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13.0 SENSITIVE AREAS

Sensitive Areas have been included as a VEC due to stakeholder and regulatory concerns about the vulnerability of such areas to potential WREP-related environmental effects, including those arising from either planned activities or accidental events.

Sensitive Areas are commonly associated with one or more of the following: rare or unique marine habitat features; habitats that support sensitive life stages of valued marine resources; and/or critical habitats for species of special conservation status. For this environmental assessment, Sensitive Areas are defined based on the definition provided in the Scoping Document (C-NLOPB 2012a):

> …any sensitive areas in the Study Areas, such as important or essential habitat to support any of the marine resources identified, or areas identified through the Grand Banks-Placentia Bay (PBGB) Large Ocean Management Area (LOMA) Integrated Management Plan Initiative (Ecologically and Biologically Sensitive Areas (EBSAs), Valuable Marine Ecosystems (VMEs), Marine Protected Areas (MPAs), etc.)

13.1 Environmental Assessment Boundaries

The spatial and temporal boundaries of the WREP, including specifically the Nearshore and Offshore Project and Study Areas, are described in Chapter 5 (Effects Assessment Methods).

13.1.1 Spatial Boundaries

Sensitive Areas identified within or near to the Nearshore and Offshore Study Areas are shown in Figures 13-1 and 13-2, respectively, with the exception of eelgrass beds, capelin beaches and salt marshes, which are identified/described in Section 13.3.1. Oil spill trajectory modelling has been used to determine the potential maximum Affected Area.

13.1.1.1 Nearshore

The Nearshore Study Area (Figure 13-1) of most relevance for the Sensitive Areas VEC is that associated with an accidental oil spill. Cape St. Mary's Seabird Ecological Reserve will be included in the review of the Sensitive Areas VEC. Although it is outside of the Nearshore Study Area and beyond the area predicted by oil spill trajectory models, Cape St. Mary's has been included in the environmental assessment because of its exceptional ecological and cultural importance.

13.1.1.2 Offshore

The Offshore Study Area (Figure 13-2) associated with an oil spill has the potential to interact with several identified sensitive areas. Routine WREP-related activities and operations (e.g., drill cuttings deposition) are not expected to interact with offshore sensitive areas, and therefore have not been included in the scope of assessment for this VEC.

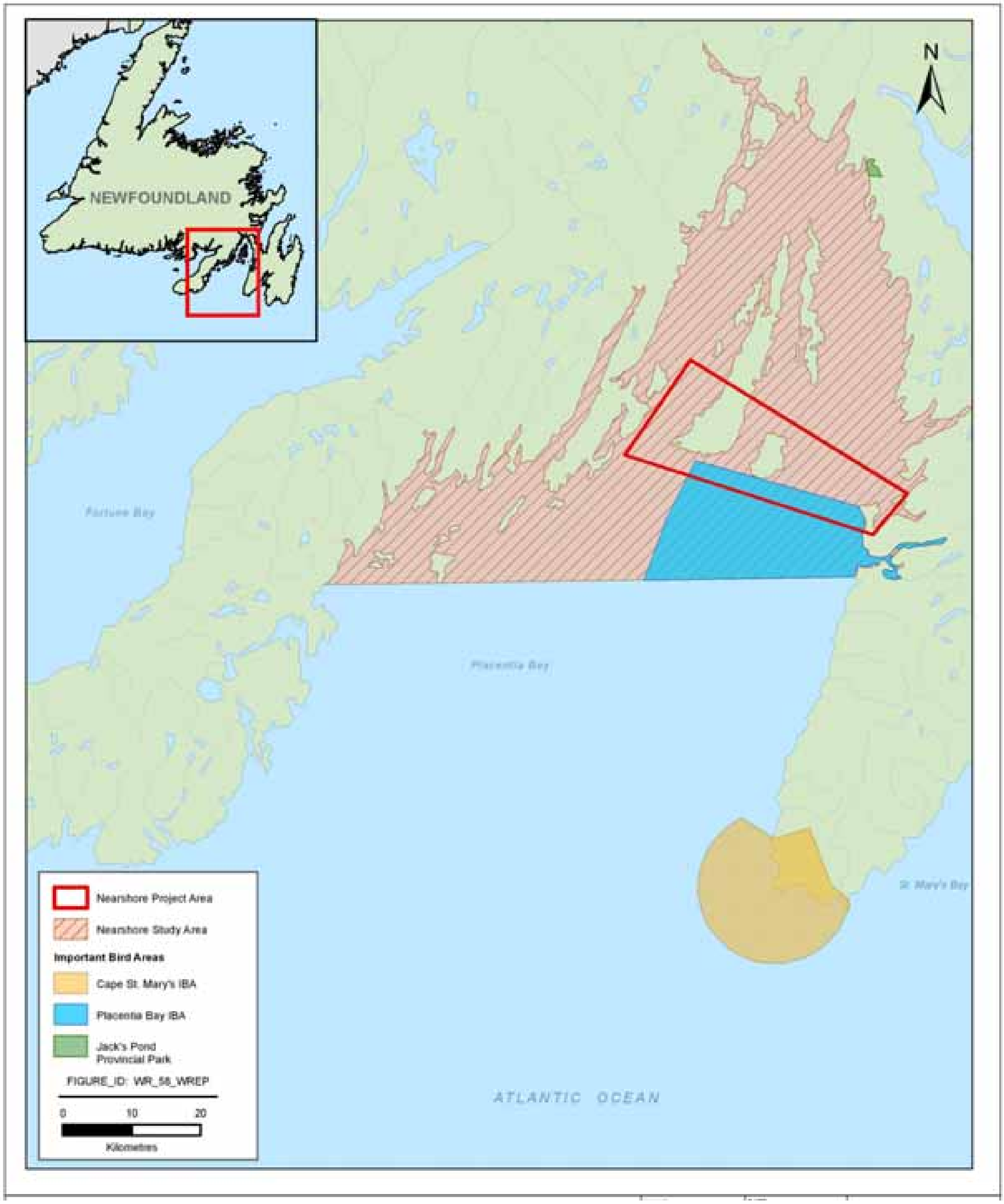


Figure 13-1 Sensitive Areas Identified Within or Near to the Nearshore Study Area

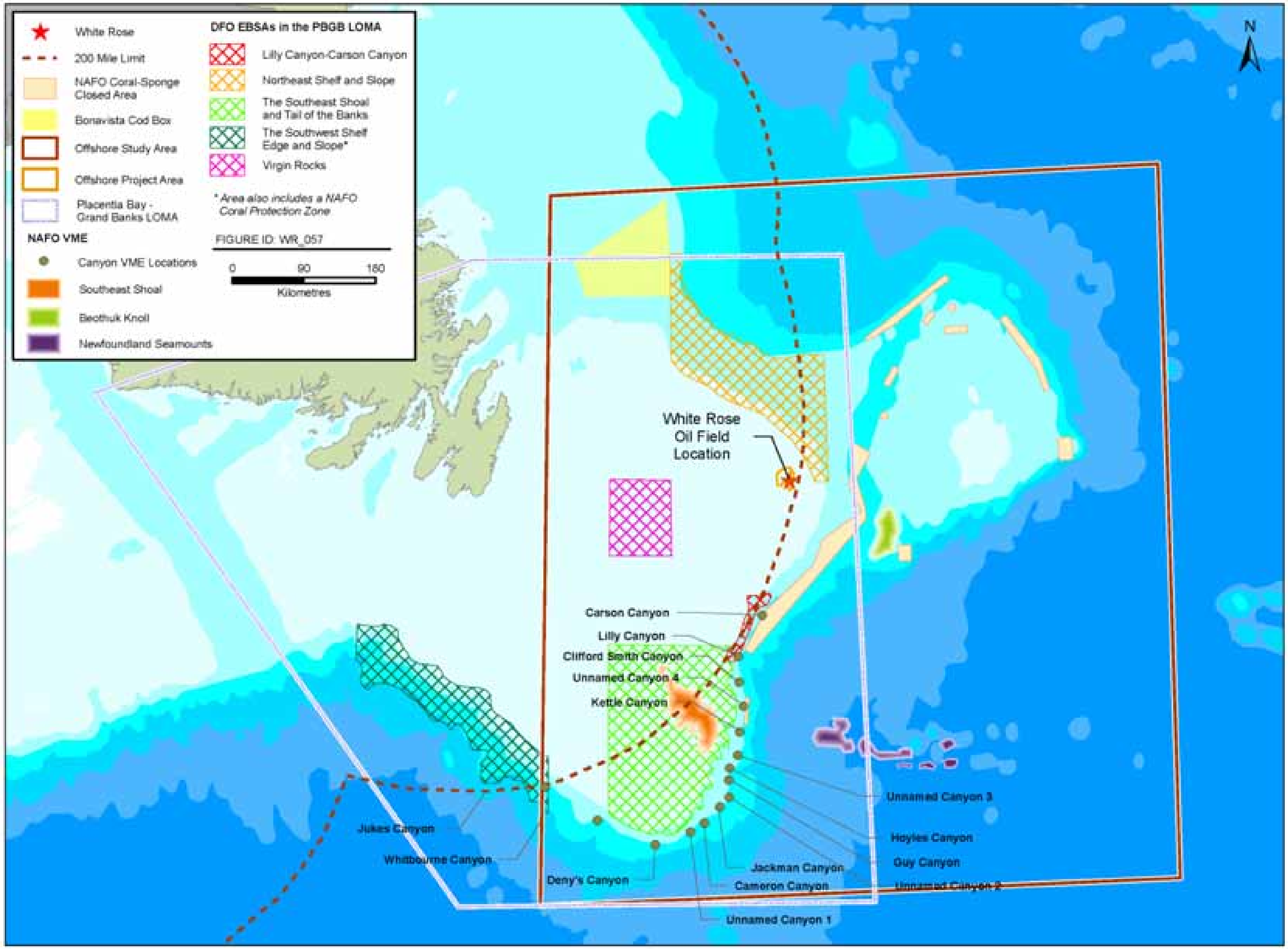


Figure 13-2 Sensitive Areas Identified Within or Near to the Offshore Study Area

13.1.2 Temporal Boundaries

The temporal boundaries for the assessment are defined in Chapter 5 and outlined in Table 13-1.

Table 13-1 Temporal Boundaries of Nearshore and Offshore Study Areas

Study Area	Temporal Boundary
Nearshore	• In the case of the WHP development option, site preparation, graving dock construction, construction of CGS, dredging, topsides mating and tow-out will occur over an estimated 30 to 38 months from 2013 to 2016. Some activity will occur at all times of year until completion. • In the case of the subsea drill centre development option, no nearshore activities will occur.
Offshore	• In the case of the WHP development option, site preparation, installation of the WHP, and initial production/maintenance will occur from 2016 or 2017. The WHP will be decommissioned and abandoned in accordance with standard practices at the end of its production life, which is anticipated to be 25 years. • The subsea drill centre option is scheduled to begin the construction phase in 2014, with first oil expected in 2015. Under this option, the wells will be plugged and abandoned at the end of its production life (anticipated to be 20 years), and the subsea infrastructure removed or abandoned in accordance with relevant regulations.

13.1.3 Administrative Boundaries

Protection of marine sensitive areas is provided by Canada's *Oceans Act,* which authorizes DFO to provide enhanced protection to marine areas of ecological or biological significance (DFO 2004e, 2007b).

In addition to the *Oceans Act*, many sensitive and/or special areas are sites that may provide habitat for species identified as threatened or endangered. Thus Sensitive Areas may be regulated under the SARA. NAFO has committed to identifying VMEs as well as areas with high densities of intact coral and/or sponge habitat (coral-sponge closure areas) in the offshore environment within the context of deep sea fisheries management. Several Sensitive Areas identified within the offshore study area are VMEs (as identified on Figure 13-2).

13.2 Definition of Significance

A significant adverse residual environmental effect is one that alters (physically, chemically or biologically) the valued habitat of the identified Sensitive Area, to such an extent that there is a decline in abundance of key species or species at risk or a change in community structure, beyond which natural recruitment is unable to return the population or community to its former level (within several generations).

An adverse residual environmental effect that does not meet the above definition is considered to be not significant.

13.3 Existing Environment

The Sensitive Areas included in this environmental assessment include any sensitive areas in the Nearshore and Offshore Study Areas, such as important or essential habitat to support any of the marine resources identified, or areas identified through the PBGB-LOMA Integrated Management Plan Initiative (EBSAs, VMEs, MPAs). The Nearshore and Offshore Study Areas occur within Canada's Newfoundland-Labrador Shelves Marine Ecozone (DFO 2010c). This biogeographic classification system is used for: i) assessing and reporting on ecosystem status and trends; and ii) spatial planning for the conservation of ecosystem properties and management of human activities.

As part of the PBGB-LOMA plan, DFO has identified EBSAs that may contain depleted or rare species, ecologically significant species and community properties, and degraded areas which require special management measures (DFO 2007b). To achieve conservation objectives, some EBSAs may be put forward as areas of interest for MPA status; other areas or species may be considered for protection under other management schemes such as *SARA.*

Sensitive areas in the Nearshore Study Area include: Placentia Bay Extension EBSA; capelin spawning beaches; eelgrass beds; salt marshes; wetlands; river otter habitat; Important Bird Areas (IBAs); and scallop beds. The Canadian Parks and Wilderness Society (CPAWS) have also identified ‘Special Marine Areas’ in Newfoundland and Labrador (CPAWS 2009), including Placentia Bay Extension and Bar Haven. Jack’s Pond Provincial Park Reserve is a terrestrial park that also occurs within the Nearshore Study Area (Figure 13-1), and was designated to preserve rare plants, as well as barren, wetland and forested stream habitat (NLDEC website, June 2012).

Sensitive areas in the Offshore Study Area and adjacent area include EBSAs designated by DFO (2007b), including: Northeast Shelf and Slope; Virgin Rocks; Lily Canyon-Carson Canyon; Southwest Shelf Edge and Slope; and Southeast Shoal and Tail of the Banks. The four areas identified as EBSAs by DFO were also recognized by CPAWS as being Special Marine Areas (CPAWS 2009). Other identified Sensitive Areas include: VMEs identified by NAFO, specifically the Southeast Shoal VME and also canyon, seamount, and knoll VMEs; NAFO coral-sponge closure areas; and the Bonavista Cod Box, an important spawning area for Atlantic cod.

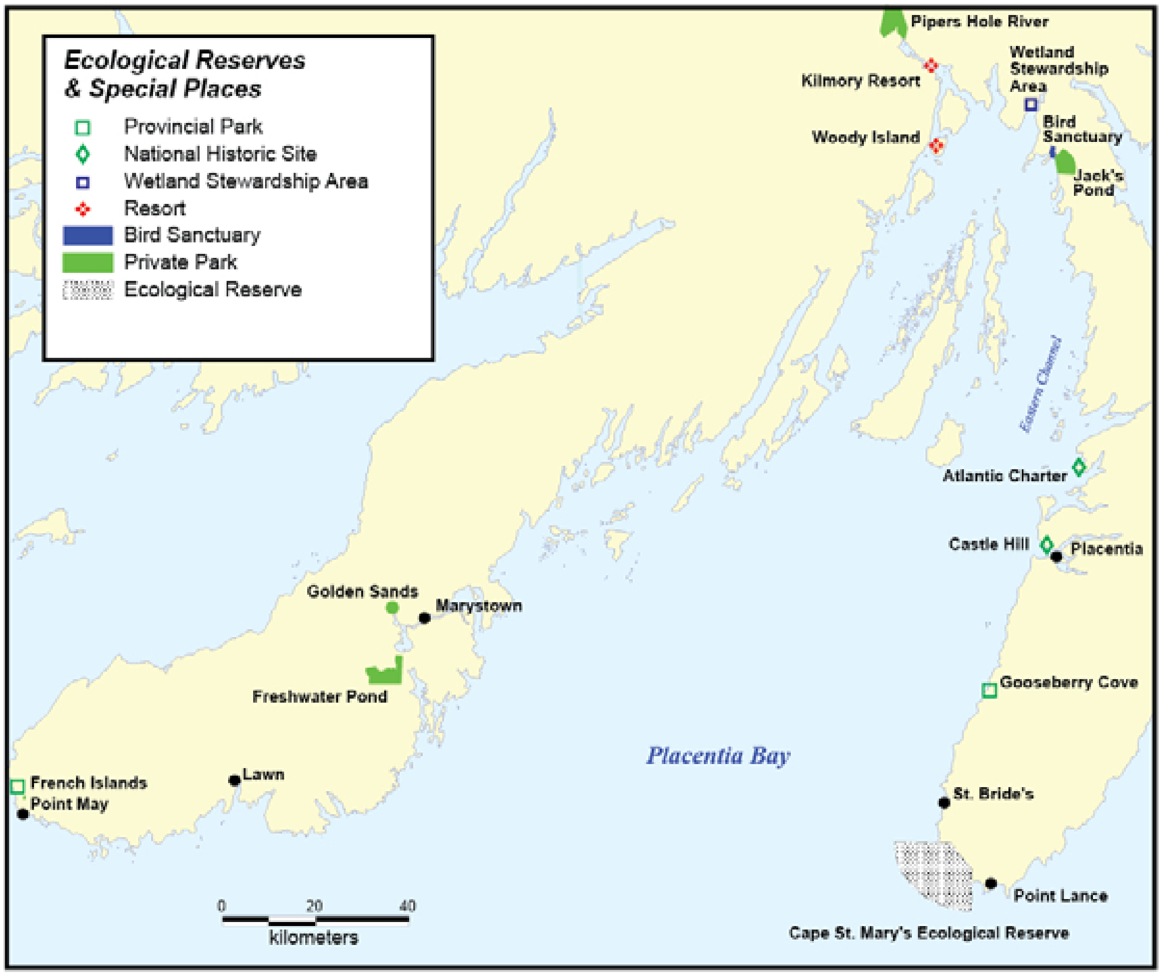
13.3.1 Nearshore

Placentia Bay has traditionally been recognized as an ecologically rich and highly productive area. Placentia Bay supports an estimated 26 species of seabirds, 13 species of waterfowl, 10 species of shorebirds, and seven species of raptors. At least 15 bird species breed in Placentia Bay. In addition, the marine environment supports at least 14 species of groundfish (including Atlantic cod), seven species of shellfish (including snow crab, lobster and scallop), 14 marine mammal species (10 whale, three seal and one river otter species), and one marine reptile (leatherback sea turtle). Some of these species are resident in the Bay, while others are seasonal visitors, predominantly migrating to the Bay during spring, summer, or fall (DFO 2008b).

The Placentia Bay Extension EBSA (which includes all of Placentia Bay) is ranked second by DFO (2007b) in priority among the 11 identified EBSAs within the PBGB-LOMA as candidate sites for designation as an MPA The geophysical and biological characteristics of Placentia Bay has been characterized by Catto et al. (1997, 1999), which provides a framework for describing the area. Catto et al. (1999) classified Placentia Bay based, in part, on the distribution of important indicator species and habitat features, including: eelgrass; salt marsh; barachois estuaries; capelin spawning beaches; rockweed; and seabird-dominated shores. Placentia Bay is highly industrialized, but is well flushed and levels of contamination are generally low; although moderate levels of persistent organic pollutants have been detected in marine birds, harbour seals, and fish (Sjare et al. 2005).

CPAWS (2009) have also identified ‘Special Marine Areas’ in Newfoundland and Labrador and three of these areas occur within the Nearshore Study Area: Placentia Bay Extension (existing EBSA); Bar Haven; and Ragged Islands. An Integrated Management Plan for Placentia Bay has been developed (DFO 2008b), and the ecological reserves and special places identified (mainly terrestrial) during this process are shown in Figure 13-3.

The identified sensitive areas within the Nearshore Study Area are discussed in further detail in the following sections.



Source: DFO 2008b

Figure 13-3 Ecological Reserves and Special Places Identified in Placentia Bay

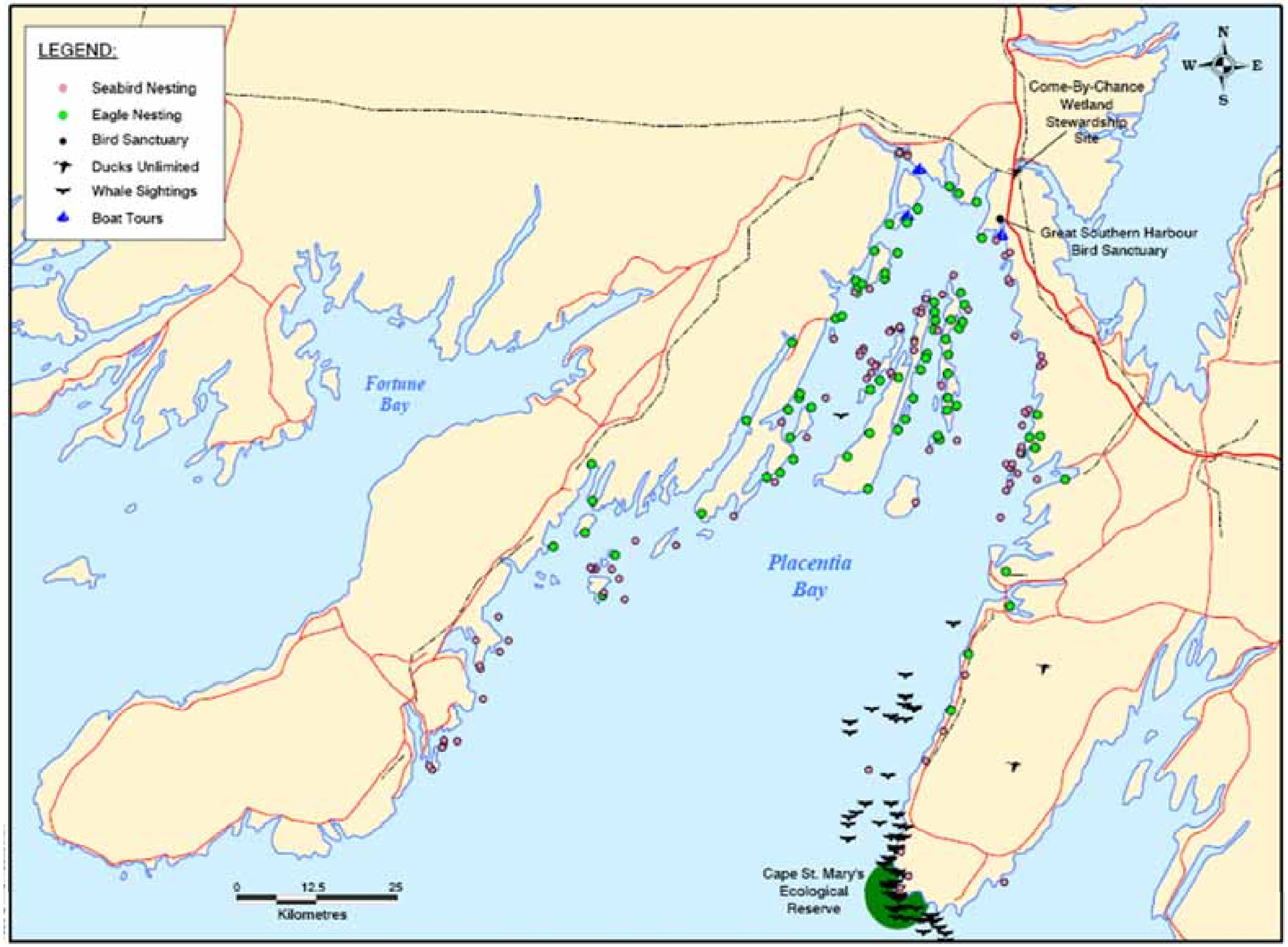
13.3.1.1 Placentia Bay Extension Ecologically and Biologically Significant Area

The Placentia Bay Extension EBSA is characterized by a counter-clockwise gyre and localized upwelling near headlands, driving high primary and secondary production and supporting very high biodiversity (DFO 2007). The area is known to contain high amounts of ichthyoplankton (e.g., Atlantic cod, cunner, American plaice, capelin), and to function as an important spawning and nursery ground for fish. The cod stock that occurs in southern Newfoundland is considered to be in the best condition of the Northwest Atlantic stocks and supports the largest cod fishery in the region (Bradbury et al. 2000; Lawson and Rose 2000; Robichaud and Rose 2001, 2002; Mello and Rose 2005).

Placentia Bay and the surrounding headlands are known to provide important breeding, feeding and overwintering areas for seabirds (e.g., Atlantic Puffin, Black Guillemot, Common Murre, Northern Gannet) (Table 13-2). There are also haul out and pupping areas for harbour seals and feeding areas for cetaceans (e.g., humpback whale, harbour porpoise), leatherback sea turtles, harbour seals and river otters (Figure 13-4). Placentia Bay may be part of the migratory route used by many cetaceans and leatherback turtles; it has historically been an aggregation area during summer when female-calf pairs of whales and porpoises seasonally visit the area to feed.

Table 13-2 Number of Pairs of Marine Birds Characteristic of Placentia Bay Colonies

Common Name	Species Name	Cape St. Mary's
Northern Fulmar	*Fulmarus glacialis*	12
Manx Shearwater	*Puffinus puffinus*	-
Leach's Storm-petrel	*Oceanodroma leucorhoa*	-
Northern Gannet	*Mora bassanus*	12,156
Herring Gull	*Larus argentatus*	Present
Great Black-backed Gull	*Larus marinus*	Present
Black-legged Kittiwake	*Rissa tridactyla*	10,000
Common Murre	*Uria aalge*	10,000
Thick-billed Murre	*Uria lomvia*	1,000
Razorbill	*Alca torda*	100
Black Guillemot	*Cepphus grylle*	Present
Sources: Stenhouse and Montevecchi (1999); Cairns et al. (1989), and Chardine (2000) [adapted from VBNC 2008]		



Source: DFO 2008

Figure 13-4 Areas Identified as Important for Birds and Whales in Placentia Bay

13.3.1.2 Eelgrass Beds

Eelgrass beds are highly productive habitats, as well as important sites for spawning, nursery and refugia for many species. Eelgrass is a flowering plant adapted to the marine environment and is of ecological importance (Gotceitas et al. 1997; Orth et al. 2006; DFO 2009c). Eelgrass has been found to be among the most productive ecosystems globally (Beal et al. 2004; DFO 2009c) and provides a number of important functions and services, including: supporting high diversity; providing refuge and nursery areas for invertebrates and fishes; providing food sources for migrating and over-wintering waterfowl; stabilizing sediments (Catto et al. 1999); filtering the water column; shoreline protection; and recycling and storing nutrients and exchanging gases (Gotceitas et al. 1997; Catto et al. 1999; DFO 2009c; Warren et al. 2010). A variety of invertebrates feed on eelgrass directly as well as upon associated epiphytes and in turn, these invertebrates attract higher trophic levels. The softshell clam, the lugworm *Arenicola marina* and the sand shrimp *Crangon septemspinosus* are common inhabitants in the soft sediment surrounding eelgrass roots. Macroalgae use the eelgrass for support and anchorage (i.e., *Polysiphonia harveyi*, *Rhodophysema georgii* and *Myrionema* sp.), as do hydroids, byozoans and serpulids. Fish common to eelgrass beds include cunner, lumpfish, Atlantic cod, Greenland cod, white hake, lobster and herring (Gotceitas 1997; Morris et al. 2011). Eelgrass is also important for several species of shorebirds and migratory birds including eiders. Eelgrass is considered an Ecologically Significant Species (DFO 2009c) and is protected under the *Fisheries Act* because it meets the following criteria by DFO:

- The structure of eelgrass creates habitat that is preferentially selected by other species.
- It physically supports other species and provides settlement substrate and/or protection for this associated community.
- It is widely distributed and abundant enough to influence the overall ecology of the habitat/community.

Extensive eelgrass beds have been identified in Placentia Bay (Catto et al. 1999; CPAWS 2009), particularly in shallow and sheltered coastal areas that have soft substrate and some freshwater input such as near Swift Current. Eelgrass beds characterize the Swift Current estuarine area (between North Harbour Point and Prowsetown in Placentia Bay) from just above the low tide level to approximately 3 m depth, and also the Placentia area. These eelgrass beds are known to support a diverse community including: red algae, shrimp, crabs, salmon and trout (Catto et al. 1999).

Marine habitat surveys of the benthos at the Argentia project site (e.g., adjacent to proposed graving dock site and the proposed tow-out routes) were undertaken using a ROV during winter 2012. Habitat characteristics such as substrate type, vegetation and macrofauna observed were described, including the proportion of habitat covered by eelgrass. Eelgrass habitat was observed within the proposed dredge area for the graving dock site and had an estimated cover of approximately 1 percent within the area surveyed (Stantec 2012b). Vegetation occurred in low densities in the areas surveyed, and was dominated by kelp, sea colander and sour weed. Eelgrass was not observed within either of dredge areas along the CGS tow-out corridor.

13.3.1.3 Salt Marshes

Salt marshes are recognized as sensitive habitats that support birds, insects and terrestrial mammals in tidal areas. Common plants that occur within these habitats include the genera *Plantago* (plantain), *Carex* (sedges), *Triglochin* (arrow grass), *Glaux* (sea milkwort), *Festuca* (fescue), *Arenaria* (sandworts) and *Potentilla* (typical cinquefoils). In Placentia Bay, salt marshes occur near Swift Current. These salt marsh plants stabilize sediments and provide coastal protection from erosion and wave action. The Swift Current estuarine area is located in northwestern Placentia Bay between North Harbour Point and Prowsetown, and includes Sound Island, Woody Island and Bar Haven Island (Catto et al. 1999). This area experiences strong freshwater influxes from Piper's Hole and other nearby rivers, although the amount and extent of freshwater discharge varies annually and seasonally (Catto et al. 1999). Waterfowl and shorebirds have not been observed to be frequent users of the salt marsh habitat, which may relate to the presence of the community of Swift Current and the Burin Peninsula Highway (Catto et al. 1999).

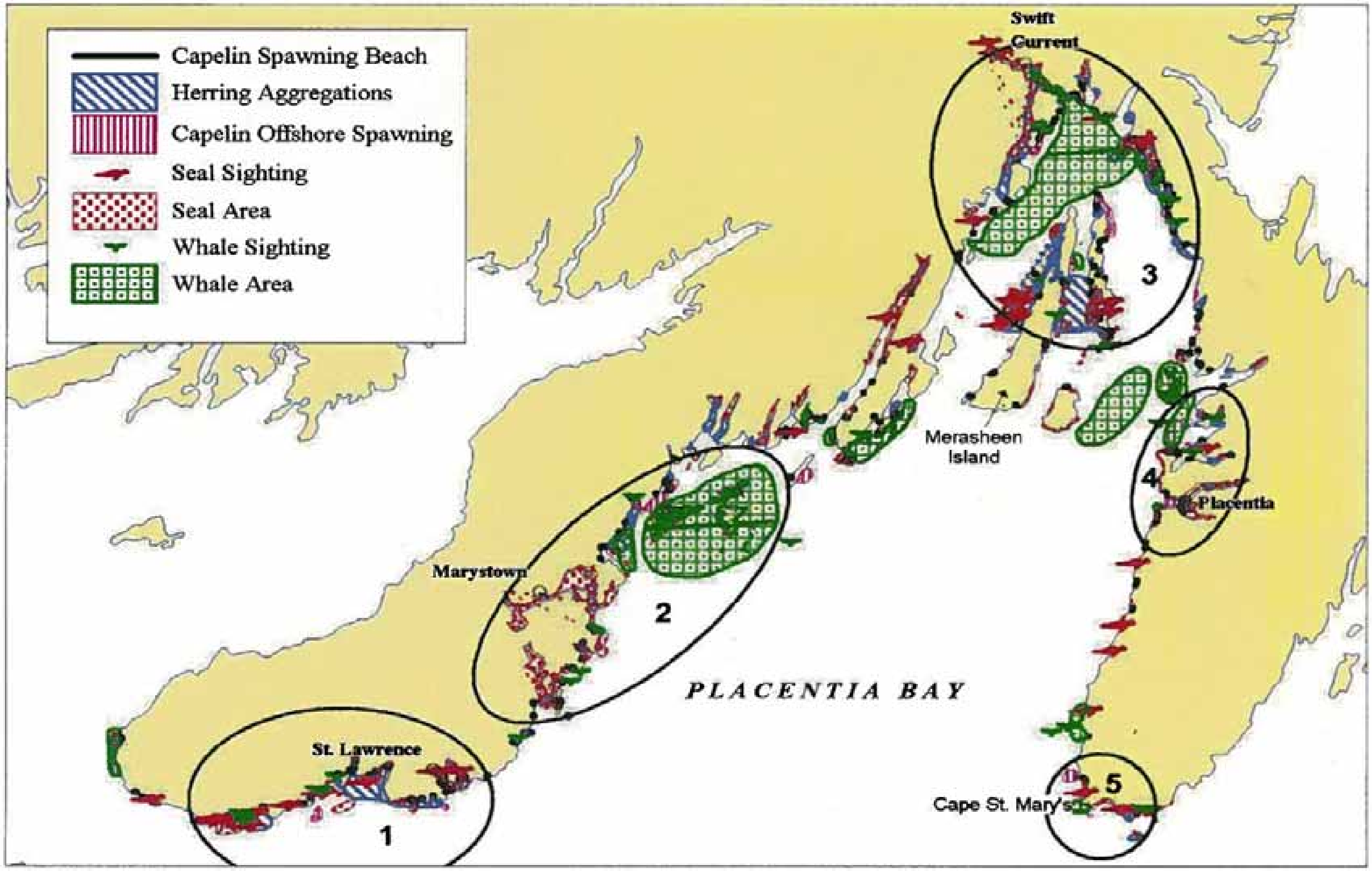
13.3.1.4 Capelin Beaches

Capelin occurring in southwestern Newfoundland commonly overwinter in offshore waters, migrate inshore to Placentia Bay in early spring to spawn on preferred beaches in spring and summer (Figure 13-5), and then return to the offshore once again in autumn (Nakashima and Wheeler 2002; Sjare et al. 2003).

Capelin spawning beaches and offshore spawning areas were identified by Sjare et al. (2003) based on local ecological knowledge (mainly provided by local area fishers) (Figure 13-5). The main capelin spawning beaches were near St. Lawrence, Lamaline, Cape St. Mary's and Placentia. Over 80 capelin spawning beaches were identified during the survey. In the St. Lawrence and Lamaline areas alone, 31 spawning beaches were identified, eight of which were thought to be annual spawning sites (based on local knowledge).

The St. Pierre Bank stock of capelin spawn along the southern coast of Newfoundland, typically at age three and four (Nakashima and Wheeler 2002; Gregoire 2011). Capelin typically arrive at the head of Placentia Bay in June and July, and have spawned in the past on beaches, including Fox Harbour, Point Verde, southern Ship Cove and Gooseberry Cove. Beach suitability appears to be determined by substrate type (i.e., gravel 5 to 15 mm in diameter), and capelin spawning beaches occur in sheltered, semi-exposed and exposed areas (Nakashima and Wheeler 2002; Gregoire 2011). Eggs are usually deposited in the intertidal zone, but are also known to be deposited in the subtidal zone up to 37 m. Larvae are generally carried out of the inshore region by surface currents.

For more detail on the biology of capelin in Placentia Bay, see Section 8.3.1.5.



Source: Sjare et al. 2003.
Note: Area 1 is St. Lawrence, Area 2 is Marystown, Area 3 is Swift Current/Merasheen Island, Area 4 is Placentia, and Area 5 is Cape St. Mary's. Black dots indicate known capelin spawning beaches based on local knowledge

Figure 13-5 Areas of Importance to Pelagic Fish and Marine Mammals

13.3.1.5 Bird Habitat

Important Bird Areas

The IBA program is an international conservation initiative coordinated by BirdLife International, designed to use scientific data to identify, conserve and monitor a network of sites that provide essential habitat for birds. In Canada, the partners for this program are Bird Studies Canada and Nature Canada. Two IBAs have been identified within or adjacent to the Nearshore Study Area: Placentia Bay; and Cape St. Mary's (see Figure 13-1).

The Placentia Bay IBA is located on the eastern shore of Placentia Bay and extends from Argentia south to Cape St. Mary's and out to 25 km from shore (total 1,398 km^2). Most of this IBA occurs outside the WREP nearshore Study Area, but is included here for ecological context. This IBA is considered to be a globally important area and supports 85 known bird species, many of which congregate in the area seasonally, particularly when capelin spawn in June and July. This IBA is particularly known for the large numbers of Greater Shearwater (greater than 100,000) that gather here, as well as large numbers of Sooty Shearwater. Local breeding seabirds include Northern Gannet, Black-legged Kittiwake and Common Murre, which often prey upon capelin in Placentia Bay. Pomarine Jaegers and Parasitic Jaegers have also been observed joining the flock of feeding kittiwakes in order to steal capelin from juvenile birds. An estimated 1,000 to 2,000 Common Eiders congregate in the rocky area between Great Barasway and Gooseberry Cove to overwinter (Cairns et al. 1989; Chardine 2000; Russell and Fifield 2001; Chapdelaine et al. 2001; DFO 2007b).

Cape St. Mary's was designated a Seabird Ecological Reserve (64 km^2) in 1983. It has also been selected by CPAWS (2009) as one of Newfoundland and Labrador's Special Marine Areas. Cape St. Mary's is located on the southwestern tip of the Avalon Peninsula, near the entrance to Placentia Bay. The designated IBA covers an area of 329.4 km^2. Although it is located outside the Nearshore Study Area, it is included here because of its ecological importance for marine birds, as well as local tourism. The site is considered globally and nationally important due to the high numbers of seabirds and shorebirds that concentrate, as well as the occurrence of at-risk species (Russell and Fifield 2001). The site includes the cliffs of the mainland as well as islands, islets and cays offshore. The colony extends along 100 to 125 m cliffs, over a distance of approximately 5 km, and is estimated to support 30,000 breeding seabirds including Common Murres, Black-legged Kittiwakes, Thick-billed Murres, Razorbills, Black Guillemots, Herring Gulls, Great Black-backed Gulls, Great Cormorants, and Double-crested Cormorants, as well as migrant seaducks (Oldsquaw, scoters, eiders).

Many seabird and shorebird species use Cape St. Mary's as a staging site during migration, and the area seasonally to feed, including Atlantic Puffin, Manx, Sooty Shearwater, Leach's Storm-petrel, Northern Fulmar, Lesser Golden Plover, Black-bellied Plover, Canada Goose, jaegers, skuas, phalaropes, terns, loons, gulls, ducks and sandpipers (Russell and Fifield 2001; Gaston et al. 2009; Montevecchi et al. 2012). Birds using Cape St. Mary's are described in Sections 10.3.1 and 10.3.5.

Cape St. Mary's is adjacent to a rich marine area where there is strong mixing and upwelling and high concentrations of plankton. This area has traditionally been known as among one of the best fishing grounds in Newfoundland, and is an important Atlantic cod spawning area (along with Oderin Bank and Bar Haven, Placentia Bay) (Lawson and Rose 2000). Capelin, herring, blue mussel, sea urchins and marine mammals are also abundant (DFO 2007b).

Bycatch of birds in gill nets has become the primary anthropogenic cause of bird mortality at the Cape St. Mary's IBA (Piatt and Nettleship 1987; Benjamins et al. 2008; Regular et al. 2009; Montevecchi et al. 2012). Common Murres appear to experience the highest mortality as result of bycatch in Newfoundland and Labrador (Benjamins et al. 2008). Between 1980 and 1994, the breeding population of Common Murres declined by 31 percent in the Cape St. Mary's area. Annual mortality due to fishery bycatch was estimated to be 16.3 percent for Common Murres at Cape St. Mary's in 1982 (Piatt and Nettleship 1987). The highest rates of bycatch occur during the four to six week period when the capelin move inshore to spawn, as well as during the peak breeding season. Such high mortality is difficult to sustain for long-lived seabird species with few offspring and high parental investment (Russell and Fifield 2001). Although fishing is permitted within the ecological reserve, hunting is prohibited.

The second main threat to marine life at Cape St. Mary's is the potential oiling of birds or accumulation of toxins due to chronic pollution and potential oil spills. The colony at Cape St. Mary's is located near a main shipping route. In 2004, total annual vessel movement in Placentia Bay was 8,286, including 1,276 oil tankers, 62 chemical tankers, 522 cargo ships, 2,046 tug boats, 1,501 ferry movements and 1,589 fishing boats and other small vessels (under 20 m) (Transport Canada 2007). Marine traffic data collected by Transport Canada for the ports of Come by Chance, Whiffen Head, Marystown and Long Harbour from May 2011 to April 2012 (with November 2011 and March 2012 data missing) reported 1,756 commercial vessels entering ports in Placentia Bay (C. McDonald, Transport Canada, pers. comm.). However, Transport Canada does not track commercial shipping traffic into ports of Argentia, Arnold's Cove, Burin, Southern Harbour or North Harbour, and that value does not include ferry or fishing vessels.

Arnold's Cove Bird Sanctuary

A bird sanctuary has been established in the town of Arnold's Cove and is an important migratory stopping site for many bird species and used year-round. Species that use the sanctuary include Black Duck, Canada Goose, Pie Ducks, Mallard Duck, Ruddy Turnstone, Plomer, Spoked Sandpiper, Twillick (Greater Yellow Legs), Merganser and variety of gulls. The largest concentration of Black Ducks in eastern Canada occurs at this site, and Ptarmigan, Bald Eagles, Osprey and Cormorants also occur occasionally. The site is protected by provincial hunting regulations (www.townofarnoldscove.com).

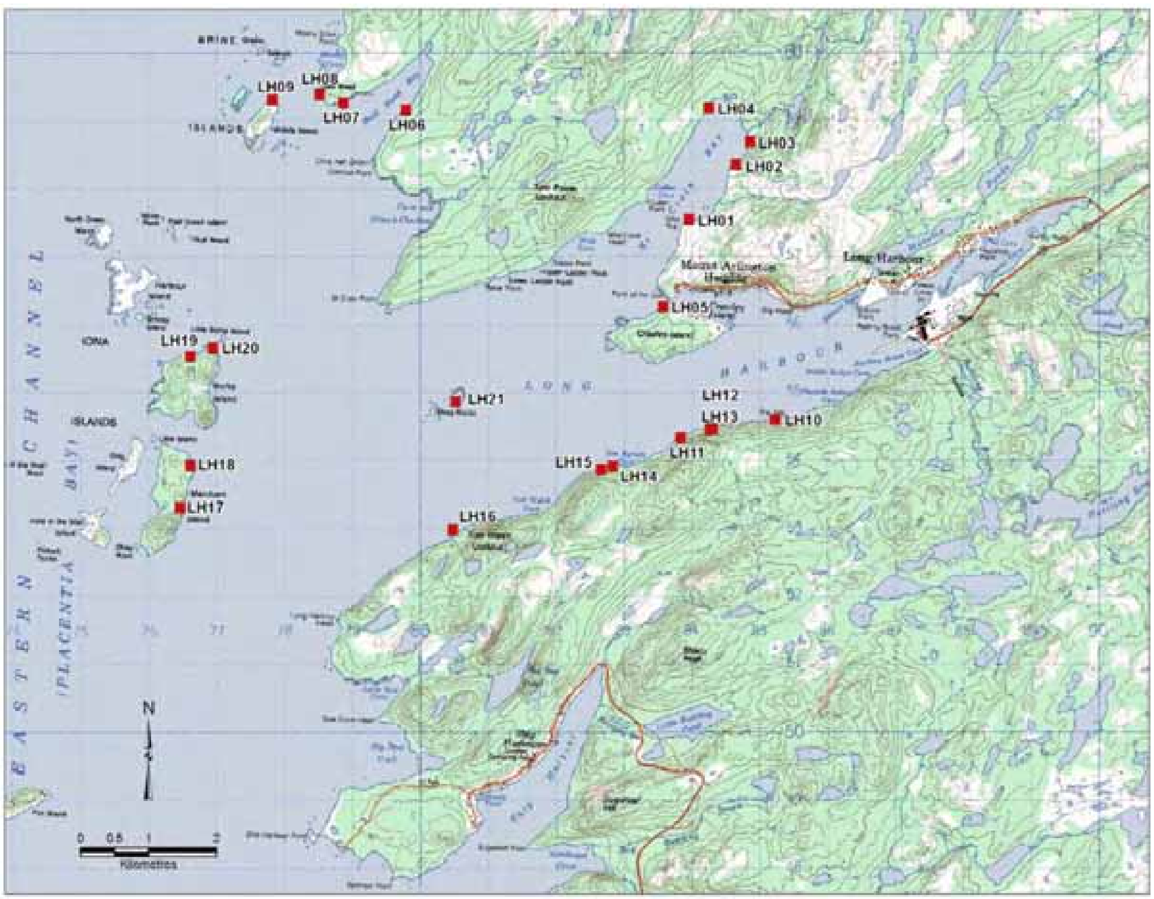
Wetlands

There is a Wetland Stewardship Area in the Come By Chance estuary. It was designated in 1995 to protect waterfowl staging habitat (CPAWS 2009) under a Municipal Stewardship Agreement (LGL 2007c). There are 4,046 ha protected, with a management unit area covering 289 ha. The wetlands provide important staging habitat for Black Duck, Canada Goose and Green-winged Teal.

13.3.1.6 River Otter Haul Outs

The river otter has adopted a marine lifestyle in Placentia Bay and is resident year-round in relatively large numbers. This species is a top predator in the ecosystem, commonly consuming invertebrates and fishes, and occasionally eating insects, waterfowl and small mammals (LGL 2007d; Cote et al. 2008). Diet studies of scat suggest river otters in Placentia Bay mainly feed on inshore fishes including cunner, gunnel, sculpin, flounder and stickleback (Cote et al. 2008).

River otter have relatively large range requirements, making the species sensitive to changes in habitat (Bowyer et al. 1995). The inner reaches of the Bay around Merasheen Island and Long Island are recognized to support one of the highest densities of river otter in Newfoundland and Labrador (Goudie 2007; Jones and Goudie 2007; Park et al. 2010). Typically, concentrations of otter are highest near the head of the Bay, and decline toward the mouth of the Bay (Mercer and Willcott 2005). Twenty-one sites have been identified as otter haul outs or 'rubs' in Long Harbour area alone (Figure 13-6). Many of the sites are located on promontories, although straight coastlines with bedrock and boulder were also frequently used (LGL 2007d).



Source: LGL 2007d
Note: Data obtained during boat surveys 2006 surveys of Long Harbour during summer and winter.

Figure 13-6 Locations of River Otter Haul Out Sites Identified in Long Harbour

Otters are trapped for their fur by licensed hunters from October 20 to March 15 annually in Newfoundland. An average of 93 otters is reported trapped annually in the Placentia Bay area (trapping zone 2 and 3) (NLDEC 2004; LGL 2007d). There are no data collected on bycatch of river otters in gillnets in Placentia Bay.

13.3.2 Offshore

Sensitive Areas identified within in the Offshore Study Area are illustrated in Figure 13-2 and are discussed in detail in the following sections.

13.3.2.1 Ecologically and Biologically Significant Areas

As part of the Integrated Management Plan for PBGB-LOMA, DFO has identified EBSAs in the area that may require specific management measures. EBSAs are identified according to pre-established criteria, including uniqueness, aggregation, fitness consequences, resilience and naturalness (DFO 2004e). In total, 11 EBSAs have been identified within the PBGB-LOMA and ranked in terms of significance in order to determine the best candidate(s) for a MPA (DFO 2007b). Five of these 11 EBSAs are located within the Offshore Study Area (Figure 13-2): Lily Canyon-Carson Canyon; Northeast Shelf and Slope; Southeast Shoal and Tail of the Banks; Virgin Rocks; and Southwest Shelf Edge and Slope. In the ranking scheme for DFO priorities, the Southeast Shoal and Tail of the Banks EBSA was given the highest ranking, and the Southwest Shelf Edge and Slope EBSA ranked third. The other three EBSAs being considered within this section were ranked in the bottom 4 of the 11. The five EBSAs being considered are described in greater detail in the follow sections.

Southeast Shoal and Tail of the Banks Ecologically and Biologically Significant Area

The Southeast Shoal and Tail of the Banks EBSA is an area east of 51°W and south of 45°N (Figure 13-2), extending to the edge of the Grand Banks (DFO 2007b). The Southeast Shoal is notable for having the warmest bottom water temperatures on the Grand Banks and a well-defined gyre that drives high rates of primary production (CPAWS 2009) and supports reproducing populations of groundfish and capelin (Walsh et al. 2001; Fuller and Myers 2004). This area was the most recently exposed area on the Grand Banks, as it was formerly beach habitat, and the last part of the area to remain above sea level during the last glacial period. It is unique in that it contains the only shallow, sandy offshore shoal in the LOMA, as well as relict populations of blue mussel, wedge clam (*Mesoderma deauratum*) and capelin associated with beach habitats, and also has the highest benthic biomass on the Grand Banks. In their characterization, DFO (2007b) also note the Southeast Shoal has:

- The only known offshore spawning site for capelin (NAFO Division 3NO)
- The single nursery area of the entire stock of yellowtail flounder
- A spawning area for several groundfish species (American plaice, yellowtail flounder and Atlantic cod)
- An important nursery area for NAFO Division 3NO cod and American plaice

- An area that attracts large aggregations of marine mammals (especially humpback and northern bottlenose whales) and marine birds due to presence of forage species

- An area with the dense concentrations of Atlantic wolffish

- An area that has supported the highest density of American plaice on the Grand Banks since the mid-1990s.

Because of these features, it has been ranked first in priority among the 11 EBSAs. This EBSA has a dynamic sandy bottom habitat that is subject to regular disturbance by wave action and is thus less sensitive to disturbance. Fishing has greatly altered the ecosystem and DFO (2007b) concluded that ecosystem and community resilience in the Southeast Shoal area has been diminished and is likely sensitive to further disturbance.

The Southeast Shoal VME proposed by NAFO is within the boundaries of DFO's existing Southeast Shoal and Tail of the Banks EBSA (Figure 13-2).

Southwest Shelf Edge and Slope Ecologically and Biologically Significant Area

The Southwest Shelf Edge and Slope is an EBSA that is located from 55°W to 52°W along the southwestern shelf edge of the Grand Bank to the 2,000 m isobaths (DFO 2007b). This area is highly productive due to upwelling processes, and is an important marine area on the Grand Banks because of the high coral species richness, groundfish biomass and seabird diversity (Kulka et al. 2003; Ollerhead et al. 2004; Edinger et al. 2007). Cetaceans and leatherback sea turtles are known to congregate in the area to feed (CPAWS 2009). NAFO closed a 14,040 km^2 area (NAFO Division 3O) to fishing from 2007 to 2012 to allow for research on the ecology and protection of deep water corals from the effects of fishing. In their EBSA characterization, DFO (2007b) noted this EBSA:

- Supports northernmost population of haddock in Northwest Atlantic, and this population spawns along edge of Southwest slope during spring

- Has high diversity of cold-water coral species and increased habitat structure and complexity due to the presence of these corals

- Greatest diversity of groundfish on the Grand Bank occurs on the Southwest Slope

- High biomass of groundfish

- Monkfish, pollock and white hake only occur along the Southwest Slope and within the Laurentian Channel within the PBGB-LOMA

- Supports Atlantic cod population and migratory route, and historically was area of high density

- Important spawning area for redfish species

- Has highest density of pelagic seabirds feeding within the PBGB-LOMA

- Cetaceans and leatherback sea turtles aggregate in this area to feed, particularly during summer.

DFO (2007b) also noted in their ranking of this EBSA that high fishing effort in this area as well as high rates of coral bycatch indicate this system has been heavily impacted by human activities. The Southwest Shelf Edge and Slope EBSA borders the Offshore Study Area and only a small proportion occurs within the Offshore Study Area (Figure 13-2).

Lily Canyon-Carson Canyon Ecologically and Biologically Significant Area

Lily Canyon-Carson Canyon is an EBSA that extends from 44.8°N to 45.6°N along the 200 m depth contour of the southeast slope of the Grand Banks (Figure 13-2). It contains Lilly Canyon and Carson Canyon, two areas where upwelling occurs due to wind (storms) as well as mixing of cold and warmer waters (CPAWS 2009). This area is variably productive, but at times can be highly productive and is strongly influenced by the Labrador Current. The area is biologically important due to the abundance of Iceland scallops, as well as feeding and overwintering of marine mammals (Ollerhead et al. 2004; CPAWS 2009). In their ranking of this EBSA, DFO (2007b) noted the area has:

- High concentrations of Iceland scallop

- Aggregations of marine mammals year-round for feeding and overwintering

- Deeper parts of canyons are relatively undisturbed by human activities.

It is ranked eighth of the 11 identified EBSAs in terms of DFO's priorities within the PBGB-LOMA. The area is assigned an overall low ranking in terms of uniqueness since other canyons occur throughout the Grand Banks, and because Iceland scallop are known to occur elsewhere.

The Northeast Shelf and Slope Ecologically and Biologically Significant Area

The Northeast Shelf and Slope EBSA is located on the northeastern Grand Banks, starting at the Nose of the Bank, from 48°W to 50°W, and from the edge of the shelf (e.g., 200 m depth contour) to the 1,000 m depth contour (Figure 13-2). The area is not considered unique but supports spotted wolffish and Greenland halibut populations, contains two important coral areas at Robin's Point and Funk Island Spur, and is a known feeding area for marine mammals, particularly harp seals, hooded seals, and pilot whales (CPAWS 2009). In their EBSA ranking assessment, DFO (2007b) noted that the Northeast Shelf and Slope EBSA has:

- Aggregations of spotted wolffish in spring (listed as threatened under SARA)

- High concentrations of Greenland halibut in spring

- Aggregations of marine mammals.

This EBSA is ranked ninth of the 11 identified EBSAs as a priority by DFO.

Virgin Rocks Ecologically and Biologically Significant Area

The Virgin Rocks EBSA is located in the northern central area of the Grand Banks, and comprises the area from 46°N to 46.8°N and from 50°W to 51°W (Figure 13-2). The area is known to have exposed rocks (as shallow as 3.6 m) near the middle of the bank, a habitat that does not occur elsewhere on the Grand Bank and supports several fish species (Ollerhead et al. 2004) as well as marine birds. An estimated 1,000 to 2,000 Common Eiders commonly overwinter near the Virgin Rocks (CPAWS 2009). The site has high plankton productivity as well as dense kelp beds in the rocky shallow subtidal (CPAWS 2009). In their assessment, DFO (2007b) noted that the Virgin Rocks EBSA:

- Is considered geologically unique in the LOMA, because large, nearly exposed rocks occur offshore
- Supports aggregations of capelin and marine birds
- Provides spawning and breeding habitat for Atlantic cod, American plaice and yellowtail flounder, although these species are known to spawn elsewhere (CPAWS 2009).

The Virgin Rocks EBSA is ranked lowest in priority of the 11 identified EBSAs, largely because historical intensive fishing has resulted in the decline of several of the traditionally abundant species in the area, thereby reducing the resiliency of the area.

13.3.2.2 Northwest Atlantic Fisheries Organization Vulnerable Marine Ecosystems

NAFO has identified candidate VMEs with the goal of managing deep sea fisheries and the potential environmental effects that such fishing could have. NAFO uses criteria that have received general consensus internationally (i.e., the Food and Agriculture Organization (FAO) of the United Nations International Guidelines for the Management of Deep Sea Fisheries in the High Seas) (NAFO 2008). Several VMEs have been proposed in the LOMA, including many of the canyons along the shelf edge, seamounts and knolls, the Southeast Shoal, cold seeps, carbonate mounds and hydrothermal vents. However to date, the focus for identifying candidate VMEs have been areas that are currently fished (i.e., benthic data available), or that are currently technically feasible for fishing (refer to Figure 13-2) (NAFO 2008). The defined VMEs will likely be subject to additional management measures aimed to protect the high biodiversity of these areas (NAFO 2008).

The five criteria for VME identification are: uniqueness or rarity; functional significance of the habitat; fragility; life history traits of component species; and structural complexity of the habitat. Specifically, sessile or slow-moving benthic organisms such as corals, sponges and bivalves were identified by NAFO (2008) as important habitat-forming organisms. These species increase habitat structure and complexity as well as the number of microhabitats and niches, thereby attracting greater concentrations of fish and other species. Many of these cold-water coral species and large sponges are slow-growing organisms that are fragile and vulnerable to fishing disturbance, and this was also considered in selecting VMEs.

The following VMEs that have been identified by NAFO occur within the Offshore Study Area.

Canyons

Canyons are distinctive features of the seafloor that are known to be important habitats for many species and communities, as they typically extend from 200 to 2,000 m depth and occur over the continental shelf. Canyon habitat can support diverse communities, including cold-water corals and deep sea fishes (Gordon and Fenton 2002). NAFO has identified 13 canyons that occur within the Offshore Study Area: Denys Canyon; Cameron Canyon; Jackman Canyon; Guy Canyon; Hoyles Canyon; Kettle Canyon; Clifford Smith Canyon; Lilly Canyon; Carson Canyon; and Unnamed Canyons 1, 2, 3 and 4 (refer to Figure 13-2). The ecological functions and services provided by canyons are not well understood, but research from well-studied canyons in the region (i.e., The Gully on the Scotian Shelf) suggest that deep-water areas support a rich, diverse community (Gordon and Fenton 2002), ranging from corals and sponges to deep-water fishes and marine mammals such as the northern bottlenose whale (Whitehead et al. 1997; Strain and Yeats 2005; Edinger et al. 2011).

Seamounts and Knolls

Seamounts are defined as an elevation in the seafloor of 1,000 m or more, and can be peaked or flat at the top, and can occur as one alone, or as a chain of seamounts. Seamounts have been recognized as ecologically important features that support habitat-structuring communities such as coral and sponges, and attract aggregations of deep-sea fishes, as well as their predators. Seamounts may also be important for the mating and spawning of some species. The Newfoundland Seamounts, a chain of seamounts, occurs within the Offshore Study Area (refer to Figure 13-2). Beothuk Knoll, located southwest of Flemish Cap, also occurs within the Offshore Study Area (refer to Figure 13-2). Although there has been very little study of Beothuk Knoll to date, there is evidence of cold-water corals and aggregations of deep-sea fishes such as redfish at this site (Power 1997; NAFO 2008).

NAFO Coral-Sponge Closed Areas

The NAFO scientific council identified areas of substantial coral and sponge communities within the NAFO Regulatory Area in 2008 and 2009 (Statoil 2011). As of January 1, 2010, NAFO implemented 11 coral-sponge area closures in NAFO Division 3LMN that total an area of 4,630 km^2. Within NAFO Division 3O, 14,000 km^2 is closed to all bottom fishing and is also considered a coral-sponge area closure (refer to Figure 13-2).

13.3.2.3 Bonavista Cod Box

The Bonavista Cod Box is an experimental protected area in the Bonavista Corridor and located in the northwest corner of the Offshore Study Area (refer to Figure 13-2). It was identified as being critical to the life cycle of Atlantic cod, and was designated as an experimental protected area in 2003 after consultation between DFO and the C-NLOPB and following recommendations by the Fisheries Resource Conservation Council. The Fisheries Resource Conservation Council recommended that commercial fishing (excluding snow crab trapping) and other potentially harmful activities such as seismic activities be prohibited.

13.4 White Rose Extension Project-Valued Environmental Component Interactions

This section reviews potential environmental interaction between WREP activities and Sensitive Areas, as well as existing knowledge related to the potential environmental effects.

13.4.1 Nearshore

In the Nearshore Study Area, eelgrass beds, capelin beaches, wetlands, salt marshes, IBAs, scallop beds and river otter haul outs have been identified as Sensitive Areas. Some of these areas are potentially at risk of disturbance from nearshore WREP activities associated with the construction and tow-out of the CGS. For example, there is potential for dredging activities in the nearshore to adversely affect habitat through sedimentation and disturbance. The potential environmental effects on fish, seabirds and mammals are assessed separately in the Fish and Fish Habitat (Chapter 8), Marine Birds (Chapter 10) and Marine Mammal (Chapter 11) sections. The only additional routine activities that could interact with Sensitive Areas are the graving dock excavation and dredging. The environmental effects of these two routine activities are described and assessed below, in addition to the potential environmental effects from an accidental event (e.g., diesel spill).

Eelgrass may be particularly sensitive to the accidental release of hydrocarbons (Dean et al. 1998). The effects of toxins on seagrasses are not well studied, and the effects on seagrass from oil spills have varied considerably (Short and Wyllie-Echeverria 1996). The accidental release of hydrocarbons also has the potential to affect capelin spawning beaches. In addition to affecting the physical habitat of the beach itself, accumulation of hydrocarbons has the potential to affect capelin that spawn on the beach (including egg and larval stages), as well as invertebrates and shorebirds that use intertidal and beach habitat for feeding, refuge and reproduction. This potential environmental effect is discussed further in the Fish and Fish Habitat VEC (Chapter 8).

The release of diesel into the Nearshore Study Area also has the potential to affect other identified Sensitive Areas in the marine environment including salt marsh habitat, wetlands, bird habitat (i.e., IBAs), and river otter habitat; the presence of diesel could cause lethal or sublethal effects on vegetation or animals using the habitat.

13.4.2 Offshore

The Offshore Study Area contains several identified Sensitive Areas including five EBSAs, but the Offshore Project Area is nearest to the Northeast Shelf and Slope EBSA. The Offshore Study Areas also includes NAFO identified vulnerable marine ecosystems including canyons, seamounts and knolls, as well as NAFO coral-sponge closed areas and the Bonavista cod box (Figure 13-2).

Routine construction and operation activities associated with the WREP are not expected to interact with offshore Sensitive Areas.

Accidental events that may occur in the Offshore Study Area are assessed including: a synthetic-based mud (SBM) whole mud spill; a subsea hydrocarbon blowout; a crude oil surface spill; other spills (i.e., fuel, waste materials); and marine vessel incident, or a collision (involving the WHP, vessel and/or ice). An accidental event in the Offshore Study Area would likely result in loss of habitat quality and potential mortality and therefore, overlaps with the environmental effects assessment undertaken for other VECs including Fish and Fish Habitat (Chapter 8), Commercial Fisheries (Chapter 9), Marine Birds (Chapter 10), Marine Mammals and Sea Turtles (Chapter 11) and Species at Risk (Chapter 12). The potential for interactions between the identified offshore Sensitive Areas and an accidental event is assessed in Sections 13.4.2 and 13.5.2.2.

13.4.3 Summary

Both the Nearshore and Offshore Study Areas have limited interactions between planned routine WREP activities and Sensitive Areas. If the WHP option is selected, then dredging activities in the nearshore may result in the removal of eelgrass in the Nearshore Project Area. The potential for interactions primarily stems from potential accidental events. An accidental event may affect Sensitive Areas, potentially resulting in changes in habitat quality or mortality of vegetation or other habitat-forming biota such as coral or sponge. The environmental effects on species using the Sensitive Areas (e.g., change in habitat use and potential mortality) are addressed in their respective VEC sections, and are not further assessed in this Sensitive Areas VEC with the exception of routine Project effects on eelgrass which is assessed further in this VEC.

A summary of the potential environmental effects from WREP-VEC interactions arising from dredging activities associated with construction of the CGS and accidental events are described in Table 13-3. Accidental events include nearshore diesel spill, offshore equipment failure, offshore subsea blowout, offshore crude oil surface spill, other offshore spills (fuel, chemicals, drilling muds, waste material) and marine vessel incident (including collisions (nearshore and offshore)).

Table 13-3 Potential White Rose Extension Project-Related Interactions: Sensitive Areas

WREP Activities	Potential Environmental Effects		
	Change in Habitat Quality	Change in Habitat Quantity	Mortality
Construction			
Dredging	x	x	x
Accidental Events			
Nearshore marine diesel fuel spill from support vessel	x		x [(A)]
Nearshore graving dock breach	x		x
Offshore SBM whole mud spill	x		
Offshore subsea hydrocarbon blowout	x		
Offshore hydrocarbon surface spill	x		
Other offshore spills (fuel, waste material)	x		
Marine vessel incident (including collision) resulting in marine diesel spill	x		
(A) A spill of diesel in the Nearshore Study Area could result in mortality of eelgrass plants. The potential for other species using Sensitive Areas are assessed in the appropriate VEC chapter			

13.5 Environmental Effects Analysis and Mitigation

13.5.1 Nearshore Pre-construction and Construction

During construction activities in the Nearshore Project Area, there will be excavation and dredging activities near the graving dock construction site, and dredging activities at Corridor 1 and Corridor 2, to deepen the tow-out route for the CGS. Habitat characterization studies carried out in November 2011 and between February and April 2012 indicated that eelgrass was absent from Corridor 1 and Corridor 2, but occurred near the graving dock construction site (Stantec 2012b). Eelgrass averaged approximately 8 percent of the macroflora species present in the vicinity of the graving dock and covered approximately 1 percent of the total surveyed seafloor area. Two eelgrass beds were delineated as approximately 100 m^2 and 1,000 m^2, respectively. The predominant substrate within these two eelgrass beds was fine material and eelgrass covered a combined total of 45 percent of the seafloor of these two delineated areas. The remaining observations of eelgrass win the vicinity of the graving dock were sporadic and interspersed with more dominant brown algae (Stantec 2012b). Outside the area to be dredged, a change in habitat quality due to sedimentation is not expected to have adverse environmental effects since eelgrass are resilient to sedimentation in the water column and are able to improve water quality.

As there are multiple eelgrass beds in the Nearshore Study Area, the removal of an eelgrass bed of 1,100 m^2 is considered to be minor. An assessment of the potential environmental effects on Sensitive Areas as a result of dredging in the Nearshore Study Area is presented in Table 13-4.

Table 13-4 Environmental Effects Assessment: Construction

WREP Activity	Potential Positive (P) or Negative (N) Environmental Effect	Mitigation Measure	Evaluation Criteria for Assessing Environmental Effects (A)						Significance Rating	Level of Confidence
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-cultural/Economic Significance		
Nearshore										
Dredging	Change in habitat quantity (N)	• Habitat compensation, if required (dredging)	L	1	1	3	R (B)	3	NS	H

Key:

Magnitude:
N = Negligible (essentially no effect)
L = Low: <10 percent of the population or habitat in the Study Area will be affected
M = Medium: 11 to 25 percent of the population or habitat in the Study Area will be affected
H = High: >25 percent of the population or habitat in the Study Area will be affected

Geographic Extent:
1 = <1 km radius
2 = 1 to 10 km radius
3 = 11 to 100 km radius
4 = 101 to 1,000 km radius
5 = 1,001 to 10,000 km radius
6 = >10,000 km radius

Frequency:
1 = <11 events/year
2 = 11 to 50 events/year
3 = 51 to 100 events/year
4 = 101 to 200 events/year
5 = >200 events/year
6 = continuous

Duration:
1 = <1 month
2 = 1 to 12 months
3 = 13 to 36 months
4 = 37 to 72 months
5 = >72 months

Reversibility (population level):
R = Reversible
I = Irreversible

Ecological/Socio-cultural/Economic Significance:
1 = Relatively pristine area not affected by human activity
2 = Evidence of existing adverse activity
3 = High level of existing adverse activity

Significance Rating:
S = Significant
NS = Not Significant
P = Positive

Level of Confidence:
L = Low level of confidence
M = Medium level of confidence
H = High level of confidence

(A) Where there is more than one potential environmental effect, the evaluation criteria rating is assigned to the environmental effect with the greatest potential for harm
(B) Dependent on whether the graving dock is single-use or multi-use

13.5.2 Accidental Events

Although serious accidental events are considered unlikely, such an event could occur at any time of year, throughout the life of the proposed WHP or subsea drill centre. Therefore, a conservative approach has been taken and the assessment will consider the potential environmental effects of a credible worst case accidental event (i.e., large hydrocarbon spill) occurring at the most sensitive time of year, within any of the identified Sensitive Areas.

13.5.2.1 Nearshore

The assessment of the environmental effects of an accidental event on the Nearshore Study Area includes the potential effects on Sensitive Areas that could result from the accidental release of diesel fuel (as a result of a collision) in the Nearshore Study Area.

In the nearshore, the potential source of hydrocarbons entering the marine environment from the WREP activities occurs from a batch spill of fuel oil as a result of a vessel accident or grounding. In the unlikely worst-case scenario, the maximum possible volume of a batch fuel spill (350 m^3) would be released. The tug boats, accommodation vessel and supply vessels that will be used in the Nearshore Study Area will use marine fuel oil, which is similar in composition and spill behaviour to diesel fuel. Batch spills are considered instantaneous events and are modelled by considering surface spreading, dispersion, emulsification and drift of a single patch (slick) of hydrocarbons. Under certain wind and ocean current conditions, the spill may reach the shoreline prior to complete evaporation and dispersion. The average summer and winter conditions were modelled based on wind speed and water temperature. There are few differences in the fate of the spills between the two seasons. The summer scenario is likely more relevant as nearshore activities involving tow-out and the deep-water mating site are expected to be completed during spring and or summer; however, the winter data show the range of possible spill fates. During summer, discharges are expected to lose approximately 37 percent of the fuel to evaporation, whereas during the winter scenario, the model suggests approximately 25 percent of the fuel evaporates. The slicks varied in minimum and maximum time to reach shore, as well as the estimated slick life at sea, depending on the location where the spill occurred. The minimum survival time of the slick was 0.5 to 1 day, with maximum between 4.5 and 8 days based on historical wind patterns. The nearshore oil spill model is discussed in detail in Section 3.7 and SL Ross (2012). The environmental assessment is based on maximum possible release (350 m^3) of diesel fuel reaching the identified Sensitive Areas.

Placentia Bay Extension Ecologically and Biologically Significant Area

Oil spill trajectory modelling suggests that hydrocarbons from a spill at the Nearshore Project Area will likely remain near the site of the spill and will reach shorelines within 24 to 48 hours, without any spill mitigation or spill response. As this EBSA covers the entire Placentia Bay, any spill has the potential to have an interaction with this Sensitive Area. The potential interactions with ichthyoplankton and spawning fish (Chapter 8), bird life (Chapter 10), marine mammals and sea turtles (Chapter 11) and species at risk (Chapter 12) have been previously discussed. The potential interactions with specific coastal habitats such as eelgrass beds, capelin beaches and salt marshes are discussed in detail in the following sections. There is potential for localized decline in productivity and for mortality of shoreline vegetation in the short-term; however, it is not expected to be at a level beyond which natural recruitment would return the population to former levels within several generations.

Eelgrass Beds

Seagrasses, including the local species of eelgrass (*Zostera marina*), are sensitive to exposure to hydrocarbons, which could result from an accidental release of diesel. Possible interactions could include uptake of hydrocarbons or the oiling of leaves, which may cause the plants to lose their leaves (Dean et al. 1998). Direct oiling is more likely to occur in very shallow water where the eelgrass sits at the surface and is exposed to the hydrocarbon slick; however, direct oiling is uncommon (Den Hartog and Jacobs 1980). The greater concern is the uptake of hydrocarbons by the plant from the water column (Den Hartog and Jacobs 1980). The presence of hydrocarbons in the water column may cause non-lethal physiological effects or the mortality of individual plants if there are moderate to high concentrations in the water column for a few hours, or low concentrations of hydrocarbons that persist over a few days (Fingas 2001); however, no effect may also be observed (Short and Wyllie-Echeverria 1996). The potential effects from oiling on eelgrass may be greater in sheltered areas that have little mixing and flushing action since oil will tend to persist for longer (Dean and Jewett 2001). Seasonal variation can also affect the duration and extent of a hydrocarbon spill, as well as potential effects on the eelgrass life cycle.

Large oil spills that have occurred in temperate coastal areas such as the *Exxon Valdez* oil spill in Prince William Sound, Alaska (1989) and the *Amoco Cadiz* spill near coast of Brittany, France (1978), have provided the opportunity to observe the effects of hydrocarbons on eelgrass communities (Jacobs 1980; Den Hartog and Jacobs 1980; Jewett and Dean 1997; Dean et al. 1998; Peterson et al. 2003). Eelgrass communities are able to recover within a few years, although the effects of hydrocarbon pollution on the associated fauna may take much longer to reverse as they tend to be more sensitive than the plants themselves. The potential environmental effects of diesel oil on eelgrass are not well studied. One incident in Newfoundland involved the accidental release of diesel fuel on a road near Bonne Bay, NL during berm construction activities in 1999. It was documented to cause a die-off of eelgrass in the adjacent coastal area (Hanson 2004). Diesel oil can be more toxic than crude oil in the short-term. Eelgrass communities were compared at oiled and non-oiled (reference) sites between 1990 and 1995 in Prince William Sound following the *Exxon Valdez* oil spill (Dean et al. 1998). At the oiled sites, direct effects (i.e., lower densities) appeared to be minimal and were not observed after one year. By 1991, communities had recovered and there was no difference observed in shoot density or flowering shoot density between sites. A second study (Jewett and Dean 1997) examined the effects of the *Exxon Valdez* oil spill on invertebrates and fish associated with eelgrass beds at oiled and reference sites and observed statistically significant differences. Common taxa including infaunal amphipods, infaunal bivalves, helmet crabs (*Telmessus cheiragonus*) and leather stars were less abundant at oiled sites than at reference sites in 1990. However, other taxa, particularly opportunistic or stress-tolerant taxa, including infaunal polychaetes and gastropods, epifauna polychaetes and mussels, were more abundant at oiled sites versus reference sites, in association with high PAH concentrations. Six years after the spill, there was evidence of recovery of most (but not all) taxa. Low levels of hydrocarbon contamination were still detectable at some sites. Some species, including sea stars and the helmet crab, were still more abundant at reference sites than at oiled sites (Jewett and Dean 1997). Pacific cod (*Gadus macrocephalus*) was the most abundant fish species in the eelgrass communities, and small (less than 15 cm) cod were substantially more abundant at oiled sites than reference sites, whereas the abundance of large cod did not differ between oiled and reference sites (Jewett and Dean 1997). The authors hypothesize that differences observed in species abundance between oiled and reference sites may be due to an increased food supply for stress-tolerant species provided by increased bacteria at the oiled sites, or that decreased competition and/or competition allowed for increased abundance at oiled sites. Alternatively, differences in the sites themselves (i.e., exposure, hydrography, productivity, nearshore community) may explain the differences observed, regardless of the presence of oil (Jewett and Dean 1997).

The observations made in Prince William Sound, Alaska, are similar to those reported by Den Hartog and Jacobs (1980) following the *Amoco Cadiz* oil spill off France. In this case, the eelgrass community near Roscoff, France, was studied from 1976 to 1978 (pre-spill), and following the 1978 oil spill that covered these eelgrass beds; the study continued in order to document the observed environmental effects. In the short term, eelgrass plants had black (burnt) leaves, which were shed (the shedding of leaves is part of the lifecycle of eelgrass). Over the longer-term, the eelgrass beds showed little effect from the spill. However, the effects of the oil spill on mobile invertebrate fauna were highly variable (Den Hartog and Jacobs 1980). The study found that observed effects on members of phylum Gastropoda were minimal, and that species belonging to Cumacea, Tanaidacea and Echinodermata recovered within a year, however those belonging to phylum Amphipoda experienced substantial declines. Of the 26 species of amphipoda that occurred before the spill, five species were observed at heavily oiled sites after the spill (Den Hartog and Jacobs 1980). Amphipods are known to be highly sensitive to hydrocarbon pollution (Lee et al. 1977; Busdosh 1981; Wolfe et al. 1996). The *Amoco Cadiz* spill occurred in spring prior to rapid growth of the eelgrass and following the winter peak of a number of littoral organisms. The environmental effects of hydrocarbon pollution during the summer peak of eelgrass biomass may differ (Den Hartog and Jacobs 1980).

Peterson et al. (2003) studied the longer-term effects of oil exposure on coastal systems in Alaska. Their study concluded that the oil from the *Exxon Valdez* spill had been more persistent than was anticipated. Peterson et al. (2003) found toxic subsurface oil had persisted much longer than anticipated, and long-term chronic effects had been observed, with the intertidal zone experiencing the greatest effects. Few long-term effects were observed in the subtidal zone. Effects were observed to occur via multiple pathways, and ecological cascades (shifts in communities) had occurred.

To date, there is little primary literature available on the observed effects of the April 2010 *Deepwater Horizon* oil spill in the Gulf of Mexico on eelgrass beds. A study of coastal fishes using seagrass nursery habitat in the Gulf of Mexico compared cohorts from 2006 to 2010 (sampled from July to October) in order to assess the potential effect of the *Deepwater Horizon* oil spill on early fish stages (Fodrie and Heck 2011). There were no decreases in recently settled juvenile abundance in eelgrass habitats at 12 sites from Chandeleur Islands, Louisiana, to Saint Joseph Bay, Florida. Twelve of the twenty common fish species were characterized by statistically higher catch rates in 2010 in comparison to 2006 to 2009. Among the other eight species, catch rates were not statistically distinguishable between pre-spill and post-spill surveys. Species composition of juvenile fish assemblages in the eelgrass beds also did not differ among survey years for any of the sites. Overall, the findings suggest that the 2010 year-class of coastal fishes using eelgrass habitat were not severely affected by the oil spill in the Gulf of Mexico (Fodrie and Heck 2011). During the Iraq-Kuwait conflict, when an estimated 1,970,000 m^3 (520 million gallons) of crude oil was released (Tawfig and Olsen 1993), there were severe shoreline effects observed on coastal habitats (Jones et. 1996), but no significant long-term effects to seagrass meadows habitats were documented as the vegetation recovered (Kenworthy et al. 1993; Richmond 1996).

In the unlikely event of an accidental spill of diesel fuel during WREP activities in the Nearshore Study Area, oil spill response plans will be initiated to clean-up and reduce potential environmental effects. Nearshore oil spill modelling (Section 3.7) suggests that a high (55 to 94 percent) proportion of the modelled slicks reach the shoreline due to the close proximity of the spill sites modelled (near Argentia and the two possible deep-water mating sites) to shore and due to the prevailing westerly and southwesterly winds in Placentia Bay. The minimum time to shore from modelling at all three possible spill locations ranged from two to five hours (SL Ross 2012). During the months of March and July, over 55 percent of the modelled spills (diesel slick) reached the shore within less than 24 hours, and more than 75 percent of the modelled spills reached the shoreline within 48 hours. Survival time of the diesel fuel that did not reach the shoreline ranged from a minimum of 0.5 days to 8 days (SL Ross 2012). In the case that a spill reaches coastal areas where eelgrass is present, knowledge to date suggests that damage to eelgrass would be localized and that recovery of the eelgrass can be expected within two or three years (Laurel et al. 2003). The effects of the faunal community associated with eelgrass beds may take several years to recover, or in the case of taxa such as amphipods and some polychaete families, they make take much longer to return to former abundance levels (den Hartog and Jacobs 1980; Jewett and Dean 1997). In addition, crude oil spills have been shown to affect higher trophic levels and to persist in the intertidal sediments for longer than anticipated (Peterson et al. 2003).

Contingency plans developed for construction activities associated with the WREP in and around Argentia and the deep-water mating site in Placentia Bay will take into consideration the variety of coastal habitats, including eelgrass beds. These plans will be in place to quickly initiate response and clean-up measures, with the goal to limit the potential of diesel reaching eelgrass beds and other Sensitive Areas.

In the event of an accidental event or collision in the nearshore results in the release of hydrocarbons, there is a high probability of a diesel slick to reach the shore potentially affecting eelgrass beds. Such an event is unlikely to happen, however due to spill prevention measures. Spill response and contingency plans will limit exposure of Sensitive Areas in the event of a spill. In the highly unlikely event of a worst case hydrocarbon spill in the Nearshore Study Area, potentially affected eelgrass beds and associated invertebrate assemblages are likely to recover within several generations as suggested by studies conducted at previous spill sites.

Capelin Beaches

Pebble beaches are used by spawning capelin in Newfoundland and Labrador (Nakashima and Wheeler 2002; Sjare et al. 2003). Pebble beaches are permeable with an unstable surface layer, and typically have low diversity and abundance of marine life. Oil on pebble beaches is less likely to stay at lower levels of the beach and more likely to concentrate on the upper beach due to wave action, or to become buried in sediment.

A diesel fuel spill as a result of an accidental event or collision occurring in May, June, or July may interact with capelin spawning, eggs and larvae (Paine et al. 1988; Frantzen et al. 2012) (refer to Section 8.5.1.3 for a review of this potential environmental effect on capelin). Natural mortality levels of capelin eggs and larvae are very high; therefore although the effect of a diesel spill on spawning success may be considerable locally if capelin spawning and the diesel fuel spill overlap spatially and temporally, it would likely be undetectable at the population level (Leggett et al. 1983; Rice 1985). Population-level effects would likely require more than 50 percent of the larvae over a substantial portion of the spawning area to be lost (Rice 1985).

An oil spill contingency plan specific to WREP activities in the nearshore of Placentia Bay will be developed accounting for local habitats and conditions and will incorporate response and clean-up measures.

In the case of an accidental hydrocarbon spill reaching the shore, there is potential for marine diesel fuel to become buried in the sediments and to persist for years before natural processes degrade the oil and diminish potential environmental effects. In the event of this unlikely case, long-term effects may affect capelin productivity within the affected area, but not at a population level.

Coastal Wetlands

Although there have been numerous field and laboratory studies of the environmental effects of oil on coastal marshes (Smith et al. 1984; Alexander and Webb 1985; Mendelssohn et al. 1990; Burger 1994; Lin and Mendelssohn 2012), the ability to predict the effects of a spill in Placentia Bay is limited because of the complexity of factors controlling the response of marsh vegetation as well as due to differences in oil type and variation among sites (Pezeshki et al. 2000). Short-term responses of plants to oil exposure include reductions and transpiration and carbon fixation to mortality of plants (DeLaune et al. 1979; Pezeshki and DeLaune 1993). Baker et al. (1990) reports that chronic oil pollution severely reduces marsh grasses and can alter marsh extent. Oil can affect root systems if it penetrates the sediment, and can also affect bacteria populations and the cycling of oxygen. Vegetation (i.e., leaves) that becomes coated in oil can reduce oxygen diffusion and cause root die-off (Baker et al. 1990). Oil adheres to most salt marsh plants and low tidal flow cannot readily wash it off (Baker et al. 1990). Plant recovery is dependent on surviving roots. The worst-case scenario would occur if seedlings and annual plant species were exposed to oil during the spring and summer growth season and there was a large-scale die-off of marsh plants. Temperate salt marsh plants may be capable of recovering from spill events over months to a few years (Baker et al. 1990); however, in other cases, oiled plants have been documented to fail to re-sprout or to recruit seedlings 17 months after oiling (Clarke and Ward 1994). There is also potential for persistence of oil in sediments, as has been reported in cases where the spill involved thick, untreated oil that was stranded on the high marsh during a spring tide in a highly sheltered area (Baker et al. 1993). Teal et al. (1992) reported that oil continued to affect a marsh ecosystem for six years after an oil spill, and that after 20 years, residual effects were “extremely small”, provided the oil remained undisturbed in sediments.

The *Deepwater Horizon* oil spill that occurred in April 2010 released an estimated 7×10^8 L (4.4 million barrels) of oil into the northern Gulf of Mexico (Crone and Tolstoy 2010; Reddy et al. 2011) and up to 500,000 tonne of methane and gases (Joye et al.

2011). This resulted in large sections of the Gulf of Mexico coastline encountering oil. DeLaune and Wright (2011) summarized available literature on Gulf of Mexico wetlands from field, greenhouse and laboratory studies and found that under most conditions, marsh vegetation will recover from oil exposure without the need for remediation. The rate of recovery will be dependent on several factors, including magnitude of oiling, amount of oil penetrating the sediment and the sensitivity of particular plant species to oiling. Oil coating of entire plants can cause injury and reduce photosynthesis of the plant and may lead to die-off. However, in the case of the *Deepwater Horizon* spill, the low tidal range meant that most oil entering wetlands would not coat leaves, but could affect roots. The study notes that salt marshes are relatively resistant even after heavy oiling, and cite the return of salt marsh plant shoots in the year following the *Deepwater Horizon* oil spill, even at heavily oiled sites (DeLaune and Wright 2011).

A study of ten salt marshes in Louisiana, Mississippi and Alabama after the oil spill compared unaffected and heavily oiled marsh sites and conducted measurements of sediment contamination to 30 cm (Natter et al. 2012). The study found elevated total organic carbon in contaminated sediments and pore water that was one to two orders of magnitude higher than pristine sites. Elevated total organic carbon was found in sediments both at the sediment surface (top 3 cm) and at depth (30 cm). In contrast, surface water dissolved organic carbon was comparable to that of the unaffected sites. This suggests hydrocarbons are able to persist in sediment for long periods even after oils in water column are dispersed and evaporate (Natter et al. 2012). Substantial degradation of lighter compounds was noted, while heavier oils persisted in sediment (Natter et al. 2012).

Lin and Mendelssohn (2012) studied the potential effects of the oil spill on saltmarsh plants in the northern Gulf of Mexico. Seven months after the spill made landfall with salt marshes in Barataria Bay, Louisiana, concentrations of total petroleum hydrocarbons in the top 2 cm of sediment were as high as 510 mg/g. Sites with heavy oiling experienced high mortality of the two plant species studied (*Spartina alterniflora* and *Juncus)*, while moderate oiling affected *Spartina* less than *Juncus*, which experienced decreased above-ground biomass and stem density (Lin and Mendelssohn 2012). A greenhouse study also supported the field results. *Spartina* was found to recover from total oil coverage of shoots within seven months; however, *Juncus* experienced less recovery, and the oiling of soil affected both species (Lin and Mendelssohn 2012).

Salt marshes have been identified near Swift Current in northwestern Placentia Bay, with estuarine influence reaching Sound Island, Woody Island and Bar Haven Island. The nearshore oil spill trajectory modelling (Section 3.7; SL Ross 2012) indicated that there is a 1 to 5 percent probability that oil could reach the outer edges of Sound Island (closest to Swift Current), but would not reach the inner reaches of Swift Current, likely due to the strong freshwater influxes from Piper's Hole and other nearby rivers.

Important Bird Areas

The Placentia Bay and Cape St. Mary's IBAs have been designated as globally important sites for seabirds, shorebirds and migratory birds. In the case of an accidental event there is potential for diesel fuel to contaminate the marine environment and reduce water quality, and potentially affect birds using the IBAs. The potential effects of contamination from a fuel spill on marine birds are further discussed in the Marine Birds chapter (Section 10.5.1.4).

An accidental release of marine diesel fuel has been modelled for the areas where project activities will occur (S.L. Ross 2012) and it is not anticipated to reach the Cape St. Mary's IBA and has a predicted one to five percent chance of reaching the Placentia Bay IBA. (Section 3.7; S.L. Ross 2012).

Otter Haul Outs

River otters are common in Placentia Bay and exhibit a marine lifestyle. They use several sites as haul out areas and for feeding. In the case of an accidental event, oiling of otters due to the accidental release of diesel fuel in the nearshore is a potential threat, as the fuel can be toxic if ingested and can reduce or remove the insulating ability of fur. A recent study of sea otters (*Enhydra lutris*) in Prince William Sound, Alaska, suggests that hydrocarbons from the 1988 *Exxon Valdez* oil spill have persisted in intertidal sediments, and that otters foraging in the intertidal zone are exposed to the oil (Bodkin et al. 2012). The exposure level is low and may have negligible effect (Neff et al. 2011); however, exposure to lingering oil may contribute to the lack of recovery of sea otters in the region (Bodkin et al. 2002, 2012; Short et al. 2006). The potential interaction is further discussed in the Marine Mammals section (Section 11.5.1.3). In the case of an accidental event, the presence of diesel fuel is not expected to affect otter habitat, but may affect the otters themselves (e.g., sub-lethal effects) (Section 11.5.1.3).

Summary

Although the likelihood of an oil spill in the Nearshore Study Area from an accidental event or collision occurring is low, spill prevention procedures and contingency planning will be developed to prepare for an accidental event. In the unlikely event of a diesel spill in the Nearshore Study Area, these procedures and plans will be implemented to reduce the severity and duration of interactions between hydrocarbons and Sensitive Areas. Significant residual adverse environmental effects on these Sensitive Areas are therefore not considered likely.

13.5.2.2 Offshore

Sensitive Areas in the Offshore Study Area are discussed in Section 13.3.2 and include EBSAs identified by DFO where there is high productivity and/or aggregations of species, as well as sensitive areas identified by NAFO including VMEs (canyons, seamounts, knolls), coral-sponge area closures and the Bonavista cod box (Figure 13-2). In assessing potential environmental effects of an accidental event on these Sensitive Areas, both the potential habitat effects and the potential effects on species that may be present in the area are addressed. In general, potential effects on species from accidental events are addressed in the assessment undertaken for other VECs, including Fish and Fish Habitat (Chapter 8), Marine Birds (Chapter 10), Marine Mammals and Sea Turtles (Chapter 11) and Species at Risk (Chapter 12).

The hydrocarbon spills considered in this environmental assessment include fuel oil batch spills from vessels or the platform and crude oil blowouts from drilling activities, either subsea or above the surface. Small batch spills could occur from hose ruptures or from platform storage facilities or a vessel collision could result in a larger batch spill. Batch spills are considered instantaneous events. Well blowouts generally involve crude oil (or gas condensate) and natural gas. The volume ratio varies depending on the fluid characteristics and the reservoir itself. Subsea blowouts are classified as shallow or deep-water, based on how the gas behaves upon exiting and contacting the water. Models for both subsea and surface blowouts were produced by SL Ross (2012), based on oil flow rates of 6,435 m^3 per day and 3,963 m^3 per day for winter and summer subsea blowouts, respectively. These represent the maximum oil flow rate estimated from the reservoir and the reduced flow expected after a 120-day release period. An oil spill is predicted to be persistent under both summer and winter conditions due to formation of water-in-oil emulsions during summer, and because the water is colder than the oil's pour point in winter. Consequently, the natural dispersion would be low, and the oil would remain at the surface for an extended period. After approximately one day of exposure at the water surface, the oil will have lost between 18 and 21 percent of its volume due to evaporation, with the maximum anticipated amount of evaporation over the life of the surface oil is estimated to be 31 to 36 percent (SL Ross 2012).

Based on historical wind and current data, a potential oil spill was modelled for two seasonal periods of year to predict the likely fate of a hydrocarbon spill in the offshore over a 30-day period. The winter zone of influence is smaller than in summer due to strong, persistent westerly winds. The summer wind direction is more variable and the modelled slick moves over a wider area. Overall, a release of crude oil from the Offshore Project Area would persist and surface slicks would remain for several weeks. A very small number of slicks are expected to reach the shore based on models, which predicted that 0.04 percent of the modelled 83,220 oil slicks reached shore in March (nine slicks), October (26) and November (one). The slicks reached the coast 45 to 92 days after the hydrocarbon release without mitigation or any spill response. Details on the oil spill fate and behaviour modeling can be found in Section 3.8 and SL Ross (2012).

SBM whole mud spill modelling was carried out to predict the dispersion footprint and potential effects of an SBM accidental release (AMEC 2012c). These models were based on the synthetic drilling fluid Puredrill IA-35LV with a total density of 1,350 kg/m^3. Four spill scenarios were considered: a surface tank discharge; a rise flex joint failure (at two difference fall velocities); and a BOP disconnect. These scenarios were modelled over varying fall velocities and release times as well as seasons. The maximum deposition footprint occurred in winter for the riser flex joint scenario with the lowest fall velocity and longest release period (three hours). The majority of modelled spills had a footprint of 1,800 m^2 or smaller (e.g., 30 m by 60 m). The smallest footprints (30 m by 30 m) were modelled for the BOP disconnect scenario over a relatively short release time (one hour) and at a high fall velocity. The footprint is expected to be influenced by the time period that SBM is accidentally released, the fall velocities and the variability of the currents. In other modelled scenarios, the maximum distance was 201 m or less from the release site. The SBM model report (AMEC 2012c) notes that there is a trade-off between the area covered by the spill and the thickness of the spill. It can be expected that an area of the seafloor that is relatively flat and with few seafloor features is likely to result in a thinner and widely distributed SBM layer, while a localized depression in the seafloor could retain the received SBM as a thicker layer within a smaller area. It is expected that biodegradation of SBM on the seafloor would occur on a scale of several weeks. Details on the SBM modeling can be found in Section 3.5 and AMEC (2012c).

The following assessment of the potential environmental effects of an accidental event occurring in the Offshore Project Area and reaching a Sensitive Area in the Offshore Study Area is based on a conservative approach and considers such an event occurring at the most sensitive time of the year. Note that spill prevention and contingency plans will be in place to reduce the likelihood of an accidental event occurring, and the likelihood of hydrocarbons reaching a Sensitive Area.

Ecologically and Biologically Significant Areas

Southeast Shoal and Tail of the Grand Banks Ecologically and Biologically Significant Area

This EBSA is located 246 km southwest of the Offshore Project Area. It contains a shallow, sandy offshore shoal that is unique in the PBGB-LOMA. In the case of an accidental event, hydrocarbons on the surface on the surface or in the water column could affect the species that use this biologically rich area. Capelin, Atlantic cod and yellowtail flounder spawn in this area, and Atlantic wolffish, marine birds and marine mammals (particularly humpback whales and northern bottlenose whales) aggregate here.

Oil spill trajectory modelling suggests that hydrocarbons from a spill due to a blow-out at the Offshore Project Area have the potential (1 to 10 percent depending on the month modelled) to reach this Sensitive Area in the absence of countermeasures. Any decline in productivity is not expected to be at a level beyond which natural recruitment would not return to the population to former levels within several generations. SBM modelling suggests that SBM from an accidental spill at the Offshore Project Area are unlikely to extend beyond 60 m (maximum) from the release site, and is highly unlikely to reach this Sensitive Area.

Southwest Shelf Edge and Slope Ecologically and Biologically Significant Area

This EBSA is located to the southwest of the WREP Project Area and much of this area is located outside the Offshore Study Area. It is a highly productive area known for high coral species richness, diversity of groundfish, fish spawning and migration and pelagic seabird diversity and densities, as well as aggregations of cetaceans and leatherback sea turtles during summer. Atlantic cod reside and migrate through this area and were historically present in very high abundance. Redfish and Atlantic haddock both spawn in this area.

Oil spill trajectory modelling suggests that hydrocarbons from a spill at the Offshore Project Area have a very low potential (0 to 1 percent) to reach only the far eastern edge of this EBSA (in the absence of countermeasures), as it is located furthest from the Offshore Project Area of the five EBSAs included in this environmental assessment. Any decline in productivity that occurs at the margin of this EBSA is not expected to be at a level beyond which natural recruitment would not return to the population to former levels within several generations. SBM modelling suggests that SBM is highly unlikely to reach this Sensitive Area.

Lily Canyon-Carson Canyon Ecologically and Biologically Significant Area

This EBSA is located 148 km to the south of the Offshore Project Area. It is similar to other canyon habitat on the Grand Bank, but it is recognized as unique because Iceland scallop are abundant here, and marine mammals feed and overwinter in the area.

Oil spill trajectory modelling suggests that hydrocarbons from a spill at the Offshore Project Area have a low to moderate potential (5 to 25 percent) to reach the surface waters of this Sensitive Area in the absence of countermeasures. Any decline in productivity is not expected to be at a level beyond which natural recruitment would not return to the population to former levels within several generations. SBM modelling suggests that SBM is highly unlikely to reach this Sensitive Area.

Northeast Shelf and Slope Ecologically and Biologically Significant Area

This EBSA is the closest Sensitive Area to the Offshore Project Area, at a distance of 37 km to the north and northeast. Habitat in this area supports aggregations of wolffish and Greenland halibut in spring, and aggregations of marine mammals, but the habitat is not considered unique.

Oil spill trajectory modelling suggests that hydrocarbons from a spill at the Offshore Project Area have a low potential (1 to 10 percent) to reach this Sensitive Area in the absence of countermeasures. It is among the most vulnerable of the EBSAs to an oil spill since it is located close to the Offshore Project Area. Any decline in productivity is not expected to be at a level beyond which natural recruitment would not return to the population to former levels within several generations. SBM modelling suggests that SBM is unlikely to reach this Sensitive Area.

Virgin Rocks Ecologically and Biologically Significant Area

This EBSA is located 155.5 km to the west and southwest of the Offshore Project Area. The site is considered geologically unique and provides the only near surface rocks on the Grand Banks. Groundfish including Atlantic cod, American plaice and yellowtail flounder spawn near this area. Schools of capelin can be found here along with marine birds that feed on them.

Oil spill trajectory modelling suggests that hydrocarbons from a spill at the Offshore Project Area have a low potential (1 to 5 percent) to reach this EBSA Sensitive Area in the absence of countermeasures. Any decline in productivity is not expected to be at a level beyond which natural recruitment would not return the population to former levels within several generations. SBM modelling suggests that SBM is unlikely to reach this Sensitive Area.

Northwest Atlantic Fisheries Organization Vulnerable Marine Ecosystems

Canyons

The canyon VMEs identified in the Offshore Study Area were designated by NAFO because these deep water habitats support diverse and unique marine communities that include fragile, long-lived deep water coral, sponges, and deep sea fishes. Fifteen canyons have been identified as VMEs in the Offshore Study Area (Figure 13-2). The closest canyon is Carson Canyon and it is located 148 km from the Offshore Project Area. All other canyons are located further to the south and southwest.

Oil spill trajectory modelling indicates that hydrocarbons from a spill at the Offshore Project Area have the potential to interact with the canyons (in the absence of countermeasures) (0 to 1 percent at Jukes and Whitbourne Canyons, 5 to 25 percent at

Lily Canyon-Carson Canyon (closest to modelled offshore spill site) and 1 to 25 percent at other canyons). Hydrocarbons reaching the canyons at the surface or within the water column are unlikely to adversely affect sensitive corals and deep sea fishes located at or near the seafloor. The productivity and diversity of this special deep water habitat is therefore not at risk. SBM modelling suggests that SBM is unlikely to reach this Sensitive Area.

Seamounts and Knolls

The seamount and knoll VMEs identified in the Offshore Study Area were designated by NAFO because these pelagic shallow habitats support communities of invertebrates that are mostly slow-growing, long-lived, late maturing and experience low natural mortality such as coral and sponge. In addition, seamounts and knolls often attract higher trophic levels. The Newfoundland Seamount chain and Beothuk knoll have been identified as occurring in the Offshore Project Area.

Oil spill trajectory modelling indicates that hydrocarbons from a spill at the Offshore Project Area have the potential to interact with both seamounts and Beothuk Knoll (in the absence of countermeasures). Beothuk Knoll is particularly at risk of interacting with hydrocarbons in the case of an accidental event (10 to 25 percent) due to its location to the southeast of the Offshore Project Area (where modelling projects the oil would disperse given wind conditions). Hydrocarbons reaching the surface or water column surrounding the seamounts and Beothuk Knoll are unlikely to adversely affect the benthic habitat. The productivity and diversity of this habitat is therefore not at risk. SBM modelling suggests that SBM is unlikely to reach this Sensitive Area.

Northwest Atlantic Fisheries Organization Coral-Sponge Closure Areas

The coral-sponge closure areas (Figure 13-2) identified in the Offshore Study Area were designated by NAFO because these habitats support diverse marine communities that include fragile, long-lived, deep-water coral and sponges, which increase habitat complexity and structure and support a variety of associated invertebrate and fish communities.

Deep-water coral communities in the Gulf of Mexico were examined at 11 sites three to four months after the well was capped following the *Deepwater Horizon* spill (White et al. 2012). Healthy coral communities were observed at all sites more than 20 km from the spill site. Seven of the 11 sites visited had been studied in September 2009 and appeared unchanged since that time (White et al. 2012). However, at one site 11 km southwest of the spill site, coral was found to exhibit signs of physiological stress, including tissue loss, sclerite enlargement, excess mucous production and bleached ophiuroids (commensal species), and were covered by brown flocculent material. The level of effect on the individual coral colonies was assessed and ranked from zero (least effect) to four (greatest effect). Of the 43 coral colonies photographed at the affected site, 46 percent showed evidence of effects on half the colony, and nearly 25 percent of the colonies were observed to have greater than 90 percent damage (White et al. 2012). This study provides strong evidence for the effect of the oil spill on deep-water ecosystems such as coral colonies.

Oil spill trajectory modelling indicates that hydrocarbons from a spill at the Offshore Project Area have the potential (1 to 50 percent) to interact with coral-sponge closure areas (in the absence of countermeasures). These identified Sensitive Areas are particularly at risk of interacting with hydrocarbons in the case of an accidental event due to their location to the south and east of the Offshore Project Area (where modelling projects the oil would disperse given wind conditions). In the unlikely event that hydrocarbons reach the surface or water column surrounding the coral-sponge closure areas there is potential to affect coral and sponge habitat; in the case of an undersea blowout there is potential for hydrocarbons to reach the benthos and affect coral and sponge habitat directly. SBM modelling suggests that SBM is unlikely to reach this Sensitive Area.

Bonavista Cod Box

The Bonavista cod box was recognized as an important area for Atlantic cod and is protected from fishing (except snow crab) and other human activities such as seismic testing.

Oil spill trajectory modelling indicates that hydrocarbons from a spill at the Offshore Project Area have a low potential (1 percent) to interact with the Bonavista cod box due to its location in the far northwest corner of the Offshore Study Area. Hydrocarbons reaching the surface or water column surrounding have the potential to interact with Atlantic cod eggs and larvae during spawning season. This potential effect is further discussed in Fish Species at Risk (Section 12.4.2.2). Any decline in productivity is not expected to be at a level beyond which natural recruitment would not return to the population to former levels within several generations. SBM modelling suggests that SBM is unlikely to reach this Sensitive Area.

Summary

The potential for adverse environmental effects to occur as result of WREP activities is considered unlikely given the low probability for an accidental event occurring and the intervening distance between a spill and most Sensitive Areas. An assessment of the potential environmental effects on Sensitive Areas as a result of an accidental event during WREP activities in the Nearshore or Offshore Study Areas is presented in Table 13-5.

Table 13-5 Environmental Effects Assessment: Accidental Events

WREP Activity	Potential Positive (P) or Negative (N) Environmental Effect	Mitigation Measure	Evaluation Criteria for Assessing Environmental Effects [A]						Significance Rating	Level of Confidence
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-cultural/Economic Significance		
Nearshore										
Hydrocarbon spill from vessel	Change in habitat quality (N) Mortality (eelgrass of particular concern) (N)	• Emergency Response Contingency Plan • Spill Prevention and Response Plan	L	2	1	2	R	2	NS	M
Offshore										
SBM whole mud spill	Change in habitat quality (N)	• Spill Prevention and Response Plan	L	2	1	2	R	3	NS	M
Subsea hydrocarbon blowout	Change in habitat quality (N)	• Spill Prevention and Response Plan	L	2	1	2	R	3	NS	M
Crude oil surface spill	Change in habitat quality (N)	• Spill Prevention and Response Plan	L	2	1	2	R	3	NS	M
Other spills (e.g., fuel, waste materials)	Change in habitat quality (N)	• Spill Prevention and Response Plan	L	2	1	2	R	3	NS	M
Marine vessel incident (including collision)	Change in habitat quality (N)	• Spill Prevention and Response Plan	L	2	1	2	R	3	NS	M

Key:

Magnitude:
N = Negligible (essentially no effect)
L = Low: <10 percent of the population or habitat in the Study Area will be affected
M = Medium: 11 to 25 percent of the population or habitat in the Study Area will be affected
H = High: >25 percent of the population or habitat in the Study Area will be affected

Geographic Extent:
1 = <1 km radius
2 = 1 to 10 km radius
3 = 11 to 100 km radius
4 = 101 to 1,000 km radius
5 = 1,001 to 10,000 km radius
6 = >10,000 km radius

Frequency:
1 = <11 events/year
2 = 11 to 50 events/year
3 = 51 to 100 events/year
4 = 101 to 200 events/year
5 = >200 events/year
6 = continuous

Duration:
1 = <1 month
2 = 1 to 12 months
3 = 13 to 36 months
4 = 37 to 72 months
5 = >72 months

Reversibility (population level):
R = Reversible
I = Irreversible

Ecological/Socio-cultural/Economic Significance:
1 = Relatively pristine area not affected by human activity
2 = Evidence of existing adverse activity
3 = High level of existing adverse activity

Significance Rating:
S = Significant
NS = Not Significant
P = Positive

Level of Confidence:
L = Low level of confidence
M = Medium level of confidence
H = High level of confidence

(A) Where there is more than one potential environmental effect, the evaluation criteria rating is assigned to the environmental effect with the greatest potential for harm

13.5.3 Determination of Significance

The overall determination of residual significance (Table 13-6) is based on the definition provided in Section 13.2. It considers the magnitude, geographic extent, duration, frequency, reversibility and ecological context of each environmental effect within the Study Areas, and their interactions, as presented in the preceding analysis (Table 13-5).

Table 13-6 Residual Environmental Effects Summary: Sensitive Areas

Phase	Residual Adverse Environmental Effect Rating (A)	Level of Confidence	Probability of Occurrence (Likelihood)
Nearshore Construction	NS	H	NA (B)
Accidental Events - WHP	NS	M	NA
Accidental Events – Subsea Drill Centre	NS	M	NA
Accidental Events – Potential Future Activities	NS	M	NA

Key:

Residual Environmental Effects Rating:
S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence in the Effect Rating:
L = Low level of Confidence
M = Medium Level of Confidence
H = High level of Confidence

Probability of Occurrence of Significant Effect:
L = Low Probability of Occurrence
M = Medium Probability of Occurrence
H = High Probability of Occurrence

NA – Not Applicable
(A) As determined in consideration of established residual environmental effects rating criteria
(B) Effect is not predicted to be significant, therefore the probability of occurrence rating is not required under CEAA

Adverse residual environmental effects are predicted to be not significant for identified Sensitive Areas in the Nearshore Study Areas. In addition, the likelihood of such an event occurring is considered low.

In the highly unlikely event of a spill offshore, spill modelling predicts that the dispersed oil will have a low to moderate chance of interacting with Sensitive Areas. But in no case is it predicted that the Sensitive Areas would be affected on a permanent basis, nor is it predicted that the resident species would be affected in such a way that natural recruitment is unable to return the population or community to its former level (within several generations). Spill prevention and contingency plans will further reduce likelihood of an accidental event. Therefore, the residual adverse environmental effects on Sensitive Areas are rated as not significant.

13.5.4 Follow-up and Monitoring

In consideration of the nature, timing and extent of an accidental event associated with a serious WREP-related spill, a monitoring program will be implemented to determine environmental effects related to the event (refer to Section 16.9 for more information on spill response). Monitoring would be particularly important for sensitive or special nearshore areas (e.g., eelgrass beds, capelin beaches and coastal wetlands), where there is greater potential for multi-year environmental effects.

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14.0 EFFECTS OF THE ENVIRONMENT ON THE WHITE ROSE EXTENSION PROJECT

14.1 Introduction

Section 5.3.1 "Physical Environment" of the WREP Scoping Document (C-NLOPB 2012a) requires a description of relevant physical environment parameters including "effects of the environment on the Project". The environmental effects to be considered pursuant to section 16(1)(a) of CEAA are defined to include, pursuant to section 2(1) of the Act, "any change to the project that may be caused by the environment".

There is a broad range of effects that the physical environment may have on the WREP. The primary means of mitigating such effects is through sound planning. The WREP is designed to withstand the environmental conditions that occur in the Nearshore and Offshore Project Areas, such as temperature, wind, snow, wave and ice loading, sea ice and icebergs and drainage. In addition, the design life is taken into consideration so that materials are chosen with sufficient durability and corrosion resistance.

This chapter discusses the expected and potential effects of the land-based and marine environment on the WREP's design, construction and operation. The purpose of this discussion is to identify environmental events of note and their potential risk to activities in the WREP Nearshore and Offshore Project Areas.

14.2 Context

To mitigate the effects of the physical environment on the WREP, there must be adequate planning, design and operations procedures that consider the expected normal and extreme physical environmental conditions that may be encountered. There must also be adequate monitoring and forecasting of physical environment conditions. Through adequate monitoring and forecasting, WREP activities can be adjusted to maintain a safe working environment. All outside activities are affected by the physical environment.

This chapter includes discussions of on-land environment parameters (soil and groundwater quality) in Section 14.3 and marine environment parameters in Sections 14.4 and 14.5 for both the Nearshore (if the WHP development option is selected) and Offshore (both development options) Project Areas, respectively.

14.3 On-Land Effects

14.3.1 Graving Dock Location

Environmental samples from the construction site indicate little risk to the environment or human health as a result of planned activities (see Section 2.6.3.2). Husky is currently conducting further environmental and geotechnical sampling at the graving dock during the FEED stage of the WREP. The current groundwater investigation will determine the risk of groundwater being drawn from adjacent land during the graving dock excavation and the possibility of any groundwater contamination. Land adjacent to the graving dock has been remediated and during the remediation, groundwater testing indicated the general absence of free-phase separated product (Dillon 2011). Groundwater monitoring from eight monitoring wells around the perimeter of the Northside Fuel Storage Area (NFSA) in August 2011 revealed petroleum hydrocarbons in five wells ranging from 0.04 to 1.3 mg/L. The impacts are sporadic occurrences and reflective of residual non-point source impacts (K. Knight, PWGSC, pers. comm.).

The results of the current groundwater investigation at the graving dock site will dictate the method and degree of drainage required to maintain a dry facility during the construction of the CGS. There are no known users of groundwater on the Argentia Peninsula. Appropriate retaining structures and pumps will be designed to minimize the water infiltration and to remove the excess water. Water removed from the graving dock will be pumped to a lined settling pond, where it will be aerated and tested against applicable regulations prior to ocean disposal. This settling pond will also be used to contain and test runoff from the site prior to ocean disposal, once the graving dock construction is complete. Water will be treated as required prior to discharge to ensure compliance with provincial and federal requirements.

14.3.2 The Pond

The graving dock will be excavated using traditional earth-moving equipment, blasting is not expected to be required. Approximately 1,100,000 m^3 of material will be removed, with approximately 250,000 m^3 of this material used to level and grade the area surrounding the graving dock site above existing grade to approximately 8 m above chart datum, to reduce the risk of marine-sourced flooding. The remaining material is intended to be disposed of in The Pond, on the tip of the Argentia Peninsula, provided it meets established criteria to ensure proper disposal of excavated and dredged material.

Environmental samples from the construction site indicate little risk to the environment or human health as a result of planned activities (see Section 2.6.3.2). However, confirmatory soil sampling will be conducted during excavation of the graving dock. If contamination is detected above applicable guidelines, the material will be moved to a quarantined area and treated, as necessary. Excavation and aeration was considered the preferred remediation method by PWGSC for the NFSA at Argentia. In fact, the act of excavation, transport and stockpiling of soil essentially resulted in the reduction of contaminant levels to meet the objectives of the remediation (Dillon 2011).

In an effort to minimize the environmental footprint and disturbance to all stakeholders as much as possible, Husky has committed to ensuring proper disposal and use of the excavated and dredged (see Section 14.4.1) material within the Argentia Peninsula. Husky has assumed environmental responsibility for the material from the AMA, and will test and treat the material as required, for the designated use.

14.4 Nearshore Potential Marine Effects

14.4.1 Bathymetry

Bathymetry is a primary consideration during tow-out of the CGS and for the mooring systems necessary to maintain the position of the CGS at the deep-water mating site during installation of the topsides. However, dredging, proper design of mooring systems and ballasting to an appropriate towing draft will ensure that bottom depth along the tow-out route will not impede the movement of the CGS in the nearshore area.

Husky has completed a bathymetric survey of the CGS tow-out route to ensure adequate water depth exists for the draft of the CGS. The survey identified that dredging will be required in two sections of the tow-out channel. A geotechnical investigation revealed that the soft material within the tow-out corridors can be removed with a trailing suction hopper dredger. A backhoe dredger may be used to along the shoreline to remove any harder material encountered.

Once construction of the CGS is complete, the structure will be floated out of the graving dock and towed to a deep-water mating site in Placentia Bay for installation of the topsides. Two potential deep-water mating sites have been identified, west of Red Island and west of Merasheen Island.

Upon completion of the topsides mating and associated hook-up between the CGS and the topsides, the CGS's designated towing draft will be established by water ballast/ deballast activities. Once the towing draft has been established, the structure will remain at this draft until it arrives at the offshore location in the White Rose field. The WHP draft is expected to be approximately 115 m.

14.4.2 Wind, Waves and Currents

Extreme wind, waves and currents have the potential to increase stress on surfaces, superstructures and vessels and disrupt scheduling of marine operations. Wind, waves and currents will be further considered during construction of the CGS, dredging, towing, mooring system design, installation of topsides and support vessel and ROV operations.

For the nearshore, extreme wind waves and currents can effect towing operations, vessel maneuvering and increase stress on moorings, which can lead to mooring failure. Also, extreme waves and currents can increase stress on or over-top the berm of the graving dock, which is why the grade surrounding the graving dock is being increased to 8 m above chart datum. The location of the graving dock within Argentia Harbour also offers protection from the fetch of Placentia Bay.

Extreme (100-year) wind speeds for the nearshore area of the WREP (Section 4.2.3) are approximately 30 m/s (hourly averaged). The 100-year significant wave height between Argentia Peninsula and Red Island is 9.2 m; it is 12.0 m at the mouth of Placentia Bay. The channel between Marasheen Island and Isle Valen offers shelter from the most severe seas, with a 100-year significant wave height of only 2.3 m.

All wind, wave and current extreme value estimates will be considered in the design of moorings and the operation of vessels and barges.

14.4.3 Tsunamis

A detailed discussion on tsunamis is provided in Section 4.2.2.3. The following is a summary of observations as related to potential effects.

While tsunamis have been observed in eastern Newfoundland and their effects can be devastating, they are not a frequent occurrence in this part of Canada. Based on the limited historical record, a return period on the order of 50 to 100 years, or longer for a destructive tsunami like the 1929 event, can be estimated. The fact that construction nearshore will take place over approximately 30 months in the next four years, a relatively short lifetime, means that the likelihood of occurrence during this period is very low and therefore it is estimated there is a low risk of tsunamis effects for the WREP nearshore.

If a tsunami were to occur, effects could include flooding or failure of the berm, interference with towing operations, or increase stress on moorings during topsides mating.

14.4.4 Tides, Water Levels and Storm Surge

The location and design of the graving dock has considered the risk of flooding from a seawater source. The graving dock location on the east side of the Argentia Peninsula is protected from tidal surges coming into Placentia Bay and the site itself will be raised to 8 m above chart datum to offer flood protection.

Detailed presentation of tidal water levels and possible extreme storm surge at Argentia is provided in Section 4.2.2.5. An extreme storm surge of 0.8 m occurring at the time of a large high tide would result in a water level of 3.4 m relative to chart datum.

All tide, water level, and storm surge extreme estimates will be considered in the design of moorings and the operation of vessels and barges.

14.4.5 Sea Temperature

Surface sea temperature in the area can fall below 0°C from January to April so that exposure to water at this temperature may pose a risk to personnel and to exposed surfaces. The combination of low air and sea temperature, strong winds, and high waves can lead to vessel or CGS icing. The CGS and WHP are being designed for these types of harsh marine conditions. The towing of the CGS and the WHP will be scheduled to avoid the risk of icing and freezing spray.

14.4.6 Sea Ice and Iceberg

Pack ice presence in Placentia Bay from year to year is variable, but the maximum frequency of occurrence over 30 years is 15 percent (Section 4.2.4.1). From mid-February through mid- to late-April, the bay experiences first year ice, which can range in thickness from 30 to 120 cm. The mouth of the Bay is more susceptible to incursions of the annual pack, while the bottom of the bay only fills with pack when there are sustained periods of onshore winds. There are few data on the exact thickness of the sea ice in Placentia Bay. Ice thicker than 100 cm is uncommon at the bottom of Placentia Bay; average thicknesses between 30 and 50 cm are the most common. The International Ice Patrol has recorded icebergs in Placentia Bay. Icebergs were recorded in 7 of the 30 years between 1974 and 2003. A total of 30 icebergs were recorded in this period

Sea ice conditions will be monitored and managed in accordance with Husky’s existing ice management plan, which will be modified to outline requirements for monitoring and managing sea ice conditions for the construction of the CGS.

14.4.7 Geohazard

The GSC's seismic hazard map (Natural Resources Canada 2011a) indicated that the nearshore region has low to moderate relative seismic hazard. Natural Resources Canada's map of earthquakes in or near Canada (from 1627 to 2010), illustrate that historically, only small earthquakes of typically Magnitude 3 or 4 occur (Natural Resources Canada 2011b).

14.4.8 Climate Change

Construction activities onshore will occur during a limited timeframe (an approximately 30-month period in the next four years (Husky 2012a), thus consideration of climate change adaptation over that time is not considered a key concern. It is noted that coastal erosion and flooding have already become a concern in many Atlantic Canadian coastal regions, including areas in Newfoundland and Labrador where erosion has been observed (Government of Newfoundland and Labrador 2012). Thus, the potential for storm surges in the onshore construction area will be considered in planning and preventative measures will be put in place to protect nearshore construction areas as deemed warranted by the construction contractor.

14.5 Offshore Potential Marine Effects

Offshore potential marine effects on the construction and operation of up to four new subsea drill centres were previously assessed in LGL (2007a). Although applicable to the WREP as a whole, this section is therefore mainly focussed on the assessment of potential marine effects on the WHP development of the WREP.

14.5.1 Bathymetry

Under the WHP development option, the CGS draft of the WHP is expected to be approximately 115 m. The structure will be designed for appropriate interaction with the seabed to ensure proper installation and operation in the water depth range of 115 to 120 m in the White Rose field.

The WHP will be towed to the White Rose field on a route determined from existing bathymetry to accommodate the WHP draft. The route will be surveyed in advance to provide the level of information required to establish a safe and accurate final route. Detailed contingency planning will be developed to manage the tow in the event of bad weather. Continuous weather forecasting will be undertaken during the tow-out, setdown and installation.

At the offshore location, the WHP will be positioned by the four towing vessels. Once the structure has been situated in the correct location and heading, the CGS will be ballasted with water onto the seabed by controlled flooding of cells within the main base caisson. The CGS foundation will penetrate the seabed; therefore, scour protection is not required. Once on the seabed, solid ballast will be placed in specific caisson cells to provide long-term stability for the WHP.

Under the subsea drill centre option, local modification of the bathymetry provides protection to the WREP. Subsea wellheads will need to be placed below the level of the sea floor to be protected from iceberg scour. A trailing suction hopper dredger vessel will excavate to a measured depth of 9 to 11 m below existing seabed level. The maximum base dimension will be approximately 45 m by 80 m, with one vertical by three horizontal graded sloped sides as required for stability and flowline ramps. Placement of the wellheads and xmas trees at the bottom of the excavated area will ensure that the top of the equipment will be a minimum of 2 to 3 m below the surrounding seabed level, thus providing protection from iceberg scour.

14.5.2 Wind, Waves and Currents

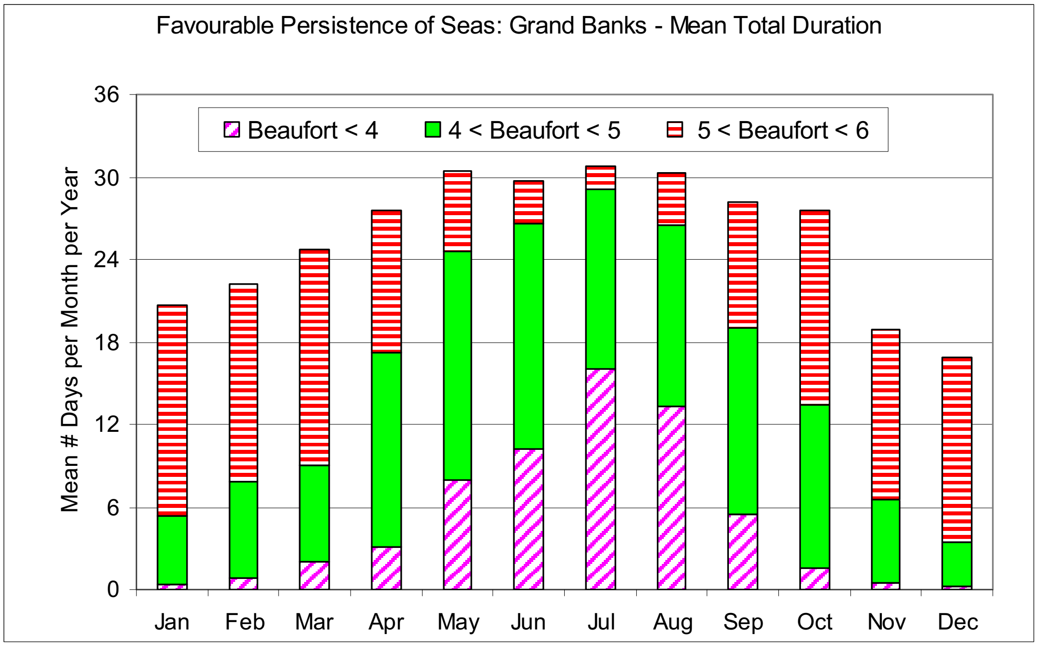
Waves and currents have the potential to increase stress on surfaces and vessels and disrupt scheduling and operations. The design, installation and operation of the CGS or of the MODU and supporting infrastructure will consider wind, wave and current loads. Wind, wave and current data are typically collected as part of a physical environment monitoring program, which would enhance the physical database for the area.

Estimates of extreme wind speeds and significant wave heights for the offshore area of the WREP are presented in Section 4.3.3. The 100-year (hourly averaged) wind speed was estimated at 32.0 m/s and the 100-year significant wave height at 15.0 m. Estimates of extreme current speeds at White Rose are presented in Husky (2011). The 100-year current speeds were estimated at 1.7, 0.7 and 0.8 m/s, respectively, for near surface, mid-depth and near bottom. The WREP infrastructures will be designed to withstand such extreme environmental parameters.

Wave conditions offshore will limit supply vessel loading and offloading of cargo to the WHP or offshore drilling rig. In addition vessel iceberg towing and spill response operations, if required, could be affected. The sea state may limit the safety and effectiveness of supply vessel operations (e.g., deployment and use of spill containment equipment, or the deflection of icebergs).

As one illustration, Figure 14-1, based on favourable persistence analysis of historical Grand Banks conditions, reports the average length of time that, in any given month, seas will persist below the given Beaufort Force (BF) sea state thresholds. The intent of the work was to quantify conditions, as well as show that while recognizing seas can get quite large on the Grand Banks, there are windows of opportunity that, depending on the threshold, may be conducive to marine operations. For example, in November to February, less than one day per month could be expected when conditions are below BF4 (Hs=1.5 m), while in June to August, it is over 10 days per month. Looking at the BF6 scale, in the winter, approximately 8 to 12 days per month when conditions persist above BF6 (i.e., waves over 4 m, near gale force or higher) could be anticipated. Conversely, in the summer these conditions will be experienced rarely, as the bars top out at approximately 30 days. Clearly, in summer, conditions are more favourable to marine operations.

Another wave-related environmental influence on vessel operations is iceberg towing and deflection, which can be routinely required during ice season. Marine conditions can play an important role in the success of these activities. Several observations (e.g., as described by McClintock et al. (2007)) are noted here in this regard.



Source: AMEC 2004

Figure 14-1 Favourable Persistence of Seas: Grand Banks - Mean Total Duration

Propeller washing, generally a successful technique for small ice mass deflection, can be difficult in high seas and reduce its effectiveness. High sea states can further complicate matters, since they may affect the success of radar detection of smaller icebergs and growlers.

Iceberg towing through high sea states can sometimes increase the risk of tow line slippage. Tow techniques, including the two-vessel iceberg net tow (C-CORE 2004), offer benefits of improved safety (including less crew time on back decks of supply vessels) and efficiency in higher sea states, and is one potential mitigation of wave effects on vessel ice operations.

These examples serve to illustrate, that in addition to design considerations, the marine environment will have effects on WREP activities. Husky will establish appropriate plans and procedures for all activities to ensure the safety of personnel, the environment and assets, and to optimize the likelihood for success in all such undertakings.

14.5.3 Tsunamis

A detailed discussion on tsunamis is provided in Section 4.3.2.3. The following is a summary of observations as relates to potential effects.

The wave height of a passing tsunami offshore is small, on the order of 1 m or less, and, should a tsunami occur, is not expected to be an issue for the offshore operation, particularly given the long period of the waves. Associated current speeds up to 70 cm/s could possibly be a concern for moorings and hawsers. Tsunamis Warning Systems are aimed at managing coastal risk; however, they may also provide useful mitigative information for offshore. Given the low likelihood of tsunamis occurrence and the anticipated low consequence should they occur, no tsunamis effects offshore are anticipated.

14.5.4 Tides and Storm Surges

At the offshore WREP site, combined effects of tides and storm surge (including atmospheric pressure changes) can lead to changes in sea level from 1.54 m below to 1.74 m above mean sea level. This factor will be considered for the tow-out, installation and operation of the WHP, or operation of the MODU.

14.5.5 Sea Temperature

Sea temperature, combined with strong winds, and high seas, is a contributing factor for marine vessel and structure icing. This will be a consideration most particularly for WREP operations in winter.

14.5.6 Sea Ice and Icebergs

While the position of White Rose is at the extreme southern limit of the regional ice pack, it does lie to the west of the path of the ice tongue that is formed by the loose pack ice being swept around the Grand Banks by the offshore branch of the Labrador Current. The median sea ice concentrations for the Grand Banks south of 49°N are usually between 4/10 and 6/10 by early February and persist at this concentration through early April, after which they slowly decrease to 1/10th to 4/10ths coverage and recede to above 49°N. The White Rose field can be affected by the seasonal ice tongue. Current patterns are largely dictated by bathymetry, and since the White Rose field is located near the 200 m depth contour, it is subject to incursions of the seasonal ice tongue. Ice concentrations in the tongue vary from 2/10 in light years to 9/10 in extreme years.

The number of icebergs off eastern Canada varies considerably both annually and monthly; the number of icebergs on the Grand Banks peaks in mid-April to late-May and their approach to 48°N varies. Typically, icebergs and pack ice begin drifting south of 48°N around March, signaling the start of the “ice season” on the Grand Banks. According to the IIP and PAL, the number of icebergs reaching the Grand Banks (48 degrees latitude) each year varied from a low of zero in 1966, 2006 and 2011, to a high of 2,202 in 1984. Of these, only a small portion will pass through the White Rose field. While the major iceberg influx falls into the March to June period, iceberg sightings on the approaches to the White Rose field have been made at least once in each month of the year.

The design, installation and operation of the CGS or subsea drill centre infrastructure will consider sea ice and icebergs (the subsea drill centre is a direct mitigation strategy for the incursion of sea ice and icebergs in the Jeanne d’Arc Basin). See Section 16.16 for a summary of ice management practices in the Jeanne d’Arc Basin).

14.5.7 Geohazard

A geotechnical field program consisting of cone penetration tests and boreholes for the potential well site locations was conducted in 2005 and 2012. While the 2012 survey data are not currently available, the soil stratigraphy can be described as 6 to 15 m of compact to very dense sands with gravel, overlying layers of very stiff to hard sandy clays and clays, interbedded with very dense sandy silts and sands to depths of at least 30 m. A reinterpretation and simplification of the soil strata shows that there are similarities in soil types and consistent sequences across the White Rose field, although there are substantial differences in strata thicknesses. The review of literature reveals that while the region around the White Rose field does have relatively low seismicity based on the existing regional seismic catalogue, large magnitude (M7 and above) earthquakes have occurred in the region. The stresses driving these events are not well understood and the probable locations of future large earthquakes cannot be robustly forecast.

Husky Oil (2001) presented a peak ground acceleration of 0.03 for a return period of 200 years, based on the findings of Foo and Crouse (1986). Foo and Crouse (1986) suggested that this peak ground acceleration was appropriate for the Hibernia site (located approximately 64 km west of White Rose).

Independent seismic hazard analyses that have been recently conducted for the region of the White Rose field (URS 2006; GSC 2010) indicate much higher peak ground accelerations. The peak ground acceleration) for the White Rose field is estimated to be approximately 0.2 g to 0.3 g based on GSC, for a probability of exceedance of 2 percent in 50 years (GSC 2010). Peak ground accelerations calculated for a 2,500-year return period are an order of magnitude higher (0.323) (URS 2006). PGA calculated for a 200-year return period is more than double the 0.03 peak ground acceleration (0.069) (URS 2006).

The risk levels for operating- and safety-level earthquakes are usually determined by the facility owner (URS Corporation 2006).

14.5.8 Climate Change

A detailed discussion on Climate Change is provided in Section 4.3.9. The following is a summary of considerations for the offshore WREP:

- Sea-level rise: Estimates of sea level rise globally over the next 50 years due to climate change alone are from 10 cm to as much as 30 cm. The productive life of the WREP is currently estimated at 25 years; therefore, sea level rise to some degree may occur. The design of the CGS should account for sea level rise.

- Waves: Increased storm intensity may result in higher associated peak wave heights and more frequent occurrence of extreme wave events; however, climate simulations for the next century show almost no change in peak significant wave heights for the western North Atlantic, consistent with recent trends in observed data. With increase temperature, more tropical storms can be expected to survive farther north, bringing with them higher waves during the tropical storm season. The design of the CGS or the selection of the MODU should account for more frequent occurrence of peak wave heights. This could also affect operation of the WREP by potentially increasing unexpected maintenance due to storm damage, as well as increasing the likelihood of evacuation during extreme adverse weather. Access by supply vessels and helicopters may be affected, the prime effect being an increase in the days in which travel is restricted due to extreme weather events.

- Sea Surface Temperatures: there is considerable uncertainty as to the question of warming sea surface temperatures, since glacial melt north of Newfoundland would exert a cooling influence on the offshore waters. A slight change of sea surface temperature may not directly affect the WREP but may contribute to increase storm frequency and icing intensity.

- Precipitations: annual precipitation increases projected for Atlantic Canada between years 2020 and 2080 range from 18 to 21. The predicted warmer fall and winter temperatures could mean later freeze up; wetter, heavier snow; more liquid precipitation occurring later into the fall; and possibly more freezing precipitation during both seasons. The design of the CGS and WHP topsides or selection of the MODU should account for possible increase in freezing precipitation and snow weight.

- Air Temperature: the warming trend may cause breakup of sea ice and melting of glaciers, increasing the numbers of icebergs and potential hazards in North Atlantic shipping lanes. Over longer periods, climate change effects are projected to reduce the thickness and extent of sea ice.

The WREP will be designed to withstand these possible variations in normal and extreme marine environment conditions that can be estimated and effectively mitigated.

14.5.9 Biofouling

Biofouling epiflora and epifauna are usually found in the photic zone, and studies in the North Sea found the species found in the upper 50 m comprised primarily of seaweeds, hydroids, soft corals, anemones and mussels. The biofouling communities below 50 m are primarily comprised of hydroids, soft corals, anemones and tubeworms (Welaptega 1993, in Husky Oil 2000).

Based on experience at the Hibernia platform, biofouling epifauna and epiflora do attach themselves to the walls of the Hibernia platform within the depths of light penetration. However, they do not impede visual inspections, nor do they contribute to fatigue or corrosion to the infrastructure of the platform (Hibernia Management and Development Company 2005).

14.6 Environmental Events

The selection of appropriate events is a key to identifying risks that are most realistic within the context of the assessment. In order to accomplish this, it is necessary to address a wide range of events. Those events that could be considered as having a potential effect, together with indication of mitigations that should be implemented to reduce the hazard are listed in Table 14-1.

Table 14-1 Environmental Effects on the White Rose Extension Project

Environmental Event	Mitigation
On-land Events	
Potential contaminated soil during excavation of the graving dock	Testing during excavation, treatment as required for regulatory compliance for commercial use, or disposal
Nearshore Events	
Waves – barge, tug or support vessel operations	Safe Operating Procedures, Site Monitoring/Forecasts
Waves – access to CGS at deep-water mating site	Safe Operating Procedures, Site Monitoring/Forecasts/ FEED/Facility Design
Waves – graving dock berm failure	Site Monitoring/Forecasts/FEED/Facility Design
Waves/Currents – mooring failure	Site Monitoring/Forecasts/FEED/Facility Design
Tsunamis – flooding and damage	Warning Systems
Storm surges/high water levels – flooding and damage to graving dock/berm	Facility Design/Site Monitoring/Forecasts
Sea Temperature – contributor to vessel and structure icing potential	Site Monitoring/Forecasts
Sea Temperature – exposure to personnel	Safe Operating Procedures
Offshore Events	
Waves – tug or support vessel operations (e.g., ice, spill response, search and rescue)	Safe Operating Procedures, Site Monitoring/Forecasts
Waves/Low water level – affecting CGS installation on seabed	Safe Operating Procedures, Site Monitoring/Forecasts/ FEED/Facility Design
Sea Temperature – contributor to vessel and structure icing potential	Site Monitoring/Forecasts/FEED/Facility Design
Sea Temperature – exposure to personnel	Safe Operating Procedures
Seasonally-occurring Sea Ice and Icebergs	Ice Management Plan/FEED/Facility Design
Climate Change – sea level rise	FEED/Facility Design
Climate Change – waves	FEED/Facility Design
Climate Change – sea surface temperature	FEED/Facility Design

14.6.1 Mitigation Measures

There is a broad range of effects which the physical environment may have on the WREP. The primary means of mitigating such effects is through detailed engineering, design and sound planning, including testing (and treatment, if necessary). All engineering design will adhere to national/international standards. These standards document the proper engineering design for site-specific normal and extreme physical environmental conditions and provide design criteria that the regulatory agencies consider satisfactory for withstanding the potential physical environmental conditions. These codes consider physical environmental criteria such as temperature, wind, snow, wave and ice loading and drainage. In addition, the design life is taken into consideration so that materials are chosen with sufficient durability and corrosion resistance. Husky has an ice management plan for its existing operations in the White Rose field. This plan will be modified to incorporate the WREP offshore location. If the WHP development option is selected, then the existing ice management plan will be modified to include activities to be conducted in Argentia/Placentia Bay. The existing ice management practices used by Husky provide a safe environment and minimize operational disruptions caused by ice. Currently, Husky's ice management is comprised of detection, monitoring and assessment and physical management (see Section 16.16).

14.6.2 Definition of Significance

A significant effect of the environment on the WREP is determined to be one that:

- Harms WREP personnel or the public
- Results in a substantial delay in construction (e.g., more than one season) or shutdown of producing operations
- Damages infrastructure and compromises public safety
- Damages infrastructure to the extent that repair is not economically or technically feasible.

It should be noted that:

- Tsunami frequency or likelihood is improbable for nearshore and remote for offshore
- There is uncertainty as to climate change events.

14.7 Conclusion

The WREP design and operations planning incorporates metocean criteria for specific nearshore and offshore conditions. Physical metocean site monitoring will be undertaken.

Due to the existing Ice Management Plan, the effects of ice, including icebergs, on the WREP (such as making contact with the WHP or MODU or severing a flowline) are predicted to be minimal. If the WHP development option is selected, the design basis for the CGS will incorporate the potential for structural impact from ice. The subsea drill centre development option incorporates protection from icebergs in its design (i.e., the infrastructure is protected in the excavated subsea drill centre). In addition, Husky has an existing ice management plan, which will result in a minimal effect from sea ice or icebergs on the WREP.

From the results presented above, it is clear that the marine environment will have an effect on the WREP; however, given that the WREP team will commit to apply the all applicable and most appropriate standards for design, planning and development of mitigation measures to maintain risk as low as reasonably practicable, including but not limited to those noted above, there are no likely significant environmental effects on the WREP.

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15.0 FOLLOW-UP AND MONITORING

Follow-up and monitoring programs are necessary to: (a) verify the accuracy of the environmental assessment of the WREP; and (b) to determine the effectiveness of any measures taken to mitigate the adverse environmental effects of the WREP. As directed by the *Development Plan Guidelines* (C-NLOPB 2006), these programs will include implementation monitoring, environmental effects monitoring (EEM), compliance monitoring, monitoring of identified Species at Risk, biological observation, physical environmental observation and forecasting. The follow-up and monitoring programs will serve as the primary means of determining and quantifying environmental change caused by the WREP.

The WREP follow-up and monitoring programs are principally divided into two components: EEM and environmental compliance monitoring (ECM). The follow-up and monitoring programs will meet the requirements of applicable federal and provincial regulations and guidelines, as well as the requirements of Husky's internal corporate standards. The following sections address these requirements.

15.1 Existing White Rose Offshore Environmental Effects Monitoring Program

An EEM program takes repetitive measurements of environmental variables over time to detect changes caused by external influences directly or indirectly attributable to a specific anthropogenic activity or development (Duinker 1985). Where such changes occur, the program enables their evaluation and the determination of appropriate mitigation measures and project modifications.

An EEM program is iterative, allowing for recurrent opportunities to review the EEM design over the life of a project, to address project changes and to incorporate new and/or improved technologies and methodologies.

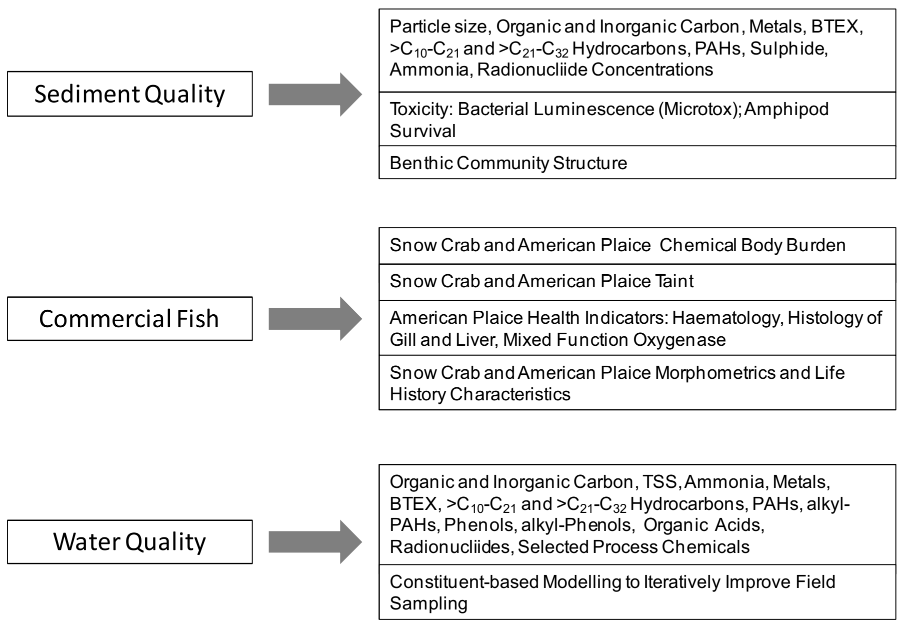
Husky previously committed, in its Environmental Impact Statement (EIS) (Part One of the White Rose Oilfield Comprehensive Study (Husky Oil 2000)), to develop and implement a comprehensive EEM program for the marine receiving environment with regards to Husky's activities at the White Rose field. This commitment was integrated into Decision 2001.01 (Canada-Newfoundland Offshore Petroleum Board 2001) as a condition of project approval. Husky's EEM program design was submitted to the C-NLOPB in May 2004 and was approved for implementation in July 2004. The design drew on information provided in the White Rose EIS (Husky Oil 2000), drill cuttings and produced water dispersion modelling for White Rose (Hodgins and Hodgins 2000), the White Rose Baseline Characterization program carried out in 2000 and 2002 (Husky 2001, 2003), stakeholder consultations and consultations with regulatory agencies. A revised version of the EEM program design document, modified to accommodate the development of the NADC, was submitted to the C-NLOPB in July 2008. The program was revised again in 2010 to include a water quality monitoring component. The existing program will be further revised to include the WHP or subsea drill centre of the WREP, as necessary.

The objectives of the White Rose EEM program are:

- To estimate the zone of influence of project contaminants
- To provide feedback to Husky for project management decisions requiring modification of operations practices where/when necessary
- To provide a scientifically-defensible synthesis, analysis and interpretation of data.

15.1.1 Monitoring Components

The White Rose EEM program is divided into three components, dealing with effects on sediment quality, commercial fish species and water quality (Figure 15-1).



Notes: BTEX: Benzene, toluene, ethylbenzene, xylene; PAH: Polyaromatic hydrocarbon; TSS: Total suspended solids

Figure 15-1 Environmental Effects Monitoring Program Components

Assessment of sediment quality includes measurement of alterations in chemical and physical characteristics, measurement of sediment toxicity and assessment of benthic community structure. These three sets of measurements are commonly known as the sediment quality triad (Long and Chapman 1985; Chapman et al. 1987, 1991; Chapman 1992). These tests are used to assess drilling effects. Potential deposition of selected constituents from liquid discharges to sediments is also assessed as part of the sediment quality program.

Assessment of effects on commercial fish species includes measurement of chemical body burden, taint, morphometric and life history characteristics for snow crab and American plaice, as well as measurement of various health indices for American plaice.

Assessment of water quality includes the measurement of change in physical and chemical characteristics in the water column. Because contamination from liquid discharges from offshore installations is difficult to detect, modelling is undertaken to identify constituents that have a higher chance of detection.

15.1.2 Environmental Effects Monitoring Sampling Design

Sediment samples are collected at stations in the vicinity of drill centres and at a series of stations located at varying distances from drill centres, extending to a maximum of 28 km along north-south, east-west, northwest-southeast and northeast-southwest axes. The sediment sampling design is commonly referred to as a gradient design. This type of design assesses change in monitoring variables with distance from source.

Commercial fish are sampled near White Rose, in the vicinity of the drill centres, and at four distant reference areas located approximately 28 km to the northeast, northwest, southeast and southwest.

Water samples are collected in the vicinity of the *SeaRose FPSO* facility and in two reference areas located approximately 28 km to the northeast and northwest. The water quality and commercial fish designs are control-impact designs (Green 1979). This design compares conditions near discharge sources to condition in areas unaffected by the discharges.

Husky will re-design the existing EEM program to incorporate the new drill location in the West White Rose pool. As there will be no change to the discharge of produced water from the *SeaRose FPSO*, there will be no change to the water quality program. The focus of the program will be the collection of sediment in the vicinity of the drilling platform (WHP or subsea drill centre) and commercial fish samples around the edge of the safety zone. The West White Rose drill centre or WHP will be within the current safety zone for the White Rose field.

In addition, in the event of an accidental release of oil in the White Rose field, a spill EEM program will be determined based on criteria established with Husky's offshore Oil Spill Response Plan.

15.2 Environmental Compliance Monitoring

ECM is actively conducted to ensure compliance with all regulatory and self-imposed environmental requirements. ECM provides regulators and the public with evidence that environmental regulations and standards are followed.

15.2.1 Nearshore Environmental Compliance Monitoring

Husky will develop a site-specific environmental protection plan (EPP) for the activities associated with graving dock excavation and CSG construction at Argentia under the WHP development option, including those activities requiring compliance monitoring pursuant to legislation and guidelines. Such legislation and guidelines include, but are not limited to:

- *Fisheries Act* Section 36
- *Fisheries Act* Section 32
- *Migratory Birds Convention Act, 1994*, Section 35
- *Canada Shipping Act, 2001*, *Vessel Pollution* and *Dangerous Chemicals Regulations*
- *Fisheries Act* Authorization for Works or Undertakings Affecting Fish Habitat (issued by Fisheries and Oceans Canada)
- Newfoundland and Labrador *Water Resources Act* Permit to Alter a Body of Water
- Newfoundland and Labrador *Environmental Control Water and Sewer Regulations* for waste water discharge
- NLDEC *Guidance Documents on Dredge Spoils Disposal* (GD-PPD-028.1) and *Leachable Toxic Waste, Testing and Disposal* (GD-PPD-026.1).

15.2.2 Offshore Environmental Compliance Monitoring

Waste discharges during either development option for the WREP could include water-based drill muds and cuttings, grey and black water, ballast water, bilge water, deck drainage, discharges from machinery spaces, cement, blowout preventer fluid and air emissions. All waste discharges associated with the operation of the *SeaRose FPSO* have been previously assessed and permitted and continue to be monitored through ECM and EEM (both part of an EPP).

Husky’s current EEM program will be revised to include assessment of the effects of discharges related to the WHP or any new subsea drill centres.

Should development of the WREP occur via a new subsea drill centre, Husky has an approved Environmental Protection Compliance Monitoring Plan in place for MODU operations. Husky will continue to fully comply with the OWTG and will develop an Environmental Protection Compliance Monitoring Plan for the WHP. Husky’s existing comprehensive offshore Waste Management Plan will be revised and adapted to include the WHP as necessary.

Husky will apply for an ocean disposal permit and will adhere to ocean disposal requirements under CEPA for disposal of dredge spoil from any future subsea drill centres.

A fish habitat compensation agreement (Authorization No. 07-01-002) has been in place with DFO since 2007 to compensate for the excavation of up to five subsea drill centre sites, of which only two have been excavated to date (the NADC and SWRX). The construction of a subsea drill centre for the West White Rose pool was one of the potential subsea drill centres assessed and compensated for in 2007.

15.3 Other Required Programs

Monitoring programs (and reporting) for various VECs during certain activities associated with the WREP may be required as conditions associated with the issuance of permits/authorizations pursuant to C-NLOPB guidelines and regulatory requirements. These may include, but are not limited to:

- As per requirements under its fish habitat compensation approval (Authorization No. 07-01-002 - for up to five subsea drill centres), Husky will continue to conduct the fish habitat compensation monitoring program in North Harbour. The requirements for further fish habitat compensation and monitoring will be discussed with DFO in light of changes to the *Fisheries Act*.

- The existing White Rose field physical environmental data collection and reporting program will include the new drilling activities in the West White Rose pool area.

- Geophysical programs for the WREP will be limited to geotechnical and geohazard programs (e.g., VSP). Marine mammal and sea turtle monitoring and observation will be conducted during any such programs protocols will be consistent with the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012d) and where necessary, marine bird observations will be undertaken as per the pelagic marine bird monitoring protocol developed by the Canadian Wildlife Service.

- Compliance monitoring will be conducted to ensure that any conditions applied to any *Navigable Waters Protection Act* authorizations are implemented as outlined by the Navigable Waters Protection Program of Transport Canada.

15.4 Environmental Assessment Validation

Various program activities during the life of the WREP (e.g., dredging, drilling, geotechnical and geohazard surveys) will require authorization under the Atlantic Accord Acts. Any such authorizations (at the discretion of the C-NLOPB) may be valid for one to five years. As authorizations are renewed or new ones are required during the life of the WREP, Husky will submit an environmental assessment update to the C-NLOPB and federal regulatory authorities that:

- Confirm that the scope and nature of activities planned and addressed under this environmental assessment have not changed

- Update the list of species at risk that could potentially occur in the Nearshore and Offshore Project and Study Areas (including review of Recovery Strategies and Management Plans)

- Confirm current fishing activities in the Nearshore and Offshore Project Areas have not changed
- Confirm commitments made in the environmental assessment are being met
- Confirm mitigation measures proposed in the environmental assessment are being applied.

Husky will continue to consult with stakeholders, including fishers, regarding ongoing operations, as necessary.

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16.0 ENVIRONMENTAL MANAGEMENT

16.1 Husky's Management System

Husky's Operational Integrity Management System (HOIMS) covers all of Husky's businesses, with particular emphasis on projects and operations, and manages operational integrity through the life-cycle of the assets. HOIMS includes 14 elements, with each element containing well-defined aims and a clear set of expectations. These expectations guide Husky employees in effectively managing the risks associated with Husky's business and creating a safe and secure place to work. The 14 elements of HOIMS are listed in Table 16-1.

Management is responsible for ensuring effective systems and procedures are implemented and adequate resources are made available to meet the HOIMS expectations. Business units, operating districts, facilities and functional areas will implement HOIMS. The resources applied will be consistent with the evaluated operational integrity risk.

Achieving conformance to HOIMS expectations requires commitment and sustained efforts over many years. Strong leadership and commitment at all levels of Husky's organization and clearly established responsibilities and accountabilities are key to the success of HOIMS.

Table 16-1 Husky Operational Integrity Management System Elements

1	Leadership, Commitment & Accountability	2	Safe Operations
3	Risk Assessment & Management	4	Emergency Preparedness
5	Reliability & Integrity	6	Personnel Competency & Training
7	Incident Management	8	Environmental Stewardship
9	Management of Change	10	Information, Documentation & Effective Communication
11	Compliance Assurance & Regulatory Advocacy	12	Design, Construction, Commissioning, Operating & Decommissioning
13	Contracted Services & Materials	14	Performance Assessment & Continuous Improvement

Resources are applied and dedicated to the implementation of HOIMS, and progress is tracked and monitored at the business units, operating districts, facility, functional areas and corporate levels. Periodic reviews and audits are undertaken to ensure that HOIMS is effectively integrated in Husky's daily operations and to continuously improve Husky's performance.

Husky's environmental management system has its basis in HOIMS. More specifically, Element 8 titled "Environmental Stewardship" sets a clear aim to: "*Operate responsibly to minimize the environmental impact of how we conduct business*" and "*Leave a* *positive legacy behind us when we leave*". A clear set of expectations details how Husky intends to meet this aim. They are the following:

8.1 A process is implemented to assess the risks and potential impacts to the environment associated with our operations. Such assessments are subject to periodic review and, where appropriate, a Life Cycle Value Assessment is carried out.

8.2 Management systems are established and specific measures are implemented to eliminate, minimize, prevent, detect, control and mitigate environmental threats. Our first priority is prevention.

8.3 Environmental impact is monitored and reported to demonstrate compliance with relevant local, national and international regulations and to ensure that any commitments are honored. Local sites metrics and targets are set to drive continual improvement in managing waste, emissions and discharges and energy efficiency.

8.4 A process is implemented to evaluate and manage the specific risks and liabilities associated with decommissioning and reclamation.

Environmental management of Husky Atlantic Region's operations is achieved using a compilation of tools to manage the environmental component of its business. Systems, plans and procedures are in place to manage Husky's environmental commitments, regulatory obligations and stakeholder expectations, as well as areas of risk. All plans and procedures are responsive to applicable legislation and undergo periodic reviews to ensure compliance with legislation.

As a key part of these expectations, all of Husky Atlantic Region's environmental assessments undergo annual reviews. These reviews are to assist Husky in fulfilling its responsibilities under CEAA by ensuring that the scope of the assessment(s) and the mitigations committed to therein remain valid.

16.2 Environmental Effects Monitoring

Husky's EEM program, designed for drilling and production related activities in the White Rose and North Amethyst fields, is intended to provide the primary means to determine and quantify project-induced change in the surrounding environment.

The program design draws on the predictions and information in the White Rose development plan Environmental Impact Statement (EIS) and its supporting modelling studies on drill cuttings and produced water dispersion. A baseline study to document pre-development conditions was conducted in 2000 and 2002. This study, combined with stakeholder and regulatory agency consultations, initiated the detailed design phase of the EEM program. Further input on EEM program design was obtained from an expert advisory group called the White Rose Advisory Group. The White Rose Advisory Group for an integral part of the review process and has provided interpretation and feedback for each EEM program to date.

Where project-induced change in the surrounding environment occurs, the EEM program enables the evaluation of effects and therefore assists in identifying the appropriate modifications to, or mitigation of, project activities or discharges. Such operational EEM programs also provide information for the C-NLOPB to consider during its periodic reviews of the OWTG (NEB et al. (2010)). Objectives to be met by the EEM program are to:

- Confirm the zone of influence of project contaminants
- Test biological effects predictions made in the EIS
- Provide feedback to Husky for project management decisions requiring modification of operations practices where/when necessary
- Provide a scientifically defensible synthesis, analysis and interpretation of data
- Be cost-effective, making optimal use of personnel, technology and equipment
- Communicate results to the public.

Data are collected on sediment quality, water quality and commercial fish species. EEM components are summarized in Figure 15.1.1.1 (Figure 15-1).

16.3 Environmental Compliance Monitoring

Husky is committed to an active program to meet and where possible exceed compliance with all relevant regulatory and corporate requirements. This is achieved through the following objectives:

- Continued focus on meeting compliance targets and guidelines
- Investigate use of most up-to-date technologies and chemical formulations.

This can be implemented through:

- Regular reviews of new and existing regulatory requirements
- Continual review of industry best practices in achieving compliance milestones
- Updating standard operating procedures as necessary to remain in compliance
- Management of key drilling and production contracts and contractors

Management of compliance focuses on the effluent streams that are regulated under the *Canada Oil and Gas Drilling and Production Regulations* and the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (the Drilling and Production Regulations) and any other applicable provincial or federal legislation that may be applicable. The requirements for the *Drilling and Production Regulations* are further defined in the OWTG, which are used to develop facility-specific environmental protection and compliance monitoring plans. Each facility's environmental protection and compliance monitoring plan outlines all compliance monitoring requirements for the facility.

In addition, once received, all monitoring results are reviewed and trending of the respective effluent streams is completed to ensure that compliance limits are met and environmental exceedances are avoided. Meeting compliance targets on effluent streams is a constant challenge operationally that requires continual focus on operational best practices and technologies that could benefit the compliance systems. Husky completes periodic reviews of compliance information in order to determine priorities for improvement initiatives.

16.4 Environmental Protection Plan

Environmental protection planning is an important component of overall project planning and implementation of construction projects. EPPs are often required as part of a project approval by governments following an environmental assessment, before construction occurs. EPPs provide a practical way in which a proponent can demonstrate its understanding of environmental regulations, practices and procedures required to reduce or eliminate the potential environmental effects of a project. An EPP is a working document for use in the field for project personnel and contractors, as well as at the corporate level for ensuring commitments made in policy statements are implemented and monitored. EPPs provide a quick reference for project personnel and regulators to monitor compliance and to make suggestions for improvements.

Husky Energy has committed to the development and implementation of a comprehensive EPP to help ensure a high level of environmental protection throughout its work areas and activities associated with the construction of the CGS in Argentia, NL. The EPP for Construction provides the general protection procedures for the routine activities associated with construction activities anticipated for the WREP and identifies applicable permits, authorizations and approvals, as well as key site-specific conditions of approvals, as appropriate.

The specific purposes of the EPP are to:

- Provide a reference document to ensure that commitments to minimize environmental effects will be met
- Document environmental concerns and appropriate protection measures
- Provide concise and clear instructions to project personnel regarding procedures for protecting the environment and minimizing environmental effects
- Provide a reference document for personnel when planning and/or conducting specific activities and working in specific areas
- Provide a training aid during implementation efforts
- Communicate changes in the program through the revision process
- Provide a reference to applicable legislative requirements and guidelines.

16.5 Chemical Selection and Management Procedures

Husky's chemical management system and associated chemical screening procedure describes the procedure to minimize the potential risks to the health and safety of personnel and harm to the environment from the identification, procurement, transport, use, storage and disposal of chemical products and substances on the *SeaRose FPSO* and all drilling-related chemicals on drilling rigs under contract to Husky. All drilling- and production-related chemicals undergo a thorough health, safety and environmental screening based in part on the C-NLOPB's *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands* (NEB et al. 2009).

Husky's chemical management system ensures that:

- Chemicals are managed in compliance with all applicable statutory requirements, codes and industry practices

- The identification, purchase, use, storage, transport and eventual disposal of chemical substances is carried out in a responsible manner that prevents harm to people and the environment

- All chemicals on the *SeaRose FPSO* and all drilling-related chemicals (does not apply to domestic chemicals) on drilling rigs under contract to Husky undergo a health, safety and environmental screening prior to being accepted for use

- All personnel who encounter chemicals in the workplace are adequately trained, Material Safety Data Sheets are provided and accessible, and the risks associated with chemical use are appropriately communicated.

16.6 Fisheries Liaison/Interaction Policies and Procedures

Husky has and will continue to work to minimize any interference with the established fishing industry operating in the Newfoundland offshore area. This will be done through various means, including but not necessarily limited to:

- Advisories, when appropriate, of *SeaRose FPSO* movements/re-locations and major operational changes through Notices to Mariners and the CBC Fisheries Broadcast

- Continued participation on the One Ocean Committee. Since its inception in 2002, Husky has maintained membership on the One Ocean Board of Directors as well as the One Ocean Working Group.

  One Ocean is a liaison organization established by the fishing and petroleum industries of Newfoundland and Labrador. Under the direction of an industry board, One Ocean promotes mutual understanding between these two vital industries and their common marine environment. The goal of One Ocean is to provide a neutral forum for both sectors to facilitate communication, information exchange and shared opportunities. One Ocean's mandate is to assist the fishing and petroleum industries in understanding each other's operations and activities. The process is based on the initiatives of each industry to endorse cooperation, transparency and a proactive approach to the exploitation of marine resources.

The structure of the One Ocean Industry Board provides balanced representation of both the fishing and petroleum industries, consisting of knowledgeable and active stakeholders from each sector. This structure enhances the opportunity for information dissemination and progressive joint initiatives for two industries operating in one ocean.

- Implementation of the attributable damage compensation described in the Fisheries Damage Compensation Program
- Establishment and enforcement of a safety zone system around the White Rose development installations in consultation with Transport Canada, C-NLOPB, DFO and the One Ocean Working Group.

16.7 Fisheries Compensation Program

Husky undertakes various activities in the Newfoundland and Labrador offshore area. Of these, operations in the White Rose field are currently the largest activity and take place within a relatively small area (approximately 50 km²) of NAFO Unit Area 3Lt, which covers approximately 25,000 km². Neither White Rose field activities nor other Husky activities elsewhere in the offshore area are to have substantive operational impacts on commercial fishing vessels, nor to reduce catches in any manner.

Husky recognizes that the fishing industry has a long tradition of fishing on the Grand Banks. Husky has worked with the fishing industry and established efficient and effective mechanisms and procedures that ensure both industries can pursue their operations safely and with the least possible interference and the greatest mutual benefit. Husky will apply that same approach to working with the fishing industry in Placentia Bay.

Husky has developed a Fisheries Damage Compensation Program to address any fisheries-related damages allegedly caused by any of Husky's operations and to compensate for resulting loss. Liaison and consultations between both industries over the life of Husky's operations in the offshore area ensure that any unanticipated problems and issues are addressed and resolved to the mutual satisfaction of both industries. It is also acknowledged that all components of the Fisheries Damage Compensation Program should abide fully with the legislative and regulatory requirements of Canada as described in relevant legislation, such as the *Canada-Newfoundland And Labrador Atlantic Accord Implementation Newfoundland And Labrador Act* and *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity* (C-NLOPB and CNSOPB 2002).

16.8 Emergency Response

16.8.1 Emergency Response Preparedness

The HOIMS provides guidance for all operations. Within the HOIMS framework, Element 4 is dedicated to emergency preparedness.

A strong emergency response program ensures the integrity of Husky operations. In the Atlantic Region this is accomplished by:

- A comprehensive response process
- Effective and accessible response documents
- Training
- Emergency Response Team (ERT) commitment.

The *Incident Coordination Plan - EC-M-99-X-PR-00003-001* outlines the necessary resources, personnel, logistics and actions to implement a prompt, coordinated and rational response to any emergency. It offers an efficient and balanced approach to dealing with the issues resulting directly from an emergency.

The plan addresses those situations that result in:

- Concern for current or forecast conditions that cause an operational alert
- Public or regulatory concern for Husky operations
- Direct threats to human safety, or actual injury or death
- Threatened or actual damage to facilities or major equipment
- Terrorism, sabotage, or criminal acts
- Unintentional discharge of materials to the natural environment.

The intention of the plan is to ensure that, in the event of an offshore or onshore emergency, personnel are mobilized onshore as soon as possible to provide the necessary support required by an emergency site.

The plan supplements the site-specific emergency response plans that have been developed for physical response to an installation emergency.

Husky’s response philosophy is to think of the scope of the response in light of immediate and future concerns. The focus of Atlantic Region response teams and the escalation of resources during a response reflect three areas of scope:

- Emergency response
- Response management
- Crisis management.

16.8.2 Emergency Response Centres/Personnel

The WHP will have designated emergency response personnel. In every case, the crew will be either in the command group, emergency action teams, or unassigned and expected to report to muster stations. The person in charge of the facility (Offshore Installation Manager) will be in command of the response.

Husky's onshore ERT has two components, the Incident Coordination Centre (ICC), which can be mobilized quickly to provide direct support to the facility in distress, and the Regional Response Management Team (RRMT), which may be mobilized immediately after the ICC to manage the issues resulting from the emergency.

Husky's Corporate Response Management Team is available to support the Atlantic Region RRMT and is responsible for issues related to the emergency that affect Husky's corporate profile.

The offshore facility will have a designated area to be used as the emergency command centre during an emergency response.

Onshore, Husky shares an emergency response centre with Suncor. This facility is located adjacent to Husky's St. John's offices and can be activated quickly when required. The facility is fully serviced for communications and consists of:

- A dedicated ICC that is always ready for use
- Dedicated offices for command, communications and human resources
- Telephone response centres for managing additional response communications
- A large area that can be quickly converted from a meeting area to a long-term response centre.

Husky owns and operates a Business Continuity Centre, which is designated to be used in the event of loss of access to the Scotia Centre or if shared facility is being used by Suncor.

Husky's emergency response structure is illustrated in Figure 16-1.

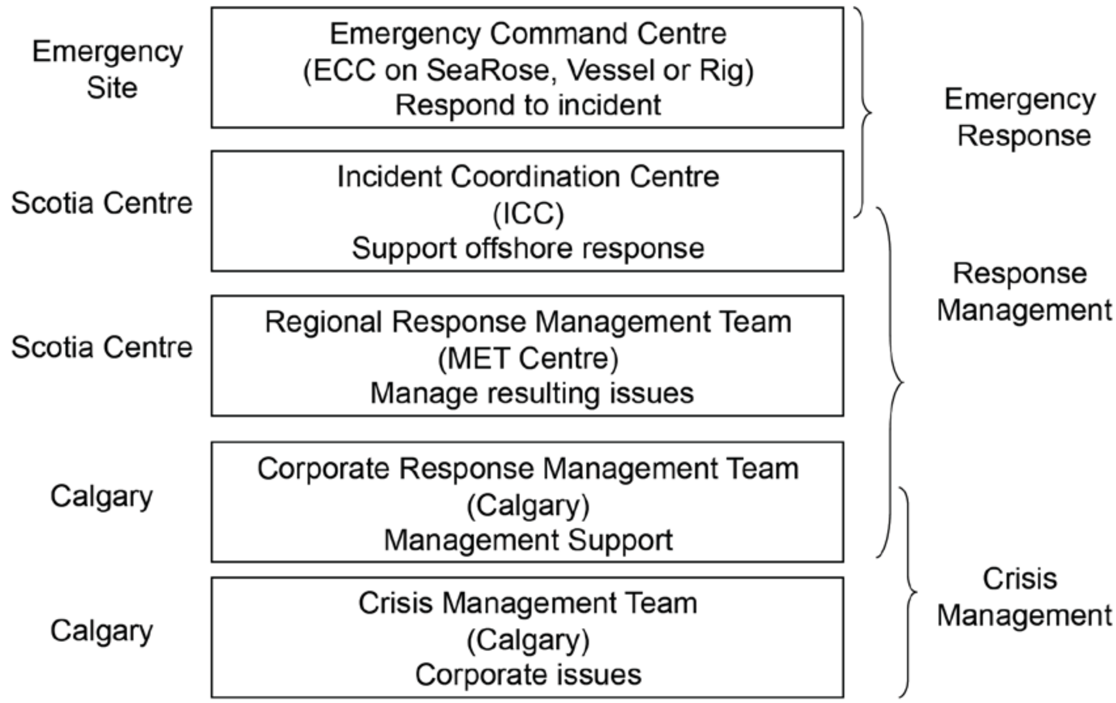

Figure 16-1 Husky's Emergency Response Structure

16.8.3 Defining the Emergency Event

During the course of Husky's Atlantic Region operations, unplanned events will occur that require immediate attention outside of normal operations. Such events may threaten or cause actual injury to personnel, impact to the environment, or damage to property. As well, there may be events that are not emergencies in terms of impact but are irregular actions that cause regulatory or public concern for the integrity of Husky's operations.

It is important that Husky operational personnel recognize the level of concern that unplanned events, even if minor, may generate. To ensure a proper response, operational personnel are encouraged to report all unplanned events and to discuss the implications of these events with supervisors and emergency response personnel. The Husky emergency response program is based on precautionary notification.

Many emergencies develop over time and require consultation before an emergency is declared. Often there is a common escalation process:

- Situation emerges – discussions with onshore management
- Situation expands – discussions result in declaration of alert
- Situation becomes an emergency – declare an emergency.

16.8.4 Mutual Aid

Husky has entered into a formal *Mutual Emergency Assistance Agreement* with Grand Banks operators to provide assistance to each other in the event of an emergency. The agreement was drafted in January, 2002, and is renewed frequently.

Assistance may take the form of:

- Exchanging current or forecast ice, weather, or oceanographic information
- Providing MedEvac support from an offshore location
- Providing personnel, vessels, equipment, facilities and other company or contracted resources to assist during an emergency response operation.

16.8.5 Business Continuity

Normal Husky business activity may be disrupted by any emergency. The most serious business disruption would occur as a result of an emergency that denies access to the Scotia Centre.

While the Husky emergency response process is intended for the response to emergencies related to offshore operations, it can be applied to emergencies that affect Husky's offices at the Scotia Centre. Features of the response include:

- The response to the emergency itself will probably be undertaken by the police and fire services
- Mobilization of an offsite emergency centre
- Husky's short-term concern will be in assessing the situation and in notifying offshore installations and employees
- Husky's longer term concerns will be in how to support offshore operations during a return to normal operations.

16.9 Drills and Exercises

Drills are a vitally important and integral part of ensuring the emergency preparedness of the organization.

Drills and exercises are planned in such a manner as to ensure that all personnel assigned emergency roles or that could be an alternate in an emergency role receive experience during a drill.

16.9.1 Offshore Installation

The offshore installation will develop a schedule of drills based on;

- Specific installation design and operations
- Regulatory requirements
- ERT training requirements
- Canadian East Coast Offshore Petroleum Industry, Training and Qualification Guide.

16.9.2 Onshore Emergency Response Team

The onshore ERT receives regular training and exercise experience. The actual number of exercises completed varies depending on level of offshore activity, with a minimum of four exercises completed in a calendar year. Exercise scenarios vary based on actual offshore activity and may be based on the following offshore emergencies;

- Security breach
- Fire and explosion
- Collision
- Oil release
- Hostage taking
- Loss of well control.

16.10 Spill Response

Husky has instituted a spill prevention program with an intention of zero spills into the marine environment. Any unintentional discharge (hydrocarbon or otherwise) is considered to be an oil spill and results in an appropriate response and may result in the activation of the *OSR Procedure - East Coast Oil Spill Response Plan (EC-M-99-X-PR-00125-001)*. This document details the response actions to be taken by Husky in the event of an oil spill while operating offshore Newfoundland and Labrador. These procedures are responsive to regulatory requirements for oil spill contingency planning. The plan provides a comprehensive review of:

- Husky’s duties when the “responsible party” as defined by various acts and regulations
- Husky’s philosophy and policies concerning oil spill response
- The organization of Husky’s response efforts, and the evolution of those efforts with the increasing scale of the spill response

- Arrangements for assistance from contractors and other operators
- Environmental issues resulting from an offshore oil spill
- Husky's policies concerning safety, oil spill waste management and training.

16.10.1 Regulatory

Under the Atlantic Accord, C-NLOPB is responsible for the regulation of all spills at offshore drilling and production operations.

16.10.2 Spill Management

For response planning purposes, oil spill events are classified as tiers. The parameters to be considered in selecting the appropriate level of response include:

- Size and nature of the oil spill
- Environmental and operational conditions at the time of the spill
- Vessel and equipment availability
- Numbers and qualifications of personnel available at site
- On-site waste oil storage
- Corporate exposure to risk and liability as a result of the oil spill.

The three levels are defined as follows:

- A Tier 1 spill poses the least threat of impact, and can be managed using resources available at site.
- A Tier 2 spill response requires local shore-based management support and resources in addition to those already at site.
- A Tier 3 oil spill has the potential to affect Husky and shareholder company business operations. A Tier 3 response may require considerable corporate and contract resources, drawn from local, regional and international sources.

16.10.2.1 Management Structure

Because of the dynamic nature of offshore spills, the facility may quickly cease to be the scene of the slick. As a result, Tier 1 spills are generally managed offshore and Tier 2 and 3 spills are managed onshore by the Husky RRMT with assistance from Eastern Canada Response Corporation (ECRC).

16.10.2.2 Management Philosophy

Five principles are considered paramount in all aspects of a spill response:

- The health and safety of all personnel must not be compromised
- Response to an emergency situation that threatens personnel safety or the integrity of the facility will take precedence over response to the oil spill
- Identifying and protecting sensitive environmental and human resources
- Response planning decisions should be based on net environmental benefit considerations to the maximum extent that is practical
- Operational response actions cover a wide range of effort and technology, depending upon the nature of the spill.

16.10.3 Response Strategy

16.10.3.1 Situation Assessment

No action should be taken in response to a marine oil spill without an understanding of the nature of the problem. This appreciation will help managers to decide:

- What response actions are necessary
- How to implement the response in the safest and most effective manner.

The decision process requires ongoing collection and assessment of information from the spill site, including:

- Nature and type of spill
- Trajectory and weathering of oil
- Weather and sea state conditions
- Environmental sensitivity
- Logistics, equipment and personnel availability
- Effectiveness of the response to date.

16.10.3.2 Net Environmental Benefit

Each spill response option, or combination of options, can have some effect on the environment beyond that of the spill itself. The Husky response strategy is based on the principle of net environmental benefit. Net environmental benefit takes into consideration the advantages and disadvantages of specific response actions and their effect on the environment. Some response methods have the potential to cause adverse environmental effects but may be justifiable because of overriding benefits and/or the avoidance of further, more serious, effects.

16.10.4 Triage

Triage is a way of setting priorities in an emergency to assist in the allocation of resources to achieve the greatest benefit. In a response, resources will be limited and actions will be severely affected by the time frame of the spreading oil. By recognizing these constraints, the triage process can focus decision making on:

- Allocation of resources for maximum benefit
- Monitoring issues that may require attention later
- Where not to use resources because of anticipated relative ineffectiveness.

When conducting a triage, Husky will consult with ECRC, C-NLOPB’s Chief Conservation Officer and Environment Canada.

16.10.5 Response Operations

16.10.5.1 Response Options

In any spill response, Husky’s objective will be to minimize the effects of the spill. At the time of a spill, it is of paramount importance that a response strategy be developed quickly. While every spill response will be unique, there are basic strategies that can be considered. Husky’s oil spill response plan identifies the response options available during an offshore spill. These include the following:

- Surveillance and monitoring
- Mechanical dispersion
- Containment and recovery
- Wildlife measures.

16.10.5.2 Capability

Husky's spill response capability includes:

- A first response capability based on Husky equipment and vessels
- Mutual aid assistance through other Grand Banks operators
- ECRC Operational Spill Management Services – provided on contract to Husky
- ECRC personnel and equipment for larger spill response operations – provided on contract to Husky

- Resources available through Oil Spill Response Limited (OSRL), including access to the Global Response Network (GRN)
- CCG environmental response personnel and equipment.

16.10.5.3 Initial Response Actions

The initial actions to be taken in the event of a spill may be severely restricted or impossible if the platform is in an emergency situation. During an emergency, the spill will assume secondary importance to the emergency that caused the general platform alarm.

16.10.5.4 Countermeasures

Husky is in a position to use a considerable pool of spill response resources. With the combined resources of Husky, Hibernia and Suncor for dealing with Tier 1 spills, and the additional capabilities of ECRC for Tier 2 spills, the inventory of offshore spill response equipment resident in St. John’s is the largest in Canada. Contract arrangements with ECRC allow Husky to access this equipment, along with trained personnel, in the event of a spill.

16.10.6 Eastern Canada Response Corporation Role

Husky has contracted ECRC to provide operational preparedness and response services. ECRC can also provide management support for a Tier 2 or 3 event.

ECRC is a full-time spill response organization certified by Transport Canada under the *Canada Shipping Act, 2001* (CSA). ECRC will take the lead in developing tactical and strategic plans and in coordinating spill response operations. Prior to implementation, all response activities and plans must be approved by Husky.

16.10.6.1 Eastern Canada Response Corporation and the Incident Command System

ECRC’s Spill Management System is based on the principles of the Incident Command System and is compatible with the Husky response management process.

16.10.6.2 Eastern Canada Response Corporation Oil Spill Response Centre

During a spill response, both the Husky RRMT and the ECRC Oil Spill Response Centre will be mobilized. All spill response operations will be managed on shore from the dedicated ECRC Oil Spill Response Centre located in Donovan’s Industrial Park. The Husky RRMT will serve as lead centre for all non-spill related components of the response, as well as for the provision of advice, information and approvals necessary for the spill response.

16.10.7 Canada Shipping Act, 2001

If the source of the spill is a supply vessel or tanker (while not attached to the loading flange or when operating independent of the platform) or a shore-based facility, the vessel or facility operator will be the Responsible Party under the CSA. The CSA requires that these vessel or facility operators have response plans, designated and trained spill response personnel, and contract arrangements with a Response Organization certified by Transport Canada. In every applicable case, ECRC is the Response Organization retained by Husky contractors. While CSA regulations do not apply to Husky drilling or production activities, Husky's spill capability meets CSA standards.

16.10.8 Waste Management

Waste management is an important component of any oil spill response operation. Procedures for handling waste must be in place before it is collected or stored. When initiating an oil spill response, a comprehensive waste management plan will be developed as soon as possible to ensure that the amount of waste generated is limited and the ultimate disposal of that waste is as efficient as possible. Husky maintains contractual arrangements with waste management service providers who will be called upon to assist in the development of the waste management plan for a specific spill, based on the countermeasures being used in the spill response and available local and national waste management options.

16.11 Tier 1 Operational Response Options

At the time of an oil spill, appropriate countermeasures, based on present conditions, must be implemented quickly. While every spill response will be unique, there are only a few basic techniques that can be practically considered. Oil spill response equipment that can be deployed quickly in the event of an oil spill has been positioned at site. The capability at site for any of these options is limited in response to small spills or the initial response to larger spills. Tier 1 countermeasures can be deployed rapidly with favorable weather conditions. Times will vary based on the equipment deployed from minutes for the tracker buoy to several hours for the Single Vessel Side Sweep (SVSS). Actual deployment time will vary based on the observed meteorological and oceanographic conditions.

Table 16-2 Tier I Oil Spill Response Equipment Available at Site

Equipment	Storage Location
8" Sorbent boom	• 97.5 m (320 ft) of boom and 30.5 m (100 ft) of pom poms stored on all Husky supply vessels
Offshore Single Vessel Side-Sweep system	• Outrigger arms stored on Husky supply vessels • Booms and skimmers stored in containers on *SeaRose FPSO*
Oil and oiled bird sampling kit	• Sampling kits are stored on all Husky supply vessels
Global Positioning Systems (GPS)/ Satellite oil spill tracker buoys	• MetOcean iSphere buoys are on all Husky supply vessels, the *SeaRose FPSO*, and the GSF Grand Banks

16.11.1 Sorbent Boom

The side sweep sorbent boom system is a single-vessel oil recovery system used by all offshore support vessels chartered by Husky, in response to small oil spills at an offshore facility. Unlike a conventional boom, which acts as an impenetrable barrier that collects floating oil, the side sweep sorbent boom system is constructed of multiple 10-foot sections of 8” sorbent boom, which will absorb oil on contact.

The system uses the ship’s crane as an outrigger arm, extending perpendicular to the side of the vessel, to tow the boom (Figure 16-2). One end of the boom is attached to the crane (winch cable hook is lowered to the water surface) and the other end is tied to the side of the vessel. As the vessel steams ahead at slow speed (1.8 to 3.7 km/h (1 to 2 knots)), a V-shaped boom is formed along the side of the vessel.

Figure 16-2 Sorbent Boom System

16.11.2 Single Vessel Side Sweep System

While in the White Rose field, the *SeaRose FPSO* has been equipped with the SVSS oil spill containment and recovery system. The philosophy of this system is to ensure that resources are available at site that can be deployed and operated in open ocean conditions by a single vessel. The system consists of a side-deployed outrigger arm and float, an inflatable containment boom and a skimmer for oil recovery (Figure 16-3).

The system was designed to be suitable for offshore conditions. The skimmer has been built on a broad flotation base and is very stable in a seaway. Its powerful thrusters ensure that the skimmer can be maneuvered into any part of the boom apex. The sea state rating for Husky’s NOFI 800 SVSS boom is approximately 2 to 2.5 m significant wave height (Hs), or Beaufort 5.

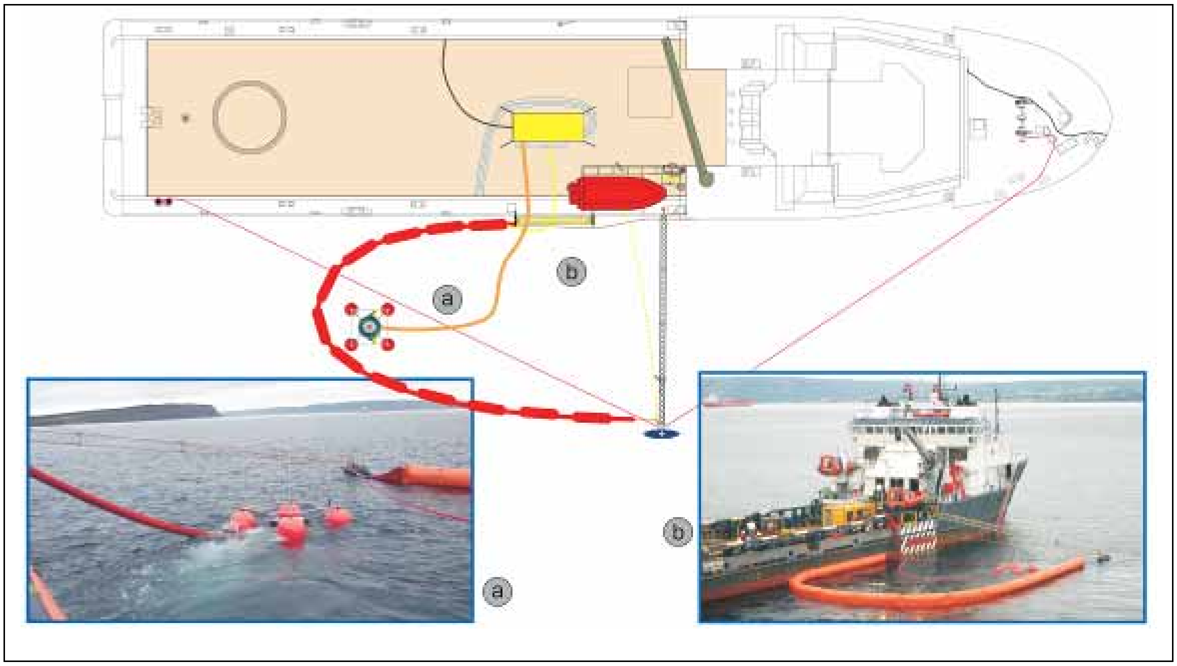

Figure 16-3 Third Generation Single Vessel Side Sweep

Each SVSS system consists of:

- Stored on the *SeaRose FPSO* - A customized 20 ft. DNV-class offshore container housing an inflatable oil containment boom, offshore oil skimmer, boom and hose deployment winches (reels), hydraulic control system, sweep arm rigging, hydraulic and discharge hoses and miscellaneous supplies.
- Stored on designated supply vessels - An outrigger arm assembly and boom deployment fairlead. The 20-m outrigger arm assembly keeps the oil containment boom positioned on the side of the vessel during oil recovery operations. The boom fairlead is designed to aid in the over-the-side deployment and recovery of the containment boom. Each vessel is equipped with dedicated SVSS hydraulics.

16.11.3 Oil and Wildlife Sampling Kits

Husky maintains oil and oiled wildlife sampling kits (Figure 16-4).

Figure 16-4 Oil and Oiled Wildlife Sampling Kits

The following features characterize Husky's oil and oiled wildlife sampling procedure:

- Offshore personnel are encouraged to sample any oil on water observed at any Husky site, regardless of source
- All Husky offshore platforms and vessels have been equipped with the sampling equipment described in this document
- Health, Safety, Environment and Quality advisors on Husky production or drilling rigs will coordinate sampling activity offshore
- The Husky Atlantic Region environmental coordinator, will manage samples on shore
- Someone will always be the custodian of the sample until analysis onshore is complete
- All sample handling actions will be documented (notifications, field notes, proper labelling and a chain of custody form)
- Samples will be kept cool at all times and shipped to St. John's as soon as possible.

16.11.4 Satellite Tracker Buoys

MetOcean satellite tracker buoys are available offshore on the vessels and platforms. An onboard Global Positioning Systems (GPS) receiver determines the buoy's position every 30 minutes. GPS positions are transmitted to shore via the Iridium satellite system. Buoy positions are processed and quality-controlled before being displayed on the JouBeh website ten minutes after transmission.

16.12 Tier 2 Equipment

There are three local sources of oil spill response equipment that might be considered for use when an offshore oil spill response escalates to the Tier 2 level:

- Producing operator-owned equipment - SVSS and Norwegian Standard System (Section 16.11.2)
- ECRC equipment stored in Donovan's
- CCG equipment stored in Donovan's.

Equipment in this pool is owned by offshore producing operators, ECRC and the CCG.

Deployment times for Tier 2 equipment will vary. Expected times are from 6 to 36 hours based on a number of conditions, such as:

- Meteorological and oceanographic conditions
- Recovery vessel locations
- Volume of crude spilled
- Amount of equipment to be mobilized and number of vessels to be outfitted.

16.12.1 Key Resources

The most suitable local resources available for an escalating offshore spill response include:

- Operators' SVSS systems
- Operator's Norwegian Standard System stored at ECRC, Donovan's
- ECRC NOFI 1000 boom stored at ECRC in Donovan's
- Various ECRC or CCG inflatable booms for sea states up to 1.5 m
- ECRC GT 260 skimmers with Desmi Helix brushes stored at ECRC, Donovan's
- CCG Transrec 200 stored at Donovan's
- CCG GT 260 skimmers stored at Donovan's.

16.12.2 Norwegian Standard System

In 2009, Suncor, Husky and HMDC shared in the purchase of a Tier 2/3 offshore oil spill containment system suitable for use in offshore Newfoundland conditions. The system consists of a Framo Transrec 150 weir skimmer and a 400 m Norlense 1200-R self-inflating boom. The system is identical to the NOFO Norwegian Standard System.

The Norwegian Standard System, with dedicated trailers and permanent deck mounts on designated response vessels, greatly improves oil collection capability because:

- Mobilization time is reduced to a few hours with deck mounts installed
- Increased safety as fewer personnel are required and boom self-inflates
- Oil recovery operations will be possible in greater sea states (3 to 3.5 m Hs)
- Skimmer efficiency is improved (oil capture, pumping rates and overall control).

The producing operators have entered into a preparedness agreement with ECRC that includes the continued system maintenance and training.

16.13 Tier 3 Equipment

If an offshore oil spill response escalates to the Tier 3 Level, Husky will arrange to mobilize equipment from outside of Newfoundland and Labrador. Sources of this equipment will be:

- ECRC offshore-grade equipment stored in mainland depots
- Suitable offshore equipment owned by OSRL
- Equipment available through OSRL and ECRC membership in the GRN.

Tier 3 equipment would be expected to start arriving on site approximately 18 to 24 hours from initial activation.

16.13.1 Eastern Canada Response Corporation Canadian Resources

The most suitable Canadian resources available for an escalating offshore spill response are stored in ECRC depots in Dartmouth, Sept Isles, and Quebec City. The most suitable equipment in this pool includes:

- ECRC NOFI Ocean Buster boom (7.4 to 9.3 km/h (4 to 5 knots) towing) stored at ECRC, Quebec
- ECRC RoBoom and Oil Stop inflatable booms for sea states up to 1.5 m
- GT 185 and Desmi 250 Skimmers
- 50 m^3 tanker barges that could be used on deck for storage of recovered waste.

16.13.2 Global Response Network

Several international oil spill cooperatives have formed an alliance, the GRN, to provide a Tier 3 mutual aid opportunity. The GRN also provides a framework between member organizations that allows all to improve benchmarking and knowledge-sharing. Members of the GRN include:

- OSRL
- Marine Spill Response Corporation
- Alaska Clean Seas
- Australian Marine Oil Spill Centre
- Clean Caribbean and Americas
- ECRC
- Western Canada Marine Response Corporation.

16.13.3 Dispersants

Husky will apply to C-NLOPB for a permit to use dispersants should this application be considered to be an appropriate countermeasure. Dispersant application will commence as soon as operationally possible after the permit is approved. Husky has undertaken several tests to confirm that White Rose field crudes can be dispersed using Corexit 9500 and existing dispersant application technologies.

16.13.3.1 Description of Dispersant

It is likely that Tier 3 resources may be mobilized In the event of a major offshore oil spill response. As part of this effort, OSRL in Southampton, England, may be asked to provide airborne chemical dispersant capability. Airborne operations will only be considered in cases where a large volume of oil can be effectively treated. An operational plan will be required before dispersants are applied.

The OSRL airborne system consists of:

- Unmodified Hercules transport aircraft on long term charter to OSRL
- Nimbus modular dispersant spray system with loading system and spares
- Dispersant monitoring kit including in situ fluorometer.

The Nimbus system is used by OSRL as it can be transported in a conventional jet transport aircraft for installation in a pre-positioned aircraft. Response time is reduced as the deployment aircraft does not have to fly loaded when crossing the Atlantic. Nimbus system specifications include:

- Chemical carrying capacity - 12,000 L in a total of four tanks
- Swath width - 40 m
- Application rate - 80 L per hectare
- Treatment rate - 10 km^2 per hour
- Treatment per load – 1.5 km^2.

16.13.3.2 Decision Making

The following should be considered when making a decision whether or not to use dispersants:

- Oil characteristics are suitable for safe and effective dispersion
- The thickness of the oil is sufficient to allow efficient application
- Sufficient water depth to allow complete mixing of oil and chemical
- Sensitive environmental or social resources are at risk of oiling
- Physical recovery methods or natural dispersion will not be adequate
- Weather or sea state conditions exceed safe working limits for physical recovery.

A generic decision-making process for dispersant use is illustrated in Figure 16-5.

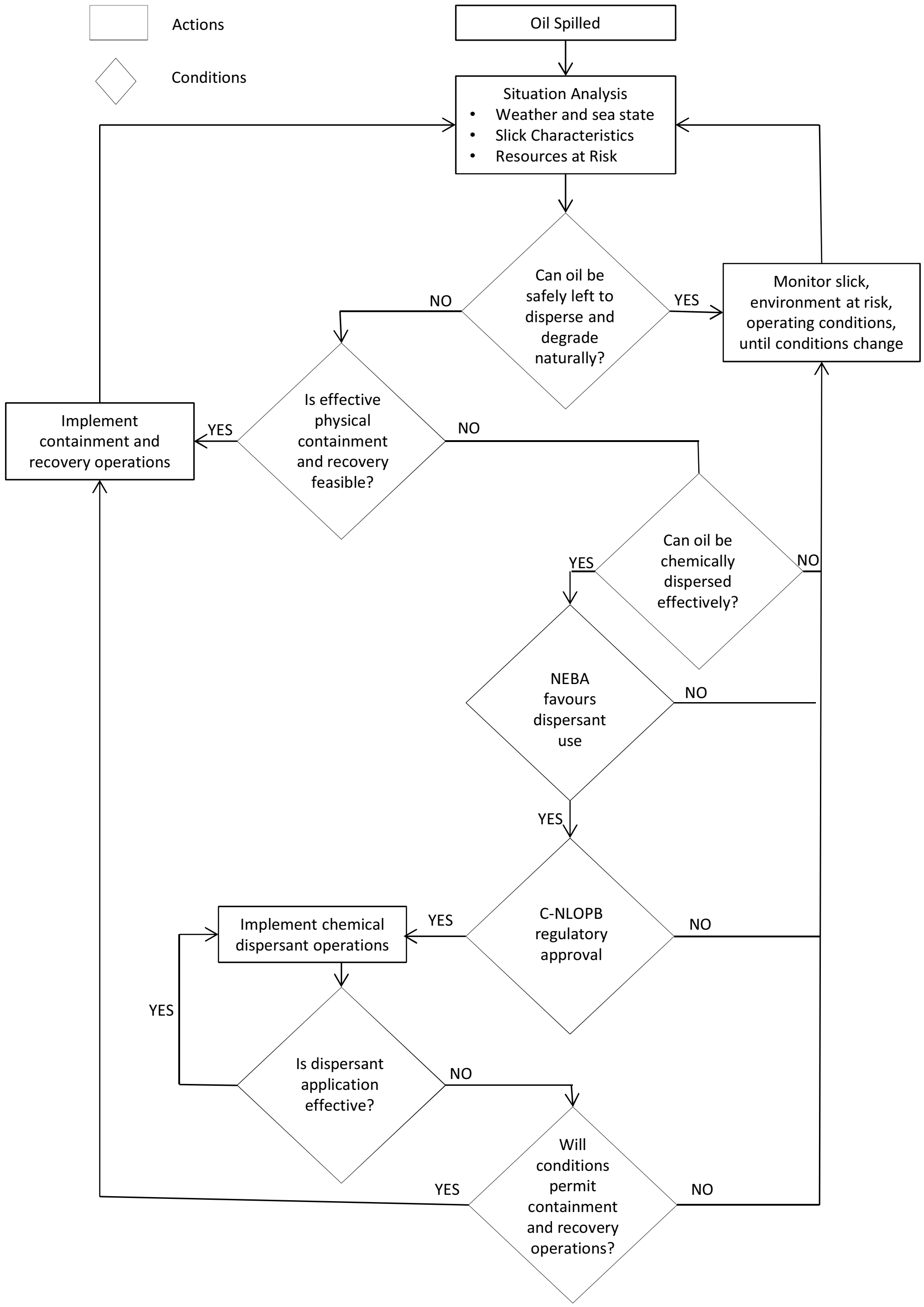

Figure 16-5 Generic Decision-making Process for Dispersant Use

16.14 Offshore Training – Spill Response Operations

Key offshore personnel receive practical instruction in oil spill operations. Emphasis is on response to small spills or the initial response to a larger spill.

Husky has entered into a preparedness agreement with ECRC that includes the provision of the following services;

- Management and maintenance of Tier 1 equipment (sorbents, tracker buoys, SVSS)
- Management and maintenance of Tier 2 equipment
- Initial and recurrent training for vessel crews
- Oil spill contingency planning and exercises.

16.14.1 Tier 1 Oil Spill Response Orientation

Offshore personnel are given an overview of Tier 1 oil spill response operations. Topics covered include: the nature of offshore oil spills; notification procedures; a review of available oil spill response resources; and determining first response strategies.

16.14.2 Oil Spill Response Techniques

All supply vessel crews, Health, Safety, Environment and Quality advisors and weather observers become familiar with on-water techniques applicable to their roles in a response.

Operational training includes sessions covering the following:

- Oil on water observations
- Use of the sorbent boom
- Oil sampling procedures
- Wildlife handling
- Basic seabird observation techniques.

On vessels that may be assigned to standby duties at the White Rose field, crews are trained in the use of the sorbent boom equipment and tracker buoy deployment. Designated vessels receive additional training on the deployment of the SSVS oil containment and recovery system.

16.15 Continuous Improvement

Husky is committed to continuous improvement in all areas of operations, including emergency response. New technologies and ideas are identified through participation in industry conferences and through relationships with service providers such as ECRC and OSRL. Examples of recent initiatives include:

- Procurement of a Norwegian Standard System in 2009 (in partnership with Suncor and HMDC)
- Conclusion of preparedness agreement with ECRC in 2010
- Ocean boom vane trials in 2010
- Procurement of second Norwegian Standard System (in Partnership with Suncor) in 2011
- Participation in industry initiatives to review dispersant effectiveness in the local operating area (2011-present).

16.16 Environment-related Training

Providing targeted assistance to employees and contractors is essential to ensuring that they understand how to work in a safe and environmentally responsible manner. To that end, both Husky and its contractors provide appropriately targeted orientation and training programs and materials to assist personnel with fulfilling their responsibility to work in a safe and environmentally responsible manner consistent with Husky's policies.

As appropriate, Husky and its contractors provide job-specific technical, health, safety and environment training and orientations. Husky's formal in-house training programs consider the level of training required for the position and responsibilities of the personnel involved. The aim of the training programs is to provide an understanding of the procedures, equipment, risks and potential hazards that may occur. Details respecting the competency and training process are outlined in the *SeaRose FPSO Training and Competency Program*. Husky audits pertinent training matrices against the Canadian Association of Petroleum Producers' Training and Qualifications Requirements to ensure that all personnel are suitably qualified and trained.

In addition to the above, Husky has developed an environmental awareness training course that is required to be completed by all personnel and an environmental responsibilities course that is required to be completed by management, supervisors, and personnel in environmentally-critical roles.

16.17 Ice Management

This section provides an overview of ice management practices used by offshore operators to provide a safe environment and minimize operational disruptions caused by ice. Currently, ice management is comprised of:

- Detection
- Monitoring and assessment
- Physical management.

Ice management was first conducted by the offshore oil industry in the early 1970s (Bruneau and Dempster 1971) and continued to develop through the following three decades. Initially, ice management was a reactive process, but as offshore oil operations expanded, ice management evolved into a proactive operation. Today, a coordinated approach is taken and decisions are made with respect to all operations being conducted on the Grand Banks. Physical management is conducted well upstream in an attempt to move any hazardous ice off the Grand Banks and out into the Flemish Pass, where faster moving currents will carry the ice safely past the production fields.

16.17.1 Detection

Sea ice and iceberg detection (in various forms) has been conducted for most of the twentieth century. These early detection efforts were primarily conducted to provide warnings to mariners about where ice would likely be encountered and a typical vessel's response was to avoid these areas. Offshore oil exploration is one of the few relatively stationary activities involving complex operations in ice-infested waters.

In the early days of exploration drilling off Canada's East Coast, most ice detection efforts were limited to detecting icebergs that drifted within radar range. With the increased use of moored semi-submersible drilling rigs in the early 1980s, the need to detect and accurately locate ice at greater distances became critical.

Detecting small floating targets in open seas is a well-understood and documented process. Technological advances in the past two decades have improved ice detection capabilities to a point where both sea ice and icebergs can be detected and their positions determined with great accuracy.

Typically, oil exploration and production operations off Canada's East Coast use a combination of radar technologies and procedures to quantify and monitor ice distribution. Between government (both Canadian and American) and private industry, there are over 5,000 hours of airborne reconnaissance conducted annually over the Grand Banks and areas to the north. In addition to these radar-equipped aircraft, the areas off Canada's East Coast are swept daily by an assortment of satellite-based sensors and long-range, shore-based radars. Data from all these sources are integrated into a daily summary of ice distribution. The sequential ice distribution data are then used to monitor growth and movement. Using these procedures, operators are able to detect and monitor ice conditions 300 km or more upstream of an operations area, allowing for long-term resource and operational ice management planning.

If ice moves south of 48°N, dedicated radar-equipped ice reconnaissance aircraft are used to monitor the advancing ice. These reconnaissance aircraft are capable of detection on even very small ice targets (Rudkin and Ripply 1988). In the unlikely event that any ice evades this detection network, most oil facilities are equipped with ice detection and monitoring radars that have been optimized for detection of small ice masses.

16.17.2 Monitoring and Assessment

Once detected, ice must be monitored to establish the speed and direction of its movement (drift) and, when enough information has been obtained, assess its potential threat to a project. Typically, this is accomplished in stages. The initial detection is usually accompanied by a general classification of the type of ice or iceberg. As successive detections are made over an area, a general drift track is established. At this stage, the available data allow only for general assumptions to be made. However, these initial data are used primarily for ice management resource planning. As ice closes on a production area, more detailed information is required. The components of detailed ice assessment data are:

- Physical dimensions of sea ice and/or icebergs
- Depth measurements of icebergs (draft)
- Accurate drift (direction and speed).

The standard methodology for obtaining physical dimensions of icebergs is comprised of a mix of measurement, calculation and, in some cases, estimation, depending on the operational importance of the ice in question. Smaller icebergs and ice floes are usually estimated because their masses are well within the capabilities of ice management vessels. More detail about the overall mass and draft of larger icebergs is required. Methods of measuring the above-water dimensions of icebergs were pioneered almost three decades ago and remain little changed today. These methods are described in the Grand Banks operators' ice management plans and have been documented in many reports.

Once the above-water dimensions are known, calculations of overall mass can be made. These calculations are described in the operators' ice management plans. However, it should be noted that due to the irregular shapes of icebergs, these mass calculations only represent an estimation of true mass. They can be in error by ±20 percent (Comfort and Edwards 1998). Several studies were conducted during the 1980s in an attempt to establish a relationship between above-water size (height and water-line length) and iceberg draft. At best, these attempts provided only a first order approximation. If the above-water-to-draft relationship shows the iceberg may be capable of running aground (scouring), then an operator must acquire more accurate data.

Obtaining accurate iceberg draft information is a long and sometimes complicated process and is accomplished by using underwater sonar deployed near the iceberg by an ice management vessel. This method has remained unchanged for nearly two decades. Although the sonar units have improved in accuracy and reliability, problems remain with deployment of the instrument and accurately maneuvering the vessel near the iceberg.

Obtaining accurate drift information is a simple process of measuring distance over time. The widespread use of GPS now provides very accurate positions and tracks, even over short distances and time periods.

Once these baseline data have been collected, a reasonable assessment of the risk posed by the ice/iceberg can be made. Typical risk assessment considers the following questions:

- Is the drift of the ice likely to pose a collision risk or disrupt operations?
- Is the draft of the iceberg sufficient to scour or strike components of a project?
- Is the ice in excess of the design criteria of a facility?
- Is the ice/iceberg within manageable parameters?

If the answer to these questions is ‘no’, then the ice need only be monitored for any drift changes. If the answer is ‘yes’, then either a physical ice management procedure will have to be attempted or the facility will have to be secured and prepared for a possible move.

One of the key assessments is establishing collision risk. This is achieved by assessing a combination of:

- The ice
- Local winds
- Local currents
- Forecasts and predictions of these components.

Several studies show that, when accurate wind and current data are available, observed iceberg trajectories can be predicted with physical-based models of iceberg drift. Results are relatively insensitive to model parameters such as air and water drag coefficients and, to some extent, iceberg dimensions and shape (Murphy and Anderson 1985; Smith 1993).

16.17.3 Physical Management

In general terms, most physical iceberg management consists of towing or deflecting the iceberg off its free-drifting track. The first documented cases of iceberg towing were in 1971 (Bruneau et al. 1977). In simple terms, these first attempts consisted of deploying a long floating rope around the iceberg, then applying force with a towboat in the direction they wished to move the iceberg. These procedures and the equipment used are described in detail in Total Eastcan’s iceberg towing manual (Eastcan Exploration Ltd. 1973). In the ensuing 30 years, other methods have been used with varying degrees of success, but this early method has remained the staple of iceberg management, having been used in nearly 500 documented iceberg tows.

The recent development of an iceberg tow net has gained popularity for management operation on the Grand Banks. The iceberg tow net was designed to reduce the amount of rope slippage and provide a reduction in iceberg rolling during towing.

The effectiveness of operational iceberg towing conducted during the 1980s has been studied (Bishop 1989). The conclusions were that, of 354 iceberg towing operations considered, 277 were successful with no difficulties, 74 were successful but required several attempts and 49 were unsuccessful. This translates into an effectiveness of 86 percent. Recently, much has been made of the criteria used in this study to define successful tows. However, since in most cases it is unknown what the free-drifting track would have been if the iceberg were not towed, tow success can only be evaluated on one simple criterion: did the offshore facility have to move? If not, the tow was successful.

Sea ice management procedures have been used much longer than iceberg management procedures and are well documented; breaking up sea ice to assist shipping is a commonplace occurrence in Canadian waters. Because of the loose nature of the pack ice in the area of the Grand Banks, sea ice management primarily consists of using support vessels to break up any large ice floes that meet or exceed the design limits of the offshore facility.

Over the 2008 and 2009 ice seasons, experience was gained using water cannons to open a path in the pack as it advanced towards offshore facilities. The method used a support vessel stationed a few hundred metres ahead of the offshore facility. By sweeping the vessel’s water cannon left and right, a path or lead was opened up, keeping the loose pack clear of the offshore facility.

Beginning in late 1988, all operators on the Grand Banks adopted a coordinated ice management approach. Under this system, the joint operators share ice information and ice management resources, along with adopting a strategy and procedures for managing icebergs over the whole Jeanne d’Arc Basin.

While the current ice management procedures are generally effective, allowing for safe and, for the most part, efficient operations, there are a few areas where improvements would be beneficial. Both the offshore operators and the authors of a Program of Energy Research and Development (PERD)-sponsored report (King et al. 2009) on ice management have identified problematic areas as:

- Detection of small icebergs within pack ice
- Iceberg towing operations within pack ice
- Obtaining iceberg draft measurements reliably and efficiently
- Improved methods of attaching tow lines to icebergs
- Cost-effectiveness.

A joint industry, academic and private enterprise initiative has been started to address these and other issues related to ice management. In addition, several studies and reports, primarily under the auspices of PERD, have been conducted to address some of those issues, providing, among other things, cross-indexed databases of existing ice and iceberg data (PERD 2004).

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17.0 Summary and Conclusions

The original White Rose field underwent an environmental assessment in 2000 pursuant to CEAA as a Comprehensive Study (Husky Oil 2000, 2001). In 2007, a further environmental assessment was undertaken in regards to activities associated with construction of up to five additional subsea drill centres and associated flowlines under the *Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment Addendum* (LGL 2007a). These previous environmental assessments encompass the location, construction and operation of the proposed subsea drill centres within the WREP. Therefore, much of the description of the WREP focuses on the WHP development option, which has not been previously assessed, although information is also provided on the subsea development option. The environmental effects analyses consider both development options. Regardless of the development option selected, the produced crude will be transported directly to the *SeaRose FPSO*. All production from the potential future drill centres will be processed through the *SeaRose FPSO* currently operating at White Rose. The effects of production have been previously assessed (Husky Oil 2000; LGL 2007a), and are not addressed in this document.

The C-NLOPB determined that the proposed WREP is not described in the *Comprehensive Study List Regulations* and therefore subject to a screening level of assessment under CEAA. The C-NLOPB and other federal Responsible Authorities set out the required scope of this environmental assessment in a Scoping Document (C-NLOPB 2012a), which was developed based on the requirements of CEAA for screening-level assessments. In July 2012, the WREP was placed on the designated projects list under CEAA 2012, the result being that the environmental assessment will continue as a screening level assessment. This environmental assessment meets these requirements, as well as the requirements of the C-NLOPB *Development Plan Guidelines* (C-NLOPB 2006).

In addition, the NLDEC considered the WREP an undertaking requiring an environmental preview report. This environmental assessment is to satisfy the requirements of both the EPA and CEAA. In that regard, a harmonized and coordinated review process will be implemented between the C-NLOPB and provincial requirements.

17.1 Summary of Proposed Activities

The WREP is considering two options to develop the West White Rose pool: a WHP or a sub-sea drill centre (existing field development method). The WREP also includes potential future construction and installation of up to two additional subsea drill centres elsewhere in the White Rose field.

The WHP consists of a CGS mated to a topsides structure. The CGS (less than 50 percent of the size of the Hibernia and Hebron gravity base structures as currently designed) will contain up to 48 well slots. The topsides structure will include drilling facilities, wellheads and support services such as accommodations for 120 to 130 persons, utilities and a helideck. The topsides will be constructed at an existing fabrication facility and is therefore not included in this environmental assessment.

The WHP development option proposes the construction of a CGS in Argentia, NL. The proposed CGS construction site is a brownfield location on the northeast portion of the Northside Peninsula, bordering Argentia Harbour. The CGS will be completely constructed in a dry graving dock. Excavation and dredging activities will be required near the graving dock construction site and at Corridor 1 and Corridor 2, to deepen the tow-out route for the CGS. Upon completion, the CGS will be floated to a deep-water mating site in Placentia Bay, where it will be mated with the topsides structure. The WHP will then be towed to and installed in the western portion of the White Rose field and tied back to the *SeaRose FPSO*.

The subsea development option includes a subsea drill centre and flowlines tied back to the *SeaRose FPSO*, similar to each of the other White Rose drill centres installed to date. The activities associated with the subsea option have previously been assessed under the *Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment Addendum* (LGL 2007a). As part of that assessment, the construction of the subsea drill centre for the West White Rose pool, plus four other subsea drill centres were assessed for the White Rose field. The temporal scope of that assessment was from 2007 to 2015. Just two of those drill centres has been excavated to date, the North Amethyst and the SWRX drill centres. Associated with the environmental assessment of these drill centres was a fish habitat compensation program for all five of the drill centres. A fish habitat compensation agreement (Authorization No. 07-01-002) and monitoring program has been in place with DFO since 2007.

17.2 Summary of Assessment Findings

17.2.1 Results of White Rose Extension Project Modelling

The environmental effects analysis on fish and fish habitat, marine birds, marine mammals and sea turtles and species at risk considered the results of the noise, dredging, drill cuttings dispersion, SBM whole mud spill and oil spill modelling to determine the potential affected area for each VEC and to enhance the rigour of the environmental assessment. Oil spill trajectory modelling was also used in the environmental effects assessment on fisheries (which also included the results of the noise model) and sensitive areas.

Dredging can have a sound source level as high as 195.4 dB re µPa at 1 m from the dredger (JASCO 2012). Results of acoustic modelling (JASCO 2012) for two different types of dredgers (a cutter suction dredge and a trailing suction hopper dredge) indicated that sound levels greater or equal to 180 dB re 1 µPa (rms) (un-weighted) occur at $R_{95\%}$ distances of 7 m or less. Sound levels of 160 dB re 1 µPa (rms) or greater we found to occur within 5 m ($R_{95\%}$) of the drilling activity (JASCO 2012).

Sediment suspension modelling showed that the thresholds for total particulate matter given in the *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME 2002) will not be exceeded. According to AMEC (2012a), maximum plume concentrations above 25 mg/L are expected to persist for no more than 4 hours for an average dredging operation in all wind scenarios. Concentrations above 10 mg/L would persist for approximately 6 hours, and levels above 5 mg/L would last for about 10 hours for a single dredging operation. Plume concentrations above 25 mg/L are expected to occur within limited areas of approximately 0.7 km^2. The only significant difference between the wind scenarios is observed in the extent and persistence of plume concentrations above 1 mg/L (but below 5 mg/L), where the southwesterly winds are about twice as efficient at dispersing these low levels of suspended sediment (within 21.9 hours) compared to the northwesterly winds (37.8 hours), and the most frequent, westerly wind conditions (32.6 hours).

The drift of WBM and cutting under the WHP option is predicted to be within a range of 2 to 4 km for up to 40 wells, with a maximum extent of 5 km to the southeast and northeast. WBM and cuttings are expected to be less than 1 mm thickness over this area. Cuttings thicknesses directly under the WHP are modelled to be 1.8 m; however, from 200 to 500 m from the discharges source, thicknesses are predicted to average 1.8 mm (AMEC 2012b). In comparison to the WHP option, the subsea drilling centre (MODU) option would result in WBM cuttings thicknesses approximately one-third to one-quarter less than that of WHP drilling within 100 m from site, with little difference in cuttings thickness between the two options beyond 100 m (AMEC 2012b). The difference is due to fewer wells drilled (16 in comparison to 40 wells under the WHP option), as well as reduced volume of cuttings released (267 m^3 per well in comparison to 295 m^3). If the WHP development option is selected, then SBM cuttings will be re-injected if a suitable disposal formation is available; this option is not technically feasible for MODU drilling. Within 100 m of the drill centre, initial SBM cuttings thicknesses are predicted to be 11.7 cm on average. Thicknesses are predicted to be 1.0 mm average 100 to 200 m out from the drill centre and 0.1 mm average from 200 to 500 m (AMEC 2012b).

Modelling to predict the footprint and potential effects of an SBM whole mud accidental release (AMEC 2012c) was based on the synthetic drilling fluid Puredrill IA-35LV (65 percent by volume), with a total density of 1,350 kg/m^3. Four spill scenarios were modelled over varying fall velocities and release times as well as seasons. The maximum deposition footprint occurred in winter for the riser flex joint scenario, with the lowest fall velocity and longest release period (three hours). The majority of modelled spills had a footprint of 1,800 m^2 or smaller (e.g., 30 m by 60 m). The smallest footprints (30 m b 30 m) were modelled for the BOP disconnect scenario over a relatively short release time (one hour) and at a high fall velocity (AMEC 2012c).

Modelling of an unmitigated nearshore oil spill scenario found that a high proportion (55 to 94 percent) of the modelled slicks reach the shoreline due to the close proximity of the spill sites modelled to shore (near Argentia and the two possible deep-water mating sites) and due to the prevailing westerly and southwesterly winds in Placentia Bay. The minimum time to shore ranged from two to five hours if there was no spill response (SL Ross 2012). During the months of March and July, over 55 percent of the modelled spills (diesel slick) reached the shore within less than 24 hours, and more than 75 percent of the modelled spills reached the shoreline within 48 hours. Survival time of the diesel fuel that did not reach the shoreline ranged from a minimum of 0.5 days to 8 days (SL Ross 2012). The average summer and winter conditions were modelled based on wind speed and water temperature. There are few differences in the fate of the spills between the two seasons.

Models for both subsea and surface blowouts were produced by SL Ross (2012), based on oil flow rates of 6,435 m^3 per day and 3,963 m^3 per day during winter and summer scenarios. Based on modelling results, the oil spill trajectory for the Offshore Project Area covers an extensive area due to the quick dispersal and the amount of hydrocarbons that could potentially be released in the event of such an accident. The winter zone of influence is smaller than in summer due to strong, persistent westerly winds in the winter, creating a tighter trajectory. The summer wind direction is more variable and the modelled slick moves over a wider area. Overall, a release of crude oil from the Offshore Project Area would persist and surface slicks would remain for several weeks. Of the 83,220 oil slicks modelled, Just 0.04 percent of slicks were predicted to reach the shore.

17.2.2 Air Quality

To assess potential effects on air quality in the nearshore and offshore environments, an emissions inventory was used to predict the annual emissions released and modelling (Stantec 2012c) estimated the maximum ground-level concentrations. The change in air quality attributable to the construction, operation and decommissioning of the WREP (both development options) is expected to be low in magnitude, local in extent, short-term in duration (during construction, but continue for the life of the WREP during operation) and reversible. Components associated with all phases of the WREP for both development options, including power generation, MODU operation, flaring and fugitive releases, as well as accidental releases and cumulative environmental effects, will result in emissions that will not exceed applicable maximum ground-level concentrations.

Construction and operation of the WREP (both development options) will result in GHG emissions. The magnitude of these emissions is ranked low (subsea drill centre option) to medium (WHP option) for both the construction (which applies only to the WHP option) and operation phases (which applies to both options) of the WREP. The WHP development option would require the preparation of a GHG management plan. By implementing appropriate mitigation measures, the environmental effects on Air Quality during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, are predicted to be not significant.

17.2.3 Fish and Fish Habitat

To assess the effects on Fish and Fish Habitat, models were used to determine the extent of the potential effects of noise, dredging and drill cuttings dispersion (see Section 17.2.1). Environmental effects of routine WREP activities from construction, installation, operation and maintenance, decommissioning and abandonment and potential future activities are generally low in magnitude, of limited geographic extent and reversible. Based on planned mitigation and the nature of the environmental effects, the environmental effects of routine WREP activities on Fish and Fish Habitat during the construction, installation and operation and maintenance phases of the WREP (including cumulative environmental effects) are predicted to be not significant.

An accidental event in the nearshore is not expected to cause a significant adverse effect on Fish and Fish Habitat, defined as a decrease in abundance or alteration in distribution of the population over more than one generation. Likewise an accidental event in the offshore is predicted to be reversible and is not expected to cause a significant adverse effect on Fish and Fish Habitat.

The potential residual adverse environmental effects of the WREP (including accidental events) on Fish and Fish Habitat are not considered of sufficient geographic extent, magnitude, duration, frequency and/or irreversibility to result in a decline in abundance or change in distribution of a population(s) over more than one generation within the Nearshore and/or Offshore Study Areas.

17.2.4 Fisheries

The required safety zones during nearshore dredging and topsides mating will create a temporary loss of access to fishing grounds and potential interference with vessel transit. As the majority of material delivered to the CGS construction site will be by land, marine traffic associated with the WREP will be minimal. Any marine traffic associated with the CGS construction will use designated routes. Dredging will be planned to void fish harvesting times, where possible. Husky will also work with active fish harvesters potentially affected by the CGS tow-out from the graving dock to the deep-water mating site and from the deep-water mating site to the White Rose field to ensure safety and minimize disturbance.

The established White Rose Safety Zone offshore has restricted fish harvesting since 2005 to avoid potential interactions between fishing gear and subsea equipment. Considering the relatively low level of fish harvesting within the Offshore Project Area in recent decades, few gear conflicts or effects are likely to occur from the WREP. The greatest potential for interaction is along the route from ports servicing the WREP to the Offshore Project Area. However, the vessels associated with the WREP will use existing routes established by current White Rose field operations.

Economic effects from accidental events resulting in loss of access, gear damage or product marketability could be considered significant to the fisheries. However, the application of appropriate mitigative measures (e.g., economic compensation) would reduce the potential effect to not significant. Likewise, the existing Gear and Vessel Damage Compensation Program would apply to damage resulting from activities associated with the WREP.

With the proposed mitigation measures in place, the environmental effects on Fisheries during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, are predicted to be not significant.

17.2.5 Marine Birds

Adverse environmental effects of attraction of birds to lights on structures and vessels during the construction/installation, operation and maintenance, and decommissioning and abandonment phases of the WREP are predicted to be low in magnitude, geographic extent, duration and frequency when mitigation measures are practiced (e.g., use only lights as necessary for safe operations). Although light-related effects could result in bird mortality, these environmental effects are predicted to be not significant at the population level.

Adverse environmental effects of accidental events (i.e., hydrocarbon and other chemical spills due to collisions, subsea blowouts, batch spills, marine vessel incidents, graving dock breach, synthetic-based mud (SBM) whole mud spills) are predicted to be low to high in magnitude, low to high in geographic extent, low to moderate in duration and low in frequency.

The environmental effects on Marine Birds during the construction, installation and operation and maintenance phases of the WREP, including cumulative environmental effects, are predicted to be not significant. While the environmental effects on Marine Birds from a large, persistent accidental event could be significant, such a significant effect is considered not likely.

17.2.6 Marine Mammals and Sea Turtles

Adverse environmental effects of underwater noise on marine mammals and sea turtles during the construction/installation, operation and maintenance and decommissioning and abandonment phases of the WREP are predicted to be mostly localized, of low to medium magnitude, and reversible at the population level when mitigation measures are practiced in both the Nearshore and Offshore Study Areas.

For WREP activities such as wellsite surveys, Husky will implement a marine mammal and sea turtle observation program consistent with the requirements outlined in the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines*. Data on marine mammal and sea turtle observations will be provided to DFO and the C-NLOPB where applicable.

Depending on the time of year, location of animals within the affected area and type of oil spill or blow-out, the effects of a nearshore or offshore oil release on the health of cetaceans is predicted to range from negligible to low magnitude over varying geographic extents.

The environmental effects on Marine Mammals and Sea Turtles during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, are predicted to be not significant.

17.2.7 Species at Risk

Many of the potential environmental effects of the WREP on species at risk, and associated mitigation measures, are the same as those for non-listed species. On an ecosystem basis, the at-risk and not at-risk species and their habitats are often highly integrated.

With the application of appropriate mitigation, the potential residual adverse environmental effects of the WREP on marine fish species at risk from routine WREP activities are not considered of sufficient geographic extent, magnitude, duration, frequency and/or irreversibility to result in the killing or harming of a fish species that is listed as extirpated, endangered or threatened, and therefore the effects are considered not significant in the Nearshore and/or Offshore Study Area. The residual adverse environmental effects of an accidental hydrocarbon spill on marine fish SAR populations are predicted to be not significant.

The *Statement of Canadian Practice on Mitigation of Seismic Noise in the Marine Environment*, appended to the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012d) will be followed to minimize environmental effects on at-risk marine mammals and sea turtles. WREP activities are mostly localized, of low to medium magnitude, and reversible at the population level. The environmental effects on marine mammal and sea turtles Species at Risk during the construction, installation and operation and maintenance phases of the WREP, including accidental events and cumulative environmental effects, is predicted to be not significant. A hydrocarbon spill associated with the WREP will not result in any significant residual environmental effects to at-risk marine mammals or sea turtles in the Nearshore or Offshore Study Areas.

Given that WREP activities are mostly localized, of negligible to low magnitude, and reversible, there are not likely to be significant adverse environmental effects on marine bird Species at Risk from routine WREP in the Nearshore or Offshore Study Areas.

Adverse environmental effects of accidental events (i.e., hydrocarbon and other chemical spills due to collisions, failure of lines, subsea blowouts, batch spills, marine vessel incidents, graving dock breach, SBM whole mud spills) are predicted to be low to high in magnitude, low to high in geographic extent, low to moderate in duration and low in frequency. Although hydrocarbon spills have the potential of being significant at the individual level, these environmental effects are predicted to be reversible at the population level. Nevertheless, the environmental effects of hydrocarbon spills have the potential of being significant. Smaller scale spills and blowouts in calm conditions may be mitigated via oil spill response measures and marine bird rehabilitation; however, these mitigations are recognized to be limited. Husky will adhere to safety and risk management systems, management of change procedures, and global standards. There will be an emphasis on accident prevention at all phases of the WREP.

17.2.8 Sensitive Areas

Sensitive areas of habitat within the Nearshore Study Area include the Placentia Bay Extension Ecologically and Biologically Significant Area (EBSA), eelgrass beds, capelin beaches, coastal wetlands, Important Bird Areas and otter haul-outs. Of these, eelgrass beds are most vulnerable to project activities. Outside the areas to be dredged, a change in habitat quality due to sedimentation is not expected to have considerable adverse environmental effects since eelgrass is resilient to sedimentation in the water column. As there are multiple eelgrass beds in the Nearshore Study Area, the removal of one small eelgrass beds from near the graving dock is considered to be not significant.

In a worst-case scenario, all sensitive areas within the Nearshore Study Area could be affected by an accidental spill. Although the likelihood of an oil spill in the Nearshore Study Area from an accidental event or collision is low, spill prevention procedures and contingency planning will be developed to prepare for an accidental event. In the unlikely event of a diesel spill in the Nearshore Study Area, these procedures and plans will be implemented to reduce the severity and duration of interactions between hydrocarbons and Sensitive Areas. Significant residual adverse environmental effects on these Sensitive Areas are therefore not considered likely.

Sensitive Areas in the Offshore Study Area include EBSAs identified by DFO where there is high productivity and/or aggregations of species, as well as sensitive areas identified by NAFO including Vulnerable Marine Ecosystems, coral-sponge areas and the Bonavista cod box. Oil spill trajectory modelling indicates that hydrocarbons from a spill at the Offshore Project Area have the potential to interact with Sensitive Areas, in the absence of countermeasures. Spill prevention and contingency plans will be in place to reduce the likelihood of an accidental event occurring, and the likelihood of hydrocarbons reaching a Sensitive Area. SBM modelling suggests that SBM is unlikely to reach any Sensitive Areas.

The environmental effects on Sensitive Areas from activities associated with the WREP, including accidental events and cumulative environmental effects, are predicted to be not significant.

17.3 Summary of Proposed Mitigation Measures

The proposed mitigation measures for each of the VECs are outlined in Table 17-1 for each phase of the WREP and accidental events.

Husky has an Environmental Protection and Compliance Monitoring Plan (see Section 16.2) for its existing activities in the White Rose field, which will be reviewed and revised as necessary to include the WREP. Husky's existing contingency plans will be revised to incorporate activities associated with the WREP prior to the onset of any WREP activities. Husky is strongly committed to protecting its employees, contractors, general public, assets and the environment in which we operate. This commitment is clearly communicated in its Health, Safety and Environment Policy. Husky has developed the HOIMS as a systematic approach towards operational excellence. Husky ensures compliance with HOIMS and regulatory requirements through the implementation of effective management systems and processes, as well as through the allocation of adequate resources. The Atlantic Region's management system includes plans for ice management, waste management, oil spill response and contingency plans for emergency events.

Husky will continue to comply with all regulatory requirements respecting environmental protection during offshore drilling and production operations, in accordance with the *Drilling and Production Guidelines* (C-NLOPB and CNSOPB 2011), OWTG (NEB et al. 2010), *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands* (NEB et al. 2009), *Environmental Protection Plan Guidelines* (NEB et al. 2011), *Offshore Physical Environmental Guidelines* (NEB et al. 2008) and the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012d).

Table 17-1 Proposed Mitigation by Phase and Valued Environmental Component

Applicable VEC	Mitigation
Nearshore Pre-construction and Construction	
Air Quality	• Dust suppression • Proper maintenance and efficient operation of machinery • Dust collection system for concrete batch plant • Equipment maintenance and inspections • Adhere to NL *Air Pollution Control Regulations, 2004* and CEPA National Ambient Air Quality Objectives

Applicable VEC	Mitigation
Fish and Fish Habitat Marine Birds Marine Mammals and Sea Turtles Species at Risk (Marine Fish, Marine Mammals and Sea Turtles and Marine Birds) Sensitive Areas	• Equipment design • Compliance with *Fisheries Act* Authorization • Use of industry best practices • Compliance monitoring and treatment as required before discharge • Settling pond • Adherence to DFO's *Freshwater Intake End-of-Pipe Fish Screen Guideline* • Safety zone • Adhere to CWS recovery and release protocol for stranded bird • Evaluate use of shielding and deflectors with directional lighting and incorporate where safe • Maintain steady course and safe speed when possible • Avoid/deviate course for marine mammal and sea turtle and marine bird concentrations when possible • Minimum altitude of 300 m and lateral distance of 2 km over active colonies, including Cape St. Mary's Ecological Reserve and elsewhere when possible
Fisheries	• Fisheries Liaison Committee (FLC) • Fisheries Liaison Officer (FLO) • Single point of contact (SPOC) • Communication/notifications • Gear damage compensation • Loss of access compensation • Use of agreed routes/Vessel Traffic Separation Scheme
Nearshore Accidental Events	
Air Quality	• Spill prevention plan • Spill response training, preparation, equipment inventory and emergency response drills • Routine inspections of equipment • Vessels will not be re-fueled in the Nearshore Project Area • Oil Spill Response Plan • Adhere to MARPOL
Fish and Fish Habitat Marine Birds Marine Mammals and Sea Turtles Species at Risk (Marine Fish, Marine Mammals and Sea Turtles and Marine Birds) Sensitive Areas	• Training, preparation, equipment inventory, prevention, and emergency response drills • Spill Prevention Plan • Oil Spill Response Plan • Vessels will not be re-fueled in the Nearshore Project Area • Adhere to MARPOL • Design of graving dock • Prevention through design standards and maintenance • Emergency Response Contingency Plan
Fisheries	• Clean-up • Compensation
Offshore Installation, Operation and Maintenance, Decommissioning and Abandonment, Potential Future Activities	
Air Quality	• Efficient technology • Use of natural gas as primary fuel • Properly maintained and efficient operation • Maintenance and inspections • Monitor the number of flaring events • Investigate the use of efficient/reduced emission and incorporate into design where technically and economically feasible

Applicable VEC	Mitigation
Fish and Fish Habitat Marine Birds Marine Mammals and Sea Turtles Species at Risk (Marine Fish, Marine Mammals and Sea Turtles and Marine Birds)	• Planning • Equipment design • Use only lights as necessary for safe operations • Compliance with *Fisheries Act Authorization* • Adhere to *Canada Shipping Act, 2001* • Minimize seabed disturbance • Adhere to OWTG • Solid waste disposed of properly onshore • Adherence to *Statement of Canadian Practice on Mitigation of Seismic Noise in the Marine Environment* in the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* • Reinjection of SBM cuttings if WHP is used • Use of *Offshore Chemical Selection Guidelines* • Avoid/deviate course for marine bird and marine mammal concentrations when possible • Maintain steady course and safe speed when possible • Minimum altitude of 300 m and lateral distance of 2 km over active colonies, including Cape St. Mary's Ecological Reserve and elsewhere when possible • Adhere to CWS recovery and release protocol for stranded bird • Evaluate use of shielding and deflectors with directional lighting and incorporate where safe • Use of best practices and improvement programs • Subsurface waste discharge • Re-use of drill mud
Fisheries	• Route analysis/selection • FLO • SPOC • Communication/notification • Gear damage compensation
Accidental Events	
Air Quality	• Train personnel in spill prevention and awareness • Spill Response Plan • Drilling design and geotechnical surveys • Alert/Emergency Response Contingency Plan • SOPs for oil handling operations • Routine maintenance, including leak detection and repair • SOPs for chemical handling and storage • Risk awareness, emergency response and preventative measures, training on fuel handling and storage
Fish and Fish Habitat Marine Birds Marine Mammals and Sea Turtles Species at Risk (Marine Fish, Marine Mammals and Sea Turtles and Marine Birds) Sensitive Areas	• Spill Prevention Plan • Oil Spill Response Plan • Use of best practices and continual improvement programs • Training, preparation, equipment inventory, prevention, and emergency response drills • Preparation for contingency planning and clean up
Fisheries	• Clean-up • Compensation

17.4 Summary of Monitoring and Follow-up

A comprehensive environmental protection plan (EPP) for onshore and nearshore activities will be submitted to the Province of Newfoundland and Labrador for review in Q1 2013. The EPP will outline Husky's approach to monitoring the potential environmental effects of graving dock and CGS construction and ensuring the regulatory compliance of all associated activities.

Husky's existing EEM monitors the effects of its offshore activities in the White Rose field. The existing EEM design will be revised to incorporate the West White Rose pool development option and potential future development options as required.

As per requirements under its fish habitat compensation approval (Authorization No. 07-01-002 - for up to five subsea drill centres), Husky will continue to conduct the fish habitat compensation monitoring program in North Harbour. The requirements for further fish habitat compensation and monitoring will be discussed with DFO in light of changes to the *Fisheries Act*.

For wellsite and VSP activities in the Offshore Study Area, Husky will implement a marine mammal and sea turtle observation program. The program will be consistent with the requirements outlined in the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012d). Data on marine mammal and sea turtle observations will be provided to DFO and the C-NLOPB where applicable.

In the event of a spill, and depending on the nature and size of the spill, marine bird monitoring will be implemented. The details regarding monitoring requirements and protocols are outlined in the oil spill response plan and will be determined in consultation with the C-NLOPB and Environment Canada.

Husky conducts an environmental monitoring program to record weather and ice conditions in the White Rose field. This program will be expanded to include environmental monitoring at the WREP offshore location.

Husky will provide quarterly reports to the Province during the construction phase, including information on the number of people employed by four-digit NOC code, the number of apprentices and journeypersons, gender and residency of the workforce. During the operations phase, Husky will continue to report to the C-NLOPB quarterly on Canada-Newfoundland and Labrador Benefits associated with the WREP, including headcount by occupation type, residency and gender for Husky and its major contractors. Husky will also report annually to the C-NLOPB on the percentage of its workforce and that of its contractors that are comprised of the four designated groups: women; Aboriginal persons; persons with disabilities; and visible minorities.

Husky will submit to the Minister responsible for the Status of Women and the Minister of Natural Resources, a WREP-specific diversity plan for the construction phase of the WREP. This plan will include strategies for women's employment and business access. Husky has in place an approved Diversity Plan with the C-NLOPB, which will continue to govern operation of the WREP.

17.5 Conclusions

A summary of the residual environmental effects assessment for each of the identified VECs is provided in Table 17-2. The residual adverse environmental effects from planned routine activities associated with the WREP are predicted to be not significant. Most environmental effects are predicted to be reversible, of limited duration, magnitude and geographic extent. The only potential for significant residual adverse environmental effects as a result of the WREP is associated with a large-scale accidental event. Should an accidental event occur, significant adverse environmental effects have been predicted for Marine Birds and marine bird Species at Risk; however, the likelihood of an accidental event of this magnitude occurring is considered very low. Husky will design the WREP and conduct all activities with a focus on safety and pollution prevention. Should the WHP option be selected, a site-specific EPP will be developed in consultation with regulatory authorities to help prevent and mitigate any accidental events.

Table 17-2 Significant and Not Significant Residual Adverse Environmental Effects on Valued Environmental Components

VEC	Significance of Residual Environmental Effect					
	Construction and installation	Operation and Maintenance	Decommissioning and Abandonment	Accidental Events	Project Overall	Cumulative Environmental Effects
Air Quality	NS	NS	NS	NS	NS	NS
Marine Fish and Fish Habitat	NS	NS	NS	NS	NS	NS
Fisheries	NS	NS	NS	NS	NS	NS
Marine Birds	NS	NS	NS	S	NS	NS
Marine Mammals and Sea Turtles	NS	NS	NS	NS	NS	NS
Marine Fish Species at Risk	NS	NS	NS	NS	NS	NS
Marine Mammal and Sea Turtle Species at Risk	NS	NS	NS	NS	NS	NS
Bird Species at Risk	NS	NS	NS	S	NS	NS
Special Areas	NS	NS	NS	NS	NS	NS
S = Significant residual environmental effect NS = Not significant residual environmental effect						

Since the temporal scope for the offshore component of the WREP is over two decades, Husky recognizes that the regulatory and biophysical environment may change during that timeframe from that assessed in this report. The renewal of any applicable authorizations and/or any important changes in environment or resource use in the Offshore Project Area requires a current and valid environmental assessment. As authorizations are renewed or new ones are required over the life of the WREP, Husky will submit the necessary documentation to the C-NLOPB and federal regulatory authorities to confirm that proposed activities are captured within the scope of the WREP and that environmental assessment predictions remain valid, including those for Species at Risk.

Husky has and will continue to follow a performance assessment and continuous improvement approach with respect to environmental management of the WREP (1 of the 14 fundamental elements of the HOIMS). Husky ensures compliance with HOIMS and regulatory requirements through the implementation of effective management systems and processes, as well as through the allocation of adequate resources.

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18.0 REFERENCES

18.1 Personal Communications

AMEC Earth & Environmental, *Grand Banks Beaufort Seas Persistence for Spill Response*. Email prepared for Husky Energy, March 2004.

Boyd, C., Clearwater Seafoods Inc., 2010.

Bowering, J., Corporate Communications and Privacy Coordinator, Newfoundland and Labrador Housing Corporation. Email January 27, 2012.

Brazil, J., Newfoundland and Labrador Wildlife Division, 2006.

Brodie, W., Senior Science Coordinator/Advisor, Northwest Atlantic Fisheries Organization, Fisheries and Oceans Canada, St. John's, NL.

Budgell, T., Newfoundland and Labrador Department of Fisheries and Aquaculture, 2006; 2012.

Collins, W., Placentia Bay Fisher, 2012.

Dawe, E., Fisheries and Oceans Canada, 2011.

Grant, C., Section Head, Marine Habitat, Habitat Protection Division, Fisheries and Oceans Canada, St. John's, NL. Letter dated October 2, 2012.

Han, G., Research Scientist, Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre, St. John's, NL. Email: "Monthly-mean near-surface climatology for Placentia Bay, based on FVCOM model", March 16, 2012.

Harris, E., Personal Correspondence, Oceanweather, October 15, 2007.

Harris, P., Canadian Wildlife Service, 2006.

Hurley, M., Fisheries and Oceans Canada, 2012.

Hogan, W., Mayor of Placentia. Telephone call February 6, 2012.

Janes, C., Senior Market Analyst, Canada Mortgage and Housing Corporation, St. John's, NL, 2012.

King, J., Clarke Real Estate, Placentia. Email January 16, 2012.

Lawson, J., Research Scientist, Marine Mammals Section, Fisheries and Oceans Canada, St John's, NL, 2007.

Lawson, J., Research Scientist, Marine Mammals Section, Fisheries and Oceans Canada, St. John's, NL, 2009.

Lee, R., Fisheries and Oceans Canada, 2011.

McDonald, C,. Area Operations/ISPS Officer, Transport Canada, St. John's, NL, 2012.

Mactavish, B., Biologist,. LGL Limited, 2007.

O'Rourke, J., Fisheries and Oceans Canada, Habitat Biologist, NL Region, Telephone Interview, July 18, 2012.

Slade, D., Wildlife Officer (retired).

Temple, G., Fishery Officer, Fisheries and Oceans Canada, NL Region, Placentia Detachment, Placentia, NL, Telephone Interview. February 24, 2012.

Tobin, F., Placentia Bay Fisher, 2012.

Wilhelm, S., Marine Issues Biologist, Northern Conservation, Canadian Wildlife Service, Environment Canada, Mount Pearl, NL.

18.2 Literature Cited

Aalbers, S.A. and M.A. Drawbridge. 2008. White sea bass spawning behavior and sound production. *Transactions of the American Fisheries Society*, 137(2): 542-550.

Abbriano, R.M., M.M. Carranza, S.L. Hogle, R.A. Levin, A.N. Netburn, K.L. Seto, S.M. Snyder and P.J.S. Franks. 2011. *Deepwater Horizon* oil spill: a review of the planktonic response. *Oceanography* 24(3): 294-301.

Abgrall, P., A.L. Lang and V.D. Moulton. In Preparation. *Marine Mammal and Seabird Monitoring of Statoil Hydro's, Petro-Canada's and Husky Energy's 3-D Seismic Program in the Jeanne d'Arc Basin, 2008.* Report by LGL Limited, St. John's, NL, for Statoil Hydro, Petro-Canada and Husky Energy.

Abgrall, P., A.L. Lang and V.D. Moulton. 2008a. *Marine Mammal and Seabird Monitoring of Husky Energy's 3-D Seismic Program in the Jeanne d'Arc Basin, 2006 and 2005-2006 Combined*. LGL Rep. SA920. Rep. by LGL Limited, St. John's, NL, for Husky Energy Inc., St. John's, NL. 98 pp. + Appendices.

Abgrall, P., A.L. Lang, B.D. Mactavish and V.D. Moulton. 2009. *Marine Mammal and Seabird Monitoring of StatoilHydro Canada and Husky Energy's 2008 Seismic Program in the Jeanne d'Arc Basin*. LGL Rep. SA984, Rep. by LGL Limited, St. John's, NL, for StatoilHydro Canada Exploration & Production Inc., and Husky Energy Inc., St. John's, NL, Calgary, AB.

Abgrall, P., B.D. Mactavish and V.D. Moulton. 2008b. *Marine Mammal and Seabird Monitoring of Orphan Basin Controlled Source Electromagnetic Survey Program, 2006-2007*. LGL Rep. SA904/939. Rep. by LGL Limited, St. John's, NL, for ExxonMobil Canada Ltd., St. John's, NL. 96 pp. + Appendices.

Abgrall, P., B.D. Mactavish and V.D. Moulton. 2007. *Marine Mammal and Seabird Monitoring of Orphan Basin Controlled Source Electromagnetic Survey Program, 2006*. LGL Rep. SA904. Rep. by LGL Limited, St. John's, NL, for ExxonMobil Canada Ltd., St. John's, NL. 88 pp. + Appendices.

Abgrall, P. and V.D. Moulton. 2007. *Marine Mammal Surveys in Placentia Bay, 2006 – 2007*. LGL Rep. SA914C-1, Rep. by LGL Limited, St. John's, NL, for SNC Lavalin, Mt. Pearl, NL. 12 pp. + Appendices.

Ackleh, A.S., G.E. Ioup, J.W. Ioup, B.Ma, J.J. Newcomb, N. Pal, N.A. Sidorovskaia and C. Tiemann. 2012. Assessing the *Deepwater Horizon* oil spill impact on marine mammal population through acoustics: Endangered sperm whales. *Journal of the Acoustical Society of America*, 131: 2306-2314.

Adams, J. 1986. Changing assessment of seismic hazard along the southeastern Canadian Margin. Pp. 42-53. In: *Proceedings of the 3rd Canadian Conference on Marine Geotechnical Engineering*, Volume 1.

Adams, J., P. Basham and S. Halchuk. 1995. Northeastern North America earthquake potential – New challenges for seismic hazard mapping. *Current Research of the Geological Survey of Canada*, 1995-D: 991-999.

Adams, J. and S. Halchuk. 2003. Fourth generation seismic hazard maps of Canada: Values for over 650 Canadian localities intended for the 2005 Building Code of Canada, *Geological Survey of Canada Open File*, 4459: 155 pp.

Adams, J., D. Weichert and S. Halchuk. 1999. Trial seismic hazard maps of Canada - 1999: 2%/50 Year values for selected Canadian cities. *Geological Survey of Canada Open File*, 3724: 114 pp.

Adcroft, A., R. Hallberg, J.P. Dunne, B.L. Samuels, J.A. Galt, C.H. Barker and D. Payton. 2010. Simulations of underwater plumes of dissolved oil in the Gulf of Mexico. *Geophysical Research Letter*, 37: doi:10.1029/2010GL044689.

Afanasyev, Y.D., N.P. Nezlin and A.G. Kostianoy. 2001. Patterns of seasonal dynamics of remotely sensed chlorophyll and physical environment in the Newfoundland region. *Remote Sensing of the Environment*, 76(2): 268-282.

Aguilar-Soto, N., M. Johnson, P.T. Madsen, P.L. Tyack, A. Bocconcelli and J.F. Borsani. 2006. Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)? *Marine Mammal Science*, 22(3): 690-699.

Aiken, D.E. and S.L. Waddy. 1986. Environmental influence on recruitment of the American lobster *Homarus americanus*: A perspective. *Canadian Journal of Fisheries and Aquatic Sciences*, 43(11): 2258-2270.

Ainley, D.G., C.R. Grau, T.E. Roudybush, S.H. Morrell and J.M. Utts. 1981. Petroleum ingestion reduces reproduction in Cassin's Auklets. *Marine Pollution Bulletin*, 12: 314-317.

Albers, P.H. 1977. Effects of external applications of fuel oil on hatchability of Mallard eggs. Pp. 158-163 In: D.A. Wolfe (ed.). *Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms*. Pergamon Press, Oxford, UK. 478 pp.

Albers, P.H. 1978. The effects of petroleum on different stages of incubation in bird eggs. *Bulletin of Environmental Contamination and Toxicology*, 19: 624-630.

Albers, P.H. and M.L. Gay. 1982. Unweathered and weathered aviation kerosene: Chemical characterization and effects on hatching success of duck eggs. *Bulletin of Environmental Contamination and Toxicology*, 28: 430-434.

Albers, P.H. and R.C. Szaro. 1978. Effects of No. 2 fuel oil on Common Eider eggs. *Marine Pollution Bulletin*, 9: 138-139.

Alexander, S.K. and J.W. Webb, Jr. 1985. Seasonal response of *Spartina alterniflora* to oil. Pp. 355-357. In: *Proceedings, Oil Spill Conference (Prevention, Behavior, Control, Cleanup)*, American Petroleum Institute, 25-28 February 1985, Los Angeles, CA.

Alonso-Alvarez, C., I. Munilla, M. López-Alonso and A. Velando. 2007. Sublethal toxicity of the *Prestige* oil spill on yellow-legged gulls. *Environment International*, 33: 773-781.

ALTRT (Atlantic Leatherback Turtle Recovery Team). 2006. *Recovery Strategy for Leatherback Turtle (Dermochelys coriacea) in Atlantic Canada*. *Species at Risk Act* Recovery Strategy Series, Fisheries and Oceans Canada, Ottawa, ON. vi + 45 pp.

Altwegg, R., R.J.M. Crawford, L.G. Underhill and A.J. Williams. 2008. Long-term survival of de-oiled Cape Gannets *Morus capensis* after the *Castillo de Bellver* oil spill of 1983. *Biological Conservation*, 141: 1924-1929.

AMA (Argentia Management Authority). No Date. *Argentia Management Authority Website*. Available at: http://www.argentia.ca/

AMEC Environment & Infrastructure. 2012a. *Environmental Impact Assessment White Rose Extension Project Dredging Assessment: Nearshore*. Prepared for Stantec Consulting Ltd., St. John's, NL.

AMEC Environment & Infrastructure. 2012b. *Environmental Impact Assessment White Rose Extension Project Drill Cuttings and WBM Operational Release Modelling*. Prepared for Stantec Consulting Ltd., St. John's, NL.

AMEC Environment & Infrastructure. 2012c. *Environmental Impact Assessment White Rose Extension Project SBM Accidental Release and Dispersion Modelling*. Prepared for Stantec Consulting Ltd., St. John's, NL.

Amoser, S. and F. Ladich. 2003. Diversity in noise-induced temporary hearing loss in otophysine fishes. *Journal of the Acoustical Society of America*, 113(4): 2170-2179.

Andersen, J.M., Y.F. Wiersma, G.B. Stenson, M.O. Hammill and A. Rosing-Asvid. 2009. Movement patterns of hooded seals (*Cystophora cristata*) in the Northwest Atlantic Ocean during the post-moult and pre-breed seasons. *Journal of Northwest Atlantic Fisheries Sciences*, 42: 1-11.

Anderson, C.M. and R.P. LaBelle. 2000. Update of comparative occurrence rates for offshore oil spills. *Spill Science and Technology Bulletin*, 6(5/6): 303-321.

Anderson, J.T., E.L. Dalley and E. Colbourne. 1999. Recent trends in the dominant pelagic fish species and environment in the Northwest Atlantic, NAFO 2J3KLNO. *DFO Canadian Stock Assessment Secretariat Research Document*, 99/114: i + 15 pp.

Andriguetto-Filho, J.M., A. Ostrensky, M.R. Pie, U.A. Silva and W.A. Boeger. 2005. Evaluating the impact of seismic prospecting on artisanal shrimp fisheries. *Continental Shelf Research*, 25: 1720-1727.

Antonio, F.J., R.S. Mendes and S.M. Thomaz. 2011. Identifying and modeling patterns of tetrapod vertebrate mortality rates in the Gulf of Mexico oil spill. *Aquatic Toxicology*, 105: 177-179.

AquaGIS. No Date. *Newfoundland and Labrador Aquaculture Geographic Information System*. Available at: www.aquagis.com

Archer, C.L. and K. Caldeira. 2008. Historical trends in the jet streams. *Geophysical Research Letters*, 35: L08803.

Archer, F.I., II. and W.F. Perrin. 1999. *Stenella coeruleoalba*. *Mammal Species*, 603: 1-9.

ARG (Argentia Remediation Group). 1995. *Phase III/IV, Environmental Site Assessment, U.S. Naval Facility, Argentia, NF. Report 2: Site Characterization; Volume 3: Ponds and Outlying Sites*. Report to Public Works and Government Services Canada.

ARG (Argentia Remediation Group). 1998. *Ecological Risk Assessment/Remedial Action Review, Argentia – Report 1: Shag, Little Shag, Island, The and Gull Ponds*. Public Works and Government Services Canada #782716.

Argentia Assessment Group, Jacques Whitford Environment Limited and G.S. Ringius and Associates. 1997. *Smelter/Refinery Site, Argentia, NF, Terrestrial Baseline Study Report*.

Argue, D.A. 2010. *The Deepwater Horizon Oil Spill and Seafood Prices*. Environmental Law Institute, Washington. Available at: http://www.eli.org/pdf/NA_40-11/40.11111.pdf

Armsworthy, S.L., P.J. Cranford, and K. Lee (Editors). 2005. *Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies*. Batelle Press, Columbus, OH. xvi + 631 pp.

Atkins, N. and S.L. Swartz (Editors). 1989. *Proceedings of the Workshop to Review and Evaluate Whale Watching Programs and Management Needs*, November 14-16, 1988, Monterey, CA. Center for Marine Conservation, Washington, DC. 53 pp.

Atkinson, D.B. 1994. Some observations on the biomass and abundance of fish captured during stratified random bottom trawl surveys in NAFO divisions 2J and 3KL, Autumn 1981-1991. *Northwest Atlantic Fisheries Organization Scientific Council Studies*, 21: 43-66.

Atkinson, G. and D. Boore. 1995. New ground motion relations for eastern North America. *Bulletin of the Seismological Society of America*, 85: 17-30.

Au, W.W.L. 1993. *The Sonar of Dolphins*. Springer-Verlag, New York, NY. 277 pp.

Au, W.W.L. and W.L. Perryman. 1985. Dolphin habitats in the eastern tropical Pacific. *Fisheries Bulletin*, 83(4): 623-643.

Aumack, C.F., K.H. Dunton, A.B. Burd, D.W. Funk and R.A. Maffione. 2007. Linking light attenuation and suspended sediment loading to benthic productivity within an Arctic kelp-bed community. *Journal of Phycology* 43(5): 853-863.

Auster, P.J. 1989. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic and mid-Atlantic) - tautog and cunner. US Army Corp of Engineers, TR EL-82-4, *US Fish and Wildlife Service Biological Report*, 82(11.105): 13 pp.

Austin, D., W.D. Bowen, J.I. McMillan and S.J. Iverson. 2006. Linking movement, diving, and habitat to foraging success in a large marine predator. *Ecology*, 87: 3095-3108.

Azkona, A., I. Zuberogoitia, J.A. Martínez, J. Etxezarreta, A. Iraeta, I. Castillo, J. Zabala and S. Hidalgo. 2006. Short-term effects of the prestige oil spill on a colony of European storm-petrels *Hydrobates pelagicus*. *Acta Zoologica Sinica*, 52: 1042-1048.

BAE Group Ltd. & SNC Lavalin Environment Ltd. 1994. *ESA Phase II and III, Reconnaissance and Detailed Testing Program, Southside and Northeast Arm Camp, US Naval Facility Argentia, Argentia, NL*. Prepared for Public Works Canada and Government Services.

BAE-Newplan Group Limited. 2007. *Final Report - Issues Scan of Selected Coastal and Ocean Areas of Newfoundland and Labrador*. Prepared for the Newfoundland and Labrador Department of Fisheries and Aquaculture and the Newfoundland and Labrador Department of Environment and Conservation. Mount Pearl, NL. 144 p.

Bailey, H., B. Senior, D. Simmons, J. Rusin, G. Picken and P.M. Thompson. 2010. Assessing underwater noise levels during pile-driving at an offshore windfarm and its potential effects on marine mammals. *Marine Pollution Bulletin*, 60: 888-897.

Baillie, S.M., G.J. Robertson, F.K. Wiese and U.P. Williams. 2005. Seabird data collected by the Grand Banks offshore hydrocarbon industry 1999-2002: Results, limitations and suggestions for improvement. *Canadian Wildlife Service Technical Report Series*, No. 434: v + 47 pp.

Bain, D.E. and R. Williams. 2006. *Long-range Effects of Airgun Noise on Marine Mammals: Responses as a Function of Received Sound Level and Distance*. Paper SC/58/E35 presented to the IWC Scientific Committee, IWC Annual Meeting, 1-13 June, St. Kitts and Nevis.

Baird, R.W. 2000. The killer whale: Foraging specializations and group hunting. Pp. 127-153 In: J. Mann, R.C. Connor, P.L. Tyack and H. Whitehead (eds.). *Cetacean Societies: Field Studies of Whales and Dolphins*. University of Chicago Press. Chicago, IL. 448 pp.

Baird, R.W. 2001. Status of harbour seals, *Phoca vitulina*, in Canada. *Canadian Field-Naturalist*, 115(4): 663-675.

Baird, R.W. 2003. *Update COSEWIC Status Report on the Humpack Whale Megaptera novaeangliae in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 25 pp.

Baird, R.W. and P.J. Stacey. 1991. Status of Risso's dolphin, *Grampus griseus,* in Canada*. Canadian Field-Naturalist,* 105(2): 233-242.

Baird, R.W., P.J. Stacey and H. Whitehead. 1993a. Status of the striped dolphin, *Stenella coeruleoalba*, in Canada. *Canadian Field-Naturalist*, 107(4): 455-465.

Baird, R.W., E.L. Walters and P.J. Stacey. 1993b. Status of the bottlenose dolphin, *Tursiops truncatus*, with special reference to Canada. *Canadian Field-Naturalist*, 107(4): 466-480.

Bajzak, C.E., S.D. Cote, M.O. Hammill and G.B. Stenson. 2009. Intersexual differences in the postbreeding foraging behaviour of the Northwest Atlantic hooded seal. *Marine Ecology Progress Series*, 385: 285-294.

Baker, C.S. and L.M. Herman. 1989. *Behavioral Responses of Summering Humpback Whales to Vessel Traffic: Experimental and Opportunistic Observations*. NPS-NR-TRS-89-01. Report by Kewalo Basin Marine Mammal Laboratory, University of Hawaii, Honolulu, HI, for US National Park Services, Anchorage, AK. 50 pp. NTIS PB90-198409.

Baker, C.S., L.M. Herman, B.G. Bays and G.B. Bauer. 1983. *The Impact of Vessel Traffic on the Behavior of Humpback Whales in Southeast Alaska: 1982 Season*. Report by Kewalo Basin Marine Mammal Laboratory, Honolulu, HI, for US National Marine Mammal Laboratory, Seattle, WA. 30 pp. + fig., tables.

Baker, C.S., L.M. Herman, B.G. Bays and W.F. Stifel. 1982. *The Impact of Vessel Traffic on the Behavior of Humpback Whales in Southeast Alaska*. Rep. by Kewalo Basin Marine Mammal Laboratory, Honolulu, HI, for US National Marine Fisheries Servuice, Seattle, WA. 78 pp.

Baker, J.M., R.B. Clark, P.F. Kingston and R.H. Jenkins. 1990. Natural recovery of cold water marine environments after an oil spill. Pp. 173-177. In: *Proceedings of the Thirteenth Annual Arctic and Marine Oil Spill Program Technical Seminar*, 6-8 June, Edmonton, AB. Environment Canada, Ottawa, ON.

Baker, J.M., L. Guzman, P.D Bartlett, D.I. Little and C.M. Wilson. 1993. Long-term fate and effects of untreated thick oil deposits on salt marshes. Pp. 395-400. In: *Proceedings of the 1993 Oil Spill Conference*, American Petroleum Institute, Washington, DC.

Baker, K.D., V.E. Wareham, P.V.R. Snelgrove, R.L. Haedrich, D.A. Fifield, E.N. Edinger and K.D. Gilkinson. 2012. *Marine Ecology Progress Series*, 445: 235-249.

Bakke, T., J.A. Berge, K. Nøs, F. Oreld, L.O. Reiersen and K.Byrne. 1989. Longterm recolonization and chemical changes in sediments contaminated with oil-based drill cuttings. In: F.R. Englehardt, J.P. Ray and A.H. Gillam (eds.). *Drilling Waste*, Elsveier Applied Science Publishers Ltd., New York, NY. 872 pp.

Balazs, G. 1985. Impact of ocean debris on marine turtles: Entanglement and ingestion. Pp. 387-429 In: R.S. Shomura and H.O. Yoshida (eds.). *Proceedings of the Workshop on the Fate of Impact of Marine Debris*, Honolulu, HI.

Balcomb, K.C., III and D.E. Claridge. 2001. A mass stranding of cetaceans caused by naval sonar in the Bahamas. *Bahamas Journal of Science*, 8(2): 2-12.

Banfield, A.W.F. 1975. *The Mammals of Canada*. University of Toronto Press, Toronto, ON.

Banke, E. 1988. *Scour Survey at White Rose E-09*. Contract report submitted to Husky East Coast Operations. 52 pp.

Banke, E. 1989. *Recent Groundings and Scours on the Grand Banks of Newfoundland*. Submitted to The Atlantic Geosciences Centre at the Bedford Institute of Oceanography, Dartmouth, NS. Open File # 2528.

Barkaszi, M.J., D.M. Epperso, and B. Bennett. 2009. Six-year compilation of cetacean sighting data collected during commercial seismic survey mitigation observations throughout the Gulf of Mexico, USA. Pp. 24-25. In: *Abstract in the 18th Biennial Conference on the Biology of Marine Mammals*, Quebec, Canada, October 2009. 306 pp.

Barker T., I. Bashmakov, L. Bernstein, J.E. Bogner, P. R. Bosch, R. Dave, O.R. Davidson, B.S. Fisher, S. Gupta, K. Halsnæs, G.J. Heij, S. Kahn Ribeiro, S. Kobayashi, M.D. Levine, D.L. Martino, O. Masera, B. Metz, L.A. Meyer, G.J. Nabuurs, A. Najam, N. Nakicenovic, H.H. Rogner, J. Roy, J. Sathaye, R. Schock, P. Shukla, R.E.H. Sims, P. Smith, D.A. Tirpak, D. Urge-Vorsatz and D. Zhou. 2007. Technical summary. In: B. Metz, O.R. Davidson, P.R. Bosch, R. Dave and L.A. Meyer (eds.). *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK and New York, NY.

Barlow, J. and R. Gisiner. 2006. Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales. *Journal of Cetacean Research and Management*, 7(3): 239-249.

Barnes, J.L., M. Stephenson and L.H. Davey. 2000. An integrated approach to cumulative environmental effects assessment, meeting requirements of the *Canadian Environmental Assessment Act*. Pp. 20-33. In: K.C. Penney, K.A. Coady, M.H. Murdoch, W.R. Parker and A.J. Niimi (eds.). P*roceedings of the 27th Annual Toxicity Workshop*, October 1-4, 2000, St. John's, NL. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2331: 139 pp.

Barron, M.G. 2011. Ecological impacts of the *Deepwater Horizon* oil spill: Implications for immunotoxicity. *Toxicologic Pathology*: 10.1177/0192623311428474.

Bartol, S.M., J.A. Musick and M.L. Lenhardt. 1999. Auditory evoked potentials of the loggerhead sea turtle (*Caretta caretta*). *Copeia*, 1999(3): 836-840.

Barton, A.D., C.H. Greene, B.C. Monger and A.J. Pershing. 2003. The Continuous Plankton Recorder survey and the North Atlantic Oscillation: Interannual- to Multidecadal-scale patterns of phytoplankton variability in the North Atlantic Ocean. *Progress in Oceanography*, 58(2-4): 337-358.

Barry, S.B., A.C. Cucknell and N. Clark. 2012. A direct comparison of bottlenose and common dolphin behaviour during seismic surveys when airguns are and are not being utilized. Pp. 73-76. In: A. Hawkins and A.N. Popper (eds.). *The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology* Series No. 730. Springer, New York. 695 pp.

Basham, P.W. and J. Adams, 1982. *Earthquake Hazards to Offshore Development on the Eastern Canadian Continental Shelves*. Second Canadian Conference on Marine Geotechnical Engineering, June 8-10, Halifax, NS, National Research Council of Canada, Ottawa, ON. 6 pp.

Basham, P.W. and J. Adams. 1983. Earthquakes on the continental margin of Eastern Canada: Need future large events be confined to the locations of large historical events? Pp. 456-467. In: W.W. Hays and P.L. Gori (eds.). *Proceedings of Conference XX, A Workshop on The 1886 Charleston, South Carolina Earthquake and its Implications for Today*. USGS Open File Report OFR-83-843.

Basham, P.W., D.H. Weichert, F.M. Anglin and M.J. Berry. 1985. New probabilistic strong seismic ground motion maps of Canada. *Bulletin of the Seismological Society of America*, 75: 563-595.

Bates, S.S. 1997. Toxic phytoplankton on the Canadian East Coast: Implications for aquaculture. *Bulletin of the Aquaculture Association of Canada*, 3: 9-18.

Bates S.S. and F.J. Forbes. In Prep. *Phycotoxins and Harmful Marine Algae of Concern to Canada*.

Batterson, M., D. Taylor, T. Bell, D. Brushett and J. Shaw. 2006. Regional ice-flow mapping, surfical geology and till geochemistry of the Northern Burin Peninsula and adjacent Placentia Bay. Newfoundland and Labrador Department of Natural Resources *Geological Survey Current Research (2006)*, Report 06-1: 161-176.

Bauer, G.B. 1986. *The Behavior of Humpback Whales in Hawaii and Modifications of Behavior Induced by Human Interventions*. Ph.D. Thesis, University of Hawaii, Honolulu, HI. 314 pp.

Bauer, G.B. and L.M. Herman. 1986. *Effects of Vessel Traffic on the Behavior of Humpback Whales in Hawaii*. Report by Kewalo Basin Marine Mammals Laboratory., University of Hawaii, Honolulu, for US National Marine Fisheries Service, Honolulu, HI. 151 pp.

Baum, J.K., R.A. Myers, D.G. Kehler, B. Worm, S.J. Harley and P.A. Doherty. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. *Science*, 299(5605): 389-392.

Baumgartner, M.F. 1997. The distribution of Risso's dolphin (*Grampus griseus*) with respect to the physiography of the northern Gulf of Mexico. *Marine Mammal Science*, 13(4): 614-638.

Baumgartner, M.F. and B.R. Mate. 2003. Summertime foraging ecology of North Atlantic right whales. *Marine Ecology Progress Series*, 264: 123-135.

Baumgartner, M.F., T.V.N. Cole, P.J. Clapham and B.R. Mate. 2003. North Atlantic right whale habitat in the lower Bay of Fundy and on the SW Scotian Shelf during 1999-2001. *Marine Ecology Progress Series*, 264: 137-154.

Beach, D.W. and M.T. Weinrich. 1989. Watching the whales: Is an educational adventure for humans turning out to be another threat for endangered species? *Oceanus*, 32(1): 84-88.

Beal, B.F., R.L. Vadas, Sr., W.A. Wright and S. Nickl. 2004. Annual aboveground biomass and productivity estimates for intertidal eelgrass (*Zostera marina* L.) in Cobscook Bay, Maine. *Northeastern Naturalist*, 11: 197-224.

Beale, C.M. and P. Monaghan. 2004. Behavioural responses to human disturbance: A matter of choice? *Animal Behavior*, 68: 1065-1069.

Beauchamp, J., H. Bouchard, P. de Margerie, N. Otis and J.-Y. Savaria. 2009. *Recovery Strategy for the Blue Whale (Balaenoptera musculus), Northwest Atlantic Population, in Canada [FINAL]. Species at Risk Act* Recovery Strategy Series, Fisheries and Oceans Canada, Ottawa, ON. 62 pp.

Belanger, M., L. Tan, N. Askin and C. Wittnich. 2010. Chronological effects of the *Deepwater Horizon* Gulf of Mexico oil spill on regional seabird casualties. *Journal of Marine Animals and Their Ecology*, 3: 10-14.

Bel'kovich, V.M. 1960. Some biological observations on the white whale from the aircraft. *Zool. Zh*., 39(0): 1414-1422 (Transl. NOO-T-403. US Naval Oceanographic Office, Washington, DC. 14 pp. TIS AD-693583).

Bell, G.D. and M. Chelliah. 2006. Leading tropical modes associated with interannual and multidecadal fluctuations in North Atlantic hurricane activity. *Journal of Climate*, 19(4): 590-612.

Bell, J.J. 2008. The functional roles of marine sponges. *Estuarine, Coastal and Shelf Science*, 79: 341–353.

Ben-David, M., T.M. Williams and O.A. Ormseth. 2000. Effects of oiling on exercise physiology and diving behavior in river otters: A captive study. *Canadian Journal of Zoology*, 78: 1380-1390.

Bence, A.E. and W.A. Burns. 1995. Fingerprinting hydrocarbons in the biological resources of the *Exxon Valdez* spill area. Pp. 84-140. In: P.G. Wells, J.N. Butler and J.S. Hughes (eds.). *Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters.* ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp.

Benjamins, S., D.W. Kulka and J. Lawson. 2008. Incidental catch of seabirds in Newfoundland and Labrador gillnet fisheries, 2001-2003. *Endangered Species Research*, 5: 149-160.

Bernier N.B and K.R. Thompson. 2006. Predicting the frequency of storm surges and extreme sea levels in the Northwest Atlantic. *Journal of Geophysical Research*, 111: C10009, doi:10.1029/2005JC003168.

Berry, W. N. Rubinstein, B. Melzian and B. Hill. 2003. *The Biological Effects of Suspended and Bedded Sediment (SABS) in Aquatic Systems: A Review*. United States Environmental Protection Agency, National Health and Environmental Effects Laboratory, Internal Report. 58 pp. Accessed online June 2012: Available at: http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/pollutants/sediment/upload/2004_08_17_criteria_sediment_appendix1.pdf

Bérubé, M., A. Aguilar, D. Dendanto, F. Larsen, G. Notarbartolo di Sciara, R. Sears, J. Sigurjónsson, J. Urbán-Ramirez and P.J. Pallsbøl. 1998. Population genetic structure of North Atlantic, Mediterranean Sea, and Sea of Cortez fin whales, *Balaenoptera physalus* (Linnaeus 1758): Analysis of mitochondrial and nuclear loci. *Molecular Ecology*, 7(5): 585-599.

Best, P.B. 1993. Increase rates in severely depleted stocks of baleen whales. *ICES Journal of Marine Sciences*, 50: 169-186.

Bigelow, W.C. and W.C. Schroeder. 1948. Sharks. *Fishes of the Western North Atlantic, Memoirs of the Sears Foundation for Marine Research*, 1(1): 56-576.

Bigg, M.A. 1981. *Phoca vitulina* Linnaeus, 1758 and *Phoca largha* Pallas, 1811. Pp. 1-27. In: S.H. Ridgeway and R. Harrison (eds.). *Handbook of Marine Mammals, Volume 2: Seals*. Academic Press, San Diego, CA. 359 pp.

Bigg, M.A., P.F. Olesiuk, G.M. Ellis, J.K.B. Ford and K.C. Balcomb. 1990. Social organization and genealogy of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. *Report of the International Whaling Commission*, 12: 383-405.

BIO (Bedford Institute of Oceanography). 2011. *Hydrographic Database and Ocean Data Inventory Database*. Available at: http://www.bio.gc.ca/science/data-donnees/base/odi-eng.php

Bishop, G. 1989. *Assessment of Iceberg Management for the Grand Banks Area: Analysis of Detection and Deflection Techniques*. Mobil Oil Canada Properties, Property Development Department, Hibernia Producing Operations.

Bjorge, R.R. 1987. Bird kill at an oil industry flare stack in northwest Alberta. *Canadian Field-Naturalist*, 101: 346-350.

Bjorndal, K.A., B.W. Bowen, M. Chaloupka, L.B. Crowder, S.S. Heppell, C.M. Jones, M.E. Lutcavage, D. Policansky, A.R. Solow and B.E. Witherington. 2011. Better science needed for restoration in the Gulf of Mexico. *Science*, 331(6017): 537-538.

Black, A. 2005. Light induced seabird mortality on vessels operating in the Southern Ocean: Incidents and mitigation measures. *Antarctic Science*, 17: 67-68.

Blackwell, S.B. and C.R. Greene, Jr. 2006. Sounds from an oil production island in the Beaufort Sea in summer: Characteristics and contribution of vessels. *Journal of the Acoustical Society of America*, 119(1): 182-196.

Blackwell, S.B., C.R. Greene, H.K. Kim, T.L. McDonald, C.S. Nations, R.G. Norman and A. Thode. 2010. Beaufort Sea acoustic monitoring program. Chapter 9. In: D.W. Funk, D.S. Ireland, R. Rodrigeus, and W.R. Koski (eds.). *Joint Monitoring Program in the Chukchi and Beaufort Seas, Open Water Seasons, 2006-2008*. LGL Alaska Rep. TA1050-2. Rep. by LGL Alaska Res. Assoc. Inc., LGL Ltd., Greenridge Sci. Inc., and JASCO Research Ltd., for Shell Offshore Inc., other Industry Contributors, and US National Marine Fisheries Service and US Fish and Wildlife Service. 506 pp.

Blackwell, S.B., C.R. Greene, T.L. McDonald, C.S. Nations, R.G. Norman, and A. Thode. 2009a. Beaufort Sea bow-head whale migration route study. Chapter 8. In: D.S. Ireland, D.W. Funk, R. Rodrigues and W.R. Koski (eds.). *Joint Monitoring Program in the Chukchi and Beaufort Seas, Open Water Seasons, 2006-2007*. LGL Alaska Rep. P971-2. Rep. by LGL Alaska Res. Assoc. Inc., Anchorage, AK et al., for Shell Offshore Inc., Anchorage, AK et al. 485 pp. + Appendices.

Blackwell, S.B., J.W. Lawson and M.T. Williams. 2004. Tolerance by ringed seals (*Phoca hispida*) to impact pipe-driving and construction sounds at an oil production island. *Journal of the Acoustical Society of America*, 115 (5, Pt. 1): 2346-2357.

Blackwell, S.B., T.L. McDonald, C.S. Nations, A.M. Thode, K.H. Kim, C.R. Greene, Jr., M. Guerra, D. Mathias and A.M. Macrander. 2011. Effects of seismic exploration activities on the calling behavior of bowhead whales, *Balaena mysticetus*, in the Alaska Beaufort Sea. Pp. 34 In: Abstract for the *19th Biennial Conference on the Biology of Marine Mammals*, Tampa, FL, 27 November-2 December. 344 pp.

Blackwell, S.B., C.S. Nations, T.L. McDonald, A.M. Thode, K.H. Kim, C.R. Greene and M.A. Macrander. 2009b. Effects of seismic exploration activities on the calling behavior of bowhead whales in the Alaskan Beaufort Sea. Pp. 35. In: *18th Biennial Conference on the Biology of Marine Mammals*, Québec, Canada, 12-16 October 2009. 306 pp.

Blenkarn, K.A. and A.E. Knapp. 1969. *Ice Conditions on the Grand Banks*. Canadian Institute of Mining and Metallurgy, Calgary, AB, *Ice Seminar,* Special Volume 10.

Bocetti, C.I. 2011. Cruise ships as a source of avian mortality during fall migration. *Wilson Journal of Ornithology*, 123: 176-178.

Bodkin, J.L., B.E. Ballachey, H.A. Coletti, G.G. Esslinger, K.A. Kloecker, S.D. Rice, J.A. Reed and D.H. Monson. 2012. Long-term effects of the '*Exxon Valdez*' oil spill: sea otter foraging in the intertidal as a pathway of exposure to lingering oil. *Marine Ecology Progress Series*, 447: 273-287.

Boehlert, G. and M. Yoklavich. 1984. Carbon assimilation as function of ingestion rate in larval Pacific herring, *Clupea harengus pallasi* Valenciennes. *Journal of Experimental Marine Biology and Ecology*, 79(3): 251-262.

BOEMRE (Bureau of Ocean Energy Management, Regulation and Enforcement). 2012. *Spill Summaries OCS Spills ≥50 Barrels CY 1964-2011*. Available at: http://www.boemre.gov/incidents/spills1996-2011.htm Accessed January 2012.

Boersma, P.D., J.K. Parrish and A.B Kettle. 1995. Common Murre abundance, phenology, and productivity on the Barren Islands, Alaska: The *Exxon Valdez* oil spill and long-term environmental change. Pp. 820-853. In: P.G. Wells, J.N. Butler and J.S. Hughes (eds.). *Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters*. ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp.

Bonfil, R. M. Meyer, M.C. Scholl, R. Johnson, S. O'Brien, H. Oosthuizen, S. Swanson, D. Kotze and M. Paterson. 2005. Transoceanic migration, spatial dynamics, and population linkages of white sharks. *Science*, 310(5745): 100-103.

Borgman, L.E., 1973. Probabilities for the highest wave in a hurricane. *Journal of Waterways, Harbors and Coastal Engineering Division*, ASCE: 185-207.

Born, E.W., F.F. Riget, R. Dietz and D. Andriashek. 1999. Escape responses of hauled out ringed seals (*Phoca hispida*) to aircraft disturbances. *Polar Biology*, 21(3): 171-178.

Borsani, J.F., C.W. Clark and L. Tedesco. 2005. Does pile-driving noise withdraw fin whales from their habitat? *Abstract for the 16th Biennial Conference on the Biology og Marime Mammals*, 12-16 December 2005, San Diego, CA.

Bossart, G.D., M. Lutcavage, B. Mealey and P. Lutz. 1995. The dermatopathologic effects of oil on loggerhead sea turtles (*Caretta caretta*). Pp. 180-181. In: L. Frink, K. Ball-Weir and C. Smith (eds.). *Wildlife and Oil Spills: Response, Research, and Contingency Plan*. Tri-State Bird Rescue and Research, DE. 182 pp.

Boulva, J. and I.A. McLaren. 1979. Biology of the harbour seal, *Phoca vitulina*, in Eastern Canada. *Bulletin of the Fisheries Research Board of Canada*, 200. 24 pp.

Boustany, A.M. S.F. Davis, P. Pyle, S.D. Anderson, B.J. Le Boeuf and B.A. Block. 2002. Satellite tagging: An expanded niche for white sharks. *Nature*, 415: 35-36.

Boutillier, J., E. Kenchington and J. Rice. 2010. A review of the biological characteristics and ecological functions served by corals, sponges and hydrothermal vents, in the context of applying an ecosystem approach to fisheries. *DFO Canadian Science Advisory Secretariat Research Document*, 2010/048. iv + 36 pp.

Bowen, B.W., S.L. Elis, S.J. Iverson and D.J. Boness. 2001. Maternal effects on offspring growth rate and weaning mass in harbour seals. *Canadian Journal of Zoology*, 79: 1088-1101.

Bowering, W.R. 2000. Trends in distribution, biomass and abundance of Greenland halibut (*Reinhardtius hippoglossoides*) in NAFO Subarea 2 and Divisions 3KLMNO from Canadian research vessel surveys during 1978-99. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 00/12: 42 pp.

Bowering, W.R. and G.R. Lilly. 1992. Greenland halibut (*Reinhardtius hippoglossoides*) off southern Labrador and northeastern Newfoundland (northwest Atlantic) feed primarily on capelin (*Mallotus villosus*). *Netherlands Journal of Sea Research*, 29: 211-222.

Bowles, A. and B.S. Stewart. 1980. Disturbances to the pinnipeds and birds of San Miguel Island, 1979-1980. Pp. 99-137. In: J.R. Jehl, Jr. and C.F. Cooper (eds.). *Potential Effects of Space Shuttle Sonic Booms on the Biota and Geology of the California Channel Island: Research Reports*. Technical Report 80-1. Rep. by Center for Marine Studies., San Diego State University and Hubbs/Sea World Research Institiute, San Diego, CA, for US Air Force, Space Division. 246 pp.

Bowles, A.E., M. Smultea, B. Würsig, D.P. DeMaster and D. Palka. 1994. Relative abundance and behavior of marine mammals exposed to transmissions from the Heard Island Feasibility Test. *Journal of the Acoustical Society of America*, 96(4): 2469-2484.

Bowyer, P. (Editor). 1995. *Where the Wind Blows. A Guide to Marine Weather in Atlantic Canada*. Environment Canada. xiii + 178 pp.

Bowyer, R.T., G.M. Blundell, M. Ben-David, S.C. Jewett, T.A. Dean and L.K. Duffy. 2003. Effects of the *Exxon Valdez* oil spill on river otters: Injury and recovery of a sentinel species. *Wildlife Monographs*, 153: 53.

Bowyer, R.T., J.W. Testa and J.B. Faro. 1995. Habitat selection and home ranges of river otters in a marine environment: Effects of the *Exxon Valdez* oil spill. *Journal of Mammalogy*, 76(1): 1-11.

Bowyer, R.T., J.W. Testa, J.B. Faro, C.C. Swartz and J.B. Browning. 1994. Changes in diets of river otters in Prince William Sound, Alaska: Effects of the *Exxon Valdez* oil spill. *Canadian Journal of Zoology*, 72: 970-976.

Boyd, S.E., H.L. Rees and C.A. Richardson. 2000. Nematodes as sensitive indicators of change at dredged material disposal sites. *Estuarine, Coastal and Shelf Science*, 51(6): 805-819.

Bradbury, I.R., G.L. Lawson, D. Robichaud, G.A. Rose and P.V.R. Snelgrove. 2000. Success and failure of Atlantic cod, *Gadus morhua*: A case study from coastal Newfoundland. *Canadian Stock Assessment Secretariat Research Document*, 2000/022. 19 pp.

Bradbury, I.R., P.V.R. Snelgrove and S. Fraser. 1999. Transport and development of cod eggs and larvae in Placentia Bay (3Ps) Newfoundland, 1997-1998. *Canadian Stock Assessment Secretariat Research Document*, 99/71. 17 pp.

Bradbury, I.R., P.V.R. Snelgrove and P. Pepin. 2003. Passive and active behavioural contributions to patchiness and spatial pattern during the early life history of marine fishes. *Marine Ecology Progress Series*, 257: 233-245.

Bradford, J.D. 1972. A *Preliminary Report of the Observation of Sea Ice Pressure and its Effects on Merchant Vessels under Icebreaker Escort*. Sea Ice Conference, Reykjavik, Iceland. Pp: 154-158.

Brander-Smith, D. 1990. *Protecting Our Waters: Final Report*. Public Review Panel on Tanker Safety and Marine Spill Response Capability. Ottawa, ON: 263 pp.

Brander-Smith, D., D. Therrien and S. Tobin. 1990. *Public Review Panel on Tanker Safety and Marine Spills Response Capability. Final Report*. 263 pp.

Brandt, M.J., A. Diederichs, K. Betke and G. Nehls. 2011. Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. *Marine Ecology Progress Series*, 421: 205-216.

Brattey, J. and B.P. Healey. 2003. Exploitation rates and movements of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL based on tagging experiments conducted during 1997-2002. *DFO Canadian Science Advisory Secretariat Research Document*, 2003/032: ii + 24 pp.

Brattey, J., D.R. Porter and C.W. George. 2002. Exploitation rates and movements of Atlantic cod (*Gadus morhua*) in NAFO Subdivision 3Ps based on tagging experiments conducted during 1997-2001. *DFO Canadian Science Advisory Secretariat Research Document*, 2002/003: 28 pp.

Brazner, J.C. and J. McMillan. 2008. Loggerhead turtle (*Caretta caretta*) bycatch in Canadian pelagic longline fisheries: Relative importance in the western North Atlantic and opportunities for mitigation. *Fisheries Research (Amsterdam)*, 91: 310-324.

Breitzke, M. and T. Bohlen. 2010. Modeling sound propagation in the Southern Ocean to estimate the acoustic impact of seismic research surveys on marine mammals. *Geophysical Journal International*, 181(2): 818-846.

Bretagnolle, V. 1990. Effet de la lune sur l'activité des pétrels (classe Aves) aux îles Salvages (Portugal). *Canadian Journal of Zoology*, 68: 1404-1409.

Brickhill, M.J., S.Y. Lee and R.M Connolly. 2005. Fishes associated with artificial reefs: attributing changes to attraction or production using novel approaches. *Journal of Fish Biology*, 67 (Supplement SB): 53-71.

Brodie, P.F. 1981. Energetic and behavioural considerations with respect to marine mammals and disturbance from underwater noise. Pp. 287-290. In: N.M. Peterson (ed.). *The Question of Sound from Icebreaker Operations: Proceedings of a Workshop*. Arctic Pilot Project, Petro-Canada, Calgary, AB. 350 pp.

Brown, M.W., D. Fenton, K. Smedbol, C. Merriman, K. Robichaud-Leblanc and J.D. Conway. 2009. *Recovery Strategy for the North Atlantic Right Whale (Eubalaena glacialis) in Atlantic Canadian Waters [Final]*. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada. vi + 66 pp.

Brown, R.G.B. 1986. *Revised Atlas of Eastern Canadian Seabirds. 1. Shipboard Surveys*. Bedford Institute of Oceanography and Canadian Wildlife Service, Dartmouth, NS, and Ottawa, ON.

Brown, R.G.B., D.I. Gillespie, A.R. Lock, P.A. Pearce and G.H. Watson. 1973. Bird mortality from oil slicks off Eastern Canada, February-April 1970. *Canadian Field-Naturalist*, 87: 225-234.

Brown, S.K., R. Mahon, K.C.T. Zwanenburg, K.R. Buja, L.W. Claflin, R.N. O´Boyle, B. Atkinson, M. Sinclair, G. Howell and M.E. Monaco. 1996. *East Coast of North America Groundfish: Initial Explorations of Biogeography and Species Assemblages*. NOAA, Silver Springs, MD, DFO, Dartmouth, Nova Scotia. 100+ pp.

Brown, S.K. and R.N. O'Boyle. 1996. *East Coast of North America Strategic Assessment Project Groundfish Atlas*. 127 pp. Available at: http://www.google.com/url?q=http://aczisc.dal.ca/96ecnasap_groundfish.pdf&sa=U&ei=mzLbT9TDH-rW2wWQmIS6CA&ved=0CBAQFjAA&usg=AFQjCNE6g0m2NwfXOZ5A_Sj0dgsAviKsgg

Bruneau, A. and R. Dempster. 1971. *Iceberg Features, Motion and Towing Problems*. Canadian Seminar on Icebergs.

Bruneau, A., R. Dempster and R. Peters. 1977. *Iceberg Towing for Oil Rig Avoidance*. Pergamon Press, New York.

Brüning, A., F. Hölker and C. Wolter. 2011. Artificial light at night: Implications for early life stages development in four temperate freshwater fish species. *Aquatic Sciences*, 73(1): 143-152.

Brushett, D. 2008. *Late Wisconsinan Glacial History of Placentia Bay, Newfoundland, as Interpreted from Seabed Geomorphology and Stratigraphy*. M.Sc. thesis, Memorial University of Newfoundland, St. John's, NL. 144 pp.

Brushett, D., T. Bell, M.J. Batterson and J. Shaw. 2007. Ice-flow history of Placentia Bay, Newfoundland: Multibeam seabed mapping. Newfoundland and Labrador Department of Natural Resources *Geological Survey Current Research (2007)*, Report 07-1: 215-228.

Bryant, P.J., C.M. Lafferty and S.K. Lafferty. 1984. Reoccupation of Laguna Guerrero Negro, Baja California, Mexico, by gray whales. Pp. 375-387. In: M.L. Jones, S.L. Swartz and S. Leatherwood (eds.). *The Gray Whale Eschrichtius robustus*. Academic Press, Orlando, FL. 600 pp.

Bue, B.G., S. Sharr, S.D. Moffitt and D. Craig. 1996. Effects of *Exxon Valdez* oil spill on pink salmon embryos and pre-emergent fry. *American Fisheries Society Symposium*, 18: 619-627.

Bugoni, L., L. Krause and M.V. Petry. 2001. Marine debris and human impacts on sea turtles in southern Brazil. *Marine Pollution Bulletin*, 42(12): 1330-1334.

Buhl-Mortensen, L. and P.B. Mortensen. 2005. Distribution and diversity of species associated with deep-sea gorgonian corals off Atlantic, Canada. Pp. 771-805. In: A. Freiwald and J. M.Roberts (eds.). *Cold-water Corals and Ecosystems*, Springer-Verlag, Heidelberg.

Bundy, A. and L.P. Fanning. 2005. Can Atlantic cod (*Gadus morhua*) recover? Exploring trophic explanations for the non-recovery of the cod stock on the eastern Scotian Shelf, Canada. *Canadian Journal of Fisheries and Aquatic Sciences*, 62(7): 1474-1489.

Bundy, A., G.R. Lilly and P.A. Shelton. 2000. A mass balance model of the Newfoundland-Labrador Shelf. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2310: xiv + 157 pp.

Burger, A.E. 1993. Estimating the mortality of seabirds following oil spills: Effects of spill volume. *Marine Pollution Bulletin*, 26: 40-143.

Burger, J. 1988. Effects of demolition and beach clean-up operations on birds on a coastal mudflat in New Jersey. *Estuarine, Coastal, and Shelf Science*, 27: 95-108.

Burger, J. 1994. *Before and After Oil Spill: the Arthur Kill, New Brunswick, NJ*. Rutgers University Press, New Brunswick, NJ. 324 pp

Burger, J., S.A. Carlucci, C.W. Jeitner and L. Niles. 2007. Habitat choice, disturbance, and management of foraging shorebirds and gulls at a migratory stopover. *Journal of Coastal Research*, 23: 1159-1166.

Burger, J. and N. Tsipoura. 1998. Experimental oiling of Sanderlings (*Calidris alba*): Behaviour and weight changes. *Environmental Toxicology and Chemistry*, 17: 1154-1158.

Burke Consulting. 2000. *Strategic Plan: Newfoundland and Labrador Aquaculture*. Prepared in collaboration with Resource Development Associates.

Burke, C.M., G.K. Davoren, W.A. Montevecchi and F.K. Wiese. 2005. Seasonal and spatial trends of marine birds along support vessel transects and at oil platforms on the Grand Banks. Pp. 587-614. In: P.J. Cranford and K. Lee (eds.). *Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies*, Battelle Press, Columbus, OH. 631 pp.

Burton, N.H.K., M.J.S. Armitage, A.J. Musgrove and M.M. Rehfisch. 2002. Impacts of man-made landscape features on numbers of estuarine waterbirds at low tide. *Environmental Management*, 30: 857-864.

Busdosh, M. 1981. Long-term effects of the water soluble fraction of Prudhoe Bay crude oil on survival, movement and food search success of the Arctic amphipod *Boeckosimus* (=*Onisimus*) *affinis*. *Marine Environmental Research*, 5: 167-180.

Butler, R.G. A. Harfenist, F.A. Leighton and D.B. Peakall. 1988. Impact of sublethal oil and emulsion exposure on the reproductive success of Leach's storm-petrels: Short and long-term effects. *Journal of Applied Ecology*, 25: 125-143.

Cairns, D.K. 2001. An evaluation of possible causes of the decline in pre-fishery abundance of North American Atlantic salmon. *Canadian Technical Reports Fisheries and Aquatic Sciences*, 2358: 67 pp.

Cairns, D.K. and R.D. Elliot. 1987. Oil spill impact assessment for seabirds: The role of refugia and growth centres. *Biological Conservation*, 40: 1-9.

Cairns, D.K., W.A. Montevecchi and W. Threlfall. 1989. *Researcher's Guide to Newfoundland Seabird Colonies, Second Edition*. Memorial University of Newfoundland Occasional Papers in Biology, No. 14: 43 pp.

Calambokidis, J. and S.D. Osmek. 1998. *Marine Mammal Research and Mitigation in Conjunction with Air Gun Operation for the USGS `SHIPS' Seismic Surveys in 1998*. Rep. by Cascadia Res., Olympia, WA, for US Geological Survey, NMFS and MMS.

Campagna, C., F.T. Short, B.A. Polidoro, R. McManus, B.B. Collette, N.J. Pilcher, Y. Sadovy de Mitcheson, S.N. Stuart and K.E. Carpenter. 2011. Gulf of Mexico oil blowout increases risks to globally threatened species. *BioScience*, 61(5): 393-397.

Campana, S.E., J. Brading and W. Joyce. 2011. Estimation of pelagic shark bycatch and associated mortality in Canadian Atlantic fisheries. *DFO Canadian Science Advisory Secretariat Research Document*, 2011/067: vi + 19 pp.

Campana, S.E., W. Joyce and M.J. Manning. 2009. Bycatch and discard mortality in commercially caught blue sharks *Prionace glauca* assessed using archival satellite pop-up tags. *Marine Ecology Progress Series*, 387: 241-253.

Campana, S., W. Joyce, L. Marks and S. Harley. 2001. Analytical assessment of the porbeagle shark (*Lamna nasus*) population in the northwest Atlantic, with estimates of long-term sustainable yield. *DFO Canadian Science Advisory Secretariat Research Document,* 2001/067: 59 pp.

Campana S.E., W. Joyce, L. Marks, L.J. Natanson, N.E. Kohler, C.F. Jensen, J.J. Mello, H.L. Pratt, Jr. and S. Myklevoll. 2002. Population dynamics of the porbeagle shark in the Northwest Atlantic. *North American Journal of Fisheries Management*, 22: 106-121.

Campana, S.E., L. Marks and W. Joyce. 2004 Biology, fishery and stock status of shortfin mako sharks (*Isurus oxyrinchus*) in Atlantic Canadian waters. *DFO Canadian Science Advisory Secretariat Research Document*, 2004/094: i + 29 pp.

Campbell, J.S. and Simms, J.M. 2009. *Status Report on Coral and Sponge Conservation in Canada*. Fisheries and Oceans Canada, St. John’s, NL. vii + 87 pp.

Camphuysen, K. 2011. Seabirds and chronic oil pollution: Self-cleaning properties of gulls, Laridae, as revealed from colour-ring sightings. *Marine Pollution Bulletin*, 62: 514-519.

Canada-Newfoundland and Labrador Action Team for Cod Recovery. 2005. *A Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador*. 69 pp.

Canada-Newfoundland Offshore Petroleum Board. 2001. *Decision 2001.01: Application for Approval – White Rose Canada-Newfoundland Benefits Plan and White Rose Development Plan*. St. John’s, NL.

CANATEC Consultants Ltd. 1999. *Compilation of Iceberg Shape and Geometry Data for the Grand Banks Region*. Prepared for Program for Energy Research and Development, National Research Council of Canada, Ottawa. ON. PERD/CHC Report 20-43.

Canning & Pitt Associates, Inc. 2004. *Placentia Bay Commercial Fisheries, 1996-2003*. Report prepared for NTL, St. John’s, NL.

Canning and Pitt Associates, Inc. 2005. *Placentia Bay Project Benefits Study*. Marine Institute Canadian Centre for Marine Communications, St. John’s,NL.

Canning & Pitt Associates, Inc. 2006. *Risk Assessment of Oil Spills on the South Coast of Newfoundland and Labrador: Commercial Fisheries and Tourism (Phases 1 and 2)*. Prepared for RMRI, St. John’s, NL.

Canning & Pitt Associates, Inc. 2009. *Placentia Bay Commercial Fisheries, 2003-2008*. Report prepared for NTL, St. John's, NL.

CAPP (Canadian Association of Petroleum Producers). 2001a. *Offshore Drilling Waste Management Review*. Technical Report, 2001-0007: 268 pp.

CAPP (Canadian Association of Petroleum Producers). 2001b. *Drilling an Offshore Well*. Canadian Association of Petroleum Producers, Calgary, AB. 6 pp.

Carew, A.M.E. 2001. *Oil Pollution and the Newfoundland and Labrador Fishery: Current and Potential Threats for the Conservation of Commercial Fisheries Resources in Placentia Bay*. Master of Marine Studies, Fisheries Resource Management, The Marine Institute of Memorial University of Newfoundland, St. John's, NL.

Cargnelli L.M., S.J. Griesbach, C. McBride, C.A. Zetlin and W.W. Morse. 1999. Essential fish habitat source document: Longfin inshore squid, *Loligo pealeii*, life history and habitat characteristics. *NOAA Technical Memo NMFS NE*, 146; 27 p

Carls, M.G., S.D. Rice and J.E. Hose. 1999. Sensitivity of fish embryos to weathered crude oil. Part 1. Low-level exposure during incubation causes malformations, genetic damage, and mortality in larval Pacific herring (*Clupea pallasi*). *Environmental Toxicology and Chemistry*, 18: 481-493.

Carlson, J.K., T.A. Randall and M.E. Mroczka. 1997. Feeding habits of winter flounder (*Pleuronectes americanus*) in a habitat exposed to anthropogenic disturbance. *Journal of Northwest Atlantic Fisheries Science*, 21: 65-73.

Carr, J.W., J.M. Anderson, G.G. Whoriskey and T. Dilworth. 1997. The occurrence and spawning of cultured Atlantic salmon (*Salmo salar*) in a Canadian river. *ICES Journal of Marine Science*, 54: 1064-1073.

Carscadden, J.E. 2001. Capelin in Subarea 2 + Div. 3KL – update. *DFO Canadian Stock Assessment Secretariat Stock Status Report*, 2001/B2: 5 pp.

Carscadden, J.E., K.T. Frank and W.C. Leggett. 2001. Ecosystem changes and the effects on capelin (*Mallotus villosus*), a major forage species. *Canadian Journal of Fisheries and Aquatic Sciences*, 58: 73-85.

Carscadden, J.E., K.T. Frank and D.S. Miller. 1989. Capelin (*Mallotus villosus*) spawning on the southeast shoal: influence of physical factors past and present. *Canadian Journal of Fisheries and Aquatic Sciences*, 46: 1743-1754.

Carscadden, J. and B.S. Nakashima. 1997. Abundance and changes in distribution, biology, and behavior of capelin in response to cooler waters of the 1990s. Pp. 457-468. In: *Forage Fishes in Marine Ecosystems, Proceedings of the International Symposium Forage Fishes in Alaska*, Sea Grant Program Report, 97-01.

Carstensen, J., O.D. Henriksen and J. Teilmann. 2006. Impacts of offshore wind farm construction on harbour porpoises: Acoustic monitoring of echolocation activity using porpoise detectors (T-PODS). *Marine Ecology Progress Series*, 321: 295-308.

Carter, H.R., V.A. Lee, G.W. Page, M.W. Parker, R.G. Ford, G. Swartzman, S.W. Kress, B.R. Siskin, S.W. Singer and D.M. Fry. 2003. The 1986 *Apex Houston* oil spill in central California: Seabird injury assessments and litigation process. *Marine Ornithology*, 31: 9-19.

Castellote, M., C.W. Clark and M.O. Lammers. 2012. Acoustic compensation to shipping and airgun noise by Mediterranean fin whales (*Balaenoptera physalus*). Pp. 321-322. In: A. Hawkins and A.N. Popper (eds.). *The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology* Series No. 730. Springer, New York. 695 pp.

Catto, N.R. 1998. The pattern of glaciation on the Avalon Peninsula of Newfoundland. *Géographie Physique et Quaternaire*, 52(1): 23-45.

Catto, N.R. M.R. Anderson, D.A. Scruton and U.P. Williams. 1997. Coastal classification of the Placentia Bay shore. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2186: v + 48 pp.

Catto, N.R., R.G. Hooper, M.R. Anderson, D.A. Scruton, J.D. Meade, L.M.N. Ollerhead and U.P. Williams. 1999. Biological and geomorphological classification of Placentia Bay: A preliminary assessment. *Canadian Technical Report of Fisheries and Aquatic Science*, 2289: v + 35 pp.

CCME (Canadian Council of Ministers of the Environment). 2002. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Total Particulate Matter. In: CCME. 1999. *Canadian Environmental Quality Guidelines*. Canadian Council of Ministers of the Environment, Winnipeg, MB. 13 pp.

C-CORE. 2001a. *Iceberg Load Design Basis for Hebron*. Report R01-05-607. Report to Chevron Canada Resources, St. John's, NL.

C-CORE. 2001b. *Iceberg Scour Characteristics at White Rose*. Contract Report Prepared for Husky Oil Operations Ltd., C-CORE Report Number 00-C44 (Version 2), May 2001.

C-CORE. 2004. *Ice Management JIP Year 2003*. C-CORE Report Number R-03-059-226 v2, May 2004.

C-CORE. 2012a. *Argentia Pond and Topographical Survey*. C-CORE Report Number R-12-073-997 v3, September 2012, prepared for Husky Energy.

C-CORE. 2012b. *Argentia Acoustic Seabed Survey Report*. C-CORE Report to Husky Energy, WH-DWH-RP-0006, Final Report (version 3.0), May 2012.

CEA Agency (Canadian Environmental Assessment Agency). 1994a. A *Reference Guide for the Canadian Environmental Assessment Act, Addressing Cumulative Environmental Effects*. Prepared by the Federal Environmental Assessment Review Office. 23 pp.

CEA Agency (Canadian Environmental Assessment Agency). 1994b. *A Reference Guide for the Canadian Environmental Assessment Act: Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects*. Prepared by the Federal Environmental Assessment Review Office.

CEA Agency (Canadian Environmental Assessment Agency). 2003. *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners*. Published by the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment, chaired by the Canadian Environmental Assessment Agency. 44 pp.

CEF Consultants Ltd. 2005. *Environmental Effects Monitoring Program for Hunt Oil Company of Canada's Seismic Survey in Sydney Bight*. Prepared for Hunt Oil Company of Canada. Halifax, NS. 11 pp.

CEF Consultants Ltd. 2011. Report on a Workshop on Fish Behaviour in Response to Seismic Sound held in Halifax, Nova Scotia, Canada, March 28-31, 2011, *Environmental Studies Research Funds Report*, No. 190: 109 pp.

Cerchio, S., S. Strindberg, T. Collins, C. Bennett and H. Rosenbaum. 2011. Humpback whale singing activity off northern Angola: An indication of the migratory cycle, breeding habitat and impact of seismic surveys on singer number. P. 56. In: *Abstrract for the 19th Biennial Conference on the Biology of Marine Mammals*, Tampa, FL, 27 November-2 December. 344 pp.

Chamberlin, T.C. 1895. Notes on the glaciation of Newfoundland. *Geological Society of American Bulletin*, 6: 467.

Chandrasekara, W.U. and C.L.J. Frid. 1998. A laboratory assessment of the survival and vertical movement of two epibenthic gastropod species, *Hydrobia ulvae* (Pennant) and *Littorina littorea* (Linnaeus), after burial in sediment. *Journal of Experimental Marine Biology and Ecology*, 221(2): 191-207.

Chapdelaine, G., A.W. Diamond, R.D. Elliot and G.J. Robertson. 2001. Status and population trends of the Razorbill in eastern North America. *Occasional Paper of the Canadian Wildlife Service*, (105), 3-20

Chapman, B.R. 1981. Effects of *Ixtoc I* oil spill on Texas shorebird populations. Pp. 461-465. In: *Proceedings of the 1981 Oil Spill Conference*, 2-5 March 1981. American Petroleum Institute, Environmental Protection Agency and United States Coast Guard, Atlanta, GA.

Chapman, P.M. 1992. Pollution status of North Sea sediments: An international integrative study. *Marine Ecology Progress Series*, 91: 313-322.

Chapman, P.M., R.N. Dexter, H.A. Anderson and E.A. Power. 1991. Evaluation of effects associated with an oil platform, using the Sediment Quality Triad. *Environmental Toxicology and Chemistry*, 10: 407-424.

Chapman, P.M., R.N. Dexter and E.R. Long. 1987. Synoptic measures of sediment contamination, toxicity and infaunal community structure (the Sediment Quality Triad) in San Francisco Bay. *Marine Ecology Progress Series*, 37: 75-96.

Chaput, G. and D.K. Cairns. 2001. Hypothesis: Predation reduces egg survival. Pp. 9-10. In: D.K. Cairns (ed.). An evaluation of possible causes of the decline in pre-fishery abundance of North American Atlantic salmon. *Canadian Technical Report of Fisheries and Aquatic Science*, No. 2358.

Chardine, J.W. 1995. The distribution and abundance of aquatic birds in Canada in relation to the threat of oil pollution. Pp. 23-36. In: L. Frink, K. Ball-Weir and C. Smith (eds.). *Wildlife and Oil Spills: Response, Research, and Contingency Plan*. Tri-State Bird Rescue and Research, DE.

Chardine, J.W. 2000. Census of Northern Gannet colonies in the Atlantic Region in 1999. Canadian Wildlife Service, Atlantic Region, *Technical Report Series*, No. 361: 1-16.

Chardine, J.W. and G. Pelly. 1994. *Operation Clean Feather: Reducing oil pollution in Newfoundland waters*. Canadian Wildlife Service, Atlantic Region, *Technical Report Series*, No. 198: 43 pp.

Chardine, J.W., G.J. Robertson, P.C. Ryan and B. Turner. 2003. *Abundance and distribution of Common Murres breeding at Funk Island, Newfoundland 1972 and 2000*. Canadian Wildlife Service, Atlantic Region, *Technical Report Series*, No. 404.

Chase, M.E., S.H. Jones, P. Hennigar, J. Sowles, G.C.H. Harding, K. Freeman, P.G. Wells, C. Krahforst, K. Coombs, R. Crawford, J. Pederson and D. Taylor. 2001. Gulfwatch: Monitoring spatial and temporal patterns of trace metal and arganic contaminants in the Gulf of Maine (1991-1997) with the blue mussel, *Mytilus edulis* L. *Marine Pollution Bulletin*, 42(6): 490-504.

CHC (Canadian Hurricane Centre). 2012. *Canadian Hurricane Centre Historical Track and Data Information for Tropical Systems Affecting Canadian Areas Since 1954*. Available at: http://www.ec.gc.ca/ouragans-hurricanes/default.asp?lang=En&n= B60AA728-1

Chevron Canada Resources. 2003. *Hebron Field Biological Characterization Survey*. Confidential Report prepared by Jacques Whitford Environment Limited for Chevron Canada Resources, St. John's, NL. vi + 72 pp. + Appendices.

Choi, J.S., K.T. Frank, W.C. Leggett and K. Drinkwater. 2004. Transition to an alternate state in a continental shelf ecosystem. *Canadian Journal of Fisheries and Aquatic Sciences*, 61(4): 505-510.

Christensen, V. S. Guénette, J.J. Heymans, C.J. Walters, R. Watson, D. Zeller and D. Pauly. 2003. Hundred-year decline of North Atlantic predatory fishes. *Fish and Fisheries*, 4(1): 1-24.

Christian, J.R. 2008. *Environmental Assessment of Petro-Canada Jeanne d'Arc Basin Exploration Drilling Program, 2009-2017*. LGL Rep. SA993. Rep. by LGL, St. John's, NL, prepared for Petro-Canada, St. John's, NL. 258 pp. + Appendix.

Christian, J.R. and E. Lee. 1998. *Nickel Smelter/Refinery Environmental Baseline Study, Marine Environment*, *1998*. Rep. by LGL Limited, St. John's, NL for Voisey's Bay Nickel Company Limited, St. John's, NL. 47 pp. + App.

Christian, J.R., A. Mathieu, D.H. Thomson, D. White, and R.A. Buchanan. 2003. *Effect of Seismic Energy on Snow Crab (Chionoecetes opilio)*. Report by LGL Ltd., St. John's, NL, for Environmental Studies Research Fund (ESRF), Calgary, AB. 56 pp.

Christian, J.R., A. Mathieu, D.H. Thomson, D. White and R.A. Buchanan. 2004. Effect of seismic energy on snow crab (*Chionoecetes opilio*). *Environmental Studies Research Funds Report*, 144: 106 pp.

Church, J.A. and N.J. White. 2011. Sea-level rise from the late 19th to the early 21st Century. *Surveys in Geophysics*, 32(4-5): 585-602.

CIS (Environment Canada Canadian Ice Service Ice). 2010. *Archive On-line Data, 1968 to 2010*. Available at: http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?Lang=eng& lnid=3&ScndLvl=no&ID=11715

CIS (Environment Canada Canadian Ice Service). 2011. *Sea Ice Climatic Atlas: East Coast Canada, 1981-2010*. Environment Canada Canadian Ice Service, Ottawa, ON.

CIS (Environment Canada Canadian Ice Service). 2012. *Historical Total Accumulated Ice Coverage for the Weeks 1126 to 0219, Seasons 1980/1981 to 2011/2012, East Coast Newfoundland Waters*. Run 2012-02-21.

Clapham, P.J. 2000. The humpback whale: Seasonal feeding and breeding in a baleen whale. Pp. 173-196. In: J. Mann, R. Connor, P.L. Tyack and H. Whitehead (eds.). *Cetacean Societies: Field Studies of Dolphins and Whales*, University of Chicago Press, Chicago, IL. 448 pp.

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, D.K. Mattila, C.A. Mayo, M.A. Murphy and S. Pittman. 1993. Seasonal occurrence and annual return of humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. *Canadian Journal of Zoology*, 71: 440-443.

Clapham, P.J. and J. Mead. 1999. *Megaptera novaeangliae*. *Mammal Species*, 604: 1-9.

Clapham, P.J., S.B. Young and R.L. Brownell, Jr. 2001. Baleen whales: Conservation issues and the status of the most endangered populations. *Mammal Review*, 29: 35-60.

Clark, C.W. and W.T. Ellison. 2004. Potential use of low-frequency sounds by baleen whales for probing the environment: Evidence from models and empirical measurements. Pp. 564-589. In: J.A. Thomas, C.F. Moss and M. Vater (eds.). *Echolocation in Bats and Dolphins*. University of Chicago Press, Chicago, IL. 604 pp.

Clark, C.W., W.T. Ellison, B.L. Southall, L. Hatch, S.M. Van Parijs, A. Frankel and D. Ponirakis. 2009. Acoustic masking in marine ecosystems: Intuitions, analysis, and implication. *Marine Ecology Progress Series*, 395: 201-222.

Clark, C.W. and G.C. Gagnon. 2006. Considering the temporal and spatial scales of noise exposures from seismic surveys on baleen whales. *International Whaling Commission Working Paper*, SC/58/E9. 9 pp.

Clark, R.B. 1984. Impact of oil pollution on seabirds. *Environmental Pollution*, 33: 1-22.

Clarke, P.J. and T.J. Ward. 1994. The response of southern hemisphere saltmarsh plants and gastropods to experimental contamination by petroleum hydrocarbons. *Journal of Experimental Biology and Ecology*, 175(1): 43-57.

Clarke, R. 1956. Marking whales from a helicopter. *Norsk Hvalfangst-Tid.*, 45(6):311-318.

Clarke, S.C., J.E. Magnussen, D.L. Abercrombie, M.K. McAllister and M.S. Shivji. 2006. Identification of shark species composition and proportion in the Hong Kong shark fin market based on molecular genetics and trade records. *Conservation Biology*, 20(1): 201-211.

Clynick, B.G., M.G. Chapman and A.J. Underwood. 2007. Effects of epibiota on assemblages of fish associated with urban structures. *Marine Ecology Progress Series*, 332: 201-210.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2006. *Development Plan Guidelines*. ii + 60 pp.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2012a. *Husky Energy – White Rose Extension Project, Final Scoping Document*". December 18, 2012. 27 pp.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2012b. *Spill Statistics and Well Statistics*. Available at: www.cnlopb.nl.ca/ env_stat.shtml,/well_chrono.shtml.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2012c. *Spill Information by Operator: Spills Greater than 1 Litre (1997-2012)*. Available at: http://www.cnlopb.nl.ca/env_stat.shtml

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2012d. *Geophysical, Geological, Environmental and Geotechnical Program Guidelines*. 38 pp + Appendices.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and CNSOPB (Canada-Nova Scotia Offshore Petroleum Board). 2002. *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity*. 15 pp.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and CNSOPB (Canada-Nova Scotia Offshore Petroleum Board). 2009. *Guideline for the Reporting and Investigation of Incidents*. 27 pp.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and CNSOPB (Canada-Nova Scotia Offshore Petroleum Board). 2011. *Drilling and Production Guidelines*. 124 pp.

Colavecchia, M.V., S.M. Backus, P.V. Hodson and J.L. Parrott, 2004. Toxicity of oil sands to early life stages of fathead minnows (*Pimephales promelas*). *Environmental Toxicology and Chemistry*, 23: 1709-1718.

Colbourne, E.B. 1997. Oceanographic conditions in the Newfoundland region during 1996 with comparisons to the 1961-1990 average. *DFO Canadian Stock Assessment Secretariat Research Document*, 97/04. 57 pp.

Colbourne, E.B. 2002. Physical oceanographic conditions on the Newfoundland and Labrador Shelves during 2001. *DFO Canadian Science Advisory Secretariat Research Document*, 2002/023: 56 pp.

Colbourne, E.B. 2004. Decadal changes in the ocean climate in Newfoundland and Labrador waters from the 1950s to the 1990s. *Journal of Northwest Atlantic Fisheries Science*, 34: 41-59.

Colbourne, E.B., J. Craig, C. Fitzpatrick, D. Senciall, P. Stead and W. Bailey. 2006. An assessment of the physical oceanographic environment on the Newfoundland and Labrador Shelf in NAFO Subareas 2 and 3 during 2005. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 06/11: 17 pp.

Colbourne, E.B. and K.D. Foote. 1994. Spatial temperature and salinity fields over the shelves of Newfoundland and Labrador. *Canadian Technical Report of Hydrography and Ocean Sciences*, 160: 128 pp.

Colbourne, E.B. and K.D. Foote. 2000. Variability of the stratification and circulation on the Flemish Cap during she Decades of the 1950s-1990s. *Journal of Northwest Atlantic Fisheries Science*, 26: 103-122.

Colbourne, E.B. and D.C Orr. 2004. The distribution and abundance of northern shrimp (*Pandalus borealis*) in relation to bottom temperatures in NAFO Divisions 3LNO based on multi-species surveys from 1995-2004. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 04/85: 22 pp.

Colbourne, E.B., D.R. Senciall and K.D. Foote. 1996. Temperature, salinity and sigma T along the standard Flemish Cap transect. *Canadian Technical Report of Hydrographic and Ocean Sciences*, 172: 222 pp.

Coleman, A.P. 1926. The Pleistocene of Newfoundland. *Journal of Geology*, 34: 193-223.

Coleman-Sadd, S.P., J.P. Hayes and I. Knight. 1990. *Geology of the Island of Newfoundland*. Newfoundland Department of Mines and Energy, Geological Survey, Map 90-01, scale 1:500 000.

Comfort, G. and R.Y. Edwards. 1998. *Ice Conditions in Viscount Melville Sound and Barrow Strait West*. ARCTEC Canada Ltd. Report 315. Arctic Pilot Project and to the Department of Fisheries and Oceans Canada.

Community Accounts. No Date. *Charts and Tables*. Available at: http://nl.communityaccounts.ca/default.asp

Compagno, L.J.V. 2001. *Sharks of the World. An Annotated and Illustrated Catalogue of Shark Species known to Date, Volume 2 - Bullhead, Mackerel and Carpet Sharks (Heterodontiformes, Lamniformes and Orectolobiformes)*. FAO Species Catalogue for Fishery Purposes No. 1, Vol. 2. Food and Agriculture Organization of the United Nations, Rome. 269 pp.

Connor, R.C., R.S. Wells, J. Mann and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. Pp. 91-126. In: J. Mann, R.C. Connor, P.L. Tyack and H. Whitehead (eds.). *Cetacean Societies: Field Studies of Dolphins and Whales*. University of Chicago Press. Chicago, IL. 448 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2000. *COSEWIC Assessment and Status Report on the Atlantic Wolffish Anarhichas lupus, in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 20 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2001a. *COSEWIC Assessment and Status Report on the Spotted Wolffish Anarhichas minor in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vi + 21 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2001b. *COSEWIC Assessment and Status Report on the Northern Wolffish Anarhichas denticulatus in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vi + 22 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2002a. *COSEWIC Assessment and Update Status Report on the Blue Whale Balaenoptera musculus in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vi + 32 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2002b. *COSEWIC Assessment and Update Status Report on the Northern Bottlenose Whale Hyperoodon ampullatus (Scotian shelf population) in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vi + 22 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2003a. *COSEWIC Assessment and Update Status Report on the Humpback Whale Megaptera novaeangliae in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. viii + 25 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2003b. *COSEWIC Assessment and Status Report on the Cusk Brosme brosme in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vi + 30 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2004. *COSEWIC Assessment and Update Status Report on the Porbeagle Shark Lamna nasus in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. viii + 43 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2005. *COSEWIC Assessment and Update Status Report on the Fin Whale Balaenoptera physalus in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. ix + 37 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006a. *COSEWIC Assessment and Update Status Report on the Harbour Porpoise Phoecena phoecena (Northwest Atlantic population) in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 32 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006b. *COSEWIC Assessment and Status Report on the White Shark Carcharodon carcharias (Atlantic and Pacific populations) in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 31 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006c. *COSEWIC Assessment and Status Report on the Shortfin Mako Shark Isurus oxyrinchus in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vi + 24 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006d. *COSEWIC Assessment and Status Report on the American Eel (Anguilla rostrata) in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. x + 71 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006e. *COSEWIC Assessment and Status Report on the Blue Shark Prionace glauca (Atlantic and Pacific populations) in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 46 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006f. *COSEWIC Assessment and Update Status Report on the Sowerby's Beaked Whale Mesoplodon bidens in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vi + 20 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006g. *COSEWIC Assessment and Update Status Report on the Ivory Gull Pagophila eburnea in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vi + 42 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007a. *COSEWIC Assessment and Update Status Report on the Harbour Seal Atlantic and Eastern Arctic Subspecies Phoca vitulina concolor and Lacs de Loups Marins Subspecies Phoca vitulina mellonae in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 40 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007b. *COSEWIC Assessment and Status Report on the Roughhead Grenadier Macrourus berglax in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 40 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007c. *COSEWIC Assessment and Status Report on the Red Knot Calidris canutus in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 58 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2008a. *COSEWIC Assessment and Update Status Report on the Roundnose Grenadier Coryphaenoides rupestris in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 42 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2008b. *COSEWIC Assessment and Update Status Report on the Killer Whale Orcinus orca, Southern Resident Population, Northern Resident Population, West Coast Transient Population, Offshore Population and Northwest Atlantic / Eastern Arctic Population, in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. viii + 65 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2009a. *COSEWIC Assessment and Status report on the American Plaice Hippoglossoides platessoides, Maritime Population, Newfoundland and Labrador Population and Arctic Population, in Canada*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. x + 74 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2009b. *COSEWIC Assessment and Status Report on the Basking Shark Cetorhinus maximus, Atlantic population, in Canada.* Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. viii + 56 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010s. *COSEWIC Assessment and Status Report on the Atlantic cod Gadus morhua in Canada.* Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xiii + 105 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010b. *COSEWIC Assessment and Status Report on the Deepwater Redfish/Acadian Redfish Complex Sebastes mentella and Sebastes fasciatus, in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. x + 80 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010c. *COSEWIC Assessment and Status Report on the Atlantic Salmon Salmo salar (Nunavik population, Labrador population, Northeast Newfoundland population, South Newfoundland population, Southwest Newfoundland population, Northwest Newfoundland population, Quebec Eastern North Shore population, Quebec Western North Shore population, Anticosti Island population, Inner St. Lawrence population, Lake Ontario population, Gaspé-Southern Gulf of St. Lawrence population, Eastern Cape Breton population, Nova Scotia Southern Upland population, Inner Bay of Fundy population, Outer Bay of Fundy population) in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xvii + 136 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010d. *COSEWIC Assessment and Status Report on the Spiny Dogfish Squalus acanthias, Atlantic population, in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 50 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010e. *Canadian Wildlife Species at Risk*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. Available at URL: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010f. *COSEWIC Assessment and Status Report on the Loggerhead Sea Turtle Caretta caretta in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. viii + 75 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011a. *Canadian Wildlife Species at Risk. Committee on the Status of Endangered Wildlife in Canada.* Ottawa, ON. Available at: http://www.cosewic.gc.ca/eng/sct0/rpt/rpt_csar_e.cfm.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011b. *COSEWIC Assessment and Status Report on the Atlantic Bluefin Tuna Thunnus thynnus in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 30 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011c. *COSEWIC Assessment and Status Report on the Northern Bottlenose Whale Hyperoodon ampullatus in Canada*. Committee on the Status of Endangered Wildlife in Canada. xii + 31 pp.

Coté, D., J. Gosse, B. Adams and M. Langdon (in preparation). *Estimating the Abundance and Spatial Requirements of Coastal River Otters in Bonavista Bay, Newfoundland, using a DNA-Based Mark-recapture Approach*.

Coté, D., H.M.J. Stewart, R.S. Gregory, J. Gosse, J.J. Reynolds, G.B. Stenson and E.H. Miller. 2008. Prey selection by marine-coastal river otters (*Lontra canadensis*) in Newfoundland, *Canadian Journal of Mammalogy*, 89(4): 1001-1011.

Cote, P.W. 1989. *Ice Limits Eastern Canadian Seaboard*. Atmospheric Environment Service, Ottawa, ON.

Couillard, C.M.A., 2002. Microscale test to measure petroleum oil toxicity to mummichog embryos. *Environmental Toxicology*, 17: 195-202.

Cox, T.M., T.J. Ragen, A.J. Read, E. Vos, R.W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, L. Crum, A. D'amico, G. D'spain, A. Fernández, J. Finneran, R. Gentry, W. Gerth, F. Gulland, J. Hildebrand, D. Houserp, R. Hullar, P.D. Jepson, D. Ketten, C.D. Macleod, P. Miller, S. Moore, D.C. Mountain, D. Palka, P. Ponganis, S. Rommel, T. Rowles, B. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. Meads and L. Benner. 2006. Understanding the impacts of anthropogenic sound on beaked whales. *Journal of Cetacean Research and Management*, 7: 177-187.

CPAWS (Canadian Parks and Wilderness Society). 2009. *Special Marine Areas in Newfoundland and Labrador: Areas of Interest in Our Marine Backyards*. Prepared for CPAWS-NL. Available at: http://cpaws.org/uploads/pubs/report_nlmarineguide.pdf [accessed March 2012].

Cranford, P.J., S.L. Armsworthy, S. McGee, T. King, K. Lee and G.H. Tremblay. 2005. Scallops as sentinel organisms for offshore environmental effects monitoring. Pp. 267-296. In: S.L. Armsworthy, P.J. Cranford and K. Lee (eds.). *Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies*, Battelle Press, Columbus, OH. 631 pp.

Cranford, P.J., S.L. Armsworthy and K. Querbach. 2000. Chronic toxicity of synthetic oil-based drilling mud to sea scallops. Pp. 33-34. In: D.C. Gordon Jr, L.D. Griffiths, G.V. Hurley, AL. Muecke, D.K. Muschenheim and P.G. Wells (eds.). *Understanding the Environmental Effects of Offshore Hydrocarbon Development*. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2311: xvii + 82 pp + Appendices.

Cripps, G.C. and J. Shears. 1997. That fate in the marine environment of a minor diesel fuel spill from an Antarctic research station. *Environmental Monitoring and Assessment*, 46(3): 221-232.

Crone, T.J. and M. Tolstoy. 2010. Magnitude of the 2010 Gulf of Mexico Oil Leak. *Science*, 330: 634-643.

Crum, L.A., M.R. Bailey, J. Guan, P.R. Hilmo, S.G. Kargl and T.J. Matula. 2005. Monitoring bubble growth in supersaturated blood and tissue *ex vivo* and the relevance to marine mammal bioeffects. *Acoustic Reserach Letters Online*, 6(3): 214-220.

Curran, M.C. 1992. *The Behavioral Physiology of Labroid Fishes*. Ph.D Dissertation, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Technical Report WHOI-92-41, Woods Hole, MA. 124 pp.

CWS (Canadian Wildlife Service). Unpublished Data.

D'Amico, A., R.C. Gisiner, D.R. Ketten, J.A. Hammock, C. Johnson, P.L. Tyack and J. Mead. 2009. Beaked whales strandings and naval exercises. *Aquatic Mammals*, 35(4): 452-472.

Dahlheim, M.E. 1987. *Bio-acoustics of the Gray Whale (Eschrichtius robustus)*. Ph.D. Dissertation, University of British Columbia, Vancouver, BC. 315 pp.

Dahlheim, M.E. and C.O. Matkin. 1994. Assessment of injuries to Prince William Sound killer whales. Pp. 163-171. In: T.R. Loughlin (ed.). *Marine Mammals and the Exxon Valdez*. Academic Press, San Diego, CA. 395 pp.

Dalley, E.L., J.T. Anderson and D.J. Davis. 2000. Short term fluctuations in the pelagic ecosystem of the Northwest Atlantic. *Canadian Stock Assessment Secretariat Research Document*, 2000/101: 36 pp.

Danil, K. and J.A. St. Leger. 2011. Seabird and dolphin mortality associated with underwater detonation exercises. *Marine Technology Society Journal*, 45: 89-95.

Davidson L.W., S.L. Hodgins and C.T. Niwinski. 1984. *The Physical Environment of Placentia Bay, Newfoundland*. Seaconsult Limited, St. John's, NL. Pp. 22-24 and Pp. 112-119.

Davis, R.A., D.H. Thomson and C.I. Malme. 1998. *Environmental Assessment of Seismic Exploration on the Scotian Shelf*. Prepared for Mobil Oil Canada Properties Ltd., Shell Canada Ltd., and Imperial Oil Ltd.

Davoren, G.K., C. May, P. Penton, B. Reinfort, A. Buren, C. Burke, D. Andrews, W.A. Montevecchi, N. Record, B. deYoung, C. Rose-Taylor, T. Bell, J.T. Anderson, M. Koen-Alonso and S. Garthe. 2008. An ecosystem-based research program for capelin (*Mallotus villosus*) in the Northwest Atlantic: Overview and results*. Journal of Northwest Atlantic Fisheries Science*, 39: 35-48.

Davoren, G.K., P. Penton, C. Burke and W.A. Montevecchi. 2012. Water temperature and timing of capelin spawning determine seabird diets*. ICES Journal of Marine Science*, doi:10.1093/icesjms/fss032.

Dawe, E.G. and L.C. Hendrickson. 1998. A review of the biology, population dynamics, and exploitation of short-finned squid in the northwest Atlantic Ocean, in relation to assessment and management of the resource. *North Atlantic Fisheries Organization Science Council Rereasch Document*, 98/59: 33 pp.

Dawe, E.G., L.C. Hendrickson, E.B. Colbourne, K.F. Drinkwater and M.A. Showell. 2007. Ocean climate effects on the relative abundance of short-finned (*Illex illecebrosus*) and long-finned (*Loligo pealeii*) squid in the Northwest Atlantic Ocean. *Fisheries Oceanography*, 16(4): 303-316.

Dawe, E.G., D. Mullowney, D. Stansbury, E. Hynick, P. Veitch, J. Drew, E. Colbourne, P. O'Keefe, D. Fiander, K. Skanes, R. Stead, D. Maddock-Parsons, P. Higdon, T. Paddle, B. Noseworthy and S. Kelland. 2010. An assessment of Newfoundland and Labrador snow crab (*Chionoecetes opilio*) in 2008. *DFO Canadian Science Advisory Secretariat Research Document*, 2010/016: iv + 183 pp.

Dawe, E.G., D. Mullowney, D. Stansbury, K. Skanes, E. Hynick, D. Fiander, P. Veitch, E. Colbourne, P. O'Keefe and D. Maddock-Parsons. 2010. An assessment of Newfoundland and Labrador snow crab (*Chionoecetes opilio*) in 2009. *DFO Canadian Science Advisory Secretariat Research Document*, 2010/016. 189 pp.

Dawe, E.G., J.C. Shears, N.E. Balch and R.K. O'Dor. 1990. Occurrence, size, and sexual maturity of long-finned squid (*Loligo pealei*) at Nova Scotia and Newfoundland, Canada. *Canadian Journal of Fisheries and Aquatic Sciences*, 47(9): 1830-1835.

Dawe, E.G. and D.M. Taylor 2003. Newfoundland and Labrador snow crab. *DFO Canadian Science Advisory Secretariat*, 2003/021. 15 pp.

Day, R.H., S.M. Murphy, J.A. Wiens, G.D. Hayward, E.J. Harner and L.N. Smith. 1995. Use of oil-affected habitats by birds after the *Exxon Valdez* oil spill. Pp. 726-761. In: P.G. Wells, J.N. Butler and J.S. Hughes (eds.). *Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters*. ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp.

Day, R.H., S.M. Murphy, J.A. Wiens, G.D. Hayward, E.J. Harner and L.N. Smith. 1997. Effects of the *Exxon Valdez* oil spill on habitat use by birds in Prince William Sound, Alaska. *Ecological Applications*, 7: 593-613.

De Grave, S. and A. Whitaker. 1999. Benthic community re-adjustment following dredging of a muddy-maerl matrix. *Marine Pollution Bulletin*, 38(2): 102-108.

De Robertis, A., V. Hjellvik, N.J. Williamson and C.D. Wilson. 2008. Silent ships do not always encounter more fish: Comparison of acoustic backscatter recorded by a noise-reduced and a conventional research vessel. *ICES Journal of Marine Science*, 65: 623-635.

Dean, F.C., C.M. Jurasz, V.P. Palmer, C.H. Curby and D.L. Thomas. 1985. *Analysis of Humpback Whale (Megaptera novaeangliae) Blow Interval Data/Glacier Bay, Alaska, 1976-1979*. Report by University of Alaska, Fairbanks, for US National. Park Service, Anchorage, AK. 224 pp.

Dean, T.A. and S.C. Jewett. 2001. Habitat-specific recovery of shallow subtidal communities following the *Exxon Valdez* oil spill. *Ecological Applications*, 11(5): 1456-1471.

Dean, T.A., M.S. Stekoll, S.C. Jewett, R.O. Smith and J.E. Hose. 1998. Eelgrass (*Zostera marina* L.) in Prince William Sound, Alaska: Effects of the *Exxon Valdez* oil spill. *Marine Pollution Bulletin*, 36(3): 201-210.

DeBlois, E.M., C. Leeder, K.C. Penney, M. Murdoch, M.D. Paine, F. Power and U.P. Williams. 2005. Terra Nova environmental effects monitoring program: From Environmental Impact Statement onward. Pp. 475-491. In: S.L. Armsworthy, P.J. Cranford and K. Lee (eds.). *Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies*, Battelle Press, Columbus, OH. 631 pp.

DeCelles, G.R. and S.X. Cadrin. 2007. An interdisciplinary assessment of winter flounder stock structure. *ICES Theme Session on Stock Identification – Applications for Aquaculture and Fisheries Management*, 2007/L:18.

DeLaune, R.D. and A.L. Wright. 2011. Projected impact of *Deepwater Horizon* oil spill on US Gulf Coast wetlands. *Soil Science Society of America Journal*, 75(5): 1602-1612.

DeLaune, R.D., W.H. Patrick, Jr. and R.J. Buresh. 1979. Effect of crude oil on a Louisiana *Spartina alterniflora* salt marsh. *Environmental Pollution*, 20(1): 21-31.

Deloitte Petroleum Services. 2012. *List of Offshore Petroleum Wells to December 31, 2011*. Report generated on request from Deloitte LLP. London, England.

Den Hartog, C. and R.P.W.M. Jacobs. 1980. Effects of the "*Amoco Cadiz*" oil spill on an eelgrass community at Roscoff (France) with special reference to the mobile benthic fauna. *Helgolander Meeresuntersuchungen*, 33: 182-191.

DeRuiter, S.L. and K. Larbi Doukara. 2012. Loggerhead turtles dive in response to airgun sound exposure. *Endangered Species Research*, 16: 55-63.

deYoung, B., T. Otterson and R. Greatbach, 1993. The local and nonlocal response of Conception Bay to wind forcing. *Journal of Physical Oceanography*, 23: 2636-2649.

DFO (Fisheries and Oceans Canada). 1986. *Policy for the Management of Fish Habitat*. iii + 28 pp.

DFO (Fisheries and Oceans Canada). 1997. Atlantic salmon Newfoundland and Labrador Salmon Fishing Areas 1-14B. *DFO Science Stock Status Report*, 1997/D2/01: 6 pp.

DFO (Fisheries and Oceans Canada). 1998. *Offshore Surf Clam Integrated Fishery Management Plan, Maritimes and Newfoundland Regions 1998-2002*. 24 pp. Available at: http://www2.mar.dfo-mpo.gc.ca/fisheries/res/imp/98srfclm.htm

DFO (Fisheries and Oceans Canada). 1999. Porbeagle shark in NAFO subareas 3-6. *DFO Science Stock Status Report*, B3-09 (1999): 8 pp.

DFO (Fisheries and Oceans Canada). 2000. Northwest Atlantic harp seals. *DFO Science Stock Status Report*, E1-01. 7 pp.

DFO (Fisheries and Oceans Canada). 2002. Lumpfish in NAFO Division 3P. *DFO Canadian Science Advisory Secretariat Science Advisory Stock Status Report*, 2002/A2/17: 3 pp.

DFO (Fisheries and Oceans Canada). 2003a. Newfoundland lobster. *DFO Science Stock Status Report*, 2003/022: 11 pp.

DFO (Fisheries and Oceans Canada). 2003b. *Profile of the Blue Mussel (Mytilus edulis): Gulf Region*. DFO Gulf Region, Policy and Economics Branch, Moncton, NB.

DFO (Fisheries and Oceans Canada). 2004a. Review of scientific information on impacts of seismic sound on fish, invertebrates, marine turtles and marine mammals. *Canadian Scientific Advisory Secretariat Habitat Status Report*, 2004/002: 15 pp.

DFO (Fisheries and Oceans Canada). 2004b. Potential impacts of seismic energy on snow crab. *Canadian Scientific Advisory Secretariat Habitat Status Report*, 2004/003: 5 pp.

DFO (Fisheries and Oceans Canada). 2004c. Allowable harm assessment for spotted and northern wolffish. *Canadian Scientific Advisory Secretariat Stock Status Report*, 2004/031: 5 pp.

DFO (Fisheries and Oceans Canada). 2004d. Description of the methods used for estimating the abundance of *Sebastes fasciatus* and *S. mentella* in Units 1 and 2. *DFO Canadian Science Advisory Secretariat Research Document*, 2004/092: iii + 50 pp.

DFO (Fisheries and Oceans Canada). 2004e. Identification of Ecologically and Biologically Significant Areas. *Canadian Scientific Advisory Secretariat Ecosystem Status Report*, 2004/006: 15 pp.

DFO (Fisheries and Oceans Canada). 2005a. West coast of Newfoundland Atlantic herring (Division 4R) in 2004. *Canadian Scientific Advisory Section Habitat Status Report*, 2005/016. 9 pp.

DFO (Fisheries and Oceans Canada). 2005b. Stock assessment report on Newfoundland and Labrador snow crab. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2005/017: 27 pp.

DFO (Fisheries and Oceans Canada). 2005c. Proceedings of the Newfoundland and Labrador Regional Advisory Process for 3Ps cod, 2+3K American plaice, and 3LNO and 3Ps monkfish. 20-24 October 2003 and 27-31 October 2003. *DFO Canadian Science Advisory Secretariat Science Advisory Proceeding Series*, 2004/039: vi + 36 pp.

DFO (Fisheries and Oceans Canada). 2006a. Assessment of the Atlantic mackerel for the Northwest Atlantic (Subareas 3 and 4) in 2005. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2006/033: 17 pp.

DFO (Fisheries and Oceans Canada). 2006b. Assessment of American lobster in Newfoundland. *Canadian Scientific Advisory Secretariat Science Advisory Report*, 2006/009: 9 pp.

DFO (Fisheries and Oceans Canada). 2006c. Recovery potential assessment report on white sharks in Atlantic Canada. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2006/052: 6 pp.

DFO (Fisheries and Oceans Canada). 2006d. *Potential Socio-economic Implications of adding Porbeagle Shark to the List of Wildlife Species at Risk in the Species at Risk Act (SARA)*. DFO Policy and Economics Branch, Maritimes Region. Available at: http://www.dfo-mpo.gc.ca/species-especes/reports-rapports/porbeagle-maraiche/index-eng.htm

DFO (Fisheries and Oceans Canada). 2007a. Placentia Bay-Grand Banks Large Ocean Management Area conservation objectives. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2007/042: 19 pp.

DFO (Fisheries and Oceans Canada). 2007b. Placentia Bay-Grand Banks Large Ocean Management Area Ecological and Biologically Significant Areas. *DFO Canadian Science Advisory Secretariat Research Document*, 2007/052: 21 pp.

DFO (Fisheries and Oceans Canada). 2007c. *Cetacean Sighting Database*. Marine Mammal Section, DFO, St. John's, NL.

DFO (Fisheries and Oceans Canada). 2008a. *Tsunami Physics Website*. Fisheries and Oceans Canada, Ottawa, ON. Available at: http://www-sci.pac.dfo-mpo.gc.ca/osap/ projects/tsunami/tsunamiphysics_e.htm

DFO (Fisheries and Oceans Canada). 2008b. *Integrated Management Planning – Placentia Bay, Newfoundland and Labrador*. Fisheries and Oceans Canada, St. John's, NL.

DFO (Fisheries and Oceans Canada). 2008c. Status of basking sharks in Atlantic Canada. *DFO Canadian Science Advisory Secretariat Research Document*, 2008/036: iv + 23 pp.

DFO (Fisheries and Oceans Canada). 2009a. Assessment of American lobster in Newfoundland. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2009/026: 9 pp.

DFO (Fisheries and Oceans Canada). 2009b. Available information for preparation of the western Atlantic bluefin tuna (*Thunnus thynnus*) COSEWIC status report. *DFO Canadian Science Advisory Secretariat Research Document*, 2009/035: vi + 13 pp.

DFO (Fisheries and Oceans Canada). 2009c. Does eelgrass (*Zostera marina*) meet the criteria as an ecologically significant species? *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2009/018: 11 pp.

DFO (Fisheries and Oceans Canada). 2010a. Recovery potential assessment for roundnose grenadier (*Coryphaenoides rupestris*). *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2010/021: 11 pp.

DFO (Fisheries and Oceans Canada). 2010b. Recovery potential assessment for loggerhead sea turtles (*Caretta caretta*) in Atlantic Canada. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2010/042: 11 pp.

DFO (Fisheries and Oceans Canada). 2010c. 2010 Canadian marine ecosystem status and trends report. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2010/030(Revised): 38 pp.

DFO (Fisheries and Oceans Canada). 2011a. Ecological assessment of the invasive European green crab (*Carcinus maenas*) in Newfoundland 2007-2009. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2010/033: 10 pp.

DFO (Fisheries and Oceans Canada). 2011b. Assessment of Newfoundland and Labrador snow crab. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2011/011: 44 pp.

DFO (Fisheries and Oceans Canada). 2011c. The status of northern shrimp (*Pandalus borealis*) resource off Labrador and northeastern Newfoundland as of March 2010. *DFO Canadian Science Advisory Secretariat Science Research Document*, 2011/004: vi + 175 pp.

DFO (Fisheries and Oceans Canada). 2011d. Current status of Northwest Atlantic harp seals (*Pagophilus groenlandicus*). *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2011/050: 16 pp.

DFO (Fisheries and Oceans Canada). 2011e. Recovery potential assessment for western Atlantic bluefin tuna (*Thunnus thynnus*) in Canadian waters. *DFO Canadian Science Advisory Secretariat*, 2011/056: 17 pp.

DFO (Fisheries and Oceans Canada). 2011f. Recovery potential assessment of American plaice (*Hippoglossoides platessoides*) in Newfoundland and Labrador. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2011/030: 27 pp.

DFO (Fisheries and Oceans Canada). 2012a. *MSC Wind and Wave Hindcast Model Data*. Available at: http://isdm.gc.ca/isdm-gdsi/waves-vagues/MscHindcast-eng.htm (Date Modified: 2011-07-05). Website accessed January 2012.

DFO (Fisheries and Oceans Canada). 2012b. *Tides, Currents and Water Levels, Station Inventory Data, Atlantic Region. Station 835, Argentia*. Available at: http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/twl-mne/inventory-inventaire/list-liste-eng.asp?user=isdm-gdsi&region=ATL&tst=1

DFO (Fisheries and Oceans Canada). 2012c. *Atlantic Canada digital catch and effort datasets*. St. John's and Ottawa, for 1990 to 2010. Georeferenced harvest data (accessed various years to 2012).

DFO (Fisheries and Oceans Canada). 2012d. *Newfoundland and Labrador Region species quota reports for 2007 to 2012* (accessed May to June 2012).

DFO (Fisheries and Oceans Canada). 2012e. Assessment of Newfoundland and Labrador snow crab. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2012/008: 47 pp.

DFO (Fisheries and Oceans Canada) and MRNF (Québec Ministère des Ressources naturelles et de la Faune). 2009. Conservation Status Report, Atlantic salmon in Atlantic Canada and Quebec: Part II – Anthropogenic Considerations. *Canadian Manuscript Reports of Fisheries and Aquatic Sciences*, No. 2870, 175 pp.

Dick, M. H. and W. Donaldson. 1978. Fishing vessel endangered by Crested Auklet landings. *Condor*, 80:235-236.

Di Iorio, L. and C.W. Clark. 2010. Exposure to seismic survey alters blue whale acoustic communication. *Biological Letters*, 6(1): 51-54. Doi: 10.1098érsbl.2009.0651.

Dobrocky Seatech. 1985. *Field Data Report: Sea Ice Documentation in the Vicinity of the Hibernia Drilling Area*. Mobil Oil Canada Ltd., Calgary, AB.

Doksæter, L., P.H. Kvadsheim, O.R. Godø, N.O. Handegard, C. Donovan, F.P. Lam and P.J.O. Miller. 2009. Behavioral responses of herring (*Clupea harengus*) to 1-2 and 6-7 kHz sonar signals and killer whale feeding sounds. *Journal of the Acoustical Society of America*, 125: 554-564.

Dominquez, L. 1999. *Reproductive Success and Environmental Contaminants among Bald Eagles in Placentia and Bonavista Bay, Newfoundland*. M.Sc. thesis, Memorial University of Newfoundland, St. John's, NL, Canada.

Dominquez, L., W.A. Montevecchi, N.M. Burgess, J. Brazil and K.A. Hobson. 2002. Reproductive status, environmental contaminants, and trophic status of nesting bald eagles in eastern Newfoundland, Canada. *Journal of Raptor Research*, 65: 1-36.

Doniol-Valcroze, T., D. Berteaux, P. Larouche and R. Sears. 2007. Influence of thermal fronts on habitat selection by four rorqual whale species in the Gulf of St. Lawrence. *Marine Ecology Progress Series*, 335: 207-216.

Dooley. D. 2011. Placentia begins to boom. *The Telegram*, September 12, 2011. Available at: http://www.thetelegram.com/Business/2011-09-12/article-2745805/Placentia-begins-to-boom/1

Dooling, R.J. and S.C. Therrien. 2012. Hearing in birds: What changes from air to water. Pp. 77-82. In: A. N. Popper and A. Hawkins (eds.). *The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology* Series No. 730. Springer, New York. 695 pp.

Douglas J.S., P. Simmons and B. deYoung. 2000. *Analysis of the Mean Circulation in Placentia Bay: Spring and Summer 1999*. Physics and Physical Oceanography Data Report 2000-1, Department of Physics and Physical Oceanography, Memorial University of Newfoundland, St. John's, NL. p: 62.

Drinkwater 2005. The response of Atlantic cod (*Gadus morhua*) to future climate change. *ICES Journal of Marine Science*, 62(7): 1327-1337.

Duarte, C.M. and C.L. Chiscano. 1999. Seagrass biomass and production: A reassessment. *Aquatic Botany*, 65: 159-174.

Dufault, S. 2005. *Draft COSEWIC Status Report on Common Minke Whale Balaenoptera acutorostrata in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. 32 pp.

Dufault, S. and R.A. Davis. 2003. *Whale Monitoring aboard The Cat, Summer 2002*. LGL Rep. 2741. Rep. by LGL Ltd., King City, ON, for Bay Ferries Ltd., Charlottetown, PEI. 33 pp. + Appendices.

Duffy, L.K., R.T. Bowyer, J.W. Testa and J.B. Faro. 1993. Differences in blood haptoglobin and length-mass relationships in river otters (*Lutra Canadensis*) from oiled and nonoiled areas of Prince William Sound, Alaska. *Journal of Wildlife Diseases*, 29: 353-359.

Duffy, L.K., R.T. Bowyer, J.W. Testa and J.B. Faro. 1994a. Chronic effects of the *Exxon Valdez* oil spill on blood and enzyme chemistry of river otters. *Environmental Toxicology and Chemistry*, 13(4): 643-647.

Duffy, L.K., R.T. Bowyer, J.W. Testa and J.B. Faro. 1994b. Evidence for recovery of body mass and haptoglobin values of river otters following the *Exxon Valdez* oil spill. *Journal of Wildlife Diseases*, 30(3): 421-425.

Duinker, P.N. 1985. Ecological effects monitoring in an environmental assessment: What can it accomplish? *Environmental Management*, 13(6): 797-805.

Dulvy, N.K., J.K. Baum, S. Clarke, L.J.V. Compagno, E. Cortés, A. Domingo, S. Forham, S. Fowler, M.P. Francis, C. Gibson, J. Martinez, J.A. Musick, A. Soldo, J.D. Stevens and S. Valenti. 2008. You can swim but you can't hide: The global status and conservation of oceanic pelagic sharks and rays. *Aquatic Conservation*, 18(5): 459-482.

Dunn, R.A. and O. Hernandez. 2009. Tracking blue whales in the eastern tropical Pacific with an ocean-bottom seismometer and hydrophone array. *Journal of the Acoustical Society of America*, 126(3): 1084-1094.

Dutton, P.H., B.W. Bowen, D.W. Owens, A. Barragan and S.K. Davis. 1999. Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). *Journal of Zoology*, 248: 397-409.

E&P Forum (Exploration and Production Forum). 1996. *Quantitative Risk Assessment (QRA) Data Sheet Directory*. The Oil Industry International Exploration and Production Forum, 25-28 Old Burlington Street, London, UK.

Eastcan Exploration Ltd. 1973. *Iceberg Towing Manual*. MAREX, Cowes, Isle of Wight.

Eckert, S.A. 2006. High-use oceanic areas for Atlantic leatherback sea turtles (*Dermochelys coriacea*) as identified using satellite telemetered location and dive information. *Marine Biology*, 149: 1257-1267.

Edinger, E, K. Baker, R. Devillers and V. Wareham. 2007. *Coldwater Corals off Newfoundland and Labrador: Distributions and Fisheries Impacts*. World Wildlife Foundation, Toronto, ON. 31 pp.

Edinger, E.N., O.A. Sherwood, D.J.W. Piper, V.E. Wareham, K.D. Baker, K.D. Gilkinson and D.B. Scott. 2010. Geological features supporting deep-sea coral habitat in Atlantic Canada. *Continental Shelf Research*, 31(2, Suppl.): S69-S84.

Edwards, B.R., C.M. Reddy, R. Camilli, C.A. Carmichael, K. Longnecker and B.A.S. Van Mooy. 2011. Rapid microbial respiration of oil from the *Deepwater Horizon* spill in offshore surface waters of the Gulf of Mexico. *Environmental Research Letters*, 6(3): 035301.

EEA (European Environment Agency). 2009. *Air Pollutant Emission Inventory Guidebook*.

Ellis, J.I., G. Fraser and J. Russell. 2012. Discharged drilling waste from oil and gas platforms and its effects on benthic communities. *Marine Ecology Progress Series*, 456: 285-302.

Elsner, J.B. 2003. Tracking hurricanes. *Bulletin of the American Meteorological Society*, 84: 353-356.

Elsner, J.B. and B.H. Bossak. 2004. Hurricane landfall probability and climate. In: R. Murnane and K.-b. Liu (eds.). *Hurricanes and Typhoons: Past, Present, and Future*, Columbia University Press.

EMCP (ExxonMobil Canada Properties). 2011. *Hebron Project Comprehensive Study*.

Engås, A, S. Løkkeborg, E. Ona and A.V. Soldal. 1996. Effects of seismic shooting on local abundance and catch rates of cod (*G. morhua*) and haddock (*M. aeglefinus*). *Canadian Journal of Fisheries and Aquatic Sciences*, 53(10): 2238-2249.

Engel, M.H., M.C.C. Marcondes, C.C.A. Martins, F.O. Luna, R.P. Lima and A. Campos. 2004. *Are Seismic Surveys Responsible for Cetacean Strandings? An Unusual Mortality of Adult Humpback Whales in Abrolhos Bank, Northeastern Coast of Brazil*. Paper SC/56/E28 presented to the International Whaling Commission Scientific Committee, International Whaling Commission Annual Meeting, 19-22 July, Sorrento, Italy.

Engelhardt, F.R. 1978. Petroleum hydrocarbons in Arctic ringed seals, *Phoca hispida*, following experimental oil exposure. Pp. 614 628. In: *Proceedings of the Conference on the Assessment of the Ecological Impacts of Oil Spills*, 14 17 June 1978, Keystone, CO. American Institute of Biological Science.

Engelhardt, F.R. 1982. Hydrocarbon metabolism and cortisol balance in oil exposed ringed seals, *Phoca hispida*. *Comparative Biochemistry and Physiology*, 72C: 133-136.

Ennis, G.P. 1974. Observations of the lobster fishery in Newfoundland. *Fisheries Research Board of Canada Technical Report*, No. 479: iii + 21 pp.

Ennis, G.P., P.W. Collins, G. Dawe and W.R. Squires. 1986. Fisheries and population biology of lobsters (*Homarus americanus*) at Arnold's Cove, Newfoundland. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 1438: 34 pp.

Ennis, P.E. 1995. Larval and postlarval ecology. Pp. 23-46. In: J.R. Factor (ed.). *Biology of the Lobster Homarus americanus*, Academic Press Inc. 528 pp.

Environment Canada. 1997. *The Canada Country Study: Climate Impacts and Adaptation, Atlantic Canada Summary*.

Environment Canada. 2007. *Environment Canada Background Document on the Management of Incidental Take of Migratory Birds: Towards a Regulatory Approach*. Last Updated October 25, 2007. Available at: www.ec.gc.ca/paom-itmb/default.asp?land=En$n=F8C0333F-1.

Environment Canada. 2011. *MSC Wind and Wave Climatologies*. Available at: http://www.oceanweather.net/MSC50WaveAtlas/index.htm

Environment Canada. 2012a. *National Climate Data and Information Archive*. Available at: http://www.climate.weatheroffice.gc.ca/Welcome_e.html

Environment Canada. 2012b. *Key Data Tables, Facility GHG Emissions Data by Province/Territory (2010)*. Available at: http://ec.gc.ca/ges-ghg/default.asp?lang=En&n=DF08C7BA-1

Environment Canada. 2012c. *Key Data Tables, Summary of GHG Emissions by Facility (2010)*. Available at: http://ec.gc.ca/ges-ghg/default.asp?lang=En&n=DF08C7BA-1

Environment Canada. 2012d. *National Pollutant Release Inventory - 2010 Facility and Substances Information*. Available at: http://www.ec.gc.ca/pdb/websol/querysite/query_e.cfm

Environment Canada. 2012e. *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada*.

Environment Canada. 2012f. *Recovery Strategy for the Piping Plover (Charadrius melodus melodus) in Canada*. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa, ON. v + 29 pp.

Eppley, Z.A. 1992. Assessing indirect effects of oil in the presence of natural variation: The problem of reproductive failure in South Polar Skuas during the *Bahia Paraiso* oil spill. *Marine Pollution Bulletin*, 25: 307-312.

Eppley, Z.A. and M.A. Rubega. 1990. Indirect effects of an oil spill: Reproductive failure in a population of South Polar Skuas following the '*Bahia Paraiso*' oil spill in Antarctica. *Marine Ecology Progress Series*, 67: 1-6.

Erasmus, T. and E.D. Wessels. 1985. Heat production studies on normal and oil-covered Jackass Penguins (*Spheniscus demersus*) in air and water. *South African Journal of Zoology*, 20: 209-212.

Erbe, C. and A.R. King. 2009. Modeling cumulative sound exposure around marine seismic surveys. *Journal of the Acoustical Society of America*, 125(4): 2443-2451.

Erftemeijer, P.L.A. and R.R.R. Lewis, III. 2006. Environmental impacts of dredging on seagrasses. *Marine Pollution Bulletin*, 52(12): 1553-1672.

Erikson, D.E. 1995. Surveys of Murre colony attendance in the Northern Gulf of Alaska following the *Exxon Valdez* oil spill. Pp. 780-819. In: P.G. Wells, J.N. Butler and J.S. Hughes (eds.). *Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters*. ASTM STP 1219. American Society for Testing and Materials. Philadelphia, PA. 965 pp.

Ernst, C.H., R.W. Barbour and J.E. Lovich. 1994. *Turtles of the United States and Canada*. Smithsonian Institute Press, Washington, DC. 578 pp.

Esler, D., B.E. Ballachey, K.A. Trust, S.A. Iverson, J.A. Reed, A.K. Miles, J.D. Henderson, B.R. Woodin, J.J. Stegeman, M. McAdie, D.M. Mulcahy and B.W. Wilson. 2011. Cytochrome P4501A biomarker indication of the timeline of chronic exposure of Barrow's Goldeneyes to residual *Exxon Valdez* oil. *Marine Pollution Bulletin*, 62: 609-614.

Esler, D., T.D. Bowman, K.A. Trust, B.E. Ballachey, T.A. Dean, S.C. Jewett and C.E. O'Clair. 2002. Harlequin Duck population recovery following the *Exxon Valdez* oil spill: Progress, process and constraints. *Marine Ecology Progress*, 241: 271-286.

Esler, D. and S.A. Iverson. 2010. Female Harlequin Duck winter survival 11 to 14 years after the *Exxon Valdez* oil spill. *Journal of Wildlife Management*, 74: 471-478.

Esler, D., K.A. Trust, B.E. Ballachey, S.A. Iverson, T.L. Lewis, D.J. Rizzolo, D.M. Mulcahy, A.K. Miles, B.R. Woodin, J.J. Stegeman, J.D. Henderson and B.W. Wilson. 2010. Cytochrome P4501A biomarker indication of oil exposure in Harlequin Ducks up to 20 years after the *Exxon Valdez* oil spill. *Environmental Toxicology and Chemistry*, 29: 1138-1145.

Exxon Valdez Oil Spill Trustee Council. 2012. *Status of Injured Resources and Services*. Accessed on 18 June 2012. Available at: http://www.evostc.state.ak.us/recovery/status.cfm.

Fader, G.B.J. and L.H. King. 1981. A reconnaissance survey of the surficial geology of the Grand Banks of Newfoundland. In: *Current Research, Part A. Geological Survey of Canada*, Paper 81-1A: 45-56.

Fader, G.B.J., L.H. King and W. Josenhans. 1982. Surficial geology of the Lurentian Channel and the Western Grand Banks of Newfoundland. *Marine Sciences Paper 21, Geological Survey of Canada Paper*, 81-22.

Fader, G.B.J. and R.O. Miller. 1986. A reconnaissance study of the surficial and shallow bedrock geology of the southeastern Grand Banks of Newfoundland. In: *Current Research, Part B. Geological Survey of Canada*, Paper 86-1B: 591-604.

Fahey, M.P. 1983. Guide to the early stages of marine fishes occurring in the western North Atlantic Ocean, Cape Hatteras to the southern Scotian Shelf. *Journal of the Northwest Atlantic Fisheries Sciences*, 4: 1-423.

Fair, P.A. and P.R. Becker. 2000. Review of stress in marine mammals. *Journal of Aquatic Ecosystem Stress Recovery*, 7: 335-354.

Faulkner, S. G., M. Welz, W.M. Tonn and D.R. Schmitt. 2008. Effects of simulated blasting on mortality of rainbow trout eggs. *Transactions Of The American Fisheries Society*, 137(1): 1-12

Fay, R.R. 1988. *Hearing in Vertebrates: Pschophysics Databook*. Hill-Fay Associates, Winnetka, IL. 621 pp.

Fay, R.R. and A.N. Popper. 2000. Evolution of hearing in vertebrates: The inner ears and processing. *Hearing Research*, 149: 1-10.

Feehan, C., R.E. Scheibling and J.S. Lauzon-Guay. 2012. Aggregative feeding behavior in sea urchins leads to destructive grazing in a Nova Scotian kelp bed. *Marine Ecology Progress Series*, 444: 69-83.

Fernández, A., M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, E. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martin, A.A. Cunningham and P.D. Jepson. 2004. Pathology: whales, sonar and decompression sickness (reply). *Nature*, 428(6984, 15 Apr.). doi: 10.1038/nature02528a.

Fernández, A., J.F. Edwards, F. Rodriquez, A.E. de los Monteros, P. Herráez, P. Castro, J.R. Jaber, V. Martin and M. Arbelo. 2005. Gas and fat embolic syndrome involving a mass stranding of beaked whales (Family Ziphiidae) exposed to anthropogenic sonar signals. *Veterin. Pathology*, 42(4): 446-457.

FGI (Fugro GeoSurveys Inc.). 2011. *Preliminary Site Characterization, Proposed Wellhead Platform Location, White Rose Extension Project*. FGI Doc No. 20110030-RPT-001 Rev 0. Contract report submitted to Husky Energy. 26 pp.

FGI (Fugro Geosurveys Inc.). 2012. *Preliminary Geophysical Investigation Proposed Wellhead Platform Location White Rose Extension Project*. FGI Doc No. 20110074-RPT-001 Rev 0 Prepared for Husky Energy, St. John's, NL.

Fifield, D.A., K.P. Lewis, C. Gjerdrum, G.J. Robertson and R. Wells. 2009. Offshore seabird monitoring program. *Environment Studies Research Funds Report*, No. 183: v + 68 pp. + Appendices.

Filadelfo, R., J. Mintz, E. Michlovich, A. D'Amico, P.L. Tyack and D.R. Ketten. 2009. Correlating military sonar use with beaked whale mass strandings: what do the historical data show? *Aquatic Mammals*, 35(4): 435-444.

Finch, B.E., K.J. Wooten, D.R. Faust and P.N. Smith. 2012. Embryotoxicity of mixtures of weathered crude oil collected from the Gulf of Mexico and Corexit 9500 in mallard ducks (*Anas platyrhynchos*). *Science of the Total Environment*, 426: 155-159.

Fingas, M. 2001. *The Basics of Oil Spill Cleanup. Second Edition*. CRC Press LLC. 256 pp.

Finneran, J.J. 2012. Auditory effects of underwater noise in odontocetes. Pp. 197-202. In: A. Hawkins and A.N. Popper (eds.). *The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology* Series No. 730. Springer, New York. 695 pp.

Finneran, J.J., D.A. Carder, C.E. Schlundt and R.L. Dear. 2010b. Temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) exposed to intermittent tones. *Journal of the Acoustical Society of America*, 127(5): 3267-3272.

Finneran, J.J., D.A. Carder, C.E. Schlundt and S.H. Ridgway. 2005. Temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones. *Journal of the Acoustical Society of America*, 118: 2696-2705.

Finneran, J.J., R. Dear, D.A. Carder and S.H. Ridgway. 2003. Auditory and behavioral responses of California sea lions (*Zalophus californianus*) to single underwater impulses from an arc-gap transducer. *Journal of the Acoustical Society of America*, 114(3): 1667-1677.

Finneran, J.J. and C.E. Schlundt. 2010. Frequency-dependent and longitudinal changes in noise-induced hearing loss in a bottlenose dolphin (*Tursiops truncatus*) (L). *Journal of the Acoustical Society of America*, 128(2): 567-570.

Finneran, J.J. and C.E. Schlundt. 2011. Noise-induced temporary threshold shift in marine mammals. *Journal of the Acoustical Society of America*, 129(4): 2432. [supplemented by oral presentation at the ASA meeting, Issaquah, WA, May 2011].

Finneran, J.J., C.E. Schlundt, R. Dear, D.A. Carder and S.H. Ridgway. 2002. Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun. *Journal of the Acoustical Society of America*, 111(6): 2929-2940.

Fisheries Resources Conservation Council. 2005. *Strategic Conservation Framework for Atlantic Snow Crab*. Report to the Minister of Fisheries of Oceans. FRCC.05.R1

Fitzpatrick, A. 2012. Looking toward operations at Long Harbour. *The Telegram*, October 6, 2012. Available at: http://www.thetelegram.com/Business/2012-10-06/article-3094084/Looking-toward-operations-at-Long-Harbour/1

FJGI (Fugro Jacques GeoSurveys). 1999a. *White Rose N-30 Well Site Report, Grand Banks*. Newfoundland, CNOPB Program No. 8926-H006-005E. Contract report submitted to Husky Oil. 31 pp. + appendices and enclosures.

FJGI (Fugro Jacques GeoSurveys). 1999b. *White Rose A-17 Well Site Report, Grand Banks, Newfoundland*. CNOPB Program No. 8926-H006-005E. Contract report submitted to Husky Oil. 30 pp. + appendices and enclosures.

FJGI (Fugro Jacques GeoSurveys). 2000a. *White Rose N-20 Well Site Report, Grand Banks. Newfoundland*, CNOPB Program No. 8926-H006-006E. Contract report submitted to Husky Oil. 36 pp. + appendices and enclosures.

FJGI (Fugro Jacques GeoSurveys). 2000b. *Site Survey Report, White Rose 2000 Survey, Grand Banks, Newfoundland*. CNOPB Program No. 8926-H006-006E. Contract report submitted to Husky Oil. 38 pp. + appendices and enclosures

FJGI (Fugro Jacques GeoSurveys Inc.). 2001. *2001 White Rose Geotechnical and Geophysical Investigations, Grand Banks of Newfoundland*. Project 1009ST/1010SG, Final Report submitted to Husky Energy.

FJGI (Fugro Jacques GeoSurveys Inc.). 2004 *Analysis of Iceberg Scour Repetitive Mapping Data, 2004 Multibeam Survey of 4000 Series Lines, Grand Banks, Newfoundland Shelf*. Project 4101SG, Final Report submitted to GSC-A.

FJGI (Fugro Jacques GeoSurveys Inc.). 2005a. *Well Site Geohazard Evaluation, Proposed White Rose K 15 Location, Jeanne d'Arc Basin, Northeast Newfoundland Shelf*. Project 5073SG, C-NLOPB Program No. 8926-H006-014E. Preliminary Report submitted to Husky Energy.

FJGI (Fugro Jacques GeoSurveys Inc.). 2005b. *Well Site Geohazard Evaluation, Proposed White Rose B-19/O-28 Locations, Jeanne d'Arc Basin, Northeast Newfoundland Shelf*. Project 5073SG, C NLOPB Program No. 8926-H006-014E. Preliminary Report submitted to Husky Energy.

FJGI (Fugro Jacques GeoSurveys Inc.). 2005c. *White Rose Development, Jack up Rig Foundation Analyses, Well Sites B-19, O-28 and K-15, Preliminary Site Investigation, Woodstock Glory Hole*. Final Report submitted to Husky Energy.

FJGI (Fugro Jacques GeoSurveys Inc.). 2007. *Summary Report for Husky Representatives on Board THSD Vasco da Gama, Dredging Operations 2007*. Letter Report submitted to Husky Energy.

Flinn, R.D., A.W. Trites and E.J. Gregr. 2002. Diets of fin, sei, and sperm whales in British Columbia: An analysis of commercial whaling records, 1963-1967. *Marine Mammal Science*, 18(3): 663-679.

Fodrie, F.J. and K.L. Heck, Jr. 2011. Response of coastal fishes to the Gulf of Mexico oil disaster. *PLoS One*, 6(7): e21609.

Foo, S.H.C. and C.B. Crouse. 1986. Evaluation of seismicity and earthquake loading at Hibernia. Pp. 55-94. In: *Proceedings, Third Canadian Conference on Marine Geotechnical Engineering*, St. John's, NL.

Ford, J. 1977. *White Whale-Offshore Exploration Acoustic Study*. Prepared for Imperial Oil Ltd., Calgary, AB, by F.F. Slaney & Co. Ltd., Vancouver, BC. 19 pp.

Ford, J.K.B., G.M. Ellis and K.C. Balcomb. 2000. *Killer Whales. Second Edition*. UBC Press, Vancouver, BC. 104 pp.

Ford, R.G., G.W. Page and H.R. Carter. 1987. Estimating Mortality of Seabirds from Oil Spills. Pp. 547-551 In: *Proceedings of the 1987 Oil Spill Conference, 6-9 April 1987*. American Petroleum Institute, Environmental Protection Agency and United States Coast Guard, Baltimore, MD.

Forrester, W.D. 1983. *Canadian Tidal Manual*. Fisheries and Oceans Canada, Canadian Hydrographic Service, Ottawa, ON, 138 pp.

Forristall, G.Z., 1978. On the statistical distribution of wave heights in a storm. *Journal of Geophysical Research*, 83: 2353-2358.

Fraker, M.A. 1977. *The 1976 White Whale Monitoring Program, Mackenzie Estuary, N.W.T*. Prepared by F.F. Slaney & Co. Ltd., Vancouver, BC, for Imperial Oil Ltd., Calgary, AB. 73 pp.

Frank, KT, B. Petrie, J.S. Choi and W.C. Leggett. 2005. Trophic cascades in a formerly cod-dominated ecosystem. *Science*, 308 (5728): 1621-1623.

Frantzena, M., I. Falk-Petersen, J. Nahrganga, T.J. Smitha, G.H. Olsena, T.A. Hangstada and L. Camus. 2012. Toxicity of crude oil and pyrene to the embryos of beach spawning capelin (*Mallotus villosus*). *Aquatic Toxicology* 108: 42-52.

Frantzis, A. 1998. Does acoustic testing strand whales? *Nature*, 392(6671): 29.

Fratantoni P.S. and R.S. Pickart. 2007. The western North Atlantic Shelfbreak current system in summer. *Journal of Physical Oceanography*, 37: 2509-2533.

French-McCay, D.P. 2004. Oil spill impact modeling: Development and validation. *Environmental Toxicology and Chemistry*, 23(10) 2441-2456.

Frink, L. and J. White. 1990. A perspective on the effects of oil on birds. Pp. 13-16. In: *The Effects of Oil on Wildlife: Research, Rehabilitation and General Concerns, Proceedings from the Oil Symposium, Herndon, VA, Volume 2*, October 16-18, 1990, presented by International Wildlife Research, Tri-State Bird Rescue and Research, Inc., and International Bird Rescue Research Center.

Frisk, M.G., T.J. Miller and M.J. Fogarty. 2001. Estimation and analysis of biological parameters in elasmobranch fishes: A comparative life history study. *Canadian Journal of Fisheries and Aquatic Sciences*, 58(5): 969-981.

Fry, D.M. 1990. Oil exposure and stress effects on avian reproduction. In: *The Effects of Oil on Wildlife: Research, Rehabilitation and General Concerns, Proceedings from The Oil Symposium, Herndon, VA, Volume 2*, October 16-18, 1990. Presented by International Wildlife Research, Tri-State Bird Rescue and Research, Inc., and International Bird Rescue Research Center.

Fuller, S.D. 2004. *Diversity of Marine Sponges in the Northwest Atlantic*. A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy. Department of Biology, Dalhousie University, Halifax, NS. 212 pp.

Fuller, S.D. and R.A. Myers. 2004. *The Southern Grand Bank: A Marine Protected Area for the World*. World Wildlife Fund Canada. Halifax, NS. 99 pp.

Funk, D.W., D.S. Ireland, R. Rodrigues and W.R. Koski. (Editors). 2010. *Joint Monitoring Program in the Chukchi and Beaufort Seas, Open Water Seasons, 2006-2008*. LGL Alaska Rep. TA1050-2. Rep. by LGL Alaska Res. Assoc. Inc., LGL Ltd., Greenridge Sci. Inc., and JASCO Research Ltd., for Shell Offshore Inc., other Industry Contributors, US National Marine Fisheries Service and US Fish and Wildlife Service. 506 pp.

Gagnon, J.-M. and K.D. Gilkinson. 1994. Discrimination and distribution of the sea urchins *Strongylocentrotus droebachiensis* (O.F. Müller) and *S. pallidus* (G.O. Sars) in the Northwest Atlantic. *Sarsia*, 79(1): 1-11.

Gardner Pinfold. 2006. *Overview of the Atlantic Snow Crab Industry*. Report submitted to Department of Fisheries and Oceans and Atlantic Council of Fisheries and Aquaculture Ministers. Available at: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/reports-rapports/sc-cn_e.pdf

Gaskin, D.E. 1991. An update on the status of the right whale, *Eubalaena glacialis*, in Canada. *Canadian Field-Naturalist*, 105(2): 198-205.

Gaskin, D.E. 1992. Status of the common dolphin, *Delphinus delphis*, in Canada. *Canadian Field-Naturalist*, 106(1): 55-63.

Gaston, A.J. D.F. Bertram, A.W. Boyne, J.W. Chardine, G. Davoren, A.W. Diamond, A. Hedd, W.A. Montevecchi, J.M. Hipfner, M.J.F. Lemon, M.L. Mallory, J.-F. Rail and G.J. Robertson. 2009. Changes in Canadian seabird populations and ecology since 1970 in relation to changes in oceanography and food webs. *Environmental Reviews*, 17: 267-286.

Gaston, A.J. and I.L. Jones. 1998. *Bird families of the world: The Auks (Alcidae)*. Oxford University Press, Oxford. 349 pp.

Gauthreaux, S.A., Jr. and C.G. Belser. 2006. Effects of artificial night lighting on migrating birds. Pp. 67-93. In: C. Rich and T. Longcore (eds.). *Ecological Consequences of Artificial Night Lighting*. Island Press, Washington, DC. 478 pp.

Gavaris, S., K.J. Clark, A.R. Hanke, C.F. Purchase, J. Gale. 2010. Overview of discards from Canadian commercial fisheries in NAFO Divisions 4V, 4W, 4X, 5Y and 5Z for 2002-2006. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2873: vi + 112 pp.

Gedamke, J., N. Gales and S. Frydman. 2011. Assessing risk of baleen whale hearing loss from seismic surveys: The effects of uncertainty and individual variation. *Journal of the Acoustical Society of America*, 129(1): 496-506.

Gentry, R. (Editor). 2002. *Report of the Workshop on Acoustic Resonance as a Source of Tissue Trauma in Cetaceans. 24-25 April, NMFS, Silver Spring, MD*. 19 pp. Available at: http://www.nmfs.noaa.gov/pr/pdfs/acoustics/cetaceans.pdf.

Geraci, J.R. 1990. Cetaceans and oil: Physiologic and toxic effects. Pp. 167-197 In: J.R. Geraci and D.J. St. Aubin (eds.). *Sea Mammals and Oil:Confronting the Risks*. Academic Press, San Diego, CA. 282 pp.

Geraci, J.R. and T.G. Smith. 1976. Direct and indirect effects of oil on ringed seals (*Phoca hispida*) of the Beaufort Sea. *Journal of the Fisheries Research Board of Canada*, 33: 1976-1984.

Geraci, J.R. and D.J. St. Aubin. 1980. Offshore petroleum resource development and marine mammals: A review and research recommendations. *Marine Fisheries Review*, 42: 1-12.

Geraci, J.R. and D.J. St. Aubin. 1982. *Study of the Effects of Oil on Cetaceans*. Final report. Report from University of Guelph for US Bureau of Land Management, Washington, DC. NTIS PB83-152991. 274 pp.

Geraci, J.R. and D.J. St. Aubin. 1990. *Sea Mammals and Oil: Confronting the Risks*. Academic Press, New York, NY.

Gilde, K. and J.L. Pinckney. 2012. Sublethal effects of crude oil on the community structure of estuarine phytoplankton. *Estuaries and Coasts*, 35(3): 853-861.

Gilkinson, K. and E. Edinger (Editors). 2009. The ecology of deep-sea corals of Newfoundland and Labrador waters: Biogeography, life history, biogeochemistry, and relation to fishes. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2830: vi + 136 pp.

Gitschlag, G.R. and B.A. Herczeg. 1994. Sea turtle observations at explosive removals of energy structures. *Marine Fisheries Review*, 56(2): 1-8.

Gjerdrum, C., D.A. Fifield and S.I. Wilhelm. 2012. Eastern Canadian Seabirds at Sea (ECSAS) standardized protocol for pelagic seabird surveys from moving and stationary platforms. *Canadian Wildlife Service Technical Report Series*, No. 515, Atlantic Region. vi + 36 pp.

Godin, G, 1980. Cotidal Charts for Canada. Marine Science Information Directorate, Fisheries and Oceans Canada. *Manual Report Series*, 55: 93 pp.

Goff, G.P. and J. Lien. 1988. Atlantic leatherback turtles, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. *Canadian Field-Naturalist*, 102(1): 1-5.

González, F.I., E. Bernard, P. Dunbar, E. Geist, B. Jaffe, U. Kânoğlu, J. Locat, H. Mofjeld, A. Moore, C. Synolakis, V. Titov and R. Weiss (Science Review Working Group). 2007. *Scientific and Technical Issues in Tsunami Hazard Assessment of Nuclear Power Plant Sites*. Pacific Marine Environmental Laboratory, Seattle, WA, NOAA Technical Memorandum, OAR PMEL-136, NTIS: PB2008-101460: 125 pp. + Appendices.

González, J.J., L. Viñas, M.A. Franco, J. Fumega, J.A. Soriano, G. Grueiro, S. Muniategui, P. López-Mahía, D. Prada, J.M. Bayona, R. Alzaga and J. Albaigés. 2009. Spatial and temporal distribution of dissolved/dispersed aromatic hydrocarbons in seawater in the area affected by the *Prestige* oil spill. *Marine Pollution Bulletin*, 53(5-7): 250-259.

Goold, J.C. 1996a. *Acoustic Assessment of Common Dolphins off the West Wales Coast, in Conjunction with 16th Round Seismic Surveying*. Rep. by School of Ocean Sciences, University of Wales, Bangor, Wales, for Chevron UK Ltd., Repsol Exploration (UK) Ltd., and Aran Energy Exploration Ltd. 22 pp.

Goold, J.C. 1996b. Acoustic assessment of populations of common dolphin *Delphinus delphis* in conjunction with seismic surveying. *Journal of the Marine Biology Association, UK*, 76: 811-820.

Goold, J.C. 1996c. *Acoustic Cetacean Monitoring off the West Wales Coast*. Rep. by School of Ocean Sciences, University of Wales, Bangor, Wales, for Chevron UK Ltd, Repsol Explor. (UK) Ltd, and Aran Energy Explor. Ltd. 20 pp.

Gordon, D.C. and D.G. Fenton (Editors). 2002. Advances in understanding the Gully ecosystem: A summary of research projects conducted at the Bedford Institute of Oceanography (1999-2001). *Canadian Technical Report on Fisheries and Aquatic Sciences*, 2377: vi + 84 pp.

Gordon, J., D. Gillespie, J. Potter, A. Frantzis, M.P. Simmonds, R. Swift and D. Thompson. 2004. A review of the effects of seismic surveys on marine mammals. *Marine Technological Society Journal*, 37: 16-34.

Gorman, M.L. and H. Milne. 1970. Seasonal changes in the adrenal steroid tissue of the Common Eider *Somateria mollissima* and its relation to organic metabolism in normal and oil polluted birds. *Ibis*, 113: 218-228.

Gorsline, J., W.N. Holmes and J. Cronshaw. 1981. The effects of ingested petroleum on the naphthalene-metabolizing properties of liver tissue in seawater-adapted Mallard Ducks (*Anas platyrhynchos*). *Environmental Research*, 24: 377-390.

Gotceitas, V., S. Fraser and J.A. Brown. 1997. Use of eelgrass beds (*Zostera marina*) by juvenile Atlantic cod (*Gadus morhua*). *Canadian Journal of Fisheries and Aquatic Sciences*, 54(6): 1306-1319.

Goudie, I. 2007. *Marine Baseline Studies: Chapter 5. River Otter in the Area of Long Harbour, Placentia Bay*. Unpublished Report to Voisey's Bay Nickel Company Limited, St. John's, NL. 17 pp.

Goudie, I. and C. Jones. 2007. *River Otter in Inner Placentia Bay, Newfoundland*. LGL Rep. SA914F. Rep. by LGL Limited, St. John's, NL. 21 pp. + Appendices.

Goudie, I. and B. Mactavish. 2007. *Marine Baseline Studies: Chapter 3. Bald Eagle in the Area of Long Harbour, Placentia Bay*. Unpublished Report to Voisey's Bay Nickel Company Limited, St. John's, NL. 19 pp.

Goudie, R.I. 1981. *Marine Bird Observations at Cape St. Mary's and Placentia and St. Mary's Bays, Newfoundland, Winter 1978-79*. Progress Notes No. 124, Oct. 1981. Canadian Wildlife Service. St. John's, NL.

Goudie, R.I. 2006. Multivariate behavioural response of harlequin ducks to aircraft disturbance in Labrador. *Environmental Conservation*, 33: 28-35.

Goudie, R.I. 2007. *Marine Baseline Studies: River Otter in the Area of Long Harbour, Placentia Bay*. Report to Voisey's Bay Nickel Company Limited, St. John's, NL. 16 pp.

Goudie, R.I. and I.L. Jones. 2004. Dose-response relationships of harlequin duck behaviour to noise from low-level military jet over-flights in central Labrador. *Environmental Conservation*, 31: 289-298.

Goudie, R.I., B. Mactavish, C. Jones and P. Abgrall. 2007. *Migratory Bird Component Study, Placentia Bay, Newfoundland*. LGL Rep. SA914, Rep. by LGL Limited, St. John's, NL, for SNC Lavalin, Mount Pearl, NL. 53 pp.

Goudie, R.I., G.J. Robertson and A. Reed. 2000. Common Eider (*Somateria mollissima*). In: A. Poole. and F. Gill (eds.). *The Birds of North America, No. 546*. The Birds of North America, Inc., Philadelphia, PA.

Government of Canada. 2007. *Regulatory Framework for Air Emissions*. Available at: http://www.ec.gc.ca/doc/media/m_124/toc_eng.htm

Government of Canada. 2008. *Turning the Corner: Regulatory Framework for Industrial Greenhouse Gas Emissions*.

Government of Canada. 2012. *Species at Risk Act Public Registry*. Available at: http://www.sararegistry.gc.ca.

Government of Newfoundland and Labrador. 2012. *Impacts of Climate Change Website, Coastal Zone Erosion*. Available at: http://www.env.gov.nl.ca/env/climate_change/coastal_zone_erosion/index.html. Last updated August 2, 2012.

Govoni, J.J., M.A. West, L.R. Settle, R.T. Lynch and M.D. Greene. 2008. Effects of underwater explosions on larval fish: Implications for a coastal engineering project. *Journal Of Coastal Research*, 24: 228-233.

Gowans, S., H. Whitehead, J.K. Arch and S.K. Hooker. 2000. Populations size and residency patterns of northern bottlenose whales (*Hyperoodon ampullatus*) using the Gully, Nova Scotia. *Journal of Cetacean Research and Management*, 2: 201-210.

Gowans, S., H. Whitehead and S.K. Hooker. 2001. Social organization in northern bottlenose whales, *Hyperoodon ampullatus*: Not driven by deep-water foraging? *Animal Behavior*, 62: 369-377.

Graham, W.M., R.H. Condon, R.H. Carmichael, I. D'Ambra, H.K. Patterson, L.J. Linn and F.J. Hernandez, Jr. 2010. Oil carbon entered the coastal planktonic food web during the *Deepwater Horizon* oil spill. *Environmental Research Letters*, 5(4): 045301.

Gramentz, D. 1988. Involvement of loggerhead turtle with the plastic, metal and hydrocarbon pollution in the central Mediterranean. *Marine Pollution Bulletin*, 19: 11-13.

Grant, S.M. and J.A. Brown. 1998. Diel foraging cycles and interactions among juvenile Atlantic cod (*Gadus morhua*) at a nearshore site in Newfoundland. *Canadian Journal of Fisheries and Aquatic Sciences*, 55(6): 1307-1316.

Gray, H. and K. Van Waerebeek. 2011. Postural instability and akinesia in a pantropical spotted dolphin, *Stenella attenuata*, in proximity to operating airguns of a geophysical seismic vessel. *Journla of Nature Conservation*, doi: 10.1016/jnc.2011.06.005

Green, J., R. Green and D.F. Jefferies. 1984. A radio tracking survey of otters (*Lutra lutra*) on a Perthshire River system. *Lutra*, 27: 85-145.

Green, J.M. and M. Farwell. 1971. Winter habits of the cunner (*Tautogolabrus adspersus*) (Walbaum 1792) in Newfoundland. *Canadian Journal of Zoology*, 49: 1497-1499.

Green, R.H. 1979. *Sampling Design and Statistical Methods for Environmental Biologists*. John Wiley and Sons, Toronto, ON.

Greene, C.H., B.C. Monger and L.P. McGarry. 2009. Some like it cold. *Ecology*, 324(5928): 733-734.

Greene, C.R., Jr. 1985. Characteristics of waterborne industrial noise, 1980-84. Pp. 197-253. In: W.J. Richardson (ed.). *Behavior, Disturbance Responses and Distribution of Bowhead Whales Balaena mysticetus in the Eastern Beaufort Sea, 1980-84*. OCS Study MMS 85-0034. Report by LGL Ecological Research Associates Inc., Bryan, TX, for US Minerals Management Service, Reston, VA. 306 pp.

Greene, C.R., Jr. 1987. Characteristics of oil industry dredge and drilling sounds in the Beaufort Sea. *Journal of the Acoustical Society of America*, 82: 1315-1324.

Greene, C.R., Jr., N.S. Altman and W.J. Richardson. 1999a. Bowhead whale calls. Pp. 6-1 to 6-23. In: W.J. Richardson (ed.). *Marine M and Acoustical Monitoring of Western Geophysical's Open-Water Seismic Program in the Alaskan Beaufort Sea, 1998*. LGL Rep. TA2230-3. Rep. by LGL Ltd., King City, ON., and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and NMFS, Anchorage, AK, and Silver Spring, MD. 390 pp.

Greene, C.R., Jr., N.S. Altman and W.J. Richardson. 1999b. The influence of seismic survey sounds on bowhead whale calling rates. *Journal of the Acoustical Soiety of America*, 106(4, Pt. 2): 2280 (Abstract).

Greene, C.R., Jr., M.W. McLennan, R.G. Norman, T.L. McDonald, R.S. Jakubczak and W.J. Richardson. 2004. Directional Frequency and Recording (DIFAR) sensors in seafloor recorders to locate calling bowhead whales during their fall migration. *Journal of the Acoustical Society of America*, 116(2): 799-813.

Gregoire, F. 2011. Assessment of the estuary and Gulf of St. Lawrence (Divisions 4RST) capelin stock in 2010. *DFO Canadian Science Advisory Secretariat Science Advisory Report*, 2011/008.

Gregory, R.S. and J.T. Anderson 1997. Substrate selection and use of protective cover by juvenile Atlantic cod *Gadus morhua* in inshore waters of Newfoundland. *Marine Ecology Progress Series*, 146: 9-20.

Gregr, E.J. and A.W. Trites. 2001. Predictions of critical habitat of five whale species in the waters of coastal British Columbia. *Canadian Journal of Fisheries and Aquatic Sciences*, 58: 1265-1285.

Griffin, R.B. 1999. Sperm whale distributions and community ecology associated with a warm-core ring off Georges Bank. *Marine Mammal Science*, 15: 33-51.

GSC (Geological Survey of Canada). 2010. *National Building Code of Canada Seismic Hazard Calculator*. Available at: http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index_2010-eng.php. Website accessed April 16, 2012.

Guerra, A., A.F. Gonzàlez and F. Rocha. 2004. A review of the records of giant squid in the north-eastern Atlantic and severe injuries in *Architeuthis dux* stranded after acoustic explorations. ICES Annual Science Conference 22-25 September 2004, Vigo, Spain. *ICES CM*, 2004/CC: 29.

Guerra, M., A.M. Thode, S.B. Blackwell, C.R. Greene, Jr. and M. Macrander. 2009. Quantifying masking effects of seismic survey reverberation off the Alaskan North Slope. *Journal of the Acoustical Society of America*, 126(4, Pt. 2): 2230 (Abstract).

Guillemette, M., R.C. Ydenberg and J.H. Himmelman. 1992. The role of energy intake rate in prey and habitat selection of Common Eiders *Somateria mollissima* in winter: a risk-sensitive interpretation. *Journal of Animal Ecology*, 61(3): 599-610.

Gunn, L.M. 1988. *A Behavioral Audiogram of the North American River Otter (Lutra canadensis)*. MS thesis, San Diego State University, San Diego, CA. 40 pp.

Hagen, N.T. and K.H. Mann. 1994. Experimental analysis of factors influencing the aggregating behavior of the green sea urchin *Strongylocentrotus droebachiensis*. *Journal of Experimental Marine Biology and Ecology*, 176(1): 107-126.

Hai, D.J., J. Lien, D. Nelson and K. Curren. 1996. A contribution to the biology of the white-beaked dolphin, *Lagenorhynchus albirostrus*, in waters off Newfoundland. *Canadian Field-Naturalist,* 110: 278-287.

Haig, S.M., L.F. Cheron, F.J. Cuthbert, J. Dingledine, J. P. Goossen, A. Hecht and N. McPhillips. 2005. A complete species census and evidence for regional declines in Piping Plovers. *Journal of Wildlife Management*, 69: 160-173.

Halchuk, S. 2009. Seismic Hazard Earthquake Epicentre File (SHEEF) used in the fourth generation seismic hazard maps of Canada. *Geological Survey of Canada Open File*, 6208: 15 pp.

Halchuk, S. and J. Adams. 2008. Fourth generation seismic hazard maps of Canada: Maps and grid values to be used with the 2005 National Building Code of Canada. *Geological Survey of Canada Open File*, 5813: 32 pp.

Haley, B., J. Beland, D.S. Ireland, R. Rodrigues and D.M. Savarese. 2010. Chukchi Sea Vessel-based monitoring program. Chapter 3. In: D.W. Funk, D.S. Ireland, R. Rodrigues and W.R. Koski (eds.). *Joint Monitoring Program in the Chukchi and Beaufort Seas, Open Water Seasons, 2006-2008*. LGL Alaska Rep. TA1050-2. Rep. by LGL Alaska Res. Assoc. Inc., LGL Ltd., Greenridge Sci. Inc., and JASCO Research Ltd., for Shell Offshore Inc., other Industry Contributors, US National Marine Fisheries Service and US Fish and Wildlife Service. 506 pp.

Hall, A.J., J. Watkins and L. Hiby. 1996. The impact of the 1993 *Braer* oil spill on grey seals in Shetland. *The Science of the Total Environment*, 186: 119-125.

Hall, R.J., A.A. Belisle and L. Sileo. 1983. Residues of petroleum hydrocarbons in tissues of sea turtles exposed to the *Ixtoc 1* oil spill. *Journal of Wildlife Diseases*, 19: 106-109.

Halvorsen, M.B., L.E. Wysocki and A.N. Popper. 2006. Effects of high-intensity sonar on fish (Abstract). *Journal of the Acoustical Society of America*, 119: 3283.

Hamazaki, T. 2002. Spatiotemporal prediction models of cetacean habitats in the mid-western North Atlantic Ocean (from Cape Hatteras, North Carolina, USA. to Nova Scotia, Canada). *Marine Mammal Science*, 18: 920-939.

Hammill, M.O. 1993. Seasonal movements of hooded seals tagged in the Gulf of St. Lawrence, Canada. *Polar Biology*, 13: 307-310.

Hammill, M.O. and G.B. Stenson. 2000. Estimated prey consumption by harp seals (*Phoca groenlandica*), hooded seals (*Cystophora cristata*), grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) in Atlantic Canada. *Journal of Northwest Atlantic Fisheries Sciences*, 26: 1-23.

Hammill, M.O. and G.B. Stenson. 2006a. Abundance of Northwest Atlantic hooded seals (1960-2005). *DFO Canadian Science Advisory Secretariat Research Document*, 2006/068: 23 pp.

Hammill, M.O. and G.B. Stenson. 2006b. Timing and whelping among northwest hooded seals. *DFO Canadian Science Advisory Secretariat Research Document*, 2006/069. 11 pp.

Hampton, S., P.R. Kelly and H.R. Carter. 2003. Tank vessel operations, seabirds and chronic oil pollution in California. *Marine Ornithology*, 31: 29-34.

Han G. 2005. Wind-driven barotropic circulation off Newfoundland and Labrador. *Continental Shelf Research*, 25: 2084-2106.

Han, G., K. Ohashi, N. Chen, P.G. Myers, N. Nunes and J. Fischer. 2010. Decline and partial rebound of the Labrador Current 199302994: Monitoring ocean currents from altimetric and CTD data. *Journal of Geophysical Research*, 115(C12012): doi:1029/2009/JC006091.

Haney, J.C. and S.D. MacDonald. 1995. Ivory gull *Pagophila eburnean*. In: A. Poole and F. Gill (eds.). *The Birds of North America, No. 175*. The Academy of Natural Sciences of Philadelphia and American Ornithologists' Union, Washington, DC. 21 pp.

Hanser, S.F., L.R. Doyle, A.R. Szabo, F.A. Sharpe and B. McCowan. 2009. Bubble-net feeding humpback whales in Southeast Alaska change their vocalization patterns in the presence of moderate vessel noise. Pp. 105. In: *Abstract for the 18th Biennial Conference on the Biology of Marine Mammals*, Quebec, Canada, October 2009. 306 pp.

Hanson, A.R. (Editor). 2004. Status and conservation of eelgrass (*Zostera marina*) in Eastern Canada. Canadian Wildlife Service, Atlantic Region, *Technical Report Series*, 412: viii. + 40 pp.

Harding, G.C. 1992. American lobster (*Homarus americanus* Milne Edwards): A discussion paper on their environmental requirements and the known anthropogenic effects on their populations. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 1887: vi + 17 pp.

Harfenist, A., A.P. Gilman and K.L. Maus. 1990. The effects of exposure of incubating adult and young Herring Gulls to a simulated No. 2 fuel oil slick. *Archives of Environment Contamination and Toxicology*, 19: 902-906.

Harris, L.E. and A.R. Hanke. 2010. Assessment of the status, threats and recovery potential of cusk (*Brosme brosme*). *DFO Canadian Science Advisory Secretariat Research Document*, 2010/004: vi + 23 pp.

Harris, R.E., T. Elliott and R.A. Davis. 2007. *Results of Mitigation and Monitoring Program, Beaufort Span 2-D Marine Seismic Program, Open-water Season 2006*. LGL Rep. TA4319-1. Rep. by LGL Ltd., King City, ON, for GX Technol. Corp., Houston, TX. 48 pp.

Harris, R.E., G.W. Miller and W.J. Richardson. 2001. Seal responses to airgun sounds during summer seismic surveys in the Alaskan Beaufort Sea. *Marine Mammal Science*, 17(4): 795-812.

Harrison, P.J., W.P. Cochlan, J.C. Acreman, T.R. Parsons, P.A. Thompson and H.M. Dovey. 1986. The effects of crude oil and Corexit 9527 on marine phytoplankton in an experimental enclosure. *Marine Environmental Research*, 18(2): 93-109.

Hart, D.J., B. deYoung and J. Foley. 1999. *Observations of Currents, Temperature and Salinity in Placentia Bay, Newfoundland, 1998-9.*, Department of Physics and Physical Oceanography, Memorial University of Newfoundland, St. John's, NL. *Physics and Physical Oceanography Data Report*, 99-3: 63.

Hart, D.R. and A.S. Chute. 2004. Essential fish habitat source document: sea scallop, *Placopecten magellanicus*, life history and habitat characteristics (second edition). *NOAA Technical Memo*, NMFS-NE-189: 21 pp.

Hart, R.E. and J.L. Evans. 2001. A climatology of extratropical transition of Atlantic tropical cyclones. *Journal of Climate*, 14: 546-564.

Hartung, R. 1965. Some effects of oiling on reproduction of ducks. *Journal of Wildlife Management*, 29: 872-874.

Hartung, R. 1967. Energy metabolism in oil-covered ducks. *Journal of Wildlife Managemen*t, 31: 798-804.

Hartung, R. 1995. Assessment of the potential for long-term toxicological effects of the *Exxon Valdez* oil spill on birds and mammals. Pp. 693-725. In: P.G. Wells, J.N. Butler and J.S. Hughes (eds.). *Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters*. ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp.

Hartung, R. and G.S. Hunt. 1966. Toxicity of some oils to waterfowl. *Journal of Wildlife Management*, 30: 564-570.

Harvey, J.T. and M.E. Dahlheim. 1994. Cetaceans in oil. Pp. 257-264. In: T.R. Loughlin (ed.). *Marine Mammals and the Exxon Valdez*. Academic Press, San Diego, CA. 395 pp.

Harvey, M., D. Gauthier and J. Munro. 1998. Temporal changes in the composition and abundance of the macrobenthic invertebrate communities at dredged material disposal sites in the Anse à Beaufils, Baie des Chaleurs, eastern Canada. *Marine Pollution Bulletin*, 36(1): 41-55.

Harwell, M.A. and J.H. Gentile. 2006. Ecological significance of residual exposures and effects from *Exxon Valdez* oil spill. *Integrated Environmental Assessment and Management*, 2(3): 204-246.

Hastings, M.C. 1990. *Effects of Underwater Sound on Fish*. Project No. 401775-1600, Document 46254-900206-01IM, Florham Park, NJ: AT&T Bell Laboratories.

Hatcher, A.I. and A.W.D. Larkum. 1982. The effects of short term exposure to Bass Strait crude oil and Corexit 8667 on benthic community metabolism in *Posidonia australis* Hook.f. dominated microcosms. *Aquatic Botany*, 12: 219-227.

Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey and B.J. Godley. 2007. Only some like it hot - Quantifying the environmental niche of the loggerhead sea turtle. *Diversity Distributions*, 13: 447-457.

Hay, K. 1982. Aerial line-transect estimates of abundance of humpback, fin, and long-finned pilot whales in the Newfoundland-Labrador area. *Report of the International Whaling Commission*, 32: 475-486.

Hays, G.C., V.J. Hobson, J.D. Metcalfe, D. Righton and D.W. Sims. 2006. Flexible foraging movements of leatherback turtles across the North Atlantic Ocean. *Ecology*, 87(10): 2647-2656.

Hays, G.C., J.D.R. Houghton and A.E. Myers. 2004. Pan-Atlantic leatherback turtle movements. *Nature*, 429: 522.

Hazel, J., I.R. Lawler, H. Marsh and S. Robson. 2007. Vessel speed increases collision risk for the green sea turtle *Chelonia mydas*. *Endangered Species Research*, 3: 105-113.

Head, E.J.H. and P. Pepin. 2010. Spatial and inter-decadal variability in plankton abundance and composition in the Northwest Atlantic (1958-2006). *Journal of Plankton Research*, 32(12): 1633-1648.

Head, E.J.H. and D.D. Sameoto. 2007. Inter-decadal variability in zooplankton and phytoplankton abundance on the Newfoundland and Scotian shelves. GLOBEC-ESSAS Symposium on Effects of Climate Variability on Sub-Arctic Marine Ecosystems. *Deep Sea Research Part II: Topical Studies in Oceanography*, 54(23-26): 2686-2701.

Healey, B.P. 2010. Greenland halibut (*Reinhardtius hippoglossoides*) in NAFO Subarea 2 and Divisions 3KLMNO: stock trends based on annual Canadian research vessel survey results during 1978-2009. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 10/21: 67 pp.

Healey, B.P., E.F. Murphy, J. Brattey, N.G. Cadigan, M.J. Morgan, D. Maddock-Parsons, D. Power, R. Riseout, E. Colbourne and J.C. Mahé. 2011. Assessing the status of the cod (*Gadus morhua*) stock in NAFO subdivision 3Ps in 2010. *DFO Canadian Science Advisory Secretariat Research Document*, 2011/076. vi + 86 pp.

Hedd. A, W.A. Montevecchi, L. McFarleneTranquilla, C.M. Burke, D.A. Fifield, G.J. Robertson. R.A. Phillips, C. Gjerdrum and P.M. Regular. 2011. Reducing uncertainty on the Grand Bank: Tracking and vessel surveys indicate mortality risk for common murres in the North-West Atlantic. The Zoological Society of London, *Animal Conservation*. (2011) 1-12.

Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling, D. Stalker and Axys Environmental Consulting. 1999. *Cumulative Effects Assessment Practitioners Guide*. Canadian Environmental Assessment Agency, Hull, QC. xii + 71 pp. + Appendices.

Heintz, R.A., J.W. Short and S.D. Rice. 1999. Sensitivity of fish embryos to weathered crude oil. Part 2. *Environmental Toxicology and Chemistry*, 18: 494-503.

Hemre, G..I., G.L. Taranger and T. Hansen. 2002. Gonadal development influences nutrient utilisation in cod (*Gadus morhua*). *Aquaculture*, 214: 201-209.

Henderson, E.P. 1972. Surficial geology of Avalon Peninsula, Newfoundland. *Geological Survey of Canada, Memoir*, 368, 121 pp.

Hendon, L.A., E.A. Carlson, S. Manning and M. Brouwer. 2008. Molecular and developmental effects of exposure to pyrene in the early life-stages of *Cyprinodon variegatus*. *Comparative Biochemistry and Physiology*, 147: 205-215.

Hendrickson, L.C. 2004. Population biology of northern shortfin squid (*Illex illecebrosus*) in the Northwest Atlantic Ocean and initial documentation of a spawning area. *ICES Journal of Marine Science*, 61(2): 252-266.

Hendrickson, L.C, D. Hiltz, H. McBride, B. North and J. Palmer. 2003. Implementation of electronic logbook reporting in a squid bottom trawl study fleet during 2002. *Northeast Fisheries Science Center Reference Document*, 03-07: 30 pp.

Hendry, A.P. and E. Beall. 2004. Energy use in spawning Atlantic salmon. *Ecology of Freshwater Fish*, 13(3): 185-196.

Hibernia Management Development Company Limited. 2005. *Hibernia Development Project Increased Production and Discharge of Produced Water Environmental Assessment Report*. Prepared by Jacques Whitford Limited for Hibernia Management and Development Company Limited, St. John's, NL. iii + 84 pp. + Appendices.

Hildebrand, J.A. 2005. Impacts of anthropogenic sound. Pp. 101-124. In: J.E. Reynolds, W.F. Perrin, R.R. Reeves, S. Montgomery and T. Ragen (eds.). *Marine Mammal Research: Conservation Beyond Crisis*. Johns Hopkins University Press, Baltimore, MD. 223 pp.

Hill, B.T. and S.J. Jones. 1990. The Newfoundland ice extent and the solar cycle from 1860 to 1988. *Journal of Geophysical Research*, 95: 5385-5394.

Hill, S.H. 1978. *A Guide to the Effects of Underwater Shock Waves on Arctic Marine Mammals and Fish*. Pacific Marine Science Report 78-26. Institute of Ocean Sciences, Patricia Bay, Sidney, BC. 50 pp.

Himmelman, J.H. 1978. Reproductive cycle of the green sea urchin, *Strongylocentrotus droebachiensis*. *Canadian Journal of Zoology*, 56: 1828-1836.

Himmelman, J.H. 1986. Population biology of green sea urchins on rocky barrens. *Marine Ecology Progress Series*, 33: 295-306.

Himmelman, J.H. and D.H. Steele. 1971. Foods and predators of the green sea urchin *Strongylocentrotus droebachiensis* in Newfoundland waters. *Marine Biology*, 9(4): 315-322.

Hinwood, J.B., A.E. Potts, L.R. Dennis, J.M. Carey, H. Houridis, R.J. Bell, J.R. Thomson, P. Boudreau and A.M. Ayling. 1994. Drilling activities. Pp. 123-207. In: J.M. Swan, J.M. Neff and P.C. Young (eds.). *Environmental Implications of Offshore Oil and Gas Development in Australia - the Findings of an Independent Scientific Review*. Australian Petroleum Exploration Society, Sydney, Australia. xiv + 696 pp.

Hodgins, D.O and S.L.M. Hodgins. 2000. *Modeled Predictions of Well Cuttings Deposition and Produced Water Dispersion for the Proposed White Rose Development*. Part Two Document by Seaconsult Marine Research Ltd for Husky Oil Operations Ltd. 45 pp.

Hoelzel, A.R., C.W. Potter and P.B. Best. 1998. Genetic differentiation between parapatric 'nearshore' and 'offshore' populations of bottlenose dolphin. *Proceedings of the Royal Society of London, Biological Sciences*, 265: 1177-1183.

Hoffman, D.J. 1978. Embryotoxic effects of crude oil in mallard ducks and chicks. *Toxicology and Applied Pharmacology*, 46: 183-190.

Hoffman, D.J. 1979a. Embryotoxic and teratogenic effects of crude oil on mallard embryos on day one of development. *Bulletin of Environmental Contamination and Toxicology*, 22: 632-637.

Hoffman, D.J. 1979b. Embryotoxic effects of crude oil containing nickel and vanadium in mallards. *Bulletin of Environmental Contamination and Toxicology*, 23: 203-206.

Hogarth, W.T. 2002. *Declaration of William T. Hogarth in opposition to plaintiff's motion for temporary restraining order, 23 Oct. Civ. No. 02-05065-JL*. US District Court, Northern District of California, San Francisco Division.

Hoin-Radkovsky, I., H. Bleckmann and E. Schwartz. 1984. Determination of source distance in the surface-feeding fish *Pantodon buchholzi* Pantodontidae. *Animal Behaviour*, 32(3): 841-851.

Holmes, W.N., J. Cronshaw and K.P. Cavanaugh. 1978. The effects of ingested petroleum on laying in mallard ducks (*Anas platyrhynchos*). Pp. 301-309. In: J. Lindstedt-Siva (ed.). *Proceedings of Energy/Environment '78*, Los Angeles. Society of Petroleum Industry Biologists. 321 pp.

Holmes, W.N., J. Gorsline and J. Cronshaw. 1979. Effects of mild cold stress on the survival of seawater-adapted mallard ducks (*Anas platyrhynchos*) maintained on food contaminated with petroleum. *Environmental Research*, 20: 425-444.

Holst, M., J. Beland, B. Mactavish, J. Nicolas, B. Hurley, B. Dawe, G. Caltavuturo, C. Fossati and G. Pavlan. 2011. Visual-acoustic survey of cetaceans during a seismic study near Taiwan, April-July 2009. Pp. 134. In: *Abstract for the 19th Biennial Conference on the Biology of Marine Mammals*, Tampa, FL, 27 November-2 December. 344 pp.

Holst, M., W.J. Richardson, W.R. Koski, M.A. Smultea, B. Haley, M.W. Fitzgerald and M. Rawson. 2006. *Effects of Large and Small-source Seismic Surveys on Marine Mammals and Sea Turtles*. Abstract. Presented at American Geophysical Union-Society of Exploration Geophysicists Joint Assembly on Environmental Impacts from Marine Geophysical and Geological Studies - Recent Advances from Academic and Industry Research Programs, Baltimore, MD. Abstract available at: http://adsabs.harvard.edu/abs/2006AGUSMOS42A..01H.

Holst, M., M.A. Smultea, W.R. Koski and B. Haley. 2005a. *Marine Mammal and Sea Turtle Monitoring during Lamont-Doherty Earth Observatory's Marine Seismic Program off the Northern Yucatán Peninsula in the Southern Gulf of Mexico, January-February 2005*. LGL Rep. TA2822-31. Rep. by LGL Ltd., King City, ON, for Lamont-Doherty Earth Observatory, Columbia Univ., Palisades, NY, and NMFS, Silver Spring, MD.

Holst, M., M.A. Smultea, W.R. Koski and B. Haley. 2005b. *Marine Mammal and Sea Turtle Monitoring during Lamont-Doherty Earth Observatory's Marine Seismic Program in the Eastern Tropical Pacific Ocean off Central America, November-December 2004*. LGL Rep. TA2822-30. Rep. by LGL Ltd., King City, ON, for Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY, and NMFS, Silver Spring, MD.

Holt, M.M., D.P. Noren, V. Veirs, C.K. Emmons and S. Veirs. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. *Journal of the Acoustical Society of America*, 125(1): EL27-EL32.

Hooker, S.K. and R.W. Baird. 1999a. Deep-diving behaviour of the northern bottlenose whale, *Hyperoodon ampullatus* (Cetacea: Ziphiidae). *Proceedings of the Royal Society of London, Biological Sciences*, 266: 671-676.

Hooker, S.K. and R.W. Baird. 1999b. Observations of Sowerby's beaked whales, *Mesoplodon bidens*, in the Gully, Nova Scotia. *Canadian Field-Naturalist*, 113(2): 273-277.

Hooper, R.C., F.M. Cuthbert and T. McKeever. 1996. *Sea Urchin Aquaculture – Phase II: Ration Size, Seasonal Growth Rates, Mixed Kelp Diets, Fish Diet, Old Urchin Growth and Baiting Confinement Experiments*. Memorial University of Newfoundland, Canadian Centre for Fisheries Innovation. 37 pp.

Hooper, R.G. and C.L. Morgan. 1999. *Impact of the Diesel Oil Spill at Rocky Barachois, Bonne Bay*. Report to Gros Morne National Park.

Hoover-Miller, A., K.R. Parker and J.J. Burns. 2001. A reassessment of the impact of *Exxon Valdez* oil spill on harbor seals (*Phoca vitulina richardsi*) in Prince William Sound, Alaska. *Marine Mammal Science*, 17(1): 111-135.

Hope-Jones, P. 1980. The effect on birds of a North Sea gas flare. *British Birds*, 73: 547-555.

Hose, J.E., M.D. McGurk, G.D. Marty, D.E. Hinton, E.D. Brown and T.T. Baker. 1996. Sublethal effects of the *Exxon Valdez* oil spill on herring embryos and larvae: Morphological, cytogenetic and histopathological assessments, 1989-1991. *Canadian Journal of Fisheries and Aquatic Sciences*, 53: 2355-2365.

Howell, S.N.G. 2012. *Petrels, Albatrosses, and Storm-petrels of North America: A Photographic Guide*. Princeton University Press, Princeton, NJ. 520 pp.

Hueckel, G.J., R.M. Buckley and B.L. Benson. 1989. *Mitigating Rocky Habitat Loss using Artificial Reefs*.

Huettel, M. and A. Rusch. 2000. Transport and degradation of phytoplankton in permeable sediment. *Limnology and Oceanography*, 45(3): 534-539.

Hughes, M.R., C. Kasserra and B.R. Thomas. 1990. Effect of externally applied bunker fuel on body mass and temperature, plasma concentration, and water flux of Glaucous-winged Gulls, *Larus glaucescens*. *Canadian Journal of Zoology*, 68: 716-721.

Huntington, C.E., R.G. Butler and R.A. Mauck. 1996. Leach's Storm-Petrel (*Oceanodroma leucorhoa*). In: A. Poole and F. Gill (eds.). *The Birds of North America*, No. 233. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Huppertz, T.J. and D.J.W. Piper. 2009. The influence of shelf-crossing glaciation on continental slope sedimentation, Flemish Pass, eastern Canadian continental margin. *Marine Geology*, 265: 67-85.

Hurley, G. and J. Ellis. 2004. *Environmental Effects of Exploratory Drilling Offshore Canada: Environmental Effects Monitoring Data and Literature Review - Final Report*. Prepared for the Canadian Environmental Assessment Agency - Regulatory Advisory Committee.114 pp

Hurley T.J., R.D. Kreisa, G.G. Taylor and W.R.L. Yates, 1992. The reservoir geology and geophysics of the Hibernia field, offshore Newfoundland: Chapter 4. Pp. 35-54. In: *American Association of Petroleum Geologists Special Volumes*.

Husky Energy. 2003. *White Rose Environmental Effects Monitoring Program 2002*. A report by Jacques Whitford Environment Limited to Husky Energy, St. John's, NL.

Husky Energy. 2004. *White Rose Environmental Effects Monitoring Program 2003*. A report by Jacques Whitford Environment Limited to Husky Energy, St. John's, NL.

Husky Energy. 2005. *White Rose Environmental Effects Monitoring Program 2004*. A report by Jacques Whitford Environment Limited to Husky Energy, St. John's, NL.

Husky Energy. 2007. *White Rose Environmental Effects Monitoring Program 2006*. A report by Jacques Whitford Environment Limited to Husky Energy, St. John's, NL. 221 pp.

Husky Energy. 2009. *White Rose Environmental Effects Monitoring Program 2008*. A report by Stantec Jacques Whitford Limited to Husky Energy, St. John's, NL.

Husky Energy. 2010. *Commercial Fisheries Risk Assessment for White Rose Field Area Assets*.

Husky Energy. 2011. *White Rose Environmental Effects Monitoring Program 2010*. A report by Stantec Consulting Ltd. to Husky Energy, St. John's, NL.

Husky Energy. 2012a. *White Rose Extension Project. Project Description*. May 2012.

Husky Energy. 2012b. *White Rose Extension Project Registration*. August 3, 2012.

Husky Energy. 2012c. *Well Blowout Data for Environmental Assessment*. Document supplied by Husky Energy for White Rose Extension Project Environmental Assessment spill modelling.

Husky Energy. 2012d. *High Level Flare Volume Estimate for Input to the White Rose Extension Project (WREP) Environmental Assessment Air Quality Model*.

Husky Oil Operations Limited. 2000. *White Rose Oilfield Comprehensive Study - Part One: Environmental Impact Statement*. Submitted to the Canada-Newfoundland Offshore Petroleum Board, St. John's, NL. 639 pp + Appendices.

Husky Oil Operations Limited. 2001. *White Rose Oilfield Comprehensive Study Supplemental Report. Responses by Husky Oil Operations Limited to comments from Canada-Newfoundland Offshore Petroleum Board, Dept. Fisheries and Oceans, Environment Canada, Natural Resources Canada, and Canadian Environmental Assessment Agency*. 265 pp. + Appendices.

Hutchings, J.A. and R.A. Myers. 1994. What can be learned from the collapse of a renewable resource? Atlantic cod, *Gadus morhua*, of Newfoundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences*, 51(9): 2126-2146.

IAGC (International Association of Geophysical Contractors). 2004. *Further Analysis of 2002 Abrolhos Bank, Brazil, Humpback Whale Strandings Coincident with Seismic Surveys*. International Association of Geophysical Contractors, Houston, TX. 12 pp.

IAOGP (International Association of Oil & Gas Producers). 2010. *Risk Assessment Data Directory: Blowout Frequencies*. International Association of Oil & Gas Producers. London, UK, Report No. 434-2. Available at: http://www.ogp.org.uk

Ice Engineering Ltd. 1981a. *Iceberg Field Survey, Volume A*. Mobil Oil Canada Ltd.

Ice Engineering Ltd. 1981b. *Iceberg Field Survey, Volume B*. Mobil Oil Canada Ltd.

Ice Engineering Ltd. 1982. *Iceberg Field Survey*. Mobil Oil Canada Ltd.

Ice Engineering Ltd. 1983. *A Survey of Icebergs off the Newfoundland Coast*. Mobil Oil Canada Ltd.

ICES. 2009. Report of the ICES-NAFO Working Group on Deep-water Ecology (WGDEC), 9–13 March 2009, ICES CM 2009\ACOM:23. 94 pp.

ICOADS (International Comprehensive Ocean-Atmosphere Data Set). 2012. *International Comprehensive Ocean-Atmosphere Data Set (ICOADS) Data and Documentation*. Available at: http://icoads.noaa.gov/products.html (Date accessed: February 12, 2012).

IIP (International Ice Patrol). 2011. *Iceberg Sightings, 1960 to 2011*. Available at: http://www.navcen.uscg.gov/?pageName=IIPIcebergCounts

Imber, M.J. 1975. Behaviour of petrels in relation to the moon and artificial lights. *Notornis*, 22: 302-306.

Incardona, J.P., T.K. Collier and N.L. Scholz. 2004. Defects in cardiac function precede morphological abnormalities in fish embryos exposed to polycyclic aromatic hydrocarbons. *Toxicology and Applied Pharmacology,* 196: 191-205.

Irons, D.B., S.J. Kendall, W.P. Erickson, L.L. McDonald and B.K. Lance. 2000. Nine years after the *Exxon Valdez* oil spill: Effects on marine bird populations in Prince William Sound, Alaska. *Condor*, 102: 723-737.

Irons, D.B., S.J. Kendall, W.P. Erickson, L.L. McDonald and B.K. Lance. 2001. A brief response to Wiens *et al.*, twelve years after the *Exxon Valdez* oil spill. *Condor*, 103: 892-894.

Iverson, S.A. and D. Esler. 2010. Harlequin Duck population injury and recovery dynamics following the 1989 *Exxon Valdez* oil spill. *Ecological Applications*, 20(7): 1993-2006.

IWC (International Whaling Commission). 2001. Report of the workshop on the comprehensive assessment of right whales: a worldwide comparison. *Journal of Cetacean Research and Management*, Special Issue 2: 1-60.

IWC (International Whaling Commission). 2007. *Whale Population Estimates: Population Table*. Last updated 09/01/09. Accessed on February 25, 2009 at: http://www.iwcoffice.org/conservation/estimate.htm#table.

Jackson, H.R., C.E. Keen, R.K.H. Falconer and K.P. Appleton. 1979. New geophysical evidence for sea-floor spreading in Baffin Bay. *Canadian Journal of Earth Sciences*, 16: 2122-2135.

Jacobs, RPWM. 1980. Effects of the '*Amoco Cadiz*' oil spill on the seagrass community at Roscoff with special reference to benthic infauna. *Marine Ecology Progress Series*, 2(3): 207-212.

Jacobson, L.D. 2005. Essential fish habitat source document: Longfin inshore squid, *Loligo pealeii*, life history and habitat characteristics (second edition). *NOAA Technical Memorandum*, NMFS-NE 193: 42 pp.

Jacques Whitford Limited. 2007. *Strategic Environmental Assessment Sydney Basin Offshore Area*. Final report prepared for the Canada-Newfoundland and Labrador Offshore Petroleum Board, St. John's, NL.

Jacques Whitford Limited. 2009. *Hibernia Drill Centres Construction and Operations Program Screening Report*. Prepared for Hibernia Management and Development Company, St. John's, NL. xix + 310 pp. + Appendices.

Jacques Whitford Limited. 2009. *Environmental Assessment for Eider Rock*.

Jahoda, M., C.L. Lafortuna, N. Biassoni, C. Almirante, A. Azzellino, S. Panigada, M. Zanardelli and G. Notarbartolo Di Sciara. 2003. Mediterranean fin whales (*Balaenoptera physalus*) response to small vessels and biopsy sampling assessed through passive tracking and timing of respiration. *Marine Mammal Science*, 19(1): 96-110.

James, M.C., C.A. Ottensmeyer and R.A. Myers. 2005. Identification of high use habitat and threats to leatherback sea turtles in northern waters: New directions for conservation. *Ecology Letters*, 8: 195-201.

James, M.C., S.A. Sherrill-Mix and R.A. Myers. 2007. Population characteristics and seasonal migrations of leatherback sea turtles at high latitudes. *Marine Ecology Progress Series*, 337: 245-254.

Jansa, L.F. and J.A. Wade. 1975. Geology of the continental margin off Nova Scotia and Newfoundland. *Geological Survey of Canada Paper*, 74-30: 51-105.

Jaquet, N. and D. Gendron. 2002. Distribution and relative abundance of sperm whales in relation to key environmental features, squid landings and the distribution of other cetacean species in the Gulf of California, Mexico. *Marine Biology*, 141: 591-601.

Jaquet, N., D. Gendron and A. Coakes. 2003. Sperm whales in the Gulf of California: Residency, movements, behavior, and the possible influence of variation in food supply. *Marine Mammal Science*, 19: 545-562.

Jaquet, N. and H. Whitehead. 1996. Scale-dependent correlation of sperm whale distribution with environmental features and productivity in the South Pacific. *Marine Ecology Progress Series*, 135(1-3): 1-9.

JASCO Applied Sciences. 2010. *Hebron Project: Modelling of Underwater Noise at the Bull Arm Construction Site*. Report for Stantec Consulting Ltd., St. John's, NL. 32 pp.

JASCO Applied Sciences 2012. *Underwater Sound Propagation Assessment for the Environmental Assessment of the White Rose Extension Project*. Report P001162-001 by JASCO Applied Sciences, Dartmouth, NS, for Stantec Consulting Ltd., St. John's, NL.

Jefferson, T.A., D. Fertl, J. Bolanos-Jimenez and A.N. Zerbini. 2009. Distribution of common dolphins (*Delphinus* spp.) in the western Atlantic Ocean: A critical re-examination. *Marine Biology*, 156: 1109-1124.

Jefferson, T.A., M.A. Webber and R. Pitman. 2008. *Marine Mammals of the World: A Comprehensive Guide to their Identification*. Academic Press, London. 573 pp.

Jensen, A.S. and G.K. Silber. 2003. Large whale ship strike database. US Department of Commerce, *NOAA Technical Memorandum*, NMFSOPR-25. 37 pp.

Jensen, C.F., L.J. Natanson, H.L. Pratt, Jr., N.E. Kohler and S.E. Campana. 2002. The reproductive biology of the porbeagle shark (*Lamna nasus*) in the western North Atlantic Ocean. *Fisheries Bulletin*, 100(4): 727-738.

Jenssen, B.M. 1996. An overview of exposure to, and effects of, petroleum oil and organochlorine pollution in grey seals (*Halichoerus grypus*). *Science of the Total Environment*, 186: 109-118.

Jepson, P.D., M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martin, A.A. Cunningham and A. Fernández. 2003. Gas-bubble lesions in stranded cetaceans. *Nature*, 425(6958): 575-576.

Jewett, S.C. and T.A. Dean. 1997. The *Effects of the Exxon Valdez Oil Spill on Eelgrass Communities in Prince William Sound, Alaska 1990-95*. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 95106), Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage, AK.

Jewett, S.C., T.A. Dean, R.O. Smith and A. Blanchard. 1999. *Exxon Valdez* oil spill: Impacts and recovery in the soft-bottom benthic community in and adjacent to eelgrass beds. *Marine Ecology Progress Series*, 185: 59-83.

Jochens, A., D. Biggs, K.J. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B.R. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P.L. Tyack and B. Wursig. 2008. *Sperm Whale Seismic Study in the Gulf of Mexico: Synthesis Report*. OCS Study MMS 2008-006. Rep. by Department of Oceanography, Texas A&M Univsity, College Station, TX, for US Minerals and Manage. Service, Gulf of Mexico OCS Region, New Orleans, LA. 341 pp.

Joensen, A.H. 1972. Studies on oil pollution and seabirds in Denmark, 1968-1971. *Danish Review of Game Biology*, 6: 1-32.

Johansson, S., U. Larsson and P. Boehm. 1980. The *Tsesis* oil spill - Impact on the pelagic ecosystem. *Marine Pollution Bulletin*, 11: 284-293.

Johnson, B.W. 1977. *The Effects of Human Disturbance on a Population of Harbour Seals*. Environmental Assessment Alaskan Continental Shelf, Annual Report Principal Investors., NOAA, Boulder, CO, 1977(1): 422-432. 708 pp. NTIS PB-280934/1.

Johnson, S.R., J.J. Burns, C.I. Malme and R.A. Davis. 1989. *Synthesis of Information on the Effects of Noise and Disturbance on Major Haulout Concentrations of Bering Sea Pinnipeds*. OCS Study MMS 88-0092. Rep. by LGL Alaska Res. Assoc. Inc., Anchorage, AK, for US Minerals Management Service, Anchorage, AK. 267 pp. NTIS PB89-191373.

Jones, C. and I. Goudie. 2007. *River Otter in Inner Placentia Bay, Newfoundland*. LGL Rep. SA913F. Report by LGL Ltd., St. John's, NL for Newfoundland and Labrador Refining Corporation. St. John's, NL. 14 pp. + appendices.

Jones, D.A., I. Watt, J. Plaza, T.D. Woodhouse, and M. Al-Sanei. 1996. Natural recovery of the intertidal biota within the Jubail Mainre Wildlife Sanctuary after the 1991 Gulf War oil spill. Pp. 138-158. In: F. Krupp, A.H. Abuzinada and

I.A. Nader (eds.). *A Marine Wildlife Sanctuary for the Arabian Gulf: Environmental Research and Conservation following the 1991 Gulf War Oil Spill*, National Commission for Wildlife Conservation and Development, Riyadh, Saudi Arabia: Kingdom of Saudi Arabia, and Frankfurt Germany: Senchenberg Research Institute.

Joyce, W.N., S.E. Campana, L.J. Natanson, N.E. Kohler, H.L. Pratt, Jr. and C.F. Jensen. 2002. Analysis of stomach contents of the porbeagle shark (*Lamna nasus* Bonnaterre) in the northwest Atlantic. *ICES Journal of Marine Science*, 59(6): 1263-1269.

Jurasz, C.M. and V.P Jurasz. 1979. *Ecology of humpback whale*. Draft report for US National Park Service (Contr. No. CX-9000-7-0045). 118 pp. + fig., tables.

JWEL (Jacques Whitford Environment Limited). 1996. *Background Information Field Observations Compiled by JWEL During Marine and Freshwater Work Related to the 1995 Phase 3 and 4, Environmental Site Assessment US Naval Facility, Argentia.* Jacques Whitford Environment Limited.

JWEL (Jacques Whitford Environment Limited). 1997. *Environmental Baseline Study, Smelter/Refinery Site, Argentia, NF - Final Report Marine Baseline Study and Habitat Survey*. Prepared for Voisey's Bay Nickel Company Limited, St. John's, NL. 56 pp. + App.

Kaiser, M.J. and A.G. Pulsipher. 2005. Rigs-to-reef programs in the Gulf of Mexico. *Ocean Development and International Law*, 36(2):119-134.

Kammerer, M., O. Mastain, S. Le Dréan-Quenech'du, H. Pouliquen and M. Larhantec. 2004. Liver and kidney concentrations of vanadium in oiled seabirds after the *Erika* wreck. *Science of the Total Environment*, 333: 295-301.

Kapel, F.O. 1979. Exploitation of large whales in West Greenland in the twentieth century. *Report of the International Whaling Commission*, 29: 197-214.

Kastak, D. and R.J. Schusterman. 1998. Low-frequency amphibious hearing in pinnipeds: Methods, measurements, noise and ecology. *Journal of the Acoustical Society of America*, 103(4): 2216-2228.

Kastak, D. and R.J. Schusterman. 1999. In-air and underwater hearing sensitivity of a northern elephant seal (*Mirounga angustirostris*). *Canadian Journal of Zoology*, 77: 1751-1758.

Kastak, D., R.J. Schusterman, B.L. Southall and C.J. Reichmuth. 1999. Underwater temporary threshold shift induced by octave-band noise in three species of pinnipeds. *Journal of the Acoustical Society of America*, 106(2): 1142-1148.

Kastak, D., B.L. Southall, R.J. Schusterman and C. Reichmuth-Kastak. 2005. Underwater temporary threshold shift in pinnipeds: Effects of noise level and duration. *Journal of the Acoustical Society of America*, 118: 3154-3163.

Kastelein, R.A., R. Gransier, R. van Mierlo, L. Hoek and C. de Jong. 2011. Temporary hearing threshold shifts and recovery in a harbour porpoise (*Phocoena phocoena*) and harbour seals (*Phoca vitulina*) exposed to white noise in a 1/1-octave band around 4 kHz. *Journal of the Acoustical Society of America*, 129(4): 2432.

Kastelein, R.A., P. Mosterd, B. van Santen, M. Hagedoorn and D. de Haan. 2002. Underwater audiogram of a Pacific walrus (*Odobenus rosmarus divergens*) measured with narrow-band frequency-modulated signals. *Journal of the Acoustical Society of America*, 112(5): 2173-2182.

Kasuya, T. 1986. Distribution and behavior of Baird's beaked whales off the Pacific coast of Japan. *Science Report of the Whales Research Institute*, 37: 61-83.

Katona, S.K. and J.A. Beard. 1990. Population size, migration and feeding aggregation of the humpback whale (*Megaptera novaeangliae*) in the Western North Atlantic Ocean. *Report of the International Whaling Commission*, 12: 295-305.

Katz, C.H., J.S. Cobb and M. Spaulding. 1994. Larval behaviour, hydrodynamic transport and potential offshore-to-inshore recruitment in the American lobster *Homarus americanus*. *Marine Ecological Progress Series*, 103: 265-273.

Keats, D.W. 1990. Food of winter flounder (*Pseudopleuronectes americanus*), in a sea urchin-dominated community in eastern Newfoundland. *Marine Ecological Progress Series*, 60: 13-22.

Keats, D.W., D.H. Steele and G.R. South. 1984. Depth-dependent reproductive output of the green sea urchin *Stronglyocentrotus droebachiensis* (O.F. Müller), in relation to the nature and availability of food. *Journal of Experimental Marine Biology and Ecology*, 30(1): 77-91.

Keats, D.W., D.H. Steele and G.R. South. 1987. The role of fleshy macroalgae in the ecology of juvenile cod (*Gadus morhua*) in inshore waters off eastern Newfoundland. *Canadian Journal of Zoology*, 65: 49-53.

Keats, D.W., G.R. South and D.H. Steele. 1985. Reproduction and egg guarding by Atlantic wolffish (*Anarchichas lupus*: Anarhichidae) and ocean pout (*Macrozoarces americanus*: Zoarchidae) in Newfoundland waters. *Canadian Journal of Zoology*, 63(11): 2565-2568.

Kenchington, E., C. Lirette, A. Cogswell, D. Archambault, P. Archambault, H. Benoit, D. Bernier, B. Brodie, S. Fuller, K. Gilkinson, M. Lévesque, D. Power, T. Siferd, M. Treble and V. Wareham. 2010a. Delineating coral and sponge concentrations in the biogeographic regions of the east coast of Canada using spatial analyses. *Canadian Scientific Advisory Secretariat Research Document*, 2010/041. vi + 202 pp.

Kenchington, E., D. Power and M. Koen-Alonso. 2010b. Associations of demersal fish with sponge grounds in the Northwest Atlantic Fisheries Organizations Regulatory Area and adjacent Canadian waters. *Canadian Scientific Advisory Secretariat Research Document*, 2010/039. vi + 27 p.

Kenchington, E.L.R., J. Prena, K. Gilkinson, D.C. Gordon, K. MacIsaac, C. Bourbonnais, P. Schwinghamer, T.W. Rowell, D.L. McKeown and W.P. Vass. 2001. Effects of experimental otter trawling on the macrofauna of a sandy bottom ecosystem on the Grand Banks of Newfoundland. *Canadian Journal of Fisheries and Aquatic Sciences*, 58: 1043-1057.

Kendall, L.S. 2010. *Construction Impacts on the Cook Inlet Beluga Whale (Delphinapterus leucas) at the Port of Anchorage Marine Terminal Redevelopment Project*. M.Sc. thesis, Alaska Pacific University, 88 pp.

Kennedy, V.S. and D.H. Steele. 1971. The winter flounder (*Pseudopleuronectes americanus*) in Long Pond, Conception Bay, Newfoundland. *Journal of the Fisheries Research Board of Canada*, 28 (8): 1153-1165.

Kenney, R.D. 2001. Anomalous 1992 spring and summer right whale (*Eubalaena glacialis*) distribution in the Gulf of Maine. *Journal of Cetacean Research and Management*, (Special Issue 2): 209-223.

Kenney, R.D. and H.E. Winn. 1987. Cetacean biomass densities near submarine canyons compared to adjacent shelf/slope areas. *Continental Shelf Research*, 7: 107-114.

Kent, E.C., P.K. Taylor, B.S. Truscott and J.S. Hopkins, 1993. The accuracy of voluntary observing ships' meteorological observations – Results of the VSOP-NA. *Journal of Atmospheric and Oceanic Technology*, 10: 591-608.

Kenworthy, W.J., M.J. Durako, S.M.R. Fatemy, H. Valavi and G.W. Thayer. 1993. Ecology of seagrasses in northeastern Saudi Arabia one year after the Gulf War oil spill. *Marine Pollution Bulletin*, 27: 213-222.

Kessler, J.D., D.L. Valentine, M.C. Redmond, M. Du, E.W. Chan, S. D. Mendes, E.W. Quiroz, C. J. Villanueva, S.S. Shusta, L.M. Werra, SA. Yvon-Lewis and T.C. Weber. 2011. A persistent oxygen anomaly reveals the fate of spilled methane in the deep Gulf of Mexico. *Science*, 331(6015): 312-315.

Ketten, D.R. 1994. Functional analysis of whale ears: Adaptations for underwater hearing. *IEEE Proc. Underwater Acoustics*, 1: 264-270.

Ketten, D.R. 2000. Cetacean ears. Pp. 43-108. In: W.W.L. Au, A.N. Popper and R.R. Fay (eds.). *Hearing by Whales and Dolphins.* Springer-Verlag, New York, NY. 485 pp.

Ketten, D.R. 2012. Marine mammal auditory system noise impacts: Evidence and incidence. Pp. 207-212. In: A. Hawkins and A.N. Popper (eds.). *The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology* Series No. 730. Springer, New York. 695 pp.

Ketten, D.R., J. O'Malley, P.W.B. Moore, S. Ridgway and C. Merigo. 2001. Aging, injury, disease, and noise in marine mammal ears. *Journal of the Acoustical Society of America*, 110(5, Pt. 2): 2721.

Khan, R.A. and J.F. Payne. 2004. Comparative study of oil well drill cuttings and polycyclic aromatic hydrocarbons on parasitism in winter flounder: A dose-response study. *Bulletin of Environmental Contamination and Toxicology*, 73: 652-658.

Khan, R.A. and P. Ryan. 1991. Long term effects of crude oil on Common Murre (*Uria aalge*) following rehabilitation. *Bulletin of Environment Contamination and Toxicology*, 46: 216-222.

Kiceniuk, J.W. 1992. Aromatic hydrocarbon concentrations in sediments of Placentia Bay, Newfoundland. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 1888: iv + 12 pp.

King, E.L.H. 1979. Aspects of regional surficial geology related to site investigation requirements – eastern Canadian shelf. Pp. 37-59. In: D.A. Ardus (ed.). *Offshore Site Investigations*, Graham and Trotman Ltd.

King, E.L.H. 2010. Quaternary geology of Laurentian Channel and Grand Banks of Newfoundland. *Geological Survey of Canada Open File*, #6449.

King, E.L.H. and G.V. Sonnichsen. 1999. Characterization of near-surface seismostratigraphy and features of Northeastern Grand Bank: Sea level fluctuations, glaciation and slope stability. *Geological Survey of Canada Open File*, Report No. 3886: 80 pp.

King, T., R. Phillips, J. Barrett and G. Sonnichsen. 2009. Probabilistic pipeline burial analysis for protection against ice scour. *Cold Regions Science and Technology*, 59: 58-64.

Kingsley, M.C.S., H.J. Cleator and M.A. Ramsay. 1994. Summer distribution and movements of narwhals (*Monodon monoceros*) in Eclipse Sound and adjacent waters, north Baffin Island, N.W.T. *Medd. Grønl., Biosci.*, 39: 163-174.

Kleinenberg, S.E., A.V. Yablokov, B.M. Bel'kovich and M.N. Tarasevich. 1964. *Beluga (Delphinapterus leucas) investigation of the species*. Translated from Russian by Israel Program Scientific Translations, Jerusalem, 1969. 376 pp.

Knowlton, A.R. 1997. *The Regulation of Shipping to Protect North Atlantic Right Whales: Need and Feasibility*. M.M.A. thesis. University of Rhode Island.

Knowlton, A.R., J. Sigurjonsson, J.N. Ciano and S.D. Kraus. 1992. Long-distance movements of North Atlantic right whales (*Eubalaena glacialis*). *Marine Mammal Science*, 8(4): 397-405.

Koeller, P., C. Fuentes-Yaco, T. Platt, S. Sathyendranath, A. Richards, P. Ouellet, D. Orr, U. Skúladóttir, K. Wieland, L. Savard and M. Aschan. 2009. Basin-scale coherence in phenology of shrimps and phytoplankton in the North Atlantic Ocean. *Science*, 324(2928): 791-793.

Kohler, N.E., P.A. Turner, J.J. Hoey, L.J. Natanson and R. Briggs. 2002. Tag and recapture for three pelagic shark species: blue shark (*Prionace glauca*), shortfin mako (*Isurus xyrinchus*) and porbeagle (*Lamna nasus*) in the North Atlantic ocean. *International Commission for the Conservation of Atlantic Tuna (ICCAT)*, 54(4): 1231-1260.

Kosheleva, V. 1992. *The Impact of Airguns Used in Marine Seismic Exploration on Organisms Living in the Barents Sea*. Summary of oral presentation at the 1992 Petro Piscis II conference.

Krauss, W., R.H. Kase and H.H. Hinrichsen, 1990. The branching of the Gulf Stream southeast of the Grand Banks. *Journal of Geophysical Research*, 95(C8): 13089-13103.

Kruse, S. 1991. The interactions between killer whales and boats in Johnstone Strait, B.C. Pp. 148-159. In: K. Pryor and K.S. Norris (eds.). *Dolphin Societies/Discoveries and Puzzles*. University of California Press, Berkeley, CA.

Kryter, K.D. 1985. *The Effects of Noise on Man. Second Edition*. Academic Press, Orlando, FL. 688 pp.

Kühnhold, W.W. 1974. Investigations on the toxicity of seawater-extracts of three crude oils on eggs of cod (*Gadus morhua* L.). *Ber. Dtsch. Wiss. Kommn. Meeresforsch*, 23: 165-180.

Kulka, D.W. 2006. Abundance and distribution of demersal sharks on the Grand Banks with particular reference to the NAFO regulatory area. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 06/20.

Kulka, D.W., N.C. Antle and J.M. Simms. 2003. Spatial analysis of 18 demersal species in relation to petroleum licence areas on the Grand Bank (1980-2000). *Canadian Technical Report on Fisheries and Aquatic Sciences*, 2473: xix + 182 pp.

Kulka, D.W. and E.M. DeBlois. 1996. Non-traditional groundfish species on the Labrador Shelf and Grand Banks - Wolffish, monkfish, white hake and winter (blackback) flounder. *DFO Atlantic Fisheries Research Document*, 96/97: 49 pp.

Kulka, D.W., E.M. DeBlois and D.B. Atkinson. 1996. Non-traditional groundfish species on Labrador Shelf and Grand Bank – Skate. *DFO Atlantic Fisheries Research Document*, 96/98: 9 pp.

Kulka, D., C. Hood and J. Huntington. 2007. *Recovery Strategy for Northern Wolffish (Anarhichas denticulatus) and Spotted Wolffish (Anarhichas minor), and Management Plan for Atlantic Wolffish (Anarhichas lupus) in Canada*. Fisheries and Oceans Canada: Newfoundland and Labrador Region. St. John's, NL. x + 103 pp.

Kulka, D.W. and C.M. Miri. 2003. The status of thorny skate (*Amblyraja radiata* Donovan, 1808) in NAFO Divisions 3L, 3N, 3O and Subdivision 3Ps. *Northwest Atlantic Fisheries Organization Science Council Research Documen*t, 03/57: 86 pp.

Kulka, D.W., C.M. Miri and M.R. Simpson. 2004. Thorny skate (*Amblyraja radiata* Donovan, 1808) on the Grand Banks of Newfoundland. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 04/35: 108 pp.

Kulka, D.W., C.M. Miri, M.R. Simpson and K.A. Sosebee. 2004b. Thorny skate (*Amblyraja radiata* Donovan, 1808) on the Grand Banks of Newfoundland. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 04/35: 108 pp.

Kulka, D.W., M.R. Simpson and R.G. Hooper. 2004a. Changes in distribution and habitat associations of wolffish (Anarchichidae) in the Grand Banks and Labrador Shelf. *DFO Canadian Science Advisory Secretariat Research Documen*t, 2004/113: ii + 44 pp.

Kulka, D.W., M.R. Simpson and C.M. Miri. 2006 An assessment of thorny skate (*Amblyraja radiata* Donovan, 1808) on the Grand Banks of Newfoundland. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 06/44: 66 pp.

Kulka, D.W., D. Swain, M.R. Simpson, C.M Miri, J. Simon, J. Gauthier, R. McPhie, J. Sulikowski and R. Hamilton. 2006. Distribution, Abundance, and Life History of *Malacoraja senta* (Smooth Skate) in Canadian Atlantic Waters with Reference to its Global Distribution. *DFO Canadian Science Advisory Secretariat Research Documen*t, 06/93: 140 pp.

Lacoste, K.N. and G.B. Stenson. 2000. Winter distribution of harp seals (*Phoca groenlandica*) off eastern Newfoundland and southern Labrador. *Polar Biology*, 23: 805-811.

Lacroix, D.L., R.B. Lancot, J.A. Reed and T.L. McDonald. 2003. Effect of underwater seismic surveys on molting male long-tailed ducks in the Beaufort Sea, Alaska. *Canadian Journal of Zoology*, 81: 1862-1875.

Ladich, F. 2004. Sound production and acoustic communication. Pp. 210-230. In: G. von der Emde, J. Mogdans and B.G. Kapoor (eds.). *The Senses of Fish: Adaptations for the Reception of Natural Stimuli*, Kluwer Academic Publishers and Narosa Publishing House. 377 pp.

Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet and M. Podesta. 2001. Collisions between ships and whales. *Marine Mammal Science*, 17(1): 35-75.

Lambert, Y. 2011. Environmental and fishing limitations to the rebuilding of the northern Gulf of St. Lawrence stock (*Gadus morhua*). *Canadian Journal of Fisheries and Aquatic Sciences*, 68(4): 618-631.

Lang, A.L. 2007. *Seabird Abundance near Terra Nova Offshore Oil Development during Late Spring 2006*. LGL Rep. No. SA919. Rep. by LGL Limited, St. John's, NL, for Petro-Canada, St. John's, NL. 11 pp.

Lang, A.L. and V.D. Moulton. 2004. *Marine Mammal and Seabird Monitoring during the* CCGS Hudson *Research Expedition, June-July 2004*. LGL Rep. SA818. Rep. by LGL Limited, King City, ON, and LGL Limited, St. John's, NL, for ExxonMobil Canada Ltd. and Chevron Canada Resources, St. John's, NL. 22 pp.

Lang, A.L. and V.D. Moulton. 2008. *Marine Mammal and Seabird Monitoring of Petro-Canada's 3-D Seismic Program in the Jeanne d'Arc Basin, 2007*. LGL Rep. SA938. Rep. by LGL Limited, St. John's, NL, for Petro-Canada, St. John's, NL. 32 pp. + Appendices.

Lang, A.L., V.D. Moulton and R.A. Buchanan. 2006. *Marine Mammal and Seabird Monitoring of Husky Energy's 3-D Seismic Program in the Jeanne d'Arc Basin, 2005*. LGL Rep. SA887. Rep. by LGL Limited, St. John's, NL, for Husky Energy Inc., Calgary, AB. 63 pp. + Appendices.

Lang, A.L., V.D. Moulton and R.A. Buchanan. 2008. *Marine Mammal and Seabird Monitoring of Husky Energy's 3-D Seismic Program in the Jeanne d'Arc Basin, 2005*. LGL Rep. SA887. Rep. by LGL Limited, St. John's, NL, for Husky Energy Inc., Calgary, AB. 57 pp. + Appendices.

Larsen, D.N. 1984. Feeding habits of river otters in coastal southeast Alaska. *The Journal of Wildlife Management*, 48: 1446-1452.

Larsen, E.M. and S.A. Richardson. 1990. Some effects of a major oil spill on wintering shorebirds at Grays Harbor, Washington. *Northwestern Naturalist*, 71: 88-92.

Laurel, B.J., R.S. Gregory and J.A. Brown. 2003. Settlement and distribution of Age-0 juvenile cod, *Gadus morhua* and *G. ogac*, following a large-scale habitat manipulation. *Marine Ecology Progress Series*, 262: 241- 252.

Lavigne, D.M. and K.M. Kovacs. 1988. *Harps and Hoods: Ice Breeding Seals of the Northwest Atlantic*. University of Waterloo Press, Waterloo, ON. 174 pp.

Lawler, G.C., W. Loong and J.L. Laseter. 1978. Accumulation of aromatic hydrocarbons in tissues of petroleum-exposed mallard ducks (*Anas platyrhynchos*). *ES & T Research*, 12: 51-54.

Laws, R. 2012. Cetacean hearing-damage zones around a seismic source. Pp. 473-476. In: A. Hawkins and A.N. Popper (eds.). *The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology* Series No. 730. Springer, New York. 695 pp.

Lawson, G.L. and G.A. Rose 1999a. The importance of detectability to acoustic surveys of semi-demersal fish. *ICES Journal of Marine Science*, 56(3): 370-380.

Lawson, G.L. and G.A. Rose. 1999b. Small-scale spatial and temporal patterns in spawning of Atlantic cod (*Gadus morhua*) in coastal Newfoundland waters. *Canadian Journal of Fisheries and Aquatic Sciences*, 57: 1011-1024.

Lawson, G.L. and G.A. Rose 2000. Seasonal distribution and movements of coastal cod (*Gadus morhua* L.) in Placentia Bay, Newfoundland. *Fisheries Research*, 49(1): 61-75.

Lawson, G.L., G.A. Rose and J. Brattey. 1998. Movement patterns of inshore cod in Subdivision 3Ps (southern Newfoundland) based on marked-recapture studies during 1996-1997. *DFO Canadian Stock Assessment Secretariat Document*, 98/24: 16 pp.

Lawson, J.W., S. Benjamins and G.B. Stenson. 2004. Harbour porpoise bycatch estimates for Newfoundland's 2002 nearshore cod fishery. *DFO Canadian Science Advisory Secretariat Research Document*, 2004/066: 33 pp.

Lawson, J.W. and J.-F. Gosselin. 2009. Distribution and preliminary abundance estimates for cetaceans seen during Canada's marine megafauna survey – A component of the 2007 TNASS. *DFO Canadian Science Advisory Secretariat Research Document*, 2009/031: iv + 29 pp.

Lawson, J.W., T. Stevens and D. Snow. 2007. Killer whales of Atlantic Canada, with particular reference to the Newfoundland and Labrador region. *DFO Canadian Science Advisory Secretariat Research Document*, 2007/062: 16 pp.

Lazier, J.R.N. 1982. Seasonable variability and salinity in the Labrador Current. *Journal of Marine Research Supplemental*, 40: 341-355.

Lazier, J.R.N. and D.G. Wright. 1993. Annual velocity variations in the Labrador Current. *Journal of Physical Oceanography*, 23: 659-678.

Le Corre, M., A. Ollivier, S. Ribes and P. Jouventin. 2002. Light-induced mortality of petrels: A 4-year study from Réunion Island (Indian Ocean). *Biological Conservation*, 105: 93-102.

LeDrew, B.R. and S.T. Culshaw. 1977. *Ship-in-the-Ice Data Report*: Report 77. C-CORE, St. John's, NL.

Le Prell, C.G. 2012. Noise-induced hearing loss: From animal models to human trials. Pp. 191-196. In: A. Hawkins and A.N. Popper (eds.). *The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology* Series No. 730. Springer, New York. 695 pp.

Leatherwood, S., F.T. Awbrey and J.A. Thomas. 1982. Minke whale response to a transiting survey vessel. *Report of the International Whaling Commission*, 32: 795-802.

LeDrew, B.R. and S.T. Culshaw. 1977. *Ship-in-the-Ice Data Report: Report 77*. C-CORE, St. John's, NL.

Ledwell, W. 2007. Live loggerhead observed in Newfoundland, Canada in late autumn. *Marine Turtle Newsletter*, 115: 17.

Ledwell, W. and J. Huntington. 2009. *Incidental Entrapments in Fishing Gear and Strandings reported to the Whale Release and Strandings Group in Newfoundland and Labrador and a Summary of the Whale Release and Strandings Program during 2008.* Report for Fisheries and Oceans Canada, St. John's, NL. 24 pp.

Lee, D.S. and C. Haney. 1996. Manx Shearwater (*Puffinus puffinus*). In: A. Poole and F. Gill (eds.). *The Birds of North America*, No. 257. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Lee, E. 2005. *Monitoring Of A Dredged Disposal Site Great Mosquito Cove, Newfoundland*. Final Report, AMEC Earth & Environmental Limited, St. John's, NL.

Lee, W.Y., M.F. Welch and J.A.C. Nicol. 1977. Survival of two species of amphipods in aqueous extracts of petroleum oils. *Marine Pollution Bulletin*, 8: 92-94.

Leggett, W.C., K.T. Frank and J.E. Carscadden. 1983. Estimating year-class strength in capelin (*Mallotus villosus*) from abiotic variables. *Northwestern Atlantic Fisheries Organization Science Council Research Document*, 83/52: 17 pp.

Leighton, F.A., R.G. Butler and D.B. Peakall. 1985. Oil and Arctic marine birds: An assessment of risk. Pp. 183-215. In: F.R. Engelhardt (ed.). *Petroleum Effects in the Arctic Environment*, Elsevier Applied Science Publishers, London. 281 pp.

Lenhardt, M. 2002. Sea turtle auditory behavior. *Journal of the Acoustical Society of America*, 112: 2314.

Leonardi, M. and A. Klempau. 2003. Artificial photoperiod influence on the immune system of juvenile rainbow trout (*Oncorhynchus mykiss*) in the Southern Hemisphere. *Aquaculture*, 221: 581-591.

Leopold, M.F. and K. Camphuysen. 2008. *Did the Pile Driving during the Construction of the Offshore Wind Farm Egmond aan Zee, the Netherlands, impact Porpoises?* Wageningen IMARES Rep. C091/09. Rep. for NoordzeeWind.

Lesage, V. and M.O. Hammill. 2001. The status of the grey seal, *Halichoerus grypus*, in the Northwest Atlantic. *Canadian Field-Naturalist*, 115(4): 653-662.

Lesage, V., C. Barrette, M.C.S. Kingsley and B. Sjare. 1999. The effect of vessel noise on the vocal behavior of belugas in the St. Lawrence River estuary, Canada. *Marine Mammal Science*, 15(1): 65-84.

Lesage, V., M.O. Hammill and K.M. Kovacs. 2004. Long-distance movements of harbour seals (*Phoca vitulina*) from a seasonally ice-covered area, the St. Lawrence River estuary, Canada. *Canadian Journal of Zoology*, 82: 1070-1081.

Levin, P.S. 1994. Small-scale recruitment variation in a temperate fish: The roles of macrophytes and food supply. *Environmental Biology of Fishes*, 40(3): 271-281.

Levy, E.M. 1980. Oil pollution and seabirds: Atlantic Canada 1976-77 and some implications for northern environments. *Marine Pollution Bulletin*, 11: 51-56.

LGL Limited. No Date. Unpublished Data.

LGL. Limited. 1998. *Nickel Smelter/Refinery Environmental Baseline Study, Marine Environment, 1998*. Report by LGL Limited for Voisey's Bay Nickel Company Limited, St. John's, NF. 47 p. + App.

LGL Limited. 2003. *Husky Lewis Hill Prospect Exploration Drilling Program Environmental Assessment*. LGL Rep. SA746. Rep. by LGL Limited, St. John's, NL, Oceans Limited, St. John's, NL, PAL Environmental Services, St. John's, NL, and SL Ross Environmental Research Limited, Ottawa, ON for Husky Oil Operations Limited, St. John's, NL. 324 pp.

LGL Limited. 2005a. *Husky Delineation/Exploration Drilling Program for Jeanne d'Arc Basin Area Environmental Assessment*. LGL Rep. SA845. Rep. by LGL Limited, Canning and Pitt Associates, Inc., and PAL Environmental Services, St. John's, NL, for Husky Oil Operations Limited, St. John's, NL. 340 pp. + Appendix.

LGL Limited. 2005b. *Northern Jeanne d'Arc Basin Seismic Program Environmental Assessment*. LGL Rep. SA836. Rep. by LGL Limited, St. John's, NL, for Husky Energy Inc., Calgary, AB. 241 pp.

LGL Limited. 2005c. *Wellsite Geohazard Survey, 2005 Environmental Assessment Terra Nova Development*. Rep. by LGL Limited, St. John's, NL, for Petro-Canada, St. John's, NL.

LGL Limited. 2005d. *Wellsite Geohazard Survey, 2005 Environmental Assessment, Hibernia Development*. LGL Rep. SA850. Rep. by LGL Limited for Hibernia Management and Development Co. Ltd., St. John's, NL. 100 pp. + Appendix.

LGL Limited. 2005e. *Orphan Basin Exploration Drilling Program Environmental Assessment.* LGL Rep. SA825. Rep. by LGL Limited, St. John's, NL, Canning & Pitt Associates, Inc., St. John's, NL, SL Ross Environmental Research Limited, Ottawa, ON, Oceans Limited, St. John's, NL, Lorax Environmental, Vancouver, BC, and PAL Environmental Services, St. John's, NL, for Chevron Canada Limited, Calgary, AB, ExxonMobil Canada Ltd., St. John's, NL, Imperial Oil Resources Ventures Limited, Calgary, AB, and Shell Canada Limited. 353 pp.

LGL Limited. 2006. *Husky Delineation/Exploration Drilling Program for Jeanne d'Arc Basin Area Environmental Assessment Update*. LGL Rep. SA886. Rep. by LGL Limited, St. John's, NL, Oceans Limited, St. John's, NL, Canning & Pitt Associates, Inc., St. John's, NL, and PAL Environmental Services, St. John's, NL, for Services, St. John's, NL, for Husky Oil Operations Limited, St. John's, NL. 67 pp. + Appendix.

LGL Limited. 2007a. *Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment Addendum*. LGL Rep. SA883a. Rep. by LGL Limited, St. John's, NL, for Husky Energy, Inc., Calgary, AB. 126 pp. + Appendices.

LGL Limited. 2007b. *Husky Delineation/Exploration Drilling Program for Jeanne d'Arc Basin Area, 2008-2017, Environmental Assessment*. LGL Rep. SA935. Rep. by LGL Limited, St. John's, NL, in association with Canning & Pitt Associates, Inc., Oceans Ltd., and PAL Environmental Services, for Husky Energy Inc., Calgary, AB. 231 pp. + Appendices.

LGL Limited. 2007c. *Environmental Impact Statement – Voisey's Bay Nickel Company Limited Long Harbour Commercial Nickel Processing Plant*.

LGL Limited. 2007d. *Marine Environment Component Study of Long Harbour, Placentia Bay and Vicinity: Climate and Oceanography, Marine Ecology, Commercial Fisheries and Aquaculture, Bald Eagle, Marine Birds and Other Avifauna, River Otter*. LGL Rep. SA889. Report by LGL Limited, St. John's, NL, for Voisey's Bay Nickel Company Limited, St. John's, NL.

LGL Limited. 2007e. *Environmental Assessment of Petro-Canada's Jeanne D'Arc Basin 3-D Seismic Program*. LGL Rep. SA882. Rep. by LGL Limited, St. John's, NL, Oceans Limited, St. John's, NL, Canning & Pitt Associates, Inc., St. John's, NL, and PAL Environmental Services, St., John's, NL, for Petro-Canada. St. John's, NL. 264 pp. + Appendices.

LGL Limited. 2008. *Environmental Assessment of StatoilHydro's Jeanne d'Arc Basin Area Seismic and Geohazard Program, 2008-2016*. LGL Report SA947a by LGL limited, Canning & Pitt Associates Inc., and Oceans Ltd., St. John's NL, for StatoilHydro Canada Ltd., St. John's, NL. 174 pp. + Appendices.

LGL Limited. 2012. *Environmental Assessment of Husky's Jeanne d'Arc Basin/Flemish Pass Regional Seismic Program 2012-2020*. LGL Report SA 1144. Prepared by LGL Limited in association with Canning & Pitt Associates Inc. and Oceans Ltd., St. John's, NL. 320 pp + appendices.

Li, W.K.W., P.M. Dickie, W.G. Harrison and B.D. Irwin. 1993. Biomass and production of bacteria and phytoplankton during the spring bloom in the western North Atlantic Ocean. *Deep Sea Research Part II: Topical Studies in Oceanography*, 40(1-2): 307-327.

Lien, J. 1985. *Wet and Fat: Whales and Seals of Newfoundland and Labrador*. Breakwater Books, Ltd., St. John's, NL. 136 pp.

Lien, J. 1994. Entrapments of large cetaceans in passive inshore fishing gear in Newfoundland and Labrador (1979-1990). *Report of the International Whaling Commission*, Special Issue 15: 149-157.

Lien, J. and F. Barry. 1990. Status of Sowerby's beaked whale, *Mesoplodon bidens*, in Canada. *Canadian Field-Naturalist*, 104: 125-130.

Lien, J., D. Nelson and D.J. Hai. 2001. Status of the white-beaked dolphin, *Lagenorhynchus albirostris*, in Canada. *Canadian Field-Naturalist*, 115: 118-126.

Lien, J., R. Sears, G.B. Stenson, P.W. Jones and N. I-Hsun. 1989. Right whale (*Eubalaena glacialis*) sightings in waters off Newfoundland and Labrador and the Gulf of St. Lawrence, 1978-1987. *Canadian Field-Naturalist*, 103: 91-93.

Lilly, G.R. and M. Simpson. 2000. Distribution and biomass of capelin, Arctic cod and sand lance on the Northeast Newfoundland Shelf and Grand Bank as deduced from bottom-trawl surveys. *Canadian Stock Assessment Secretariat Research Document*, 2000/091: 40 pp.

Lin, Q. and I.A. Mendelssohn. 2012. Impacts and recovery of the *Deepwater Horizon* oil spill on vegetation structure and function of coastal salt marshes in the northern Gulf of Mexico. *Environmental Science and Technology*, 46: 3737-3743.

Lindholm, J.B., P.J. Auster and L.S. Kaufman. 1999. Habitat-mediated survivorship of juvenile (0-year) Atlantic cod *Gadus morhua*. *Marine Ecology Progress Series*, 180: 247-255.

Link, J.S., K. Bolles and C.G. Milliken. 2002. The feeding ecology of flatfish in the Northwest Atlantic. *Journal of Northwest Atlantic Fisheries Science*, 30: 1-17.

Lock, A.R., R.G.B. Brown and S.H. Gerriets. 1994. *Gazetteer of Marine Birds in Atlantic Canada. An Atlas of Seabird Vulnerability to Oil Pollution*. Canadian Wildlife Service, Atlantic Region. 137 pp.

Loehefener, R.R., W. Hoggard, C.L. Roden, K.D. Mullin and C.M. Rogers. 1989. Petroleum structures and the distribution of sea turtles. In: *Proceedings of the Spring Ternary Gulf of Mexico Studies Meeting*, Minerals Management Service, US Department of the Interior, New Orleans, LA.

Løkkeborg, S., E. Ona, A. Vold, H. Pena, A. Salthaug, B. Totland, J.T. Øvredale, J. Dalen and N.O. Handegard. 2010. Effects of seismic surveys on fish distribution and catch rate of gillnets and longlines in Vesterålen in summer 2009. *Havforskningsinstituttet Prosjekrapport Fisken og Havet*, 2-2010: 74 pp.

Long, E.R. and P.M. Chapman. 1985. A Sediment Quality Triad: Measures of sediment contamination, toxicity and infaunal community composition in Puget Sound. *Marine Pollution Bulletin*, 16: 405-415.

Long Harbour Development Corporation. 2011. *The Long Harbour Chronicle*, 1(1): Spring.

Loughlin, T.R. 1994. Tissue hydrocarbon levels and the number of cetaceans found dead after the spill. Pp. 359-370. In: T.R. Loughlin (ed.). *Marine Mammals and the Exxon Valdez*. Academic Press Inc., San Diego, CA.

Louis, J. P., B.D. Petrie and P.C. Smith, 1982. Observations of topographic Rossby waves on the continental margin off Nova Scotia. *Journal of Physical Oceanography*, 12: 47-55.

Lowry, L.F., K.J. Frost and K.W. Pitcher. 1994. Observations of oiling of harbor seals in Prince William Sound. Pp. 209-225. In: T.R. Loughlin (ed.). *Marine Mammals and the Exxon Valdez*. Academic Press, San Diego, CA. 395 pp.

Lucke, K., P.A. Lepper, M.-A. Blanchet and U. Siebert. 2011. The use of an air bubble curtain to reduce the received sound levels for harbor porpoises (*Phocoena phocoena*). *Journal of the Acoustical Society of America*, 130: 3406-3412.

Lucke, K., U. Siebert, P.A. Lepper and M.-A. Blanchet. 2009. Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. *Journal of the Acoustical Society of America*, 125(6): 4060-4070.

Lusseau, D. 2003. Effects of tour boats on the behavior of bottlenose dolphins: Using Markov chains to model anthropogenic impacts. *Conservation Biology*, 17(6): 1785-1793.

Lusseau, D. 2004. The hidden cost of tourism: Detecting long-term effects of tourism using behavioral information. *Ecological Society*, 9(1): 2.

Lusseau, D. 2005. The residency patterns of bottlenose dolphins (*Tursiops* spp.) have different strategies to avoid interactions with tour boats in Doubtful Sound, New Zealand. *Marine Ecology Progress Series*, 257: 265-272.

Lusseau, D., D.E. Bain, R. Williams and J.C. Smith. 2009. Vessel traffic disrupts the foraging behavior of southern resident killer whales *Orcinus orca*. *Endangered Species Research*, 6: 211-221.

Lusseau, D. and L. Bejder. 2007. The long-term consequences of short-term responses to disturbance experience from whalewatching impact assessment. *International Journal of Comparative Psychology*, 20(2-3): 228-236.

Lutcavage, M.E., P.L. Lutz, G.D. Bossart and D.M. Hudson. 1995. Physiologic and clinicopathologic effects of crude oil on loggerhead sea turtles. *Archives of Environmental Contaminants and Toxicology*, 28(4): 417-422.

Lutz, P.L., M. Lutcavage and C.W. Caillouet. 1989. The effects of petroleum on sea turtles: Applicability to Kemp's ridley. Pp. 52-54. In: A.M. Landry (ed.). *Proceedings of the First International symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management*, October 1-4, 1985, Galvaston, TX, Texas A&M University Sea Grant Program.

Ma Z., G. Han and B. de Young. 2011. Modelling temperature, currents and stratification in Placentia Bay. *Atmosphere-Ocean*, accepted.

MacDonald, E. 2012. Vale construction chugging along. *Horizons*, 2012. Available at: http://horizons2012.wordpress.com/land/vale-construction-chugging-along/.

MacDonald, S.M. and C.F. Mason. 1980. Observation on the marking behaviour of a coastal population of otters. *Acta Theriologica*, 25: 245-253.

Mackay, A.H., and A.J. Tankard.1990. Hibernia oil field – Canada Jeanne d'Arc Basin, Grand Banks offshore Newfoundland. Pp. 145-175. In: *American Association of Petroleum Geologists Special Volumes*.

Macko, S.A. and S.M. King. 1980. Weathered oil: Effect on hatchability of heron and gull eggs. *Bulletin of Environment Contamination and Toxicology*, 25: 316-320.

MacLean, S.A. and B. Haley. 2004. *Marine Mammal Monitoring during Lamont-Doherty Earth Observatory's Seismic Study in the Støregga Slide area of the Norwegian Sea, August - September 2003*. LGL Rep. TA2822-20. Rep. by LGL Ltd., King City, ON, for Lamont-Doherty Earth Observatory, Palisades, NY, and National Marine Fisheries Service, Silver Spring, MD. 59 pp.

MacLeod, C.D., W.F. Perrin, R. Pitman, J. Barlow, L.T. Ballance, A. D'Amico, T. Gerrodette, G. Joyce, K.D. Mullin, D. Palka and G.T. Waring. 2006. Known and inferred distributions of beaked whale species (Cetacea: Ziphiidae). *Journal of Cetacean Research and Management*, 7(3): 271-286.

MacLeod, D. 2000. Review of the distribution of *Mesoplodon* species (order Cetacea, family Ziphiidae) in the North Atlantic. *Mammal Revue*, 30(1): 1-8.

Macleod, K., R. Fairbairns, A. Gill, B. Fairbairns, J. Gordon, C. Blair-Myers and E.C.M. Parsons. 2004. Seasonal distribution of minke whales *Balaenoptera acutorostrata* in relation to physiography and prey off the Isle of Mull, Scotland. *Marine Ecology Progress Series*, 277: 263-274.

Maddock-Parsons, D. 2006. Witch flounder in NAFO Divisions 3NO. North Atlantic Fisheries Organization Scientific Council Meeting, June 2006. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 06/37: 32 pp.

Maddock-Parsons, D. 2009. Divisions 3LNO yellowtail flounder (*Limanda ferruginea*) in the 2008 Canadian stratified bottom trawl survey. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 09/31: 28 pp.

Madsen, P.T., B. Mohl, B.K. Nielsen and M. Wahlberg. 2002. Male sperm whale behavior during exposures to distant seismic survey pulses. *Aquatic Mammalls*, 28(3): 231-240.

Madsen, P.T., M. Wahlberg, J. Tougaard, K. Lucke and P. Tyack. 2006. Wind turbine underwater noise and marine mammals: Implications of current knowledge and data needs. *Marine Ecology Progress Series*, 309: 279-295.

Magnussen, J.E., E.K. Pikitch, S.C. Clarke, C. Nicholson, A.R. Hoelzel and M.S. Shivji. 2007. Genetic tracking of basking shark products in international trade. *Animal Conservation*, 10(2): 199-207.

Magoon, L.B., T.L. Hudson and K.E. Peters. 2005. Egret-Hibernia, a significant petroleum system, northern Grand Banks area, offshore eastern Canada. *American Association of Petroleum Geologists Bulletin*, 89(9): 1203-1237.

Maillet, G.L., P. Pepin, S. Fraser and D. Lane. 2006. Biological oceanographic conditions in NAFO Subareas 2 and 3 on the Newfoundland and Labrador Shelf during 2005. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 06/18: 15 pp.

Makkonen, L., R.D. Brown and P.T. Mitten. 1991. Comments on "Prediction of Vessel Icing for Near-Freezing Sea Temperatures". *Weather Forecasting*, 6: 565-567.

Malakoff, D. 2002. Suit ties whale deaths to research cruise. *Science*, 298(5594): 722-723.

Mallet, M. and B. Myrand. 1995. The culture of the blue mussel in Atlantic Canada. Pp. 257-298. In: A.D. Boghen (ed.). *Cold water Aquaculture in Atlantic Canada, Second Edition*, CIRRD, University of Moncton, Moncton, NB.

Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack and J.E. Bird. 1983. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior*. BBN Rep. 5366. Rep. by Bolt, Beranek and Newman, for Minerals Management Service, US Department of the Interior, Washington, DC. Various pages.

Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack and J.E. Bird. 1984. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior/Phase II: January 1984 Migration*. BBN Rep. 5586. Rep. by Bolt Beranek & Newman Inc., Cambridge, MA, for US Minerals Management Service, Anchorage, AK. Various pages.

Malme, C.I., P.R. Miles, P. Tyack, C.W. Clark and J.E. Bird. 1985. *Investigation of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Feeding Humpback Whale Behavio*r. BBN Rep. 5851; OCS Study MMS 85-0019. Rep. by BBN Labs Inc., Cambridge, MA, for MMS, Anchorage, AK. NTIS PB86-218385.

Mann, D.A., R.A. Varela, J.D. Goldstein, S.D. McCulloch, G.D. Bossart, J.J. Finneran, D. Houser and M.L.H. Cook. 2005. Gervais' beaked whale auditory evoked potential hearing measurements. Pp. 178-179. In: *Abstracts for the 16th Biennial Conference on the Biology of Marine Mammals*, 12-16 December 2005, San Diego, CA.

Mann, K.H. 1977. Destruction of kelp beds by sea urchins: A cyclical phenomenon or irreversible degradation. *Helgoland Marine Research*, 30(1-4): 455-467.

Markham, W.E. 1980. *Ice Atlas: Eastern Canadian Seaboard*. Environment Canada, Atmospheric Environment Service, Ottawa, ON.

Marko, J.R., D.B. Fissel and D.R. Haller. 1994a. *Study of Interannual Variability of Sea Ice Off the Canadian East Coast*. Arctic Sciences Ltd.

Marko, J.R., D.B. Fissel, P. Wadhams, P.M. Kelly and R.D. Brown. 1994b. Iceberg severity off eastern North America: Its relationship to sea ice variability and climate change. *Journal of Climate*, 7: 1335-1351.

Marques, F.C. 1996. *Baleen Whale Distribution Patterns and the Potential Influence of Physical and Biological Processes*. M.Sc. Thesis, Biopsychology Department, St. John's, NL. 97 pp.

Marty, G.D., J.E. Hose, M.D. McGurk, E.D. Brown and D.E Hinton. 1997. Histopathology and cytogenetic evaluation of Pacific herring larvae exposed to petroleum hydrocarbons in the laboratory or in Prince William Sound Alaska, after the *Exxon Valdez* oil spill. *Canadian Journal of Fisheries and Aquatic Sciences*, 54: 1846-1857.

Mate, B.R., S.L. Nieukirk and S.D. Kraus. 1997. Satellite-monitored movements of the northern right whale. *Journal of Wildlife Management*, 61: 1393-1405.

Matkin, C.O., G.M. Ellis, E.L. Saulitis, L.G. Barrett-Lennard and D.R. Matkin. 1999. *Killer Whales of Southern Alaska*. North Gulf Oceanic Society, Homer, AK.

Matkin, C.O., G.M. Ellis, M.E. Dahlheim and J. Zeh. 1994. Status of killer whales in Prince William Sound, 1985-1992. Pp. 141-162. In: T.R. Loughlin (ed.). *Marine Mammals and the Exxon Valdez*, Academic Press, San Diego, CA. 395 pp.

Matkin, C.O., E.L. Saulitis, G.M. Ellis, P. Olesiuk and S.D. Rice. 2008. Ongoing population-level impacts on killer whales *Orcinus orca* following the '*Exxon Valdez*' oil spill in Prince William Sound, Alaska. *Marine Ecology Progress Series*, 356: 269-281.

Mazzotti, S. and J. Adams. 2005. Rates and uncertainties on seismic moment and deformation in eastern Canada. *Journal of Geophysical Research*, 10; doi: 10.1029/2004JB003510.

McAlpine, D.F., M.C. James, J. Lien and S.A. Orchard. 2007. Status and conservation of marine turtles in Canadian waters. Pp. 85-112. In: C.N.L. Seburn and C.A. Bishop (eds.). *Ecology, Conservation and Status of Reptiles in Canada, Herpetological Conservation Series No. 2*, Society for the Study of Amphibians and Reptiles.

McCabe, G., M.P. Clark and M.C. Serreze, 2001. Trends in Northern Hemisphere surface cyclone frequency and intensity. *Journal of Climate*, 4: 2763-2768.

McCall, B.D. and S.C. Pennings. 2012. Disturbance and recovery of salt marsh arthropod communities following BP *Deepwater Horizon* oil spill. *PLoS One*, 7(3): e32735.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch and K. McCabe. 2000a. *Marine Seismic Surveys: Analysis of Airgun Signals; and Effects of Airgun Exposure on Humpback Whales, Sea Turtles, Fishes and Squid*. Report by Centre for Marine Science and Technology, Curtin University, Perth, WA, for Australian Petroleum Production and Exploration Association, Sydney, NSW.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch and K. McCabe. 2000b. Marine seismic surveys – A study of environmental implications. *Australian Petroleum Production and Exploration Association Journal*, 40: 692-706.

McClintock, J., R. McKenna and C. Woodworth-Lynas. 2007. *Grand Banks Iceberg Management*. PERD/CHC Report 20-84. Report prepared by AMEC Earth & Environmental, St. John's, NL, R.F. McKenna & Associates, Wakefield, QC, and PETRA International Ltd., Cupids, NL, for PERD/CHC, National Research Council Canada, Ottawa, ON. vi + 84 pp.

McDonald, M.A., J.A. Hildebrand and S.C. Webb. 1995. Blue and fin whales observed on a seafloor array in the Northeast Pacific. *Journal of the Acoustical Society of America*, 98(2, Pt. 1): 712-721.

McDonald, T.L., W.J. Richardson, K.H. Kim and S.B. Blackwell. 2010. Distribution of calling bowhead whales exposed to underwater sounds from Northstar and distant seismic surveys, 2009. Pp. 6-1 to 6-38. In: W.J. Richardson (ed.). *Monitoring of Industrial Sounds, Seals, and Bowhead Whales near BP's Northstar Oil Development, Alaskan Beaufort Sea: Comprehensive Report for 2005-2009*. LGL Rep. P1133-6. Rep. by LGL Alaska Res. Assoc. Inc., Anchorage, AK, Greeneridge Sciences Inc., Santa Barbara, CA, WEST Inc., Cheyenne, WY, and Applied Sociocult. Res., Anchorage, AK, for BP Explor. Alaska Inc., Anchorage, AK. 265 pp.

McEachran, J.D., D.F. Boeschand and J.A. Musick. 1976. Food division within two sympatric species-pairs of skates (Pisces: Rajidae). *Marine Biology*, 35: 301-317.

McElhanney Offshore Surveys Ltd. 1981. *Well Site Survey Report: Mobil et al., White Rose Flank. Newfoundland Grand Banks. July - August 1981*. Contract report submitted to Mobil Oil (Canada) Ltd. 28 pp. + Appendices + Enclosures.

McElhanney Offshore Surveys Ltd. 1982. *Well Site Survey Report: Mobil et al., Archer Flank. Newfoundland Grand Banks. March - June 1982*. Contract report submitted to Mobil Oil (Canada) Ltd. 28 pp. + Appendices + Enclosures.

McEwan, E.H. and F.C. Koelink. 1973. The heat production of oiled Mallards and Scaup. *Canadian Journal of Zoology*, 51: 27-31.

McEwan, E.H. and P.M. Whitehead. 1980. Uptake and clearance of petroleum hydrocarbons by the Glaucous-winged Gull (*Larus glaucescens*) and the Mallard Duck (*Anas platyrhynchos*). *Canadian Journal of Zoology*, 58: 723-726.

McKenna, M.F. 2011. *Blue Whale Response to Underwater Noise from Commercial Ships*. PhD Thesis, University of California, San Diego, CA. 218 pp.

McKenzie, C. H., T. Baines, K. Best, R. Boland, E. Dawe, D. Deibel, D. Drover, E. Johnson, S. Kenny, S. Macneill, D. Mouland, R. O'Donnell, L. Park, P. Sargent, C.Vickers and A.Vickerson. 2007. *The European Green Crab, Carcinus maenas, in Placentia Bay, Newfoundland: Aquatic Invasive Species Survey 2007*. Aquatic Invasive Species Newfoundland Workshop. St. John's, NL. November 16, 2007.

McKibben, J.R. and A.H. Bass. 1998. Behavioral assessment of acoustic parameters relevant to signal recognition and preference in a vocal fish. *Journal of the Acoustical Society of America*, 104: 3520-3533.

McLellan, H.J. 1957. A slope water survey - July 1954. *Fisheries Research Board of Canada Manuscript Reports of the Biological Stations*, 632: 49 pp.

McPhie, R.P. and S.E. Campana. 2009. Reproductive characteristics and population decline of four species of skate (Rajidae) off the eastern coast of Canada. *Journal of Fish Biology*, 75: 223-246. doi:10.1111/j.1095-8649.2009.02282.

Meindel, S.K. and R.E Scheibling 1998. Size and age structure of the sea urchin *Strongylocentrotus droebachiensis* in different habitats. Pp. 737-742. In: A.A. Balkema, (ed.). *Echinoderms*, Mendeley, Rotterdam.

Melcón, M.L., A.J. Cummins, S.M. Kerosky, L.K. Roche, S.M. Wiggins and J.A. Hildebrand. 2012. Blue whales response to anthropogenic noise. *PLoS ONE*, 7(2): e32681. doi:10.1371/journal.pone.0032681.

Mello, L.G. and G.A. Rose. 2005. Using geostatistics to quantify seasonal distribution and aggregation patterns of fishes: An example of Atlantic cod (*Gadus morhua*). *Canadian Journal of Fisheries and Aquatic Sciences*, 62(3): 659-670.

Mendelssohn, I.A., M.W. Hester, C. Sasser and M. Fischel. 1990. The effect of Louisiana crude oil discharge from a pipeline break on the vegetation of a southeast Louisiana brackish marsh. *Oil and Chemical Pollution*, 7: 1-15.

Mercer, D. and T. Willcott. 2005. *Placentia Bay Ecosystem Overview Report*. Internal DFO Document. Fisheries and Oceans Canada, Newfoundland and Labrador Region: Oceans and Habitat Management.

Merkel, F.R. 2010. Light-induced bird strikes on vessels in Southwest Greenland. Greenland Institute of Natural Resources. *Teknisk Rapport Pingortitaleriffik*, 84: 26 pp.

Meteorological Service of Canada Canadian Ice Service. 2005. *MANICE: Manual of Standard Procedures for Observing and Reporting Ice Conditions*. Meteorological Service of Canada, Ottawa, ON.

Methven, D. 1999. Annotated bibliography of demersal fish feeding with emphasis on selected studies from the Scotian Shelf and Grand Bank of the Northwestern Atlantic. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2267: iv + 106 pp.

Miles, W., S. Money, R. Luxmoore and R.W. Furness. 2010. Effects of artificial lights and moonlight on petrels at St Kilda. *Bird Study*, 57: 244-251.

Milich, L. 1999. Resource mismanagement versus sustainable livelihoods: The collapse of the Newfoundland cod fishery. *Society and Natural Resources*, 12(7): 625-642.

Miller, A.A.L. 1999. *The Quaternary Sediments and Seismostratigraphy of the Grand Banks of Newfoundland and the Northeast Newfoundland Shelf: Foraminiferal Refinements and Constraints*. Ph.D. Thesis, George Washington University, Washington, DC. 972 pp.

Miller, P.J.O., M.P. Johnson, P.T. Madsen, N. Biassoni, M. Quero and P.L. Tyack. 2009. Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico. *Deep Sea Research Part I: Oceanographic Research Papers*, 56(7): 1168-1181.

Miller, G.W., R.E. Elliott, W.R. Koski, V.D. Moulton and W.J. Richardson. 1999. Whales. Pp. 5-1 to 5-109. In: W.J. Richardson (ed.). *Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-water Seismic Program in the Alaskan Beaufort Sea, 1998*. LGL Rep. TA2230-3. Rep. by LGL Ltd., King City, ON, and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and NMFS, Anchorage, AK, and Silver Spring, MD. 390 pp.

Miller, G.W., V.D. Moulton, R.A. Davis, M. Holst, P. Millman, A. MacGillivray and D. Hannay. 2005a. Monitoring seismic effects on marine mammals-Southeastern Beaufort Sea, 2001-2002. Pp. 511-542. In: S.L. Armsworthy, P.J. Cranford and K. Lee (eds.). *Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies*. Battelle Press, Columbus, OH. 631 pp.

Miller, J.H., A.E. Bowles, B.L. Southall, R.L. Gentry, W.T. Ellison, J.J. Finneran, C.R. Greene, Jr., D. Kastak, D.R. Ketten, P.L. Tyack, P.E. Nachtigall, W.J. Richardson and J.A. Thomas. 2005b. Strategies for weighting exposure in the development of acoustic criteria for marine mammals. *Journal of the Acoustical Society of America*, 118: 2019 (Abstract). Presentation available at: http://www.oce.uri.edu/faculty_pages/miller/Noise_Weighting_10_18_2005.ppt.

Miller, P.J.O., M.P. Johnson, P.T. Madsen, N. Biassoni, M. Quero and P.L. Tyack. 2009. Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico. *Deep Sea Research Part I: Oceanographic Research Papers*, 56(7): 1168-1181.

Milton, S., P. Lutz and G. Shigenaka. 2003. Chapter 4. Oil Toxicity and Impacts on sea turtles. Pp. 35-48. In: G. Shigenaka (ed). *Oil and Sea Turtles: Biology, Planning and Response*. NOAA, Seattle, WA.

Minor, M.A. and R.E. Scheibling. 1997. Effects of food ration and feeding regime on growth and reproduction of the sea urchin *Strongylocentrotus droebachiensis*. *Marine Biology* ,129(1): 159-167.

Minsk, L.D. 1977. *Ice Accumulation on Ocean Structures*. Cold Regions Research and Engineering Laboratory, Hanover, NH. CRREL Report, 77-17: 42 pp.

Mitchell, E. and D.G. Chapman. 1977. Preliminary assessment of stocks of Northwest Atlantic sei whales (*Balaenoptera borealis*). *Report of the International Whaling Commission Special Issue*, 1: 117-120.

Mitchell, E. and R.R. Reeves. 1988. Records of killer whales in the western North Atlantic, with emphasis on eastern Canadian waters. *Rit Fiskideildar*, 9: 161-193.

Mitson, R.B. (Editor). 1995. Underwater noise of research vessels: review and recommendations. *ICES Cooperative Research Report*, 209: 61 pp. Mitson, R.B. and H.P. Knudsen. 2003. Causes and effects of underwater noise on fish-abundance estimation. *Aquatic Living Resources*, 16: 255-263.

MMS (Mineral Management Service). 1997. *Federal Offshore Statistics: 1995. Leasing, Exploration, Production and Revenues to December 31, 1995*. US Department of the Interior, Mineral Management Service, Operations and Safety Management, OCS Report MMS 97-0007.

Mobil Oil Canada, Ltd. 1985. *Hibernia Development Project - Environmental Impact Statement: Volumes IIIa and IIIb – Biophysical Assessment*. Prepared by Mobil Oil Canada, Ltd. as Operator, on behalf of the joint venture participants (Gulf Canada Resources Inc., Petro-Canada Inc., Chevron Canada Resources Limited and Columbia Gas Development of Canada Ltd.).

Moein, S.E., J.A. Musick, J.A. Keinath, D.E. Barnard, M. Lenhardt and R. George. 1994. *Evaluation of Seismic Sources for Repelling Sea Turtles from Hopper Dredges*. Report from Virginia Institute of Marine Science, [Gloucester Point], VA, for US Army Corps of Engineers. 33 pp.

Mollomo, P. 1998. The white shark in Maine and Canadian Atlantic waters. *Northeastern Naturalis*t, 5(3): 207-214.

Montevecchi, W.A. 2006. Influences of artificial light on marine birds. Pp. 94-113. In: C. Rich and T. Longcore (eds.). *Ecological Consequences of Artificial Night Lighting*, Island Press, Washington, DC. 478 pp.

Montevecchi, W.A., A. Hedd, L. McFarlane Tranquilla, D.A. Fifield, C.M. Burke, P.M. Regular, G.K. Davoren, S. Garthe and R.A. Phillips. 2012. Tracking seabirds to identify ecologically important and high risk marine areas in the western North Atlantic. *Biological Conservation (In Press, Available Online)*. http://dx.doi.org/10.1016/ j.biocon.2011.12.001.

Montevecchi, W.A., F.K. Wiese, G.K. Davoren, A.W. Diamond, F. Huettmann and J. Linke. 1999. *Seabird Attraction to Offshore Platforms and Seabird Monitoring from Offshore Support Vessels and Other Ships: Literature Review and Monitoring Designs*. Prepared for the Canadian Association of Petroleum Producers. 56 pp.

Mooney, T.A., P.E. Nachtigall, M. Breese, S. Vlachos and W.W.L. Au. 2009a. Predicting temporary threshold shifts in bottlenose dolphin (*Tursiops truncatus*): The effects of noise level and duration. *Journal of the Acoustical Society of America*, 125(3): 1816-1826.

Mooney, T.A., P.E. Nachtigall and S.Vlachos. 2009b. Sonar-induced temporary hearing loss in dolphins. *Biology Letters*, 4(4): 565-567.

Moore, S.E. and R.P. Angliss. 2006. *Overview of Planned Seismic Surveys Offshore Northern Alaska, July-October 2006*. Paper SC/58/E6 presented to IWC Scientific Committee, IWC Annual Meeting, 1-13 June, St Kitts and Nevis.

Moore, S.E., K.W. Shelden, D.J. Rugh, B.A. Mahoney and L.K. Litzky. 2000. Beluga, *Delphinapterus leucas*, habitat associations in Cook Inlet, Alaska. *Marine Fisheries Review*, 62(3): 60-80.

Morgan, M.J., J. Bailey, B.P. Healey, D. Maddock-Parsons and R. Rideout. 2011. Recovery potential assessment of American plaice (*Hippoglossoides platessoides*) in Newfoundland and Labrador. *DFO Canadian Science Advisory Secretariat Research Document*, 2011/047: iv + 32 pp.

Moriyasu, M. and C. Lanteigne 1998. Embryo development and reproductive cycle in the snow crab, *Chionoecetes opilio* (Crustacea: Majidae), in the southern Gulf of St. Lawrence, Canada. *Canadian Journal of Zoology*, 76: 2040-2048.

Moriyasu, M. and C. Lanteigne. 1998. Embryo development and reproductive cycle in the snow crab, *Chionoecetes opilio* (Crustacea: Majidae), in the southern Gulf of St. Lawrence, Canada. *Canadian Journal of Zoology*, 76(11): 2040-2048.

Morreale, S.J., P.T. Plotkin, D.J. Shaver and H.J. Kalb. 2007. Adult migration and habitat utilization: Ridley sea turtles in their element. Chapter 11. In: P.T. Plotkin (ed.). *Biology and Conservation of Ridley Sea Turtles*. John Hopkins University Press, Baltimore, MD.

Morris, C.J., R.S. Gregory, B.J. Laurel, D.A. Methven, and M.A. Warren. 2011. Potential effect of eelgrass (*Zostera marina*) loss on nearshore Newfoundland fish communities, due to invasive green crab (*Carcinus maenas*). *DFO Canadian Science Advisory Secretariat Research Document*, 2010/140: iv + 17 pp.

Mougeot, F. and V. Bretagnolle. 2000. Predation risk and moonlight avoidance in nocturnal seabirds. *Journal of Avian Biology*, 31: 376-386.

Moulton, V.D., J. Christian, R.A. Pitt, B.D. Mactavish and R.A. Buchanan. 2006b. *Jeanne d'Arc Basin 3D Seismic Program, Environmental Assessment Update, 2006 - 2010*. LGL Rep. SA884. Rep. by LGL Limited and Canning & Pitt Associates, Inc., St. John's, NL, for Husky Energy Inc., Calgary, AB. 56 pp. + Appendices.

Moulton, V.D. and M. Holst. 2010. Effects of seismic survey sound on cetaceans in the Northwest Atlantic. *Environmental Studies Research Funds Report*, No. 182: 28 pp.

Moulton, V.D. and J.W. Lawson. 2002. Seals, 2001. Pp. 3-1 to 3-48. In: W.J. Richardson (ed.). *Marine Mammal and Acoustical Monitoring of WesternGeco's Open-water Seismic Program in the Alaskan Beaufort Sea, 2001*. LGL Rep. TA2564-3. Rep. by LGL Limited, King City, ON, and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, National Marine Fisheries Service, Anchorage, AK, and Silver Spring, MD.

Moulton, V.D., B.D. Mactavish and R.A. Buchanan. 2005. *Marine Mammal and Seabird Monitoring of Chevron Canada Resources' 3-D Seismic Program on the Orphan Basin, 2004*. LGL Report SA817 by LGL Limited, St. John's, NL, for Chevron Canada Resources, Calgary, AB, ExxonMobil Canada Ltd., St. John's, NL, and Imperial Oil Resources Ventures Ltd., Calgary, AB. 90 pp. + Appendices.

Moulton, V.D., B.D. Mactavish, R.E. Harris and R.A. Buchanan. 2006a. *Marine Mammal and Seabird Monitoring of Chevron Canada Limited's 3-D Seismic Program on the Orphan Basin, 2005*. LGL Report SA843 by LGL Limited, St. John's, NL, for Chevron Canada Limited, Calgary, AB, ExxonMobil Canada Ltd., St. John's, NL, and Imperial Oil Resources Ventures Ltd., Calgary, AB. 109 pp. + Appendices.

Moulton, V.D. and G.W. Miller. 2005. Marine mammal monitoring of a seismic survey on the Scotian Slope, 2003. Pp. 29-40. In: K. Lee, H. Bain and G.V. Hurley (eds.). *Acoustic Monitoring and Marine Mammal Surveys in the Gully and Outer Scotian Shelf before and during Active Seismic Programs*. *Environmental Studies Research Funds Report*, 151. 154 pp (Published 2007).

Mowbray, F.K. 2002. Changes in the vertical distribution of capelin (*Mallotus villosus*) off Newfoundland. *ICES Journal of Marine Science*, 59(5): 942-949.

Muhling, B.A., M.A. Roffer, J.T. Lamkin, G.W. Ingram Jr., M.A. Upton, G. Gawlikowski, F. Muller-Karger, S. Habtes and W.J. Richards. 2012. Overlap between Atlantic bluefin tuna spawning grounds and observed *Deepwater Horizon* surface oil in the northern Gulf of Mexico. *Marine Pollution Bulletin*, 64(4): 679-687.

Mullin, K., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers and B. Taggart. 1991. *Cetaceans on the Upper Continental Slope in the North-Central Gulf of Mexico*. OCS Study MMS 91-0027. Report by US National Marine Fisheries Servervis, Pascagoula, MS, for US Minerals Management Service, New Orleans, LA. 108 pp.

Murillo, F.J., P. Durán Muñoz, A. Altuna and A. Serrano. 2011. Distribution of deep-water corals of the Flemish Cap, Flemish Pass, and the Grand Banks of Newfoundland (Northwest Atlantic Ocean): Interaction with fishing activities. *ICES Journal of Marine Science*, 68: 319-332.

Murphy, D.L. and I. Anderson. 1985. *An Evaluation of the International Ice Patrol Drift Model: U.S. Coast Guard Report CG-188-40*. Report of the International Ice Patrol in the North Atlantic Ocean, Season of 1985. International Ice Patrol.

Murphy, S.M., R.H. Day, J.A. Wiens and K.R. Parker. 1997. Effects of the *Exxon Valdez* oil spill on birds: Comparisons of pre- and post-spill surveys in Prince William Sound, Alaska. *Condor*, 99: 299-313.

Murray, A. 1883. Glaciation of Newfoundland. *Royal Society of Canada, Proceedings and Transactions*, 1(sec. IV): 55-76.

Murty, T.S. 1977. Seismic sea waves. *Fisheries Research Board of Canada*, 198: 337 pp.

Musick, J.A., D.E. Barnard and J.A. Keinath. 1994. Aerial estimates of seasonal distribution and abundance of sea turtles near the Cape Hatteras faunal barrier. In: B.A. Schroeder and B.E. Witherington (eds.). *Proceedings of the 13th Annual Symposium on Sea Turtle Biology and Conservation*, *NOAA Technical Memorandum*, NMFSSEFSC-341. 281 pp.

Myrberg, A.A. 1981. Sound communication and interception in fishes. Pp. 395-426. In: W.N. Tavolga, A.N. Popper, R.R. Fay and L.A. Wilber (eds.). *Hearing and Sound Communication in Fishes*, Springer-Verlag, New York, NY.

Myrberg, A.A. and M. Lugli. 2006. Reproductive behavior and acoustical interactions. Pp. 149-176. In: F. Ladich, S.P. Collin, P. Moller and B.G.. Kapoor (eds.). *Communication in Fish Volume 1*, Science Publishers, Enfield, NH.

Myrberg, A.A., Jr., M. Mohler and J.D. Catala. 1986. Sound production by males of a coral reef fish (*Pomacentrus partitus*): Its significance to females. *Animal Behavior*, 34: 913-923.

Myers, R.A., J.A. Hutchings and N.J. Barrowman. 1997. Why do fish stocks collapse? The example of cod in Atlantic Canada. *Ecological Applications*, 7: 91-106.

Myers, R.A., N.J. Barrowman, G. Mertz, J. Gamble and H.G. Hunt. 1994. Analysis of continuous plankton recorder data in the Northwest Atlantic, 1959-1992. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 1966: iii + 246 pp.

NAFO (Northwest Atlantic Fisheries Organization). 2008. Scientific Council Meeting, Report of the NAFO Scientific Council. Working Group on Ecosystem Approach to Fisheries Management (WGEAFM). NAFO Headquarters, Dartmouth, Canada, 26-30 May 2008. *Northwest Atlantic Fisheries Organization Science Council Secretariat Document*, 08/10: 70 pp.

NAFO (Northwest Atlantic Fisheries Organization). 2011. *Regulated Stocks, Annual Assessments: Northern Shrimp in Div. 3M (for 2011)*. Available at: http://www.nafo.int/science/advice/2011/pan3m.pdf

NAFO (Northwest Atlantic Fisheries Organization). 2012. *STATLANT 21B Dataset*. (Accessed June 2012).

Nakano, H. and M.P. Seki. 2002. Synopsis of biological data on the blue shark, *Prionace glauca* Linnaeus. *Bulletin of the Fisheries Research Agency*, 6: 18-55.

Nakashima, B. and J.P. Wheeler. 2002. Capelin (*Mallotus villosus*) spawning behaviour in Newfoundland waters: The interaction between beach and demersal spawning. *ICES Journal of Marine Science*, 59: 909-916.

NAS (National Academy of Sciences). 2002. *Oil in the Sea: Impacts, Fates and Effects*. National Academy Press, Washington, DC.

National Audubon Society. 2012. *The Christmas Bird Count Historical Results*. Available at: http://www.audubon.org/bird/cbc (Date accessed: May 2, 2012).

National Climate Data and Information. 2003. *Archive Weather Winners*. Available at: http://www.climate.weatheroffice.gc.ca/winners/intro_e.html

National Climate Data Center. 1986. S*ea Ice Climate Atlas: Vol. II NAVAIR 50-1C-541*. Naval Oceanography Command Detachment National Climate Data Center, Ashville, AL.

National Geophysical Data Center. 2012. *NOAA/WDC Historical Tsunami Database at National Geophysical Data Center*. Natural Hazards KMZ file. Available at: http://www.ngdc.noaa.gov/hazard/ .

Natter, M., J. Keevan, Y. Wang., A.R. Keimowitz, B.C. Okeke, A. Son and M.-K. Lee. Level and degradation of *Deepwater Horizon* spilled oil in coastal marsh sediments and pore-water. *Environmental Science and Technology*, 46(11): 5744-5755.

Natural Resources Canada. 2008. *Earthquakes Canada Website*. Earth Sciences Sector, Ottawa, ON. Available at URL: http://earthquakescanada.nrcan.gc.ca/histor/20th-eme/1929/1929-eng.php.

Natural Resources Canada. 2008. *National Resources Canada, Storm Surge*. Available at: http://atlas.nrcan.gc.ca/site/english/maps/environment/naturalhazards/storm_surge/storm_surge Date modified: 2008-03-12.

Natural Resources Canada. 2011a. *2010 National Building Code of Canada Seismic Hazard Maps*. Available at: http://earthquakescanada.nrcan.gc.ca/hazard-alea/zoning/NBCC2010maps-eng.php. Accessed October 12, 2011.

Natural Resources Canada. 2011a. *Seismic Hazard in Canada*. Available at: http://www.earthquakescanada.nrcan.gc.ca/gen_info/images/NBCC2010can0.2simp.pdf Date modified: 2011-05-18. Accessed June 2012.

Natural Resources Canada. 2011b. *Earthquake Map of Canada, 1627-2010*. Available at: http://earthquakescanada.nrcan.gc.ca/historic_eq/images/caneqmap_e.pdf. Date modified: 2011-11-24”=. Accessed June 2012.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2008. *Offshore Physical Environment Guidelines*. vii + 28 pp. + Appendices.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2009. *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands.* iii + 13 pp.

NEB (National Energy Board), Canada-Newfoundland Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2010. *Offshore Waste Treatment Guidelines*. vi + 28 pp.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2011. *Environmental Protection Plan Guidelines*. viii + 20 pp.

Neff, J.M., D.S. Page and P.D. Boehm. 2011. Exposure of sea otters and harlequin ducks in Prince William Sound, Alaska, USA, to shoreline residues 20 years after *Exxon Valdez* oil spill. *Environmental Toxicology and Chemistry*, 30: 659-672.

Nelson, D. and J. Lien. 1996. The status of the long-finned pilot whale, *Globicephala melas*, in Canada. *Canadian Field-Naturalist*, 110: 511-524.

Nesis, K.N. 2001. West Arctic and east-Arctic distributional ranges of cephalopods. *Sarsia*, 86(1): 1-11.

Newfoundland and Labrador Department of Natural Resources. 2011. *Minfo: Mineral Information*, 17(1): Summer. Available at: http://www.nr.gov.nl.ca/nr/mines/production/mrip/MINFO-Volume17Number1.pdf

Newfoundland and Labrador Heritage. 2000. *Natural Environment, Landscape, Geological Hazards Website*. Available at: http://www.heritage.nf.ca/environment/tablemap4.html

Newfoundland and Labrador Tourism. 2012. *Newfoundland and Labrador Tourism Website*. Available at: http://www.newfoundlandlabrador.com/

NHC (National Hurricane Center). 2012. *National Hurricane Center (United States) Historical Track and Data Information for Tropical Systems Affecting Atlantic Ocean, Pacific Ocean, Caribbean and Gulf of Mexico*. Available at: http://www.nhc.noaa.gov/ pastall.shtml

Nieukirk, S.L., D.K. Mellinger, J.A. Hildebrand, M.A. McDonald and R.P. Dziak. 2005. Downward shift in the frequency of blue whale vocalizations. *Abstracts for the 16th Biennial Conference on the Biology of Marine Mammals*, San Diego, CA, 12-16 December. 2005.

Nieukirk, S, D.K. Mellinger, S.E. Moore and J. Goslin. 2012. Sounds from airguns and fin whales recorded in the mid-Atlantic Ocean, 1999-2009. *Journal of the Acoustical Society of America*, 131(2): 1102-1112.

Nieukirk, S.L., H. Klinck, K. Klinck, D.K. Melllinger and R.P. Dziak. 2011. Seismic airgun sounds and whale vocalizations recorded in the Fram Strait and Greenland Sea. Pp. 218.. In: *Abstracts for the 19th Biennial Conference on the Biology of Marine Mammals*, Tampa, FL, 27 November-2 December. 344 pp.

Nieukirk, S.L., K.M. Stafford, D.K. Mellinger, R.P. Dziak and C.G. Fox. 2004. Low-frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean. *Journal of the Acoustical Soceity of America*, 115(4): 1832-1843.

Nightingale B., T. Longcore and C.A. Simenstad. 2006. Artificial night lighting and fishes. Pp. 257-276. In: C. Rich and T. Longcore (eds). *Ecological Consequences of Artificial Lighting*, Island Press, Washington, DC.

NLDEC (Newfoundland and Labrador Department of Environment and Conservation). 2004. *Fur Harvest by Species, as Determined from Fur Ledgers and Export Permits in Zone 22 (1998-1999 to 2002-2003)*.

NLDEC (Newfoundland and Labrador Department of Environment and Conservation). 2006. *Guideline for Plume Dispersion Modelling*.

NLDEC (Newfoundland and Labrador Department of Environment and Conservation). 2012a. *2011 Ambient Air Monitoring Report*.

NLDEC (Newfoundland and Labrador Department of Environment and Conservation). 2012b. *Provincial Park Reserves*. Available at: http://www.env.gov.nl.ca/env/parks/parks/reserves/index.html#jackspond [Accessed June 2012].

NLDEC 2012. Newfoundland and Labrador. 2012. *2012-2013 Hunting and Trapping Guide*. 68 pp. Available at: http://www.env.gov.nl.ca/env/wildlife/hunting/hunttrap.pdf

NLDFA (Newfoundland and Labrador Department of Fisheries and Aquaculture). 2003/2004. *Licence Files for Placentia Bay*.

NMFS (US National Marine Fisheries Service). 1987. Endangered fish and wildlife: Approaching humpback whales in Hawaiian waters. *Federal Registry*, 52(225): 44912-44915 [50 CFR Part 222].

NMFS (US National Marine Fisheries Service). 1995. Small takes of marine mammals incidental to specified activities: Offshore seismic activities in southern California. *Federal Registry*, 60(200): 53753-53760.

NMFS (US National Marine Fisheries Service). 1998. *Recovery Plan for the Blue Whale (Balaenoptera musculus)*. Prepared by R.R. Reeves, P.J. Clapham, R.L. Brownell, Jr. and G.K. Silber, for the National Marine Fisheries Service, Silver Spring, MD. 42 pp.

NMFS (US National Marine Fisheries Service). 2000a. Small takes of marine mammals incidental to specified activities; Marine seismic-reflection data collection in southern California. *Federal Registry*, 65(20): 16374-16379.

NMFS (US National Marine Fisheries Service). 2000b. Taking and importing marine mammals; Taking marine mammals incidental to Naval activities/proposed rule. *Federal Registry*, 65(239 12 December): 77546-77553.

NMFS (US National Marine Fisheries Service). 2011. *Sea Turtles, Dolphins, and Whales and the Gulf of Mexico Oil Spill*. Accessed on 18 June 2012. Available at: http://www.nmfs.noaa.gov/pr/health/oilspill/.

NOAA (National Oceanic and Atmospheric Association). 2012. *Some Gulf Dolphins Severely Ill, says Study by NOAA and Partners*. Accessed on 18 June 2012. Available at: http://response.restoration.noaa.gov/about/media/some-gulf-dolphins-severely-ill-says-study-noaa-and-partners.html.

NOAA (National Oceanic and Atmospheric Association) and USN (US Navy). 2001. *Joint Interim Report: Bahamas Marine Mammal Stranding Event of 15-16 March 2000*. NMFS, Silver Spring, MD, and Assistant Secretary of the Navy, Installations and Environment., Washington, DC. 61 pp. Available at: http://www.nmfs.noaa.gov/pr/acoustics/reports.htm.

Nolte, K.G. and M.E. Trethart. 1971. *North Atlantic Sea Ice Survey*. AMOCO Canada Petroleum Co. Ltd., Calgary, AB.

NORDCO Ltd. 1977. *Analysis of Laser Profilometry of Sea Ice*. NORDCO Ltd., St. John's, NL.

Nortech Jacques Whitford Inc. 1998. *Well Site Report, White Rose L-08: Grand Banks, Newfoundland*. Contract report submitted to Husky Oil. 38 pp. + Appendices + Enclosures.

Nowacek, D.P., M.P. Johnson and P.L. Tyack. 2004. North Atlantic right whales (*Eubalaena glacialis*) ignore ships but respond to alerting stimuli. *Proceedings: Biological Sciences*, 271(1536): 227-231.

Nowacek, D.P., L.H. Thorne, D.W. Johnston and P.L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. *Mammal Review*, 37(2): 81-115.

NSF (National Science Foundation) and L-DEO (Lamont-Doherty Earth Observatory). 2006a. *Draft Environmental Assessment of the Batholiths Marine Seismic Survey, Inland Waterways and Near offshore, Central Coast of British Columbia*. LGL Report TA2822-32. Rep. by LGL Limited, Sidney, BC.

NSF (National Science Foundation) and L-DEO (Lamont-Doherty Earth Observatory). 2006b. *Request by Lamont-Doherty Earth Observatory for an incidental harassment authorization to allow the incidental take of marine mammals during seismic testing in the northern Gulf of Mexico, Fall 2006*. LGL Report TA4295-1.

NTT (Newfoundland Transshipment Terminal). 1996. *Newfoundland Transshipment Terminal Project Environmental Assessment. Volumes 2 and 3*. A report by Jacques Whitford Limited, St. John's, NL.

O'Boyle, R.N., G.M Fowler, P.C.F. Hurley, W. Joyce and M.A. Showell. 1998. Update on the status of NAFO SA 3-6 porbeagle shark (*Lamna nasus*). *DFO Canadian Stock Assessment Secretariat Research Document*, 98/41: 58 pp.

O'Driscoll, R.L. and G.A. Rose. 1999. Seasonal changes in abundance, distribution and vertical migration of capelin in Placentia Bay. Pp. 182-195. In: DFO Science, Oceans and Environment Branch. *Capelin in SA2 and Division 3KL. DFO Canadian Science Advisory Secretariat Research Document*, 99/206: xx + 195 pp.

O'Driscoll, R.L., M.J.D. Parsons and G.A. Rose. 2001. Feeding of capelin (*Mallotus villosus*) in Newfoundland waters. *Sarsia*, 86(3): 165-176.

O'Hara, J. and J.R. Wilcox. 1990. Avoidance responses of loggerhead turtles, *Caretta caretta*, to low frequency sound. *Copeia*, 1990(2): 564-567.

O'Hara, P.D. and L.A. Morandin. 2010. Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds. *Marine Pollution Bulletin*, 60: 672-278.

Oceans Ltd. 2011. *White Rose Physical Environmental Data for Production Systems*. Final report, ADCP datasets 2008-2011.

Oceanweather Inc. and Environment Canada. 2011. *MSC50 Wind and Wave Climatologies*. Available at: http://www.oceanweather.net/MSC50WaveAtlas/ then go to MSC50: Canadian East Coast Region, Wave Climate.

Okubo, A. 1971. Oceanic diffusion diagrams. *Deep Sea Research*, 18: 789-802.

Ollerhead, L.M.N., M.J. Morgan, D.A. Scruton and B. Marrie. 2004. Mapping spawning times and locations for 10 commercially important fish species found on the Grand Banks of Newfoundland. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2522: iv + 45 pp.

Olsgård, F. and J.S. Gray. 1995. A comprehensive analysis of the effects of offshore oil and gas exploration and production on the benthic communities of the Norwegian Continental Shelf. *Marine Ecology Progress Series*, 122: 388-306.

Ormseth, O.A. and M. Ben-David. 2000. Ingestion of crude oil: Effects on digesta retention times and nutrient uptake in captive river otters. *Journal of Comparative Physiology, B*, 170: 419-428.

Oro, D., A. De León, E. Minguez and R.W. Furness. 2005. Estimating predation on breeding European Storm-petrels (*Hydrobates pelagicus*) by Yellow-legged Gulls (*Larus michahellis*). *Journal of Zoology (London),* 265: 421-429.

Oropesa, A-L., M. Pérez-López, D. Hernández, J. Pablo García, L. Eusebio Fidalgo, A. López-Beceiro and F. Soler. 2007. Acetylcholinesterase activity in seabirds affected by the *Prestige* oil spill on the Galician coast (NW Spain). *Science of the Total Environment*, 372: 532-538.

Orth, R.J., T.J.B. Carruthers, W.C. Dennison, C.M. Duarte, J.W. Fourqurean, K.L. Heck, Jr., A.R. Hughes, G.A. Kendrick, W.J. Kenworthy, S. Olyarnik, F.T. Short, M. Waycott and S.L. Williams. 2006. A global crisis for seagrass ecosystems. *Bioscience*, 56(12): 987-996.

Osborn, L.S. 1985. *Population Dynamics, Behaviour and the Effect of Disturbance on Haulout Patterns of the Harbor Seal Phoca vitulina richardsi/Elkhorn Slough, Monterey Bay, California*. B.A. thesis, Department of Environmental Studies and Department of Biology, University of California, Santa Cruz, CA. 75 pp.

O'Sullivan, W.M. 1993. The nature and distribution of otter resting sites on part of the river Blackwater Catchment, Southern Ireland. *Biological Environment*, 93B: 159-162.

Ottensmeyer, C.A. and H. Whitehead. 2003. Behavioural evidence for social units in long-finned pilot whales. *Canadian Journal of Zoology*, 81: 1327-1338.

Overland, J.E. 1990: Prediction of vessel icing for near-freezing sea temperatures. *Weather and Climate*, 5: 62-77.

Overland, J.E., C.H. Pease, R.W. Priesendorfer and A.L. Comiskey, 1986: Prediction of vessel icing. *Journal of Climate and Applied Meteorology*, 25: 1793-1806.

Packer, D.B., C.A. Zetlin and J.J. Vitaliano. 2003. *Essential Fish Habitat Source Document:* Smooth Skate, *Malacoraja senta, Life History and Habitat Characteristics*. NOAA Technical Memorandum NMFS-NE-177. US Department of Commerce, National Oceanic and Atmospheric Administration National Marine Fisheries Service, Northeast Region Northeast Fisheries Science Center, Woods Hole, MA.

Paine, M.D., W.C. Leggett, J.K. McRuer and K.T. Frank. 1988. Effects of chronic exposure to the water-soluble fraction (WSF) of Hibernia Crude oil on capelin (*Mallotus villosus*) embryos. *Canadian Technical Report of Fisheries and Aquatic Sciences*, No. 1627: iv + 25 pp.

PAL (Provincial Aerospace Limited Environmental Services). 1990. *Iceberg Tow Data*. Petro-Canada for the King's Cove wellsite, St. John's, NL.

PAL (Provincial Aerospace Limited Environmental Services). 1995. *Historical Iceberg Sightings 1989-1995*. Petro-Canada for the Terra Nova Project, St. John's, NL.

PAL (Provincial Airlines Limited). 2011a. *Iceberg Sightings Database, 1985 to 2008*. Available at: http://www.provair.com/icebergnet/home.htm

PAL (Provincial Aerospace Limited) Ice Management Group. 2011b. *The 2011 Ice Season Report for the Grand Banks of Newfoundland*. Prepared for the Grand Banks Joint Operators, St. John's, NL.

Palka, D., A.J. Read and C.W. Potter. 1997. Summary of knowledge of white-sided dolphins (*Lagenorhynchus acutus*) from US and Canadian Atlantic waters. *Report of the International Whaling Commission*, 47: 729-734.

Palka, D., A.J. Read, A.J. Westgate and D.W. Johnston. 1996. Summary of current knowledge of harbour porpoises in US and Canadian Atlantic waters. *Report of the International Whaling Commission*, 46: 559-565.

Pardini, R. and E. Trajano. 1999. Use of shelters by the Neotropical river otter (*Lontra longicaudis*) in an Atlantic forest stream, southeastern Brazil. *Journal of Mammalogy*, 80(2): 600-610.

Park, L.E., L.A. Beresford and E. Kissler. 2010. *Prioritization of Key Ecosystem Components Based on Risk of Harm from Human Activities within the Placentia Bay/Grand Banks Large Ocean Management Area*. Newfoundland and Labrador Region Oceans, *Habitat and Species at Risk Publication Series*, 0004: vi + 9 pp. + working notes.

Parks, S.E., C.W. Clark and P.L. Tyack. 2007. Short- and long-term changes in right whale calling behavior: The potential effects of noise on acoustic communication. *Journal of the Acoustical Society of America*, 122(6): 3725-3731.

Parks, S.E. M. Johnson, D. Nowacek and P.L. Tyack. 2011. Individual right whales call louder in increased environmental noise. *Biology Letters*, 7(1): 33-35.

Parks, S.E., I. Urazghildiiev and C.W. Clark. 2009. Variability in ambient noise levels and call parameters of North Atlantic right whales in three habitat areas. *Journal of the Acoustical Society of America*, 125(2): 1230-1239.

Parnell, J.F., M.A. Shield and D. Frierson, Jr. 1984. Hatching success of Brown Pelican eggs after contamination with oil. *Colonial Waterbirds*, 7: 22-24.

Parry, G.D. and A. Gason. 2006. The effect of seismic surveys on catch rates of rock lobsters in western Victoria, Australia. *Fisheries Research*, 79: 272-284.

Parsons, J.L. and J.E. Brownlie. 1981. Distribution and abundance of marine mammals of the Grand Banks, 1980-1981. In: MacLaren Plansearch. *Grand Banks Wildlife Study, Final Report: Chapter 4*. Rep. for Mobil Oil Canada Ltd.

Pascoe, P.L. 1990. Light and the capture of marine animals. Pp. 229-244. In: P.J. Herring, A.K. Campbell, M. Whitfield and L. Maddock (eds.). *Light and Life in the Sea*, Cambridge University Press, Cambridge.

Patenaude, N.J., W.J. Richardson, M.A. Smultea, W.R. Koski, G.W. Miller, B. Würsig and C.R. Greene, Jr. 2002. Aircraft sound and disturbance to bowhead and beluga whales during spring migration in the Alaskan Beaufort Sea. *Marine Mammal Science*, 18(2): 309-335.

Payne, R., O. Brazier, E.M. Dorsey, J.S. Perkins, V.J. Rowntree and A. Titus. 1983. External features in southern right whales (*Eubalaena australis*) and their use in identifying individuals. Pp. 371-445 In: R. Payne (ed.). *Communication and Behaviour of Whales*. AAAS Sel. Symp. 76. Westview Press, Boulder, CO. 643 pp.

Payne, J.F., C. Andrews, and L. Fancey. 2008. Potential effects of seismic energy on fish and shellfish: An update since 2003. *DFO Canadian Science Advisory Secretariat Research Document*, 2008/060.

Payne, J.F., J. Coady and D. White. 2009. Potential effects of seismic airgun discharges on monkfish eggs (*Lophius americanus*) and larvae. *Environmental Studies Research Funds Report*, No. 170, 32 pp.

Payne, J.F., L. Fancey, C. Andrews, J. Meade, F. Power, K. Lee, G. Veinott and A. Cook. 2001. Laboratory exposures of and vertebrate species to concentrations of IA-35 (Petro-Canada) drill mud fluid, production water, and Hibernia drill mud cuttings. *Canadian Manuscript Report of Fisheries and Aquatic Sciences*, 2560: iv + 27 pp.

Peakall, D.B., D.J. Hallet, J.R. Bend, G.L. Foureman and D.S. Miller. 1982. Toxicity of Prudhoe Bay crude oil and its aromatic fractions to nestling Herring Gulls. *Environmental Research*, 27: 206-215.

Peakall, D.B., D.J. Hallet, D.S. Miller, R.G. Butler and W.B. Kinter. 1980. Effects of ingested crude oil on Black Guillemots: A combined field and laboratory study. *Ambio*, 9: 28-30.

Peakall, D.B., J. Tremblay, W.B. Kinter and D.S. Miller. 1981. Endocrine dysfunction in seabirds caused by ingested oil. *Environmental Research*, 24: 6-14.

Pearce, C.M., J.L. Manuel, S.M Gallager, D.A. Manning, R.K. O'Dor and E. Bourget. 2004. Depth and timing of settlement of veligers from different populations of giant scallop, *Placopecten magellanicus* (Gmelin), in thermally stratified mesocosms. *Journal of Experimental Marine Biology and Ecology*, 312(1): 187-214.

Peddicord, R.K. 1980. Direct effects of suspended sediments on aquatic organisms. In: R.A. Baker (ed.). *Contaminants and Sediments - Volume 1: Fate and Transport, Case Studies, Modelling, Toxicity*, Ann Arbor Science, Ann Arbor, MI. EPA-600/J-80-154. 576 pp.

Pepin, P. and M. Paranjape. 1996. Summary of biological oceanographic variables in the Newfoundland region. *DFO Atlantic Fisheries Research Document*, No. 96/2: 8 pp. + Figures.

Pepin, P., E. Colbourne, and G. Maillet. 2011. Seasonal patterns in zooplankton community structure on the Newfoundland and Labrador Shelf. *Progress in Oceanography* 91(3): 273-285.

Pepin, P., G.L. Maillet, S. Fraser, T. Shears and G. Redmond. 2008. Biological and chemical oceanographic conditions on the Newfoundland and Labrador Shelf during 2007. *DFO Canadian Science Advisory Secretariat Research Document*, 2008/034: 61 pp.

Pepin, P., G. Maillet, S. Fraser, T. Shears and G. Redmond. 2011. Optical, chemical, and biological oceanographic conditions on the Newfoundland and Labrador Shelf during 2009 and 2010. *DFO Canadian Science Advisory Secretariat Research Document*, 2011/074. iv + 45 pp.

PERD (Panel on Energy Research & Development). 2004. *Comprehensive Iceberg Management Database 2004*. PERD/CHC Report 20-70. Available at: http://www.chc.nrc.ca/Cold Regions Technology/Cold Regions.html

Pereira, J.J., R. Goldberg, J.J. Ziskowski, P.L. Berrien, W.W. Morse and D.L Johnson. 1999. Essential fish habitat source document: Winter flounder, *Pseudopleuronectes americanus*, life history and habitat characteristics. *NOAA Technical Memorandum*, NMFS-NE 138.

Perez, C., M. Lores and A. Velando. 2011. Oil pollution increases plasma antioxidants but reduces coloration in a seabird. *Oecologia (Berlin)*, 163: 875-884.

Pérez-López, M., F. Cid, A.L. Oropesa, L.E. Fidalgo, A.L. Beceiro and F. Soler. 2006. Heavy metal and arsenic content in seabirds affected by the *Prestige* oil spill on the Galician Coast (NW Spain). *Science of the Total Environment*, 359: 209-220.

Perkins, J. and H. Whitehead. 1977. Observations on three species of baleen whales off northern Newfoundland and adjacent waters. *Journal of the Fisheries Research Board of Canada*, 34: 1436-1440.

Peterson, C.H., S.D. Rice, J.W. Short, D. Esler, J.L. Bodkin, B.E. Ballachey and D.B. Irons. 2003. Long-term ecosystem response to the *Exxon Valdez* oil spill. *Science*, 302(5653): 2082-2086.

Petrie, B. and D. Warnell. 1988. Oceanographic and meteorological observations from the Hibernia region of the Newfoundland Grand Banks. *Canadian Data Report of Hydrography and Ocean Science*, 69: 270 pp.

Petrie, B., K. Lonk and S. de Margerie, 1987. Tides on the Newfoundland Grand Banks. *Atmosphere-Ocean*, 25(1): 10-21.

Petro-Canada. 1995. *Development Application – Terra Nova Development: Environmental Impact Statement*. Terra Nova Proponents.

Pezeshiki, S.R., M.W. Hester, Q. Lin and J.A. Nyman. 2000. The effects of oil spill and clean-up on dominant US Gulf coast marsh macrophytes: A review. *Environmental Pollution*, 108(2): 129-139.

Pezeshki, S.R. and R.D. DeLaune. 1993. Effects of soil hypoxia and salinity on gas exchange and growth of *Spartina patens*. *Marine Ecology Progress Series*, 96: 75-81.

Piatt, J.F., C.J. Lensink, W. Butler, M. Kendziorek and D.R. Nysewander. 1990. Immediate impact of the *Exxon Valdez* oil spill on marine birds. *Auk*, 107: 387-397.

Piatt, J.F., D.A. Methven, A.E. Burger, R.L. McLagan, V. Mercer and E. Creelman. 1989. Baleen whales and their prey in a coastal environment. *Canadian Journal of Zoology*, 67: 1523-1530.

Piatt, J.F. and D.N. Nettleship. 1987. Incidental catch of marine birds and mammals in fishing nets off Newfoundland, Canada. *Marine Pollution Bulletin*, 18(6, Suppl B): 344-349.

Piper, D.J.W. 2005. Late Cenozoic evolution of the continental margin of eastern Canada, *Norwegian Journal of Geology*, 85: 305-318.

Piper, D.J.W. and D.C. Campbell. 2005. Quaternary geology of Flemish Pass and its application to geohazard evaluation for hydrocarbon development. *Geological Association of Canada Special Paper*, 43: 29-43.

Placentia Town Council. 2011. *Council Meeting Minutes, December 13, 2011*. Available at: http://www.placentia.ca/wqadmin/assets/minutes/12.13.11.pdf

Polar Gas Project. 1977. *Application to National Energy Board. Volume 5, Part A. Environmental Statement*. Prepared by Polar Gas Project, Toronto, ON.

Pollino, C.A and D.A. Holdway. 2002. Toxicity testing of crude oil and related compounds using early life stages of the crimson-spotted rainbowfish (*Melanotaenia fluviatilis*). *Ecotoxicology and Environmental Safety* 52: 180-189.

Ponti, M., M. Abbiati and V.U. Ceccherelli. 2002. Drilling platforms as artificial reef: Distribution of macrobenthic assemblages of the "*Paguro*" wreck (northern Adriatic Sea). *ICES Journal of Marine Science*, 59 (Supplement): S316-S323.

Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand and J.M. Marquenie. 2008. Green light for nocturnally migrating birds. *Ecology and Society*, 113(2): 47. Available at: http://www.ecologyandsociety.org/vol13/iss2/art47/. Accessed: 1 January 2011.

Popov, V.V., A.Y. Supin, D. Wang, K. Wang, L. Dong and S. Wang. 2011. Noise-induced temporary threshold shift and recovery in Yangtze finless porpoises *Neophocaena phocaenoides asiaeorientalis*. *Journal of the Acoustical Society of America*, 130(1): 574-584.

Popper, A.N. 2003. Effect of anthropogenic sounds on fishes. *Fisheries*, 28: 24-31.

Popper, A.N., M.B. Halvorsen, A. Kane, D.L. Miller, M.E. Smith, J. Song, P. Stein and L.E. Wysocki. 2007. The effects of high-intensity, low-frequency active sonar on rainbow trout. *Journal of the Acoustical Society of America*, 122(1): 623-636.

Power, D. 1997. Redfish in NAFO Division 3LN. *North Atlantic Fisheries Organization Science Council Research Document*, 97/64: 37 pp.

Prinsenberg, S.J., J.S. Holladay and L.A. Lalumiere. 1993. Electromagnetic/radar ice and snow sounding project over the Newfoundland Shelf in 1992. *Canadian Technical Report of Hydrography and Ocean Sciences*, No. 144.

PWGSC (Public Works and Government Services Canada)..1998. *Ecological Risk Assessment/Remedial Action Review, Argentia: Report 1: Shag, Little Shag, Island, The and Gull Ponds*. PWGSC Project 782716. 404 pp.

Raffaelli, D., E. Bell, G. Weithoff, A. Matsumoto, J.J. Cruz-Motta, P. Kershaw, R. Parker, D. Parry and M. Jones. 2003. The ups and downs of benthic ecology: Considerations of scale, heterogeneity and surveillance for benthic-pelagic coupling. *Journal of Experimental Marine Biology and Ecology*, 285-286: 191-203.

Ramey, P.A. and P.V.R. Snelgrove. 2003. Spatial patterns in sedimentary macrofaunal communities on the south coast of Newfoundland in relation to surface oceanography and sediment characteristics. *Marine Ecology Progress Series*, 262: 215-227.

Read, A.J. 1999. Harbour porpoise *Phoecena phoecena*. Pp. 323-355.. In: S.H. Ridgeway and R.J. Harrison (eds.). *Handbook of Marine Mammals. Volume 6: The Second Book of Dolphins and Porpoises*. Academic Press, San Diego, CA. 486 pp.

Reddin, D.G. 2006. Perspectives on the marine ecology of Atlantic salmon (*Salmo salar*) in the Northwest Atlantic. *DFO Canadian Science Advisory Secretariat Research Documents*, 2006/018: iv + 39 pp.

Reddin, D.G. and K.D. Friedland. 1993. Marine survival of North American and European Atlantic salmon: Effects of growth and environment. *ICES Journal of Marine Science*, 50(4): 481-492.

Reddin, D.G., K.D. Friedland, P. Downton, J.B. Dempson and C.C. Mullins. 2004. Thermal habitat experienced by Atlantic salmon kelts (*Salmo salar* L.) in coastal *Newfoundland waters. Fisheries and Oceanography*, 13: 24-35.

Reddy C.M., J.S. Arey, J.S. Seewald, S.P. Sylva, K.L. Lemkau, R.K. Nelson, C.A. Carmichael, C.P. McIntyre, J. Fenwick, G.T. Ventura, B.A.S. Van Mooy and R. Camilli. 2011. Composition and fate of gas and oil released to the water column during the *Deepwater Horizon* oil spill. *Proceedings of the National Academy of Sciences of the United States of America*. Published ahead of print. doi: 10.1073/pnas.1101242108.

Reed, J.R., J.L. Sincock and J.P. Hailman. 1985. Light attraction in endangered Procellariiform birds: Reduction by shielding upward radiation. *Auk*, 102: 377-383.

Reeves, R.R. and E. Mitchell. 1986. American pelagic whaling for right whales in the North Atlantic. *Report of the International Whaling Commission*, Special Issue 10: 221-254.

Reeves, R.R., E. Mitchell and H. Whitehead. 1993. Status of the northern bottlenose whale, *Hyperoodon ampullatus*. *Canadian Field-Naturalist*, 107: 490-508.

Reeves, R.R. and H. Whitehead. 1997. Status of the sperm whale, *Physeter macrocephalus*, in Canada. *Canadian Field-Naturalist*, 111: 293-307.

Regular, P.M., F. Shuhood, T. Power, W.A. Montevecchi, G.J. Robertson, D. Ballam, J.F. Piatt and B. Nakashima. 2009. Murres, capelin and ocean climate: Inter-annual associations across a decadal shift. *Environmental Monitoring and Assessment*, 156: 293-302.

Reid, P.C. and L. Valdes (Editors). 2011. ICES status report on climate change in the North Atlantic . *ICES Cooperative Research Report*, 310: 262 pp.

Rice, S.D. 1985. Effects of oil on fish. Pp: 157-182. In: F.R. Engelhardt (ed.). *Petroleum Effects in the Arctic Environment*, Elsevier Science Publishing Co., NY. xxiv + 282 pp.

Richardson, W.J., R.A. Davis, C.R. Evans, D.K. Ljungblad and P. Norton. 1987. Summer distribution of bowhead whales, *Balaena mysticetus*, relative to oil industry activities in the Canadian Beaufort Sea, 1980-84. *Arctic*, 40(2): 93-104.

Richardson, W.J., M.A. Fraker, B. Würsig and R.S. Wells. 1985a. Behaviour of bowhead whales *Balaena mysticetus* summering in the Beaufort Sea: Reactions to industrial activities. *Biology Conservation*, 32(3): 195-230.

Richardson, W.J., C.R. Greene, Jr., W.R. Koski and M.A. Smultea, with G. Cameron, C. Holdsworth, G. Miller, T. Woodley and B. Würsig. 1991. *Acoustic Effects of Oil Production Activities on Bowhead and White Whales Visible during Spring Migration near Pt. Barrow, Alaskan 1990 Phase*. OCS Study MMS 91-0037. Rep. by LGL Limited, King City, ON, for U.S. Minerals Management Service, Herndon, VA. 311 pp. NTIS PB92-170430.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme and D.H. Thomson. 1995. *Marine Mammals and Noise*. Academic Press, San Diego, CA. 576 pp.

Richardson, W.J., M. Holst, W.R. Koski and M. Cummings. 2009. Responses of cetaceans to large-source seismic surveys by Lamont-Doherty Earth Observatory. Pp. 213. In: *Abstracts for the 18th Biennial Conference on the Biology of Marince Mammals*, Quebec, Canada, October, 2009. 306 pp.

Richardson, W.J., G.W. Miller and C.R. Greene, Jr. 1999. Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea. *Journal of the Acoustical Society of America*, 106(4, Pt. 2): 2281.

Richardson, W.J., R.S. Wells and B. Würsig. 1985b. Disturbance responses of bowheads, 1980-84. Pp. 89-196. In: W.J. Richardson (ed.). *Behavior, Disturbance Responses and Distribution of Bowhead Whales Balaena mysticetus in the Eastern Beaufort Sea, 1980-84*. Rep. by LGL Ecological Research Associates, Inc., Bryan, TX, for US Minerals Management Service, Reston, VA. OCS Study MMS, 85-0034. 306 pp.

Richardson, W.J. and M.T. Williams (Editors). 2004. *Monitoring of Industrial Sounds, Seals, and Bowhead Whales near BP's Northstar oil Development, Alaskan Beaufort Sea, 1999–2003*. Rep. by LGL Limited, King City, ON, Greeneridge Sciences Inc., Santa Barbara, CA, and WEST Inc., Cheyenne, WY, for BP Explor., Alaska Inc., Anchorage, AK, US National Marine Fisheries Service, Anchorage, AK, and Silver Spring, MD.

Richardson, W.J., B. Würsig and C.R. Greene, Jr. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. *Journal of the Acoustical Society of America*, 79(4): 1117-1128.

Richardson, W.J., B.W. Würsig and C.R. Greene, Jr. 1990. Reactions of bowhead whales, *Balaena mysticetus*, to drilling and dredging noise in the Canadian Beaufort Sea. *Marine Environmental Research*, 29(2): 135-160.

Richmond, M.D. 1996. Status of subtidal biotopes of the Jubail Mainre Wildlife Sanctuary with special reference to soft-substrata communities. Pp. 159-176. In: F. Krupp, A.H. Abuzinada, and I.A. Nader (eds.). *A Marine Wildlife Sanctuary for the Arabian Gulf: Environmental Research and Conservation Following the 1991 Gulf War Oil Spill*, National Commission for Wildlife Conservation and Development, Riyadh, Saudi Arabia: Kingdom of Saudi Arabia, and Frankfurt, Germany: Senchenberg Research Institute.

Richter, C.F., S.M. Dawson and E. Slooten. 2003. Sperm whale watching off Kaikoura, New Zealand: Effects of current activities on surfacing and vocalisation patterns. Department of Conservation, Wellington. *Science for Conservation*, 219: 78 pp. Available at: http://www.doc.govt.nz/Publications/004~Science-and-Research/Science-for-Conservation/PDF/SFC219.pdf

Ridgway, S.H., E.G. Wever, J.G. McCormick, J. Palin and J.H. Anderson. 1969. Hearing in the giant sea turtle, *Chelonia mydas*. *Proceedings of the National Academy of Science US*, 64: 884-890.

Riffaut, L., K.D. McCoy, C. Tirard, V.L. Friesen and T. Boulinier. 2005. Population genetics of the Common Guillemot *Uria aalge* in the North Atlantic: Geographic impact of oil spills. *Marine Ecology Progress Series*, 291: 263-273.

Rilov, G. and Y. Benayahu. 1998. Vertical artificial structures as an alternative habitat for coral reef fishes in disturbed environments. *Marine Environmental Research*, 45(4-5): 431-451.

Ringuette, M., M. Castonguay, J.A. Runge and F. G. Grégoire. 2002. Atlantic mackerel (*Scomber scombrus*) recruitment fluctuation in relation to copepod production and juvenile growth. *Canadian Journal of Fisheries and Aquatic Sciences*, 59(4): 646-656.

Risch, D., P.J. Corkeron, W.T. Ellison and S.M. Van Parijs. 2012. Changes in humpback whale song occurrence in response to an acoustic source 200 km away. *PLoS One*, 7: e29741.

Rivard, D., L.C. Hendrickson, and F.M Serchuk. 1998. Yield estimates for short-finned squid (*Illex illecebrosus*) in SA 3-4 from research vessel survey relative biomass indices. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 98/75: 4 pp.

Roberts, B.A. and A. Robertson. 1986. Salt marshes of Atlantic Canada: Their ecology and distribution. *Canadian Journal of Botany*, 64: 455-467.

Roberts, R.D. and B.M. Forrest. 1999. Minimal impact from long-term dredge spoil disposal at a dispersive site in Tasman Bay, New Zealand. *New Zealand Journal of Marine and Freshwater Research*, 33(4): 623-633.

Robertson, G. J. 2002. Current status of the Manx Shearwater (*Puffinus puffinus*) colony on Middle Lawn Island, Newfoundland. *Northeastern Naturalist*, 9: 317-324.

Robertson, G.J. and R.D. Elliot. 2002. Changes in seabird populations breeding on Small Island, Wadham Islands, Newfoundland. *Canadian Wildlife ServiceTechnical Report Series*, No. 381.

Robertson, G.J. and R.I. Goudie. 1999. Harlequin Duck (*Histrionicus histrionicus*). In: A. Poole and F. Gill (eds.). *The Birds of North America*, No. 466. The Birds of North America, Inc., Philadelphia, PA.

Robertson, G.J., D. Fifield, M. Massaro and J.W. Chardine. 2001. Changes in nesting-habitat use of large gulls breeding in Witless Bay, Newfoundland. *Canadian Journal of Zoology*, 79: 2159-2167.

Robertson, G.J., J. Russell and D. Fifield. 2002. Breeding population estimates for three Leach's Storm-Petrel colonies in southeastern Newfoundland, 2001. *Canadian Wildlife Service Technical Report Series*, No. 380.

Robertson, G.J., S.I. Wilhelm and P.A. Taylor. 2004. Population size and trends of seabirds breeding on Gull and Great Islands, Witless Bay Islands Ecological Reserve, Newfoundland, up to 2003. *Canadian Wildlife Service Technical Report Series*, No. 418.

Robertson, M.J., J.B. Dempson, D.G. Reddin, G.I. Veinott, N.M. Cochrane, C.E. Bourgeois and D. Caines. 2011. Status of Atlantic salmon (*Salmo salar* L.) stocks of insular Newfoundland (SFAs 3-14A), 2009. *DFO Canadian Science Advisory Secretariat Research Document*, 2010/139: iv + 50 pp.

Robichaud, D. and G. Rose. 2001. Multiyear homing of Atlantic cod to a spawning ground. *Canadian Journal of Fisheries and Aquatic Sciences*, 58(12): 2323-2329.

Robichaud, D. and G. Rose. 2006. Density-dependent distribution of demersal juvenile Atlantic cod (*Gadus morhua*) in Placentia Bay, Newfoundland. *ICES Journal of Marine Science*, 63(4): 766-774.

Robinson, C.L.K. and I.D. Cuthbert. 1996. *The Impacts of Backshore Developments on Nearshore Biota and their Habitats*. (No. 2432/WP1192n). Triton Environmental Consultants Ltd., Nanaimo, BC.

Rodríguez, A. and B. Rodríguez. 2009. Attraction of petrels to artificial lights in the Canary Islands: Effects of the moon phase and age class. *Ibis*, 151: 299-310.

Rodway, M.S., H.M. Regehr and J.W. Chardine. 2003. Status of the largest breeding concentration of Atlantic Puffins, *Fratercula arctica*, in North America. *Canadian Field-Naturalist*, 117: 70-75.

Rogers, E. and L.F. Bosart. 1986. An investigation of explosively deepening oceanic cyclones. *Monthly Weather Review*, 114: 702-718.

Rolland, R.M., S.E. Parks, K.E. Hunt, M. Castellote, P.J. Corkeron, D.P. Nowacek, S.K. Water and S.D. Kraus. 2012. Evidence that ship noise increases stress in right whales. *Procedings of the Royal Society, Part B*, 279: 2363-2368.

Romano, T.A., M.J. Keogh, C.Kelly, P. Feng, L. Berk, C.E. Schlundt, D.A. Carder and J.J. Finneran. 2004. Anthropogenic sound and marine mammal health: Measures of the nervous and immune systems before and after intense sound exposure. *Canadian Journal of Fisheries and Aquatic Sciences*, 61(7): 1124-1134.

Rose, G.A. 2004. Reconciling overfishing and climate change with stock dynamics of Atlantic cod (*Gadus morhua*) over 500 years. *Canadian Journal of Fisheries and Aquatic Sciences*, 61(9): 1553-1557.

Rose, G.A. 2005. On distributional responses of North Atlantic fish to climate change. *ICES Journal of Marine Science* 62(7): 1360-1374.

Ross, P.S. G. Ellis, J.K.B. Ford and L.G. Barrett-Lennard. 2002. Toxic chemical pollution and Pacific killer whales (*Orcinus orca*). Pp. 126-130. In: *Fourth International Orca Symposium and Workshops*, September 23-28, 2002, CEBC-CNRS, France.

Ross, P.S., G.M. Ellis, M.G. Ikonumou, L.G. Barrett-Lennard and R.F. Addison. 2000. High PCB concentrations in free-ranging Pacific Killer whales, *Orcinus orca*: effects of age, sex and dietary preference. *Marine Pollution Bulletin*, 40: 504-515.

Røstad, A., S. Kaartvedt, T.A. Klevjer and W. Melle. 2006. Fish are attracted to vessels. *ICES Journal of Marine Science*, 63(8) 1431-1437.

Roul, S. 2011. Current Status of the Manx Shearwater (*Puffinus puffinus*) population at Lawn Islands Archipelago Provisional Ecological Reserve. *Osprey*, 42: 26-34.

Rowe, S., J.A. Hutchings, D. Bekkevold and A. Rakitin. 2004. Depensation, probability of fertilization, and the mating system of Atlantic cod (*Gadus morhua* L.). *ICES Journal of Marine Science*, 61(7): 114-1150.

Rowe S., J.A. Hutchings J.E. Skjæraasen and L. Bezanson. 2008. Morphological and behavioural correlates of reproductive success in Atlantic cod *Gadus morhua*. *Marine Ecology Progress Series*, 354: 257-265.

Rudkin, P., T. King, F. Ralph and S.A. Stoermer. 2005. *Investigations into the Increased Sightings of Ice Islands in the North Atlantic*. Port and Ocean Engineering under Arctic Conditions Conference (POAC ’05), Potsdam, NY.

Rudkin, P., T. King, F. Ralph and S.A. Stoermer. 2005. *Provincial Aerospace Limited (PAL) Investigations into the Increased Sightings of Ice Islands in the North Atlantic*. Port and Ocean Engineering under Arctic Conditions Conference (POAC ’05), Potsdam, NY.

Rudkin. P. and H. Ripply. 1988. *Integrated Aerial Ice Reconnaissance System for Ice Management in the Marginal Ice Zone*. POLARTEC 88 Conference, Trondheim, Norway.

Russell, J. 2008. *Population Estimate for the Colony of Leach's Storm-Petrels (Oceanodroma leucorhoa) Breeding on Green Island, Fortune Bay, Southeastern Newfoundland in 2008*. Fisheries and Oceans Canada internal report.

Russell J. and D. Fifield. 2001. *Marine Bird Important Bird Areas in Southeast Newfoundland: Conservation Concerns and Potential Strategies*. Canadian Nature Federation, Bird Studies Canada, Natural History Society of Newfoundland and Labrador. 160 pp.

Russell, I.C., M.W. Aprahamian, J. Barry, I.C. Davidson, P. Fiske, A.T. Ibbotson, R.J. Kennedy, J.C. Maclean, A. Moore, J. Otero, E.C.E. Potter and C.D. Todd. 2012. The influence of the freshwater environment and the biological characteristics of Atlantic salmon smolts on their subsequent marine survival. *ICES Journal of Marine Science*, 69(9): 1563-1573. doi:10.1093/icesjms/fsr208.

Russell, R.W. 2005. *Interactions between Migrating Birds and Offshore Oil and Gas Platforms in the Northern Gulf of Mexico: Final Report*. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2005-009. 348 pp.

Russell, R.W. (Editor). 2005. Interactions between migrating birds and offshore oil and gas platforms in the northern Gulf of Mexico: Final report. US Department of the Interior, *Minerals Management Service OCS Study MMS*, 2005-009: 348 pp.

Ruzzante, D.E., C.T. Taggart and D. Cook. 1998. A nuclear DNA basis for shelf- and bank-scale population structure in northwest Atlantic cod (*Gadus morhua*): Labrador to Georges Bank. *Molecular Ecology*, 7(12): 1663-1680.

Ryals, B.M., R.J. Dooling, E. Westbrook, M.L. Dent, A. MacKenzie and O.N. Larsen. 1999. Avian species differences in susceptibility to noise exposure. *Hearing Research*, 131: 71-88.

Sætre, R. and E. Ona. 1996. Seismike undersøkelser og på fiskeegg og -larver en vurdering av mulige effecter pa bestandsniva. [Seismic investigations and damages on fish eggs and larvae: An evaluation of possible effects on stock level] *Fisken og Havet*, 1996:1-17, 1-8. (in Norwegian, with an English summary - full translation not published).

Sanders, H.L., J.F. Grassle, G.R. Hampson, L.S. Morse, S. Garner-Price and C.C. Jones. 1980. Anatomy of an oil spill: Long-term effects from the grounding of the barge *Florida* off West Falmouth, Massachusetts. *Journal of Marine Research*, 38: 265-380.

Sardá, R., S. Pinedo, A. Gremare and S. Taboada. 2000. Changes in the dynamics of shallow sandy-bottom assemblages due to sand extraction in the Catalan Western Mediterranean Sea. *ICES Journal of Marine Science*, 57: 1446-1453.

Saucier, M.H. and D.M. Baltz. 1993. Spawning site selection by spotted seatrout, *Cynoscion nebul*osus, and black drum, *Pogoniascromis*, in Louisiana. *Environmental Biology of Fishes*, 36: 257-272.

Sayle, S., M. Seymour and E. Hickey. 2001 *Assessment of Environmental Impacts from Drilling Muds and Cuttings Disposal, Offshore Brunei*. SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production, 20-22 March 2002, Kuala Lumpur, Malaysia. 13 pp.

Scandpower A/S 2000. *Blowout Frequencies 2000, BlowFAM Edition*. Report No. 27.20.01/R3.

Scheibling, R.E. and A.W. Hennigar. 1997. Recurrent outbreaks of disease in sea urchins *Strongylocentrotous droebachiensis* in Nova Scotia: Evidence for a link with large-scale meteorologic and oceanographic events. *Marine Ecology Progress Series*, 152: 155-165.

Scheibling, R.E. and J. Hamm. 1991. Interactions between sea urchins (*Strongylocentrotus droebachiensis*) and their predators in field and laboratory experiments. *Marine Biology*, 110(1): 105-116.

Scheibling, R.E. and J.-S. Lauzon-Guay. 2010. Killer storms: North Atlantic hurricanes and disease outbreaks in sea urchins. *Limnology and Oceanography*, 55(6): 2331-2338.

Scheibling, R.E., A.W. Hennigar and T. Balch. 1999. Destructive grazing, epiphytism, and disease: the dynamics of sea urchin-kelp interactions in Nova Scotia. *Canadian Journal of Fisheries and Aquatic Sciences*, 56 (12): 2300-2314.

Scheidat, M. J. Tougaard, S. Brasseur, J. Carstensen, T. van Polanen Petel, J. Teilmann and P. Reijnders. 2011. Harbour propoises (*Phocoena phocoena*) and wind farms: A case study in the Dutch North Sea. *Environmental Research Letters*, 6: 025102.

Scheifele, P.M., S. Andrew, R.A. Cooper, M. Darre, F.E. Musiek and L. Max. 2005. Indication of a Lombard vocal response in the St. Lawrence River beluga. *Journal of the Acoustical Society of America*, 117(3, Pt. 1): 1486-1492.

Schneider, D.C. and R.L. Haedrich 1991. Post-mortem erosion of fine-scale spatial structure of epibenthic megafauna on the outer Grand Bank of Newfoundland. *Continental Shelf Research*, 11(8-10): 1223-1236.

Scholik, A.R. and H.Y. Yan. 2001. Effects of underwater noise on auditory sensitivity of a cyprinid fish. *Hearing Research*, 152: 17-24.

Scott, W.B. and M.G. Scott. 1988. *Atlantic Fishes of Canada*. *Canadian Bulletin of Fishery and Aquatic Sciences*, 219: 731 pp.

Seaconsult Ltd. 1988a. *Final Report, Placentia Bay Circulation Study, Phase 1*. Seaconsult Ltd. 18 pp.

Seaconsult Ltd. 1989. *Final Report, Placentia Bay Circulation Study, Phase 2*. Seaconsult Ltd. 13 pp.

Seaconsult Ltd, 1988b. *Terra Nova Development Studies: Physical Environmental Data for Production Systems at Terra Nova*. Prepared for Petro-Canada Inc. and Terra Nova partners. 13 pp.

Sears, R., F. Wenzel and J.M. Williamson. 1987. *The Blue Whale: A Catalog of Individuals from the Western North Atlantic (Gulf of St. Lawrence)*. Mingan Island Cetacean Study, St. Lambert, QC. 27 pp.

Sears, R., J.M. Williamson, F. Wenzel, M. Bérubé, D. Gendron and J. Jones. 1991. Photographic identification of the blue whale (*Balaenoptera musculus*) in the Gulf of St. Lawrence, Canada. *Report of the International Whaling Commission*, Special Issue 12: 335-342.

Seiser, P.E., L.K. Duffy, A.D. McGuire, D.D. Roby, G.H. Golet and M.A. Litzow. 2000. Comparison of Pigeon Guillemot, *Cepphus columba*, blood parameters from oiled and unoiled areas of Alaska eight years after the *Exxon Valdez* oil spill. *Marine Pollution Bulletin*, 40: 52-164.

Selzer, L.A. and P.M. Payne. 1988. The distribution of white-sided (*Lagenorhynchus acutus*) and common dolphins (*Delphinus delphis*) *vs.* environmental features of the Continental Shelf of the northeastern United States. *Marine Mammal Science*, 4: 141-153.

Sergeant, D.E. 1962. The biology of the pilot or pothead whale *Globicephala melaena* (Traill) in Newfoundland waters. *Fisheries Research Board of Canada Circular*, No. 132: 1-82.

Sergeant, D.E. 1963. Minke whales, *Balaenoptera acutorostrata* Lacepede, of the western North Atlantic. *Journal of the Fisheries Research Board of Canada*, 20: 1489-1504.

Sergeant, D.E. 1966. Populations of large whale species in the western North Atlantic with special reference to the fin whale. *Fisheries Research Board of Canada Circular*, No. 9.

Sergeant, D.E. 1991. Harp seals, man and ice. *Canadian Special Publications of Fisheries and Aquatic Sciences*, 114: 153 pp.

Sergeant, D.E. and H.D. Fisher. 1957. The smaller cetacea of eastern Canadian waters. *Journal of the Fisheries Research Board of Canada*, 14(1): 83-115.

Sergeant, D.E., A.W. Mansfield and B. Beck. 1970. Inshore records of cetacea for eastern Canada, 1949-68. *Journal of the Fisheries Research Board of Canada*, 27: 1903-1915.

Seuront L. 2011. Hydrocarbon contamination decreases mating success in a marine planktonic copepod. *PLoS ONE*, 6(10): e26283

Shane, S.H., R.S. Wells and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. *Marine Mammal Science*, 2(1): 34-63.

Sharp, B.E. 1996. Post-release survival of oiled, cleaned seabirds in North America. *Ibis*, 138: 222-228.

Shaw, J. 2006. Paleogeography of Atlantic Canadian continental shelves from the last glacial maximum to the present, with an emphasis on Flemish Cap. *Journal of Northwest Atlantic Fisheries Science*, 37: 119-126.

Shaw, J., D.J.W. Piper, G.B.J. Fader, E.L. King, B.J. Todd, T. Bell, M.J. Batterson and D.G.E. Liverman. 2006. A conceptual model of the deglaciation of Atlantic Canada. *Quaternary Science Reviews*, 25: 2059-2081.

Shaw, J., D.P. Potter and V.E. Kostylev. 2011. Seascapes, Placentia Bay, Newfoundland and Labrador. *Geological Survey of Canada, Open File* #6683, scale 1:250 000. Doi: 20.4095/288644

Shaw, J., D.R. Parrott and J. Hughes-Clarke. 1996. Use of multibeam bathymetry to determine seabed impacts at the Argentia Naval Base. Newfoundland. Pp. 499-506. In: J. Taussik and J. Mitchell (eds.). *Coastal Zone Management*, Samara Publishing Limited, Cardigan.

Shaw, J., L. Johnston and B. Wile. 1989. Navicula operations in Placentia Bay, Newfoundland. *Geological Survey of Canada Open File*, #2029.

Shenoy, K., S. Varma and K.V.D. Prasad. 2006. Factors determining habitat choice of the smooth-coated otter, *Lutra perspicillata* in a South Indian river system. *Current Science*, 91(5): 637-643.

Sheridan, P. 2004. Recovery of floral and faunal communities after placement of dredged material on seagrasses in Laguna Madre, Texas. *Estuarine, Coastal and Shelf Science*, 69(3): 441-458.

Sherwood, O.A. and E.N. Edinger. 2009. Ages and growth rates of some deep-sea gorgonian and antipatharian corals of Newfoundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences*, 66: 142-152.

Short, F.T. and S. Wyllie-Echeverria. 1996. Natural and human-induced disturbance of seagrasses. *Environmental Conservation*, 23(1): 17-27.

Short, F.T., R.C. Davis, B.S. Kopp, C.A. Short and D.M. Burdick. 2002. Site-selection model for the optimal transportation of eelgrass, *Zostera marina*, in the northeastern US. *Marine Ecology Progress Series*, 227: 253-267.

Simard, Y., F. Samaran and N. Roy. 2005. Measurement of whale and seismic sounds in the Scotian Gully and adjacent canyons in July 2003. Pp. 97-115 In: K. Lee, H. Bain and C.V. Hurley (eds.). *Acoustic Monitoring and Marine Mammal Surveys in The Gully and Outer Scotian Shelf before and during Active Seismic Surveys*. *Environmental Studies Research Funds Report*, No. 151: 154 pp (Published 2007).

Simmonds, M.P. and L.F. Lopez-Jurado. 1991. Whales and the military. *Nature*, 351(6326): 448.

Simon, J.E. and K.T. Frank. 2000. Assessment of the winter skate fishery in Division 4VsW. *DFO Canadian Stock Assessment Secretariat Research Document*, 2000/140, 52 pp.

Simon, J.E., L.E. Harris, and T.L. Johnston. 2003. Distribution and abundance of winter skate, *Leucoraja ocellatta*, in the Canadian Atlantic. *DFO Canadian Science Advisory Secretariat Research Document*, 2003/028: ii + 67 pp.

Simon, J.E., S. Rowe, and A. Cook. 2011. Status of smooth skate (*Malacoraja senta*) and thorny skate (*Amblyraja radiata*) in the Maritimes region. *DFO Canadian Science Advisory Secretariat Research Document*, 2011/080: viii + 102 p.

Simonini, R., I. Ansaloni, F. Cavallini, F. Graziosi, M. Iotti, G. Massamba N'Siala, M. Mauri, G. Montanari, M. Preti and D. Prevedelli. 2001. Effects of long-term dumping on harbor-dredged material on macrozoobenthos at four disposal sites along the Emilia-Romagna coast (Northern Adriatic Sea, Italy). *Marine Pollution Bulletin*, 50(12): 1595-1606.

Simpson, M.R. and D.W. Kulka. 2002. Status of three wolffish species (*Anarhichus lupus*, *A. minor*, and *A. denticulatus*) in Newfoundland waters (NAFO Divisions 2GH3JKLNOP). *DFO Canadian Science Advisory Secretariat Research Document*, 2002/078: 96 pp.

Simpson, M.R., L.G.S. Mello, C.M. Miri, and M. Treble. 2012. A pre-COSEWIC assessment of three species of Wolffish (*Anarhichas denticulatus, A. minor,* and *A. lupus*) in Canadian waters of the Northwest Atlantic Ocean. *DFO Canadian Science Advisory Secretariat Resource Document*, 2011/122. iv + 69 pp.

Simpson, M.R., L.G.S. Mello, C.M. Miri, M. Treble and T. Siferd. 2011. A pre-COSEWIC assessment of thorny skate (*Amblyraja radiata* Donovan, 1808) on the Grand Bank, Newfoundland Shelf, Labrador and northern waters. *DFO Canadian Science Advisory Secretariat Research Document*, 2011/084.

Simpson, M.R., L.G.S. Mello, C.M. Miri, M. Treble and T. Siferd. 2012. Distribution, abundance, and life history of smooth skate (*Malacoraja senta* Garman 1885) in Northwest Atlantic waters. *DFO Canadian Science Advisory Secretariat Research Document*, 2011/116. iv + 40 pp.

Simpson, R.D., S.D.A. Smith and A.R. Pople. 1995. The effects of a spillage of diesel fuel on a rocky shore in the sub-Antarctic region (Macquarie Island). *Marine Pollution Bulletin*, 31(4-12): 367-371.

Singh, S., X. Li and G. Comfort. 1999. *PERD Grand Banks Iceberg Database Update*. Panel on Energy Research and Development (PERD), National Research Council, Ottawa, ON. PERD/CHC Report 20-40.

Sjare, B., M. Lebeuf and G. Veinot. 2005a. Harbour seals in Newfoundland and Labrador: A preliminary summary of new data on aspects of biology, ecology and contaminant profiles. *DFO Canadian Science Advisory Secretariat Resource Document*, 2005/030. 42 pp.

Sjare, B., B. Nakashima and D. Mercer. 2003. Integrating scientific and local ecological knowledge to identify potential critical habitats: A case study in Placentia Bay, Newfoundland. *DFO Canadian Science Advisory Secretariat Research Document*, 2003/114: ii + 15 pp.

Sjare, B., G.B. Stenson and S. Benjamins. 2005b. An update on harp seal (*Pagophilus groenlandicus*) by-catch estimates in the Newfoundland lumpfish fishery. *DFO Canadian Science Advisory Secretariat Research Document*, 2005/049. 23 pp.

SL Ross Environmental Research Ltd. 2007. *Synopsis Report: Environmental Oil Spill Risk Assessment for the South Coast of Newfoundland (Edition 1)*. Document TP 14740E. Prepared by SL Ross Environmental Research Limited on behalf of Transport Canada. Ottawa, ON.

SL Ross Environmental Research Ltd. 2012. *Oil Spill Fate and Behaviour Modelling in Support of Husky Energy White Rose Extension Environmental Assessment*. Report by SL Ross Environmental Research for Husky Energy. 51 pp.

Slade, D. and I. Pitcher. 1971. *Otter Tagging Project, June to August 1971*. Unpublished Internal Report, Newfoundland Wildlife Division. 13 pp.

Slabbekoorn, H., N. Bouton, I.V. Opzeeland, A. Coers, C. ten Cate and A.N. Popper. 2010. *A Noisy Spring: The Impact of Globally Rising Underwater Sound Levels on Fish*. doi:10.1016/j.tree.2010.04.005 9 pp.

Slotte, A., K. Hansen, J. Dalen and E. Ona. 2004. Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. *Fisheries Research*, 67:143-150.

Small, R.J., L.E. Lowry, J.M. Ver Hoef, K.J. Frost, R.L. DeLong and M.J. Rehberg. 2005. Differential movements by harbor seal pups in contrasting Alaska environments. *Marine Mammal Science*, 21(4): 671-694.

SmartBay. 2012. *SmartBay Placentia Bay, Newfoundland. Come By Change Point, Pilot Boarding Station/Red Island Shoal, Mouth of Placentia Bay*. Buoy Data Available at: www.smartbay.ca

Smith, C.J., R.D. DeLaune, W.H. Patrick, Jr. and J.W. Fleeger. 1984. Impact of dispersed and undispersed oil entering a Gulf Coast salt marsh. *Environmental Toxicology and Chemistry*, 3: 609-616.

Smith, M.E., A.S. Kane and A.N. Popper. 2004. Noise-induced stress response and hearing loss in goldfish (*Carassius auratus*). *The Journal of Experimental Biology*, 207: 427-435.

Smith, P.C. and F.B. Schwing. 1991. Mean circulation and variability on the eastern Canadian Continental Shelf. *Continental Shelf Research*, 11: 977-1012.

Smith, S.D. 1993. Hindcasting iceberg drift using current profiles and winds. *Cold Regions Science and Technology*, 22: 33-45.

Smith, S.D.A. and M.J. Rule. 2001. The effects of dredge-spoil dumping on a shallow water soft-sediment community in the Solitary Islands Marine Park, NSW, Australia. *Marine Pollution Bulletin*, 42(11): 1040-1048.

Smultea, M.A., M. Holst, W.R. Koski and S. Stoltz. 2004. *Marine Mammal Monitoring during Lamont-Doherty Earth Observatory's Seismic Program in the Southeast Caribbean Sea and Adjacent Atlantic Ocean, April–June 2004*. LGL Rep. TA2822-26. Rep. by LGL Ltd., King City, ON, for Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY, and National Marine Fisheries Service, Silver Spring, MD. 106 pp.

Smultea, M.A. and B. Würsig. 1995. Behavioral reactions of bottlenose dolphins to the *Mega Borg* oil spill, Gulf of Mexico 1990. *Aquatic Mammals*, 21: 171-181.

SNC-Lavalin Incorporated. 1998. *ESA Phase I/II at the Former Concrete Plant and Quarry Near The Pond Sites, Northside Argentia, Argentia, NL*. Prepared for Public Works Canada and Government Services.

SNC-Lavalin Incorporated0. 2012. *Disposal Options Analysis: White Rose Extension Project, NL*. Document Number 511548-ENVI-4EER-0001-PB. Subnmitted to Husky Energy, St. John's, NL.

Snelgrove, P.V.R., I.R. Bradbury, B. deYoung and S. Fraser. 2008. Temporal variation in fish egg and larval production by pelagic and bottom spawners in a large Newfoundland coastal embayment. *Canadian Journal of Fisheries and Aquatic Sciences*, 65(2): 159-175.

Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (Editors). 2007. Oceanic Climate Change and Sea Level. Chapter 5. In: *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Sonnichsen, G.V and E.L. King. 2005. Grand Banks seafloor and shallow subsurface geology in relation to subsea engineering design. Pp. 11-27. In: R.N. Hiscott and A.J. Pulham (eds.). *Petroleum Resources and Reservoirs of the Grand Banks, Eastern Canadian Margin*, *Geological Association of Canada Special Paper*, 43.

Sonnichsen, G.V. and E. Cumming. 1996. Shallow stratigraphy, sediment properties, and foundation stability in the Jeanne d'Arc Basin discovery area. Pp. 181-188. In: *49th Canadian Geotechnical Conference Proceedings*, St. John's, NL. Volume 1.

Sonnichsen, G.V. and E.L. King. 2005. Grand Bank seabed and shallow subsurface geology in relation to subsea engineering design. Pp. 11-27. In: R.N. Hiscott and A.J. Pulham (eds.). *Petroleum Resources and Reservoirs of the Grand Banks, Eastern Canadian Margin, Geological Association of Canada Special Paper*, 43: viii + 175 pp.

Sonnichsen, G.V., K. Moran, C.F.M. Lewis and G.B.J. Fader. 1994. Regional seafloor geology and engineering considerations for Hibernia and surrounding areas. *Energy Exploration and Exploitation*, 12: 325-345.

Sonnichsen, G.V., T. King, I. Jordaan and C. Li. 2005. *Probabilistic Analysis of Iceberg Scouring Frequency Based on Repetitive Seabed Mapping Offshore Newfoundland and Labrador*. Port and Ocean Engineering under Arctic Conditions Conference (POAC ’05), Potsdam, NY.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals*, 33: 411-521.

Sowden, W.J. and F.E. Geddes. 1980. *Weekly Median and Extreme Ice Edges for Eastern Canadian Seaboard and Hudson Bay*. Ice Climatology and Applications Division, Ottawa, ON.

Spotila, J.R. 2004. *Sea Turtles: A Complete Guide to their Biology, Behavior, and Conservation*. The Johns Hopkins University Press, Baltimore, MD. 227 pp.

Spraker, T.R., L.F. Lowry and K.J. Frost. 1994. Gross necropsy and histopathological lesions found in harbor seals. Pp. 281-311 In: T.R. Loughlin (ed.). *Marine Mammals and the Exxon Valdez*, Academic Press, San Diego, CA. 395 pp.

St. Aubin, D.J. 1990. Physiologic and toxic effects on polar bears. Pp. 235-239 In: J.R. Geraci and D.J. St. Aubin (eds.). *Sea Mammals and Oil: Confronting the Risks*. Academic Press, San Diego, CA. 282 pp.

St. Aubin, D.J., J.R. Geraci, T.G. Smith and T.G. Friesen. 1985. How do bottlenose dolphins, *Tursiops truncatus*, react to oil films under different light conditions? *Canadian Journal of Fisheries and Aquatic Sciences*, 42: 430-436.

Stantec Consulting Ltd. 2012a. *Test Pit Program Relocated Concrete Gravity Structure, Graving Dock Site, Argentia, NL*. Prepared for Husky Energy, St. John's, NL.

Stantec Consulting Ltd. 2012b. *Marine Habitat Characterization - Argentia, Newfoundland*. Prepared for Husky Energy, St. John’s, NL. 61 pp.

Stantec Consulting Ltd. 2012c. *Air Emissions Study, White Rose Extension Project*. Prepared for Husky Energy, St. John’s, NL.

Starr, M. J.H. Himmelman and J.-C. Therriault. 1990. Direct coupling of marine invertebrate spawning with phytoplankton blooms. *Science*, 247(4946): 1071-1074.

Statistics Canada. 2012. *St. John's, Newfoundland and Labrador and Newfoundland and Labrador. Census Profile. 2011 Census*. Released February 8, 2012. Available at: http://www12.statcan.ca/census-recensement/2011/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=1001519&Geo2=PR&Code2=10&Data=Count&SearchText=St.%20John's&SearchType=Begins&SearchPR=01&B1=All&GeoLevel=PR&GeoCode=1001519

Statoil Canada Limited. 2011. *Geophysical Program for Jeanne d’Arc and Central Ridge/Flemish Pass Basins, 2011-2019*. Canada-Newfoundland Offshore Petroleum Board Screening Report – Part A. 24 pp.

Stein, M. 2007. Oceanography of the Flemish Cap and adjacent waters. *Journal of Northwest Atlantic Fisheries Science*, 37: 135-146.

Stemp, R. 1985. Observations on the effects of seismic exploration on seabirds. Pp. 217-233. In: G.D. Greene, F.R. Engelhardt and R.J. Paterson (eds.). *Proceeding Workshop on Effects of Explosives Use in the Marine Environment, January, 1985, Halifax, NS*. Canadian Oil and Gas Lands Administration, Environmental Protection Branch, Ottawa, ON. *Technical Report*, 5. 398 pp.

Stenhouse, I.J. 2004. *Canadian Management Plan for Ivory Gull (Pagophila eburnean)*. Canadian Wildlife Service, St. John's, NL x + 22 pp.

Stenhouse, I.J. and W.A. Montevecchi. 1999. Increasing and expanding populations of breeding Northern Fulmars in Atlantic Canada. *Waterbirds*, 22(3): 382-391.

Stenhouse, I.J. and W.A. Montevecchi. 1999. Indirect effects of the availability of capelin and fishery discards: Gull predation on breeding storm-petrels. *Marine Ecology Progress Series*, 184: 303-307.

Stenhouse, I.J., G.J Robertson and W.A. Montevecchi. 2000. Herring Gull *Larus argentatus* predation on Leach's Storm-Petrels *Oceanodroma leucorhoa* breeding on Great Island, Newfoundland. *Atlantic Seabirds*, 2: 35-44.

Stenson, G.B., G.A. Badgero and H.D. Fisher. 1984. Food habits of the river otter *Lutra canadensis* in the marine environment of British Columbia. *Canadian Journal of Zoology*, 62: 88-91.

Stenson, G.B. and D.J. Kavanagh. 1994. Distribution of harp and hooded seals in offshore waters of Newfoundland. *Northwest Atlantic Fisheries Organization Science Council Studies*, 21: 121-142.

Stenson, G.B., M.O. Hammill, J.W. Lawson, J.F. Gosselin and T. Haug. 2005. 2004 pup production of harp seals, *Pagophilus groenlandicus*, in the Northwest Atlantic. *DFO Canadian Science Advisory Secretariat Research Document*, 2005/037: 38 pp.

Stenson, G.B. and B. Sjare. 1997. Seasonal distribution of harp seals, *Phoca groenlandica*, in the Northwest Atlantic. *ICES C.M.* 10 pp.

Stephenson, R. 1997. Effects of oil and other surface-active organic pollutants on aquatic birds. *Environmental Conservation*, 24: 121-129.

Stevenson, D.K. and M.L. Scott. 2005. Essential fish habitat document: Atlantic herring, *Clupea harengus*, life history and habitat characteristics (second edition). *NOAA Technical Memorandum*, NMFS-NE-192: vi + 84 pp.

Stevick, P.T., J. Allen, P.J. Clapham, N.A. Friday, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsboll, J. Sigurjonsson, T.D. Smith, N. Oien and P.S. Hammond. 2003. North Atlantic humpback whale abundance and rate of increase four decades after protection from whaling. *Marine Ecology Progress Series*, 258: 263-273.

Stevick, P.T., J. Allen, P.J. Clapham, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsboll, R. Sears, J. Sigurjonsson, T.D. Smith, G. Vikingsson, N. Oien and P.S. Hammond. 2006. Population spatial structuring on the feeding grounds in North Atlantic humpback whales (*Megaptera novaeangliae*). *Journal of Zoology*, 270(2): 244-255.

Stewart, B.S. and S. Leatherwood. 1985. Minke whale - *Balaenoptera acutorostrata*. Pp. 91-136. In: S.H. Ridgeway and R.J. Harrison (eds.). *Handbook of Marine Mammals, Volume 3: The Sirenians and Baleen Whales*. Academic Press. San Diego, CA. 330 pp.

Stewart, B.S., W.E. Evans and F.T. Awbrey. 1982. *Effects of Man-made Waterborne Noise on Behavior of Beluga Whales (Delphinapterus leucas) in Bristol Bay, Alaska*. Rep. by Hubbs/Sea World Research Institute, San Diego, CA, for National Oceanic & Atmospheric Administration, Juneau, AK. HSWRI Technical Report, 82-145. 29 pp. + Figures + Tables.

Stirling, H.P. 1977. Effects of a spill of marine diesel oil on the rocky shore fauna of Lamma Island, Hong Kong. *Environmental Pollution*, 12(2): 93-117.

Stockin, K.A., D. Lusseau, V. Binedell, N. Wiseman and M.B. Orams. 2008. Tourism affects the behavioural budget of the common dolphin *Delphinus* sp. in the Hauraki Gulf, New Zealand. *Marine Ecology Progress Series*, 355: 287-295.

Stoermer, S.A. and P. Rudkin. 2003. *Very Large Tabular Icebergs: Ice Season 2002 and the Past*. LT Report of the International Ice Patrol in the North Atlantic.

Stoffyn-Egli, P., G.V. Sonnichsen and A. Zawadski. 1992. Clay-size minerals and near-surface stratigraphy on the Northeastern Grand Banks, Newfoundland. In: *Current Research, Part E. Geological Survey of Canada*, Paper 92-1E: 323-331.

Stokesbury, M.J.W., C. Harvey-Clark, J. Gallant, B.A. Block and R.A. Myers. 2005. Movement and environmental preferences of Greenland sharks (*Somniosus microcephalus*) electronically tagged in the St. Lawrence Estuary, Canada. *Marine Biology*, 148(1): 159-165.

Stone, C.J. 2003. *The Effects of Seismic Activity on Marine Mammals in UK Waters 1998-2000*. JNCC Rep. 323. Joint Nature Conservation Committee, Aberdeen, Scotland. 43 pp.

Stone, C.J. and M.L. Tasker. 2006. The effects of seismic airguns on cetaceans in UK waters. *Journal of Cetacean Research and Management*, 8(3): 255-263.

Storey, A.E. and J. Lien. 1985. Development of the first North American colony of Manx Shearwaters. *Auk*, 102: 395-401.

Strain, P.M. and P.A. Yeats. 2005. Nutrients in the Gully, Scotian Shelf, Canada. *Atmosphere-Ocean*, 43: 145-161.

Stubblefield, W.A., G.A. Hancock, H.H. Prince and R.K. Ringer. 1995. Effects of naturally weathered *Exxon Valdez* crude oil on Mallard reproduction. *Environmental Toxicology and Chemistry*, 14: 1951-1960.

Suchanek, T.H. 1993. Oil impacts on marine invertebrate populations and communities. *Integrative and Comparative Biology*, 33(6): 510-523.

Sulikowski, J.A., S. Elzey, J. Kneebone, J. Jurek, W.H. Howell and P.C.W. Tsang. 2007. The reproductive cycle of the smooth skate, *Malacoraja senta*, in the Gulf of Maine. *Marine and Freshwater Research*, 58: 98-103.

Suncor Energy. No Date. Unpublished Seabird and Marine Mammals Observation Data.

Swail, V.R. 1996. Analysis of climate variability in ocean waves in the Northwest Atlantic Ocean. Pp. 313-318. In: *Proceedings of the Symposium on Climate Change and Variability in Atlantic Canada*, December 3-6, Halifax, NS.

Swail, V.R., A.T. Cox and V.J. Cardone. 1999. *Analysis of Wave Climate Trends and Variability*. CLIMAR 1999 Preprints. September 8-15, 1999, Vancouver, BC.

Swail, V.R., V.J. Cardone, M. Ferguson, D.J. Gummer, E.L. Harris, E.A. Orelup and A.T. Cox. 2006. *The MSC50 Wind and Wave Reanalysis*. 9th International Wind and Wave Workshop, September 25-29, 2006, Victoria, BC.

Swiss, J.J. and J.M. Osbourne. 1976. Baseline characteristics of Come by Chance Bay, Newfoundland. *Environment Protection Service Report Series*, No. EPS-5-AR-76-9.

Szaro, R.C., G. Hensler and G.H. Heinz. 1981. Effects of chronic ingestion of No. 2 fuel oil on Mallard ducklings. *Journal of Toxicology and Human Health*, 7: 789-799.

Szaro, R.C., M.P. Dieter and G.H. Heinz. 1978. Effects of chronic ingestion of South Louisiana crude oil on Mallard ducklings. *Environmental Research*, 17: 426-436.

Tan, L., M. Belanger and C. Wittnich. 2010. Revisiting the correlation between estimated seabird mortality and oil spill size. *Journal of Marine Animals and Their Ecology*, 3: 20-26.

Tankard, A.J. and H.J. Welsink. 1987, Extensional tectonics and stratigraphy of Hibernia Oilfield, Grand Banks, Newfoundland. *American Association of Petroleum Geologists Bulletin*, 71: 1210-1232.

Tavolga, W.N. 1971. Sound production and detection. Pp. 135-205. In: W.S. Hoar and D.J. Randall (eds.). *Fish Physiology, Volume V*, Academic Press.

Tawfig, N.I. and D.A. Olsen. 1993. Saudi Arabia's response to the 1991 Gulf oil spill. *Marine Pollution Bulletin*, 27: 333-345.

Taylor, B.B., J.F. Lewis and R.W. Ingersoll. 1993. Comparison of interpreted seismic profiles to geotechnical borehole data at Hibernia. Pp. 684-708. In: *Proceedings Fourth Canadian Conference on Marine Geotechnical Engineering*, VII.

Teal, J.M. and R.W. Howarth. 1984. Oil spill studies: A review of ecological effects. *Environmental Management*, 8(1): 27-43.

Teilmann, J., J. Carstensen, R. Dietz, S.M.C. Edrén and S.M. Andersen. 2006. *Final Report on Aerial Monitoring of Seals near Nysted Offshore Wind Farm*. Technical report to Energi E2 A/S by Ministry of Environment, Denmark. 41 pp.

Teilmann, J., J. Tougaard and J. Carstensen. 2006. *Summary on Harbour Porpoise Monitoring 1999-2006 Around Nysted and Horns Rev Offshore Wind Farms*. Rep. for Energi E2 A/S and Vattenfall A/S.

Teilmann, J., J. Tougaard and J. Carstensen. 2008. Effects from offshore wind farms on harbour porpoises in Denmark. Pp. 50-59. In: P.G.H. Evans (ed.). *Proceedings of the ASCOBANS/ECS Workshop, ECS Special Publication Series*, No. 49: 68 pp.

Telfer, T.C., J.L. Sincock, G.V. Byrd and J.R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. *Wildlife Society Bulletin*, 15: 406-413.

Templeman, W. 1963. Distribution of sharks in the Canadian Atlantic (with special reference to Newfoundland waters). *Bulletin of Fisheries Research Board of Canada*, 140: 1-77.

Templeman, W. 1984. Migrations of wolffishes, *Anarhichas* sp., from tagging in the Newfoundland area. *Journal of Northwest Atlantic Fisheries Science*, 5: 93-97.

Templeman, W. 1987. Differences in sexual maturity and related characteristics between populations of thorny skate (*Raja radiate*) in the Northwest Atlantic. *Journal of Northwest Atlantic Fishery Science*, 7: 155-167.

Terhune, J.M. 1999. Pitch separation as a possible jamming-avoidance mechanism in underwater calls of bearded seals (*Erignathus barbatus*). *Canadian Journal of Zoology*, 77(7): 1025-1034.

Terhune, J.M. and W.C. Verboom. 1999. Right whales and ship noises. *Marine Mammal Science*, 15(1): 256-258.

Terraquest Associates, 1996. *Extension of the Shallow Seismostratigraphic Framework for Northeastern Grand Bank, Newfoundland*. Submitted to Geological Survey of Canada (Atlantic).

Terraquest Associates. 1995. *Structural Contour Maps of the Shallow Seismostratigraphy, Northeast Grand Bank, Newfoundland*. Geological Survey of Canada (Atlantic), Bedford Institute of Oceanography, Open File Report 3128: 18 pp.

Terraquest Associates. 1998. *White Rose Repetitive Seafloor Mapping: A Correlation of Side-scan Sonar Data and a Swath Bathymetry Image from the Grand Banks, Newfoundland*. GSC Contract Report.

Testa, J.W., D.F. Holleman, R.T. Bowyer and J.B. Faro. 1994. Estimating populations of marine river otters in Prince William Sound, Alaska, using radiotracer implants. *Journal of Mammalogy*, 75: 1021-1032.

Thomas, L., M.O. Hammill and B.W. Bowen. 2007. Estimated size of the Northwest Atlantic grey seal population 1977-2007. *DFO Canadian Science Advisory Secretariat Research Document*, 2007/082: 31 pp.

Thompson, D., M. Sjöberg, E.B. Bryant, P. Lovell and A. Bjørge. 1998. Behavioural and physiological responses of harbour (*Phoca vitulina*) and grey (*Halichoerus grypus*) seals to seismic surveys. Pp. 134. In: *Abstracts of the 12th Biennial Conference and World Marine Mammal Science Conference*, 20-25 January, Monte Carlo, Monaco. 160 pp.

Thomson, D.H., R.A. Davis and T. Hillis. 1991. *Effects of Operational Discharges from Ships on Marine Life*. Rep. by LGL Limited, King City, ON, for Government Consulting Group, Ottawa, ON, and Canadian Coast Guard, Ottawa, ON. 30 pp.

Thompson, P.M., D. Lusseau, T. Barton, D. Simmons, J. Rusin and H. Bailey. 2010. Assessing the responses of coastal cetaceans to the construction of offshore wind turbines. *Marine Pollution Bulletin*, 60: 1200-1208.

Tinney, R.T., Jr. 1988. *Review of information bearing upon the conservation and protection of humpback whales in Hawaii*. Report for US Marine Mammal Commission, Washington, DC. 56 pp. NTIS PB88-195359.

Toro, G., N. Abrahamson and J. Schneider. 1997. Model of strong ground motion in eastern and central North America: Best estimates and uncertainties. *Seismological Research Letters*, 68: 41-57.

Torrent A., S. Deniz, A. Ruiz, P. Calabuig, J. Sicilia and J. Oros. 2002. Esophageal diverticulum associated with *Aeroccus viridans* infection in loggerhead sea turtles (*Caretta caretta*). *Journal of Wildlife Diseases*, 38(1): 221-223.

Tougaard, J., J. Carstensen, N.I. Bech and J. Teilmann. 2006b. *Final Report on the effect of Nysted Offshore Wind Farm on Harbour Porpoises*. Annual Report to Energi E2 A/S. NERI, Roskilde, Denmark.

Tougaard J., J. Carstensen, O.D. Henriksen, H. Skov and J. Teilmann. 2003. *Short-term Effects of the Construction of Wind Turbines on Harbour Porpoises at Horns Reef*. Technical report to Techwise A/S, HME/362–02662. Hedeselskabet, Roskilde, Denmark. 72 pp.

Tougaard, J., J. Carstensen, H. Skov and J. Teilmann. 2005. Behavioral reactions of harbour porpoises to underwater noise from pile drivings. *Abstracts for the 16th Biennial Conference on the Biology of Marine Mammals*, 12-16 December 2005, San Diego, CA.

Tougaard J., J. Carstensen, J. Teilmann, H. Skov and P. Rasmussen. 2009. Pile driving zone of responsiveness extends beyond 20 km for harbour porpoises (*Phocoena phocoena* (L.)). *Journal of the Acoustical Society of America*, 126(1): 11-14.

Tougaard, J., J. Carstensen, M.S. Wisz, N.I. Bech and H. Skov. 2006a. *Harbour Porpoises on Horns Reef in Relation to Construction and Operation of Horns Rev Offshore Wind Farm*. Technical Report to Elsam Engineering A/S. NERI, Roskilde, Denmark.

Tougaard, J., J. Teilmann and J. Carstensen. 2011. Offshore wind energy and marine mammals – is there a conflict? *Abstracts fof the 19th Biennial Conference on the Biology of Marine Mammals*, 27 November-2 December 2011, Tampa, FL.

Trannum, H.C., H.C. Nilsson, M.T. Schanning and S. Øxnevad. 2010. Effects of sedimentation from water-based drill cuttings and natural sediment on benthic macrofaunal community structure and ecosystem processes. *Journal of Experimental Marine Biology and Ecology*, 383(2): 111-121.

Transport Canada. 2011. *User Guide for Urban Transportation Emissions Calculator (UTEC) V.3.0.*

Transport Canada and RMRI (Canada) 2007. *Quantitative Assessment of Oil Spill Risk for the South Coast of Newfoundland and Labrador*. CAN/0179/R003, 1-329. Transport Canada.

Trivelpiece, W.Z., R.G. Butler, D.S. Miller and D.B. Peakall. 1984. Reduced survival of chicks of oil-dosed adult Leach's Storm-petrels. *Condor*, 86: 81-82.

Troisi, G.M. and L. Borjesson. 2005. Development of an immunoassay for the determination of polyaromatic hydrocarbons in plasma samples from oiled seabirds. *Environmental Science and Technology*, 39: 3748-3755.

Tupper, M. and R.G. Boutilier. 1995a. Size and priority at settlement determine growth and competitive success of newly settled Atlantic cod. *Marine Ecology Progress Series*, 118: 295-300.

Tupper, M. and R.G. Boutilier. 1995b. Effects of habitat on settlement, growth, and postsettlement survival of Atlantic cod (*Gadus morhua*). *Canadian Journal of Fisheries and Aquatic Sciences*, 52: 1834-1841.

Tupper, M. and R.G. Boutilier. 1997. Effects of habitat on settlement, growth, predation risk and survival of a temperate reef fish. *Marine Ecology Progress Series*, 151: 225-236.

Turner, D.B. 1970. *Workbook of Atmospheric Dispersion Estimates*. US Environmental Protection Agency.

Turnpenney, A.W. and J.R. Nedwell. 1994. The *Effects on Marine Fish, Diving Mammals and Birds of Underwater Sounds Generated by Seismic Surveys*. Report by FAWLEY Aquatic Research Laboratory Ltd. 40 pp + Appendices.

Tyack, P.L. 2008. Implications for marine mammals of large-scale changes in the marine acoustic environment. *Journal of Mammalogy*, 89(3): 549-558.

Tyack, P., M. Johnso, and P. Miller. 2003. Tracking responses of sperm whales to experimental exposures of airguns. Pp. 115-120. In: A.E. Jochens and D.C. Biggs (eds.). *Sperm Whale Seismic Study in the Gulf of Mexico/ Annual Report: Year 1*. OCS Study MMS 2003-069. Rep. by Texas A&M Univsity, College Station, TX, for MMS, Gulf of Mexico OCS Region, New Orleans, LA.

United States Geological Survey, Conservation Division. 1979. *OCS Platform Verification Program. Reston, Virginia*.

Urbán-Ramirez, J., L. Rojas Bracho, H. Pérez Cortés, A. Gómez Gallardo, S.L. Swartz, S. Ludwig and R.L. Brownell, Jr. 2003. A review of gray whales (*Eschrichtius robustus*) on their wintering grounds in Mexican waters. *Journal of Cetacean Research and Management*, 5(3): 281-295.

URS Corporation. 2006. *Seismic Hazard Analysis for the Hebron Site. Final Report*, URS Job No. 3962518, 86 pp.

US EPA (United States Environmental Protection Agency). 1991. *Compilation of Air Pollutant Emission Factors, AP-42, Chapter 13.5, Industrial Flares*.

US EPA (United States Environmental Protection Agency). 1996a. *Compilation of Air Pollutant Emission Factors, Section 13.2.5, Gasoline and Diesel Industrial Engines*.

US EPA (United States Environmental Protection Agency). 1996b. *Compilation of Air Pollutant Emission Factors, Section 3.4, Large Stationary Diesel and All Stationary Duel-fuel Engines*.

US EPA (United States Environmental Protection Agency). 1998. *Compilation of Air Pollutant Emission Factors, AP-42, Chapter 1.4, Natural Gas Combustion*.

US EPA (United States Environmental Protection Agency). 2000a. *Compilation of Air Pollutant Emission Factors, AP-42, Chapter 3.1, Stationary Gas Turbines*.

US EPA (United States Environmental Protection Agency). 2000b. *Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data*.

US EPA (United States Environmental Protection Agency). 2005. *Best Practices in Preparing Port Emission Inventories*.

US EPA (United States Environmental Protection Agency). 2010. *US EPA NR-009d Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling – Compression Ignition*.

Vadas, R.L., B. Beal, T. Dowling and J.C. Fegley. 2000. Experimental field tests of natural algal diets on gonad index and quality in the green sea urchin, *Strongylocentrotus droebachiensis*: A case for rapid summer production in post-spawned animals. *Aquaculture*, 182(1-2): 115-135.

VALE INCO. 2008. *Environmental Impact Statement: Long Harbour Commercial Nickel Processing Plan*t. Volume 1.

Van Dalfsen, J.A., K. Essink, H. Toxvig Madsen, J. Birklund, J. Romero and M. Manzanera. 2000. Differential response of macrozoobenthos to marine sand extraction in the North Sea and the western Mediterranean. *ICES Journal of Marine Science*, 57: 1439-1445.

Van Guelpen, L. and C.C. Davis. 1979. Seasonal movements of the winter flounder *Pseudopleuronectes americanus*, in two contrasting inshore locations in Newfoundland. *Transactions of the American Fisheries Society*, 108: 26-37.

Vanderlaan, A.S.M. and C.T. Taggart. 2007. Vessel collisions with whales: The probability of lethal injury based on vessel speed. *Marine Mammal Science*, 23(1): 144-156.

Vangilder, L.D. and T.J. Peterle. 1980. South Louisiana crude oil and DDE in the diet of Mallard hens: Effects on reproduction and duckling survival. *Bulletin Environment Contamination and Toxicology*, 25: 23-28.

Varela, M., A. Bode, J. Lorenzo, M.T.A. lvarez-Ossorio, A. Miranda, T. Patrocinio, R. Anadón, L. Viesca, N. Rodríguez, L. Valdés, J. Cabal, A. Urrutia, C. García-Soto, M. Rodríguez, M.A. lvarez-Salgado and S. Groom. 2006. The effect of the ‘‘*Prestige*’’ oil spill on the plankton of the N-NW Spanish coast. *Marine Pollution Bulletin*, 53: 272-286.

Vargo, S., P. Lutz, D. Odell, E. Van Vleet and G. Bossart. 1986. *Study of the Effects of Oil on Marine Turtles*. Final report to Minerals Management Service MMS Contract No. 14-12-0001-30063. 181 pp.

VBNC (Voisey’s Bay Nickel Company). 2002. *Argentia Hydrometallurgical Demonstration Plant Project Registration*. vi + 93 pp. + Appendix.

Veinott, G and K. Clarke. 2011. Status of American eel in Newfoundland and Labrador region: Prepared for the pre-COSEWIC and eel Zonal Advisory Process (ZAP), August 31 to September 3, 2010, Ottawa, ON. *DFO Canadian Science Advisory Secretariat Resource Document*, 2010/138. iv + 20 pp.

Velando, A., I. Munilla and P. M. Leyenda. 2005a. Short-term indirect effects of the *Prestige* oil spill on European shags: Changes in availability of prey. *Marine Ecology Progress Series*, 302: 263-274.

Velando, A., D. Lvarez, J. Mourin, F. Arcos and I. Barros. 2005b. Population trends and reproductive success of the European shag *Phalacrocorax aristotelis* on the Iberian Peninsula following the *Prestige* oil spill. *Journal of Ornithology*, 146: 116-120.

Verwoerd, D.J. 1987. Observations on the food and status of the cape clawless otter *Aonyx capensis* at Betty’s Bay, South Africa. *South African Journal of Zoology*, 22: 33-39.

von Ziegesar, O., E. Miller and M.E. Dahlheim. 1994. Impacts on humpback whales in Prince William Sound. Pp. 173-191. In: T.R. Loughlin (ed.). *Marine Mammals and the Exxon Valdez*. Academic Press, Inc., San Diego, CA.

Voorheis, G.M., K. Aagaard and L.K. Coachman. 1973. Circulation patterns near the tail of the Grand Banks. *Journal of Physical Oceanography*, 3: 397-405.

Votier, S.C., B.J. Hatchwell, A. Beckerman, R.H. McCleery, F.M. Hunter, J. Pellatt, M. Trinder and T.R. Birkhead. 2005. Oil pollution and climate have wide-scale impacts on seabird demographics. *Ecology Letters*, 8: 1157-1164.

Wahle, R.A. and R.S. Steneck. 1992. Habitat restrictions in early benthic life: Experiments on habitat selection and in situ predation with the American lobster. *Journal of Experimental Marine Biology and Ecology*, 157: 91-114.

Walli, A., S.L.H. Teo, A. Boustany, C.J. Farwell, T. Williams, H. Dewar, E. Prince and B.A. Block. 2009. Seasonal movements, aggregations and diving behavior of Atlantic bluefin tuna (*Thunnus thynnus*) revealed with archival tags. *PLoS ONE*, 4(7): e6151. doi:10.1371/journal.pone.0006151.

Wallis, A. 1981. North Sea gas flares. *British Birds*, 74: 536-537.

Walsh. S.J. 1992. Factors influencing distribution of juvenile yellowtail flounder (*Limanda ferruginea*) on the Grand Bank of Newfoundland. *Netherlands Journal of Sea Research*, 29(1-3): 193-203.

Walsh, S.J., M. Simpson, M.J. Morgan, K.S. Dwyer and D. Stansbury. 2001. Distribution of juvenile yellowtail flounder, American plaice and Atlantic cod on the Southern Grand Bank of Newfoundland: A discussion of nursery areas and marine protected areas. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 01/78: 49 pp.

Walsh, S.J., M.J. Veitch, M.J. Morgan, W.R. Bowering and B. Brodie. 2000. Distribution and abundance of yellowtail flounder (*Limanda ferruginea*) on the Grand Bank, NAFO Divisions 3LNO, as derived from annual Canadian bottom trawl surveys. *Northwest Atlantic Fisheries Organization Science Council Research Document*, 00/35: 54 pp.

Walton, P., C.M.R. Turner, G. Austin, M.D. Burns and P. Monaghan. 1997. Sub-lethal effects of an oil pollution incident on breeding Kittiwakes *Rissa tridactyla*. *Marine Ecology Progress Series*, 155: 261-268.

Wang, J.Y., D.E. Gaskin and B.N. White. 1996. Mitochondrial DNA analysis of harbour porpoise, *Phoecena phoecena*, subpopulations in North American waters. *Canadian Journal of Fisheries and Aquatic Sciences*, 53: 1632-1645.

Wardle, C.S., T.J. Carter, F.G. Urquhart, A.D.F. Johnstone, A.M. Kiolkowski, G. Hampson and D. Mackie. 2001. Effects of seismic air guns on marine fish. Continental Shelf Seabed Symposium, Dartmouth, NS, 2 October 1989. *Continental Shelf Research*, 21: 1005-1027.

Wareham, V.E. 2009. Updates on deep-sea coral distributions in the Newfoundland, Labrador and Arctic regions, Northwest Atlantic. In: K. Gilkinson and E. Edinger (eds.). *The Ecology of Deep-sea Coral of Newfoundland and Labrador Waters: Biogeography, Life History, Biogeochemistry, and Relation to Fishes*. *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2830. 144 pp.

Wareham, V.E. and E.N. Edinger. 2007. Distribution of deep-sea coral in the Newfoundland and Labrador region, Northwest Atlantic Ocean. *Bulletin of Marine Science*, 81(Suppl 1): 289-313.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and sperm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the northeast US. *Marine Mammal Science*, 17: 703-717.

Waring, G.T., E. Josephson, C.P. Fairfield-Walsh and K. Maze-Foley. 2009. US Atlantic and Gulf of Mexico marine mammal stock assessments -- 2008. *NOAA Technical Memorandum*, NMFS-NE 210. 440 pp.

Warren, M.A., R.S. Gregory, B.J. Laurel and P.V.R. Snelgrove. 2010. Increasing density of juvenile Atlantic (*Gadus morhua*) and Greenland cod (*G. ogac*) in association with spatial expansion and recovery of eelgrass (*Zostera marina*) in a coastal nursery habitat. *Journal of Experimental Marine Biology and Ecology*, 394: 154-160.

Wartzok, D., A.N. Popper, J. Gordon and J. Merrill. 2004. Factors affecting the responses of marine mammals to acoustic disturbance. *Marine Technology Society Journal*, 37(4): 6-15.

Watanuki, Y. 1986. Moonlight avoidance behavior in Leach's Storm-Petrels as a defense against slaty-backed gulls. *Auk*, 103: 14-22.

Watkins, W.A. 1986. Whale reactions to human activities in Cape Cod waters. *Marine Mammal Science*, 2(4): 251-262.

Watkins, W.A. and K.E. Moore. 1983. Three right whales (*Eubalaena glacialis*) alternating at the surface. *Journal of Mammalogy*, 64(3): 506-508.

Weilgart, L.S. 2007. A brief review of known effects of noise on marine mammals. *International Journal of Comparative Psychology*, 20: 159-168.

Weinrich, M.T., C.R. Belt and D. Morin. 2001. Behavior and ecology of the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) in coastal New England waters. *Marine Mammal Science*, 17: 231-248.

Weir, C. R. 2007. Observations of marine turtles in relation to seismic airgun sound off Angola. *Marine Turtle Newsletter*, 116: 17-20.

Weir, C.R. 2008. Overt responses of humpback whales (*Megaptera novaeangliae*), sperm whales (*Physeter macrocephalus*), and Atlantic spotted dolphins (*Stenella frontalis*) to seismic exploration off Angola. *Aquatic Mammals*, 34(1): 71-83.

Westgate, A.J., A.J. Read, T.M. Cox, T.D. Schofield, B.R. Whitaker and K.E. Anderson. 1998. Monitoring a rehabilitated harbor porpoise using satellite telemetry. *Marine Mammal Science*, 14(3): 599-604.

White, C.M., R.J. Ritchie and B.A. Cooper. 1995. Density and productivity of Bald Eagles in Prince William Sound, Alaska, after the *Exxon Valdez* oil spill. Pp. 762-779. In: P.G. Wells, J.N. Butler and J.S. Hughes (eds.). *Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters.* ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp.

White, H.K, P-Y. Hsing, W. Cho, T.M. Shank, E.E. Cordes, A.M. Quattrini, R.K. Nelson, R. Camilli, A.W.J. Demopoulos, C.R. German, J.M. Brooks, H.H. Roberts, W. Shedd, C.M. Reddy and C.R. Fisher. 2012. *Impact of the Deepwater Horizon Oil Spill on a Deep-water Coral Community in the Gulf of Mexico*. Proceedings of the National Academy of Sciences of the United States of America 109(29). doi: 10.1073. Published online before print.

Whitehead H., S. Gowans, A. Faucher and S.W. McCarrey. 1997. Population analysis of northern bottlenose whales in the Gully, Nova Scotia. *Marine Mammal Science*, 13(2): 173-185.

Whitehead, H. 1982. Populations of humpback whales in the Northwest Atlantic. *Report of the International Whaling Commission*, 32: 345-353.

Whitehead, H. 2002. Estimates of the current global population size and historical trajectory for sperm whales. *Marine Ecology Progress Series*, 242: 295-304.

Whitehead, H. 2003. *Sperm Whale Societies; Social Evolution in the Ocean*. University of Chicago Press, Chicago, IL. 431 pp.

Whitehead, H., S. Brennan and D. Grover. 1992. Distribution and behaviour of male sperm whales on the Scotian Shelf, Canada. *Canadian Journal of Zoology*, 70: 912-918.

Whitehead, H. and C.A. Carlson. 1988. Social behaviour of feeding finback whales off Newfoundland: Comparisons with the sympatric humpback whale. *Canadian Journal of Zoology*, 66: 217-221.

Whitehead, H. and C. Glass. 1985. The significance of the Southeast Shoal of the Grand Bank to humpback whales and other cetacean species. *Canadian Journal of Zoology*, 63: 2617-2625.

Whitehead, H. and L.S. Weilgart. 2000. The sperm whale: Social females and roving males. Pp. 154-172. In: J. Mann, R. Connor, P.L. Tyack and H. Whitehead (eds.). *Cetacean Societies: Field Studies of Dolphins and Whales*. University of Chicago Press. Chicago, IL. viii + 433 pp.

Whitehead, H. and T. Wimmer. 2005. Heterogeneity and the mark-recapture assessment of the Scotian Shelf population of northern bottlenose whales (*Hyperoodon ampullatus*). *Canadian Journal of Fisheries and Aquatic Sciences*, 62: 2573-2585.

Whitmore, P., U. ten Brink, M. Caropolo, V. Huerfano-Moreno, W. Knight, W. Sammler and A. Sandrik, 2009. *NOOA/West Coast and Alaska Tsunami Warning Centre Atlantic Oceans Response Criteria Science* Tsu, Hazards, 28(2): 86-107.

Wiens, J.A. 1995. Recovery of seabirds following the *Exxon Valdez* oil spill: An overview. Pp. 854-893. In: P.G. Wells, J.N. Butler and J.S. Hughes (eds.). *Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters*. ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp.

Wiens, J.A. 1996. Oil, seabirds, and science - The effects of the *Exxon Valdez* oil spill. *BioScience*, 46: 587-597.

Wiens, J.A., R.H. Day, S.M. Murphy and K.R. Parker. 2001. On drawing conclusions nine years after the *Exxon Valdez* oil spill. *Condor*, 103: 886-892.

Wiens, J.A., T.O. Crist, R.H. Day, S.M. Murphy and G.D. Hayward. 1996. Effects of the *Exxon Valdez* oil spill on marine bird communities in Prince William Sound, Alaska. *Ecological Applications*, 6: 828-841.

Wiese, F.K. and G.J. Robertson. 2004. Assessing seabird mortality from chronic oil discharges at sea. *Journal of Wildlife Management*, 68: 627-638.

Wiese, F.K. and P.C. Ryan. 1999. Trends of chronic oil pollution in southeast Newfoundland assessed through beached-bird surveys, 1984-1997. *Bird Trends*, 7: 36-40.

Wiese, F.K. and P.C. Ryan. 2003. The extent of chronic marine oil pollution in southeastern Newfoundland waters assessed through beached bird surveys, 1984-1999. *Marine Pollution Bulletin*, 46: 1090-1101.

Wiese, F.K. and W.A. Montevecchi. 1999. *Marine Bird and Mammal Surveys on the Newfoundland Grand Bank from Offshore Supply Vessels*. Contract report prepared for Husky Oil Operations Limited, St. John's, NL. 23 pp.

Wiese, F.K., W.A. Montevecchi, G.K. Davoren, F. Huettmann, A.W. Diamond and J. Linke. 2001. Seabirds at risk around offshore oil platforms in the North-west Atlantic. *Marine Pollution Bulletin*, 42: 1285-1290.

Wiese, F.K., G.J. Robertson and A.J. Gaston. 2004. Impacts of chronic marine oil pollution and the murre hunt in Newfoundland on thick-billed murre *Uria lomvia* populations in the eastern Canadian Arctic. *Biological Conservation*, 116: 205-216.

Wilbur, D.H. and D.G. Clarke. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. *North American Journal of Fisheries Management*, 21(4): 855-875.

Wilber, D. H., W. Brostoff, D.G. Clarke and G.L. Ray. 2005. *Sedimentation: Potential Biological Effects from Dredging Operations in Estuarine and Marine Environments*. DOER Technical Notes Collection (ERDC TNDOER-E20), US Army Engineer Research and Development Center, Vicksburg, MS.

Wilhelm, S.I., G.J. Robertson, P.C. Ryan and D.C. Schneider. 2007. An assessment of the number of seabirds at risk during the November 2004 *Terra Nova FPSO* oil spill on the Grand Banks. *Canadian Wildlife Service Technical Report Series*, No. 461. 25 pp.

Williams, A.S. 1985. Rehabilitating oiled seabirds. In: J. Burridge and M. Kane (eds.). *A Field Manual*, International Bird Rescue Research Center, Berkely, CA. 79 pp.

Williams, R., A.W. Trites and D.E. Bain. 2002a. Behavioural responses of killer whales (*Orcinus orca*) to whale-watching boats: Opportunistic observations and experimental approaches. *Journal of Zoology, London*, 256: 255-270.

Williams, R., D.E. Bain, J.K.B. Ford and A.W. Trites. 2002b. Behavioural responses of killer whales to a 'leapfrogging' vessel. *Journal of Cetacean Research and Management*, 4(3): 305-310.

Williams, R., D.E. Bain, J.C. Smith and D. Lusseau. 2009. Effects of vessels on behaviour patterns of individual southern resident killer whales, *Orcinus orca*. *Endangered Species Research*, 6: 199-209.

Williams, T.M., W.A. Friedl, M.L. Fong, R.M. Yamada, P. Sedivy and J.E. Haun. 1992. Travel at low energetic cost by swimming and wave-riding bottlenose dolphins. *Nature (London)*, 355(6363): 821-823.

Williams, U. and J. Chardine. No Date. *The Leach's Storm-Petrel: General Information and Handling Instruction*. Petro-Canada, St. John's, NL. 3 pp.

Wilson, J., L. Rotterman and D. Epperson. 2006. Minerals Management Service overview of seismic survey mitigation and monitoring on the US Outer Continental Shelf. Paper SC/58/E8 presented to IWC Scientific Committee, IWC Annual Meeting, 1-13 June, St. Kitts and Nevis. *Zoology*, 74(9): 1661-1672.

Wiltschko, W., U. Munro, H. Ford and R. Wiltschko. 1993. Red light disrupts magnetic orientation of migratory birds. *Nature*, 364: 525-527.

Wimmer, T. and H. Whitehead. 2004. Movements and distribution of northern bottlenose whales, *Hyperoodon ampullatus*, on the Scotian Slope and in adjacent waters. *Canadian Journal of Zoology*, 82: 1782-1794.

Winn, H.E., C.A. Price and P.W. Sorenson. 1986. The distributional biology of the right whale (*Eubalaena glacialis*) in the western North Atlantic. *Report of the International Whaling Commission*, Special Issue 10: 129-138.

Witherington, B.E. 1994. Flotsam, jetsam, post-hatchling loggerheads and the advecting surface smorgasbord. In: K.A. Bjorndal, A.B. Bolten, D.A. Johnson and P.J. Eliazar (compilers). Procedings of the 14th Annual Symposium on Sea Turtle Biology and Conservation, Miami, FL. *NOAA Technical Memorandum*, NMFS-SEFSC-351: 166 pp.

Withrow, D.E., G.C. Bouchet and L.L. Jones. 1985. *Response of Dall's Porpoise (Phocoenoides dalli) to Survey Vessels in both Offshore and Nearshore Waters: Results of 1984 Research*. International North Pacific Fisheries Commission Document, US National Marine Mammal Laboratory, Seattle, WA. 16 pp.

Witt, M.J., A.C. Broderick, D.J. Johns, C. Martin, R. Penrose, M.S. Hoogmoed and B.J. Godley. 2007. Prey landscapes help identify potential foraging habitats for leatherback turtles in the NE Atlantic. *Marine Ecology Progress Series*, 337: 231-243.

Witzell, W.N. 1999. Distribution and relative abundance of sea turtles caught incidentally by the US pelagic longline fleet in the western North Atlantic Ocean, 1992-1995. *Fisheries Bulletin*, 97: 200-211.

Wolfe, D. A., M.M Krahn, E. Casillas, S. Sol, T.A. Thomas, J. Lunz and K.J. Scott. 1996. Toxicity of intertidal and subtidal sediments in contaminated by the *Exxon Valdez* oil spill. Pp. 121-139. In: S.D. Rice, R.B. Spies, D.A. Wolfe and B.A. Wright (eds.). *Proceedings of the Exxon Valdez Oil Spill Symposium*, American Fisheries Society Symposium 18.

Woodley, T.H. and D.E. Gaskin. 1996. Environmental characteristics of North Atlantic right and fin whale habitat in the lower Bay of Fundy. *Canadian Journal of Zoology*, 75: 75-84.

Woodruff, S.D., H.F. Diaz, J.D. Elms and S.J. Worley. 1998. ICOADS release 2 data and metadata enhancements for improvements of marine surface flux fields. *Physics and Chemistry of the Earth*, 23: 517-527.

Woodruff, S.D., H.F. Diaz, S.J. Worley, R.W. Reynolds and S.J. Lubker. 2005. Early ship observational data and ICOADS. *Climatic Change*, 73: 169-194.

Woodruff, S.D., S.J. Worley, S.J. Lubker, Z. Ji, J.E. Freeman, D.I. Berry, P. Brohan, E.C. Kent, R.W. Reynolds, S.R. Smith and C. Wilkinson, 2011. ICOADS Release 2.5: Extensions and enhancements to the surface marine meteorological archive. *International Journal of Climatology*, 31, 951-967.

Woodworth-Lynas, C. 1989. *Iceberg Scouring Event at the White Rose Well Site: April 9-12th, 1988*. Contract report to Husky East Coast Operations. 16 pp.

Worcester, T. 2006. Effects of seismic energy on fish: A literature review. *DFO Canadian Science Advisory Secretariat Research Document*, 2006/092. 72 pp.

Worley, S.J., S.D. Woodruff, R.W. Reynolds, S.J. Lubker and N. Lott. 2005. ICOADS release 2.1 data and products. *International Journal of Climatology*, (CLIMAR-II Special Issue), 25: 823-842.

Worm, B., M. Sandow, A. Oschlies, H. K. Lotze and R.A.Myers. 2005. Global patterns of predator diversity in the open oceans. *Science*, 309:1365-1369.

Wright, A.J. and S. Kuczaj. 2007. Noise-related stress and marine mammals: An introduction. *International Journal of Comparative Psychology*, 20(2-3): iii-viii.

Wright, A.J., N. Aguilar Soto, A.L. Baldwin, M. Bateson, C.M. Beale, C. Clark, T. Deak, E.F. Edwards, A. Fernández, A. Godinho, L.T. Hatch, A. Kakuschke, D. Lusseau, D. Martineau, L.M. Romero, L.S. Weilgart, B.A. Wintle, G. Notarbartolo-di-Sciara and V. Martin. 2007a. Do marine mammals experience stress-related to anthropogenic noise? *International Journal of Comparative Psychology*, 20(2-3): 274-316.

Wright, A.J., N. Aguilar Soto, A.L. Baldwin, M. Bateson, C.M. Beale, C. Clark, T. Deak, E.F. Edwards, A. Fernández, A. Godinho, L.T. Hatch, A. Kakuschke, D. Lusseau, D. Martineau, L.M. Romero, L.S. Weilgart, B.A. Wintle, G. Notarbartolo-di-Sciara and V. Martin. 2007b. Anthropogenic noise as a stressor in animals: A multidisciplinary perspective. *International Journal of Comparative Psychology*, 20(2-3): 250-273.

Wright, A.J., T. Deak, and E.C.M. Parsons. 2009. Concerns related to chronic stress in marine mammals. *International Whaling Commission Working Paper*, SC/61/E16: 7 pp.

Wright, A.J., T. Deak and E.C.M. Parsons. 2011. Size matters: Management of stress responses and chronic stress in beaked whales and other marine mammals may require larger exclusion zones. *Marine Pollution Bulletin*, 63(1-4): 5-9.

Wu, Y., I.K. Peterson, C.C.L. Tang, T. Platt, S. Sathyendranath and C. Fuentes-Yaco. , 2007. The impact of sea ice on the initiation of the spring bloom on the Newfoundland and Labrador shelves. *Journal of Plankton Research*, 29(6): 509-514.

Wu, Y.S. and C.L. Tang. 2011. *Atlas of Ocean Currents in Eastern Canadian Waters*. Ocean Sciences Division, Maritimes Region, Fisheries and Oceans Canada.

Würsig, B. 1990. Cetaceans and oil: Ecologic perspectives. Pp. 129-165. In: J.R. Geraci and D.J. St. Aubin (eds.). *Sea Mammals and Oil: Confronting the Risks*. Academic Press, San Diego, CA. 282 pp.

Würsig, B., S.K. Lynn, T.A. Jefferson and K.D. Mullin. 1998. Behaviour of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. *Aquatic Mammals*, 24: 41-50.

Xia, K., G. Hagood, C. Childers, J. Atkins, B. Rogers, L. Ware, K. Ambrust, J. Jewell, D. Diaz, N. Gatian and H. Folmer. 2012. Polycyclic aromatic hydrocarbons (PAHs) in Mississippi seafood from areas affected by the *Deepwater Horizon* oil spill. *Environmental Science and Technology*, 46(10): 5310-5318.

Yano, K., J.D. Stevens, and L.J.V. Compagno. 2007. Distribution, reproduction and feeding of the Greenland shark *Somniosus (Somniosus) microcephalus*, with notes on two other sleeper sharks, *Somniosus (Somniosus) pacificus* and *Somniosus (Somniosus) antarcticus*. *Journal of Fish Biology*, 70(2): 374-390.

Yazvenko, S.B., T.L. McDonald, S.A. Blokhin, S.R. Johnson, S.K. Meier, H.R. Melton, M.W. Newcomer, R. Nielson, V.L. Vladimirov and P.W. Wainwright. 2007a. Distribution and abundance of western gray whales during a seismic survey near Sakhalin Island, Russia. *Environmental Assessment and Monitoring*, 34(1-3): 44-73.

Yazvenko, S.B., T.L. McDonald, S.A. Blokhin, S.R. Johnson, H.R. Melton, M.W. Newcomer, R. Nielson and P.W. Wainwright. 2007b. Feeding of western gray whales during a seismic survey near Sakhalin Island, Russia. *Environmental Assessment and Monitoring*, 34(1-3): 93-106.

Yelverton, J.T. 1981. *Underwater Explosion Damage Risk Criteria for Fish, Birds, and Mammals*. Unpublished Manuscript, presented at 102nd Meeting of the Acoustical Society of America, Miami Beach, FL, December 1981. 32 pp.

Yelverton, J.T., D.R. Richmond, E.R. Fletcher and R.K. Jones. 1973. *Safe Distances from Underwater Explosions for Mammals and Birds*. Report by Lovelace Foundation, for Medical Education Research, Albuquerque, NM, and Defence Nuclear Agency, Washington, DC. 67 pp.

Yochem, P.K., B.S. Stewart, R.L. DeLong and D.P. DeMaster. 1987. Diel haulout patterns and site fidelity of harbor seals (*Phoca vitulina richardsi*) on San Miguel Island, California, in autumn. *Marine Mammal Science*, 3: 323-332.

Yoder, J.A. 2002. *Declaration James A. Yoder in Opposition to Plaintiff's Motion for Temporary Restraining Order, 28 October 2002. Civ. No. 02-05065-JL*. U.S. District Court, Northern District of California, San Francisco Division.

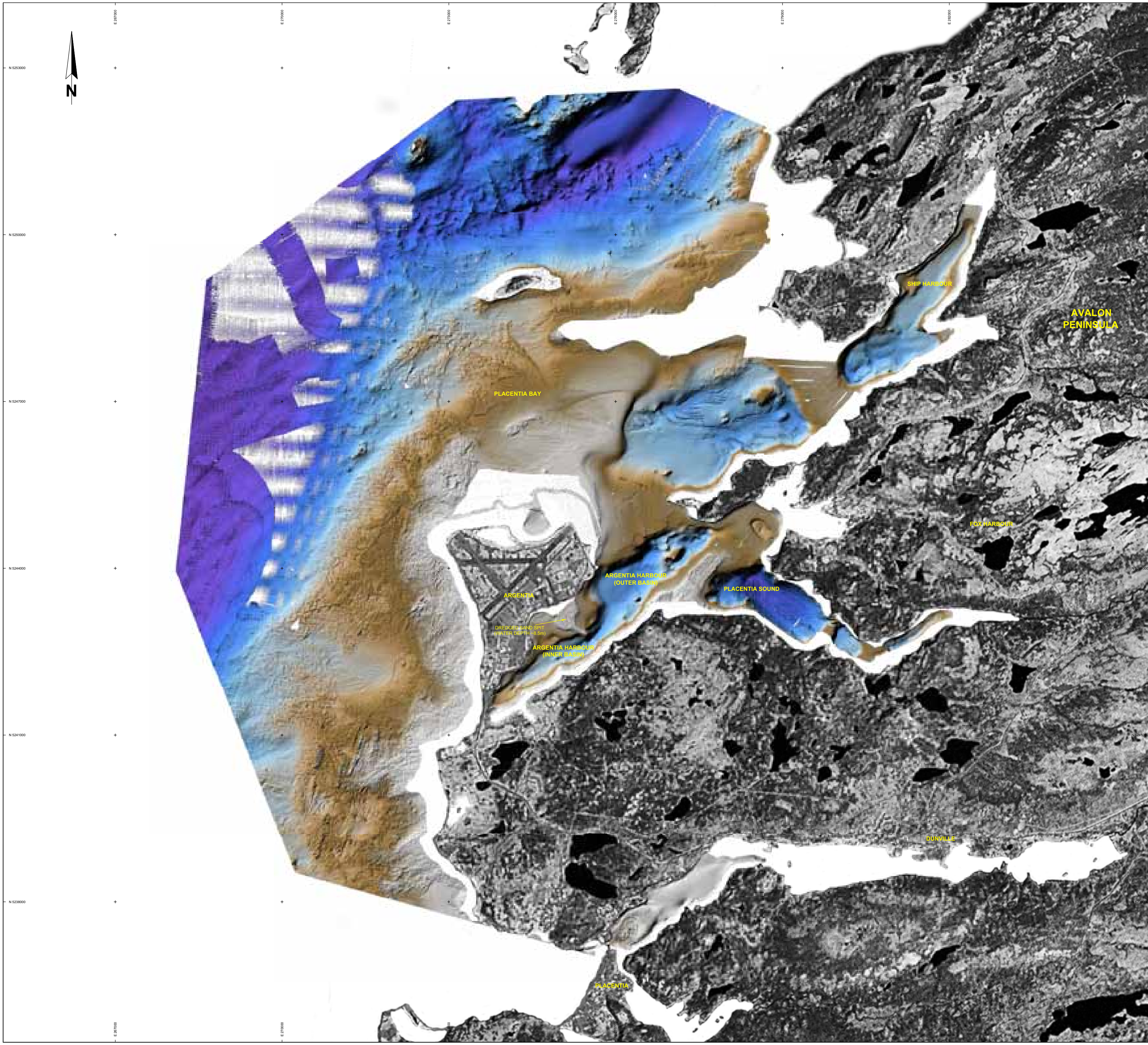
Zabala, J., I.I. Zuberogoitia, J.A. Martínez-Climent and J. Etxezarreta. 2011. Do long lived seabirds reduce the negative effects of acute pollution on adult survival by skipping breeding? A study with European storm petrels (*Hydrobates pelagicus*) during the *Prestige* oil spill. *Marine Pollution Bulletin*, 62: 109-115.

Appendix A

List of Fishers Consulted during the Environmental Assessment

Group	Participant
Fishers Attending Consultation Meetings, Arnold's Cove, Placentia and Petit Forte, June 14 and 15, 2012	Jerome Barry, Independent Fisher, Petite Forte Tony Barry, Independent Fisher, Placentia Shawn Boutcher, Independent Fisher, Little Harbour Wilbert Crann, Independent Fisher, Fairhaven Joseph Culleton, Independent Fisher, Fox Harbour Merv Hollett, Independent Fisher, Arnold's Cove Earl Johnson, Independent Fisher, North Harbour Ambrose Jones, Independent Fisher, Petite Forte Francis King, Independent Fisher, Fox Harbour Ken King, Independent Fisher, Fox Harbour Colm Leonard, Independent Fisher, Petite Forte Terry Leonard, Independent Fisher, Petite Forte Paul Mulroney, Independent Fisher, Arnold's Cove Chris Pearson, Independent Fisher, Petite Forte Cecil Penney, Independent Fisher, Arnold's Cove Leonard Picco, Independent Fisher, Arnold's Cove Charlie Pittman, Independent Fisher, Fox Harbour Mike Pittman, Independent Fisher, Fox Harbour Robert Pittman, Independent Fisher, Fox Harbour Donald Pomeroy, Independent Fisher, Dunville Gerald (Carter) Pomeroy, Independent Fisher, Placentia Frankie Spurvey, Independent Fisher, Placentia Kerry Ward, Independent Fisher, South East Bight Loretta Ward, Independent Fisher, South East Bight
Other Fishers (Telephone Interviews)	William Collins, Independent Fisher, Davis Cove Ross Dunphy, Independent Fisher, Monkstown Freeman Tobin, Independent Fisher, Davis Cove
Agency Managers	Todd Budgell, Manager of Aquaculture Licencing and Inspections, Dept. of Fisheries and Aquaculture, Grand Falls Mike Hurley, Fisheries Officer, DFO, Placentia Office Ann-Margret White, Regional Director, Maritime Services, Canadian Coast Guard, St. John's Captain Clem Murphy, Ship's Safety Branch, Transport Canada Stan Gutt, Ship's Safety Branch, Transport Canada Gladys Tucker, Licensing Branch, DFO, NL Region, St. John's
FFAW/One Ocean	John Boland, Staff Representative, FFAW, St. John's Roland Hedderson, Staff Representative, FFAW, Clarenville Robyn Saunders-Lee, Petroleum Liaison Coordinator, FFAW, St. John's Maureen Murphy-Rustad, Director of Operations, One Ocean, St. John's

Group	Participant
Fishers/FFAW/One Ocean Attending Consultation Meeting September 20, 2012	Gerard Chidley, Independent Fisher Nelson Bussey, Independent Fisher Robbie Green, Independent Fisher Glen Winslow, Independent Fisher Glen White, Independent Fisher David Decker, FFAW Representative Bill Broderick, FFAW Representative Harvey Jarvis, FFAW Representative Johan Joensen, FFAW Representative Maureen Murphy Rustad, One Ocean



REGIONAL LOCATION PLAN (not to scale)

NOTES

SATELLITE IMAGERY PROVIDED BY:
NASA'S EARTH SCIENCE ENTERPRISE SCIENTIFIC DATA PURCHASE PROGRAM
PRODUCED, UNDER NASA CONTRACT, BY EARTH SATELLITE CORPORATION

BATHYMETRY DATA SUPPLIED BY HUSKY ENERGY INC. DATA GRIDDED AT 5m.

BATHYMETRIC IMAGERY RENDERING PARAMETERS:
AZIMUTH = 315°
ELEVATION = 45°
EXAGGERATION = 10

MAP PROJECTION DETAILS

NORTH AMERICAN DATUM (NAD) 1983
GRS80 ELLIPSOID
SEMI-MAJOR AXIS 6378137.00
INVERSE FLATTENING 298.25722210
6° UNIVERSAL TRANSVERSE MERCATOR
ZONE 22 CENTRAL MERIDIAN: 51° W
SCALE FACTOR AT C.M.: 0.9996
FALSE EASTING: 500,000m
FALSE NORTHING: 0m
VERTICAL DATUM: CHART DATUM (CD)

FGI REVISION REFERENCE

REV.	DATE	DESIGNATION	DRAWN	CHECK'D	APPR'D
0	28/MAR/12	INITIAL SUBMISSION	DPD/AC	DJD	-

SCALE

1000 800 600 400 200 0 600 1200 1800 2400 3000
Metres
1 : 30,000

CLIENT

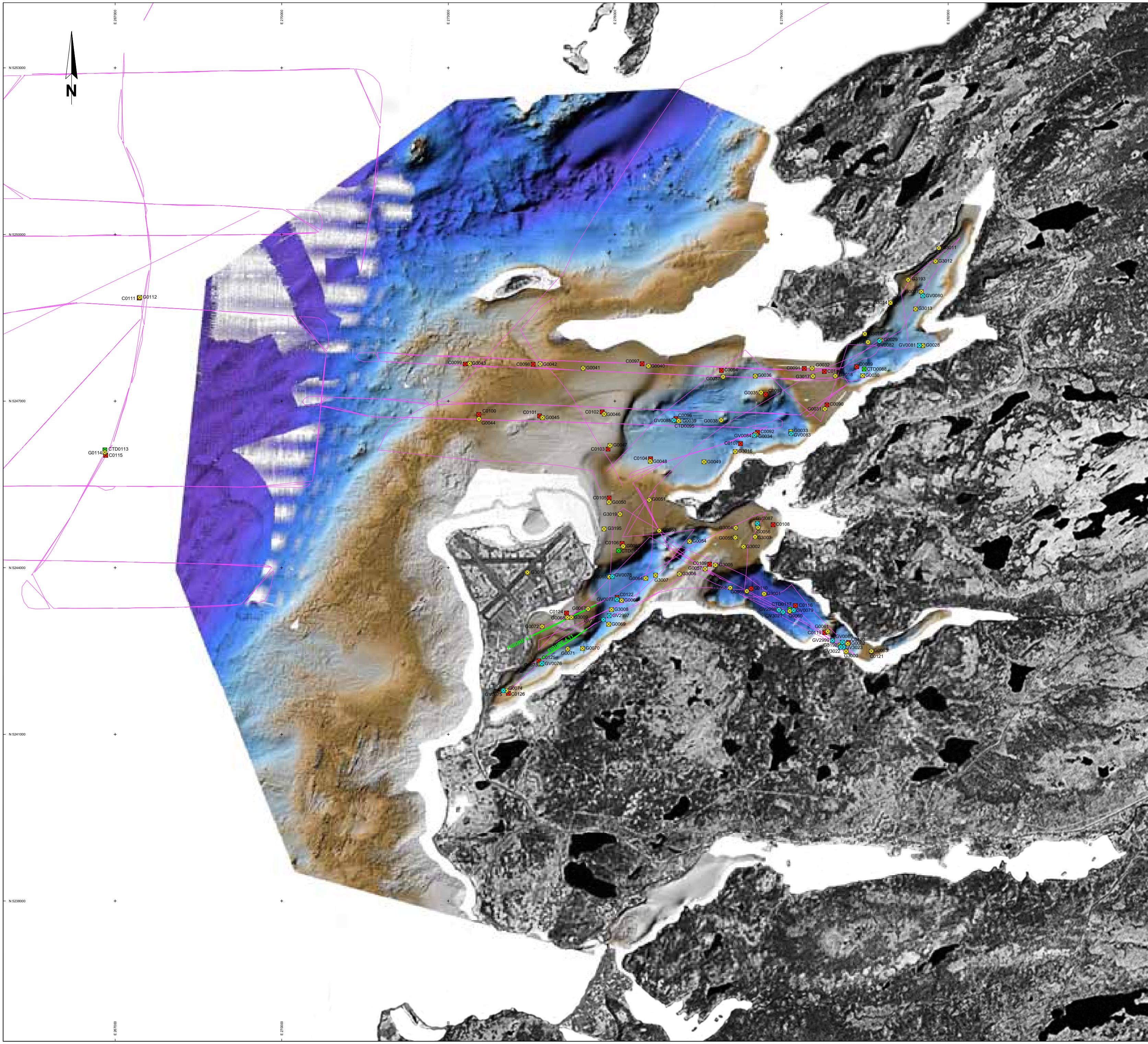
Stantec

PREPARED BY

TITLE

ARGENTIA
BATHYMETRY AND SEAFLOOR RENDERING

JOB NUMBER: 20110071
DATE: MARCH 28, 2012
C-NLOPB No.:
DRAWING No.: 20110071-BTY-REGARG-E01
DRAWN BY: DPD/AC.
CHECKED BY: DJD
ENCLOSURE 1
REV 0



REGIONAL LOCATION PLAN (not to scale)

LEGEND/NOTES

G0040	GRAB SAMPLE LOCATION (GSC-A)
C0101	CAMERA LOCATION (GSC-A)
CTD01001	CTD LOCATION (GSC-A)
GV0074	GRAVITY CORE LOCATION (GSC-A)
	GEOPHYSICAL TRACK LINE (GSC-A)
	SUB-BOTTOM PROFILE LOCATION

SATELLITE IMAGERY PROVIDED BY:
NASA'S EARTH SCIENCE ENTERPRISE SCIENTIFIC DATA PURCHASE PROGRAM
PRODUCED, UNDER NASA CONTRACT, BY EARTH SATELLITE CORPORATION

BATHYMETRY DATA SUPPLIED BY HUSKY ENERGY INC. DATA GRIDDED AT 5m.

BATHYMETRIC IMAGERY RENDERING PARAMETERS:
AZIMUTH = 315°
ELEVATION = 45°
EXAGGERATION = 10

DEPTH (m): -12, -15, -16, -17, -18, -20, -22, -23, -25, -29, -33, -37, -40, -46, -54, -66, -75, -81, -100, -167

MAP PROJECTION DETAILS

NORTH AMERICAN DATUM (NAD) 1983
GRS80 ELLIPSOID
SEMI-MAJOR AXIS 6378137.00
INVERSE FLATTENING 298.25722210
6° UNIVERSAL TRANSVERSE MERCATOR
ZONE 22 CENTRAL MERIDIAN: 51° W
SCALE FACTOR AT C.M.: 0.9996
FALSE EASTING: 500,000m
FALSE NORTHING: 0m
VERTICAL DATUM: CHART DATUM (CD)

FGI REVISION REFERENCE

REV.	DATE	DESIGNATION	DRAWN	CHECK'D	APPR'D
0	28/MAR/12	INITIAL SUBMISSION	DPD/AC	DJD	-

SCALE

1000 800 600 400 200 0 600 1200 1800 2400 3000
Metres
1 : 30,000

CLIENT

PREPARED BY

TITLE

ARGENTIA BATHYMETRY AND SEAFLOOR RENDERING SHOWING GSC-A CRUISE DATA

JOB NUMBER: 20110071	DRAWN BY: DPD/AC. CHECKED BY: DJD
DATE: MARCH 28, 2012	
C-NLOPB No.:	ENCLOSURE 2
DRAWING No.: 20110071-GSC-REGARG-E02	REV 0