

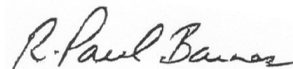
The Honourable Christian Paradis, P.C., M.P.
(Mégantic–L'Érable)
Natural Resources Canada
House of Commons
Ottawa, Ontario
K1A 0A6

The Honourable John Duncan, P.C., M.P.
Indian Affairs and Northern
Development Canada
House of Commons
Ottawa, Ontario
K1A 0A6

Dear Ministers:

On behalf of the Environmental Studies Research Funds Management Board, it is my pleasure to submit the 2010 Annual Report for the Environmental Studies Research Funds in accordance with paragraph 79(1)(d) of the *Canada Petroleum Resources Act*.

Sincerely yours,



Paul Barnes
Chairman
Environmental Studies Research Funds
Management Board

2010

**ANNUAL REPORT FOR THE
ENVIRONMENTAL STUDIES RESEARCH FUNDS**

FEBRUARY 2011

Environmental Studies Research Funds

Profile

The Environmental Studies Research Funds (ESRF) is a research program that sponsors environmental and social studies. It is 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 through levies on frontier lands by interest holders such as oil and gas companies. The ESRF is directed by a 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 in Ottawa, Ontario.

Published under the auspices of the
Environmental Studies Research Funds
ISBN NE22-4/2010E-PDF

TABLE OF CONTENTS

	Page
Background on the Structure and Operation of the Funds	1
Study Program - 2010	3
Financial Statement	7
Plans for 2011	9
Publication of Reports	10
Appendix 1 - ESRF Reports, 1985 - 2010.....	12
Appendix 2 – 2010 ESRF Management Board Members.....	25

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 to the terms and conditions under which, petroleum exploration, development and production activities on frontier lands should be conducted.

Subsection 101(1) of the *Canada Petroleum Resources Act* (CPRA) defines an environmental study as “*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.*”

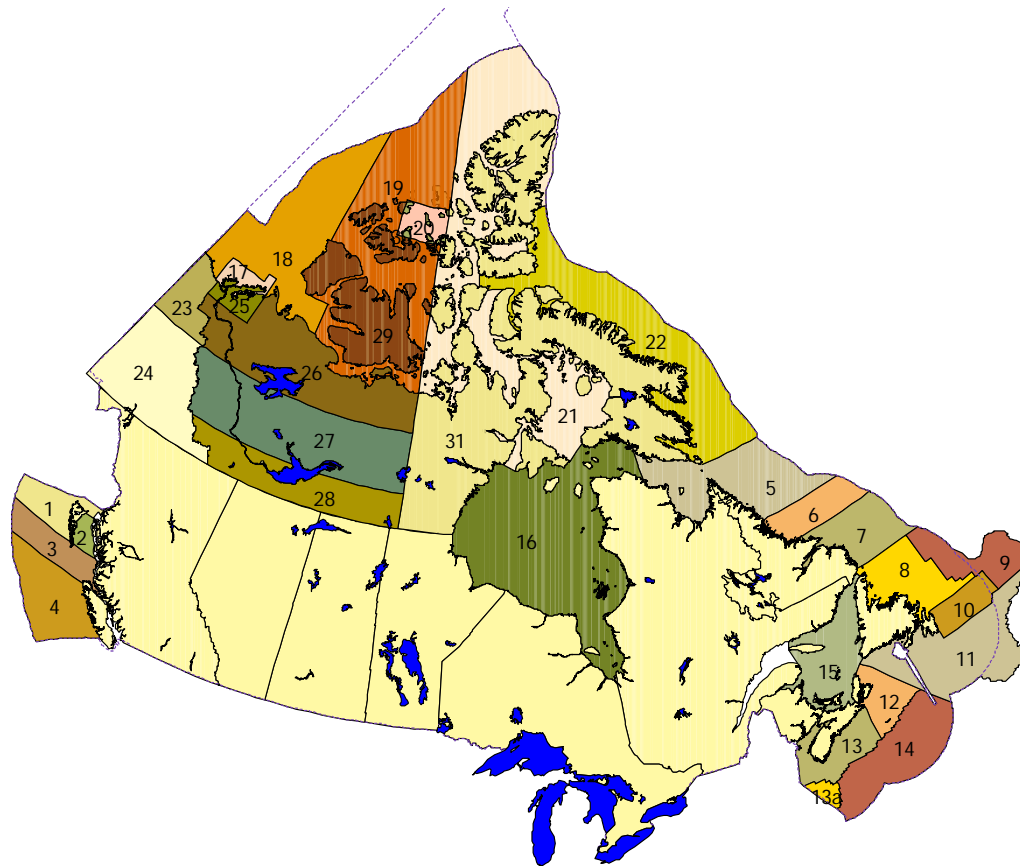
The Environmental Studies Research Funds are directed by a twelve-member Management Board that has representation from the federal government, the Canada–Nova Scotia Offshore Petroleum Board (CNSOPB), the Canada–Newfoundland and Labrador Offshore Petroleum Board (CNLOPB), the oil and gas industry and the general public. Mr. Paul Barnes, Manager, Atlantic Canada, Canadian Association of Petroleum Producers, is the chairman 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 and Northern Affairs Canada.

The program operates on a calendar year basis. The Board generally meets three times a year; however, the frequency of meetings may be 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 levies that generally occurs in the first quarter of the calendar year.

ESRF Regions

Descriptions and maps can be viewed on the ESRF website at: http://www.esrfunds.org/legloi_e.php



Study Program - 2010

The ESRF Management Board approved the following eight new studies for the 2010 study program:

Northern Studies – 2010

Regional Effects Management

- Development of a Regional Waste Management Strategy (NWT)

Oil Spill Prevention/Management

- Detection of Oil Under Ice with Helicopter-borne Ground Penetrating Radar
- Tracking Oil Spills and Ice Hazards in the Canadian Beaufort Sea with a Sub-Grid Ice Ocean Forecast Model

Regional Effects Management

- Legacy Data Review for Melville Island
- Seabed Stability Conditions in the Shelf/Slope Transition Zone, Canadian Beaufort Sea

Oil and Gas Effects on Marine Mammals

- Comparison of Model Predictions versus Actual Seismic Sound Measurement in the Beaufort Sea.



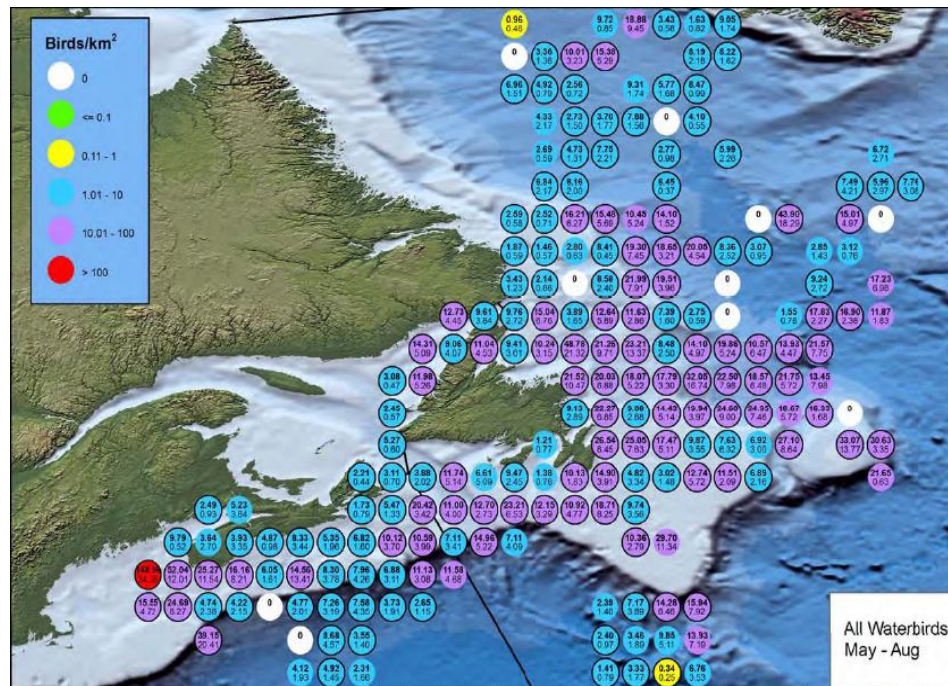
Report [174 Bosworth Creek \(NWT\) Literature Review](#).

SENES Consultants and G. Guthrie. October. 2009.

East Coast Studies – 2010

Seismic Activity

- Labrador Coast Seabird Baseline Survey
- Labrador Coast Marine Mammal Baseline Survey



Report 183 [*Offshore Seabird Monitoring Program.*](#)

D. A. Fifield, K. P. Lewis, C. Gjerdrum, G. J. Robertson and R. Wells.
December. 2009.

Continuing Studies 2010 – Northern

Oil and Gas Effects on Northern Use of Land and Water

- An Analysis of Historical Water Quality Data for Bosworth Creek

Seismic Issues – Offshore

- Development of Aerial Survey Techniques and Whale Detection Methods for Seismic Operations in the Beaufort Sea

- Development of Ecologically-Based Criteria to Assess the Impact and Recovery of Seismic Lines
-



Report 173 [Assessment of Drilling Waste Disposal Options in the Inuvialuit Settlement Region.](#)

AMEC Earth and Environmental. December. 2009.

Continuing Studies 2010 – East Coast

Socio-Economic

- Evaluation of potential socio-economic effects on the Labrador coast as a result of the resumption of offshore oil and gas exploration and development and possible future production

Air Emissions

- Modelling Emissions from Offshore Installations

Seabirds

- Simulation of fate and “Detectability” of “Dead” Seabirds

Seismic

- Mapping of Sensitive Fish Habitat Areas on the Labrador Coast
- Seismic and Lobster Feeding
- Marine Mammal Observation Data Synthesis for the East Coast

Wastes

- Publication of International Conference Volume
 - Biological Effects of Produced Water on Life Stages of Fish
 - Validation of Risk Assessment Numeric Models
-



Report 181 [Sable Island Air Monitoring Program Report, 2003-2006](#)

Waugh, D., T. Inkpen, M. Hingston, S. Keast, J. McPherson, D. Worthy and G. Forbes. June. 2010.

Financial Statement

The total value of the 2010 ESRF program was \$2,880,949. The budget included \$2,304,250 for the proposed studies and \$576,699 for the administration of the ESRF research activities program (refer to Levy #22 – Table 1).

The difference in the total required levy and total revenue collected is the result of land sales after the calculation of the levy as well as changes in interest owner holdings. The collection of unpaid levies is pursued on an ongoing basis by the ESRF Secretariat.

January 1, 2010 to December 31, 2010

(in dollars)

REGIONS	Opening Cash Balance	Levies and Back Levies Collected	Administrative Costs	Study Program Expenditures	Closing Cash Balance
SOUTH: Regions 1 to 16	\$3,093,434	\$1,130,428	-\$156,812	-\$439,108	\$3,627,943
NORTH: Regions 17 to 31	\$1,154,570	\$1,389,012	-\$188,299	-\$149,160	\$2,206,123

Table I ESRF Revenues

January 01, 2010 to December 31, 2010 (in dollars)

REGIONS	A Opening Cash Balance January 1, 2010	C Revenues 2010 Annual Levy January 1, 2010 to December 31, 2010	D Back Levies & Suppl. Levies January 1, 2010 to December 31, 2010	E Administrative Costs January 1, 2010 to December 31, 2010	F Expenditures of Study Program January 1, 2010 to December 31, 2010	Residual: Closing Cash Balance to 31-Dec-10 (A+B+C+D+E+F)
1	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
2	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
3	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
4	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
5	\$1,489.02	\$251.33	\$25,000.00	-\$137.23	-\$64.27	\$26,538.85
6	\$122,574.96	\$389,982.88	\$25,000.00	-\$12,116.82	-\$35,096.61	\$490,344.41
7	\$20,787.96	\$162,698.87	\$25,000.00	-\$6,028.08	-\$17,460.45	\$184,998.30
8	\$16,475.42	\$0.00	\$0.00	\$0.00	\$0.00	\$16,475.42
9	\$727,920.10	\$116,103.71	\$44,505.89	-\$34,486.32	-\$132,463.99	\$721,579.40
10	\$985,368.18	\$53,613.28	\$31,440.64	-\$15,924.77	-\$61,168.82	\$993,328.51
11	\$70,797.77	\$91,930.30	\$0.00	-\$27,306.08	-\$40,777.94	\$94,644.05
12	\$352,689.98	\$55,923.93	\$2,134.89	-\$16,611.10	-\$20,019.04	\$374,118.66
13	-\$43,606.97	\$0.00	\$0.00	\$0.00	\$0.00	-\$43,606.97
14	\$772,465.13	\$65,744.28	\$0.00	-\$19,528.04	-\$72,599.50	\$746,081.87
15	\$66,419.91	\$41,098.71	\$0.00	-\$24,673.43	-\$59,457.06	\$23,388.13
16	\$52.93	\$0.00	\$0.00	\$0.00	\$0.00	\$52.93
SOUTH	\$3,093,434.39	\$977,347.29	\$153,081.42	-\$156,811.87	-\$439,107.68	\$3,627,943.56
17	\$155,247.47	\$133,573.97	\$38,405.09	-\$30,440.59	-\$16,632.00	\$280,153.94
18	\$632,084.22	\$819,670.28	\$0.00	-\$56,914.28	-\$78,865.00	\$1,315,975.22
19	\$2,937.82	\$1,928.74	\$0.00	-\$1,227.36	-\$251.00	\$3,388.19
20	\$25,898.26	\$20,582.96	\$0.00	-\$13,098.06	-\$2,679.00	\$30,704.16
21	-\$2,793.74	\$2,957.14	\$0.00	-\$1,016.72	-\$208.00	-\$1,061.33
22	-\$1,188.03	\$0.00	\$0.00	\$0.00	\$0.00	-\$1,188.03
23	\$700.03	\$0.00	\$0.00	\$0.00	\$0.00	\$700.03
24	\$11,263.98	\$0.00	\$0.00	\$0.00	\$0.00	\$11,263.98
25	\$237,961.14	\$31,295.01	\$0.00	-\$10,759.85	-\$36,240.50	\$222,255.80
26	\$20,207.34	\$72,099.62	\$0.00	-\$29,080.18	-\$5,927.00	\$57,299.78
27	\$105,782.66	\$222,854.27	\$0.00	-\$36,918.43	-\$6,564.00	\$285,154.50
28	-\$38,818.03	\$38,448.04	\$0.00	-\$6,369.37	-\$1,299.00	-\$8,038.37
29	\$513.89	\$0.00	\$0.00	\$0.00	\$0.00	\$513.89
30	\$6,555.38	\$6,529.86	\$0.00	-\$2,245.10	-\$447.00	\$10,393.14
31	-\$1,782.68	\$667.40	\$0.00	-\$229.46	-\$47.00	-\$1,391.75
NORTH	\$1,154,569.69	\$1,350,607.29	\$38,405.09	-\$188,299.41	-\$149,159.50	\$2,206,123.16
TOTAL	\$4,248,004.08	\$2,327,954.58	\$191,486.51	-\$345,111.28	-\$588,267.18	\$5,834,066.71

Plans for 2011

In September 2010, the ESRF Management Board established the budget for the 2011 program which will be supported by Levy #23. This program was recommended by the Management Board and has been approved by the Minister of Natural Resources Canada and the Minister of Indian and Northern Affairs Canada. The study program has a total value of \$2,595,343 and an administration budget of \$475,500.00 for new programs. Continuing studies from 2010 will be funded from the balance of existing funds.

The ESRF Management Board has established the following priority areas for 2011:

North

Marine Seismic

Regional Effects Management

Oil Spill Prevention & Management

Changing Sea Ice Conditions

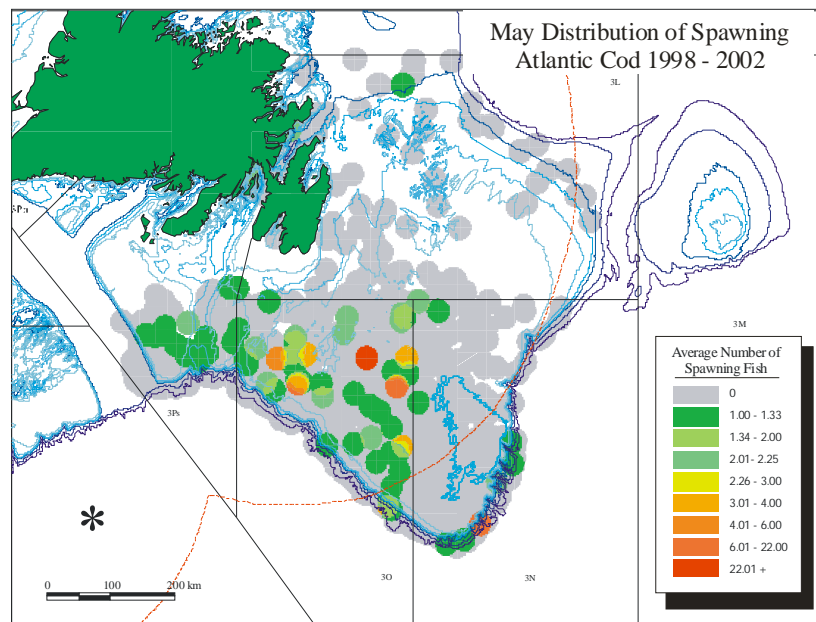
East Coast

Air Emissions

Seabirds

Seismic

Wastes



Report 167 [*Mapping the Spawning Times and Locations for Ten Commercially Important Fish Species Found on the Grand Banks of Newfoundland*](#) . Ollerhead, L.M.N., M.J. Morgan, D.A. Scruton and B. Marie. 2004.

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.

Since its inception in 1983, the ESRF has published 177 reports. All reports are available to download for free on the [ESRF website](#).

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

Recent Publications - 2010

- 164 Goodard, D.R., L. Peters, R. Evans, K. Wautier, P. A. Cott, B. Hanna and V. Palace. *Development of histopathology tools to assess instantaneous pressure change-induced effects in rainbow trout (Onchorhynchus mykiss) early life stages*. 2008. 93 p.
- 167 Ollerhead, L.M.N., M.J. Morgan, D.A. Scruton and B. Marie. *Mapping the Spawning Times and Locations for Ten Commercially Important Fish Species Found on the Grand Banks of Newfoundland*. 2004. 42 p.
- 168 Ollerhead, L.M.N. *Mapping Spatial and Temporal Distribution of Spawning Areas for Eight Finfish Species Found on the Scotian Shelf*. June 2007. 54 p.
- 169 Ollerhead, L.M.N., J. Lawrence. *Mapping the Spatial Distribution of Juveniles for Nine Selected Finfish Species Found in the Gulf of St. Lawrence*. June 2007. 64 p.
- 170 Payne, J.F., J. Coady and D. White. *Potential Effects of Seismic Airgun Discharges on Monkfish Eggs (Lophius americanus) and Larvae*. July 2009. 32 p.

- 171 Payne, J.F., C.A. Andrews, L.L. Fancey, A.L. Cook and J.R. Christian. *Pilot Study on the Effects of Seismic Air Gun Noise on Lobster (Homarus americanus)*. 2007. 34 p.
- 172 Antoniuk, T., S. Kennett, C. Aumann, M. Weber, S. Davis Schuetz, R. McManus, K. McKinnon and K. Manuel. *Valued Component Thresholds (Management Objectives) Project*. March 2009. 164 p.
- 173 AMEC Earth & Environmental. *Assessment of Drilling Waste Disposal Options in the Inuvialuit Settlement Region*. December 2009. 140 p.
- 174 SENES Consultants Limited and G. Guthrie. *Bosworth Creek (NWT) Literature Review*. October 2009. 28 p.
- 175 AECOM. *Considerations in Developing Oil and Gas Industry Best Practices in the North*. April 2009. 36 p.
- 176 Centre for Offshore Oil, Gas and Energy Research and K. Lee. *Environmental Persistence of Drilling Mud and Fluid Discharges and Potential Impacts*. December 2009. 35 p.
- 178 Courtenay, S.C., M. Boudreau and K. Lee. *Potential Impact of Seismic Energy on Snow Crab: An Update to the 2004 Peer Review*. April 2009. 181p.

Appendix 1 – ESRF Publications 1985–2010

Bibliographies

- 010 Goodwin, C.R., J.C. Finley and L.M. Howard. *Ice Scour Bibliography*. July 1985. 99 p.
- 026 Young, S.C. *Bibliography on the Fate and Effects of Arctic Marine Oil Pollution*. March 1986. 212 p.
- 030 Howard, L.H. *Icebergs: A Bibliography Relevant to Eastern Canadian Waters*. May 1986. 277 p.
- 050 Finley, J.C. and C.R. Goodwin. *The Training and Employment of Northern Canadians: An Annotated Bibliography*. November 1986. 206 p.
- 130 Hunter, S.P. and J.H. Vandermeulen. *Bibliography of Aquatic Oil Pollution Fate and Effects*. December 1994. CD-Rom.
- 136 Coastal Resource Inventory: Great Northern Peninsula. Not published.

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. Cubbage 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. and S.L. Davies (eds.). *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 the 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*. March 1987. 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.
- 138 Montevecchi, W.A., F.K. Wiese, G. Davoren, A.W. Diamond, F. Huettmann and 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 Thomson, D. H., J. W. Lawson and A. 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, September 7–8 2000*. April 2001. 92 p.
- 142 ERIN Consulting Ltd. and OCL Services Ltd. *Sheens Associated with Produced Water Effluents – Review of Causes and Mitigation Options*. March 2003. 46 p.
- 143 Mortensen, Pål B., Lene Buhl-Mortensen, Susan E. Gass, Donald C. Gordon Jr., Ellen L.R. Kenchington, Cynthia Bourbonnais and Kevin G. MacIsaac. *Deep-Water Corals in Atlantic Canada: A Summary Of ESRF-Funded Research (2001–2003)*. December 2004. 43 p.
- 144 Christian, J. R., A. M. Mathieu, D. H. Thomson, D. White and R. A. Buchanan. *Effect of Seismic Energy on Snow Crab (Chionoecetes opilio)*. November 2003. 106 p.
- 145 Racca, R. G., D. E. Hannay, R. B. Murray, W. B. Griffiths, and M. Muller. *Testing Fish Deterrents for Use Under-Ice in the Mackenzie Delta Area*. March 2004. 118 p.
- 146 Buchanan, R. A., J. A. Cook and A. M. Mathieu. *Environmental Effects Monitoring for Exploration Drilling*. December 2003. 86 p.
- 147 Dillon Consulting Limited with DMT Cordah. *Pollution Prevention Opportunities in the*

- Offshore Oil and Gas Sector – Final Report.* October 2003. 73 p.
- 148 Dillon Consulting, BMT Cordah Ltd. *Standardizing the Reporting of Air Emissions to Ambient Air from Atlantic Canada Offshore Petroleum Activities.* March 2003. 52 p.
- 149 Trudel, K. *Workshop on Dispersant Use in Eastern Canada.* 2004. 109 p.
- 150 Martec Limited, CEF Consultants Ltd, DRDC Atlantic, St. Francis Xavier University. *Effects of Pipelines/Gathering Lines on Snow Crab and Lobster.* December 2004. 61 p.
- 151 Lee, K., H. Bain, and G.V. Hurley, (eds.). *Acoustic Monitoring and Marine Mammal Surveys in the Gully and Outer Scotian Shelf Before and During Active Seismic Programs.* December 2005. 154 p + appendices.
- 152 Ellis & Associates. *Drilling Waste Management – Recommended Best Practices.* January 2005. CD-Rom.
- 154 AMEC Earth & Environmental. *Inuvialuit Settlement Region Drilling Waste Disposal Sumps Study.* February 2005. CD-Rom.
- 155 Dillon Consulting Limited and Salmo Consulting. *Beaufort-Delta Cumulative Effects Project.* February 2005. CD-Rom.
- 156 Moulton, V.D., and B.D. Mactavish. *Recommended Seabird and Marine Mammal Observational Protocols for Atlantic Canada.* March 2004. 80 p.
- 158 Christian, J. R., A. Mathieu, and R. A. Buchanan. *Chronic Effects of Seismic Energy on Snow Crab (Chionoecetes opilio).* March 2004. 45 p.
- 159 Kemper, J. Todd. *Vegetation Changes on Seismic Lines from Recent (2000–2001) and Historic (1970–1986) Seismic Programs in the Mackenzie Delta Area.* May 2006. 29 p.
- 160 Armsworthy, S.L., A. Muecke and P.J. Cranford. *Workshop on Offshore Oil and Gas Environmental Effects Monitoring,* Bedford Institute of Oceanography, Dartmouth, Nova Scotia, May 26-30. November 2003. 125 p.
- 161 Kavik-AXYS Inc. *Review of the Ikhil Gas Development and Pipeline Regulatory and Environmental Process: Lessons Learned.* January 2007. 49 p.
- 162 Harwood, L., T. G. Smith, H. Melling. *Assessing the Potential Effects of Near Shore Hydrocarbon Exploration on Ringed Seals in the Beaufort Sea Region 2003-2006.* November 2007. 103 p.
- 163 Kavik-AXYS Inc. *Biophysical Research Requirements for Beaufort Sea Hydrocarbon Development.* August 2008. 125 p.
- 164 Goodard, D.R., L. Peters, R. Evans, K. Wautier, P. A. Cott, B. Hanna and V. Palace.

- Development of histopathology tools to assess instantaneous pressure change-induced effects in rainbow trout (Onchorhynchus mykiss) early life stages.* 2008. 93 p.
- 167 Ollerhead, L.M.N., M.J. Morgan, D.A. Scruton and B. Marie. *Mapping the Spawning Times and Locations for Ten Commercially Important Fish Species Found on the Grand Banks of Newfoundland.* 2004. 42 p.
- 168 Ollerhead, L.M.N. *Mapping Spatial and Temporal Distribution of Spawning Areas for Eight Finfish Species Found on the Scotian Shelf.* June 2007. 54 p.
- 169 Ollerhead, L.M.N., J. Lawrence. *Mapping the Spatial Distribution of Juveniles for Nine Selected Finfish Species Found in the Gulf of St. Lawrence.* June 2007. 64 p.
- 170 Payne, J.F., J. Coady and D. White. *Potential Effects of Seismic Airgun Discharges on Monkfish Eggs (Lophius americanus) and Larvae.* July 2009. 32 p.
- 171 Payne, J.F., C.A. Andrews, L.L. Fancey, A.L. Cook and J.R. Christian. *Pilot Study on the Effects of Seismic Air Gun Noise on Lobster (Homarus americanus).* 2007. 34 p.
- 172 Antoniuk, T., S. Kennett, C. Aumann, M. Weber, S. Davis Schuetz, R. McManus, K. McKinnon and K. Manuel. *Valued Component Thresholds (Management Objectives) Project.* March 2009. 164 p.
- 173 AMEC Earth & Environmental. *Assessment of Drilling Waste Disposal Options in the Innuvialuit Settlement Region.* December 2009. 140 p.
- 174 SENES Consultants Limited and G. Guthrie. *Bosworth Creek (NWT) Literature Review.* October 2009. 28 p.
- 175 AECOM. *Considerations in Developing Oil and Gas Industry Best Practices in the North.* April 2009. 36 p.
- 176 Centre for Offshore Oil, Gas and Energy Research and K. Lee. *Environmental Persistence of Drilling Mud and Fluid Discharges and Potential Impacts.* December 2009. 35 p.
- 178 Courtenay, S.C., M. Boudreau and K. Lee. *Potential Impacts of Seismic Energy on Snow Crab: An Update to the 2004 Peer Review.* April 2009. 181 p.

Environmental Loading and Design

- 111 Maddock, B., G. Khng and M. Gerin. *Verification of CSA Code for Fixed Offshore Steel Structures.* October 1992. 92 p.
- 112 Allyn, N., W.J. Cichanski and P. Adebar. *Verification of CSA Code for Fixed Offshore*

- Concrete Structures*. November 1992. 62 p.
- 116 Traynor, S. and S.R. Dallimore. *Geological Investigations of Proposed Pipeline Crossings in the Vicinity of Taglu and Niglintgak Islands, Mackenzie Delta, NWT*. May 1992. 115 p.
- 131 Allyn, N., et al. *Environmental Loading Studies for the CSA Offshore Structures Code*. January 1995. 86 p.
- 135 Dallimore, S.R. and J.V. Matthews, Jr. *The Mackenzie Delta Borehole Project*. April 1997. CD-Rom.

Frontier Social and Economic Issues

- 002 Gardner, M. *Interaction Between the Fisheries & the Oil and Gas Industry off the East Coast of Canada*. March 1985. 70 p.
- 003 Cleland Dunsmuir Consulting Ltd., Community Resource Services Cooperative Ltd., Maritime Resource Management Services and H. Mills. *Petroleum-Related Socio-Economic Issues – Atlantic Canada*. March 1985. 101 p.
- 004 Usher, P.J., D. Delancey, G. Wenzel, M. Smith and P. White. *An Evaluation of Native Harvest Survey Methodologies in Northern Canada*. April 1985. 249 p.
- 015 Gardner, M. *Construction Projects – Frame of Reference for Oil & Gas Developments in Atlantic Canada*. November 1985. 86 p.
- 024 DPA Group Inc. and Intergroup Consulting Economics Ltd. *Northern Employment and Training in the Oil and Gas Industry*. March 1986. 105 p.
- 040 Storey, K., J. Lewis, M. Shrimpton and D. Clark. *Family Life Adaptations to Offshore Oil and Gas Employment*. July 1986. 207 p.
- 046 Constable, G.A., R.M. Griggs, N.E. Millbank and M.S. Sinclair. *Business Opportunities Related to Oil and Gas Exploration and Production in Northern Canada*. August 1986. 269 p.
- 047 IDP Consultants Ltd. *Public Information on Oil and Gas Activities*. September 1986. 170 p.
- 067 Pinfold, T. *An Evaluation of the Utility of Large-Scale Economic Models for Socio-Economic Impact Assessment*. March 1987. 34 p.
- 071 Atlantic Consulting Economists Limited. *Local Business Adaptation to East Coast Offshore Energy Development*. July 1987. 57 p.
- 085 Groves, S., W.G. Green and J.R. Harper. *Queen Charlotte Islands Coastal Zone: Digital Mapping and Linked Data-Base System*. September 1988. 115 p.

- 087 Storey, K. and M. Shrimpton. *Planning for Large-Scale Construction Projects: A Socio-Economic Guide for Communities, Industry and Government*. October 1987. 78 p.
- 153 Fedirchuk, G. J., S. Labour, N Nicholls, FMA Heritage Resources Consultants. *Traditional Knowledge Manual Volume 1 & 2: Literature Review and Evaluation and Using Traditional Knowledge in Impact Assessments*. August 2005. CD-Rom

Ice – Icebergs – Ice Detection

- 008 Ryan, J.P., M. Harvey and A. Kent. *The Assessment of Marine Radars for the Detection of Ice and Icebergs*. August 1985. 127 p.
- 011 Gammon, P.H. and J.C. Lewis. *Methods for the Fracturing of Icebergs*. July 1985. 91 p.
- 014 Buckley, T., B. Dawe, A. Zielinski, S. Parashar, D. MacDonald, H. Gaskill, D. Finlayson and W. Crocker. *Underwater Iceberg Geometry*. September 1985. 216 p.
- 016 Rossiter, J.R., L.D. Arsenault, E.V. Guy, D.J. Lapp, E. Wedler, B. Mercer, E. McLaren, and J. Dempsey. *Assessment of Airborne Imaging Radars for the Detection of Icebergs*. September 1985. 320 p.
- 022 Ryan, J.P. *Enhancement of the Radar Detectability of Icebergs*. January 1986. 83 p.
- 035 Harvey, M.J. and J.P. Ryan. *Further Studies on the Assessment of Marine Radars for the Detection of Icebergs*. June 1986. 82 p.
- 038 Marko, J.R., D.B. Fissel and J.R. Birch. *Physical Approaches to Iceberg Severity Prediction*. July 1986. 104 p.
- 042 Anderson, D.G., D. McDonald, P. Mitten, S. Nicholls and D. Tait. *Management of Small Ice Masses*. August 1986. 195 p.
- 044 Hay & Company Consultants Inc. *Motion and Impact of Icebergs*. September 1986. 146 p.
- 045 Canpolar Consultants Ltd. *Iceberg Detection by Airborne Radar: Technical Review and Proposed Field Program*. September 1986. 235 p.
- 048 Davidson, L.W., W.I. Wittman, L.H. Hester, W.S. Dehn, J.E. Walsh and E.M. Reimer. *Long-Range Prediction of Grand Banks Iceberg Season Severity: A Statistical Approach*. October 1986. 163 p.
- 052 de Margerie, S., J. Middleton, C. Garret, S. Marquis, F. Majaess and K. Lank. *Improvement of Iceberg Drift Forecast – Grand Banks*. November 1986. 86 p.
- 081 Warbanski G. and E. Banke. *Evaluation of a Modified Water Cannon System to Control*

- Small Iceberg Masses.* August 1987. 142 p.
- 091 Klein, K., J.P. Ryan and M. House. *Ryan Evaluation of Two Search Radar Systems for Detection of Ice Masses.* January 1988. 240 p.
- 104 Terry, B.F., D.J. Lapp, C.L. Balko, K.E. Hancock and P.A. Lapp. *Ice Data Management System.* July 1989. 151 p. + appendices.
- 113 Finlayson, D.J., J. Bobbitt, P. Rudkin and I.J. Jordan. *Iceberg Trajectory Model: Real-Time Verification.* March 1992. 47 p.
- 115 Pilkington, G.R., M.C. Hill, M. Metge and D. McGonigal. *Beaufort Sea Ice Design Criteria – Acquisition of Data on EIFs.* October 1992. 154 p.
- 125 Davidson, L.W. *Long-Range Ice Forecasting System (LRIFS) Applied for the Beaufort Sea.* May 1993. 58 p.
- 132 Rossiter, J.R., et al. *Remote Sensing Ice Detection Capabilities – East Coast.* April 1995. 172 p.
- 133 Davidson, S.H. and A. Simms. *Characterization of Iceberg Pits on the Grand Banks of Newfoundland.* February 1997. 162 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.
- 019 Wotherspoon, P., J. Swiss, R. Kowalchuk and J. Armstrong. *Oil in Ice Computer Model.* December 1985. 129 p.
- 031 Harper, J.R. and B. Humphrey. *Stranded Oil in Coastal Sediments: Permeation in Tidal Flats.* April 1986. 23 p.
- 033 Harper, J.R. *Practical Insights into Decision-Making for Shoreline Cleanup of Oilspills.* May 1986. 44 p.
- 034 Belore, R.C. *Development of a High Pressure Water Mixing Concept for Use with Ship-*

- Based Dispersant Application.* May 1986. 51 p.
- 051 S.L. Ross Environmental Research Ltd. and Energetex Engineering. *Decision-Making Aids for Igniting or Extinguishing Well Blowouts to Minimize Environmental Impacts.* November 1986. 119 p.
- 053 MacNeill, M.R. and R.H. Goodman. *Oil Motion During Lead Closure.* January 1987. 13 p.
- 058 S.L. Ross Environmental Research Ltd. and Hatfield Consultants Ltd. *Countermeasures for Dealing with Spills of Viscous, Waxy Crude Oils.* October 1986. 59 p.
- 062 S.L. Ross Environmental Research Ltd. and D.F. Dickins Associates Limited. *Field Research Spills to Investigate the Physical and Chemical State of Oil in Pack Ice.* February 1987. 116 p.
- 064 Brown, H.M. and R.H. Goodman. *In Situ Burning of Oil in Ice Infested Waters.* February 1987. 27 p.
- 068 Belore, R.C. *Mid-Scale Testing of Dispersant Effectiveness.* April 1987. 82 p.
- 069 Hatfield Consultants Ltd. *Spills-of-Opportunity Research.* February 1987. 124 p.
- 070 Lane, P., M.J. Crowell, D.G. Patriquin and I. Buist. *The Use of Chemical Dispersants in Salt Marshes.* May 1987. 100 p.
- 072 Nawwar, A., A. Godon, H.W. Jones, E. Yeatman, J. Ohuja, M.B. Frish and I. Arvin. *Acoustical Methods for Measuring Thickness of Oil on Water.* April 1987. 57 p.
- 074 Bennett, J., I.R. McAllister, L. Pertile and D. McQuillan. *Removal of Stranded Oil from Remote Beaches by In-Situ Combustion.* March 1987. 122 p.
- 077 Comfort, G. *Analytical Modelling of Oil and Gas Spreading Under Ice.* August 1987. 57 p.
- 078 Reimer, E.M. and J.R. Rossiter. *Measurement of Oil Thickness on Water from Aircraft: A. Active Microwave Spectroscopy. B. Electromagnetic Thermoelastic Emission.* August 1987. 82 p.
- 079 S.L. Ross Environmental Research Ltd. and L.C. Oddy Training Design Ltd. *The Development of a Canadian Oil-Spill Countermeasures Training Program.* May 1987. 194 p.
- 082 Belore, R.C. and D. MacKay. *Drop Size and Dispersant Effectiveness: Small-Scale Laboratory Testing.* July 1987. 31 p.
- 083 Thorpe, J.W. and K.E. Hellenbrand. *Microbial Degradation of Hydrocarbon Mixtures in a Marine Sediment Under Different Temperature Regimes.* September 1987. 48 p.
- 084 S.L. Ross Environmental Research Limited and D. MacKay. *Laboratory Studies of the*

- Behaviour and Fate of Waxy Crude Oil Spills*. December 1988. 250 p.
- 086 Pelletier, E. and C. Brochu. *Prototype, Mesoscale Simulator for the Study of Oil Weathering Under Severe Conditions*. November 1987. 55 p.
- 092 Trudel, B.K., B.J. Jessiman, S.L. Ross and J.J. Swiss. *Guide to Dispersant – Use Decision Making for Oil Spills in the Canadian Southern Beaufort Sea*. February 1988. 227 p.
- 095 D.F. Dickins Associates Ltd., S.L. Ross Environmental Research Ltd. and Seakem Oceanography, Ltd. *Evaluation of Hovercraft for Dispersant Application*. February 1988. 57 p.
- 098 Goodman, R.H. Simple Remote Sensing System for the Detection of Oil on Water. December 1988. 32 p.
- 100 Swiss, J.J. and N. Vanderkooy. *Beaufort Sea Dispersant Trial*. July 1988. 44 p.
- 106 S.L. Ross Environmental Research Ltd. *Proceedings of a Workshop to Establish Canadian Marine Oil Spill Research and Development Priorities*. April 1990. 56 p.
- 108 Harper, J.R. *Development of a National Directory of Canadian Oil Spill Specialists*. October 1991. 62 p.
- 119 Guenette, C. *Modification and Testing of a Portable Reciprocating Kiln for Cleaning Oiled Sand and Gravel*. March 1992. 46 p.
- 120 Guenette, C. *Development and Testing of a Prototype Rock Washer for Cleaning Oiled Beach Cobble*. January 1991. 45 p.
- 124 Englehardt, R. *Oil Base Drilling Mud Toxicity*. December 1989. 47p. (Unpublished)
- 126 Koski, W.R., S.D. Kevan and W.J. Richardson. *Bird Dispersal and Deterrent Techniques for Oil Spills in the Beaufort Sea*. December 1993. 122 p.
- 127 Dempsey, J., A. Simms, J. Harper, E. Lambert, and R. Hooper. *West Coast Newfoundland Oil Spill Sensitivity Atlas*. March 1995. 62 p.
- 140 Jacques Whitford Environment Limited. *Atlas of Ecologically and Commercially Important Areas in the Southern Gulf of St. Lawrence*. 2001. CD-Rom.
- 141 Oil Pollution Seabird Mortality Assessment on the Sable Island Bank. Not published.
- 165 Newfoundland and Labrador Environmental Industry Association, L. Gratton & Associates and the Institute for the Advancement of Public Policy, Inc. *An Integrated Approach to Oil Spill Preparedness and Response*. May 2008. 60 p.
- 166 Jacques Whitford Stantec Limited. *Cuttings Treatment Technology Evaluation*. July 2009. 100 p.

Sea Bottom Ice Scour

- 007 El-Tahan, M., H. El-Tahan, D. Courage and P. Mitten. *Documentation of Iceberg Groundings*. May 1985. 162 p.
- 032 Shearer, J., B. Laroche and G. Fortin. *Canadian Beaufort Sea 1984 Repetitive Mapping of Ice Scour*. May 1986. 93 p.
- 037 Comfort, G. and B. Graham. *Evaluation of Sea Bottom Ice Scour Models*. June 1986. 115 p.
- 039 Woodworth-Lynas, C.M.T., D.W. Bass and J. Bobbitt. *Inventory of Upslope and Downslope Iceberg Scouring*. July 1986. 103 p.
- 043 Geonautics Ltd. *Design of an Iceberg Scour Repetitive Mapping Network for the Canadian East Coast*. March 1987. 45 p.
- 049 Lewis, C.F.M., D.R. Parrott, P.G. Simpkin and J. T. Buckley (eds.). *Ice Scour and Seabed Engineering. Report on Calgary Workshop, February 1985*. November 1986. 322 p.
- 055 Gilbert, G. and K. Pedersen. *Ice Scour Data Base for the Beaufort*. December 1986. 93 p. + appendices.
- 094 Hodgson, G.J., J.H. Lever, C.M.T. Woodworth-Lynas and C.F.M. Lewis (eds.). *Dynamics of Iceberg Grounding and Scouring. Volume I The Field Experiment. Volume II Maps and Charts*. June 1988. 316 p.
- 097 Gilbert, G.R., S.J. Delory and K.A. Pedersen. *Beaufort Sea Ice Scour Data Base (Scourbase)*. Update to 1986. March 1989. 99 p.
- 105 Geonautics Limited. *Regional Ice Scour Data Base Update Studies*. October 1989. 177p. + appendices.
- 107 Davidson, S.H., W.T. Collins and P.G. Simpkin. *An Experiment to Monitor Four Iceberg Scours on the Grand Banks of Newfoundland*. December 1991. 110 p.
- 128 Geonautics Limited. *East Coast Repetitive Seafloor Mapping 1979/1990*. March 1991. 49 p. + appendices.
- 129 Myers, R., S. Blasco, G. Gilbert, and J. Shearer. *1990 Beaufort Sea Ice Scour Repetitive Mapping Program*. March 1996. 147 p + appendices.
- 157 Sonnichsen, G.V., T. Hundert, P. Pocklton and R. Myers. *Documentation of Recent Iceberg Grounding Events and a Comparison with Older Events of Know Age - Northern Grand Banks, Canada*. April 2006. 206 p.

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.

Waves

- 020 Brown, R.D., P. Roebber and K. Walsh. *Climatology of Severe Storms Affecting Coastal Areas of Eastern Canada*. February 1986. 233 p.
- 023 Murray, M.A. and M. Maes. *Beaufort Sea Extreme Wave Studies Assessment*. January 1986. 97 p.
- 056 Lemon, D.D. *Wind Speeds from Underwater Acoustic Measurements During the Canadian Atlantic Storm Program*. December 1986. 116 p.
- 059 Dobrocky Seatech Ltd. *Wave Climate Study – Northern Coast of British Columbia*. May 1987. 93 p.
- 065 LeDrew Environmental Management Ltd. (ed.). *Proceedings of the International Workshop on Wave Hindcasting and Forecasting. Halifax Workshop, September 1986*. February 1987. 370 p.
- 073 Hodgins, S.L.M. and D.O. Hodgins. *Evaluation of Wave Forecasting Models and Forecast Wind Fields in the Canadian Context*. June 1988. 356 p.
- 076 Eid, B.M. and V.J. Cardone. *Operational Test of Wave-Forecasting Models During the*

- Canadian Atlantic Storms Program (CASP). August 1987. 256 p.*
- 088 Penicka, F.X. *Wave Hindcast Sensitivity. April 1987. 114 p.*
- 099 Juszko, B.A. *Comparison of Directional Wave Spectra. July 1988. 227 p.*
- 103 Hodgins, D.O., C.T. Niwinski and D.T. Resio. *Comparison and Validation of Two Shallow Water Spectral Wave Models. June 1989. 143 p. + appendices.*
- 114 Eid, B.M. and V.J. Cardone. *Beaufort Sea Extreme Waves Study. March 1992. 143 p.*

Appendix 2

ESRF Management Board

<p>Chair Paul Barnes Manager, Atlantic Canada Canadian Association of Petroleum Producers 403, 235 Water Street St. John's NL A1C 1B6</p>	<p>Ruth McKechnie Science Advisor Northern Oil and Gas Branch Indian & Northern Affairs Canada Room 10E1 15 Eddy Street Gatineau QC K1A 0H4</p>
<p>Lynne Patenaude Manager, Natural Gas and Crude Oil Oil, Gas and Alternative Energy Division Environnement Canada 351 St. Joseph Blvd Gatineau QC K1A 0H3</p>	<p>Patrice Simon Director, Environment & Biodiversity Science Br. Ecosystems Sciences Fisheries and Oceans Canada 200 Kent Street Ottawa ON K1A E6</p>
<p>Robert Steedman Professional Leader, Environment National Energy Board 444-7th Avenue S.W. Calgary AB T2P 0X8</p>	<p>Greg Janes Team Lead Environment, Emergency Response and Security Suncor Energy Suite 201, Scotia Centre 235 Water Street St. John's NL A1C 1B6</p>
<p>Alan Kennedy Environment/Regulatory Manager Syncrude Development Imperial Oil Resources 237 4th Avenue, S.W. Calgary AB T2P 3M9</p>	<p>Francine Wight Health, Safety & Environment Lead Husky Energy Suite 901, Scotia Centre 235 Water Street St. John's NL A1C 1B6</p>

<p>David Burley Manager, Environmental Affairs Canada-Newfoundland and Labrador Offshore Petroleum Board 5 Fl, TD Place 140 Water Street St. John's NL A1C 6H6</p>	<p>Eric Theriault Advisor, Environmental Affairs Canada-Nova Scotia Offshore Petroleum Board 6th Fl, TD Centre 1791 Barrington Street Halifax NS B3J 3K9</p>
<p>Norman Snow 107 Mackenzie Road Inuvik NT X0E 0T0</p>	<p>Gerard Chidley P.O. Box 22 Renews NL A0A 3N0</p>