Environmental Studies Research Fund

ANNUAL REPORT 2015 - 2016

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The Environmental Studies Research Fund

ANNUAL REPORT 2015 - 2016

Message from the Chair

I am very pleased on behalf of the ESRF Management Board to submit the Environmental Studies Research Fund (ESRF) 2015 - 2016 Annual Report.

This year saw the start of four new projects and the continuation of five exciting research projects that each help to advance understanding in our research priorities. In the Southern regions, we remain committed to improving knowledge on the effects of seismic sound on marine life, while in the Northern regions, we continue to support the important work involved in regional effects assessment and management. The research we support on spill preparedness and response in all regions inform industry and regulatory decision-making in oil and gas exploration, development and production activities across Canada's frontier lands.

This annual report marks an important transition year for the ESRF. We have completed our move from a calendar year to align with the Government of Canada's planning and reporting cycle. You will see in our reporting that our new fiscal year starts on April 1 and runs to March 31 of the following year. This report, on an exceptional basis this year, covers 15 months of fiscal information to complete the transition.

The Fund's ongoing support of research in Canada's frontier lands would not be possible without the dedication of the Management Board Members. Their continued service, ongoing dedication and expertise supporting the oversight of the Fund are commendable. This year, I would specifically like to thank Linda Graf and Gerard Chidley (whose terms on the Board have expired) for their service to the Board. Their insights over their years of service have contributed greatly to our ongoing success.

Looking ahead, the ESRF Management Board will continue its efforts to deliver a high quality study program that meets our research priorities and the ongoing information needs within our mandate.

Thank you for your support in working towards this objective.

Paul Barnes
Chairperson, ESRF Management Board
May 31, 2016

Mandate

The Environmental Studies Research Fund (ESRF) is a research program that sponsors studies on environmental and social implications related to oil and gas exploration and development in Canada's frontier lands.

The information arising from these studies is designed to assist all involved stakeholders, including citizens, companies and government, in their decision-making related to oil and gas exploration and development.

Initiated in 1983 under the *Canada Oil and Gas Act* (COGA), the ESRF now receives its legislated mandate through the superseding legislation, the *Canadian Petroleum Resources Act* (CPRA), proclaimed in February 1987.

ESRF research is funded by levies on oil and gas companies that hold licenses for exploration and development in Canada's frontier lands.

The Minister, Natural Resources, is responsible for the administration of the ESRF South Account for regions mainly south of 60° latitude, including the Hudson Bay, and the Minister, Indigenous and Northern Affairs, is responsible for the administration of the North Account for regions north of 60° (See Annex 1 for specific details).

The ESRF is directed by a twelve-member joint government/ industry/public Management Board and is administered by a Secretariat that resides within the Office of Energy Research and Development of Natural Resources Canada.

FRONTIER LANDS

The *Canada Petroleum Resources Act* "frontier lands" definition was amended on April 1, 2014, to include:

(a) that part of the onshore that is under the administration of a federal minister,

(b) Nunavut,

(c) Sable Island,

(d) the submarine areas in that part — of the internal waters of Canada or the territorial sea of Canada — that is not situated

(i) in a province other than the Northwest Territories, or

(ii) in that part of the onshore that is not under the administration of a federal minister, or

(e) the continental shelf of Canada,

but does not include the adjoining area, as defined in section 2 of the *Yukon Act*.

ESRF Management Board Members

Private Sector
Paul Barnes, Chairperson
Canadian Association of Petroleum Producers

Greg Janes
Suncor Energy

Francine Wight
Husky Energy

Linda Graf
ConocoPhillips Canada
(Term ended February 2015)

Public Sector
Norman Snow
Joint Secretariat-Inuvialuit Settlement Region

Gerard Chidley
Atlantic Champion and Ocean Alliance Fishing Vessels
(Term ended November 2015)

Government of Canada
Michel Chénier
Indigenous and Northern Affairs Canada

Marc D'Iorio
Environment and Climate Change Canada

Patrice Simon
Fisheries and Oceans Canada

Robert Steedman, Vice-Chairperson
National Energy Board

Offshore Petroleum Boards
David Burley
Canada-Newfoundland and Labrador Offshore Petroleum Board

Eric Theriault
Canada-Nova Scotia Offshore Petroleum Board

The ESRF Management Board members are selected for their expertise and specialized technical knowledge relative to the mandate of the Fund.

Members of the Management Board are appointed jointly by the Minister of Natural Resources and the Minister of Indigenous and Northern Affairs.

The ESRF Management Board directs the business of the Fund, sets priorities for study topics, determines the program budget and facilitates the development of study proposals.

Contact Information:
ESRF Secretariat
Natural Resources Canada
14th Floor
580 Booth Street

E-mail:
NRCan.environmental_studies_research_fund-environmental_studies_research_fund.RNCan@canada.ca

ESRF Research Priority Areas 2015-2018

In 2013, the ESRF Management Board developed and approved a new selection process for studies to be funded by the ESRF. This selection process is adapted from those used by other governmental programs, including the ecoEnergy Innovation Initiative. Annex 2 and Annex 3 provide a complete description of the current research priorities and selection process.

In brief, the selection process starts by the ESRF Management Board defining research priority areas, informed by industry and based on current knowledge gaps. The current priority areas are for the period 2015-2018. Potential proponents are invited to submit study proposals for consideration as part of an open call for proposals. The ESRF Management Board, in consultation with the necessary technical reviewers, evaluate the proposals and fund the best suite of studies that collectively address each research priority.

Research Priority Areas

The four research priority areas for its 2015-2018 funding cycle (see Annex 2 for the full description of each area):

North

1. Spill Preparedness and Response, Fate and Effects: to support marine safety by studying the fate and effects of accidental releases of petroleum and other hazardous substances in the Arctic marine environment and improve responses.
2. Regional Effects Assessment and Management: to support stakeholders in preparing and reviewing applications for oil and gas activities on themes including biophysical, socio-economic, traditional knowledge and cumulative effects.

Atlantic Offshore

3. Seismic: to improve the understanding of the effects of seismic sound on commercial fish and invertebrates, as well as marine mammals and/or species at risk.
4. Oil and Gas Liquids Spill Fate and Effects: to support marine safety by studying the fate and effects of accidental releases of petroleum in the Newfoundland-Labrador and Nova Scotia Offshore Areas.

Current Studies (2016 – 2017)

SOUTHERN REGIONS

Mid-Labrador Marine Megafauna and Acoustic Surveys on the Labrador Coast (2010-07S). Baseline Surveys for Seabirds on the Labrador Sea (2010-08S). These two projects are documenting the occurrence and population densities of marine mammals and seabirds along those parts of the Labrador Sea potentially of interest for oil and gas development. The marine mammal surveys are supplemented by the deployment of acoustic recorders at two locations to record cetacean vocalizations. Another objective of the projects is to involve and transfer survey skills to local individuals, particularly Indigenous Labradoreans, whenever possible.

Effectiveness of Observers in Visually Detecting Dead Seabirds on Open Ocean (2010-21S). This field study assesses the accuracy of observers in evaluating seabird mortality from a vessel platform in the open ocean. To achieve this objective, simulated seabirds, equipped with satellite telemetry, will be released into an area of open ocean in advance of a survey vessel carrying observers. Since the number and location of the simulated seabirds will be known, the effectiveness of the observers can be evaluated. The outcome of this experiment will improve the models used by the Canadian Wildlife Service to help evaluate seabird mortality from hydrocarbon spills.

Data Display and Source Apportionment of Volatile Organic Compounds and Particulate Matter on Sable Island, Nova Scotia, Canada (2011-05S). This study measures airborne volatile organic carbons and particulate matter through sensors placed on Sable Island. The experimental design will permit researchers to determine the proportion of these air contaminants that originates from nearby gas production installations versus marine traffic sources versus natural sources.

The ESRF has sponsored and published over 200 studies on oil and gas exploration and development on frontier lands, including such topics as:

- *environmental effects on fish, bird and animal habits and habitats;*
- *iceberg detection and flow patterns*
- *oil spill prevention and countermeasures;*
- *dispersant effectiveness in cold waters and ice;*
- *social and economic issues*
- *improving accuracy of ocean and weather forecasting; and*
- *verification of codes and standards.*

All study publications are available at www.esrfunds.org

Development, Validation and Implementation of an Operational Ocean Forecasting System for the Grand Banks and Orphan Basin for Daily Operational Delivery at the Canadian Meteorological Centre (2013-03S). Accurate forecasting of oceanographic and weather conditions to support routine offshore oil and gas operations and emergency response operations is essential. This project will provide a significant enhancement in the resolution and hence, the accuracy of ocean forecasting services provided through Environment Canada over a large part of the Newfoundland and Labrador Offshore Area and northern parts of the Nova Scotia Offshore Area. The project will provide improved forecast data for input into oil spill modelling and iceberg drift scenarios and modelling through the Canadian Meteorological Center. Additionally, research and development is occurring to benchmark the ocean forecast system performance in real time with oceanographic observations that are made available.

Assessment of the Potential Risks of Seismic Surveys to Affect Snow Crab Resources (2014-01S). The snow crab fishery is one of the highest landed value fisheries in the Newfoundland and Labrador region. Fishers have expressed concern over the potential for reduction in catch of snow crab in proximity to active seismic survey operations. This study aims to investigate potential effects of seismic exploration activity on commercial snow crab catch rate using scientific measures of changes in crab behaviour (i.e. movement), commercial catchability, and physiological effects in response to seismic air gun operations.

Acoustic Modeling and Monitoring on Canada's East Coast (2014-02S). This study will record the natural soundscape on Canada East Coast and study seismic sound propagation. It will create new knowledge on the natural soundscape in the region, generate accurate models of the effects of seismic surveys, and validate particle motion models for seismic airguns.

Assessing the Quality of Marine Mammal Detections using Three Complementary Methods (2014-03S). Monitoring for marine mammals is a required mitigation measure during the performance of marine seismic surveys in Canada. Routinely, sound energy emissions from seismic survey air gun arrays are halted when marine mammals and/or species at risk move within 500 meters of an array. Efficient and accurate observations of marine mammals are important in this context. This project will evaluate the comparative effectiveness and efficiency of three different methods of detecting marine mammals in the field.

Investigation of effects of East Coast Canada Water Accommodated Fraction and Chemically Enhanced Water Accommodated Fraction on Early Life Stages of Commercially Harvested Marine Species (2014-04S). The potential effects of exposure of commercial fish species to a crude oil spill and any dispersants used to mitigate the effects of such a spill are a concern. This study examines the toxicology of those fractions of a representative east coast crude oil that are entrained in water, both naturally and as a result of dispersant use, to the early life stages of Atlantic herring, Atlantic cod, American lobster and Northern shrimp

NORTHERN REGIONS

Quantitative Assessment of the Interaction between Beaufort Sea Crude Oils and Mackenzie River Delta Suspended Sediments (2013-06N). Extensive bench-scale testing will be conducted on oil-sediment interaction at low temperatures with and without chemical dispersants, using selected

crude oils from the Beaufort Sea and Norman Wells and selected sediment samples from the Mackenzie River Delta and Norman Wells.

Experimental Spill to Research Spill Treating Agent Use in the Beaufort Sea: Preparation of Detailed Experimental Plan (2014-01N). There has been a renewed effort to develop and improve countermeasures techniques that deal with some of the unique aspects of Arctic spill response. Spills in pack ice conditions have long been a difficult problem for spill responders. In particular, the remoteness of potential spill locations means that storing, transferring, and disposing of collected materials present a significant logistical challenge. As well, the presence of ice can greatly complicate the ability to collect and concentrate oil using containment booms for skimming. This project will develop three detailed experimental plans that include large-scale field tests to study the effectiveness and operational issues of three promising marine spill responses.

Integrated Beaufort Observatory (2014-02N). This study will establish a regional ocean, sea ice and atmosphere observing system in the Canadian Beaufort Sea called the integrated Beaufort Observatory (iBO). The project will use a series of integrated state-of-the-art environmental technologies deployed on ocean moorings in the Beaufort Sea to enable systematic observation of the marine environment including ice and ocean conditions. Ultimately, this information will enhance the numerical models required for planning and review of offshore activities throughout the region.

See Annex 5 for abstracts of projects completed in 2015-2016.

Financial Statements

STATEMENT OF FINANCIAL POSITION

The ESRF Management Board is responsible for the presentation of the annual financial statements to the Ministers of Natural Resources and Indigenous and Northern Affairs pursuant to the Canada Petroleum Resources Act.

Levies are collected from oil and gas companies that hold licenses for exploration and development in Canada's frontier lands. In accordance with the *Canada Petroleum Resources Act,* when a license is issued during the course of the year, levies are collected for the current year and the two years prior. The collection of unpaid levies is pursued on an ongoing basis by the ESRF Secretariat.

Over the past fifteen months, the ESRF Management Board has transitioned from a calendar year to a fiscal year, in order to align with the Government of Canada planning and reporting cycle. The new fiscal year cycle now begins on April 1 and runs to March 31 of the following year. Table 1 below shows the fiscal information for the three month transition period, while Table 2 provides the annual expenditures for ESRF in the 2015 fiscal year. All expenses are paid out of the fiscal year in which they are invoiced.

The total study expenditures for the ESRF over the full 15 month period amounted to $5,630,934. Administration costs for this period amounted to $433,180. Revenues were $3,981,100, with $494,977 remaining in outstanding levies across both the North and the South as of March 31, 2016 (refer to Table 3 for details).

Table 1 – ESRF Expenditures January 1, 2015 to March 31, 2015 (in dollars)

REGION	OPENING CASH BALANCE JANUARY 1, 2015 ($)	TOTAL REVENUE, LEVIES & RETURNS ($)	ADMINISTRATION COSTS ($)	STUDY PROGRAM COSTS ($)	CLOSING BALANCE MARCH 31, 2015 ($)
SOUTH REGION	4,385,446	25,648	51,317	825,274	3,534,503
NORTH REGION	2,054,160	-	38,460	693,109	1,322,591
TOTAL	6,439,606	25,648	89,778	1,518,382	4,857,094

Table 2 – ESRF Expenditures April 1, 2015 to March 31, 2016 (in dollars)

REGION	OPENING CASH BALANCE APRIL 1, 2015 ($)	TOTAL REVENUE, LEVIES & RETURNS ($)	ADMINISTRATION COSTS ($)	STUDY PROGRAM COSTS ($)	CLOSING BALANCE MARCH 31, 2016 ($)
SOUTH REGION	3,534,503	3,398,930	195,064	3,450,131	3,288,238
NORTH REGION	1,322,591	556,528	148,337	662,420	1,068,361
TOTAL	4,857,096	3,955,457	343,402	4,112,551	4,356,600

NOTE: The Public Accounts of Canada show a closing balance of $3,246,813 in the Southern Region and $1,109,787 in the Northern Region at the end of the 2015-16 fiscal year. Given accounting processes at year end, the equal distribution of Administration Costs between the regional accounts is not possible until the new fiscal year. The Administration Costs in this table account for the redistribution of $41,425 in funds between the accounts.

Table 3 – ESRF Regional sub accounts – Levy income 2015-16 (in dollars)

	REGION	LEVY RATE Levy #27 2015-2016 ($/Hectare)	REVENUES Levy #27 2015-2016 ($)	REVENUES Back Levies ($)	TOTAL LEVY INCOME ($)
1	Queen Charlottes North	0	-	-	
2	Hecate Strait	0	-	-	
3	Queen Charlottes South	0	-	-	
4	Vancouver Island	0	-	-	
5	Labrador North	0.1981	1,439	-	1,439
6	Labrador Central	0.3110	4,720	-	4,720
7	Labrador South	0.3110	1,754	25,648	27,402
8	Northeast Newfoundland	0.4323	-	-	-
9	Newfoundland Slope	0.4323	532,336	704,617	1,236,953
10	Grand Banks North	0.4323	381,025	-	381,025
11	Grand Banks South	0.4323	619,378	-	619,378
12	Scotian Shelf East	0.8360	291,798	-	291,798
13	Scotian Shelf West	0.3113	11,712	-	11,712
14	Scotian Slope	0.1981	678,856	110,043	788,899
15	Gulf of St. Lawrence	0.3113	61,247[1]	-	61,247
16	Hudson Bay	0	-	-	-
	Total South		**$2,584,265**	**$840,308**	**$3,424,573**
17	Beaufort South	0.3586	124,286[2]	-	124,286
18	Beaufort North	0.3586	431,886[3]	-	431,886
19	Western Archipelago-Offshore	0	-	-	-
20	Central Archipelago-Offshore	0	-	-	-
21	Eastern Archipelago-Offshore	0	-	-	-
22	Baffin Bay	0	-	-	-
23	Yukon North	0	-	-	-
24	Yukon South	0	-	-	-
25	Mackenzie Delta	0.3586	355	-	355
26	Mackenzie North	0	-	-	-
27	Mackenzie Central	0	-	-	-
28	Mackenzie South	0	-	-	-
29	Western Archipelago-Onshore	0	-	-	-
30	Central Archipelago-Onshore	0	-	-	-
31	Eastern Archipelago-Onshore	0	-	-	-
	Total North		**$556,527**	**-**	**$556,527**
	TOTAL				**$3,981,100**

1 A levy of $145,222 remains outstanding in this region as of May 31, 2016.
2 A levy of $136,434 remains outstanding in this region as of May 31, 2016.
3 A levy of $213,321 remains outstanding in this region as of May 31, 2016.

Annex 1: ESRF Regions

ESRF Southern Regions (Natural Resources Canada)

Region 1: Queen Charlottes North

Region 2: Hecate Strait

Region 3: Queen Charlottes South

Region 4: Vancouver Island

Region 5: Labrador North

Region 6: Labrador Central

Region 7: Labrador South

Region 8: Northeast Newfoundland

Region 9: Newfoundland Slope

Region 9: Newfoundland Slope

Region 10: Grand Banks North

Region 11: Grand Banks South

Region 12: Scotian Shelf East

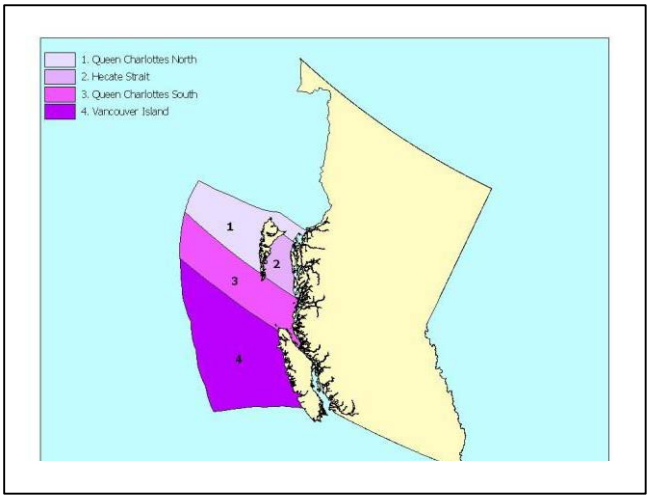
Region 13: Scotian Shelf West

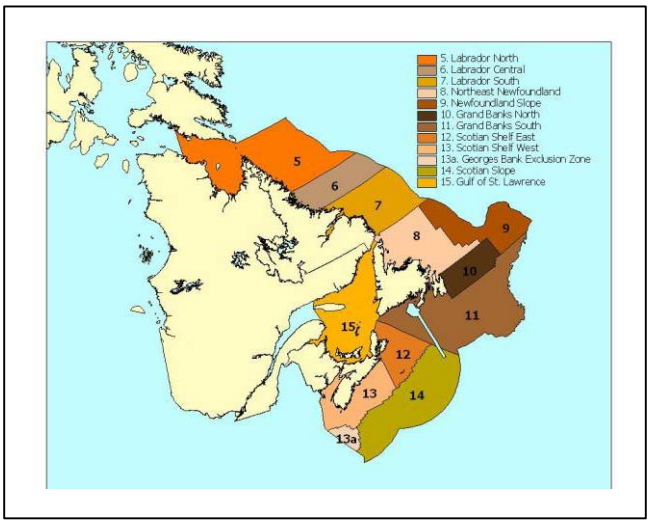
Region 13a): Georges Bank Exclusion Zone

Region 14: Scotian Slope

Region 15: Gulf of St. Lawrence

Region 16: Hudson Bay





ESRF Northern Regions (Indigenous and Northern Affairs Canada)

Region 17: Beaufort South

Region 18: Beaufort North

Region 19: Western Archipelago — Offshore

Region 20: Central Archipelago — Offshore

Region 21: Eastern Archipelago — Offshore

Region 22: Baffin Bay

Region 23: Yukon North

Region 24: Yukon South

Region 25: Mackenzie Delta

Region 26: Mackenzie North

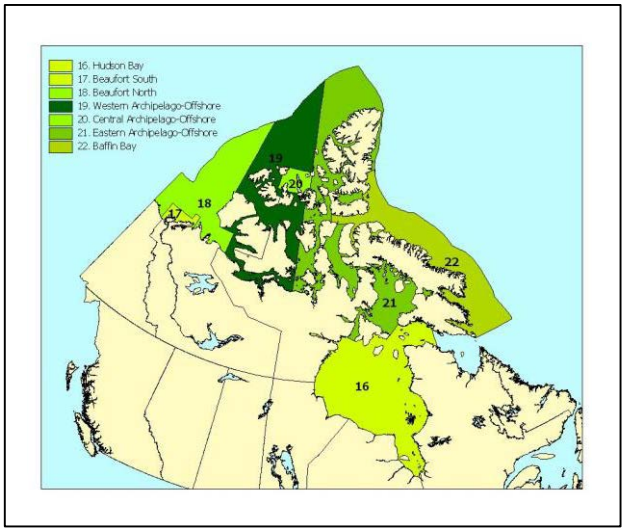
Region 27: Mackenzie Central

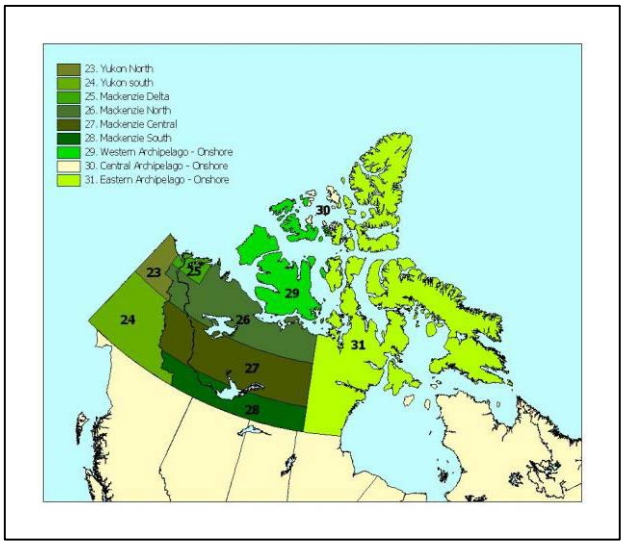
Region 28: Mackenzie South

Region 29: Western Archipelago — Onshore

Region 30: Central Archipelago — Onshore

Region 31: Eastern Archipelago — Onshore





Annex 2: Complete description of the ESRF Research Priority Areas for the 2015-2018 cycle

Northern Research Priority Areas

1. Research Priority Area #1: Spill Preparedness and Response, Fate and Effects

Summary: Studies will build on knowledge of the fate and effects of accidental releases of petroleum hydrocarbons and other hazardous substances in the Arctic marine environment and would be directed at the improvement of responses to such accidental releases.

Targeted Area: Eligible spill research areas include, but are not limited to, the biophysical, socio-economic, impact and assessment aspects of spills in the following categories:

- In-situ Burning;
- Dispersants;
- Mechanical Recovery;
- Shorelines;
- Spill Modelling; and,
- Detection and Monitoring.

Details regarding each of the eligible research areas can be found in the following report prepared by C-CORE for the ESRF Management Board. This report is on the ESRF website: http://www.esrfunds.org/pdf/194.pdf - C-CORE (2013) Strategic Plan for Oil Spill Research in Canadian Arctic Waters, C-CORE Report R-13-108-1018, Revision 3.1.

Description: The risk of accidental releases of petroleum hydrocarbons and other hazardous substances into the Arctic marine environment has increased with the growing interest in the development of offshore petroleum operations in the Canadian Arctic. Hydrocarbon exploration is or might be taking place in both the near and offshore waters of the Beaufort Sea. In terms of oil spill response, the Arctic presents unique challenges, including the remote locations of potential spill sites, cold temperatures and limited availability of first-response personnel. Most of the research data on oil fate, effects and spill response in the Arctic have been derived from laboratory studies and field trials conducted in the 1970-1980's, with the exception of the recent Joint Industry Project effort by SINTEF in Norway (completed in 2009). The consensus of the international scientific community is that field trials are essential to advance the development of oil spill countermeasures for use in the Arctic. Unless methodologies can be validated in the field, they may not be fully accepted by regulators, Indigenous communities and the public as operational tools. Research in this priority area will focus on filling gaps in current spill countermeasures knowledge that will contribute to the production of effective environmental protection through the improvement of operational guidelines and best practices.

Studies should demonstrate benefit to stakeholders in areas where offshore petroleum operations are either ongoing or expected in the foreseeable future. In the North, offshore petroleum operations are anticipated in the foreseeable future only in the Beaufort Sea, encompassed by ESRF regions 17 and 18.

Exclusions: Research proposed exclusively for onshore areas.

2. Research Priority Area #2: Regional Effects Assessment and Management

Summary: Studies will focus on environmental and socio-economic studies that will build a knowledge base that extends to a regional scale, beyond single oil and gas lease blocks or operations. The information gathered by these studies is intended for use by all interested stakeholders in preparing and reviewing applications for oil and gas activities on Canada's northern frontier lands.

Targeted Area: Eligible research areas include:

- Biophysical studies;
- Socio-economic studies;
- Traditional knowledge studies; and,
- Studies contributing to the assessment and management of cumulative effects.

Description: Studies building on other regional research programs may be of particular interest including areas around offshore fish and bird populations and habitats, maintenance of long-term oceanographic observatories, and remote sensing, monitoring and modelling of sea ice.

Studies should demonstrate benefit to stakeholders in areas where petroleum operations are either ongoing or expected in the foreseeable future. In the North, offshore petroleum operations are anticipated in the foreseeable future only in the Beaufort Sea, encompassed by ESRF regions 17 and 18.

Exclusions: Research proposed exclusively for onshore areas.

Southern Research Priority Areas

3. Research Priority Area #3: Seismic

Summary: Studies will build on knowledge of the effects of the sound energy released to the marine environment during marine seismic surveys and be directed particularly at improving the understanding of the nature of seismic sound energy and its effects on commercial fish and invertebrate species as well as marine mammals and/or species at risk.

Targeted Area: Eligible research areas include but are not limited to:
understanding the "natural" underwater sound environment in the absence of sound energy arising from seismic survey operations; measuring the particle motion and sound pressure levels experienced by organisms at specified distances from seismic survey operations; modelling the propagation of sound energy from marine seismic surveys and the in-field verification of those model predictions documenting commercial fish and invertebrate behaviour in response to marine seismic survey sound energy in the field; documenting the effects of marine seismic survey sound energy on commercial fish and invertebrate physiology and gene expression associated with behavioural responses in the field; understanding of the quality (i.e., accuracy, data resolution) of the observations made by marine mammal observers and/or passive acoustic monitoring techniques; best practice for training and qualifying observers and passive acoustic monitoring operators.

Description: The effects of the sound energy released into the water column from the routine operation of airgun arrays used in marine seismic surveys on fish and invertebrate behaviour and, potentially, commercial harvesting of these species, are not fully understood.

There have been some attempts to study this issue in the field and the laboratory over the last twenty years but there is no consensus on the nature and/or significance of the effects observed. In recent years, workshops and conferences, some sponsored by the ESRF, have attempted to come to terms

with this issue. These efforts were driven in no small measure by the concern for the socio-economic effects of seismic surveys on fish harvesters. Without an understanding of the behavioural effects of the sound energy, including particle motion, resulting from marine seismic surveys' air gun arrays, the effects on marine species and their behaviour, and consequently on harvesting these species, is difficult to assess.

For the purposes of focussing this research priority area, the commercial fish species of greatest interest are Northern Shrimp, Snow Crab and Atlantic Cod.

Exclusions: Laboratory scale studies, unless as part of a field study.

4. Research Priority Area #4: Oil and Gas Liquids Spill Fate and Effects

Summary: Studies will build on existing knowledge of the fate and effects of accidental releases of petroleum hydrocarbons in the Newfoundland- Labrador and Nova Scotia Offshore Areas.

Targeted Area: Eligible research areas include, but are not limited to:
water column and benthic fate and effects of crude oil or natural gas liquids that may or may not have been treated with dispersants; surface and water column detection and monitoring of dispersed and non-dispersed crude oil or natural gas liquids; taint, toxicology and persistence of dispersed and non-dispersed crude oil or natural gas liquids in commercially harvested fish and invertebrate species; toxicology and persistence of dispersed and non-dispersed crude oil or natural gas liquids in seabirds; toxicology and persistence of dispersed and non-dispersed crude oil or natural gas liquids to benthic, zooplankton and/or phytoplankton species; modelling the fate and behaviour of dispersed and non-dispersed crude oil or natural gas liquids in deep water environments; socio-economic effects of a major spill event on the fisheries sector, particularly, the impact of markets refusing to purchase commercially harvested fish species and how those effects might be mitigated.

Description: This priority area is directed at improving the understanding of the effects of such releases on marine species, ecosystems and commercial fisheries.

Research proposed in response to this call should take into account recent research undertaken by the ESRF (e.g. ongoing studies that address: biodegradation rates for dispersed and non-dispersed crude oil and gas liquids and oceanography of the Flemish Pass) and findings and lessons learned arising from international research efforts, e.g., research on the Macondo Spill. Project proponents should also take in to account the trend to exploration in continental shelf break and deep-water areas of Canada's East Coast.

Exclusions:

- Laboratory scale, unless specifically linked to field studies or large scale experiments in wave tanks.
- Research designed and focussed exclusively on shorelines.
- Mechanical countermeasures and in-situ burning.

Annex 3: Study Selection Process

ESRF funding can be provided solely to legal entities validly incorporated or registered in Canada, including companies, industry associations, research associations, standards organizations, Indigenous and community groups, academic institutions as well as federal, provincial, territorial and municipal governments and their departments and agencies. These organisations are invited to participate in the ESRF study selection process.

The study selection process has three distinct phases:

- Letters of Interest
- Full proposals
- Funding Agreements (or Memoranda of Understanding)

The selection process is launched with the ESRF Call for Letters of Interest (LOI). The received letters are reviewed by technical review committees and the ESRF Management Board members. The ESRF Management Board decides which proponents should be invited to submit full proposals.

Proponents who were successful in having their Letter of Interest selected are invited to submit a full proposal, presenting a detailed version of their proposed research study. The received full proposals are reviewed, similarly to Letters of Interest, by technical review committees and the ESRF Management Board members.

The ESRF Management Board decides which full proposal proponents should be invited to negotiate a Funding Agreement or, if the proponent is a federal, provincial or municipal government organization, a Memorandum of Understanding.

Selection Criteria

The LOI and proposals that meet basic requirements regarding eligibility and completeness of information will be reviewed by a committee of technical experts mandated by the ESRF Management Board. These Technical Review Committees use the criteria provided in the LOI and full proposal Applicants' Guides to evaluate:

- the significance of the potential impact of the study being proposed; and,
- the probability that the study achieves its stated objective.

In addition to the above, the ESRF Management Board may consider other criteria, such as regional balance, in the final project selection. Any such criteria will be applied equitably to all Project Proposals reviewed.

Commitment to fairness and transparency

The ESRF Management Board and Natural Resources Canada are committed to manage the selection process for the ESRF studies fairly and transparently. All assessments and decisions will be done in accordance with this commitment. No specific guidance or advice on preparing a LOI or full project proposal will be provided to any of the proponents. No meetings on the ESRF call for LOIs or call for full project proposals will be held between any applicant and anyone involved

with the project selection process. Further, to avoid the risk of real, perceived or potential conflict of interest, members of expert technical committees who have a vested interest as a potential participant in a particular project will be required to sign a declaration regarding their interest in the project and will not be allowed to participate in the assessment of that project.

Annex 4: Published Reports

All ESRF studies are subject to a scientific/technical peer review. Reports that are deemed to be scientifically or technically significant are published in the ESRF Technical Report Series. Since its inception in 1983, the ESRF has published over 200 reports and related studies.

All reports and studies are available to download for free on the ESRF website: http://www.esrfunds.org/pubpub_e.php

Publications are listed under the following categories:

- Bibliographies
- Environmental Effects and Monitoring
- Environmental Loading and Design
- Frontier Social and Economic Issues
- Ice-Icebergs-Ice Detection
- Oil Spill Research and Countermeasures
- Sea Bottom Ice Scour
- Sediment Transport
- Waves

Annex 5: Abstracts of Completed Studies 2015 - 2016

SOUTHERN REGIONS

Biodegradation of Chemically Dispersed and Non-Chemically Dispersed Oil (2012-01S). Biodegradation of Chemically Dispersed and Non-Chemically Dispersed Condensate (2013-02S). The biodegradation of crude oils and gas condensate off eastern Canada in the event of a spill could be an important natural component of an area risk assessment and a spill response strategy. The purpose of this study was to evaluate the natural attenuation potential for hydrocarbons in near surface seawater from eastern Canada in the areas of crude oil and natural gas production facilities. Seawater samples, collected in the summer and winter to evaluate possible seasonal variations, were subjected to a variety of microbiological, chemical and genomic analyses, to determine hydrocarbon degradation rates, the microbial populations performing the degradation and the activities involved, and the impact of dispersants on the degradation rates.

Overall the results demonstrate that the indigenous microbial populations in the marine environment in the areas of the Hibernia, Terra Nova and Thebaud facilities possess hydrocarbon-degrading bacteria that respond positively to exposure to oil under ambient temperature conditions in the summer (13°C) and winter (6-7°C). Their population densities are typically quite low to non-detectable prior to oil exposure, but they did become dominant components of the total bacterial population when oil was present. This is possibly not entirely surprising, since some members of these bacterial groups are known obligate hydrocarbon degraders, meaning that the only substrates they can use are hydrocarbons. Under conditions where the substrates are not present these bacteria undergo modifications to conserve energy, such as dormancy. Under appropriate conditions when substrate is present and other conditions are favourable, they respond rapidly. The exposure to oil resulted in increased numbers and activity of known degrader genera of bacteria in addition to the increased expression of their hydrocarbon degradation genes. Crude oil and gas condensate were rapidly degraded under summer conditions, but more slowly under winter conditions, with the alkane fraction being the most rapidly degraded. The presence of dispersant did have a positive impact on the degradation kinetics for the alkane fraction, and especially in the winter. There were some indications that dispersant had a slight negative impact on hydrocarbon degradation but this appeared to affect primarily the aromatic substrates, and was not consistently observed throughout the study. Of importance to note, dispersant did not have a negative impact on alkane degradation in the summer or winter at any of the study sites.

ESRF report 201: National Research Council Canada and Fisheries and Oceans Canada - Centre for Offshore Oil, Gas and Energy Research. Biodegradation of Naturally and Chemically Dispersed Crude Oils and Scotian Shelf Condensate from Atlantic Canada. October 2015. 109 p.

Characterization of Ocean Currents, Variability and Dispersion in the Vicinity of Sackville Spur (2013-01S). The Grand Banks of Newfoundland and Flemish Cap are separated by the Flemish Pass which reaches depth of 1200 m. The northern approach to the pass is the site of the prominent Sackville Spur sediment drift that is currently an area of significant offshore hydrocarbon exploration. This report presents a summary of oceanographic data collected during

a field program carried out in 2013-14 with funding from the Environmental Studies Research Fund. The primary objective of this research project is to provide an improved understanding of ocean currents, variability and dispersion in the vicinity of Sackville Spur as well as to characterize some of the benthic habitat for assessment of vulnerable marine ecosystems. The data collected include shipboard CTD, lowered ADCP, vessel-mounted ADCP and water samples during two cruises in July 2013 and 2014. Moorings were deployed at three locations for that duration between the cruises and successfully collected CTD and current meter data. The oceanographic data have been made available for industry, research and public access through the DFO Ocean Data and Information Section at the Bedford Institute of Oceanography. These data were used to develop particle trajectory simulations using high-resolution computer model results for the region which demonstrate strong seasonality in the flow field in the area of Sackville Spur even at depths near the ocean bottom. In addition, benthic imagery and grabs were collected on the 2013 cruise to characterize coral and sponge species present in the region of Sackville Spur and provide samples for experimental lab cultures of these organisms.

ESRF report 202: Greenan, B.J.W, D. Hebert, D. Cardoso, E.L. Kenchington, L. Beazley and A. van der Baaren. Ocean Currents and Benthic Habitat in the Sackville Spur Region. February 2016. 144 p.

NORTHERN REGIONS

The Uniqueness of Fishes and Habitat Utilization in Oil and Gas Lease Blocks Relative to Non-Lease Areas in the Canadian Beaufort Sea (2012-04N). This project was developed as a multi-stakeholder initiative aimed to address information gaps for deep-water fish communities relevant to the regulatory review, assessment, and management of offshore oil and gas exploration and development in the Canadian Beaufort Sea. The project provides important basic knowledge as to what species are present, habitat parameters, and ecological linkages (e.g. food web connections), which together allow for an understanding of ecosystem structure and function. Prior to this project, only 70 fish species were known to occur in the region, most of which were found on the Canadian Beaufort Shelf, whereas offshore fish habitats remained virtually unstudied. The basic design of the survey was onshore to offshore transects with stations situated at key depths in order to sample shelf (40-200 m), upper-slope (200-500 m), and lower-slope (500+ m) habitats. A total of 184 stations were sampled from 2012-2014. Sixteen tentative new marine fish species (12 pending expert taxonomic verification) were recorded for the Canadian Beaufort Sea during the Beaufort Sea Marine Fishes project. Benthic and mid-water trawling confirmed that there was low water column diversity and relatively high bottom diversity in marine fishes. Sampling of marine fishes in waters deeper than 200 m, coupled with information on water properties and different components of the food web, allowed us to determine that fish communities in the Canadian Beaufort Sea differ by habitat and by area. Ultimately, by increasing our knowledge of the fishes and their relationships to other important organisms harvested by Inuvialuit within this critical Arctic marine ecosystem, results from this project provide a benchmark from which environmental stressors and anticipated effects of climate change may be assessed.

ESRF report 203: Majewski, A.R., K.D. Suchy, S.P. Atchison, J. Henry, S.A. MacPhee, W. Walkusz, J. Eert, M. Dempsey, A. Niemi, L. de Montety, M. Geoffroy, C. Giraldo, C. Michel, P. Archambault, W.J. Williams, L. Fortier and J.D. Reist. Uniqueness of Fishes and Habitat Utilization in Oil & Gas Lease Blocks Relative to Non-Lease Areas in the Canadian Beaufort Sea. February 2016. 99 p.

Timing of Beluga Entry Relative to Ice Break-Up in the Mackenzie Estuary During Late Spring (2013-05N). To enhance knowledge of beluga spring habitat use in the Mackenzie Estuary, Beaufort Sea Shelf area, this ESRF project collected recent data on beluga location in relation to sea ice break-up and integrated historical beluga surveys into a digital format for comparisons. The objectives of this project were to: (1) provide an updated dataset on the spring arrival of beluga whales into the Mackenzie Estuary in relation to sea ice, (2) digitize historical surveys so they are available for comparisons with current aerial surveys so changes in beluga arrivals can be assessed as they relate to sea ice break-up and the start of beluga harvest in the region, and (3) involve local Inuvialuit students and community members in the data collection.

Prior to this project, the last beluga aerial survey was completed in 1992 (Harwood & Norton 1996). Spring aerial surveys were flown in 2012-2013 to provide updated information on the location and arrival timing of belugas. Historical surveys occurring in the 1970s and 1980s, were integrated into digital formats and made accessible for future use (https://polardata.ca; http://beaufortseapartnership.ca). This project has made decades of beluga aerial surveys available for continuing research. Community participation and feedback was an integral component to the data collection and presentation of results. While community members were active participants during all three years of data collection, during the last year methods were developed to provide the communities with near real-time data accessible via the internet. The new data collection methods combined with the positive response by the communities will allow future researchers to employ these methods to make data available to communities in a timely manner.

This report details the survey methodology and results of surfaced belugas and other marine mammals, as observed during eight days of aerial surveys in June of 2012 and 2013. In addition, it provides an overview on community involvement and methods for providing faster turnaround times on data back to the communities and HTCs (Hunters and Trappers Committees). Further analysis and interpretation of these results will enhance and update our understanding of beluga arrival patterns, and how spring distribution may be impacted by changing sea ice conditions and climate. Results will assist regulators, managers and Inuvialuit in protecting critical habitats, ensuring continued subsistence harvesting and advance our understanding of beluga habitat use.

ESRF report 199: Hoover, C., C. Hornby, M. Ouellette, V. Torontow, K. Hynes and L. Loseto. Arrival and distribution of beluga whales (Delphinapterus leucas) along the Mackenzie Shelf: Report on the spring aerial surveys. January 2016. 38 p.

A Road Map for Planning Controlled Oil-Spill Countermeasures Research in the Canadian Beaufort Sea (2013-09N). The Roadmap for Planning Controlled Oil Spill Counter Measures Research in the Canadian Beaufort Sea (the Roadmap) is intended to provide support and guidance to assist researchers “through the long and complicated process of obtaining all of the necessary approvals and permits required to conduct controlled oil spill countermeasures research in Arctic waters”. As there is limited field knowledge on oil spill fate and effects or

efficient response measures in the Canadian Arctic, it has been suggested that countermeasures should be developed by conducting controlled oil spill field trials in Arctic waters. Such an applied research project can only be conducted after detailed planning, comprehensive consultations and obtaining the necessary approvals from the regulators at federal and territorial levels, as well as co-management boards and land claim organizations with authority under the Inuvialuit Final Agreement (IFA) and potentially the Umbrella Final Agreement in the Yukon.

The Roadmap describes consultation, Environmental Assessment (EA), and permit requirements for oil spill countermeasures research in the Canadian Beaufort Sea and adjacent onshore areas within the Northwest Territories (NWT) and Yukon portions of the Inuvialuit Settlement Region (ISR) only. Requirements of organizations or agencies of neighbouring jurisdictions (e.g., Nunavut or Alaska) should also be considered when applying for permits and authorizations for potential future oil spill countermeasures research. Following extensive laboratory and test tank studies in the 1970s and 1980s, research into oil spill counter measures occurred in the Canadian and Alaskan portions of the Beaufort Sea which included the behaviour of oil in ice, the effectiveness of dispersant use, in-situ burning and the effectiveness of several skimmers. Renewed interest in oil exploration in the Canadian Beaufort Sea, as well as in Arctic areas in Russia, Norway, and the United States has led to a demand for further research. The seven research categories of potential future field trials in support of oil spill countermeasures research include: mechanical recovery; in-situ burning; dispersant use; shoreline clean-up techniques; modeling; detection and monitoring; and impact and assessment.

Based on these seven potential research categories, the Roadmap addresses the comprehensive consultation and permitting processes in separate chapters outlining the following requirements: northern community stakeholder consultation process; EA requirements; regulatory permit requirements; and safety, logistical and support requirements.

ESRF report 200: SL Ross Environmental Research Limited, IMG Golder Corporation Environmental Consulting and Golder Associates. Roadmap for Planning Controlled Oil Spill Countermeasures Research in the Canadian Beaufort Sea. June 2015. 158 p.

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