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Natural Resources Canada
House of Commons
Ottawa, Ontario
K1A 0A6

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Indian Affairs and Northern Development
House of Commons
Ottawa, Ontario
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Dear Ministers:

On behalf of the Environmental Studies Research Funds Management Board, it is my pleasure to submit the 2003 Annual Report for the Environmental Studies Research Funds in accordance with the *Canada Petroleum Resources Act*, paragraph 79(1)d.

Sincerely yours,

Bonnie J. Gray
Chair
Environmental Studies Research Funds
Management Board

ENVIRONMENTAL STUDIES RESEARCH FUNDS

ANNUAL REPORT

2003

FEBRUARY 2004

Environmental Studies Research Funds Profile

The Environmental Studies Research Funds (ESRF) sponsor environmental and social studies designed to assist government decision-making related to oil and gas exploration and development on Canada's frontier lands. The ESRF program, initiated in 1983 under the *Canada Oil and Gas Act* (COGA), now receives its legislated mandate through the superseding legislation, the *Canada Petroleum Resources Act* (CPRA) proclaimed in February 1987. Funding for the ESRF is provided by industry through levies on exploration and production properties on frontier lands. The ESRF is directed by a joint government / industry / public Management Board and is administered by a secretariat which resides within the National Energy Board in Calgary, Alberta.

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Background on the Structure and Operation of the Funds

The Environmental Studies Research Funds (ESRF) finance environmental and social studies pertaining to the manner in which, and the terms and conditions under which, petroleum exploration, development and production activities on frontier lands should be conducted. Section 101(1) of the *Canada Petroleum Resources Act (CPRA)* defines an environmental study as “A work pertaining to the measurement or statistical evaluation of the physical, chemical, and biological elements of the lands, oceans, or coastal zones, including winds, waves, tides, currents, precipitation, ice cover and movement, icebergs, pollution effects, flora and fauna, both onshore and offshore, human activity and habitation, and any related matter.”

The Environmental Studies Research Funds (ESRF) are directed by a twelve-member Management Board which has representation from the federal government, the regional petroleum boards, the oil and gas industry, and the general public. Bonnie J. Gray, Professional Leader, Environment of the National Energy Board, is the current chairperson of the ESRF Management Board.

The ESRF Management Board directs the business of the ESRF, sets priorities for study topics, determines the program budget, and facilitates the development of study proposals on behalf of the Minister of Natural Resources Canada and the Minister of Indian Affairs and Northern Development.

The program operates on a calendar year basis. The Board generally meets quarterly; however, the frequency of meetings is adjusted as circumstances dictate. The Board assesses the information requirements of government and industry to determine priorities for the study program for the coming year. The budget to support the study program and its administration forms the basis for the calculation of the levy rate schedule. The budget and levy rates are submitted to the Ministers for approval by November 1 of each year. The projects under the study program are initiated following the collection of the levies that generally occurs in the first quarter of the calendar year.

Activities in 2003

The ESRF undertook an ambitious program of activity for 2003. The ESRF Management Board met four times during the year. A number of new studies were approved for 2003 with a total value of \$700,000. As well, six studies continued in 2003 with a budget of \$640,000 for the year. The 2003 ESRF operations budget of \$217,500 supported the management of the ongoing study program and provided administrative support to the ESRF Management Board.

Funding for the 2003 studies and administration program was raised through Levy #15 (refer to Table 1). Levy #15 invoiced in total \$1,569,590 which covered the new study program, the administration budget, and the continued funding of ongoing studies. The collection of unpaid levies is being pursued by the Management Board.

TABLE 1
ESRF LEVY #15

REGION	LEVY #15 \$/hect 2003	TOTAL LEVIES INVOICED 2003	TOTAL LEVIES COLLECTED 2003	BACK LEVIES COLLECTED 2003	TOTAL REVENUES COLLECTED 2003
1 Queen Charlottes North	\$0.0000				
2 Hecate Strait	\$0.0000				
3 Queen Charlottes South	\$0.0000				
4 Vancouver Island	\$0.0000				
5 Labrador North	\$0.0000				
6 Labrador Central	\$0.0000				
7 Labrador South	\$0.0000				
8 Northeast Newfoundland	\$0.0785	\$5,432.20	\$5,432.20	\$2,773.00	\$8,205.20
9 Newfoundland Slope	\$0.0684	\$73,497.17	\$73,497.17	\$289,604.16	\$363,101.30
10 Grand Banks North	\$0.0822	\$84,907.75	\$79,050.92		\$79,050.92
11 Grand Banks South	\$0.1110	\$183,807.68	\$109,944.95		\$109,944.95
12 Scotian Shelf East	\$0.1468	\$240,169.20	\$147,913.77		\$147,913.77
13 Scotian Shelf West	\$0.1222	\$58,388.38	\$48,012.38		\$48,012.38
14 Scotian Shelf	\$0.0931	\$429,225.54	\$391,659.25		\$391,659.25
15 Gulf of St. Lawrence	\$0.0566	\$46,543.09	\$14,078.63		\$14,078.63
16 Hudson Bay	\$0.0000				
17 Beaufort South	\$0.2049	\$140,276.18	\$140,276.18		\$140,276.18
18 Beaufort North	\$0.0739	\$2,222.91	\$2,222.91		\$2,222.91
19 Western Archipelago-Offshore	\$0.0207	\$154.61	\$154.61		\$154.61
20 Central Archipelago-Offshore	\$0.0207	\$4,985.53	\$4,985.53		\$4,985.52
21 Eastern Archipelago-Offshore	\$0.0000				
22 Baffin Bay	\$0.0000				
23 Yukon North	\$0.0000				
24 Yukon South	\$0.0000				
25 Mackenzie Delta	\$0.2672	\$226,776.55	\$226,776.55		\$226,776.55
26 Mackenzie North	\$0.0781	\$80,282.35	\$73,783.18		\$73,783.18
27 Mackenzie Central	\$0.0577	\$35,479.21	\$33,505.64		\$33,505.64
28 Mackenzie South	\$0.0576	\$11,906.44	\$11,906.44		\$11,906.44
29 Western Archipelago-Onshore	\$0.0207	\$33.02	\$33.02		\$33.02
30 Central Archipelago-Onshore	\$0.0207	\$987.70	\$987.70		\$987.70
31 Eastern Archipelago-Onshore	\$0.0000				
TOTAL		\$1,625,075.51	\$1,364,221.03	\$292,377.16	\$1,656,598.19

2003 Study Program

The 2003 study program comprised continuing studies and a number of new studies. The following are brief descriptions of the projects' objectives.

Ongoing Studies

Effects of Seismic Exploration on the East Coast Fishery \$267,500

As a follow-on to an ESRF-sponsored workshop on seismic effects (ESRF Report #139), the ESRF Management Board awarded a contract LGL Limited, St. John's, NF, to determine the physiological and catch-related effects of seismic exploration activity on small and commercial-sized snow crab. This contract involved both an experimental phase and a field study. The draft final report was received.

Airshed Monitoring on Sable Island \$100,000

The ESRF Management Board assisted Environment Canada, Atlantic Region to monitor regional air quality, specifically, "contaminants of concern" which include oxides of nitrogen, volatile organic compounds, methane and oxides of sulfur. The monitoring will be valuable for validation of pollutant models, end point impact, pollutant concentration trends and exposures and will provide a basis for potential establishment of guidelines or regulations for air emissions on the Scotian Shelf. The equipment was installed on Sable Island in spring 2003, and Environment Canada will provide summary reports of the observations to the ESRF Management Board for the next 4 years.

Deep Water Benthic Community Study \$405,000

In the second year of a three-year study the ESRF Management Board provided funding to the Department of Fisheries and Oceans to analyse and interpret data on deepwater benthic communities (corals) collected by DFO during groundfish trawl surveys and video and photographic were also collected on research cruises at deepwater sites along the continental slope and in canyons of prime interest to the oil and gas industry. The final report is anticipated in April 2004.

Documentation of Iceberg Scouring and Degradation Processes Based on Recent Grounding Events \$160,000

The ESRF Management Board provided funding to the Geological Survey of Canada, Atlantic Region for this study which is intended to confirm the accuracy of design burial depths for sub-sea facilities in order to protect them from possible damage by grounding icebergs. The study will allow validation of ice scour models and allow subsequent monitoring of the processes and rates of biological recolonization and scour degradation. The report is expected in the second quarter of 2004.

Marine Bird and Mammal Monitoring Study \$60,000

A contract was awarded to Memorial University of Newfoundland to determine if using offshore supply vessels of opportunity could provide an effective and comprehensive program of year-round surveys for marine birds and mammals on the Grand Banks. The final report is expected in February 2004.

Sensitivity Mapping of Spawning and Nursery Areas on the Grand Banks \$55,000

The ESRF Management Board provided funding to the Department of Fisheries and Oceans (DFO) to support this study which identified the locations and timing of spawning and nursery areas on the Grand Banks that may be affected by seismic exploration activity. Maps were generated for a number of commercial finfish and shellfish species to show the locations and seasonality of spawning and nursery areas. The final report, to be published in the DFO Technical Report Series, provides the data sources, methodologies employed, summary meteorological data, and an atlas of all mapping products.

Atlas of Fish Spawning, Nursery and Larval Concentrations on the Scotia Shelf \$100,000

The ESRF Management Board provided funding to the Department of Fisheries and Oceans (DFO) to support a study to identify the locations and timing of spawning and nursery areas for commercial finfish and shellfish that may be affected by seismic exploration activity on the Scotian Shelf. The final report, to be published as a DFO Technical Report, will provide an atlas and a CD-ROM.

Effects of Pipelines/Gathering Lines on Snow Crab and Lobster \$80,000

This study was to determine and evaluate the issues related to the catchability of lobster and snow crab in the vicinity of gathering lines and pipelines. A contract was issued to Martec Limited for a literature review and a field study. An interim report was received by June 2003 and the initial promising results led the Management Board to extend contract funding by \$30,000 for 2004.

Assessment of Hearing Structures of Large Pelagic Species \$30,000

The ESRF Management Board will issue a contract for this study area in the first quarter of 2004. The main objective is to evaluate the potential sensitivity of the hearing structures of large pelagic fish species to sounds associated with seismic surveying, based solely upon the physical characteristics of those hearing structures.

Mackenzie Valley Research Gaps Study \$50,000

The ESRF Management Board provided a contribution to a study on research gaps in the Mackenzie Valley led by the Department of Indian and Northern Affairs in collaboration with the Government of the Northwest Territories. This project is similar, though broader in scope, to the

one recently completed for the Mackenzie Delta. The study identified gaps in existing information, traditional knowledge and research related to all aspects of the biophysical environment of the Mackenzie Valley and the potential effects of future hydrocarbon exploration, development and transportation on that environment (ESRF funding is applied to the exploration and development components). The final report summarized the findings and includes a draft action plan for dealing with the gaps identified.

Fish Deterrents – Mackenzie Delta \$100,000

The ESRF Management Board awarded a contract to Jasco Ltd. to evaluate the effectiveness of several fish deterrent devices on freshwater fish species of importance to residents in the Mackenzie Delta (for example, lake whitefish, northern pike, burbot, lake trout). The final report will be published in 2004.

Standardizing the Reporting of Emissions to Ambient Air from Atlantic Canadian Offshore Petroleum Activities \$30,000

The ESRF Management Board awarded a contract to Dillon Consulting to investigate existing requirements for reporting of air emissions in the Atlantic offshore and to provide recommendations for a standardized reporting framework. The study provided a qualitative understanding of air emissions from offshore oil and gas activity, and benchmarked existing reporting practices in Canada and other offshore regions. The final report was received in March 2003.

Environmental Effects Monitoring (EEM) for Exploratory Drilling \$40,000

The ESRF Management Board awarded a contract to LGL Limited to design a generic EEM program that could be used as a model for programs to measure the scale and or scope of environmental effects likely to be associated with exploratory drilling in typical eastern Canadian marine areas. The final report will be published in 2004.

Pollution Prevention Opportunities in the Offshore Oil and Gas Sector \$25,000

The ESRF Management Board awarded a contract to Dillon Consulting for this project. The latest draft of the revised Offshore Waste Treatment Guidelines (OWTG) requires operators of drilling and production installations offshore Canada to describe specific pollution prevention measures they intend to implement to reduce waste generation and discharge and to monitor and report on progress. Over time, the offshore oil and gas industry has developed methods and practices that have reduced the generation of waste, but those pollution prevention measures have not been compiled into a reference document for industry and regulatory use. This study documents pollution prevention practices relevant to the Canadian offshore oil and gas sector in a form that facilitates updating as practices evolve. The final report will be published in 2004.

Sheens Associated with Produced Water Effluents \$10,000

The ESRF Management Board awarded a contract to Erin Consulting Ltd. for this project. Oil sheens have been observed at offshore production platforms even when treatment systems were operating optimally to reduce oil in produced water to within regulatory compliance levels. This is a concern in the context of effects upon seabirds because of their sensitivity and vulnerability to oiling. This study will determine the factors that influence the formation of sheens as a result of discharging treated produced water at sea and identify effective prevention and mitigation actions. The final report was received in the first quarter of 2003.

Workshop on Approaches and Technologies for Offshore Oil and Gas Environmental Effects Monitoring (EEM) \$50,000

The ESRF Management Board contributed funding towards this workshop. This funding will be used to provide materials, equipment, contracted services, and internationally recognized keynote speakers to facilitate the workshop in May 2003. The workshop will focus on approaches and technologies for carrying out EEM in the offshore. The results and conclusions of the workshop will be compiled into two reports, which will provide information that will be used for the improvement of offshore oil and gas EEM programs and the identification of potential research priorities.

Studies for 2004

Effects of Produced Water Discharges \$50,000

The ESRF Management Board will soon issue an RFP for a study to review existing work in the area of long-term chronic and cumulative effects of produced waters from offshore oil and gas activities on the Scotian Shelf and Grand Banks. The study will also identify knowledge gaps and focus further work in the research area.

Effects of Drill Mud Discharges on Lobster and Crab \$50,000

An RFP will be issued for a study that will assess existing information to better define and focus future studies on the issue of the potential effects of the discharge of high volumes of water-based drill muds on lobsters will be issued in early 2004.

Data Collection Optimization \$50,000

An RFP for a study and a workshop to investigate the use and effectiveness of regional monitoring as opposed to installation-specific monitoring of physical environmental parameters that is currently undertaken by individual offshore operators .

Effect of Seismic on Snow Crab \$100,000

The ESRF Management Board is negotiating a Memorandum of Understanding with the Department of Fisheries and Oceans to facilitate the completion of research conducted on the effects of seismic exploration on Snow crab off Cape Breton, NS. The funding is to: complete the current analyses of data collected; retrieve the remaining caged crab from the study area in the spring of 2004; conduct analysis of the remaining crab; analyze the sound recordings collected during the experiment; and conduct a results workshop.

Effects of Seismic Energy on the Eggs of Selected Fishery Species \$250,000

The ESRF Management Board will soon issue an RFP for a study to identify the exposure levels at which acoustic energy from airguns and/or airgun arrays used in marine seismic surveying cause mortality, delayed development or both in snow crab and lobster eggs. The study will involve mesocosm and/or field exposures with sufficient replicates for each species to assure statistically sound measure of defined effect / no-effect exposure level.

Ice Issues - East Coast \$30,000

The ESRF will contribute to an existing Canada-Newfoundland Offshore Petroleum Board initiative with C-CORE for a workshop to address the effects of sea ice and icebergs upon various types of drilling and production systems which have been a source of public concern in all three environmental assessments of production systems offshore Newfoundland and Labrador (spanning 1985 through 2000). The workshop will focus expert discussion on state-of-the-art ice design and management in the eastern Canadian context, including an update on current practice in ice management and new designs and/or approaches for protection of potentially sensitive equipment. It will also describe the current risk analysis approach and how this is factored into design codes.

Mapping of Spawning Areas – Newfoundland \$50,000

The second stage of this project, to examine spawning locations for Grand Banks finfish and shellfish species, will begin by examining the DFO archives to determine additional species for which sufficient amounts of appropriate data exist. When the additional species are selected, a literature search will be performed to determine species spawning times. The remainder of the project will involve implementing the methodologies developed in the first study for data formatting, analysis and map production. Widening the scope of the project to include other fish species will create a more comprehensive spawning reference document.

Seismic Effects Monitoring in the Gully \$75,000

This project will address the potential impact of seismic surveys on whales along the Scotian Shelf through the verification of the integrity of acoustic models currently used to support environmental impact statements. Statistical analysis will be conducted to correlate the presence of seismic noise with whale distribution monitored by direct observations and recordings of vocalization

Seismic Technical Knowledge Gathering \$80,000

The ESRF Management Board is negotiating a Memorandum of Understanding with the Department of Fisheries and Ocean to collect and synthesize industry literature in support of writing teams that will be producing scientific review papers on the effects of seismic energy on marine biota. In addition, the research plans of international jurisdictions with respect to seismic issues will be identified and documented.

Effects of Oils and Sheens on Pelagic Seabirds \$40,000

This study will be carried out in two phases. Phase 1 involves a comprehensive literature review of oil and sheen concentrations that are lethal or sub-lethal to seabirds, sources of oil and sheens and persistence under various conditions. This phase would also be used to identify any significant information or data gaps in relation to this issue. Based on the above results, the need for laboratory evaluation would be determined and designed if required, to measure physical/physiological effects, based on a range of variables, such as temperature, salinity, oil/sheen type, species type.

Waste Management – North \$50,000

The ESRF Management Board will soon issue an RFP for a study to review alternatives to drilling sumps, including the use of injection wells.

Effect of Seismic on Fish – Mackenzie Delta \$100,000

The ESRF Management Board will soon issue an RFP for a study to explore the scientific background for restrictions on seismic exploration technical options in the Mackenzie Delta.

Resource Mapping – Mackenzie Delta \$100,000

Effective use of existing resource and biophysical information depends on integration of databases. ESRF will contribute to ongoing work that directly addresses the effective use of baseline information by both proponents and regulators

Traditional Knowledge \$106,000

The ESRF Management Board will soon issue an RFP for a two-phase study to produce a guidance document that will assist proponents and regulators to obtain, use, present and evaluate traditional knowledge in environmental assessment and regulatory applications.

Phase 1 would synthesize and consolidate existing information and practice with respect to traditional knowledge. It would identify key issues and concerns and develop a project design for phase 2; the product of phase 2 would be a guidance document based in part on consultation with key stakeholders.

Waterfowl Mackenzie Delta \$12,000

The Management Board will support this ongoing study which involves GIS-format mapping of an additional data set on the fall distribution of waterfowl collected over 3 years in the Mackenzie Delta Region.

Assessing the potential effects of nearshore hydrocarbon exploration activity on ringed (*Phoca hispida*) and bearded (*Erignathus barbatus*) seal populations in the nearshore Beaufort Sea \$150,000

The ESRF will contribute to the continuation of this three-year study to examine the potential impact of the winter oil and gas exploration activities on local seal populations and advise on appropriate mitigation measures and suitable monitoring programs which could be implemented.

CSA Structures \$195,000

The ESRF Management Board will continue to support the CSA Offshore Structures Program to ensure that International (ISO) Offshore Structures Standards are adopted into Canada as they become available, with national annexes that include unique Canadian requirements.

Financial Statement

ESRF Regions South (NRCan) 1-16 North (IAND) 17-31	Revenue Forwarded Jan 1, '03	Administrative Expenditures 2003	Study Payments 2003	Levy Revenues & Adjustments	Outstanding Study Commitments	Uncommitted Funds as of Dec 31, '03
South	\$1,020,683.56	\$70,743.78	\$1,012,362.06	\$1,570,319.99	\$1,194,486.53	\$313,411.18
North	\$517,675.16	47,162.52	\$214,401.63	\$529,388.06	\$784,396.43	\$1,102.64
Total	\$1,538,358.72	\$117,906.30	\$1,226,753.69	\$2,099,708.05	\$1,978,882.96	\$314,513.82

Plans for 2004

In October 2003, the ESRF Management Board established the budget for the 2004 program, which will be supported by Levy #16. This program was recommended by the Management Board and has been approved by the Minister of Natural Resources Canada and the Minister of Indian Affairs and Northern Development. The program has an estimated value of \$1.4 million which includes funding for continuing 2003 programs and for new programs within the established priority areas of seismic impacts, effects on seabirds, waste management, subsea pipeline effects, air quality monitoring, effects on waterfowl and marine mammals in the northern offshore.

A budget of \$250,000 was approved for 2004 to cover the administrative costs of the ESRF Secretariat and to support travel by some members of the Management Board.

In 2003, two appointments to the Management Board were made.

Publication of 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. Reports are distributed to oil and gas companies, universities, federal, provincial and territorial government libraries, and research institutes. The series is documented on several international databases including the Canadian Institute for Scientific and Technical Information (CISTI).

In addition to the technical report series, the ESRF publishes a newsletter, UPDATE, which contains information on the status of the program. This includes notification of requests for proposals for studies, and brief descriptions of study results. UPDATE is circulated to a broad audience of about 1400 across Canada and selected international institutes. Should you wish to have your name or organization added to the general distribution list, please contact the ESRF Secretariat (below).

List of ESRF Reports

Since its inception in 1983, the ESRF has published 141 reports which are distributed free of charge. The latest reports have been posted on the ESRF website. You may obtain copies of reports by visiting the website at www.esrfunds.org or contacting:

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SEDIMENT TRANSPORT

- 017 Keith Philpott Consulting Ltd. with Acres Consulting Services Ltd. **Scour Around Seafloor Structures.** April 1986. 225 p
- 027 Hodgins, D.O., D.A. Huntley, W.D. Liam Finn, B. Long, G. Drapeau and A.J. Bowen. **Sediment Transport - Present Knowledge and Industry Needs.** April 1986. 394 p.
- 029 Plasse, D. **Surficial Geology Surveys on the Scotian Shelf: Compilation of Maps from Government, Industry, University & Foreign Sources.** April 1986. 47 p.
- 041 Hodgins, D.O., G. Drapeau and L.H. King. **Field Measurements of Sediment Transport on the Scotian Shelf - Volume I. The Radio-isotope Experiment.** June 1986. 160 p. Hodgins, D.O. and O.J. Sayao - **Volume II. Boundary Layer Measurement and Sand Transport Prediction.** August 1986. 222 p.
- 054 Hodgins, D.O., O.J. Sayao, E.D. Kinsella and P.W. Morgan. **Nearshore Sediment Dynamics -Beaufort Sea.** December 1986. 195 p.
- 061 Judge, J.T., R.K. Watanabe and J.L. Warner. **Seafloor Stability Study, Inner Scotian Shelf.** May 1987. 88 p.
- 096 Gillie, R.D. **Beaufort Sea Artificial Island Erosion Data.** May 1988. 119 p.

ENVIRONMENTAL EFFECTS AND MONITORING

- 001 McLaren, P.L. and R.A. Davis. **Distribution of Bowhead Whales in the Beaufort Sea.** Summer 1983. February 1985. 62 p.
- 005 Thomas, D.J., W.S. Duval, C.S. Johnston, G.S. Lewbel, A. Birdsall, M.S. Hutcheson, G.D. Greene, R.A. Buchanan and J.W. MacDonald. **Effects Monitoring Strategies and Program for Canada's East Coast.** May 1985. 88 p.
- 009 Harwood, L.A. and A. Borstad. **Bowhead Whale Monitoring Study in the Southeast Beaufort Sea.** July-September 1984. August 1985. 99 p.
- 021 Tidmarsh, W.G., R. Ernst, R. Ackman and T. Farquharson. **Tainting of Fishery Resources.** January 1986. 174 p.
- 025 Kingsley, M.C.S. **Distribution and Abundance of Seals in the Beaufort Sea, Amundsen Gulf & Prince Albert Sound.** 1984. February 1986. 16 p.
- 028 Thomson, D.H., D.B. Fissel, J.R. Marko, R.A. Davis and G.A. Borstad. **Distribution of Bowhead Whales in Relation to Hydrometeorological Events in the Beaufort Sea.** March 1986. 119 p.
- 036 Norton, P. and L.A. Harwood. **Distribution, Abundance and Behavior of White Whales in the Mackenzie Estuary.** June 1986. 73 p.
- 057 Duval, W.S. (ed.) **Distribution, Abundance and Age Segregation of Bowhead Whales Relative to Industry Activities and Oceanographic Features in the Beaufort Sea, August-September 1985.** March 1987. 117 p.
- 060 Yunker, M.B. and R.W. Drinnan. **Dispersion and Fate of Oil from Oil-based Drilling Muds near Sable Island, N.S.** January 1987. 169 p.
- 063 Drinnan, R.W., M. Yunker, A. Gillam, N. Charchuk and S.R.H. Davis. **Options for Treatment and Disposal of Oil-based Mud Cuttings in the Canadian Arctic.** February 1987. 167 p.
- 066 Nenninger, R.D. **Monitoring a Sump Containing Drilling Mud with High Salt Content.** March 1987. 47 p.
- 075 Cross, W.E. and B. Humphrey. **Monitoring the Long-Term Fate and Effects of Spilled Oil in an Arctic Marine Subtidal Environment.** August 1987. 120 p.
- 080 Ernst, R.J., W.M.N. Ratnayake, T.E. Farquharson, R.G. Ackman and W.G. Tidmarsh. **Tainting of Finfish by Petroleum Hydrocarbons.** September 1987. 150 p.

- 089 Ford, J.K.B., J.C. Cabbage and P. Norton. **Distribution, Abundance, and Age Segregation of Bowhead Whales in the Southeast Beaufort Sea, August-September, 1986.** November 1987. 53 p.
- 090 Wainwright, P.F. and B. Humphrey. **Analysis of Sediment Data from the Beaufort Shorebase Monitoring Program, 1982-1984.** March 1988. 78 p.
- 093 Hardy BBT Limited and Stanley Associates Engineering Ltd. **Handling and Disposal of Waste Drilling Fluids from On-Land Sumps in the Northwest Territories and Yukon.** February 1988. 58 p.
- 101 Erickson, P., B. Fowler, and D. Thomas. **Oil-based Drilling Muds: Off Structure Monitoring-Beaufort Sea.** June 1988. 188 p.
- 102 Nakashima, D.J. and D.J. Murray. **The Common Eider of Eastern Hudson Bay: A Survey of Nest Colonies and Inuit Ecological Knowledge.** November 1988. 174 p.
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- 110 Hurlbut, S.E., D.P. French and B.J. Taylor. **Evaluation of the Potential Effects of Major Oil Spills on Grand Banks Commercial Fish Species as a Result of Impacts on Eggs and Larvae.** January 1991. 53 p.
- 117 Sekerak, A.D., N. Stallard and W.B. Griffiths. **Distribution of Fish and Fish Harvests in the Nearshore Beaufort Sea and Mackenzie Delta During Ice Covered Periods, October-June.** November 1992. 157 p.
- 118 Thomas, D.J. **Considerations in the Design of Effects Monitoring Strategies: Beaufort Sea Case Study.** January 1992. 54 p.
- 121 S.L. Ross Environmental Research Limited and Ledrew, Fudge and Associates. **The Risk of Tainting Flatfish Stocks During Offshore Oil Spills.** January 1993. 67 p.

- 122 Mackinnon, D.S. and P.A. Lane. **Saltmarsh Revisited - The Long-Term Effects of Oil and Dispersant on Saltmarsh Vegetation.** September 1993. 24 p.
- 123 Duval, W.S. **Proceedings of a Workshop on Beaufort Sea Beluga February 3-6, 1992, Vancouver, B.C.** March 1993. 26 p.
- 134 Richard, P.R., A.R. Martin and J.R. Orr. Study of Summer and Fall Movements and Dive Behaviour of Beaufort Sea Belugas, Using Satellite Telemetry. 1992-1995. 34 p.
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- 138 W.A. Montevecchi, F.K. Wiese, G. Davoren, A.W. Diamond, F. Huettmann, J. Linke **Seabird Attraction to Offshore Platforms and Seabird Monitoring from Offshore Support Vessels and other Ships Literature Review and Monitoring Design.** 1999. 56 p.
- 139 Denis H. Thomson, Jack W. Lawson and Anne Muecke: **Proceedings of a Workshop to Develop Methodologies for Conducting Research on the Effects of Seismic Exploration on the Canadian East Coast Fishery, Halifax, Nova Scotia, 7-8 September 2000.** April 2001. 92 p.

OIL SPILL RESEARCH AND COUNTERMEASURES

- 006 Belore, R.C. **Effectiveness of the Repeat Application of Chemical Dispersants on Oil.** June 1985. 66 p.
- 012 Harper, J.R. and E.H. Owens. **Shoreline Monitoring Programs for Oil Spills-of-Opportunity.** September 1985. 50 p.
- 013 Abdelnour, R., T. Johnstone, D. Howard and V. Nisbett. **Laboratory Testing of an Oil-Skimming Bow in Broken Ice.** January 1986. 60 p.
- 018 S.L. Ross Environmental Research Ltd. **Testing of an Oil Recovery Concept for Use in Brash and Mulched Ice.** January 1986. 43 p.
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