MODULE 12:
FISHERIES AND OTHER OCEAN USES: OVERVIEW OF POTENTIAL EFFECTS

12.1 Introduction

Fisheries are an important component of the socioeconomic environment of Newfoundland and Labrador and other parts of Canada. The fishery has played a key role in the region's history, and thus in shaping its people, communities and overall culture. It continues to be an essential element of the economy and lifestyles of the people that live in these areas. Numerous individuals and organizations depend on fish harvesting and its associated processing and spin-off industries, with many residents participating in recreational fishing as an important aspect of their culture and overall way of life (Module #). Other human activities also occur within the marine environment offshore Eastern Newfoundland and are likewise important for their economic or cultural value. These include general marine shipping, offshore oil and gas related activities (such as seismic exploration, production platforms and associated marine traffic), military operations, other submarine infrastructure (such as communication cables) and the possible presence of unexploded ordnance (UXOs) (Module #).

12.2 Planned Drilling Activities and Emissions

Potential interactions between offshore exploratory drilling and associated activities and fisheries and other ocean uses, and possible resulting effects on this Valued Component (VC), include:

Fisheries

- Temporary loss of access to established fishing grounds due to drilling activities and components, and a resulting decrease in the efficacy or value (economic or otherwise) of these fishing activities.

- Possible damage to fishing gear, vessels, equipment, or other components due to interactions between vessels, equipment, emissions or discharges and fishing activities.

- Possible interference with scheduled government / industry fisheries research activities, which might also affect research results and associated management decisions.

- Possible price implications resulting from market or consumer perception of a reduced quality of fish products (e.g., taint).

- Possible indirect effects on fisheries due to changes in the abundance, distribution or availability of fish species on established fishing grounds.

Other Ocean Uses

- Interference or conflict with other offshore petroleum exploration activities (seismic and other surveys, supply and service vessels).

- Interference with other shipping in the area (commercial, pleasure craft, military operations).

- Potential direct physical interactions with existing submarine infrastructure (subsea cables) or other human-made components (such as UXO).

Much of the available information and insights regarding potential interactions between fisheries and other ocean uses and the offshore oil and gas industry has been gathered through discussions with fishers and other individuals and organizations that are involved in these industries. This includes the various engagement activities undertaken as part of this Regional Assessment (see Main Report, Chapter #), as well as in other strategic environmental assessments (SEAs) and project-specific environmental assessment (EAs) for oil and gas exploration and development projects off Newfoundland and Labrador and elsewhere. These analyses and engagement initiatives have identified potential damage to gear, loss of access and associated logistics, reduced fish catches (quantity and/or value), biophysical effects on fish (including real or perceived tainting) and subsequent reductions in fish landings and value, and oil spills as being amongst the primary issues of concern.

Table 12.1 Fisheries and Other Ocean Uses: Potential Effects of Planned Drilling Activities and Emissions

Potential Effects	Overview
Fisheries	
Direct interference with fishing or exclusion from established fishing grounds	• Temporary loss of access to marine areas can occur due to the presence of drill units and other exploration equipment and activities, including safety zones. • Temporary interference/disruption of fishing or actual or de facto loss of access to fishing grounds necessitating altered vessel routes or movement to alternative grounds. • This might affect the effectiveness or efficiency of harvesting resulting in lower catches and/or revenues, lost time and additional operating costs.
Damage to fishing gear or vessels	• Offshore exploratory drilling activities may result in damage to fishing gear or vessels if they come into direct contact with offshore drill units or other equipment, or if drilling equipment and activities tangle or foul fishing gear. • Possible associated economic effects on fishers might result from lost fishing efficiency, lost catch, and associated repair or replacement costs.
Decreases in the abundance, distribution and actual or perceived quality of fisheries resources	• Any change in the abundance, distribution and availability of commercial fish species on established grounds because drilling activities (e.g. sound and other emissions) may result in diminished fishing success (e.g. lower catches and revenues, lost time, additional operating costs). • Any change in the (real or perceived) quality of marine resources also has a potential to result in lower market demand and/or commercial prices.
Other Ocean Uses	
Direct contact with and damage to in situ component	• Drilling and other associated activities that result in direct contact with the seabed may result in interactions with and possible damage to other components and infrastructure, such as subsea cables or UXOs.
Interference with other marine activities	• There may be a temporary loss of access to localized marine areas because of the presence of drill rigs and other exploration equipment and activities, including safety zones. • This may also result in associated interference/disruption of other shipping (including other petroleum exploration) diverting around safety zone or active work areas outside the safety zone.

Table 12.2 indicates which of the various components and activities that are associated with offshore exploratory drilling and their associated emissions and disturbances are potential contributors to these effects on this VC.

Table 12.2 Potential Contributors to Effects on Fisheries and Other Ocean Uses (Planned Drilling Activities and Emissions

Potential Effects	Potential Contributors: Planned Components and Activities							Potential Contributors: Associated Emissions / Disturbances / Interactions						
	Drill Rig and Associated Equipment	Well Drilling (Exploration and Delineation)	Vertical Seismic Profiling	Other Survey Activities	Well Evaluation and Testing	Well Abandonment or Suspension	Supply and Servicing (Vessels and Aircraft Use)	Presence and Operation of Drill Rig	Lights, Heat and Noise	Underwater Noise	Air Emissions	Drill Fluids and Cuttings	Other Liquid Discharges	Other Waste Materials
1) Direct interference with fishing or exclusion from established fishing grounds	●	●	●	●		●	●	●				●		
2) Damage to fishing gear or vessels	●	●	●	●		●	●	●				●	●	
3) Decreases in the abundance, distribution and actual or perceived quality of fisheries resources	●	●	●		●	●	●	●		●		●	●	
4) Direct contact with and damage to in situ component	●	●		●		●	●	●				●		
5) Interference with other marine activities	●	●	●	●		●	●	●				●		

Table 12.3 summarizes current information and knowledge from the literature and other sources on the nature and degree of these potential effects.

As noted above, offshore oil and gas exploration and production activities have been occurring in the Eastern Newfoundland Offshore Area and elsewhere for decades. The views and insights of those involved in the fishing and offshore petroleum industries as a result of their experiences to date, therefore, provide an important source of "existing knowledge" regarding potential issues and effects, mitigation measures and their effectiveness, and other factors relevant to the planning and possible conduct of future offshore oil and gas activities in the Study Area (Main Report, Chapter #).

Table 12.3 Potential Effects on Fisheries and Other Ocean Uses: Summary of Current Knowledge (Planned Drilling Activities and Emissions)

Physical Activities/Components	Potential Effects: Summary of Current Knowledge
Presence and Operation of Drill Rig	• The presence and operation of the drill rig could potentially decrease efficiencies and increase costs for fisheries and other ocean users directly through restricted access and/or indirectly through effects on marine resources. • Mobilization of the drill rig to the wellsite (either by towing or self-propelled transit) could interact with fishing gear that is located in the transit route, particularly fixed fishing gear which is left in place for several days before it is retrieved. The use of a fisheries liaison officer and/or fishery guide vessel during transit-tow operations reduces risk of gear interaction or damage (One Ocean, undated). • In accordance with regulatory requirements, safety zones (typically 500 m in radius) are established around drill rigs (including anchors if applicable) within which fishing and other non-Project vessels are excluded. The establishment of safety zones around drilling installations helps to protect human safety and eliminate potential for vessel or gear damage within these designated locations. • The safety zone remains in effect for the duration of well drilling activity while the drill rig is on the wellsite. Length of time to drill an exploration well may range from approximately 30 days to more than 180 days. • The exclusion of access to a designated safety zone for the duration of a well has the potential to decrease fishing efficiency and/or increase costs to fishing and other vessel transits (FFAW-Unifor 2017). The impact of this loss of access depends on the location of the safety zone relative to areas where fishers historically fish and the timing (seasonality, length of time) of the exclusion. • Underwater sound and light emissions from the drill rig could result in behavioural effects on fish (e.g., localized attraction) which could indirectly affect harvesting activities if fish move from surrounding areas into the safety zone (where fishing is prohibited). • Prior to drilling a seabed survey is conducted to confirm the absence of existing infrastructure or other human-made components (e.g., subsea cable, unexploded ordnance, shipwreck) to manage safety risks and prevent damage.
Vertical Seismic Profiling (VSP)	• Sound source arrays for VSP are much smaller than used for conventional seismic surveys and would be suspended from the drill rig (zero-offset VSP) or towed (few metres long) behind a vessel (walk-away VSP). • Underwater sound from VSP surveys could potentially affect fish behaviour and/or fish health, thereby affecting availability of fisheries resources (*see Vertical Seismic Profiling for Marine Fish and Fish Habitat*). • Fish vary widely in hearing ability, morphology, and behaviour, and responses to seismic sounds (and therefore catchability) can vary considerably. Extrapolation and generalization of effects is therefore cautioned (Løkkeborg et al. 2012). • The fishing industry has consistently raised concerns about potential effects of seismic operations on fish and fisheries (FFAW-Unifor 2017). Although seismic surveys have not been found to have significant effects on stock recruitment, scare effects on adult fish (particularly pelagic species) can affect fisheries catch where surveys are being conducted in close proximity (time and space) to fisheries activities (Dalen et al. 1996). • Effects of seismic surveys on fish catchability can vary depending on fish species and fishing gear use (Dalen 2007). Studies on the effects of seismic surveys on fish catchability have shown various results including no change in catch-per-unit effort (Christian et al. 2003; Morris et al. 2018), decreased catch rates (Engås et al. 1996; Løkkeborg et al. 2012; Streever et al. 2016) and increased catch rates (Løkkeborg et al. 2012; Streever et al. 2016).

Physical Activities/Components	Potential Effects: Summary of Current Knowledge
	• Where effects on catchability have been observed, the spatial and temporal extent of effects were limited; effects did not persist long after exposure to the seismic source array ended (Engas et al. 1996) and in most cases did not appear to displace fish from fishing grounds (Løkkeborg et al. 2012). • Long term changes in average catch rates or to the size of fish stocks in general are not expected (Gausland 2003).
Well Drilling and Associated Marine Discharges	• The discharge of drilling muds and cuttings and other marine discharges can affect sediment and water quality however these discharges are made in accordance with MARPOL and the Offshore Waste Treatment Guidelines. • Environmental effects monitoring (EEM) programs for offshore drilling and production projects on the east coast of Canada have found negligible effects on commercial species such as American plaice, Icelandic scallop, and snow crab (Buchanan et al. 2003; Suncor 2017; HMDC 2019). • The White Rose EEM results show no significant body burden (chemical) differences in plaice fillets or crab tissue collected in the White Rose field and reference areas and no significant differences in the taste of each species during panel tests. Sediment contamination and effects on benthos noted in 2016 and in previous years have not translated into effects on the fisheries resources, as indicated by fish health assessment and taint tests (Husky Energy 2019).
Well Evaluation and Testing	• There is no likely interaction with commercial fisheries and other ocean users as a result of well evaluation and testing as activities. Activities and effects will be confined to within the 500 m safety (exclusion) zone. Refer to the Literature Table for Marine Fish and Fish Habitat for potential effects on fish.
Supply and Servicing (Vessel and Helicopter Use)	• There is no readily available literature on potential effects of vessel and helicopter use on commercial fisheries and other ocean users although the "extra traffic" introduced by oil and gas activities offshore Newfoundland and Labrador is recognized as a concern by the fishing industry (McCurdy and Coady 2009).
Well Abandonment or Suspension	• If the wellhead is removed, associated activity occurs within the designated safety zone and no interactions with fisheries or other ocean users are expected. When decommissioning and abandonment activities are completed and the safety zone is rescinded, normal fishing and shipping activity can resume. • In some cases, where potential interactions with fisheries activities are limited due to water depth, approval may be sought to abandon the well with the wellhead remaining in place on the seafloor. This would result in limited infrastructure protruding from the seafloor which would have the potential to interact with and cause damage to fishing and/or research equipment. • The integrity of the well would not be affected by an interaction with fishing gear and/or research equipment. • Although there is no designated restricted zone, locations of abandoned or suspended wells are communicated to stakeholders and charted by the Canadian Hydrographic Service enabling voluntary avoidance.

12.3 Unplanned Events

Most of the potential interactions and resulting effects on fisheries and other ocean uses associated with planned, routine activities (Section 12.2) are also relevant for potential accidental events. These include:

Fisheries

- Temporary lost or reduced/delayed access to commercial species (from interference, excluded fishing grounds, decreased harvesting efficiency, or species availability, abundance, and distribution) by fishers and science surveys;
- Increased expenses associated with fishing more distant grounds, detours to avoid affected areas, and reduced availability of affected fishing gear;
- Costs to repair or replace damaged fishing gear, facilities or vessels caused by spilled hydrocarbons or debris; and
- Actual or perceived quality of fisheries resources and resulting market/price effects.

Other Ocean Uses

- Direct contact with and damage to in situ component of spill and/or debris; and
- Interference with other marine activities.

In the case of an unplanned event such as a batch spill or a blowout, the potential for negative interactions with fish harvesting and other ocean uses is likely to be greater than from planned activities, although the actual effects from any such event will depend on the interaction of several factors such as the quantity and type of hydrocarbons released, the specific location of the release, the time of year (in particular, what fisheries and other activities are occurring then), the prevailing environmental conditions at the time, the duration of the hydrocarbon release, the location of hydrocarbons in the water column, the effectiveness of clean-up or other response actions and, overall, the fate of the released substance. These conditions will determine the severity of the effects of a spill, and the type and extent of any effects on fisheries. Other ocean uses (particularly any activities at or near the ocean surface) could also be impeded by the presence of an oil slick and clean-up activities, which would have to be avoided while present.

Table 12.4 summarizes current information and knowledge from the literature and other sources on the nature and degree of the potential effects of oil spills and other such events on this VC.

Table 12.4 Potential Effects on Fisheries and Other Ocean Uses: Summary of Current Knowledge (Unplanned Events)

Potential Accidental Event	Potential Effects: Summary of Current Knowledge
Oil Spills (Batch Spills and Blowouts)	General Effects on Fisheries and Other Ocean Users • Oil spills can have extensive socio-economic and even cultural impacts, including effects on marine resource and livelihoods and public health (Sumaila et al. 2012). • Oil spills can affect fisheries directly through effects on fisheries species, and/or interference with fishing activity (e.g., through fisheries closures or gear loss/damage). Effects may also occur due to reduced consumer confidence and marketability of seafood following a spill (ITOPF 2011). • Similarly, other ocean users may be affected through effects on species of interest (e.g., in the case of biological research programs), loss or damage of equipment, or restricted access to affected areas. • Oil can foul boats and gear, including mariculture facilities in the nearshore, and then be transferred to the catch or produce (ITOPF 2011). Seafood Contamination and Tainting • Seafood is only at risk of contamination from a spill if it is exposed to the oil. Once exposed, an organism becomes contaminated to the extent that it takes up and retains petroleum compounds (Yender et al. 2002).

Potential Accidental Event	Potential Effects: Summary of Current Knowledge
	• Though only a small percentage of the spilled oil volume dissolves into the water column, the components that do dissolve are often the most toxic and may also taint seafood at low concentrations (Yender et al. 2002). • Exposure to contaminated sediments (e.g., oiled intertidal and subtidal sediments) is a possible pathway of contamination, particularly for invertebrate deposit feeders or sediment grazers, although this pathway of contamination is usually more associated with chronic pollution than individual spill events (Yender et al. 2002). • Previous oil spills have shown that seafood contamination is determined by numerous factors, including the type and quality of the oil, the proximity of the spill to fishing grounds, ambient temperature and weather conditions, and species- and ecosystem-specific parameters that determine metabolism and the potential for bioaccumulation at different levels of the food chain (Yender et al. 2002; Gohlke et al. 2011). • When conducting risk assessments and developing safe consumption estimates for consumers of seafood harvested recreationally and/or for subsistence use, it is important to consider that these people may have higher seafood consumption rates than the general population and rely more heavily on local seafood resources for sources of protein (Yender et al. 2002). • Adult free-swimming fish and invertebrates seldom suffer long-term damage from oil spill exposure since effects are generally temporary and localized (ITOPF 2011). • Sedentary species, particularly seaweeds and shellfish including caged animals (e.g., mariculture) can be particularly vulnerable to smothering and oil toxicity (ITOPF 2011). • Tainting of seafood (when a fish absorbs oil-derived substances into its tissues causing petroleum tastes and odours) can occur at exposures to low hydrocarbon concentrations. Filter-feeding sedentary animals (e.g., bivalve molluscs) and caged fish are particularly vulnerable to tainting (ITOPF 2011). • Tainting of live tissue is reversible through depuration. The presence or absence of taint is determined through sensory testing. If a seafood product is determined to be taint-free, it is considered safe to eat (ITOPF 2011). However, consumer concerns and altered consumption patterns may linger after seafood has been determined safe for consumption. This may lead to price reductions or rejection of product (Yender et al. 2002; ITOPF 2011; Carroll et al. 2016; Naquin et al. 2016), leading to additional economic losses for fishers and the seafood industry. Fisheries Closures • Following the 2010 Deepwater Horizon oil spill in the Gulf of Mexico, there were no documented cases of fish-kills in offshore waters but many fisheries were closed intermittently due to increased potential for oil contamination of pelagic seafood species (Beyer at al. 2016). Systematic monitoring found little evidence for significant seafood contamination (Ylitalo et al. 2012). • Fisheries closures may be imposed after a spill to protect human health and safety, including safety of harvesters and of seafood consumers and potentially alleviate concerns about tainted product. The implementation of a closure would prevent contamination of fishing gear and harvesting of potentially contaminated seafood. However, in the event of a closure, harvesters may have to switch species or travel farther to reach unclosed water (Carroll et al. 2016). Economic Loss and Recovery • Estimates of loss in commercial, recreational and mariculture fisheries are dependent on the combination of initial mortality of fish species as well as the continued economic unmarketability that can result when consumers believe the seafood is less desirable because of real or perceived pollutants (Sumaila et al. 2012). • Market recovery time (i.e., time required for the market conditions for affected fish to return to pre-spill levels) of commercially important fish depends on the length of

Potential Accidental Event	Potential Effects: Summary of Current Knowledge
	fisheries closures after a spill, public perceptions of seafood safety and the degree of tainting (Sumaila et al. 2012). Decades after the *Exxon Valdez* oil spill in in 1989, herring and salmon species in the region have not fully recovered ecologically or economically (Sumaila et al. 2012).
Drill Fluids (SBM) Spills	• SBM is a dense, low toxicity fluid which sinks rapidly through the water column (Neff et al. 2000; CNSOPB 2005, 2018). • Effects on commercial fish species would be similar to that describe above for other drilling discharges.

12.4 References

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