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

The Honourable Robert Nault, P.C., M.P.
Indian Affairs & 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 2002 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

2002

FEBRUARY 2003

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, which was 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 through which resides within the Operations Business Unit of the National Energy Board office 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 Awork 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 conduct of 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 2002

The ESRF undertook an ambitious program of activity for 2002. The ESRF Management Board met six times during the year. Nine new studies were approved for 2002 with a total value of \$675,000. As well, nine studies continued in 2002 with a budget of \$750,000 for the year. The 2002 ESRF operations budget of \$140,000 supported the management of the ongoing study program and provided administrative support to the ESRF Management Board.

Funding for the 2002 studies and administration program was raised through Levy #14 (see Refer to Table 1). Levy #14 invoiced in total \$1,252,930 which covered the new study program, the administration budget, and the continued funding of ongoing studies. Collection of unpaid levies of \$146, 956.50 is being pursued by the Management Board.

TABLE 1
ESRF LEVY #14

REGION	LEVY #14 \$/hect 2002	TOTAL LEVIES INVOICED 2002	TOTAL LEVIES COLLECTED 2002	BACK LEVIES COLLECTED 2002	TOTAL REVENUES COLLECTED 2002
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	0.0823	\$5,695.16	\$5,695.06		\$5,695.06
9 Newfoundland Slope	0.3690	\$74,141.88	\$74,141.88	\$12,842.91	\$86,984.79
10 Grand Banks North	0.1284	\$206,437.54	\$197,288.91	\$116,210.32	\$313,499.23
11 Grand Banks South	0.0000	\$0.00	\$0.00	\$23,230.49	\$23,230.49
12 Scotian Shelf East	0.1316	\$240,337.06	\$158,420.4	\$13,328.41	\$171,748.81
13 Scotian Shelf West	0.1048	\$50,074.49	\$41,175.92	\$10,459.52	\$51,635.44
14 Scotian Shelf	0.0339	\$156,291.58	\$142,612.76	\$63,035.46	\$205,648.22
15 Gulf of St. Lawrence	0.0122	\$23,020.99	\$2,685.72	\$17,981.65	\$20,667.37
16 Hudson Bay	0.0000				
17 Beaufort South	0.1778	\$113,542.37	\$113,542.37		\$113,542.37
18 Beaufort North	0.1353	\$4,069.82	\$4,069.82		\$4,069.82
19 Western Archipelago-Offshore	0.0579	\$432.46	\$432.46		\$432.46
20 Central Archipelago-Offshore	0.0579	\$13,945.04	\$13,945.04		\$13,945.04
21 Eastern Archipelago-Offshore	0.0000				
22 Baffin Bay	0.0000				
23 Yukon North	0.0000				
24 Yukon South	0.0000				
25 Mackenzie Delta	0.1508	\$127,794.86	\$127,794.86		\$127,794.86
26 Mackenzie North	0.1508	\$155,013.83	\$142,464.83		142,464.83
27 Mackenzie Central	0.0757	\$63,671.95	\$63,671.95		\$63,671.95
28 Mackenzie South	0.0755	\$15,606.53	\$15,177.09		\$15,177.09
29 Western Archipelago-Onshore	0.0578	\$92.19	\$92.19		\$92.19
30 Central Archipelago-Onshore	0.0579	\$2,762.70	\$2,762.70		\$2,762.70
31 Eastern Archipelago-Onshore	0.0000				
TOTAL		\$1,252,930.42	\$1,105,973.96	\$257,088.73	\$1,363,062.69

2002 Study Program

The 2002 study program comprised nine continuing studies and nine new studies. The following are brief descriptions of the projects' objectives:

Ongoing Studies

Effects of Seismic Exploration on the East Coast Fishery

This is a one-year study valued at \$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, Nfld., to determine the physiological and catch-related effects of seismic exploration activity on small and commercial-sized snow crab. This contract involves both an experimental phase and a field study. The draft final report is due February 28, 2003.

Update the CSA Offshore Structure Standards

This is the third year of a three-year study with a total value of \$200,000.

The ESRF Management Board entered into an agreement with Canadian Standards Association to assist with the updating of the CSA Offshore Structure Standards. This project will ensure that the CSA Offshore Structures Standards harmonize with those of ISO for the benefit of Canadian industry and will ensure the ISO Standards account for the challenging environment conditions offshore Canada. The new editions of the CSA Offshore Structures Standards will be published in 2003.

Abstracting of Existing Studies and Reports Related to the Oil & Gas Development in the North.

This is a one-year study valued at \$100,000.

The ESRF Management Board approved funding to the Arctic Institute of North America to further their ongoing project to archive and abstract existing studies and reports related to the Oil and Gas Development in the North. This project has captured the extensive and valuable work that was done in the North in the 1970s and 1980s and will make it accessible electronically. As of December 2002, a total of 1,402 reports have been completed and added to the Arctic Science and Technology Information System (ASTIS) data base. This study is completed.

Airshed Monitoring on Sable Island

This is a one-year study valued at \$100,000.

The ESRF Management Board assisted Environment Canada Atlantic Region with equipment acquisition, calibration, and deployment of this equipment on Sable Island 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. This will provide a basis for potential establishment of guidelines or regulations for air emissions on the Scotian Shelf. The equipment will be 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.

Field Verification of Benthic Boundary Layer Modelling Effects

This is the second year of a two-year study with a total value of \$120,000.

The ESRF Management Board provided funding to the Department of Fisheries and Oceans to support this study. The fate and environmental effects of discharged drilling muds are ongoing issues to operators, regulators, government agencies and environmentalists, particularly with multiple development sites in proximity to each other. Sound scientific assessments of the fate and effects for different mud/discharge scenarios can provide a basis for cost-effective strategies that minimize both real and perceived adverse impacts. This study utilized existing data from the SOEI Tier I Environmental Effects Monitoring (EEM) and Physical Environmental (PE) programs to compare the predications of the benthic boundary layer models against observed drilling-mud distributions. The model applications for the SOEI tier I sites were also compared with model applications at the Cohasset-Panuke site (funded by PERD and CNSOPB/industry) to evaluate the representativeness of the Sable Bank model simulations. Validated or calibrated dispersion models can be an effective tool in a generic assessment approach which is presently being developed by C-NSOPB and in waste management planning. The final report is due in June 2003.

Deep Water Benthic Community Study

This is the second year of a three-year study with a total value of \$405,000.

The ESRF Management Board provided funding to the Department of Fisheries and Oceans to support this study. The study will analyse and interpret existing data on deepwater benthic communities (corals) collected by DFO during groundfish trawl surveys and using video and photographic equipment on research cruises, as well as similar data that are available from other sources; and collect new data using video and photographic equipment at deepwater sites along the continental slope and in canyons of prime interest to the oil and gas industry. An additional survey is planned for September 2003, and the final report is anticipated in April 2004.

Documentation of Iceberg Scouring and Degradation Processes Based on Recent Grounding Events

This is the second year of a two-year study with a total value of \$200,000.

The ESRF Management Board provided funding to Geological Survey of Canada, Atlantic Region for this study.

The study is intended to confirm that the design burial depths for sub-sea facilities are accurate in order to protect them from possible damage caused by grounding icebergs. Knowing how icebergs scour and damage the seabed is of critical importance for design and approval of safe and cost-effective sub-sea facilities. Understanding scouring processes and calculating loads imposed on the seabed will be significantly improved by identifying grounded icebergs and conducting follow-up seabed mapping surveys. This will allow validation of ice scour models and allow subsequent monitoring of the processes and rates of biological recolonization and scour degradation.

Mesocosm and Laboratory Study of Effects of Drill Cuttings

This is the second year of a two-year study with a total value of \$155,000.

The ESRF Management Board provided funding to the Department of Fisheries and Oceans to support this study. Modelling of well development scenarios can predict cutting dispersion and thickness, but the key questions in relation to cumulative environmental effects are biological in nature. This study addressed a number of these potential biological effects related to habitat, recovery rates, physical versus chemical effects, and possible interactions of several rig sites. The final report is due March 2003.

Research Gaps: Natural Gas Exploration and Development in the Canadian Mackenzie Delta

This is a one-year study valued at \$98,700.

The ESRF Management Board awarded a contract for this study to Kavik-Axys in 2001. The three primary objectives were to:

- § document past and ongoing research on the potential environmental impacts of natural gas exploration, development and gathering systems in the Canadian Mackenzie Delta and near-shore Beaufort Sea.
- § review the current state of this knowledge in part by organizing, facilitating and reporting on a workshop of key stakeholders
- § analyse the existing database and the results of the workshop, and provide a report which includes a summary of the information gaps and potential priority areas for further research to facilitate the comprehensive assessment of natural gas exploration, development and gathering systems in the Canadian Mackenzie Delta and near-shore Beaufort Sea.

The workshop was held in January 2002 in Inuvik, and a final report is expected in February 2003. The report will be used as internal guidance for the ESRF Management Board as it sets priorities for northern projects in the coming years.

Marine Bird and Mammal Monitoring Study

This is the second year of a two-year study valued at \$60,000.

The ESRF Management Board awarded a contract to Memorial University of Newfoundland for this project. The principal objective of the project was to carry out an effective and comprehensive program of year-round surveys for marine birds and mammals on the Grand Banks using offshore supply vessels of opportunity. The final report is expected in August 2003.

Oil Pollution Seabird Mortality Assessment on the Sable Island Bank with Applications on the Grand Banks

This is a one-year study valued at \$60,000.

This study was completed in 2002 resulting in the publication of ESRF Report #141: F.K. Wiese. August 2002. Oil Pollution Seabird Mortality Assessment on the Sable Island Bank with Applications on the Grand Banks. Environmental Studies Research Funds Report No. 141. Calgary. 28 p.

Sensitivity Mapping of Spawning and Nursery Areas on the Grand Banks

This is a one-year study valued at \$55,000.

The ESRF Management Board provided funding to the Department of Fisheries and Oceans to support this study. The study 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 ESRF Technical Report, expected in June 2003, will provide 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

This is a one-year study valued at \$100,000.

The ESRF Management Board provided funding to the Department of Fisheries and Oceans to support this study. The study identified the locations and timing of spawning and nursery areas for commercial finfish and shellfish that maybe affected by seismic exploration activity on the Scotian Shelf. The final report will provide an atlas and a CD-rom that will aid in the identification of areas and times where commercial and forage species may be adversely affected by seismic activity. A final report is anticipated in December 2003.

Effects of Seismic Surveying upon Groundfish Catchability Offshore Eastern Canada: An Opportunistic Study

This is a one-year study valued at \$100,000.

The ESRF Management Board awarded a contract to Jacques Whitford Environmental Limited for this project. The potential effects of energy discharges associated with marine seismic surveying upon the catchability of commercial fish species are of concern to fisheries interests. Potential effects on catchability continue to present uncertainties to those planning such surveys and to the regulatory agencies. This study was identified as a high priority at an ESRF-funded workshop on methodologies for conducting research on the effects of seismic exploration off the East Coast of Canada. This project takes advantage of the common interests of the seismic industry and the fishing industry in this problem to conduct an opportunistic analysis of direct effects of seismic activity on fishing success. Completion date of the study has been extended from December 2002 to a date to be determined in 2003.

New Studies for 2002

Assessment of Hearing Structures of Large Pelagic Species

This is a one-year study valued at \$25,000.

The ESRF Management Board will soon issue a Request for Proposals (RFP) for this study area. 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 the hearing structures.

Seabird Attraction to Production Installations: Instrument-Based Approaches

This is a one-year study valued at \$50,000.

The ESRF Management Board will soon issue a Request for Proposal for this study area. The main objective of the project will be to evaluate the feasibility of using instruments to monitor bird collisions with flares on offshore platforms. The study includes provision for limited field testing. The RFP will be issued in the first quarter of 2003.

Mackenzie Valley Research Gaps Study

This is a one-year study valued at \$50,000.

The ESRF Management Board provided \$50,000. as a contribution to a study lead by the Department of Indian and Northern Affairs in collaboration with the Government of the Northwest Territories on research gaps in the Mackenzie Valley. This project is similar, though broader in scope, to the one recently completed for the Mackenzie Delta. The study will identify 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 study will accomplish this through development of a discussion paper and conducting workshops in some affected communities in the area. The final report will summarize the findings and will include a draft action plan for dealing with the gaps identified.

The information base to be consulted and reviewed to meet the objectives of the project is to include both western and traditional knowledge science. The focus of this project is on the biophysical and only those socio-economic issues of land and resource use directly associated with hydrocarbon development and gas pipeline construction and operation. **The socio-economic issues such as jobs, benefits and training etc. will not be included in this project.**

The draft discussion paper is expected by the end of February 2003 with two workshops to follow; Fort Simpson in late February and Norman Wells in early March. A final report is anticipated in May 2003.

Standardizing the Reporting of Emissions to Ambient Air from Atlantic Canadian Offshore Petroleum Activities

This is a one-year study valued at \$30,000.

The ESRF Management Board awarded a contract to Dillon Consulting for this project. Considerable prospective and retrospective research has been conducted to support policy development respecting air emissions from offshore oil and gas production facilities in Canada and abroad; however, it is unclear which, if any, existing reporting framework would be appropriate for offshore activities in Atlantic Canada. To address this uncertainty, this ESRF-funded 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. This information will ultimately support recommendations for the establishment of standardized reporting metrics for emissions to ambient air in the Atlantic Offshore Areas. The final report is expected in the first quarter of 2003.

Environmental Effects Monitoring (EEM) for Exploratory Drilling

This is a one-year study valued at \$40,000.

The ESRF Management Board awarded a contract to LGL Limited for this project. Drilling of several exploratory wells is planned for offshore Nova Scotia and Newfoundland in the next few years. These projects will be subject to environmental impact assessment under the Canadian Environmental Assessment Act. To date, EIAs submitted for drilling programs have predicted minimal effects from routine operations of exploratory drilling, however few EEM programs exist to confirm these predictions.

Some stakeholders have expressed concern that significant effects may indeed be associated with exploratory drilling and have cited the lack of EEM data as a knowledge gap that precludes a conclusive determination of the accuracy of predictions of environmental effects. The desired end

result of this study is 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 is expected early in the first quarter of 2003.

Pollution Prevention Opportunities in the Offshore Oil and Gas Sector

This is a one-year study valued at \$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 is expected in the first quarter of 2003.

Sheens Associated with Produced Water Effluents

This is a one-year study valued at \$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 is expected in the first quarter of 2003.

Workshop on Approaches and Technologies for Offshore Oil and Gas Environmental Effects Monitoring (EEM)

This is a one-year study valued at \$50,000.

The ESRF Management Board has contributed \$50,000 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. 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.

Financial Statement

ESRF Regions South (NRCAN) 1-16 North (IAND) 17-31	Revenue Forwarded Jan 1, '02	Administrative Expenditures 2002	Study Payments 2002	Levy Revenues & Adjustments	Outstanding Study Commitments	Uncommitted Funds as of Dec 31, '02
South	\$1,153,936.14	\$ 67,883.60	\$ 944,478.46	\$ 879,109.48	\$ 683,074.64	\$337,608.92
North	\$ 248,123.47	\$ 45,255.73	\$ 169,145.90	\$ 483,953.31	\$ 505,256.19	\$ 12,418.96
Total	\$1,402,059.61	\$ 113,139.33	\$1,113,624.36	\$1,363,062.79	\$1,089,704.95	\$350,027.88

Plans for 2003

In October 2002, the ESRF Management Board established the budget for the 2003 program, which will be supported by Levy #15. 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 \$1.5 million which includes funding for continuing 2002 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 \$215,700 was approved for 2003 to cover the administrative costs of the ESRF Secretariat and to support travel by some members of the Management Board.

In 2002, one re-appointment to the Management Board was 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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Facsimile : (403) 292-5503

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.
- 109 Lawrence, M.J. (ed.) and S.L. Davies (ed.) **Wildlife and Wildlife Habitat Restoration and Compensation in the Event of an Oil Spill in the Beaufort Sea.** March 1993. 88 p.
- 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.
- 137 Hatch Associates Limited and Griffiths Muecke Associates. **Workshop on Cumulative Environmental Effects Assessment and Monitoring on the Grand Banks and Scotia Shelf.** 2000. 61 p.
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