Weight (kg)	2015 Value ($)	Average Weight 2014-2015 (kg)	Average Value 2014-2015 ($)	% Weight	% Value
3Ke	7,612,583	21,912,799	10,528,715	44,519,934	9,070,649	33,216,366	31.1	25.3
3Kf	2,275,879	5,266,747	454,022	1,897,824	1,364,951	3,582,285	4.7	2.7
3Kg	889,543	2,710,902	847,238	3,240,444	868,391	2,975,673	2.9	2.3
3Kj	-	-	-	-	-	-	-	-
3Kk	-	-	-	-	-	-	-	-
3Lc	4,159,573	19,963,269	3,733,172	20,328,563	3,946,373	20,145,916	13.5	15.4
3Ld	2,269,675	9,028,312	2,012,733	9,869,431	2,141,204	9,448,872	7.3	7.2
3Le	199,255	572,666	27,115	147,653	113,185	360,160	0.4	0.3
3Lh	3,404,484	17,563,155	3,258,562	17,744,250	3,331,523	17,653,702	11.4	13.5
3Li	3,202,805	1,5612,350	3,367,207	18,335,833	3,285,006	16,974,092	11.3	12.9
3Lr	764,565	3,944,257	405,137	2,206,141	584,851	3,075,199	2.0	2.3
3Lt	2,180,668	11,249,744	1,980,964	10,787,227	2,080,816	11,018,486	7.1	8.4
3Ma	-	-	-	-	-	-	-	-
3Mb	-	-	-	-	-	-	-	-
3Mc	-	-	-	-	-	-	-	-
3Md	-	-	-	-	-	-	-	-
3Mm	-	-	-	-	-	-	-	-
3Na	-	-	-	-	-	-	-	-
3Nb	1,581,376	8,157,934	1,391,156	7,575,433	1,486,266	7,866,684	5.1	5.9
3Nd	930,371	4,799,584	921,254	5,016,636	925,813	4,908,110	3.2	3.7
Total	**29,470,777**	**120,781,719**	**28,927,275**	**141,669,371**	**29,199,026**	**131,225,545**	**100**	**100**

Note: Dashes (-) in the above table reflect instances where the DFO dataset does not reflect recorded fishing activity in that Unit Area, which may presumably also be due to data redaction by DFO prior to release

Domestic Commercial Fish Harvests: Overall Geographic Distribution

Figure 4.6 provides a general illustration of the overall geographic distribution of commercial fishing activity within and adjacent to the Study Area from 2014 to 2016 for the May to December period. As indicated previously, the information provided in the maps that follow is based on the geospatial data received from DFO, and shows the general presence of recorded fishing activity for a series of 6 x 4 nautical mile "cells" that together comprise a map grid that covers the region. For the multi-year (2014, 2015 and 2016) fishing maps included in this report, where fishing activity occurred within a single cell in more than one year the figures indicate only the most recent year in which fishing activity occurred within that cell (i.e. the later year's data overlays that from earlier years). Further information on commercial fishing activity by species, season, gear type and other parameters is provided in the sections that follow.

Domestic Commercial Fish Harvests: By Species

In recent years, the fishery in the various NAFO Unit Areas that overlap the planned 2018 survey area for the Project has been strongly dominated by queen / snow crab in terms of both landed weight and value (Table 4.6, Figures 4.7 and 4.8). This is well reflected in the DFO fish landings statistics for the most recent years available (2014 and 2015), as summarized below.

Queen / snow crab comprised approximately 64 percent of the total fish landings by weight in this region in 2014 and 2015, followed by Northern shrimp (also referred to herein as *Pandalus borealis* shrimp, 30 percent) and turbot / Greenland halibut (six percent), with no other individual species accounting for greater than one percent of total landings by weight (Figure 4.7) based on the data provided by DFO. Until 2013- 2014, the Northern shrimp fishery had been one of the most substantial commercial species harvests in the Study Area, as it continues to be in more northern fishing areas. However, recent quota reductions and closures (in NAFO 3L and 3M) have significantly reduced commercial shrimp fishing off Eastern Newfoundland (Parrill 2016), including in parts of the Study Area. In terms of landed value in 2014 and 2015 (Figure 4.8), queen / snow crab accounted for 76 percent of the area's recorded fish landings overall, followed by Northern shrimp and turbot / Greenland halibut (20 and four percent, respectively).

An important fishery that is not included in the catch and effort data provided by DFO because of confidentiality requirements is the fishery for deep-sea clams in the Project Area, focused mainly on the eastern Grand Banks shelf and south-eastern slope near the tail. The main harvest is Arctic/Stimpson's surf clams (*Mactromeris polynyma*), under quota, but may also include other species, such as Greenland cockles and propeller clams. The fishery may be conducted year-round and utilizes large factory-freezer vessels equipped with hydraulic dredges for harvesting. For 2017, Clearwater Seafoods Limited Partnership, which held the only Atlantic Canada licences for this fishery until 2018, reported clam sales of $109.2 million from harvests on both the Newfoundland Grand Banks and the Eastern Scotian Shelf (Clearwater 2018a). In 2018 DFO awarded a new licence representing 25 percent of the TAC to the Five Nations Clam Company. This newly founded company is made up of a partnership among the Elsipogtog First Nation in New Brunswick, Potlotek First Nation in Nova Scotia, Abegweit First Nation in Prince Edward Island, Innu First Nation of Nutashkuan in Quebec and, in Newfoundland and Labrador, the Southern Inuit of NunatuKavut through NDC Fisheries (Clearwater 2018b; Hansard 2018).

The various Figures in Appendix C show the overall geographic distribution of recorded commercial fishing activity for key fish species in 2014, 2015 and 2016, based on the DFO geospatial databases described above. This includes those species that comprised the highest proportion of the area's fishery, by quantity or value, over that period (with the exception of deep-sea clams), as well as other species with recorded fishing activity in the area and/or those which were mapped in the original EA Report.

Table 4.6 Fish Harvests by Species by Weight and Value (2014 and 2015)

Species by Year (2014 - 2015)	Weight (kg)	Value ($)
2014	**29,470,777**	**120,781,719**
Crab, Queen/Snow	18,865,283	97,322,640
Shrimp, Pandalus Borealis	8,816,523	18,235,359
Turbot/Greenland Halibut	1,782,806	5,217,694
Other	6,165	6,027
2015	**28,927,275**	**141,669,371**
Crab, Queen/Snow	18,593,868	101,251,443
Shrimp, Pandalus Borealis	8,942,858	35,171,967
Turbot/Greenland Halibut	1,389,208	5,245,233
Other	1,341	728

Figure 4.6 Commercial Fishing Locations, All Species: 2014 - 2016 (May to December)

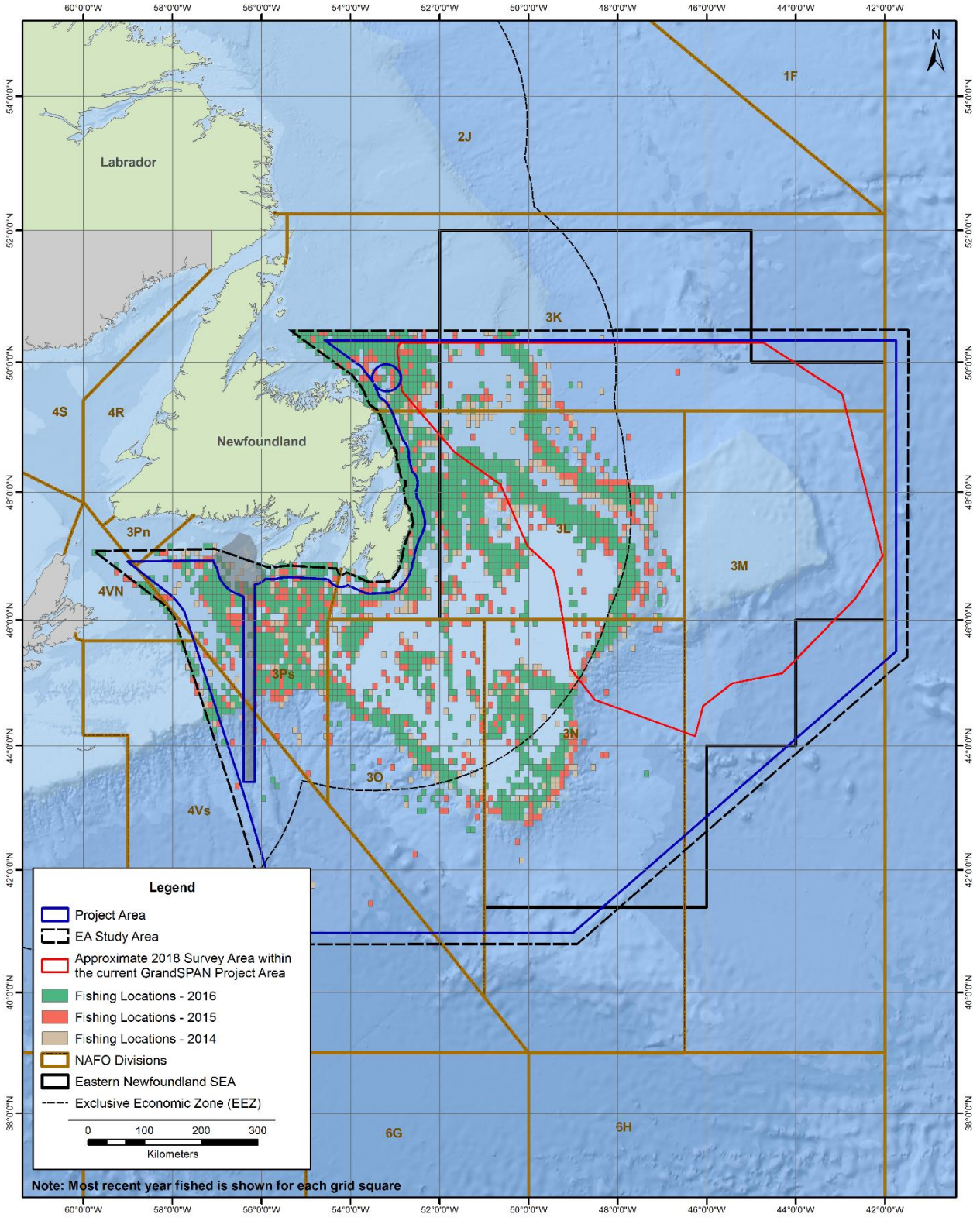


Figure 4.7 Fish Harvests by Weight by Species (2014 and 2015)

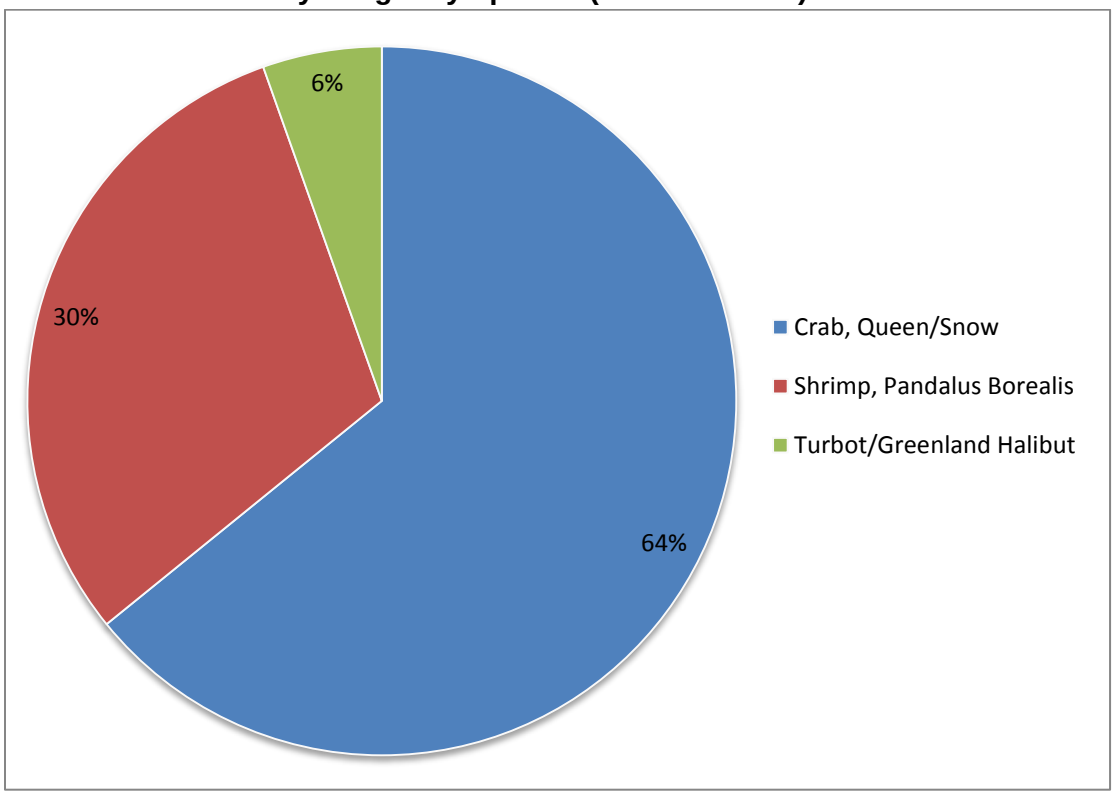
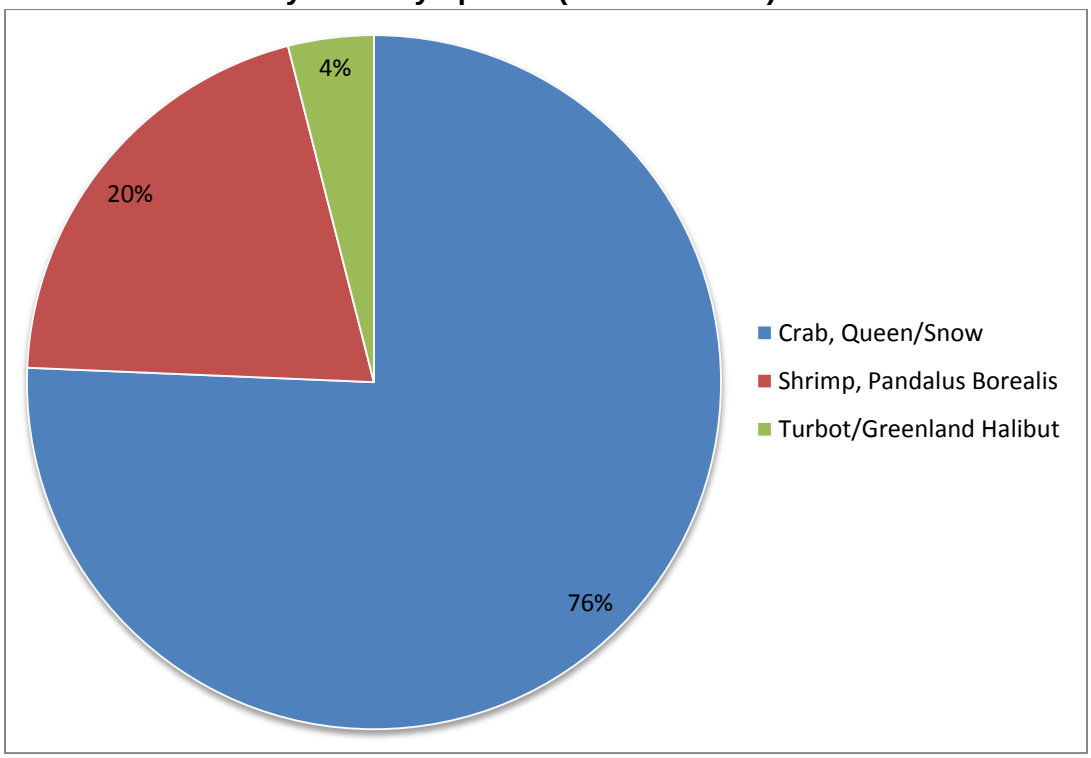


Figure 4.8 Fish Harvests by Value by Species (2014 and 2015)



Commercial Fish Harvests - Seasonality

Fishing activity was recorded in the area during the 2014 to 2015 period in most months of the year, with the highest landings by weight and value occurring in the May – July period (Table 4.7, Figures 4.9 and 4.10).

Table 4.7 Fish Harvests by Month by Weight and Value (2014 and 2015)

Month	2014	2015	Total
Weight (Kg)			
January	0	0	0
February	0	485,457	485,457
March	0	0	0
April	2,551,485	1,701,969	4,253,454
May	8,934,844	7,874,041	16,808,885
June	8,322,541	7,196,145	15,518,686
July	6,473,323	6,412,089	12,885,412
August	2,306,155	4,429,902	6,736,057
September	375,038	645,566	1,020,604
October	507,391	136,596	643,987
November	0	45,510	45,510
December	0	0	0
Total	**29,470,777**	**28,927,275**	**58,398,052**
Value ($)			
January	0	0	0
February	0	2,350,151	2,350,151
March	0	0	0
April	13,162,652	9,267,864	22,430,516
May	46,093,285	42,877,510	88,970,794
June	35,638,001	38,318,810	73,956,810
July	18,926,146	28,432,336	47,358,482
August	4,902,379	17,213,621	22,116,000
September	851,172	2,500,186	3,351,358
October	1,208,085	530,000	1,738,085
November	0	178,894	178,894
December	0	0	0
Total	**120,781,719**	**141,669,371**	**262,451,090**

Figure 4.9 Total Monthly Fish Harvests, All Species, by Weight (2014-2015)

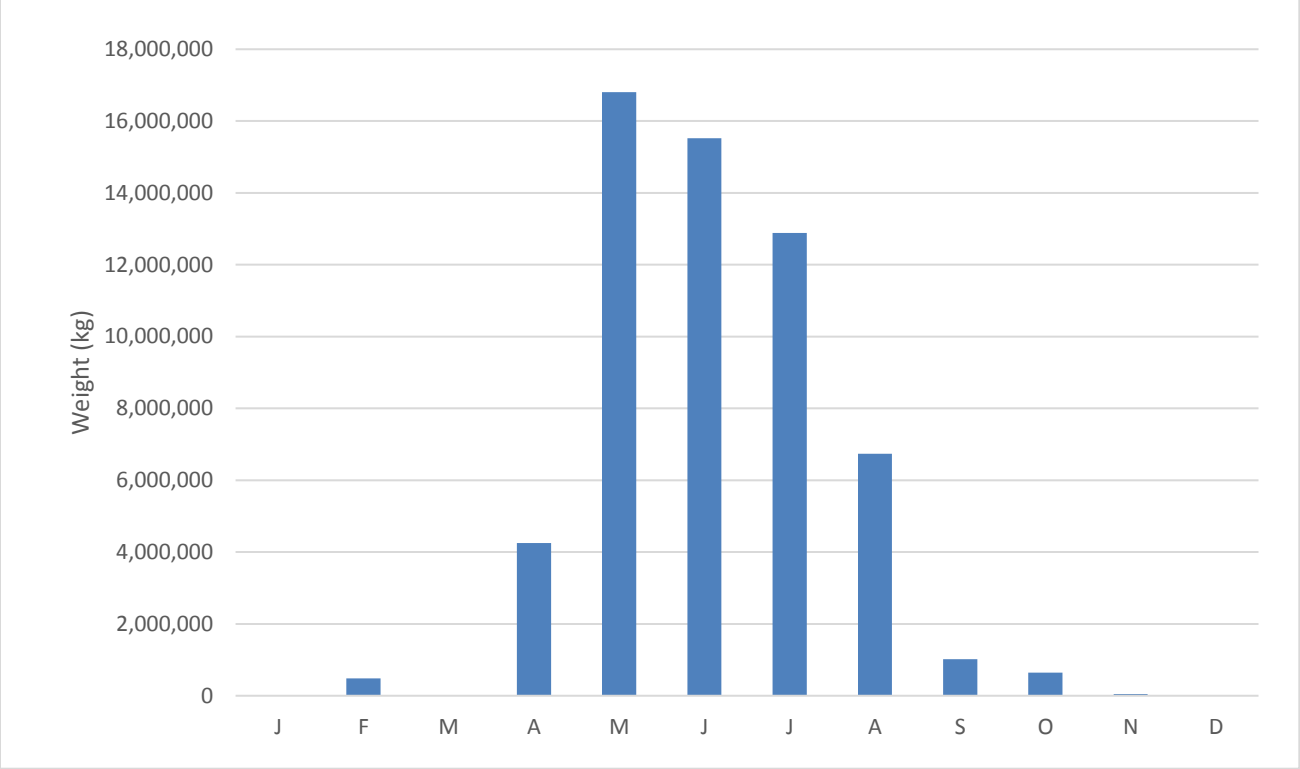
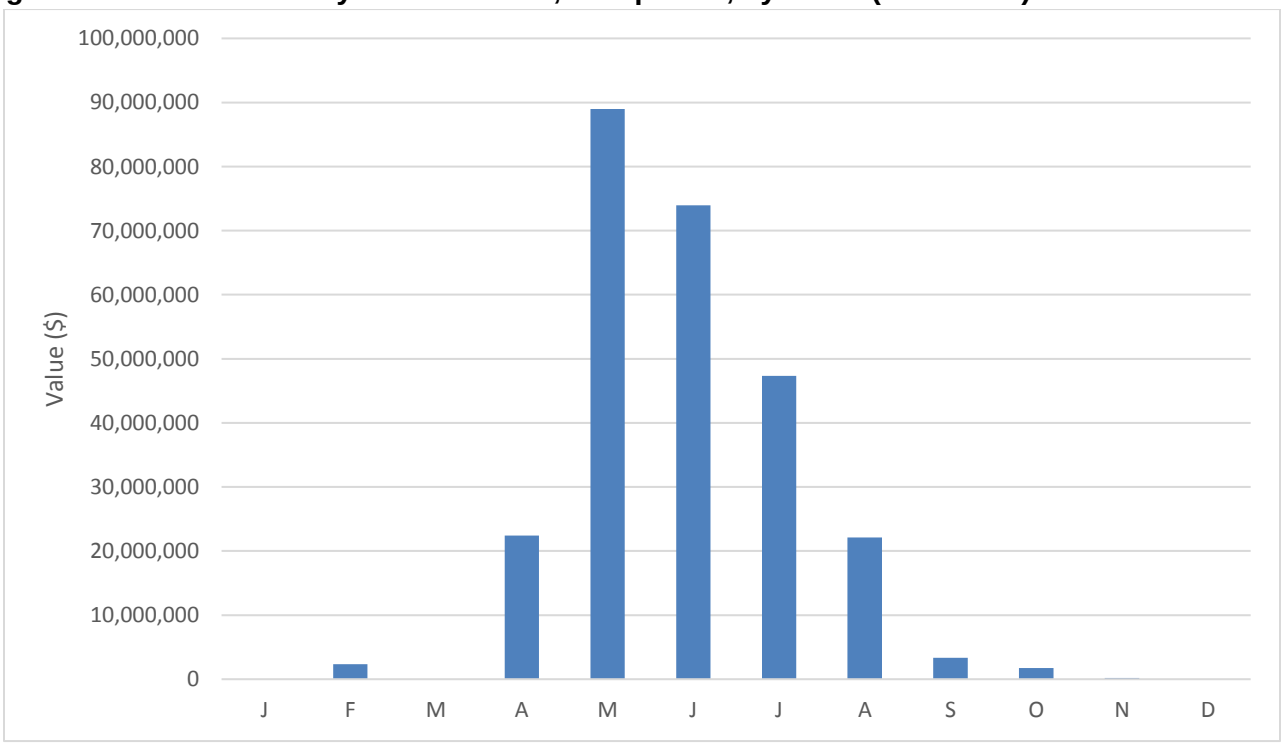


Figure 4.10 Total Monthly Fish Harvests, All Species, by Value (2014-2015)



Commercial Fish Harvests – Gear Types

The available DFO datasets also reflect that a variety of fishing gear types were used as part of the commercial fishery in the various Unit Areas that overlap the planned 2018 GrandSPAN survey area from 2014 to 2015 (Table 4.8).

Of these, pots (unspecified) accounted for approximately 64 percent of the total fish landings over that period by weight, followed by shrimp trawls (30 percent), and gill nets (six percent) (Figure 4.11)

In terms of landed value, pots used in the shellfish (especially crab) fisheries accounted for the large majority (76 percent) of the total value of the fishery in that area over that time, followed by shrimp trawls (20 percent), and gill nets (four percent) (Figure 4.12).

Table 4.8 Fish Harvests by Gear Type by Weight and Value (2014-2015)

Gear Type	2014 Weight (kg)	2015 Weight (kg)	Total Weight (kg)	2014 Value ($)	2015 Value ($)	Total Value ($)
Mobile Gear Types						
Shrimp Trawl	8,816,523	8,942,858	17,759,381	18,235,359	35,171,967	53,407,326
Fixed Gear Types						
Pot	18,865,283	18,593,868	37,459,151	97,322,640	101,251,443	198,574,082
Gillnet (set or fixed)	1,788,971	1,390,549	3,179,520	5,223,721	5,245,962	10,469,683
Total	**29,470,777**	**28,927,275**	**58,398,052**	**120,781,719**	**141,669,371**	**262,451,090**

Figure 4.11 Fish Harvests by Gear Type by Weight of Catch (2014-2015)

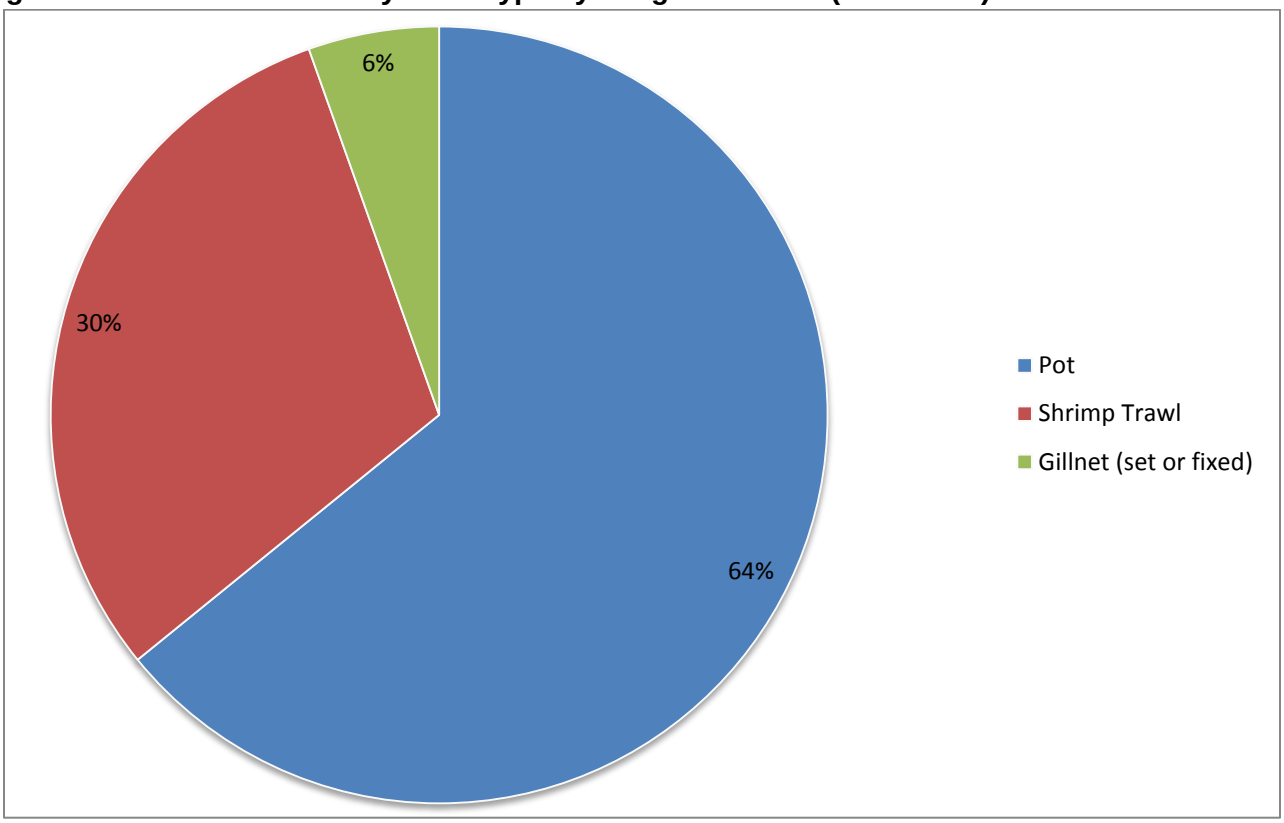


Figure 4.12 Fish Harvests by Gear Type by Value of Catch (2014-2015)

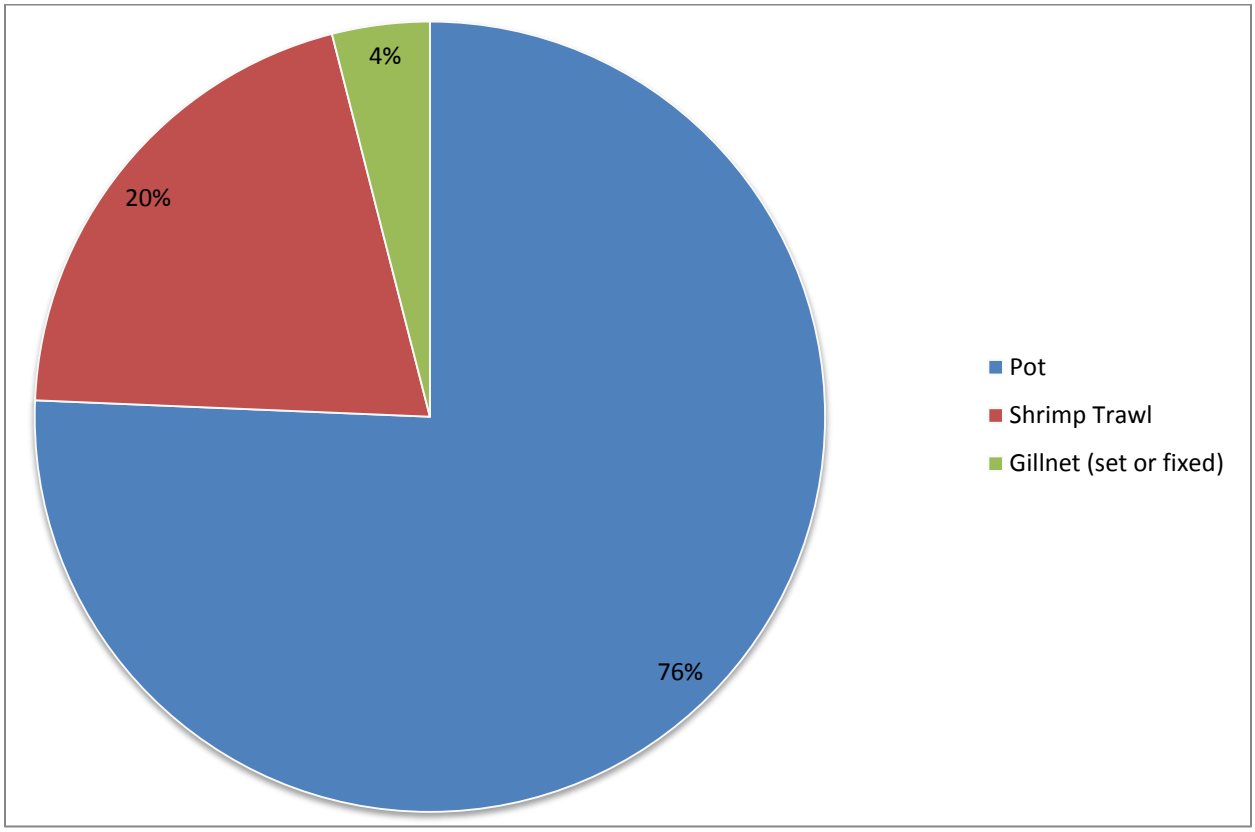


Figure 4.13 Fish Harvests Using Fixed Gear Types (May to December, 2014 - 2016)

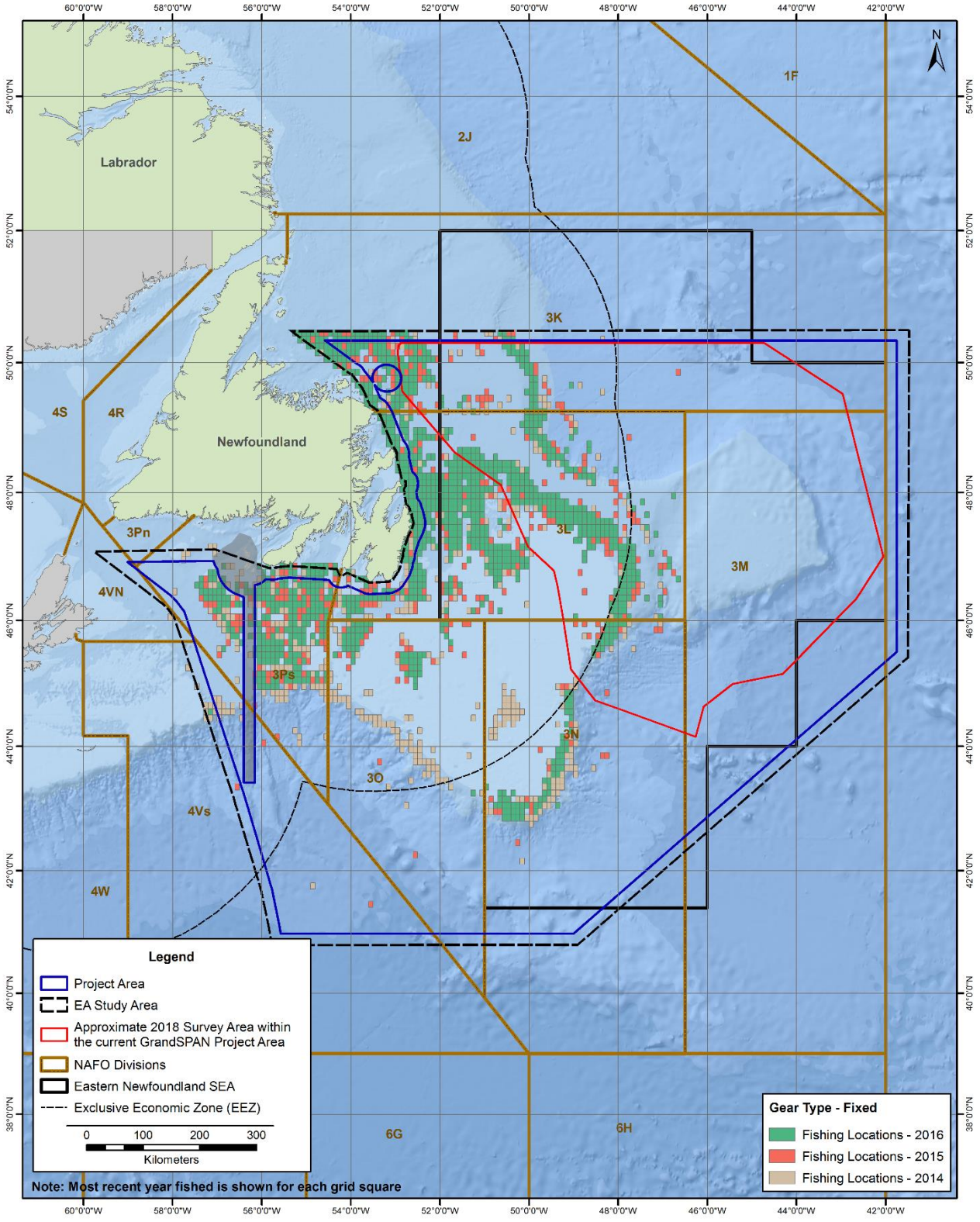
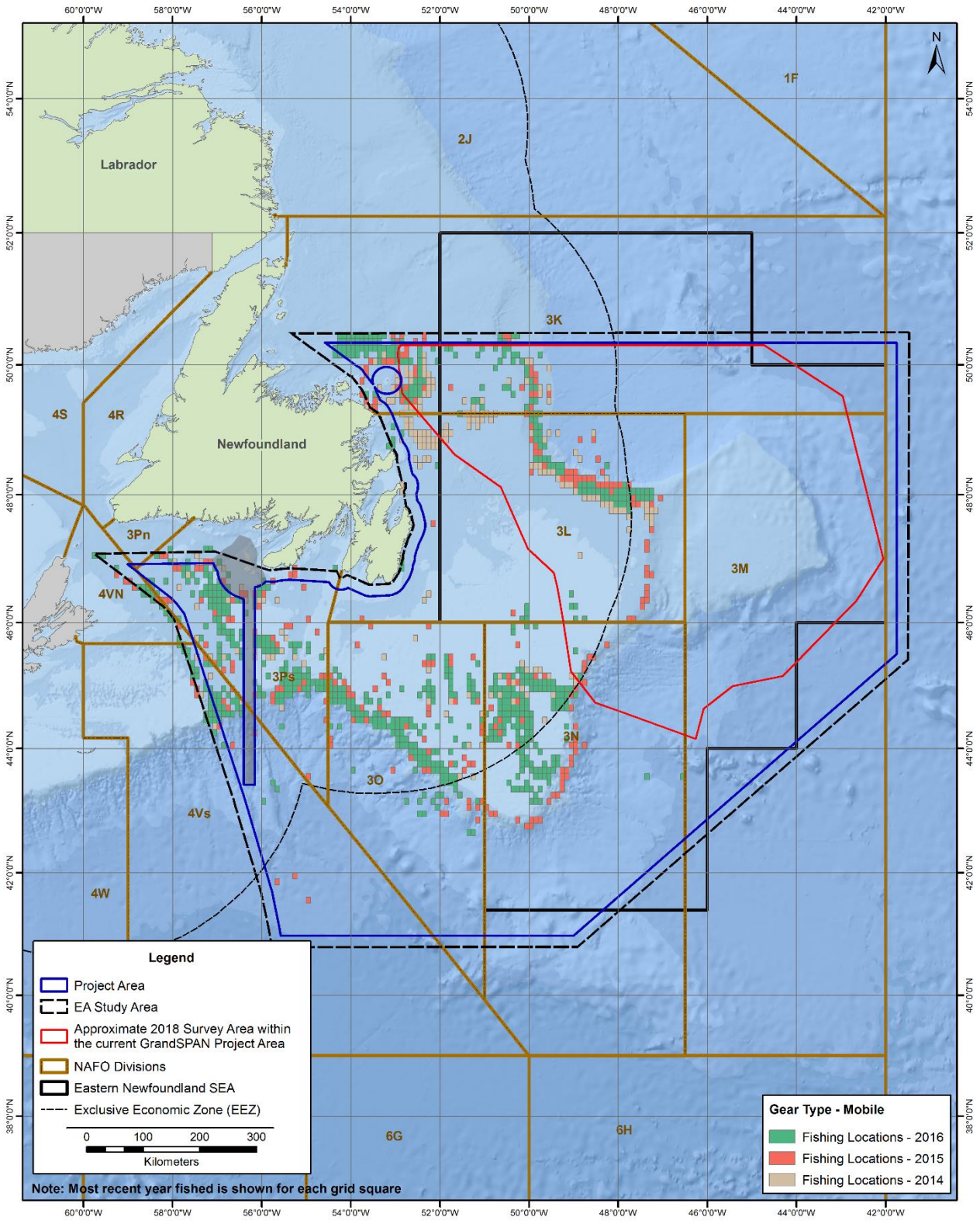


Figure 4.14 Fish Harvests Using Mobile Gear Types (May to December, 2014 - 2016)



Commercial Fishing Activity by Canadian and Foreign Fishers in the GrandSPAN Study Area

As described at the beginning of this section, the NAFO Data Extraction Tool (Statlant 21A) fish landings data are available for the 2014 to 2016 period, and are used to provide an updated summary of commercial fish landings in the various NAFO Divisions that overlap the GrandSPAN Study Area as a whole.

As noted previously, there are several regulatory jurisdictions that pertain to marine fish and fisheries within the Study Area. The Government of Canada has jurisdiction over fish stocks and fishing activities within the 200 nautical mile limit and for benthic invertebrates (such as crab) across the entire continental shelf, with NAFO managing groundfish activities and other resources beyond that 200-mile limit. NAFO manages some 19 commercial stocks consisting of 11 species, and reported that in 2011 there were vessels from 13 flag states fishing in the Northwest Atlantic (Amec 2014). Other international agreements and conventions also apply to fishing and other human activities in international waters.

The preceding discussion has focussed upon recent (2014 and 2015) commercial fishing activity within the NAFO Unit Areas that overlap the planned 2018 survey area for the Project. The datasets used to conduct these analyses were obtained through DFO and record only the domestic and foreign harvests that are landed in Canada.

The following Tables and Figures provide updated summaries of the Canadian and foreign fishing activity in various NAFO Divisions that overlap the Study Area for the period 2014 to 2016. The Division level is the highest resolution for which such data are available from the NAFO (Statlant 21A) dataset (Table 4.9).

As indicated, crab is the most commonly caught species of fish in this overall region, representing 20 percent of the total landed catch recorded for these Divisions in the STATLANT 21A database for 2016 (Table 4.10, Figure 4.15), with other key species including Atlantic redfish, Atlantic cod, capelin, Greenland halibut, Northern shrimp, and others. Spain and Portugal were the two non-Canadian countries that carried out most fishing activity fished in the area in 2016 (Table 4.11, Figure 4.16).

Table 4.9 Canadian and International Fishing Activity by NAFO Division (tonnes) (2014 – 2016)

NAFO Division	2014	2015	2016	Total
3K	60,361	66,651	23,517	150,529
3L	65,733	65,285	54,038	185,056
3M	26,024	21,930	21,420	69,374
3N	19,073	14,033	20,356	53,462
3O	14,649	16,174	13,475	44,298
3PN	682	436	317	1,435
3PS	20,722	19,391	15,390	55,503
4VN	7,386	1,244	902	9,532
4VS	36,129	17,007	4,179	57,315
Total	250,759	222,151	153,594	626,504
Source: NAFO Data Extraction Tool (Statlant 21A)				

Table 4.10 Canadian and International Fishing Activity by Species (2016)

Species	Total Catch (tonnes)
Queen/Snow Crab	30,648
Atlantic Redfishes (ns)	24,905
Atlantic Cod	23,180
Capelin	19,916
Turbot/Greenland Halibut	10,942
Shrimp, Pandalus Borealis	10,195
Surf Clam	6,944
Yellowtail Flounder	5,989
Skates (ns)	4,180
Other	15,793
Total	152,692
Source: NAFO Data Extraction Tool (Statlant 21A)	

Figure 4.15 Canadian and International Fishing Activity by Species (2016)

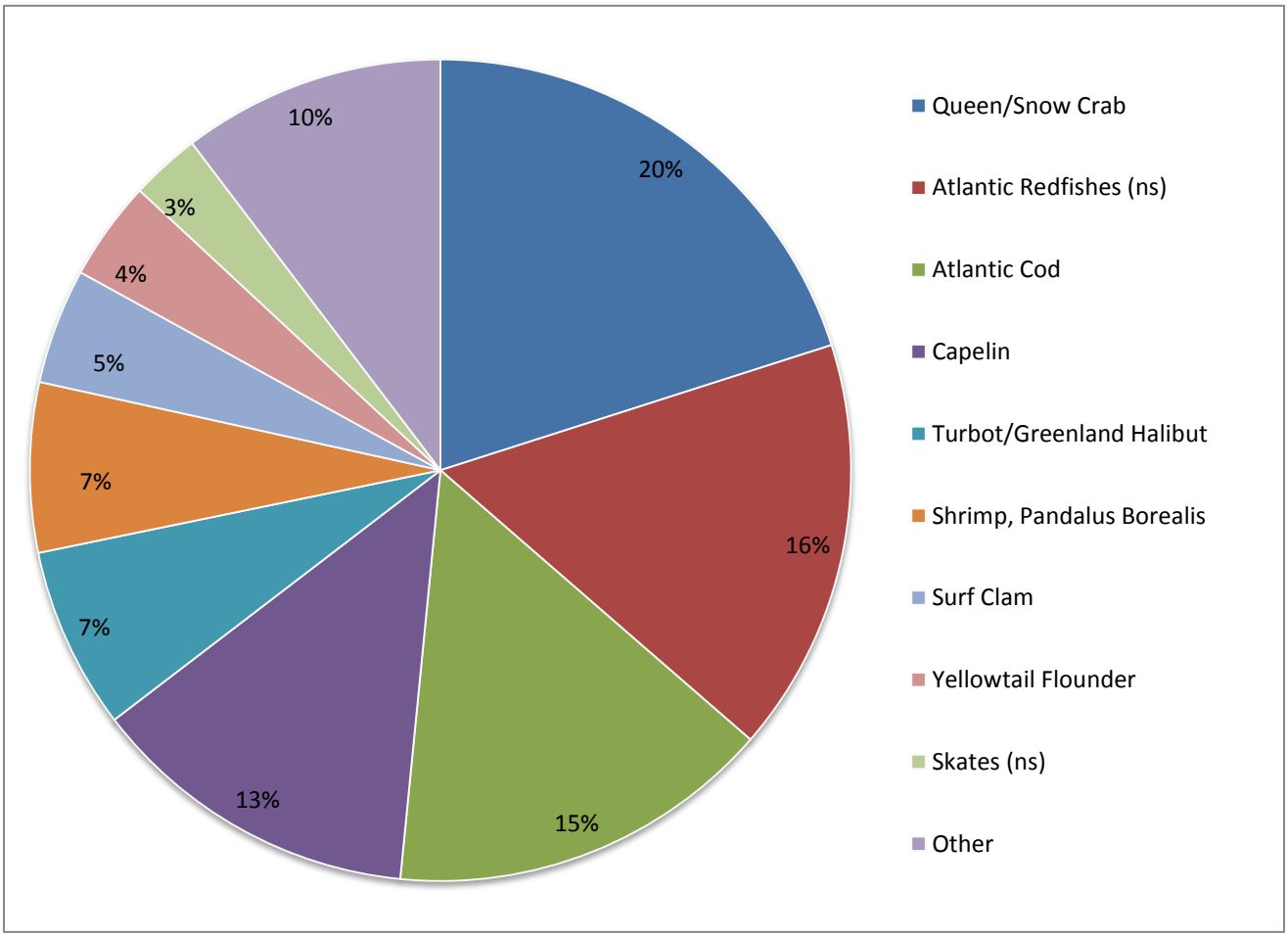
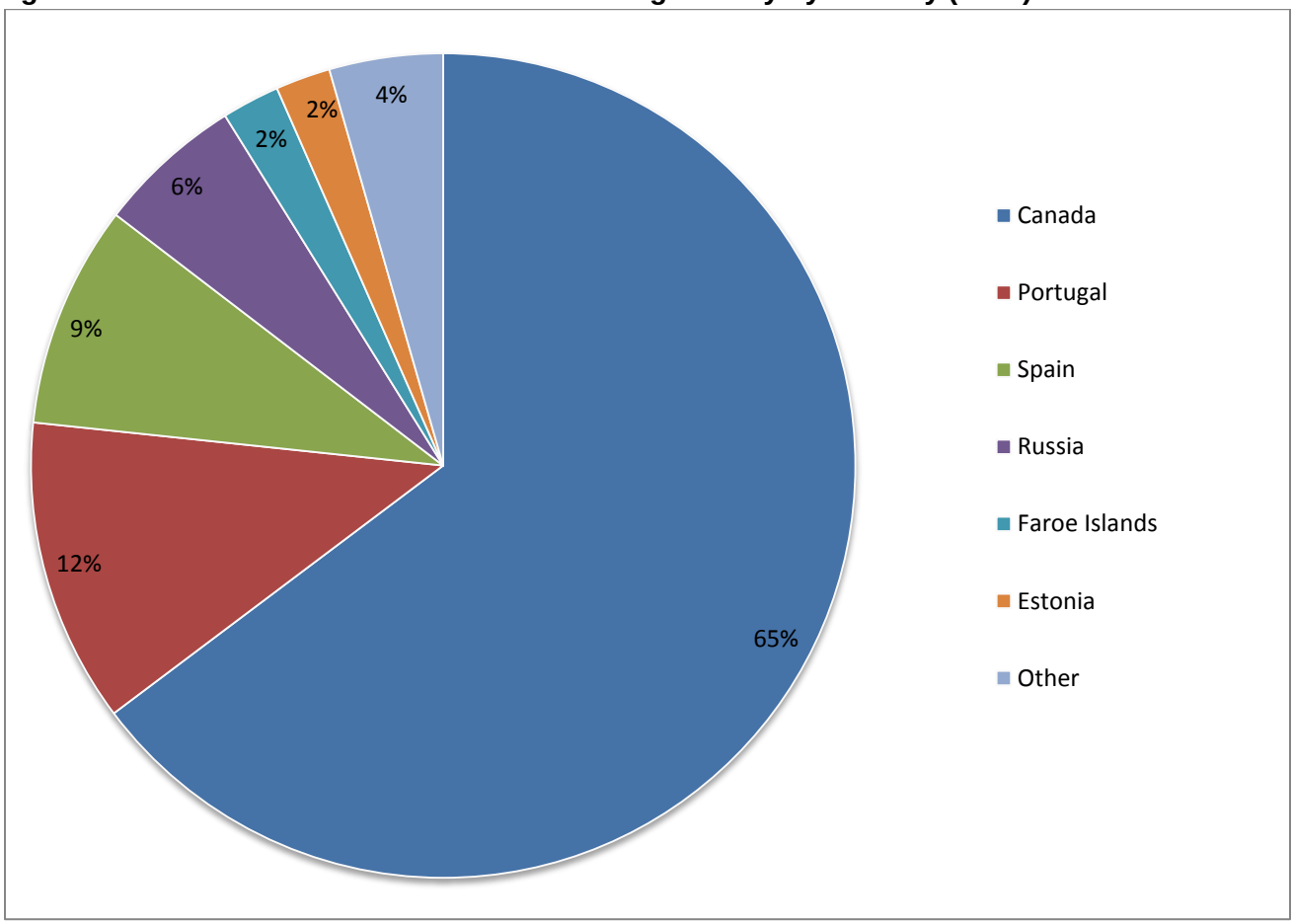


Table 4.11 Canadian and International Fishing Activity by Country (2016)

Country	Total Catch (tonnes)
Canada	98,845
Portugal	18,221
Spain	13,338
Russia	8,737
Faroe Islands	3,462
Estonia	3,284
Other	6,805
Total	152,692
Source: NAFO Data Extraction Tool (Statlant 21A)	

Figure 4.16 Canadian and International Fishing Activity by Country (2016)

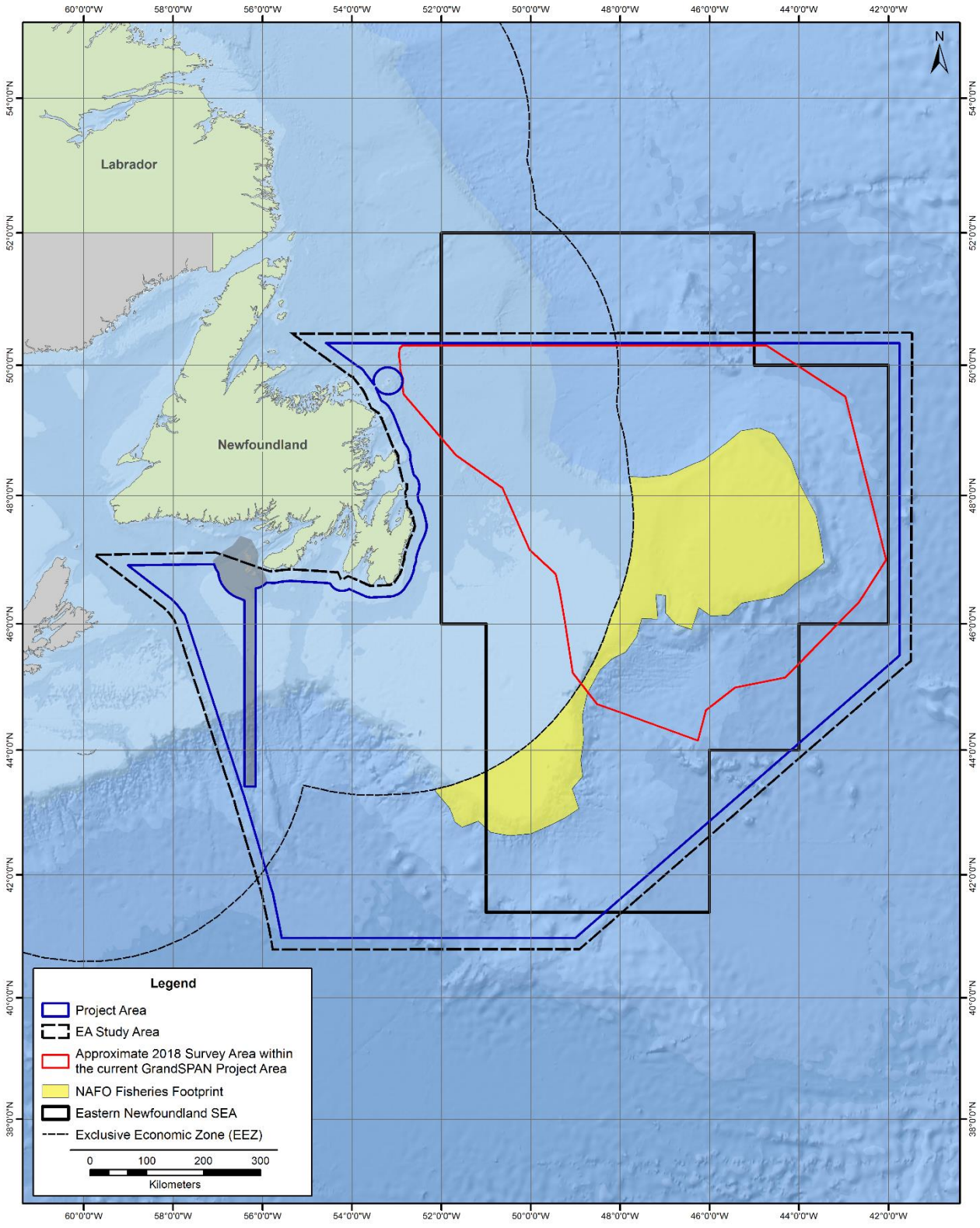


The NAFO Regulatory Area (NRA) is some 2,707,895 km^2 in size (or 41 percent of the total NAFO Convention Area) and comprises that part of the Northwest Atlantic high seas located adjacent to Canada's 200-mile EEZ. Fishing activity in the NRA targets a range of species, including cod, redfish, Greenland halibut, shrimp, skates, and other finfish, and has an approximate landed value of $200 million annually across all members. There are approximately 160 fishing vessels that are authorized to fish in the NRA, which are primarily large vessels (30-100 m), and in 2013 a total of 64 vessels fished in the region (NAFO 2014, cited in Amec 2014).

As a result of the 2007 United Nations General Assembly (UNGA Res. 61/105, paragraph 83) request that Regional Fisheries Management Organizations regulate bottom fisheries that cause a significant adverse impact on VMEs, NAFO undertook an exercise to identify bottom fishing areas in the NRA, and in doing so, to identify and map NAFO's bottom fishing footprint in the area.

The NAFO fisheries footprint is 120,048 km^2 in size (NAFO 2009, 2014, cited in Amec 2014), and its location and relationship to the Study Area are illustrated in Figure 4.17.

Figure 4.17 NAFO Fisheries "Footprint" and its Proximity to the Study Area



Industry and DFO Research Surveys

Fisheries survey programs by government and/or industry also occur in parts of the Canada-NL Offshore Area, including DFO Multispecies Research Vessel (RV) Trawl Surveys, which comprise annual (spring and fall) standardized bottom-trawl surveys to collect information for managing and monitoring fish resources in the Newfoundland and Labrador Region. Table 4.12 shows the 2017 schedule for DFO's surveys as obtained from DFO representatives. GXT will obtain and verify 2018 survey plans with DFO as they are available, and will consider these and will continue associated consultations and communications with DFO in planning and undertaking its activities, as applicable.

Table 4.12 2018 DFO RV Surveys off Eastern Newfoundland: Areas Relevant to 2018 GXT Program (Preliminary)

Survey / RV	Start	End	NAFO Division
R/V CCGS Needler			
NL Spring Survey	23 May	17 June	3L + 3N
Shellfish Survey	30 August	11 September	2J + 4R
NL Fall Survey	25 September	9 October	3O + 3N
NL Fall Survey	10 October	23 October	3N + 3L
NL Fall Survey	23 October	6 November	3L
NL Fall Survey	7 November	1 December	3K + 3L
R/V CCGS Teleost			
NL Summer AZMP[1]	8 July	29 July	Grand Banks
NL Fall Survey	20 Nov	4 December	3K
NL Fall Survey	5 December	19 December	3K

[1] Atlantic Zone Monitoring Program
Source: L. Mello, DFO-NL (2018)

There is also an annual Industry - DFO Collaborative Post-season Trap Survey for snow crab in NAFO Divisions 2J3KLOPs4R, which is conducted using commercial and modified snow crab traps at established trap stations starting in late August or early September after the commercial snow crab season has ended. The survey continues until all the stations selected for the year are finished, sometimes into late November. The station locations are determined by DFO, selected from a set of pre-established locations and up to 1,500 are surveyed annually. Each survey station is fixed and follows a general grid pattern. Figure 4.18 shows the locations of the longstanding stations, which have been the principal focus of this survey, in relation to the Project Area. For 2018 and beyond, it is expected that 50 percent of the stations surveyed will be selected from these locations. The remaining station coordinates will be part of a stratified random design. When finalized, survey planners have agreed to provide the coordinates to GXT (R. Lee pers comm 2018; K. Baker, pers comm 2018).

The Canadian Association of Prawn Producers (CAPP), a national Canadian organization representing the interests of at-sea producers of coldwater shrimp which conducts research and marketing activities on their behalf, and Northern Coalition have established the Northern Shrimp Research Fund (NSRF), a non-profit initiative that provides funding and a vessel for shrimp surveys from Northern Shrimp Fishing Areas. However, for the foreseeable future no related surveys are planned in areas south of SFA 4 (northern Labrador Shelf) (B. Chapman, pers comm 2017).

Groundfish Enterprise Allocation Council (GEAC) and DFO-GEAC surveys occurred annually from 1997-2001 and biannually after 2001, using bottom trawls and a commercial trawler. In 2018 the only survey planned is for redfish in Unit 2, which does not extend east of NAFO 3Ps, so it will be outside of the planned GXT work area (K. Vascotto, pers comm 2018).

DFO (Bedford Institute, Halifax), in cooperation with Nova Scotia swordfish harvesters, conducted a survey of sharks in set locations from Georges Bank to the eastern Grand Banks in 2017, but the survey will not be conducted in 2018 (H. Bowlby pers comm 2018).

The annual Atlantic halibut abundance survey is a collaborative effort involving the FFAW-Unifor, the Eastern Shore Fisherman's Protective Association, the Shelburne County Quota Group and the Atlantic Halibut Council working with DFO. It occurs each summer from the end of May to the end of July, across the Scotian Shelf and southern Grand Banks Atlantic halibut management unit (3NOPs4VWX+5Zc). For 2017 and following years, the survey has expanded its coverage in 3NOPs. The survey consists of fixed stations which are fished every year and additional random stratified stations that are chosen annually. Figure 4.18 also shows the locations of both the fixed stations and the 2018 randomly chosen stations. The survey methodology varies slightly for the fixed vs. random sets, but both use halibut longlines approximately 5-km long on the sea floor, with about 1,000 hooks per line. Soak time is six to twelve hours, and the gear must be set between 0400 and 1200 local time. As the figure shows, the planned survey area does not overlap any of the 2018 stations (locations supplied by DFO); however, GXT will maintain communications with the Atlantic halibut survey planners (B. Wringe pers comm 2018; C. den Heyer, pers comm 2017, 2018).

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Figure 4.18 Location of Industry – DFO Survey Stations