

INTERNAL WORKING PAPER. NOT TO BE CITED WITHOUT
THE PERMISSION OF ARCOD

TD 195 .P4 A72 1982 c.2
Clarke, R.
Compilation of DFO
positions on Arctic...
63049 05003859 c.2

ARCOD WORKING PAPER 82-5

COMPILATION OF DFO POSITIONS
ON ARCTIC OFFSHORE HYDROCARBON DEVELOPMENTS

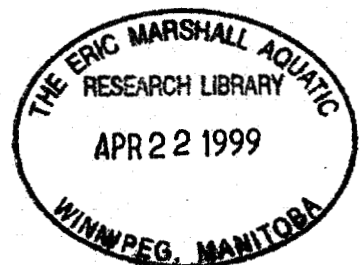
Compiled by
R. Clarke
DFO, Winnipeg

for

Arctic Offshore Development Committee
Department of Fisheries and Oceans

July 1982

THE ERIC MARSHALL AQUATIC RESEARCH LIBRARY
501 UNIVERSITY CRESCENT
WINNIPEG, MANITOBA CANADA R3T 2N6



FOREWORD

The Department of Fisheries and Oceans (DFO) and its predecessors (Fisheries and Marine Service and the Department of Fisheries and the Environment) have made several statements related to hydrocarbon activities in arctic marine waters. Public statements were made to the Environmental Assessment Panels for the Eastern Arctic Offshore Drilling - South Davis Strait Project, the Lancaster Sound Drilling Project and the Arctic Pilot Project (Northern Component). As part of the Lancaster Sound Regional Study, DFO made a public statement at the Southern Workshop. Also, DFO provided comments in 1977 on the offering of federal lands for hydrocarbon exploration, and in 1980 on the disposition of lease acreage in Hudson Bay.

Hydrocarbon activities are continuing in arctic marine waters, and DFO is required to make comments and take positions on them. Current examples are the Canada Oil and Gas Lands Administration's renegotiation of oil and gas exploration agreements, and the Environmental Assessment Panel's review of the Beaufort Sea Hydrocarbon Production Proposal. In preparing new positions on hydrocarbon activities, DFO should consider the positions it has taken previously on related issues. Consequently DFO's Arctic Offshore Development Committee, which is DFO's focus for preparing such positions, concluded that these statements should be compiled in a single volume to aid in the development of new departmental positions.

The statements included in this compilation are arranged in the following sequence of topics: Federal Reserve Lands Offered for Hydrocarbon Exploration; South Davis Strait; Lancaster Sound; Arctic Pilot Project (Northern Component); and Hudson Bay. If there was more than one statement for a topic, the statements are arranged by date.

TABLE OF CONTENTS

FOREWORD

A. FEDERAL RESERVE LANDS OFFERED FOR HYDROCARBON EXPLORATION

A.1 Collation of Fisheries and Marine Services Concerns, November 1977.

B. SOUTH DAVIS STRAIT

B.1 Department of Fisheries and the Environment Review of the EIS for Offshore Drilling in South Davis Strait, August 1978.

B.2 Department of Fisheries and Oceans Position on Supplemental EIS and 1978 Studies for South Davis Strait, June 1979.

C. LANCASTER SOUND

C.1 Department of Fisheries and the Environment Review of the EIS in Support of Exploratory Drilling in Lancaster Sound, October 1978.

C.2 Department of Fisheries and Oceans Brief Presented to Southern Workshop, Lancaster Sound Regional Study, May 1981.

D. ARCTIC PILOT PROJECT (NORTHERN COMPONENT)

D.1 DFO/DOE Joint Review of the Draft EIS Submitted in Support of the Arctic Pilot Project, May 1979.

D.2 DFO/DOE Review of Supplementary Information to the Arctic Pilot Project EIS, February 1980.

D.3 Department of Fisheries and Oceans Position Statement on the Arctic Pilot Project, February 1980.

D.4 DFO Opening Statement - Arctic Pilot Project Panel Hearings, 23 April 1980, Resolute Bay, NWT.

D.5 DFO Closing Statement - Arctic Pilot Project Hearings, Resolute Bay, 29 April 1980.

D.6 DFO Supplementary Comments on the Arctic Pilot Project EIS, May 1980.

E. HUDSON BAY

E.1 A Summary of DFO Concerns and Recommendations Associated with the Disposition of Lease Acreage in Hudson Bay, 1980.

A. FEDERAL RESERVE LANDS OFFERED FOR HYDROCARBON EXPLORATION

A.1 Collation of Fisheries and Marine Services Concerns,
November 1977.



MEMORANDUM

NOTE DE SERVICE

TO
À

Dr. G.L. Robins
Chief, Northern Affairs
Aquatic Environment Branch

FROM
DE

D.G. Wright
Coordinator
Environmental Secretariat

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE - N/REFERENCE
YOUR FILE - V/REFERENCE
DATE November 14, 1977

SUBJECT
OBJET

FEDERAL RESERVE LANDS TO BE OFFERED FOR HYDROCARBON EXPLORATION

As per your request, please find attached a collation of FMS concerns with regards to the offering of Federal lands for hydrocarbon exploration.

We have taken the position that exploration can take place in most areas provided that there are adequate terms and conditions attached to exploration permits in order to mitigate potential impacts. In those areas in which there are few baseline data but in which there may be significant environmental concerns we request that appropriate baseline studies be undertaken before exploration leases are issued. Appropriate terms and conditions can be developed for each specific area following the completion of these studies.

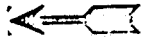
Because of the biological sensitivity of the Cardigan Strait - Hell Gate area, we recommend that no leases be issued for this area and that it become a biological sanctuary.

Should you have any concerns or questions, do not hesitate to call.

D.G. Wright
Coordinator
Environmental Secretariat

gep

- c.c. R.J. Paterson
- J.N. Stein
- A.W. Mansfield
- M.J. Lawrence
- B.W. Fallis





TELECOPIER MESSAGE TO:

TO
A
Dr. G.L. Robins
Chief, Northern Affairs
Aquatic Environment Branch
Resource Services Directorate
Ottawa

FROM
DE
D.G. Wright
Coordinator
Environmental Secretariat
Fisheries & Marine Service
Winnipeg

SECURITY - CLASSIFICATION - DE SECURITE
OUR FILE - N/RÉFÉRENCE
YOUR FILE - V/RÉFÉRENCE
DATE November 14, 1977

SUBJECT
OBJET

The Dept. of Indian and Northern Affairs and the Dept. of Energy, Mines & Resources have initiated a new process whereby Federal Reserve Lands will be offered to industry for the purpose of hydrocarbon exploration. Industry have identified specific areas which they consider to have the highest potential and would wish to come under exploration permit. The major departure in this new system from the previous one is that environmental, social and economic implications of exploration are to be considered before exploration permits are granted.

The Dept. of Fisheries & Environment has been requested to provide comment on the environmental sensitivity of the nominated areas before a decision is made concerning those areas which will be offered for exploration.

General Position

As a general principle, our position is that exploration should be allowed to proceed provided that appropriate terms and conditions are attached to permits which will mitigate potential impacts and that these are strictly adhered to by the proponent and enforced by the appropriate regulatory agency. DFE will oppose the release of lands in cases where available environmental information is limited but that a significant sensitivity is suspected. In such cases, a delay will be requested to permit the acquisition of necessary baseline information so that an informed recommendation can be made.

Concerns by Area

Lancaster Sound/Baffin Bay/Davis Strait

Several tracts have been nominated in the Lancaster Sound/Baffin Bay/Davis Strait area. It is anticipated that the proposed EAMES project and the review established under EARP will be sufficient to cover our concerns in these areas. Our one concern is that the EAMES project may not include those blocks in the "North Water" area of Baffin Bay/Smith Sound. This area is unique in that it is an open-water area throughout the winter and thus provides overwintering habitat for many of the marine mammals in the eastern Arctic. As yet there has been little in the way of study of this area. It is recommended that the nominated areas between 75 10'N lat. and 77 N lat. and from west of the demarcation line between Canada and Greenland to 76 W long. be deferred from exploration permit until such time as appropriate environmental studies have been completed. These studies should be undertaken as part of the EAMES project.

Viscount Melville Sound

A large area has been nominated by the hydrocarbon industry in Viscount Melville Sound. The area, lying between 74 20' N. lat. and 74 50' N. lat. and 100 W long. and 111 30' W long. comprises some 1,713,488 ha (4,234,123 acres). Some marine mammal work, primarily on ringed seals and polar bears has been undertaken by researchers under the auspices of the Arctic Islands Pipeline Program (AIPP). However, at the time of this review, copies of the interim reports by Stirling (polar bears) and by Smith (ringed seals) were not available for review and comment. Nothing is known of the status of beluga, bowhead, narwhale and marine fish populations in this area. However, because of the heavy ice cover in the Sound and the lateness of breakup it can be assumed that marine mammal utilization is light.

Although some biological baseline studies have been undertaken in the Bridport Inlet area for the Panarctic/Petro Canada LNG project, few data are available on the marine ecology of Viscount Melville Sound.

It is the recommendation of FMS that monies from the proposed Environmental Studies Fund be used to undertake a baseline study in this area prior to the granting of exploration permits. This is not to say that the permitting process should be contingent on the completion and findings of the studies but rather that appropriate studies be undertaken before exploration begins in order that suitable terms and conditions for exploration can be developed. Because of the heavy ice conditions and the lack of a suitable drilling system, it is not anticipated that active exploration (drilling) of this area could begin within the next five years, at least.

Northwest Queen Elizabeth Islands

Several blocks of prospective leases have been identified on Banks, Prince Patrick, Mackenzie King, Brock and Borden Islands and surrounding waters. It is unlikely that there are any significant environmental considerations which would preclude the offering of these areas to industry. Because of the lack of immediately identifiable concerns, these areas could be offered to industry without the need for further studies. Terms and conditions can be attached to site-specific permits to mitigate any of the potential impacts in these areas.

Norwegian Bay

Two tracts with a combined area of 197,121 ha (487,202 acres) have been identified in the southeastern portion of Norwegian Bay off the southwest coast of Ellesmere Island. The more southerly of these two areas is biologically significant in that it includes part of a proposed IBP biological site (number 2-10). The area is unique in that there are several large colonies of Black Guillemots, Cephus grylle, numbering some 7-8000 pairs, nesting in steep cliff crevices on North Kent and Calf Island. In addition, tides and upwellings create year-round open water conditions, thus providing overwintering habitat for several species of marine mammals.

Because of the unique character of this area, it is recommended that the tract which includes the IBP site not be offered to industry for hydrocarbon exploration but be set aside as an ecological preserve or sanctuary. The other tract in Norwegian Bay could be offered to industry but with the understanding that strict terms and conditions would be applied to exploration permits in order to preserve and protect the Cardigan Strait - Hell Gate area.


West Coast Ellesmere Island

Three areas on the west coast of Ellesmere Island have been nominated as potential leases. Because of the heavy ice concentrations in the various sounds and fiords in these areas, it is unlikely that there are any concentrations of marine mammals, other than ringed seals and polar bears. The Eureka Sound area is a ringed seal pupping area. This would suggest that there are ample food supplies (benthos and fish) in this area.

Some land use problems could occur in these areas and a potential IBP site has been identified on the Froshem Peninsula. Given appropriate terms and conditions, exploration could proceed with minimal impacts.

Mackenzie Valley

Elsewhere in the NWT, extensive areas have been nominated in the Mackenzie Valley. Because of the numerous studies that have been undertaken in conjunction with the various pipeline proposals, further studies should not be required. Aquatic concerns can be met with terms and conditions attached to exploration permits.


for D.G. Wright

gep



12-32

TO
A

FROM
DE

G. L. ROBINS
CHIEF, NORTHERN AFFAIRS
AQUATIC ENVIRONMENT BRANCH
FISHERIES AND MARINE SERVICE, OTTAWA

M. J. LAWRENCE and B. W. FALLIS
ENVIRONMENTAL IMPACT SECTION
FISHERIES AND MARINE SERVICE, WINNIPEG

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE - N/RÉFÉRENCE
YOUR FILE - V/RÉFÉRENCE
DATE NOVEMBER 8, 1977

SUBJECT
OBJET

FEDERAL RESERVE LANDS TO BE OFFERED TO INDUSTRY FOR THE PURPOSE OF HYDROCARBON EXPLORATION

With respect to the lands within the Northwest Territories which are soon to be offered to industry for hydrocarbon exploration, this section has prepared a summary which collates the available information on fish resources found to exist for each of the various areas. It is our feeling that while the present knowledge base is far from adequate for all of the blocks of land to be offered to industry, the attached summary serves to earmark those areas where there are particular concerns for fishery resources and in which further environmental work is required before exploration permits are granted. In several instances the importance of fishery resources within an area has been inferred from the presence of higher predators (sea birds and polar bears) which rely almost exclusively upon fisheries resources. In other cases there is such a paucity of information that it is very difficult to predict the likely impact of drilling and well head development.

It is the feeling of personnel within the section that industry should not be given a "carte blanche" to drill within any of the lease areas without a case by case assessment of the implications of such development. The attached summary is a first attempt at bringing together the existing data to identify those areas considered most sensitive and susceptible to damage. The south coast of Devon Island, the North Kent Island area, the North Water, Baffin Bay and Viscount Melville Sound are respectively considered to be the areas warranting the greatest concern for the living resources they support.

It is our understanding that the Environmental Secretariat (Western Region) has submitted their position with regard to the offering of additional federal lands to industry for the purpose of hydrocarbon exploration. We ask that you consider our submission along with that of the secretariat and would appreciate being kept up to date on activities concerning the offering of the aforementioned lands to industry. Should you have any questions concerning the attached, please do not hesitate to call.

- Att
cc: J. Loch
J. Stein
K. Chang-Kue
G. McKinnon
R. Paterson

M. J. LAWRENCE B. W. FALLIS

BLOCK A NORTH COAST OF BANKS ISLAND

Geographical Limits of Lease Area: N 74 10 W 119 00
S 73 45 E 118 00

Acreage: 177,490 acres

Habitat Type(s): Freshwater
Coastal marine

Marine Ice Cover Synopsis 1961 to 1968 (3):

Open water was present for various durations between July 6 and freeze-up in the years 1961-66. In 1967 and 1968 no open water was observed.

Fish & marine mammals present	Abundance	Function	Ref.
Arctic char	unknown	spawning, rearing	(1, 4)
Seals (harp & bearded)	common	unknown	(2, 4)
Beluga whales	common	unknown	(4)
Bowhead whales	unknown	unknown	(4)
Marine fish	unknown	unknown	-

Comments:

This lease area encroaches upon the Banks Island Migratory Bird Sanctuary #2. The disturbance of rivers used by migrating Arctic char and the harassment of seals and other marine mammals in the coastal area are of concern. The suspected dependency of the Arctic fox population on being able to scavenge polar bear killed seals, implies economic ramifications to the trappers of Banks Island should seals avoid coastal waters as a result of barge traffic in the area. Any increases in vessel traffic along the west coast of Banks Island could have a serious impact on the beluga and bowhead whale populations that migrate through the area.

This lease is approximately 800 km from Inuvik which implies a fairly high degree of transmission difficulty.

BLOCK B PRINCE PATRICK ISLAND

Geographical Limits of Lease Area: B¹ N 76 40 W 120 30
S 76 30 E 118 15
B² N 77 30 W 118 00
S 76 50 E 115 30

Acreage: B¹ = 119,142
B² = 511,080

Habitat Type(s): Freshwater
Coastal marine

Marine Ice Cover Synopsis 1961 to 1968 (3):

A lead of varying size frequently opened along the west side of Prince Patrick Island making connection with McClure Strait and the Beaufort Sea.

Fish and Marine Mammals:

Present	Abundance	Function	Ref.
Beluga	unknown	unknown	-
Seals	unknown (prob. common)	unknown	(4)
Marine fish	unknown	unknown	-
Other	unknown	unknown	-

Comments:

It is doubtful that the seasonal freshwater streams occurring in the lease areas harbour any freshwater species of fish. On the basis of the suspected importance of the southeast coast of Prince Patrick Island as a polar bear denning area, and on the large number of sightings (4), large numbers of seals may be considered to occur in the coastal open water areas. The remoteness of the area will have important implications on the transmission of hydrocarbon finds to the south.

BLOCK C MACKENZIE KING ISLAND

Geographical Limits of Lease Area: N 78 10 W 115 00
S 77 20 E 109 30 .

Acreage: 1,127,500 (approximately)

Habitat Type(s): Seasonal freshwater streams
Small lake
Coastal marine

Marine Ice Cover Synopsis 1961 to 1968 (3):

Open water occurred in the coastal areas of Mackenzie King Island in 1961, 1962, 1963 and 1966, however none was observed in the years 1964, 1965, 1967 and 1968.

Fish & Marine Mammals Present	Abundance	Function	Ref.
Possibly Arctic char	unknown (limited)	unknown	-
Seals	unknown	unknown	(4)
Marine fish	unknown	unknown	-

Comments:

The offshore areas of Mackenzie King are utilized by polar bears for hunting in the spring (5). Assumedly they are hunting seals which must be present in this area in the spring.

BLOCK D BORDEN ISLAND

Geographical Limits of Lease Area: N 78 45 W 114 00 -
S 78 05 E 109 00 .

Acreage: 1,030,000 (approximately)

Habitat Type(s): Seasonal freshwater streams
Coastal marine

Marine Ice Cover Synopsis 1961 to 1968 (3):

Open water occurred during the latter part of August in the years 1961-1966. No observations were possible in 1967 and 1968.

Fish & Marine Mammals Present	Abundance	Activity	Ref.
Unknown	unknown	unknown	-

Comments:

A polar bear migration route encompasses Borden island (4). Insufficient information exists to say whether they actively hunt seals during this migration.

BLOCK F VISCOUNT MELVILLE SOUND

Geographical Limits of Lease Area: N 74 55 W 111 30
S 74 20 E 100 00

Acreage: 4,233,000 (approximately)

Habitat Type(s): Marine
Coastal marine

Marine Ice Cover Synopsis 1961 to 1968:

Open water occurred in Viscount Melville to varying degrees in each year of observation. The south coast area of Melville Island is usually the first area free of ice.

Fish & Marine Mammals Present	Abundance	Activity	Ref.
Belugas	numerous	unknown	(4)
Seals (sp ?)	unknown	unknown	(6)
Marine fish	unknown	unknown	-
Anadromous & char	unknown	unknown	-

Comments:

Beluga whale sightings are common along the south coast of Bathurst Island into the eastern portion of the lease area most years. Seal (sp) sightings are also common dependant upon ice cover conditions. It is presumed that marine fish such as Arctic cod are present in the area and are used as food by both seals and belugas. Streams and river systems of south Melville and Bathurst Islands with fish overwintering capacity should be considered to harbour Arctic char (anadromous or land locked) (7).

The importance of Viscount Melville Sound as summer range to both the eastern and western populations of beluga whales is not known. The beluga overwintering area on the southeast coast of Bathurst Island (4) implies an important migration of these whales through portions of Viscount Melville Sound.

BLOCK G EUREKA SOUND (near MOKKA FIORD)

Geographical Limits of Lease Area: N 79 45 W 85 30
S 79 05 E 84 30

Acreage: 342,000 (approx.)

Habitat Type(s): Marine
Freshwater lakes
Freshwater (seasonal) streams

Marine Ice Cover Synopsis 1961-1968 (3):

Open water occurred to a large extent for approximately two months (Aug. 10 to October) in each year.

Fish & marine mammals present	Abundance	Activity	Ref.
Ringed seals	numerous	pupping	(4)
Marine fish	unknown	-	-
Freshwater fish	unknown	-	-

Comments:

There are three freshwater stream-lake systems which drain into Eureka Sound in this lease area. It is not known whether any species of fish (freshwater or anadromous) inhabit these systems. The observations of ringed seal pupping activity in this region combined with the large number of polar bears that are known to inhabit the region, indicate its importance as a marine mammal haven and presumes ample quantities of marine food source (fish) for the seals. The documentation of two Thule campsites (one at Mokka Fiord and another 10 miles to the north) on Axel Heiberg imply a former reliance on the area as an adequate food resource.

BLOCK H FOSHEIM PENINSULA - CANON FIORD

Geographical Limits of Lease Area: N 80 10 W 83 30
S 79 30 E 82 00

Acreage: 480,000 (approx.)

Habitat Type(s): Small lakes
Glacier fed streams
Marine fiord

Marine Ice Cover Synopsis 1961-1968 (3):

Open water was observed by early to late August in the years 1961, 62, 65, 66, 67. In the other years ice cover ranged from .2 to .9.

Fish & marine mammals present	Abundance	Activity	Ref.
Freshwater & anadromous fish	unknown	unknown	-
Seals (sp)			
Marine fish			

Comments:

Some physical and chemical oceanographic data is available on the Nansen-Greely Fiord system. Biological observations are scanty to non-existent. The lake-river systems may harbour limited Arctic char populations.

BLOCK I RAANES PENINSULA

Geographical Limits of Lease Area: N 78 50 W 87 30
S 78 10 E 86 00

Acreage: 361,000 (approx.)

Habitat Type(s): Marine
Coastal
Seasonal streams

Marine Ice Cover Synopsis 1961-1968 (3):

Open water occurred to a greater or lesser extent in each year.
Water was usually open by mid August and as early as July 17
in 1962.

Fish & marine mammals present	Abundance	Activity	Ref.
Ringed seals	unknown	migration?	see comments below
Marine fish	unknown	unknown	

Comments:

Ringed seals may inhabit Eureka Sound in this region during the summer months or may migrate through this area to the more northerly pupping area (see Block G Comments). No lakes occur in the lease area - nor rivers of apparent sufficient size to overwinter any freshwater fish.

BLOCK J NORWEGIAN BAY - BJORNE PENINSULA

Geographical Limits of Lease Area: N 77 25 W 89 30
S 77 00 E 87 30

Acreage: 368,000 (approx.)

Habitat Type(s): Marine
Coastal
Seasonal streams
Small lakes

Marine Ice Cover Synopsis 1961-1968 (3):

Open water occurred in the area in each year of observation.
Earliest records of open water was August 12 - latest was
September 2.

Fish & marine mammals present	Abundance	Activity	Ref:
Anadromous or landlocked char	unknown	unknown	-
Marine mammals	unknown	unknown	-
Marine fish	unknown	unknown	-

Comments:

Bjorne Peninsula is a polar bear denning area (4) and the offshore area is the site of annual (normally) polar bear migrations. The presence of a significant number of polar bears in this area may be construed to indicate the presence of seals and marine fish populations.

BLOCK K NORTH KENT ISLAND - HELL GATE

Geographical Limits of Lease Area: N 77 00 W 91 00
S 76 50 E 89 30

Acreage: 174,360 acres (approx.)

Habitat Type(s): Marine
Coastal
Seasonal streams

Marine Ice Cover Synopsis 1961-1968 (3):
Open water occurs at Hell Gate year round.

Fish & marine mammals present	Abundance	Activity	Ref.
Walrus	abundant	overwintering	(4,8)
Beluga whales	unknown	overwintering	(4,8)
Narwhal	unknown	overwintering	(4,8)
Marine fish	unknown (probably plentiful)		
Seals (sp.)	unknown (high)		(8)

Comments:

Few, if any, intensive studies have been done in this area; however observations by a number of arctic researchers (4,8) indicate this to be an area critical to the overwintering of abundant numbers of seals, walruses and whales. It has been recommended as an IBP Ecological Site. The presence of a large Black Guillemot Colony on North Kent and Calf Island and the abundance of marine mammals between October and June supports the belief that large populations of marine fish inhabit the waters of the area.

BLOCK L LANCASTER SOUND

Geographical Limits of Lease Area: N 74 30 W 85 00
S 74 15 E 80 30

Acreage: 722,400 acres

Habitat Type(s): Coastal
Marine

Marine Ice Cover Synopsis 1961-1968 (3):

Open water is recorded as early as March 16 and first appearance as late as August 23. Extensive open water occurs in Lancaster Sound each year. The area along the south coast of Devon Island is normally the first to open.

Fish & marine mammals present	Abundance	Activity	Ref.
Arctic cod	abundant		(9,10)
Other marine fish	unknown		-
Narwhal	abundant	migration	(10)
Beluga	abundant	migration	(10)
Walrus	numerous	unknown	(10)
Ringed seal	numerous	unknown	(10)
Bearded seal	(unknown) numerous	unknown	(10)
Harp seal	numerous (N. coast of Baffin)	unknown	(10)
Bowhead whale			

Comments:

Beluga concentrations as high as 50-250/km² occurred along the south coast of Devon at various times between May and September in 1971. Narwhal occurred in fewer numbers during the same period along this coast. They were observed in greater abundance during the latter part of September moving eastward. Bowhead whale sightings were made in the lease area in 1976. As many as 90 walrus sightings were made along the S. Devon coast in the two day July 18/19 period of 1976. Hundreds of harp seals occurred in the lease area during this same year. Numerous ringed seals were also observed.

Frequent sightings of individual bearded seal have also been recorded. The combination of large numbers of seals and whales and extensive sea bird colonies indicate large populations of marine fishes (including Arctic cod) in the S. coast area of Devon Island. Lancaster Sound is of critical importance to many species of mammals that occur there (either during migration or as summer residents). The alteration or degradation of this marine habitat would have impact on a resource valuable to both local and distant communities.

BLOCK M NORTH WATER

Geographical Limits of Lease Area: N 77 00 W 76 00
S 75 10 E Inf. Boundary

Acreage: 2,151,250 (approx.)

Habitat Type(s): Marine

Marine Ice Cover Data:

The "North Water area" or portions of it are open year round.

Fish & marine mammals present	Abundance	Activity	Ref.
Walrus	abundant	overwintering	(4)
Bearded seals	abundant	overwintering	(4)
Narwhal	abundant	overwintering	(4)
Beluga whales	abundant	overwintering	(4)
Harp seals	unknown	migration	(4)
Marine fish	unknown (presumably abundant)	-	-

Comments:

The North Water provides an overwintering habitat for several species of marine mammals which are believed to occur there in abundance. Alterations to this habitat and/or harrassment of marine mammals which occur there may jeopardize the survival of large portions of the Arctic populations of these mammals.

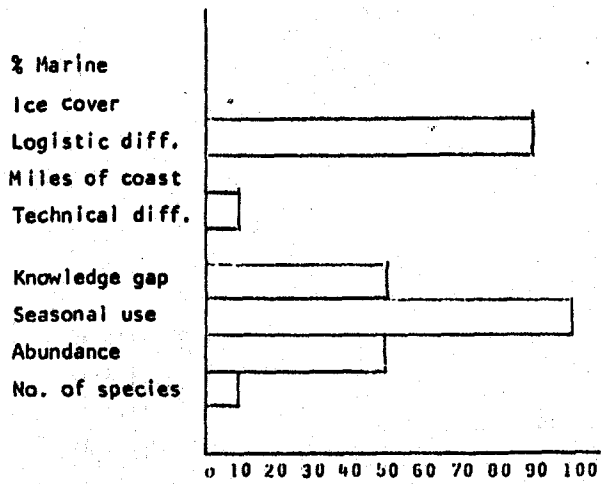
CITED REFERENCES

- (1) A.L.U.R. 1976. Field notes and recorded observations from Fisheries and Marine Service field work - Banks Island.
- (2) Freeman, M.M.R. 1976 (ed.). Inuit Land Use and Occupancy Project Volume I, II and III. A report prepared by M. Freeman Research Ltd. under contract with the Department of Indian and Northern Affairs.
- (3) Lindsay, D.G. 1975. Sea Ice Atlas of Arctic Canada 1961-1968. Department of Energy, Mines and Resources, Canada.
- (4) Canadian Wildlife Service. 1972. Arctic Ecology Map Series, Critical Wildlife Areas - Descriptive Reports. Environment Canada, Wildlife Service.
- (5) Fraker, M.A. 1977. 1977 Arctic Whale Studies, Beaufort Sea Region. Progress report to 15 October 1977. Department of Fisheries and the Environment. FWI, Winnipeg.
- (6) Tener, J.S. 1961. Queen Elizabeth Islands Game Survey, 1961. Canadian Wildlife Service. Occasional Papers No. 4.
- (7) Hatfield, C. 1977. (pers. comm.). Observations of landlocked char populations in lakes along the south coast of Melville Island, 1976.
- (8) Nettleship, D.N. and P.A. Smith. 1975. Ecological sites in Northern Canada. Canadian Committee for the International Biological Programme. Conservation Terrestrial, Panel 9.
- (9) Bradstreet, S.W.M. 1976. Summer feeding ecology of sea birds in Eastern Lancaster Sound 1976. L.G.L. Ltd. for Norlands Petroleum Ltd. Calgary, Alberta.
- (10) Johnson, S.R. et al. 1976. Marine mammals recorded during aerial surveys of birds in Eastern Lancaster Sound 1976. L.G.L. Ltd. for Norlands Petroleum Ltd. Calgary, Alberta.

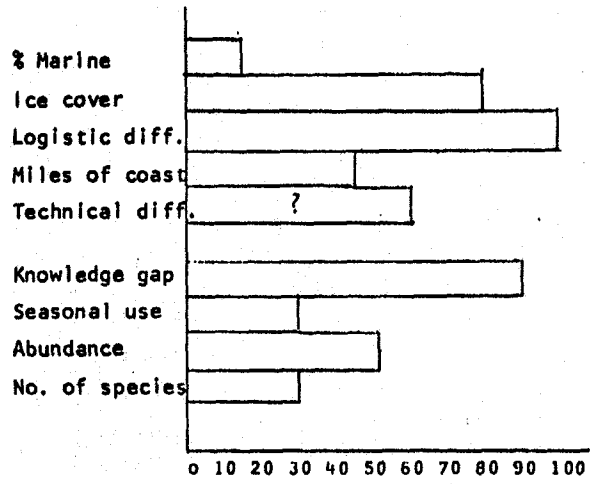
KEY TO SYNOPTIC HEADINGS

1. % Marine An estimate of the percent of the Block which is in the marine element. It is believed that potential for unmitigated hazardous occurrence are greatest in this element.
2. Ice cover An estimate of the portion of the year during which ice cover exists has been made. Oil spill clean-up is hampered by ice cover and consequently is considered a negative aspect regarding habitat protection.
3. Logistic difficulty An estimate of relative distance from market. Greater distance implies greater environmental hazard.
4. Miles of coast An estimate of the relative miles of coast within a fifty mile radius of marine drill sites that could not feasibly be protected from blowout or oil spill in the lease area. This estimate is based on a hypothetical drill site at the centre of the "Block" and hence is itself very hypothetical.
5. Technical difficulty Based on the degree of "tried and true" industrial experience. Land based well sites rate low - deep-water marine under moving ice conditions rate high.
6. Knowledge gap An expression (barely measurable) of the lack of a reported resource data base upon which any description of the area may be written.
7. Seasonal use Suspected or known portion of the year during which marine mammals inhabit or frequent the area (unless otherwise indicated, e.g. Arctic char).
8. Abundance Abundant - 100% Rare - 20%
Numerous - 70% Unknown
Common - 50%
9. No. of species 1 known species = 10 units
marine fish = 10 units

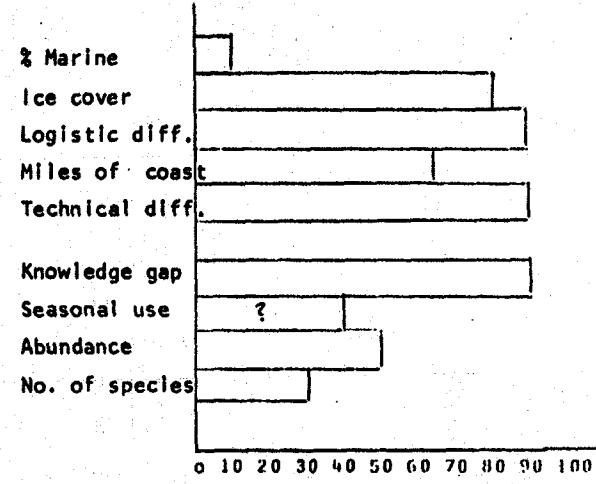
NOTE: The credibility of 7, 8 and 9 are highly dependent on 6 (knowledge gaps); hence where a large knowledge gap is indicated, little faith is placed on the species, abundance and seasonal use headings.



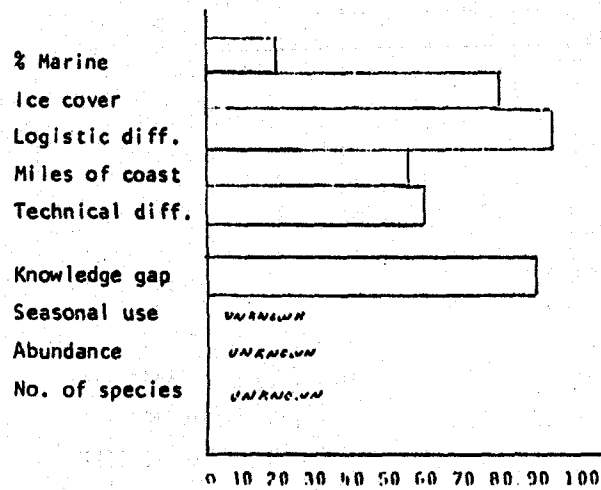
BLOCK A



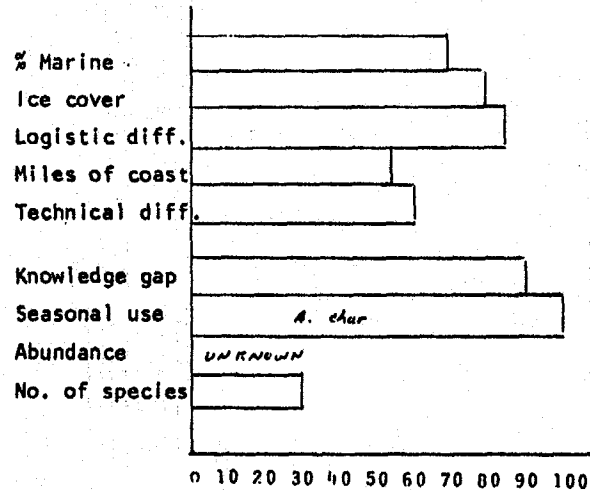
BLOCK B



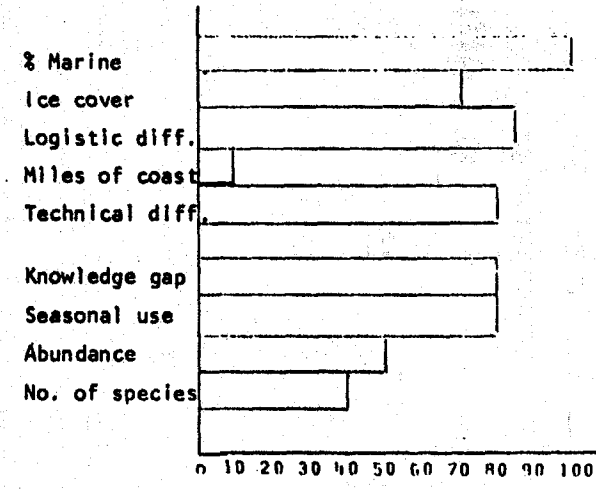
BLOCK C



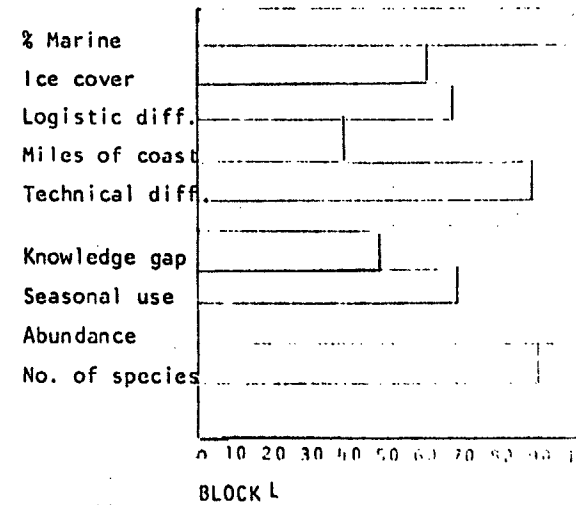
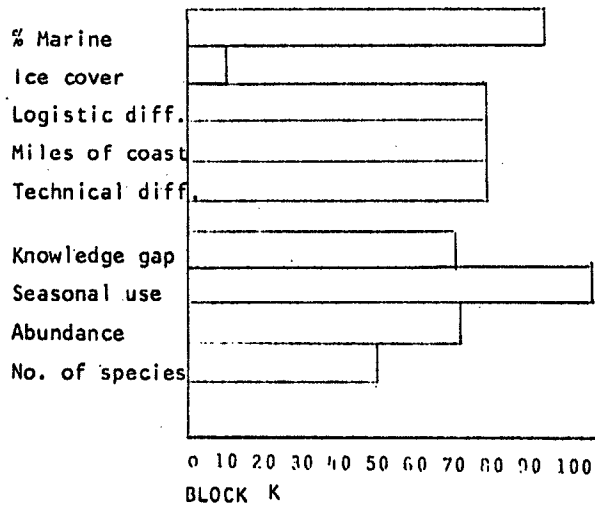
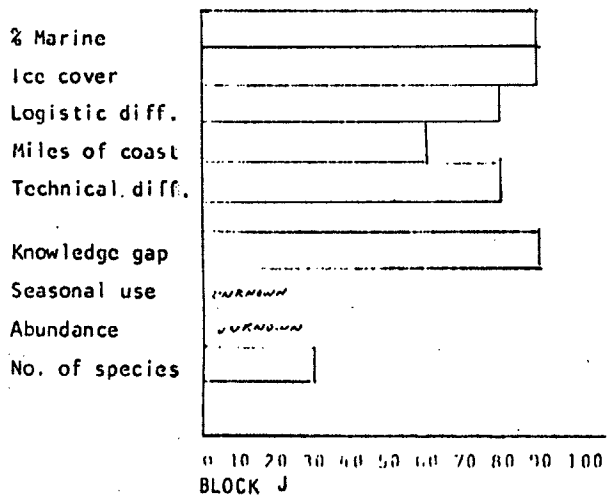
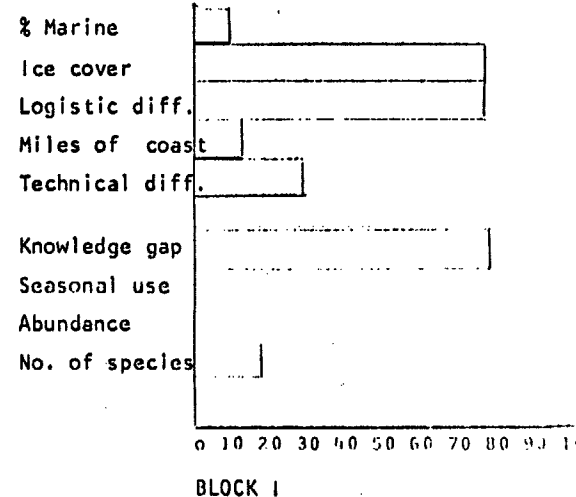
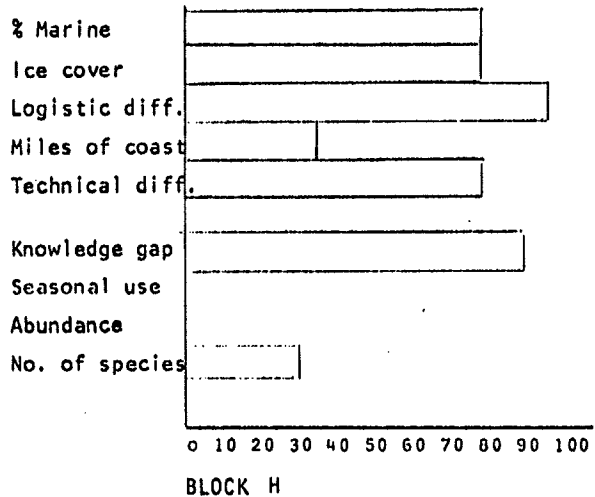
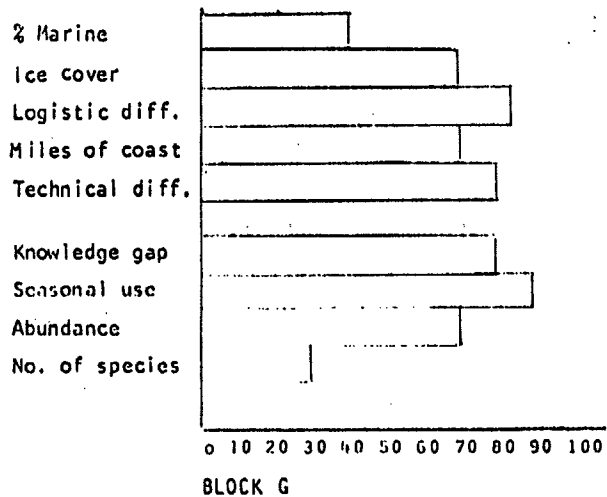
BLOCK D

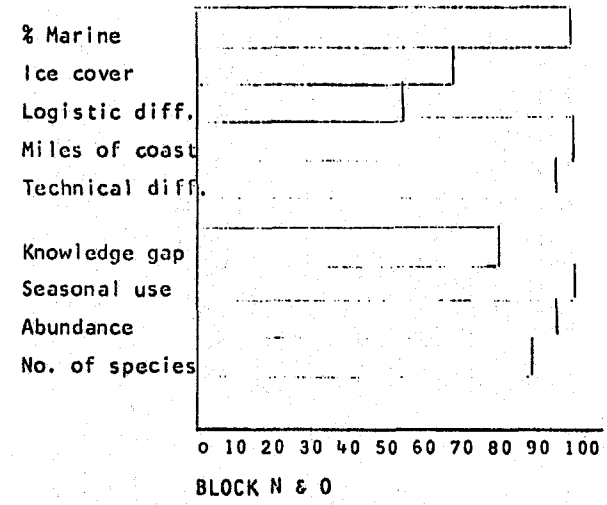
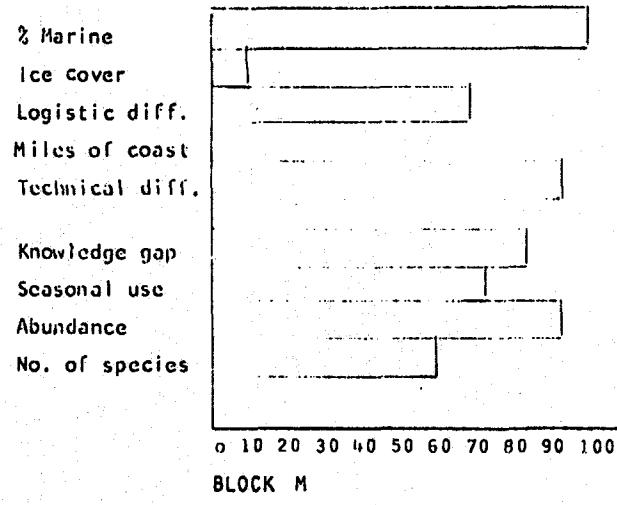


BLOCK E



BLOCK F





B. SOUTH DAVIS STRAIT

**B.1 Department of Fisheries and the Environment Review of the EIS
for Offshore Drilling in South Davis Strait, August 1978.**

Review of the
Environmental Impact Statement (E.I.S.)
for
Exploratory Drilling in Davis Strait Region
by
Imperial Oil Limited
Aquitaine Co. of Canada Limited
Canada-Cities Service Limited

This review contains contributions from staff of the Atlantic, Québec, Pacific, Western and Northern, and Headquarters Regions of the Department of Fisheries and the Environment. Its preparation has been coordinated by the Regional Hydrocarbons Committee, Western and Northern Region (Chairman, M. J. Lawrence).

Submitted to the Environmental Assessment and Review Panel 15 August 1978.

REVIEW RATINGS BY THE REGIONAL HYDROCARBON COMMITTEE

Environmental Impact of the Action - No Rating

Adequacy of Impact Statement - (3) inadequate¹

¹"The reviewer believes that the Statement does not adequately assess the environmental impact of the proposed project or action. The reviewer requires more information and analysis concerning the environmental hazards, and asks that substantial revision be made to the Statement". (From Guidelines for the Review of Initial Environmental Evaluations and Environmental Impact Statements, RSS, Western and Northern Region, Department of Fisheries and the Environment, April 1978.)

INTRODUCTION

The E.I.S. submitted by the initiator in support of their proposal to drill offshore in Davis Strait represents the expenditure of considerable sums of time, effort and money. However, in their present form the E.I.S. and supporting documents fulfil the role of an interim report which fails to collate and interrelate the available information in a manner which clearly defines the likely impacts of offshore drilling with an associated oil well blowout. Consequently, subsequent to review of the material submitted it is the opinion of the Department of Fisheries and the Environment that many of the conclusions reached in the E.I.S. are unwarranted and are often based upon inadequate or no knowledge of the resources which could be affected. This has led to the proponents' assignment of subjective impact ratings which have little value and in many cases negate the effects which offshore drilling activities and an associated oil well blowout would have.

The lack of availability of much of the information purported to have been collected in support of the proponents' E.I.S., or currently ongoing has hindered the overall review of the E.I.S. Of note in this respect is the work carried out on the nearshore benthic communities.

In general the E.I.S. and supporting documents have been hurriedly prepared, exhibit a minimal amount of data interpretation and show little evidence of having been scrutinized prior to submission, as illustrated by the inexcusable number of typographical errors.

Moreover, the literature is referenced in a grossly inadequate and unscientific manner, and the review of information relevant to the study area is generally incomplete.

In view of the foregoing it is the general consensus of the various DFE personnel who participated in this review that the E.I.S. submitted by the initiator is inadequate and insufficient to permit the proposed project to be rated. In support of this position a summary of general concerns relating to the E.I.S. is presented, followed by detailed comments related to specific sections of the E.I.S. and to the supporting documentation. Appended to this review document are the comments from each of the various Service participants. Time constraints associated with review of the pertinent documents and the limited availability of certain documents prevented some personnel from providing the indepth comment which might otherwise have been forthcoming. Comparison of the adequacy of the proponents' E.I.S. to the F.E.A.R.O. "Guidelines for the preparation of an E.I.S. for Eastern Arctic Offshore Exploratory Drilling" has not been carried out since it is apparent from the January 1978 dates on the Guideline document and the proponents' E.I.S. that the Guidelines were not followed in the preparation of the E.I.S.

SUMMARY OF MAJOR CONCERNS AND CRITICISMS

This summary focusses most of its attention on concerns associated with an oil blowout. This does not imply that concerns relative to normal drilling and support operations are not important. They are of prime consideration in assessing the adequacy of the proponents' preparedness to conduct the project in an acceptable manner. Nevertheless, we consider the potential impact of a blowout to be the single most important issue associated with the proposed development.

Blowout Probability

Based upon the optimistic belief, that in the extremely rare "one in a million" possibility of an oil blowout, insignificant quantities of oil will impact the shoreline or will rapidly disperse in the water column, the proponents conclude that no significant adverse environmental impacts are likely to result from exploratory drilling in the Davis Strait. Much of the proponents optimism is not warranted and generally based on purely theoretical considerations, often poorly tested. Presumably, because of this optimism and the lack of development of realistic "worst case scenarios", the proponents have not adequately attended to the study of the offshore marine and coastal ecology within the range of spilled oil impact. Similarly, the necessary detailed attention has not been given to the determination of the kinds, magnitude of and ramifications of, specific localized impacts resulting from a possible blowout. Consequently the proponents pay insufficient attention to the development of contingency and countermeasure strategies.

The proponents' contention that the risk of an oil blowout occurring in the Davis Strait exploratory drilling programme is "one in a million," is not adequately supported by documentation and is contradictory to other similar statistics which increase the risk by two orders of magnitude. As well, the uncontrolled flow record of Canmar's drilling offshore in the Beaufort Sea, (three in ten wells spudded) raises grave doubts about the value of risk analysis statistics in unfamiliar environments. The fact that the proposed programme must contend with the hazards of cold weather, frequent severe storms, and iceberg

incursions (with associated scour potential), drifting pack ice, often limited visibility and geological formations having potential overpressure zones, with a potential to bear oil, renders the risk attendant with drilling in deep water in the Eastern Arctic far greater than the risks associated with Canmar's drilling experience in the Beaufort Sea.

Subsurface - Fate of Oil

The proponents' predictions that oil from a blowout will rarely impinge upon the coastline are based on overly simple models, with poor input data, containing unfounded assumptions and some questionable input from the results of short term field programmes. The formation of gas hydrates at the well head are mentioned, and rather too quickly dismissed - a serious shortcoming when such formation may have considerable effect on the plume and wave ring structure which in turn will have a major bearing on the formation of a surface oil slick.

Surface Fate of Oil - Open Water

The proponents do however consider the formation of a surface slick as being a possibility, and in turn perform an analysis of the likely trajectories and fate of an oil slick based upon the "Sliktrak" model of oil spill movement. The Department has serious reservations regarding the validity of the input data used in this rather simplistic model and upon its application to provide locations of shoreline impact in a complex and poorly understood environment. The use of "Monte Carlo" generated weather data, based upon "averaged" wind velocities obtained from a weather station not representative of the Davis Strait region, the lack of a tidal current input capability in a region where tidal

currents are of considerable significance, the use of surface current data generated from too few locations and of questionable value, are but some of the reviewers' objections. Moreover, the lack of a "worst case" scenario using real wind data (which suggest the likelihood of frequent persistent easterly and southeasterly winds) and the lack of consideration given to other available models which may better predict the fate of oil, are serious omissions.

Fate of Oil in Ice

In addition to reservations regarding the validity of predicted oil movement in open water, is our concern for the proponents' assessment of the fate of oil entrained within pack ice. Studies conducted by their consultants and other data to which they refer do not as they state "show a significant amount of divergence (of ice floes). . .". There is little evidence to support their belief that oil, once trapped and transported south by the Labrador current will be significantly spread out by floe movements prior to its release during melt conditions.

Delay in Drilling

The proponents judge that a delay in drilling is not an acceptable alternative on the basis that it will not reduce the environmental impact associated with the project, since further studies will not alter the threat of an uncontrolled blowout. While further studies may not alter the magnitude of the threat, an effort at more precise definition of resource sensitivities and species distributions and interactions can be made. This would allow more enlightened assessments of the kinds of potential threats to the environment. Such assessments are not possible

at this time and thus a realistic evaluation of potential resource losses cannot be made. It is also foreseeable that a delay in drilling would improve the likelihood of the development of effective countermeasures if energies were directed toward countermeasures' technology and strategies for the environment and living resources in the proposed drilling area.

In summation, it is felt that neither the likelihood of an oil blowout, nor the possible fates of spilled oil, have been realistically assessed.

The Existing Environment

In order to properly assess the environmental impact of any industrial undertaking a full description of the existing environment is required. In this respect, the proponents' description of the environment, within the study area to be affected by the consequences of offshore exploratory drilling, is generally inadequate with respect to physical, chemical, atmospheric, and biological components. The oceanography of the Davis Strait was well reported, however the validity of the surface currents analysis suffers from shortcomings related to inadequacies of the surface drifter buoys programme.

Coastal Environment

The report on the coastal environment of Baffin Island by the University of Colorado Institute of Arctic and Alpine Research was reasonably well done and provides a good picture of the types and abundance of various coastal habitats which could be affected by an oil well blowout, however, it fails to identify those coastal areas which

would be most sensitive to the effects of an oil well blowout.

Sea Floor

The proponents have not delineated hazards associated with hydrate formation, boulder encounters during drilling, and mass movement of seafloor sediments.

Atmospheric Environment

In evaluating atmospheric effects on the implications of offshore drilling, the proponent has failed to consider worst case situations associated with storms which move north along the Atlantic coast and dissipate in this area. In addition the proponents have not adequately evaluated the speed and direction of prevailing winds within the study area during various seasons of the year, so as to be able to predict the movement of ice floes within the study area which comprise a crucial habitat for seals. In turn the lack of use of actual weather information from the study area in the modelling of the pattern of oil dispersion has hindered the usefulness of fate of oil predictions. Furthermore the effect of various weather conditions, such as fog, blowing snow, temperature and sea state conditions have received insufficient consideration in the evaluation of the impact of the proposed project.

Marine Habitat and Oceanography

The proponents have not provided an adequate description of the chemical nature of the environment with respect to existing concentrations of hydrocarbons in water; sediment; and tissues of various marine biota. Such information on the existing environment is essential to assess the consequences of an oil well blowout during exploratory drilling.

Similarly, the chemical nature and toxicity of the drilling fluids to be discharged, have not been assessed through the use of bench scale tests. The oceanographic work undertaken, while considered to have been generally well reported, has provided only a rudimentary understanding of the seasonal pattern of currents and distribution of waters of varying salinity. In turn such information has not been correlated with the information obtained on biota of the area to arrive at an assessment of the likely impacts on the various components of each trophic level.

Biota

The proponents have not considered the impact of an oil well blowout on the microbiota of the study area, the impact on benthic productivity in various nearshore areas, or the ultimate effect of weathering on the long term impact of oil. The proponent has failed to delineate those localities within the study area which are biologically most sensitive at various times of the year, thus preventing a proper assessment of likely impacts. Furthermore the implications of oil carried south of the study area to the coasts of Labrador and Newfoundland are not considered in spite of the fact that oil transported southward could have significant effects on commercial fishing and sealing in these areas.

Only casual mention is made of the seven I.B.P. sites located within the study area and no assessment has been made of the impacts likely to occur on the resources in each of these sites. The proponents have presented insufficient information to enable evaluation of the likely effects of oil on the ice edge community, on seals migrating through the area or whales and seabirds consuming large quantities of zooplankton contaminated with oil. In addition sufficient information is lacking on

the seasonal abundance and distribution of larval fishes and the occurrence and migration of adult fishes through the area. For example, it is known that Greenland halibut, a commercially important species, utilize the area south of the submarine ridge connecting Greenland to Baffin Island in the vicinity of the Arctic Circle and that Atlantic salmon migrate through the Davis Strait to summer feeding grounds off the coast of Greenland. However, the proponents have not delineated those areas most used by the Greenland halibut or the route followed by the Atlantic salmon. Disruption to either of these fish species as a result of exploratory offshore drilling could have far reaching international implications.

Insufficient information has been obtained to adequately identify major food chain relationships within the study area and impacts on the feeding and breeding areas of fishes and whales and the feeding habits of seabirds within the study area are sorely lacking. While the proponents have identified the major impact which an oil well blowout would likely have on murre populations in the area, no data has been obtained to clearly define the timing and actual migration routes followed by this species. Such casual mention is made of the whales sighted in the study area that the information is of little value whereas the known occurrence of the narwhal in the area is virtually neglected.

While surficial examination is given to the use made by the Inuit of various resources in the area, the seasonal pressures on the various fish, seabird and marine mammal resources are neither defined nor compared to the times at which impacts from an oil well blowout would be greatest.

Impacts

In general the rating system utilized by the proponent is too subjective and does not adequately outline the magnitude of effects in a manner which enables the reader to gain an appreciation of the time frame required for environmental recovery. Owing to the incomplete nature of the data base with respect to the occurrence and seasonal abundance of larval and adult fishes, seals, whales, seabirds and zooplankton, impacts which have been assigned comprise merely guesstimates lacking the precision which should be associated with a project of this magnitude.

The proponents conveniently disregard the cumulative effects of the residual accumulation of oil dispersed southwards from the study area into waters off the coasts of Labrador and Newfoundland; areas which are commercially important for fishing and sealing. Impacts of oil on the large Arctic char fishery at Nain would have serious repercussions on both the fishery and the local residents. Similarly no consideration is given to the impacts of oil on individual groups of biota or to single components of the trophic system as they relate to other trophic levels. In other words impacts on the total biology of the study area as a whole are not considered.

Only passing mention is made of the ice edge community which according to the proponent is a biologically active area, yet no assessment of impact on the community associated with the ice edge is made. Similarly the ice-algae community which plays such a vital role in the productivity of waters in northern latitudes is recognized as being important but no assessment of likely impacts is made. The lack of

assessment of impacts on these two biologically important areas conflicts greatly with the conclusions associated with the results of the Sliktrak modelling which only considered oil encounters with land as significant, when in fact oil encounters with the edges of land fast ice and ice floes will likely have severe impacts on seals, birds, the ice edge and ice-algae communities.

Contingency Planning

The proponents of this E.I.S. have not designed a realistic countermeasures programme and instead rely upon assembling a programme six months prior to drilling. Such lack of foresight with respect to the consequences of an uncontrolled oil well blowout reflects the proponents apparent disregard for measures which are not legally binding and indicates inadequate assessment of likely impacts and overall lack of concern for potentially sensitive areas. However, without a well organized and detailed site specific contingency plan, it is not possible to assess the extent of possible impacts.

LIST OF CONTRIBUTORS

<u>Atlantic Region</u>	<u>Western & Northern Region</u>	<u>Quebec Region</u>
G. Beanlands, EMS	P. Addison, EMS*	A. Mansfield
R. Brown, EMS	T. Dafoe, EPS	
L. Coady, EPS (Nfld.)	E. Einarsson, AES*	<u>Headquarters</u>
J. Day, EPS	B. Fallis, FMS*	H. Ferguson
A. Gates, AES	A. Goodman, EMS	
R. Hendry, OAS	J. Kotylak, AES*	<u>Pacific Region</u>
D. Lawrence, OAS	M. Lawrence, FMS*	A. Milne
J. Lazier, OAS	G. Miller, EPS*	B. Smiley
C. F. M. Lewis, GSC (EMR)	J. moore, EPS	
A. R. Longhurst, OAS	R. Prach, EMS*	
G. Needler, OAS	R. Semkin, EPS	
D. Nettleship, EMS	D. Thornton, EPS	
R. Percy, EPS		
D. Riley, FMS		
J. Swis, EPS		
R. Wiseman, FMS (Nfld.)		

* Members, DFE Regional Hydrocarbon Committee (WNR)

B.2 Department of Fisheries and Oceans Position on Supplemental EIS
and 1978 Studies for South Davis Strait, June 1979.

REVIEW OF 1978
STUDIES AND SUPPLEMENTAL EIS
IN SUPPORT OF
EXPLORATORY DRILLING IN SOUTH DAVIS STRAIT

Prepared by

Regional Hydrocarbon Committee W&NR

in Collaboration with

Atlantic, Quebec, and Pacific

Regional Staff of DOE and DFO

CONTENTS

	Page
INTRODUCTION	1
SUMMARY	1
OVERVIEW	1
Physical and Chemical Oceanography	1
Atmospheric Environment	2
Fate of Oil	2
Offshore Biology	2
Nearshore Biology	3
Ice Associated Biota	3
Marine Mammals	3
Seabirds	3
South of 60°	4
Impact Assessment	4
CONCLUSIONS	4
RECOMMENDATIONS	4
APPENDED COMMENTS ON SUPPORTING DOCUMENTS	7
A. Atmospheric Environment	8
B. Physical Oceanography	10
C. Biological Environment	13
D. Terrestrial Studies	18

OVERVIEW
of
JOINT DFO/DOE REVIEW
OF SUPPLEMENTARY EIS AND SUPPORTING DOCUMENTS

INTRODUCTION

The review of supplemental information submitted by Esso Resources in support of offshore exploratory drilling in Davis Strait was conducted by DFO and DOE staff from the Pacific, Western & Northern, Quebec and Atlantic Regions. The Regional Hydrocarbon Committee of the Western & Northern RSCC was responsible for the consolidation of the review material and the preparation of this document. This review evaluates information provided in light of the deficiencies identified by DIAND and DFE following the review of the original (1978) EIS.

SUMMARY

The Supplementary EIS and supporting documents provide useful new information. While a slightly better appreciation of the impacts associated with the proposed project has been gained, the impact predictions remain inadequate because of a failure to utilize the information generated in a manner which allows the assessment of impacts, and because significant deficiencies still exist in the knowledge of the physical, chemical and biological environment. Consequently the significance of impacts cannot be assessed at present.

The overview that follows identifies the remaining major gaps in knowledge and identifies concerns regarding the modelling of oil movement and the method of impact assessment used in the EIS.

Conclusions are presented and recommendations are made regarding information required before drilling should be approved, conditions which should form part of the drilling authority and for further studies. Attached to this overview is a synopsis of reviewers' comments of each of the EIS' supporting documents.

THE OVERVIEW

Physical and Chemical Oceanography

The information on ocean currents still needs to be expanded and the outstanding current information from meters deployed in 1978 incorporated into the modelling of oil dispersal from proposed drill sites. As stated by the Proponents, "The data on tidal currents were not sufficiently dense that a distribution of current patterns over the area of interest could be constructed" and hence additional data on this facet of the operation is required for incorporation into contingency planning.

The deficiency with respect to trace metal concentrations in the waters surrounding the proposed drill sites has been addressed inadequately. Although some information has been collected, the number of sites sampled and the frequency of sampling does not provide firm baseline information for comparison with future concentrations.

Baseline hydrocarbon concentrations in Davis Strait and downstream waters were not reported.

Atmospheric Environment

The Proponents have made considerable effort to obtain new atmospheric data and to analyze comprehensively the climatological features of the Davis Strait. However the new data were obtained over a very short time period, were not reported in detail and their interpretation and presentation in the EIS was sketchy.

Fate of Oil

Although stated that "One of the objectives of the Davis Strait EAMES program was to provide information for use in oil spill contingency . . . planning", information presented on the movement of oil from the vicinity of drill sites was insufficient and inappropriate to be of much use in contingency planning. The model employed to describe the behaviour of oil on the ocean surface was of little value in predicting probable locations of impact, of little value in predicting magnitude and type of impact, and of doubtful use for prescribing appropriate countermeasures."

Until the Proponent approaches the modelling of the fate of oil as a means to develop impact mitigation design criteria instead of employing the modelling technique only to demonstrate probability of risk, little headway will be made towards (a) identification of probable areas of impact, (b) effective counter measures planning, and (c) determination of residual impacts.

Offshore Biology

The microbiological studies provide a tentative understanding of heterotrophic hydrocarbon bacteria in Davis Strait and their role in the degradation of hydrocarbon products. Information on the activity of heterotrophic bacteria under winter ice conditions in Davis Strait would enhance the understanding of the degree to which hydrocarbons might be degraded when entrapped under or amongst ice floes.

The supplemental EIS remains deficient on the seasonal variations in the distribution and abundance of adult and larval fishes both within the area of proposed drilling and south of the 60th parallel, where impacts from an oil well blowout conceivably could be significant.

Nearshore Biology

Studies conducted in the nearshore biological environment have concentrated on specific areas which may not be representative of other nearshore areas. The ability to extrapolate information from one area to other coastal areas, which also may be affected by oil, needs to be investigated.

Ice Associated Biota

While additional effort was directed towards examining the under-ice biota in the supplemental EIS the impacts on this important community are down played since the Sliktrak modelling pays no attention to oil interaction with land-fast ice. The relative importance of this community still needs to be considered in contingency plans.

Marine Mammals

The information presented on marine mammals provides a fuller picture than that originally presented. However significant data gaps still exist on the seasonal distribution of marine mammals, the timing and course of their migrations and their important feeding areas. For example Figure 4.5-4¹ indicates that a major feeding area for walrus exists on Brevoort Island which is also one of the proposed staging areas to be used by industry; much more detailed information is required on the times at which and extent to which walrus use this area. Evidence from other localities has shown that walrus are very sensitive to disturbance by humans. Figure 4.5-5¹ provides only sketchy data on beluga migration routes and it appears that the major migration routes are closely aligned with possible areas of impact and page 72¹ points to the fact that there is insufficient information on beluga movements and timing to be able to adequately assess impacts. The narwhal movements and overwintering areas indicated in Figure 4.5-6¹ are poorly understood and more detailed knowledge is required in order to assess adequately likely impacts on this resource. Comments on page 63¹ indicate that narwhal were present in the area in both winter and spring. It should be determined if these narwhal are part of the Lancaster Sound population.

Seabirds

The supplementary EIS pays more attention than the original to the late summer swimming migrations of thick-billed murre chicks. These migrations have been recognized as one of the biological components most at risk from offshore oil exploration activities. The EARP Panel concluded that drilling operations might have to be curtailed during such migrations; its timing therefore is of particular relevance. Murre chicks probably usually begin to move through Hudson Strait into Davis Strait at the end of August, at least two weeks earlier than in 1978. Since the 1977 surveys, presented in the original EIS, missed this swimming migration,

¹ From Supplementary EIS.

and the 1978 surveys are representative of a heavy ice year, we have no knowledge (from these studies) of the timing of migrations in a "normal" Arctic summer.

South of 60°

No attempt has been made to assess potential impacts south of the 60th parallel, with the exception of studies conducted at Nachvak Fiord.

Impact Assessment

The method of impact assessment is too subjective and speculative. The method of evaluating the level impacts on the lower trophic forms is particularly deficient as a result of averaging of effects over the entire Davis Strait.

CONCLUSIONS

1. Advances have been made in the description of the Davis Strait environment.
2. Studies have not been conducted over a sufficient number of years to address "normal" variations in population abundances and distributions nor to delineate ocean currents and climate variability.
3. The "fate of oil from a blowout" predictions are inadequate to assist in an evaluation of impacts or to assist in appropriate counter-measure design implementation.
4. In general, knowledge of interactions among environmental components in areas likely to be affected by exploration and development in Davis Strait are lacking.
5. Baseline descriptions and impact assessments south of 60°N, are inadequate.

RECOMMENDATIONS

1. The following information is deemed necessary before drilling should be approved:
 - a) a contingency plan that meets the approval of regulatory agencies;
 - b) an assessment of the more likely coastal and/or ice edge locations to be affected by oil originating from each of the proposed drill sites;
 - c) an approved weather forecasting system and an ice alert system;

- d) the designation of a relief drilling vessel.
2. The following conditions should be attached to drilling authority:
 - a) suspension of drilling in hydrocarbon bearing structures at a time when a blowout would affect the thick-billed murre migrations;
 - b) the drilling season should be specified based on conservative estimates of the open water season. A provision for drilling season extension should be made and such extensions should be defined and regulated by government;
 - c) a relief drillship should be specified along with a statement of commitment to relief drilling from the operators of the designated relief vessel;
 - d) trace metal, hydrocarbon levels, ocean current profiles and surface currents should be monitored throughout the drilling season, according to a schedule determined by the Arctic Waters Advisory Committee;
 - e) ship and air traffic should avoid areas critical to birds and marine mammals e.g. walrus haul-out areas near or on Brevoort Island, Lady Franklin and Monumental islands.
 3. The following research is still required:
 - a) collection of ocean current information should continue. This type of information has obvious relevance both in the exploratory and possible future production phases of oil and gas development in the Davis Strait.
 - b) models for the prediction of movement and fate of oil in the water column and on the surface must be developed further and tested if they are to be of any operational value. Attention in this regard is drawn to comments in the following section B, #53, submitted by Bedford Institute oceanographers.
 - c) microbiological studies should continue. The conclusions presented regarding bacterial degradation of oil are tentative at this time. The effects of various fractions of oil on the normal plant/bacteria/nutrient balance should receive more research effort. In particular the seasonal aspects of oleoclast activity should be investigated.
 - d) effects of oil on the development of larval fish indigenous to the Davis Strait and Labrador Sea require further study.
 - e) quantitative assessments have yet to be made of the relationships of epontic flora to the rest of the system. Without this information it is impossible to make conclusions about the effects of

stress on the system. In general, future studies should be directed towards more quantitative descriptions of species and species-environment relationships.

- f) nearshore sites, selected on the basis of predicted impact by oil, should be studied further to delineate normal ranges of fluctuations in the abundance and distribution of animals and plants.
- g) attempts should be made to relate the migration characteristics of flightless seabirds to annual ice ablation and accretion characteristics.
- h) studies to delineate the migrations of beluga and narwhal to and from overwintering locations should continue. Relationships between ice cover, annual climatological conditions and marine mammal movements should be investigated.
- i) harp seal migration characteristics require further delineation and should be investigated.
- j) the physiological effects and behavioural responses of marine mammals and polar bears to contact with oil should be investigated.

APPENDIX
of
Comments¹ on
Supporting Documents

¹ Individual reviewers comments were collated and a précis of comments is presented.

A. Atmospheric Environment

Report #'s 34, 35, 36, 37, 38.

- #34 Nordco Ltd. Nov. 1978a. A climatological study of the Southern Davis Strait.

This is regarded as relatively good report for the purpose intended. The appendices in particular contain a good deal of useful material. The storm track study is a valuable effort however it suffers from the omission of Appendix B figs. 1-9. Deficiencies are noted in the estimation of surface wind speed and direction from pressure gradient information. It is suspected that some of the winds in this study may be derived from geostrophic winds that are half of the appropriate value as a result of interpreting surface maps at 4 mb intervals when in fact they represented 8 mb intervals. The Forecast Research Division of AES found the description of synoptic case studies weak professionally and confusing.

- #35 Nordco Ltd. Nov. 1978b. Wave climate study of Southern Davis Strait.

The work fills a gap in the wave climatology of Southern Davis Strait. Some concern is expressed that this study makes use of the wind climatology reviewed above, and the same cautions apply. The return periods of 2.2 years and 5 years for 10 m and 12 m waves respectively, are judged reasonable.

- #36 Nordco Ltd. Nov. 1978c. A proposed forecasting system for Southern Davis Strait.

Forecast system developments subsequent to the preparation of this report render it obsolete.

- #37 Nordco Ltd. Jan. 1979a. Comparison of meteorological data from Brevoort Island and the "ASIAK" buoy.

The authors do not define the averaging period used for the wind data. The exposure of the MARS station wind sensor is not described. This is needed in order to evaluate the utility of the data collected there.

A presentation of the limits of agreement, the correlation coefficients, mean deviations, etc. should replace the phrase "wind directions were basically in agreement".

This report is based on a very small sample. While nothing can be done to increase the sample size a more rigorous statistical analysis could be carried out.

- #38 Nordco Ltd. Jan. 1979b. Comparison of "ASIAC" bouy data to data extracted from synoptic weather maps.

There is no description of the instrumentation carried by the buoy, apart from the oblique reference to two sensors for most parameters. Information is required on the type and mounting height of anemometer, on the buoy response to wave motion and consequent effect on the wind and wave observations. A figure depicting the installation would be an asset.

The reference (page 6 - 5.2) to time lag of up to six hours on the analyses in response to major pressure changes. This is not borne out by the data. Synoptic maps present a picture of the pressure pattern and weather at a particular time. There is no lag.

The authors do not mention the averaging time for the wind data. Judging from figure 5.4 either the buoy sensors underestimate wave heights or the technique used to estimate wave heights from synoptic data is not particularly reliable. There is, at times, some confusion in distinguishing between synoptic and climatological data.

B. Physical Oceanography, Surface Currents, Effect on the Fate of Oil
Report #'s 39, 53.

#39 Esso Resources Canada Ltd. Jan. 1979. Davis Strait Surface
Drifter Bouy Program, 1978 (IPRT-1ME-79)

The ocean current measuring program appears to have been a reasonable effort. Perhaps the most significant finding to emerge was the variability of the surface currents in the region. The 1978 drift tracks indicate more westerly flows when compared to those of 1977.

In general, however, it would appear that the collection of data by satellite tracking of RAMS buoys is still fraught with uncertainties. Improper labelling of figures and the mistaken numbering of buoys within the text when combined with minimal discussion of the results leave much to be desired in the reporting of the program.

#53 Esso Resources Canada Ltd. Feb. 1979. Additional Sliktrak
Simulations - Davis Strait (IPRT-3ME-79)

It is the expressed feeling of the reviewers that the Proponent has made a commendable effort to obtain new wind and ocean current data which presumably besides being of significant operational importance are similarly as important in determining the fate of oil from a blowout. It is, however, felt that this effort has not been reflected in its use in predicting the fate of oil, which is a major reason for collecting it.

Sliktrak Inputs

The Proponent has not utilized the most satisfactory wind data available to him, namely that derived from synoptic charts. Instead data from a single ship's cruises in 1977 with the buoy data in October, 1978, make up the wind input data set for the required two years. Is there any reason to believe that the 1978 weather was a repeat of that in 1977, especially since the ocean surface current pattern was quite different?

The variability of surface currents is reflected in the new simulations only to the extent of what is called "updating the current vector map for the Sliktrak Program". This ill-advised merging of old and new data involves only slight modification of the previous current field, whence it is no surprise that the new results "compare favourably with those obtained in the previous study". Yet the percentage of simulations contacting the shoreline jumped from 4% to 11%. It is interesting to speculate what the percentage might be with greater weight given to the 1978 Drifter Bouy data?

The Model

The criticisms of the Sliktrak model and its usefulness as an operational tool which were raised by DOE & DFO reviewers in 1978 remain. The model has undergone no refining, input data, while changed, is no more realistic (see above), oil-ice encounters again have been discounted completely, although such impacts of oil on the ice-edge may be as significant as oil on the shoreline. Additionally, there is no evidence that these simulations are of any value from an operational stand-point. From the conclusions it is apparent that the Proponent has not modelled oil movement for the purpose of shoreline contingency strategies but for the purpose of demonstrating minimal risks.

A major concern is the rate of oil dispersion used in the simulations and the subsequent fate of the dispersed oil. The model has an apparent built-in safety factor. During periods of high winds, when the slick would be driven farthest, the assumed high dispersion rate leads to fastest break-up of the slick and the removal of it from the Sliktrak simulation system. But would it be removed from the ocean system? What happens to the oil which is dispersed in the upper 30 to 50 metres of the ocean?

Suggested work to quantify uncertainties of the Sliktrak Model

There was the general feeling that the comments in the "Review of the EIS for exploratory drilling in Davis Strait Region" (1978) prepared by Ocean Circulation were still valid. In particular the concern that ". . . the simulation results depend entirely on the input data and the model assumptions and any uncertainties in these propagate directly to the final probabilities," has not been answered. The detailed comments in the review are still relevant, i.e. a sensitivity analysis of the model should be performed.

1. The random selection technique which specifies spill location, duration, date, chance of bridging and rates of evaporation and dispersion should be changed to allow these to be specified. With these fixed or varied at will, the relevant probabilities can be worked out.

2. Blowouts should be simulated for a reasonable length of time (30 days or more) with no bridging, evaporation or dispersion, then the probable effects of each of these factors as well as different flow rates can be examined to give their individual and combined influence in mitigating or worsening the effects.

3. Output from the model should include the number of barrels which entered a grid box adjacent to land as well as the number of barrels which crossed through the box to land. When nearshore processes are better understood, this information can be used to evaluate how and if the slick and dispersed oil would move to shore.

4. The effects of meteorological variability in both time and space should be investigated. The variation within one day should be examined at even one hour intervals to ensure that daily averaging gives the same results. In the long term, variation from one year to the next will also have to be considered. An evaluation must also be made of the effects of considering the wind to act uniformly over the whole area instead of varying it in much smaller space scales.

5. Another possible source of error is the considering of currents to be constant for the whole season. In reality the currents will vary due to the tides, winds and pressure fluctuations in the short and long term. Year to year variability has been demonstrated with drifter measurements. An estimate must be made of the variations in results from these alternate current fields.

6. It is recognized that the model cannot be used when ice conditions are present, but the winter spills should not be dismissed on the grounds that oil will follow the pack ice off shore, without a detailed examination and discussion.

The model as it stands gives a representation of slicks moving in a constant mean current with daily averaged weather and randomly varying evaporation and dispersion. It is difficult to see what use these model results can be without the knowledge the preceding suggested tests are designed to give.

C. Biological Environment

Report #'s 40, 41, 42, 43, 44, 45, 47, 48, 49, 50, 51

- #40 Bunch, J., Feb. 1979. Microbiological Investigation of Davis Strait.

Work was competently conducted and made considerable strides towards answering difficult questions. The conclusions made by the author are well supported and are very relevant to an understanding of the dynamics of Davis Strait heterotrophic bacterial activity and to their potential for petroleum hydrocarbon utilization.

- #41 Aquatic Environments Ltd. Dec. 1978. Studies of benthic fauna and macroalgae in coastal areas of Southeast Baffin Island.

This report was for the most part considered to be scientifically sound. Some concern was expressed that the stated objectives may have been poorly proposed given the short term nature of the study and that the indexing of species diversity is of little value when stations are sampled at one time only.

It was also expressed that considerably more useful information may have been gained from this study if weight measurements had been taken of species sampled.

In summary, the report is well presented, was carried out in a thorough manner, and provides data and information on areas which have not been previously studied.

- #42 Aquatic Environments Ltd. Dec. 1978. Studies of Arctic char populations in Nachvak Fiord, Labrador.

Reviewers expressed mixed sentiments regarding this report. While it was felt that the study was conducted in a workmanlike manner, and was of a good quality baseline survey, it contributed very little new information on arctic char biology. It was considered that Nachvak Fiord was perhaps not the best choice for consideration as a "representative locality" and that statements/conclusions made regarding char life history (e.g. diel movements, offshore movements etc.) were not warranted from either the data collected or the literature quoted.

- #43 MacLaren Marex Inc. Feb. 1979a. Report on cruise 78-1, April and May 1978. Environmental Studies in the pack ice zone of Davis Strait.

Certainly this report fills at least part of the need indicated at the 1978 hearings for more information on under-ice biology. There is much in the report that contributes to knowledge on these waters in terms of spatial groupings of phytoplankton and zooplankton, chemistry and biology of the floating pad and the under-ice fauna.

It is unfortunate that thoughts on the relevance of the ice flora to the rest of the system were not well developed. The critical depth assessments are not developed and in fact come to nothing. Discussion of the importance of the "ice edge" are not carried to the point of being especially informative, and food chain implications are not at all clear.

The work undertaken on trace metals in sea water is inadequate and no determination of hydrocarbons were made (a previously identified deficiency). The number of trace metal samples taken and the frequency of sampling (once) are insufficient to allow any meaningful statements to be made with respect to existing metal concentrations in the proposed drilling area.

Studies on larval fish distribution were inadequate and should be undertaken on a year round basis to provide a better understanding of those areas which could be most affected on a seasonal basis.

Appendix B is potentially valuable in meeting a basic requirement for this and other localities. This "zooplankton production study" represents a start on an important and inevitably long-term undertaking, the real value of which can only be realized by its continuation.

- #44 MaLaren Marex Inc. Feb. 1979b. Report on cruise 78-2, Aug. 1978. Environmental studies in the Davis Strait.

More emphasis is required on the possible importance of quite extensive upwelling along the east Baffin coast and near Resolution Island. This would permit various deep, offshore features (biota, oil) to find their way to shallower, near-shore or on-shore waters.

- #49 Aquatic Environments Ltd. Feb. 1979. Nearshore marine fisheries studies in coastal areas of Southeastern Baffin Island.

Statements in this report regarding the remote possibility of oil pollution and the minimal impact of oil on zooplankton because of higher densities occurring below 25 m are unfounded on the basis of data from this study. Regarding the zooplankton studies, the absence of a clear statement of objectives is noted, and it is suggested that species composition information has already been better handled by MaLaren and others.

The use of the Shannon-Weaver index to describe baseline conditions in the absence of clarification of seasonal and annual variations is unprofitable and unwise. In general the study has not increased to any significant degree our understanding of the nearshore zooplankton of Southeast Baffin Island.

Larval fish distributions and abundances were described as well as the data permitted. Variability in numbers and distributions between years and seasons is probably the critical element now.

- #50 Smith, T. G. et al. Feb. 1979. Marine mammal studies in South-Baffin Island.

Insufficient time was available to review this report, however the recommendations regarding the need for specific future studies and the need for new government policy regarding environmental research in general, are appropriate and pertinent.

- #51 Stirling, I. Feb. 1979. Polar bear research on Southern and Southeastern Baffin Island.

The authors stress the need for a 'predictive capability for environmental assessment' but realise that this is not likely to be attained until after a 'disaster' has occurred (page 3). Then a meaningful evaluation of the impact might be made provided good background knowledge is already available. This is their argument for continued studies on polar bears in Davis Strait and is a reasonable point of view. However, they also state that the detailed type of information they envisage collecting is necessary for management.

This report includes enough information on distribution, numbers and movements of bears to provide a rough estimate of the numbers of bears likely to come into contact with oil, whether directly or by feeding on oiled seals. What is not known, as yet, is the physiological effect of oil on bears. This is probably the most important deficiency in our knowledge at the moment.

While the report is primarily concerned with the effects of oil drilling on polar bears, the authors point out that the bears themselves have an impact on the human exploiters of the resource. Thus great care would have to be taken to avoid attracting bears to base camps since the resulting mortality, necessitated by having to destroy them, might in the long run be greater than the effects of a possible oil spill.

- #47 MacLaren Marex Inc. Feb. 1979e. Report on aerial surveys of birds and marine mammals, April-November, 1978.
#48 MacLaren Marex Inc. Jan. 1979f. Report on aerial surveys of marine mammals and birds in Southern Davis Strait and Eastern Hudson Strait in March, 1978.

Narwhal which were not considered in the initial EIS are acknowledged in the supplemental EIS to frequent the area. However, based on the effort devoted to delineating their movements and

occurrence within the study area some of the statements made seem somewhat far reaching considering the data base. More information is required on the timing of the northward migration of narwhals overwintering in Davis Strait and whether or not they join "the wintering animals from south Baffin Bay" as they move northward. The statement that "the waters at the mouth of Hudson Strait" are considered to be important as overwintering waters for a significant portion of the eastern Canadian Arctic narwhal" needs to be quantified. Similarly since southward movement was not observed during the surveys, additional effort needs to be directed toward defining migration times and routes so as to be able to predict the implications which an oil well blowout would have on this resource.

Similarly for beluga "spring and fall migration routes for beluga in Davis Strait are not clear" and additional study is warranted before potential impacts of an oil well blowout on beluga in the area can be assessed.

Although Northern bottlenose whales are recognized as being year round residents of Davis Strait and the Labrador Sea, "the proportion of the western North Atlantic population wintering in the Davis Strait and northern Labrador Sea waters is unknown". Once again impacts on this resource are difficult to predict owing to the insufficient data base.

Information on the winter distribution of walrus in the Davis Strait area is scanty and no major wintering areas have been identified through the studies undertaken, although Frobisher Bay has been identified as an overwintering area for a segment of the population.

- #45 McLaren Marex Inc. Feb. 1979c. Report on feeding studies of marine mammals and birds from the Southern Davis Strait region between November 1977 and December 1978.

This report meets its objective of identifying the major food species of certain birds and mammals. The literature review, as it pertains to bird feeding, is useful and pertinent to the additional new feeding data given for many of the bird species, especially the red-throated loon, northern fulmar, common eider, glaucous gull and black guillemot.

In view of the recognized importance of arctic cod to the diet of several bird species and ringed seal more effort should be expended delineating the whereabouts of this food resource at different times of year. Clearly an improved understanding of this important food item is required to mitigate the effects of an oil well blowout. The fact that the food habits of various species of birds studied "were observed to shift seasonally" points also to the need for a better understanding of the seasonal distribution and abundance of these other food items.

The number of stomachs of marine mammals sampled is limited in the case of harp seals and bearded seals. Additional samples are required before any meaningful statements can be made. In view of the importance of harp seals to the economy of Newfoundland, the impact of oil on the food resources of this species must be further investigated.

With the exception of the discussion on killer whale food, the section on whales presents little new information.

The food webs presented are interesting, and represent a start on what has to become a much better understood feature of the system.

D. Terrestrial Studies
Report # 46.

- #46 MacLaren Marex Inc. Feb. 1979d. Report on the preliminary habitat study of the old military air strip and shore installations in Brevoort Island.

Vegetation

In studies such as this, it is critical that the plant communities found be related to previously described ones so that overall impact of the action can be assessed accurately. More rigor is required in the identification of plant species and the sampling techniques must improve if estimates of how sensitive different areas on Brevoort Island are to man's influence are to be made.

Animals

On site observations of birds and mammals that frequent the area should replace the list based upon the literature, that was presented. Field observations of nesting locations should have accompanied the author's discussion of nesting habits and avian behaviour.

General

Timing of field studies was rather late in the season to accomplish the objectives of this piece of work.

DEPARTMENT OF FISHERIES AND OCEANS
REVIEW OF SOUTH DAVIS STRAIT
SUPPLEMENTARY EIS AND 1978 STUDY REPORTS

Department of Fisheries and Oceans' (DFO) staff from the Atlantic, Quebec, Western and Pacific regions have participated, with the Department of Environment (DOE), in a technical review of the Supplementary Environmental Impact Statement (EIS) and the 1978 study reports submitted by Esso Resources of Canada, Canada City Services Co. Ltd. and Aquitaine Co. Ltd., in support of their drilling application in the South Davis Strait.

The original EIS for the South Davis Strait project was reviewed in 1978 by the Department of Fisheries and the Environment (DFE). DFE concluded that the original EIS was inadequate and that, generally, environmental impacts could not be assessed adequately because of significant gaps in knowledge. At the EARP Panel Hearings both the proponent and the initiating department declared that the unreported 1978 studies would fill knowledge gaps and identify impacts to the satisfaction of DFE and the Panel.

The joint DFO/DOE technical review of the Supplementary EIS and the 1978 study reports concluded that, although the new information provided a slightly better understanding of the impacts associated with the project, significant deficiencies still exist in the knowledge of the physical, chemical and biological environment and impact predictions still remain inadequate.

DFO endorses fully the conclusions and concerns expressed in the joint DFO/DOE technical review.

Although the 1979 drilling program has been approved, DFO wishes to bring several particular concerns to the attention of the Department of Indian Affairs and Northern Development (DIAND).

Baseline information in the following major areas of concern to DFO is still too inadequate to permit proper mitigative measures to be prescribed or to enable accurate impact predictions to be made:

- 1) ocean currents, 2) background concentrations of metals and hydrocarbons in the water, 3) distribution and abundance of adult and larval fish, 4) seasonal distribution of marine mammals, 5) the importance of the ice associated biota, 6) the ability to extrapolate information on the nearshore biological environment to different sites, 7) the ability of heterotrophic bacteria, under winter ice conditions, to degrade hydrocarbons, and 8) environmental information for south of 60°N.

DFO has serious concerns about the adequacy of contingency plans and of the operators' oil spill countermeasure capabilities to predict the effects and to reduce the impact of a major oil blowout or fuel spill. In particular the model employed to describe the behaviour of oil on the ocean surface remains of little value in predicting the magnitude and type of impact and of doubtful use for presenting appropriate countermeasures. DFO recommends that DIAND ensure the proponent develops an accurate and operationally useful model to predict the movement of oil in this area.

Department of Fisheries and Oceans
Review of South Davis Strait
Supplementary EIS and 1978 Study Reports

- 2 -

A second concern is that under normal operating conditions, ship and air traffic may have adverse effects on marine mammal populations frequenting the South Davis Strait area. DFO recommends that areas critical for marine mammals should be identified and that ship and air traffic should avoid these areas.

Also DFO is disturbed that the operators are relying heavily on the use of dispersants to combat oil slicks. DFO wishes to stress that no blanket approval for the use of dispersant can be given and that much more information is required on the abundance and distribution of ichthyoplankton and other planktonic species before any approval for dispersant use can be granted. Development of appropriate counter-measures is required.

It is unclear whether, in fact, the Arctic Waters Pollution Prevention Act is applicable to the South Davis Strait project; legal opinion should be obtained on this issue. If the conclusion is that the Arctic Waters Pollution Prevention Act does not apply to this project, then Environmental Operating Conditions should be developed under Sections 31 and 33 of the Fisheries Act.

In conclusion DFO endorses the joint DFO/DOE technical review and recommends that the proponents address the existing inadequacies and that the Environmental Operating Conditions for this project reflect DFO's concerns and are adhered to by the operators.

C. LANCASTER SOUND

C.1 Department of Fisheries and the Environment Review of the EIS
in Support of Exploratory Drilling in Lancaster Sound,
October 1978.

DEPARTMENT OF FISHERIES AND THE ENVIRONMENT

REVIEW OF NORLANDS PETROLEUM LTD. PROPOSAL TO CONDUCT EXPLORATORY

DRILLING IN LANCASTER SOUND, NWT AND ASSOCIATED ENVIRONMENTAL

IMPACT STATEMENT

Introductory Remarks

The following remarks are designed to provide background to the Department's review of the Environmental Impact Statement.

The review was conducted by a group of scientific and technical experts covering a variety of different disciplines. The document represents a consensus position and is based upon more extensive and detailed comments prepared by the respective contributors. I am supported here today by a number of these specialists who will be able to explain to you the Department's position in certain areas and answer specific questions that may arise.

The primary objective of the Department's review is to address two questions:

1. Whether the EIS adequately describes the potential impacts which might result from the development, and
2. Whether the impacts identified are acceptable from an environmental point of view.

While the Department has identified a number of deficiencies in the review none of these is sufficiently serious that a reasonable appreciation of environmental impact cannot be achieved. The initiator has, in fact, delineated the impacts with reasonable predictability. In the considered opinion of DFE, neither the impacts, nor the risks of impact, are acceptable. The reasons for this are described in the review document.

A major concern of the reviewers is that the current exercise addresses only a proposal to drill one exploratory well. Viewed in this context alone, one might well conclude that the environmental risks incurred could be justified in order to determine whether or not oil is present. However, should oil be found it is reasonable to conclude that the proponent would wish to exploit it. This would lead to the development of production wells, undersea pipelines, new shore facilities and possibly tanker traffic into the Sound. These would pose new and far greater environmental hazards which could have very serious adverse effects on this highly productive area.

In conclusion, it is important to stress that the area under consideration is not a relatively barren ice-covered one, but is highly productive and recognized as such by the International Biological Programme. It supports major populations of marine mammals and seabirds which migrate in and out of the area. It is one of the more ecologically significant areas among the Arctic regions of the world. For this reason we cannot afford to treat this proposal lightly. Whether we exploit an area such as this or how we do it is of major national and international concern.

R. J. Paterson
Dept. of Fisheries & the Environment

September 29, 1978

Department of Fisheries & Environment

Review of

THE ENVIRONMENTAL IMPACT STATEMENT

IN SUPPORT OF EXPLORATORY DRILLING

IN LANCASTER SOUND

October 4, 1978

SUMMARY

THE REVIEW IN HIGHLIGHT

Adequacy of the Environmental Impact Statement

Environmental Impact of the Action

1. Probability of a Blowout
2. Mitigative Capability
3. Biological Disruptions

RECOMMENDATIONS

FURTHER STUDIES

SUMMARY

The environmental impact statement prepared by Norlands Petroleum and submitted by DINA (the Initiator) in support of exploratory drilling in Lancaster Sound, was found to be technically well written. Environmental impacts were, for the most part, openly presented and information gaps were identified.

Staff from the Atlantic, Quebec, Western & Northern and Pacific Regions of the Department of Fisheries and Environment have reviewed the Lancaster Sound EIS and its supporting documentation. The Departmental reviewers are of the opinion that the potential harmful effects on the environment, from an oil blowout at the Dundas K-56 well site, render the proposed project action unacceptable.

THE REVIEW IN HIGHLIGHT

ADEQUACY OF THE ENVIRONMENTAL IMPACT STATEMENT

The reviewers believe that the statements do not contain sufficient information to assess fully the environmental impact of an oil blowout in Lancaster Sound. Following is a list of deficiencies in the EIS which DFE considers to be of particular concern:

1. No discussion is provided on the weather forecast system to be used by the proponent.
2. No description is given of the proposed methodologies for the detection, tracking and avoidance of icebergs and large icefloes (The data presented by Milne and Smiley for icebergs are not fully represented in the EIS).
3. The proponent has not fully and accurately interpreted the

supporting documents regarding the spread and fate of oil discharged from a possible oil blowout.

4. The proponent does not consider a "worst case" oil blowout scenario for Lancaster Sound based on realistic (day-to-day variations) data. Rather the proponent has relied upon long-term averaged data.
5. Insufficient discussion is given of the contingencies and countermeasures necessary to mitigate the spread of oil from an oil blowout.
6. There is a lack of information on the availability, effectiveness and quantities of dispersants which may be required for use in the arctic marine environment.
7. The proponent has inadequately described the ultimate fate and effects of oil beyond the confines of Lancaster Sound, from a possible blowout at the Dundas K-56 well.
8. No assessment is presented of the toxicity of oil and dispersants to organisms indigenous to Lancaster Sound.
9. The blowout probability analysis is superficial and does not attempt to relate the special hazards of the area to the likelihood of loss of well control.

Even though these deficiencies in the EIS do exist, there is sufficient information presented by the proponent to permit a prediction of possible project impacts on the environment.

ENVIRONMENTAL IMPACT OF THE ACTION

The reviewers believe that the proposed action is inadvisable because of the potential for harmful effects on the environment, arising

from an oil blowout at the Dundas K-56 well site.

The potential for unacceptable risks to the environment is based upon the combination of 1) probability of a blowout, 2) the ability to mitigate impact, and 3) the magnitude of the residual impacts.

1) Probability of a Blowout

The probability analysis of a major oil well blowout (1:1,000,000) presented by the proponent is overly optimistic. It does not take into account the prospect (good or bad) of target horizons bearing oil, nor the special hazards (ice and iceberg encounters, frequency of storms, severity of storm events, frequency of icing, reduced visibility conditions and wind chill extremes) unique to the Lancaster Sound environment, but is based upon historical, world wide drilling performance. The system of analysis used in the Lancaster Sound EIS was also employed in the Beaufort Sea and predicted that a blowout of any kind would occur in that environment with a probability of 1:200. However, the actual blowout record in offshore Beaufort Sea drilling has been approximately 1:4. As demonstrated by this past performance in the Beaufort Sea, the historical approach to developing blowout probability statistics bear little relation to actual events. Consequently, the major blowout probability of 1:1,000,000 is considered unduly optimistic.

2) Mitigative Capability

If an oil blowout does occur during the drilling of the Dundas K-56 well, the proponent's capability to effect countermeasures

adequate to mitigate major impacts is not considered satisfactory. Mechanical clean up of oil from a blowout is predicted to be less than 50% effective in August and September and virtually ineffective during the remaining ten months of the year.

While it is apparent that same season relief well capability is not possible if drilling proceeds beyond the 1500 - 2000 m depth in the first year, the proponent does not commit the proposed program to depth restrictions in the first year.

3) Residual Impacts

A major oil blowout would most likely result in losses to seabird populations of the area which would significantly reduce Eastern Arctic and even North American populations. Predicted bird mortalities resulting from an oil blowout, could threaten the survival of certain species in the area or in North America.

Furthermore, the predicted impact on marine mammals from an oil blowout depends upon the unsubstantiated assumption in the EIS that many mammals will detect and avoid oil. Impacts could be much more severe than estimated, either through direct contact with oil, or through the disturbance of marine mammal migrations.

It is highly significant that two-thirds of Canada's fulmar population migrate through or feed in Lancaster Sound, that the largest known kittiwake colony in Eastern North America is at Cape Hay on Lancaster Sound, that well over 1 million thick-billed murrelets breed, forage and migrate through Lancaster Sound, that 1.5 million dovekies (or more) are dispersed in Lancaster Sound for several weeks during the open water season, that one-third of North America's beluga whales

migrate through the Sound each summer, that approximately 85% of the North American narwhal population migrates through or summers and probably overwinters near Lancaster Sound, that thousands of ringed seals occur in Lancaster Sound and adjacent waters and that many tens of thousands of harp seals migrate through Lancaster Sound each year (Milne and Smiley, 1978). Furthermore, the concentration of birds and mammals in this area may be attributed to, in part, the presence of an abundant food supply, of which the Arctic cod is undoubtedly of major importance.

In recognition of the high biological value of Lancaster Sound, the Arctic Panel of the Canadian Committee for the International Biological Program has delineated eight ecological sites within the potential project impact area. The proposed IBP ecological preserves encompass approximately 80% of the south coast of Devon Island, all of Prince Leopold Island, 80% of the Bylot Island coast and approximately 15,000 to 20,000 km² of marine habitat within the Sound.

Combined with the significance of the continuation of a healthy marine environment to the social and economic existence of Arctic Bay and Pond Inlet, the foregoing assessments:

- that blowout probability is underestimated,
- that mitigative measures to control the impact of a blowout are largely ineffective,
- that major losses to both seabirds and marine mammals (directly or through food chain interactions) are expected in the event of a blowout.

have resulted in the reviewers' collective opinion that the proposed

project is environmentally unacceptable.

RECOMMENDATIONS

As a result of the environmentally unacceptable nature of this project, and in view of the deficiencies within the impact statement, the department recommends that consideration of approval to drill in Lancaster Sound be withheld until such time as certain defined objectives are met. These objectives are designed to reduce both the probability of a blowout and the environmental impacts from the proposed project.

Objectives aimed at reducing the probability of a blowout:

1. A real-time meteorological data collection and weather prediction system sufficient to support a safe drilling program should be developed.
2. A system to detect, track and avoid collisions with icebergs and icefloes must be in place.

Objectives aimed at reducing the impacts on the environment:

1. Countermeasures technology for controlling the fate of oil in the Arctic marine environment must be advanced beyond the "current state of the art". Incentives in recent years to develop technology which renders deep sea drilling feasible (exclusive of environmental hazards) have not resulted in the evolution of the necessary concomitant oil spill countermeasures. As a result of the current low level of competence to clean up oil spilled in arctic waters, and of the predicted fate of oil in Lancaster Sound, the marine and coastal life of the Sound would be placed in a position of inordinate vulnerability

should approval to drill be granted at this time. At least the same level of protection should be afforded the Lancaster Sound environment as can be attained in less hazardous environments.

2. The regulatory agency should require the capability for same season relief well drilling. Drilling schedules must reflect the time required to drill a relief well to target horizons and the availability and identity of a back-up drillship should be stipulated.
3. A more refined oil spill model which incorporates "real data" rather than statistical data to describe a blowout situation should be developed.

FURTHER STUDIES

Additional biological studies are not deemed necessary in connection with the proposed drilling of the Dundas K-56 well as the collection of additional biological data will not alter the environmentally unsatisfactory rating of impacts. However, further studies are deemed necessary to better define and predict the extent of possible future impacts should drilling eventually proceed under safe and strict operating conditions. These studies should address the information deficiencies listed below, which in most cases, were identified in the EIS.

1. There is a lack of information regarding the population size of the Cape Hay seabird colony, annual variations, feeding habits and migration patterns.

2. There are not enough data to adequately assess the environmental impact of an oil blowout on polar bears and ringed, bearded and harp seals.
3. There are not enough data to adequately assess the environmental impact of an oil blowout on marine mammals, especially narwhal which migrate through the most probable impact area identified by oil spill modelling and beluga whales which pass through the possible impact area on the north side of Lancaster Sound.
4. The distribution and abundance of Arctic cod which form a key part of the food chain are not adequately known.
5. The distribution of Arctic char and the effects of oil on this species should be assessed.
6. The effects of a continuing oil blowout on under-ice communities should be assessed.
7. The presence and significance of oleoclasts in the Lancaster Sound environment, and the rates of degradation of oil by these organisms should be assessed.
8. The avoidance of oil by marine mammals should be substantiated.
9. Trophic relationships in Lancaster Sound are not well understood and should, therefore, be thoroughly researched.
10. The effects of oil on nearshore zoobenthic communities should be elaborated through field and laboratory investigations.
11. The development of a producing oil or gas field in Lancaster Sound will most assuredly result in adverse environmental impacts, none of which, to this time, have been addressed. Prolonged and frequent ship traffic in Lancaster Sound may

have pronounced effects on the migratory habits of marine mammals and some bird species of Lancaster Sound, as well as affecting the suitability to mammals and birds of important forage habitat provided by the Sound and adjacent waters. The long-term impacts to the biota of the region, many of which may be of an insidious nature should be carefully studied prior to any development commitments. The drilling of the Dundas K-56 well may be considered to be the first stage of these commitments.

C.2 Department of Fisheries and Oceans Brief Presented to
Southern Workshop, Lancaster Sound Regional Study, May 1981.

DEPARTMENT OF FISHERIES AND OCEANS

BRIEF

PRESENTED TO SOUTHERN WORKSHOP
REGIONAL STUDY
CARLETON UNIVERSITY, May 25-27, 1981

Presented by:

Dr. G. H. Lawler
Director-General
Western and Northern Region
Department of Fisheries and Oceans

1. Introduction

The Department of Fisheries and Oceans welcomes this opportunity to participate in the Southern Workshop of the Lancaster Sound Regional Study.

The Draft Green Paper and Background Reports document some of the many factors at play in the Lancaster Sound region. In order that the resources of the region can be used in the best possible way, for the benefit of all Canadians, it is clearly necessary that a deliberate regime of management, coordination, consultation and planning be established in which we can all share. We welcome the Lancaster Sound Regional Study as an initial, progressive step in the ongoing assessment of the best use of Lancaster Sound, which if successful, could be applied in other regions of the Canadian Arctic.

We believe it is useful to address several issues relevant to the role of DFO in the matters at hand. These comments are preliminary, and are made with the intention of assisting this workshop, primarily to facilitate the development of options but without prejudging either the discussions that will take place over the next three days or the eventual selection of use options.

2. DFO's Northern Mandate

Based upon the Department of Fisheries and Oceans Act, the northern objectives of DFO can be summarized as follows:

- to acquire oceanographic knowledge of Arctic waters and ecosystems, and to interpret and apply this knowledge towards the solution of problems arising from Arctic development;
- to ensure the adequacy of nautical charts and related publications necessary for the safe conduct of Arctic shipping;
- to provide Ocean Information Services;
- to protect fish and marine mammal resources and habitat from disruptive and destructive actions and to restore, develop and manage the habitat base so as to improve and maintain the capability of these populations to serve the needs of Northern residents;
- to understand the biology of important Arctic species and the functioning of Arctic aquatic ecosystems and to understand how man's uses affect them, in order that predictions of possible impact can be made.

From these objectives, the DFO role vis-à-vis regional planning and management in Lancaster Sound includes:

- a responsibility to participate actively in regional management and planning in light of DFO management responsibilities under the Fisheries Act;
- a responsibility to provide scientific and technical information and advice to regional management and planning, in areas within the department's technical competence, such as oceanography, hydrography, and marine environmental research;
- a lead role in coordinating the provision of multidisciplinary environmental advice in support of regional management;
- the provision of research support towards the design and implementation of Arctic marine services and monitoring;
- the provision of ocean information services to regulatory agencies and industries operating in Lancaster Sound.

3. The Current Planning Process

Several aspects of the current planning exercise deserve comment. It is noted that some of these have also been addressed at the Northern Workshop.

Firstly, DFO recognizes that the current planning (Green Paper) exercise must at some point culminate with the selection by Cabinet of an option or plan for the use of Lancaster Sound. Such a first plan is necessary to provide a clearcut framework within which government agencies, industry, the people of the region and other players can operate effectively and in concert. However, many of the factors at play are dynamic processes, and there is no question that planning assumptions will continue to evolve and change. Therefore, it is our belief that the Regional Study must lead to the establishment of a management framework involving the participation of the various interests in Lancaster Sound and that this framework must incorporate a continuing planning process. The Final Green Paper must address these management issues and it may be appropriate that alternatives be developed.

Secondly, we note that a number of people are confused with respect to the "Final Green Paper" and the "Draft Green Paper". Certainly, major concern has been raised at the lack of defined options, within the Draft Green Paper, to which people can respond. It is our view that the "Final Green Paper" should contain clearly defined use options and a proper treatment of costs and benefits. This would constitute what is normally termed a green paper. It would be on the basis of that document that government would receive public comment and feedback before making a decision or choice. DFO supports the need for further consultation at that stage but recognizes that the timing and format of such consultation are yet to be determined. For the

moment, the "Draft Green Paper" does not include options and thus this workshop, while useful, may be viewed only as consultations in a drafting process. This workshop should not be construed as constituting adequate consultations in a decision-making context (that is, the public expression of preferred choices). We recognize that the format for this workshop has been modified to provide for discussion of sample options. This is a positive step and is to be commended, but, in view of the restricted timing, it is not adequate as a final public consultation prior to decision making. We note however, the commitment made by DINA at the Northern Workshop to pursue further consultation at a later date.

4. Development in Lancaster Sound

Industrial development in Lancaster Sound, whether it be mining, shipping or hydrocarbon development, presents a major challenge in that new and innovative technology is required to cope with the extreme physical environmental operating conditions. Whether for safety or for economy and efficiency, the technological challenge is further complicated by the inadequacies of our physical knowledge, particularly the underlying, fundamental processes and their year to year variability.

In Lancaster Sound, the waters and surrounding area are also demonstrably rich in biological resources. The environmental consequences of technological failure may thus be high. Even though there exists biological and chemical oceanographic baseline data, knowledge of natural processes and population dynamics is not very good. As a result, we lack the capability to predict impacts accurately and to manage living resources in more than general fashion. This in turn constrains us from optimal environmental design and proper planning.

It should be emphasized that renewable resource development is also a legitimate use in Lancaster Sound, both to provide the needs of local people and to provide a base for potential economic development. Any plan for the multiple use of Lancaster Sound must include measures for the protection of living resources and critical habitat and for their effective management.

We note that the topic of parks and preserves received some attention at the Northern Workshop. At this time we would add the observation that the aspirations of the local people with respect to economic development of living marine resources may be incompatible with the park concept. If necessary, the Fisheries Act could be used as a means to protect critical habitat areas.

5. Proposed General Principles for Lancaster Sound

At the Northern Workshop, the Baffin Region Inuit Association proposed seven principles for development and protection of Lancaster Sound, which were developed at the Kananaskis workshop. These related to:

- biological productivity and environmental quality
- integrated environmental management
- interrelationships between biological, technical and social concerns
- rights and responsibilities of northern residents
- protection of special areas
- regional and long term management
- accident prevention and mitigation of environmental damage

The Department of Fisheries and Oceans generally agrees with the proposed principles, but feels they need to be discussed further and possibly fine-tuned at this workshop. The real challenge will lie in their implementation.

6. A Management Process

At the Northern Workshop, Titus Alooos, on behalf of the four communities, proposed a Management Board for Lancaster Sound, comprising DOE, DFO and the Inuit. This was clearly explained as distinctly different from the Environmental Advisory Committee on Shipping that was proposed by the Arctic Pilot Project Environmental Assessment Panel. We would like to clarify the DFO view on this matter.

We support the suggestion that there should be a management process for Lancaster Sound. However, the basic functions of such a process have not yet been defined and we would hope that this workshop will have some discussion on this point. We have already stressed the need for the Final Green Paper to address options for management and planning. With respect to participation in management and decision-making, there is no doubt that DFO, DOE and the Inuit should be involved. However, we believe there are others who should also be participants. Again, we urge that this be addressed in the Final Green Paper.

On a related but separate point, we wish to reconfirm that DFO and DOE are currently in the process of establishing the recommended Environmental Advisory Committee on Shipping in the Northwest Passage. Clearly, the geographic area of concern includes Lancaster Sound. In the interests of efficiency, we proposed at the Northern Workshop that the mandate of the Advisory Committee and its technical working groups be modified or expanded to include considerations relating to multiple uses in the Lancaster Sound Region. We wish to make it clear that this would not in any way interfere with any regional management function that might be eventually established. To the contrary, the

Advisory Committee would be a supportive body, its main role being to provide advice to such a management and decision-making body.

D. ARCTIC PILOT PROJECT (NORTHERN COMPONENT)

D.1 DFO/DOE Joint Review of the Draft EIS Submitted in Support of
the Arctic Pilot Project, May 1979.

DFO/DOE JOINT REVIEW
OF THE DRAFT EIS
SUBMITTED IN SUPPORT OF
THE ARCTIC PILOT PROJECT

May 1979

INTRODUCTION

The Arctic Pilot Project has been proposed by a consortium of companies which include Petro-Canada, Alberta Gas Trunk Line Co. Ltd. and Melville Shipping, as a means of delivering natural gas from the High Arctic to southern markets. The project plans involve the gathering and transmission of natural gas through a 22" diameter buried pipe from the Drake Field on Melville Island, south approximately 160 km to a barge mounted liquification facility at Bridport Inlet on the south coast of Melville Island. Gas will be transmitted at well head pressures in a refrigerated state, with an anticipated rate of exploitation of 708,000 m³/day (250 mm cfd).

It is proposed that the natural gas, once in the liquid state (LNG) will be shipped by two specially designed Arctic Class 7 tankers to an undetermined southern site. The two tankers are being designed to enable year round operation through the Parry Channel with each vessel completing approximately fifteen round trips per year.

SUMMARY

In its present form, the Environmental Impact Statement prepared by the proponent in support of the Arctic Pilot Project does not adequately assess the environmental impacts of the proposed action nor does it fully describe the necessary mitigative measures to the satisfaction of reviewers.

A significant effort has been made by the proponent to collate and assess existing resource and environmental data, and in most cases potential project/environment interactions have been

identified. Major deficiencies noted by reviewers included the lack of:

1. detail for the rationale of choosing a pipeline route through good wildlife habitat over routes through less productive areas.
2. information on Bridport Inlet water circulation in relation to the assessment of project impacts on the marine biota of the Inlet.
3. discussion of Melville Island stream hydrology and terrain investigations beneath the active layer.
4. description of relevant climatic conditions on Melville Island and their effect on project operation.
5. appropriate detailed baseline descriptions south of 60° N.
6. information pertaining to tanker route selection criteria and to navigation aids.

Mitigative measures are generally inadequately specified and in particular considerable amplification is required regarding the means to minimize the effects of disturbance of wildlife, accidental spillages and hydraulic erosion.

A program of 'future studies' is proposed by the proponent. Completion of many of these studies, prior to submission of this EIS may have eliminated many of the deficiencies noted by reviewers.

The following comments and recommendations are not exhaustive; a compendium of individual review contributions is on file with the respective reviewing departments.

1. MELVILLE ISLAND COMPONENT

A. METEOROLOGY

The meteorological description of Bridport Inlet suffers from a lack of information on how Rea Point atmospheric data were transformed to Bridport data, and on methods and equipment employed at the Bridport Inlet weather station. Atmospheric data have been treated in terms of averages and extremes with no reference made to return periods to put the extreme values into perspective.

The atmospheric data obtained for Bridport Inlet is, in general, of limited use without specific relationships to project actions being made. There is an absence of discussion on orographic precipitation along relevant portions of the proposed pipeline routes which may have significant effects on pipeline stability, and the degree to which maintenance and erosion control measures are required. Bridport Inlet atmospheric stability which influences the persistence of fogs which could lead to a number of operational hazards most likely has been underestimated. This should have been estimated from Mould Bay and Resolute Bay profile data.

RECOMMENDATIONS

- (a) Provide adequate descriptions of methods used to gather Bridport Inlet meteorological data and to infer Bridport data from Rea data.
- (b) Conduct vertical profile observations to better establish Bridport mesometeorology.

(c) Discuss and analyze the following:

- (i) Bridport Inlet climatological stability;
- (ii) extreme events in relation to return period and duration;
- (iii) the extent and effects of orographic precipitation on pipeline stability and maintenance;
- (iv) weather data in relation to 'normal climate'; and
- (v) meteorological information in terms of its effect on project actions.

B. TERRAIN AND VEGETATION

The description of terrain and vegetation is quite adequate and complete, and a reasonable representation of existing conditions is presented. The EIS provides no indication of the effects of the project on terrain and vegetation. Much of the environmental impact is contingent upon proper procedures being followed, but details of these are so scant that no estimate of environmental impact is possible. A set of clearly defined criteria for the design of mitigative measures needs to be specified, rather than a review of statements of assumed mitigative capabilities.

Specifically, the proposed depth of pipe burial may result in considerable thermokarst and hydraulic erosion, especially following abandonment, and active layer depression, resulting from terrain disturbance, may lead to pipeline exposure in some areas.

No information is provided from beneath the active layer. The thickness of ice and the presence of ice-rich lenses are therefore unknown. While most anticipated environmental effects are identified, the potential terrain damage due to lenticular massive ice thaw is underestimated. Some impacts resulting from proposed construction are underestimated. The use of compacted snow roads on fine-textured soils, for example, is not recommended because changes in snow distribution can cause modifications in spring run-off patterns, and may result in severe hydraulic erosion.

Supplementary back-filling requirements may be greatly underestimated. Back-filling is likely to be required over several years, and over much of the pipeline length, rather than just in the year following construction. No consideration is given to the potential hazard to the line by frost heave of fissured rock if blasting occurs.

A major deficiency is the lack of discussion of alternative site selection criteria, both for the pipeline route and for the port and liquifaction facility.

RECOMMENDATIONS

- (a) Erosion and drainage control measures are generally undefined. Measures to protect unstable slopes and to minimize hydraulic erosion should be provided. Drainage control measures and long-term drainage control structures should be specified.

- (b) The potential for active layer depression and the presence of ice rich formations should be delineated. A more thorough discussion of the magnitude of impact resulting from thaw season traffic is required. Define measures to protect ice-rich materials.
- (c) Provide a description and an assessment of impacts resulting from the Drake Point facilities.
- (d) It is stated that 'The final selection of camp locations will reflect a detailed evaluation of terrain and vegetation considerations so as to minimize impacts'. This does not allow evaluation of the proponent's awareness of potential impacts or his ability to minimize them. A discussion of potential impacts should be presented followed by the various criteria which will be employed in designing or establishing construction practices and construction locations to minimize impacts.
- (e) Provide a more thorough discussion of the requirements for supplementary back-filling.
- (f) Provide a more thorough discussion of pipeline route alternatives. Consider and discuss a third, more easterly route alternative which follows drainage divides from Drake Point to the liquifaction facility.
- (g) Provide a more thorough discussion of port selection criteria and rationale for the selection of Bridport Inlet over other potential sites.

C. MAMMALS AND BIRDS

The proponent demonstrates an awareness of the potential detrimental effects of the project on Melville Island wildlife.

At virtually the same time as a significant destructive wildlife/project interaction is mentioned however, it is discussed as being of negligible importance to the Melville Island community of mammals and birds. In many cases there is no discussion of the methods used to assign magnitudes to expected impacts.

Disturbances in the form of traffic, erosion control maintenance, air traffic, plant noise, etc., are predicted to occur primarily in the more richly vegetated lowland areas, and in the Mecham Delta area. This will result in the restriction of east-west musk-oxen movement, and the harrassment of musk-oxen and birds from the few available feeding and breeding areas. If construction activity occurs in critical habitat areas during a severe winter, the caribou and musk-oxen populations could be reduced to a level from which recovery may not occur. More elaborate analyses of these problems are required.

RECOMMENDATIONS

- (a) Provide elaboration of the analyses of the magnitudes of potential impacts on wildlife through presentation of a detailed impact assessment rationale, including the factors that lead to the choice of a pipeline route through good wildlife habitat over routes through less productive areas.

D. FRESHWATER RESOURCES AND HYDROLOGY

The freshwater surveys were designed to 'determine the abundance of fish and prey species'. No population estimates were made however, nor were studies conducted in a manner which would permit meaningful population estimates to be made.

The methods used to evaluate stream hydrology, classify stream types, evaluate fish habitat and determine the presence of fish in streams were a combination of 'streamside observations', and observations from a helicopter at 60 - 200 m ASL at speeds up to 100 kph. Such methods are not appropriate to these tasks.

References to hydrological and water quality studies performed on Melville and Bathurst Islands are lacking. The proponent does not demonstrate an awareness of government studies conducted on Melville Island in conjunction with the Arctic Islands Pipeline Program (AIPP).

RECOMMENDATIONS

- (a) Define present and future scenarios for aquatic resource utilization, and based on these:
 - (i) Provide population estimates of fish in lakes accessible to project personnel and assess the effects of future harvest on the population, and
 - (ii) Provide a more thorough classification of stream types and evaluation of fish habitat.
- (b) Undertake a more thorough investigation of the presence/absence of sea run fish in the Mecham River because of possible effects from borrow pits and other construction activities.

- (c) Provide an evaluation of water quality and quantity of streams and rivers which the pipeline may cross.

E. PHYSICAL OCEANOGRAPHIC STUDIES AND BRIDPORI INLET MARINE BIOLOGY

The Summary Environmental Statement states that the entrance to the Inlet is approximately 3 km wide. In fact, the useable width of the Inlet, from a navigable point of view is 1.5 km. It should be noted that within the Inlet itself, there is a shallow area (minimum depth 16m), 3.5 km north eastward from the entrance. In the immediate approach to the Inlet, shoal water will limit the width of the navigable area to 2.2 km.

Ocean current information necessary to assess likely operational and environmental hazards and to determine many operational procedures regarding discharges of warm water effluents and ice management practices were not available from information collected prior to 1979.

Dredging and blasting, thermal and brine discharges and ice breaking are identified by the proponents as potential hazards. The studies planned in response to those potential hazards nevertheless were carried out only in spring and late

summer, even though the hazards are expected to occur year-round. Only a general biological account is given with no emphasis on specific hazards. Detailed information on water movement within the inlet, a very important phase of the study, is given only limited attention. This is unfortunate, because the impact of several of the more important environmental threats is clearly related to water movements. The effects of heated effluent on the Bridport Inlet fauna can be assessed only when such factors as the quantity and rate of heat input, discharge point(s), surface currents in the inlet and the amount of ice cover are known. Most of the effects described are for winter. The summer situation is not described. It is also unclear from the discussion whether thermal shock during plant shutdown will be a serious problem, or if biocides will be used to prevent fouling of the cooling system.

Bridport Inlet was the only area subjected to site-specific environmental studies. The field studies were far from adequate; epontic algae were studied only in June, phytoplankton in June and August and marine birds not considered after August during the one year that studies were conducted.

It is predicted that there will be little adverse effect on ringed seal breeding habitat by ship traffic within Bridport Inlet. Elaboration of this, based on information obtained during various times of the year, is required.

The discharge in Bridport Inlet of ballast water from Davis Strait provides the potential for upsetting the Bridport ecosystem. In particular the possibility exists that parasitic copepods not found in Bridport Inlet could be introduced from Davis Strait and affect arctic cod populations.

RECOMMENDATIONS

- (a) Undertake additional research and analyses of the potential impacts of discharging LNG plant, desalinization plant and domestic effluents into Bridport Inlet.
- (b) Conduct detailed studies of seasonal circulation patterns and flushing rates in relation to operational practices, and anticipated impacts resulting from effluent discharges and accidental oil spillages. The residence time of effluents and the effect of permanent (or semi permanent) structures on the existing water circulation characteristics of the Inlet should be reported.
- (c) Conduct biological studies during appropriate seasons to supplement previous investigations.
- (d) Provide more information on numbers of seals and discuss in relation to their potential utilization by man.

F. PROJECT DESCRIPTION

Insufficient detail on a number of aspects of Melville Island facilities was provided to enable an assessment of probable environmental perturbations resulting from project operation and maintenance activities. No information was provided on the location of the water source(s) for winter

construction crews, nor on the means by which water would be transported from the source to the users. Insufficient information has been provided on the rates and quantities of discharge of a variety of plant and plant related effluents. No description of the Drake Point facilities has been offered by the proponent.

RECOMMENDATIONS

- (a) In order to assess the capability of the proposed camp waste treatment facility to meet the suggested BOD and suspended solids levels, design details are required.
- (b) Estimates of plant water budget are required.
- (c) Estimates of brine effluent (quantity and quality) from desalination equipment are required.
- (d) Information on sources and methods to supply water for winter construction camps are required.
- (e) Information on anticipated noise levels and noise frequencies is required for an assessment of the effects of noise on safe plant operation.

II. SHIPPING COMPONENT

A. ATMOSPHERIC ENVIRONMENT/ICE RECONNAISSANCE

While the use of waste heat only to thin the ice in Bridport Inlet shows an appreciation for the potential effects of open water as an infinite source of heat and moisture in the Arctic winter, the same concern is not reflected in the analysis of the open water leads created by the ships' passage. The assumption of rapid refreezing is not defended by literature reference or experiment and no scenario is presented as to the effects that might occur if it does not happen. Likewise the plausible positive/negative effects on wildlife (e.g. sea birds) by a potentially longer open water period created by open shipping lanes should receive more attention.

The charts of ice conditions for the January to June period are poorly done with the terminology not adequately defined, and the expected thickening trend not apparent.

Ice reconnaissance is still primarily a visual operation which leads to problems under low light fog or low ceiling conditions - even in summer. Shipborne radar does not easily identify icebergs, bergy bits or growlers, hence additional problems are foreseen if adequate tactical airborne reconnaissance is not available. How navigation is going to proceed in all weather, all year round, is not explained. In fact there is a lack of realization on the part of the authors

that the real time data are currently inadequate and that a real time environmental prediction system is needed.

Wave data presented in the shipping report are insufficient as the wave climate is based on a one year report only; however, the four year data available suggests waves greater than 3 m occur more frequently than the proponents indicate.

RECOMMENDATIONS

- (a) The analysis of wave climate data appears to suffer from omissions of available data, and should be re-investigated.
- (b) Some serious consideration should be given to a possible cooling trend along the Parry Channel, resulting in increased ice thickness, shorter open-water seasons and more multi-year ice, all of which may result in shorter tanker life and greater fuel consumption as a result of increased operation in the ramming mode.
- (c) Courses required for operational personnel should include real time environmental prediction systems and their input needs.
- (d) The various plausible scenarios regarding the rate of refreezing of open water created by ships' traffic and the possible extension of the open water season in some areas, requires more in-depth analysis.

B. HYDROGRAPHY/NAVIGATION AIDS/ROUTE SELECTION

Hydrography - Parry Channel

The proposed LNG route will pass close to the south coast of Bathurst Island. Recent surveys show this to be an area of irregular relief which may present hazards to tanker traffic.

Hydrography - Baffin Bay

There are no conventional surveys in Baffin Bay. However, for the most part, the Bay is covered by dense track soundings which show very deep water.

Hydrography - West Coast of Greenland

The two proposed northerly routes for the LNG vessels will pass close to some shoal soundings derived from reconnaissance tracks. It is doubtful that these areas have been examined in detail. From Disko Island to Frederikstaab, the Summary EIS makes reference to Store Hellefiske Bank as being the only potential hazard on the Davis Strait route. This reference is not entirely true as further south, the route passes over the bank of Sukkertoppen. A 30 m sounding lies close to this bank. Further hydrographic investigation of this portion of the route is required.

Navigation Aids

Further discussion is required on the use of, location of and type of navigation aids required.

Route Selection

The preferred tanker route and several alternatives coincide with areas of greatest iceberg density (Melville Bay) and with known ringed seal breeding habitat between Lowther and Griffith Islands.

It is mentioned that LNG carriers will be intercepting ice edges at their weakest point 'namely near the coast of Devon Island'. However, because ice containing algae may be 50% weaker in mechanical strength than algae-free ice, it is questionable whether the proponents can in fact predict where the weakest ice is without preliminary testing of ice strength.

RECOMMENDATIONS

- (a) A more thorough discussion of iceberg avoidance procedures in the event of reduced visibility is required.
- (b) More detailed hydrographic information is required for that portion of the route south of Bathurst Island and that portion in Danish waters north of 63°N.
- (c) Serious consideration should be given to moving the southern segments of the tanker route out beyond the edge of the Shelf. This will avoid traversing important fishing banks and thus reduce the risk of collisions with

fishing craft and vessels associated with hydrocarbon exploration activities offshore.

- (d) Tanker route selection should take into account seasonally important seal and whale habitat as well as ice conditions.
- (e) Ice-strength/ice algae productivity relationships should be further investigated.

C. VESSEL DESIGN/OPERATION

Concern has been raised regarding lack of information on the protection of steering mechanisms from ice damage.

The use of carbon dioxide as the inert blanketing gas, instead of nitrogen, is questioned in light of U.K.'s recommendation to avoid the use of carbon dioxide where buildup of static electricity may present a hazard in the presence of inflammable gases.

D. TANKER TRAFFIC - MARINE BIOTA INTERACTIONS

Areas of tanker penetration through ice may coincide with ice surfaces preferentially selected by ringed seals, and hence impacts on these animals may be far greater than supposed by the proponents.

As stated by the proponents, the effects which tanker traffic in the arctic will have on whales is poorly understood. Gaps in knowledge exist regarding disruption of normal whale migration patterns (whether through avoidance

or attractant responses by whales), the effect of vessel noise on normal whale communications, and the disturbance of animals in overwintering areas which may result in excessive stress.

RECOMMENDATIONS

- (a) Studies are required to further elucidate relationships of ringed seal habitat with ice formation processes and to better assess possible vessel - ringed seal interactions.
- (b) Investigation of problems associated with whale populations and vessel interaction is required for all seasons with special emphasis on winter.

E. SAFETY

While nearly all of the accident scenarios have a high probability of occurrence south of 60°N, this portion of the route is treated very superficially in the LIS. The proponents appear to have understated the potential public safety aspect of the project. The probability of a collision between an LNG tanker and drilling rigs, supply vessels, fishing craft and other marine traffic is underestimated. In developing risk analyses, the projected increase in vessel traffic in the six years between project approval and operation should have been taken into account.

RECOMMENDATIONS

- (a) A revised public safety risk analysis is required which will incorporate the projected increase in seagoing traffic

and stationary devices (offshore drill rigs) between the time of application and the projected time of operation.

D.2 DFO/DOE Review of Supplementary Information to the
Arctic Pilot Project EIS, February 1980.

REPORT TO
THE WESTERN AND NORTHERN RSCC
ON THE REVIEW OF
SUPPLEMENTARY INFORMATION
TO THE ARCTIC PILOT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

PREPARED BY THE
REGIONAL HYDROCARBON COMMITTEE

FEBRUARY 15, 1980

INTRODUCTION

The Arctic Pilot Project has been proposed by a consortium of companies which include Petro-Canada, Alberta Gas Trunk Line Co. Ltd. and Melville Shipping, as a means of delivering natural gas from the High Arctic to southern markets. The project plans involve the gathering and transmission of natural gas through a 22" diameter buried pipe from the Drake Field on Melville Island, south approximately 160 km to a barge mounted liquification facility at Bridport Inlet on the south coast of Melville Island. Gas will be transmitted at well head pressures in a refrigerated state, with an anticipated rate of exploitation of 708,000 m³/day (250 mm cfd).

It is proposed that the natural gas, once in the liquid state (LNG) will be shipped by two specially designed Arctic class 7 tankers to an undetermined southern site. The two tankers are being designed to enable year round operation through the Parry Channel with each vessel completing approximately fifteen round trips per year.

An initial EIS, submitted by the initiator(s) was reviewed jointly by the Department of the Environment and Department of Fisheries and Oceans in April 1979. Subsequent to the issuance of guidelines for the completion of the Arctic Pilot Project EIS, the Proponents have submitted supplementary information which is the subject of this review.

SUMMARY

Major concerns related to potential impacts and to the effect of the environment on the project have been identified as follows:

1. The implementation and effectiveness of proposed further studies and their relation to project design and scheduling;
2. The preferred pipeline route alignment as related to pipeline integrity and to unacceptable impact on musk-oxen and nesting geese;
3. The lack of an adequate environmental prediction system;
4. The questionable choice of sea routes in Baffin Bay;
5. The lack of pipeline construction design considerations regarding stream bed responses in high energy events and to soil active layer thickness;
6. The potential for negative impacts on marine mammals resulting from LNG vessel traffic through prime marine mammal habitat.

In general, the concerns expressed by the reviewers do not warrant opposition to approval-in-principle for the Arctic Pilot Project. Given the necessary environmental information, identified in the review which follows, proper design and mitigative measures are expected to keep environmental impacts to a tolerable level.

Appropriate terms and conditions, applied throughout the approval process are required to ensure the provision of adequate information on which to base final designs. In particular, a detailed re-assessment requiring on site analysis of pipeline alignment, and the development of an adequate environmental prediction system are deemed to be a requirement of any approval-in-principle.

REVIEW OF SUPPLEMENTARY INFORMATION

Following is a collation of reviewers' comments on the adequacy of information presented by the Proponents in response to guidelines issued by the Panel, and to some specific concerns raised in the DFO/DOE review of the January 1979 EIS. Marginal numbering follows that of the Panel Guidelines.

A. GENERAL

1. Project Scope

- a) Drake Point facilities: Environmental concerns and mitigative measures associated with the Drake Point facilities were not available at the time of this review.

2. Long-term implications

- a) Interactions: The joint Petro-Canada/DINA response was not available at the time of this review. In view of other concurrent and future petroleum and mining developments in the north, (Dome Petroleum, Arvik Mine) this could become an important aspect in the development of the Arctic Pilot Projects' environmental monitoring program.
- c) Environmental program: An excellent list of topics of research, regarding the operational aspects and the discussion regarding topics of more general scientific interest, were well received by reviewers, as was the proposal to establish a joint government/Proponent/public technical advisory committee. The early establishment of the advisory committee should be given a high priority.

Since with the Arctic Pilot Project we are dealing with a large number of unknowns, and for which we can not

draw on knowledge gained from related projects, the monitoring program will be the only means of providing an assessment of the impacts of this and future expanded or similar projects. Since the success of the monitoring programs are largely dependent upon the validity of baseline descriptions, prerequisite site specific baseline studies must be completed prior to regulatory approvals.

As its name implies, the Project is intended as a feasibility study which can lead to implementation of an LNG system on a large scale, or to projects which are, in part, of a similar nature. It is therefore important that the terms of reference of the proposed advisory committee, its composition and its means of effecting changes in the operational aspects of the project based on the analysis of ongoing studies, receive considerable attention.

B. MELVILLE ISLAND

1. GAS PIPELINE

1.1 Pipeline Alignment

Neither the process by which the preferred pipeline route was selected, nor the inputs to the decision making process, nor the lack of consideration of a third "drainage divide" alternative are to the satisfaction of reviewers. It is the opinion of reviewers that high costs in terms of pipeline maintenance, habitat disruption, and wildlife and bird harrassment will result from the construction of a pipeline along the now preferred route. Based upon evidence given by the Proponents, this route choice will

result in unacceptable environmental impacts and will afford questionable pipeline integrity.

While the Proponents point out that an increase in surface area disturbance is a disadvantage of the alternate route (and would be of a third alternative), it is the type of surface disturbed that is important. The primary route crosses a greater amount of well vegetated, high ice content terrain, much of which is prime bird and wildlife habitat. Hamilton and Bliss, 1979 in their report to Petro-Canada state "Sites along the tops of ridges and other elevated sites have much less plant cover and lower levels of soil moisture. Detachment slides are less frequent in these areas, and thus should be used." The authors go on to recommend that removal of plant cover in wetter, more susceptible areas should be avoided, since it may result in the melting of the ice rich layer found above the permafrost, causing saturation of the active layer-permafrost interface and result in instability.

Disappointingly, no discussion has been presented regarding an alignment which would take the pipeline along the east-west drainage divide. An alignment along this route would avoid cross slope ditching, would essentially limit all crossings to first order streams at or near their sources, would traverse terrain that has low ice content, would minimize the number of grade changes and would minimize wildlife and bird impacts. Unfortunately the route is longer and ditching conditions are unknown.

1.2 Geotechnical

1.2(a) Soil/Permafrost: Deficiencies still remain regarding information necessary for pipeline construction. The borehole data along the primary route was not collected later than July 24, a period too early to determine maximum thickness of the active layer, and thus of limited value in determining appropriate depth of pipe burial. This information, along with the results of the test burial program will be necessary before proper evaluation of the proposed pipeline construction practices may be made.

1.2(b) Design floods: Based on its low frequency of occurrence, the impact of a severe storm on the integrity of the pipeline is covered superficially. This also suggests very little is known of the runoff characteristics and changes in channel geometry as a result of such events. A better understanding of stream response to infrequent high-energy events may be more important to the integrity of a buried pipeline than some knowledge of normal no-flow, low-flow or peak-flow conditions.

1.3 Construction

1.3(a) Borrow material: No discussion of the identified Meham River borrow sites identified in the R. M. Hardy, Landscape Survey, 1978 was included in the supplementary report. It is unclear whether removal of material from these three locations is no longer being considered or whether the information requested is forthcoming. (Dependent upon backfill configurations and results of the test pipeline burial program.)

1.3(d) Temporary access roads: Reviewers await the report of observations of the terrain performance tests over the 1979 thaw season at the pipe burial test site. Design of temporary access roads will incorporate these observations.

2. LNG PLANT AND ANCILLARY FACILITIES AT BRIDPORT INLET

2.1 LNG Plant

2.1(a) Mecham flood conditions: The presence of the Mecham River in the High Arctic region does not preclude the possibility of less severe flood conditions than in southern climes. Because of the presence of permafrost, it is more typically the case that under extreme precipitation events, flood conditions will be more severe in arctic than in the south.

2.1(b) River training: It is not clear from the information provided whether the design of the proposed Mecham River works have taken the permafrost conditions, which exist under the Mecham River bed, into account.

3. CONTINGENCY PLANNING AND PROJECT CONTROL

Project Control

An environmental education program similar to the one described by the Proponents was used for the Sarnia-Montreal pipeline. It generally was not successful in preventing unnecessary environmental degradation, particularly at stream crossings. One of the main reasons for its lack of effectiveness was that it was not possible to have the responsible officers at all points of construction on a continuous basis. Other problems were identified and it may be worth while drawing upon this experience, which has been documented, for

optimum development of a similar plan in the north.

- 4(a) Musk-oxen: The construction phase as well as the operational phase of the APP will most likely interfere with musk-oxen movements in the coastal areas of Melville Island as a result of loss of habitat or as a result of the disturbing presence of man. What reduction in population will result from the project is not known but one can speculate that during severe winters, loss of habitat coupled with induced stresses will result directly or indirectly in the death of individuals and reduce calving.

The Proponents are aware of the potential problems of musk-oxen/project interaction and "propose to fund a study of musk-oxen on the south coast of Melville Island to determine whether regular coastal movements occur and the timing of these movements." The results of these studies have a major strategical significance in the development of mitigative measures, which may include alteration of the proposed pipeline alignment. The Panel should be advised on how the Proponents perceive the scheduling of these studies in relation to project scheduling.

- 4(b) Peary caribou: The proposed mitigative measures to minimize the impacts of pipeline construction activities on caribou should prove effective. Surveys to locate calving areas will be of considerable importance to further reduce impacts.
- 4(d) Bird habitat: The loss of good to excellent non-passerine (non-dickie) bird habitat on the east side of Bridport Inlet is suggested by the Proponents to have minor effect on all

but local populations. There is no evidence to refute this.

Operational inspection flights will most likely cause unacceptable levels of disturbance to nesting brant geese in the Sabine lowlands, however reconsideration of pipeline alignment would solve this problem. Borrow activity in and around the Mecham Meadows (some of the most productive terrain in the Bridport Inlet area) should also be avoided in this excellent bird and mammal habitat.

- 4(e) Physical oceanography: The supplementary information provided is based on work being conducted by the Frozen Sea Research Group at the Institute of Ocean Sciences. The information provided is an accurate general statement of our present knowledge and questions that arise can generally be answered. Some details are not fully understood and are the subject of future work.

Variability of the biota and comparative assessment of Bridport Inlet: No site specific data which will describe seasonal and annual variability or which will allow a comparison of Bridport Inlet with adjacent habitat has been presented. The prediction that seasonal variation in the biology of the Inlet should be similar to that in other Arctic systems may be a reasonable conclusion, but it is of limited value in predicting local impacts and of no value in future monitoring of impacts.

Ice management system: We remain skeptical of the method used to determine the temperature rise of sea water in the ice management zone. The basic work contained in "Ice

Management within Bridport Inlet" by Acres-Nordco have some serious deficiencies, among them an inadequate consideration of the buoyancy and stability of thermal plumes, dispersion and mixing processes and the transfer of heat from water to ice. This deficiency is primarily an engineering one.

Nutrient enrichment - temperature increases and decreases:

In the absence of thermal tolerance characteristics of individual species (which are lacking for Arctic species) the Proponents have produced a plausible scenario of the effects of low temperature increases on marine biota. A similar discussion is lacking on the effects of nutrient enrichment coupled with increases and subsequent decreases in temperature (during plant shutdowns).

- 4(f) Air pollutants: The Proponents have made a reasonable attempt to relate the effects of construction and operation of the project on local air pollutant concentrations from the limited data and information available. A more detailed assessment will require a longer term environmental data base in addition to the data from weather observing stations established at Bridport Inlet during periods of 1977 and 1978. The longer term data base should include low level wind and temperature profiles for Bridport Inlet. The problem of the production of photo chemical smog (arctic haze) and of nitrogen oxides and carbon monoxide emissions as they may relate to regional air quality and their cumulative effect has not been considered. The latter is particularly important

as resulting vegetation damage may be particularly significant in the Arctic under the critical equilibrium between vegetation and wildlife, and the harsh environment. These factors should be examined under conditions of restricted diffusion - a common occurrence in the High Arctic throughout the year.

Transformations of NO and NO₂ under the influence of sunlight "should be slow on Melville Island where solar radiation levels are usually either small or non-existent". This statement would be true only during certain months of the year. Energy attenuation, due to the low sun-angle at higher latitudes, is compensated by the increased length of day. The total incoming solar radiation available to the area around Melville Island in June and July is about the same as at temperate latitudes.

Thus, at this time of the year, conditions associated with the production of photochemical smog (Arctic haze) would be a serious problem. These conditions are further complicated by other factors such as the frequent episodes of fog in the marine stratum of the coastal inversions that develop over the icy waters and advance inland. A location like the LNG facility at Bridport Inlet would frequently experience such conditions in the summer.

Also, the cumulative effect on regional air quality should be considered for extended periods of operation during the 3-4 months of darkness during the winter. The horizontal transport of polluted layers in a deep surface-based inversion or above a shallow mixed layer takes place without significant

dilution. Surface layer turbulent exchange processes, including dry deposition, are either cut off aloft or greatly reduced (Wesley and Hicks, 1977). In this 'decoupled' state, pollutants emitted into layers aloft are often transported without appreciable dilution. Some of this pollution accumulated from the previous days activity can remain essentially intact (Sisterton et al, 1979). Due to the absence of a diurnal mixed layer cycle in the Arctic from late fall to early spring, the pollution would be transported with the flow in stably stratified layers at the effective stack height level until encountering and being entrained by a mixed layer from below (e.g. over open water). This could lead to high local concentrations when combined with other sources.

Another important factor to be considered is snow pack accumulation and spring snowmelt impact on the environment. Pollutant concentrations in spring snowmelt is often 2-3 times higher in the first meltwater fractions than in bulk snow, and may contain more than 5 times the snowpack concentrations. 50-80% of the pollutant load is released in the first 30% of the meltwater (Johannessen and Henriksen, 1978). Information may be required on regional 'shock potential' and its effect on local ecology when pollution accumulated in the winter snow pack is suddenly released in spring.

Ice fog: We question the comparability of Bridport Inlet and Edmonton for the estimation of ice fog conditions, and also the assumption that amount of moisture emission during the

construction phase will be similar to those in downtown Edmonton. Other emission parameter assumptions have been made elsewhere in the document (pg 122); temperature and stability data are obtainable for other Arctic locations more likely to be comparable to Bridport, such as Resolute.

The probability of ice fog formation has not really been described, nor, perhaps more important, the likelihood of its persistence and the effects on surface and air transportation. Estimated H₂O emissions from generator and compressor turbines, at 21.1°C ambient, is estimated in the Melville Island Component Volume as being 11.5 m³ per second which is an appreciable input to a frequently cold, stable atmospheric environment. The question of water vapour emissions from the drying process has not been included.

Noise: During the course of travels to and from Bridport Inlet, it has been noted that when approaching the airstrip from the east, one overflies one or two musk-oxen herds located between Bridport and Beverly Inlet. Unless flying fairly high, these herds were invariably disturbed. Approaches to the Bridport airstrip will have to be controlled to minimize disturbance.

- 4(h) Anadromous fish populations: Studies conducted to determine the presence/absence of sea run fish utilizing the Meham River were not sufficiently rigorous to support the Proponents' conclusion that the river does not support a sea run population. In view of potential impacts resulting from proposed borrow operations in the river bed, and from river

training works, a more thorough assessment of the utilization of the river by Arctic char will be required.

B. SHIPPING COMPONENT

1. LNG CARRIERS

- 1(b) Shipping routes: Among the proposed shipping routes in Baffin Bay, several traverses, legs 16b to 19c and 20c to 22c are areas of high iceberg occurrence along the Greenland coast. It is suggested that tracks further offshore in this area would encounter substantially fewer icebergs and also less severe sea ice conditions than are expected west of Resolute. Further explanation of their choices is required from the Proponents.
- 1(c) Pack-ice reconnaissance: The Proponents state that "'standard' maps of weather, ice conditions will be received aboard the ship by normal receiving equipment". It is suggested that a statement from the Proponents is needed to show whether, in their judgement, year-round shipping can be conducted using the existing DOE surveillance and forecasting system or whether an augmented government ice service would be required and if so, what additional public resources might be required.
- 1(g) Hydrographic surveys: Further hydrographic data are needed as outlined by the Proponents. AOS Atlantic consider that a survey of the eastern end of Lancaster Sound and from Byam Martin Island to Bridport Inlet should receive a high priority. The effect on the resources of the Canadian Government, of the Proponents' suggestion that necessary hydrographic surveys be obtained by government, needs to be addressed.

1(h) Critical areas: No comment was provided by the Proponents on the identification of areas considered to be critical to the ship or to living resources.

1(i) Environmental prediction: "The present environmental forecasting charts will be received on board and translated by the Officers of the ship using their experience, into one more additional piece of information used in the navigation of the ships" (pg 182). What are the "present environmental forecasting charts" and who will generate them from what?

The Proponents state that they "believe that the present systems of weather reporting is (sic) adequate, but could be improved by the use of more stations in the Northern areas of Canada and Greenland" (pg 182). Reasons for the belief in the adequacy of the present systems should be indicated, by relating the existing information from the observational network, with the Proponents' requirements. The Proponents should also be aware that an expansion of the weather reporting network in northern Canada could not likely be undertaken within the level of resources now, or historically allocated to the Department.

LNG VESSELS-PART II

1(e) Vessel drift/fire: The discussion and calculations regarding an LNG fire from a ruptured tank related to vessel drift appear somewhat confusing. On the one hand a constant spill rate is assumed to calculate distance of drift over the spill duration, and subsequently a differential rate of spill is described (as the gravity head reduces) to suppose that a

smaller flame would result near the end of the drift. The latter spill description is more correct. Consequently the ship would drift over a considerably greater distance while gas was burning off resulting in a potentially greater risk to stationary structures in the drift path.

- 2(a) North Water impacts: The Proponents have identified that a principle concern with respect to shipping in the "North Water" is the potential for entrapment of whales in artificial leads created by the ship. While this is an often identified and real concern, it is likewise a concern that marine mammal habitat may be effectively lost to them as a result of their avoidance of areas frequently disturbed by vessel traffic.
- 2(b) Ringed seals: The Proponents plan to conduct further studies on the effects of LNG vessel traffic on ringed seal survival is desirable as is their proposal to avoid vessel traffic through predictable birth lair areas during the pupping season. In conjunction with these studies, a research effort to determine the response of ringed seal pups to vessel noise would be of considerable benefit in assessing impacts.

D.3 Department of Fisheries and Oceans Position Statement on the Arctic Pilot Project, February 1980.

**DEPARTMENT OF FISHERIES AND OCEANS
POSITION STATEMENT
ARCTIC PILOT PROJECT**

I. ANTICIPATED IMPACTS ON AQUATIC ECOSYSTEMS

The Department of Fisheries and Oceans participated, along with the Department of Environment, in a joint review of the Environmental Impact Assessment submitted by the proponent to FEARO in January 1979. The DFO/DOE review document identified deficiencies and made recommendations with respect to additional information needs. Following the issuance of FEARO Guidelines the proponent submitted supplementary information, which was similarly reviewed jointly by DFO and DOE.

The following is a summary of the potential impacts identified by DFO in the most recent review:

(1) Production/Pipeline and Ancillary Facilities

- (a) Habitat loss as a result of**
 - (i) water extraction**
 - (ii) gravel removal**
 - (iii) river training works**
 - (iv) construction of pipeline crossings**
- (b) Increased harvest demands on local fish stocks (e.g. land-locked char), ringed and bearded seals, as a result of expansion of the human population in the area.**
- (c) Potential fish losses as a result of a pollution incident, such as a spillage of fuel or chemicals.**

(2) Liquefaction Facilities

- (a) Resource losses resulting from:**
 - (i) dredging and blasting during terminal construction, and**
 - (ii) accidental spills of fuels or other contaminants.**
- (b) Effects on the biota of Bridport Inlet as a result of ice breaking activities or discharges of warm water, domestic wastes or brine.**
- (c) Introduction of Atlantic Ocean biota into Bridport Inlet through discharge of ballast water.**

(3) Transportation

- (a) Habitat destruction, fish and marine mammal losses as a result of spills of oil or other contaminants.
- (b) Losses of marine mammals through entrapment in artificial leads created by vessel traffic.
- (c) Loss of marine mammal habitat as a result of avoidance of areas frequently disturbed by vessel traffic.
- (d) Destruction of seal birth lairs during vessel passage.
- (e) Unknown resource interactions through construction and operation of the 'as-yet-identified' southern shipping terminus.

II. DFO CONCERNS

It is the opinion of DFO that the potential impacts to aquatic habitats and resources have been adequately identified by the proponent. However, it has proved very difficult to judge the significance of these impacts due to the limited nature of the environmental studies conducted to date and the lack, in many instances, of specific project designs or details.

Some specific concerns are the following:

- (1) The information provided on the water circulation, thermal plume dispersion and seasonal variability of biota in Bridport Inlet was insufficient and was not adequately taken into account in the assessment of impacts on the marine life.
- (2) Mitigative measures designed to minimize the adverse effects of major accidental spillages, hydraulic erosion of streams, and borrow operations are considered to be inadequate.
- (3) The proponent's conclusion that anadromous fish populations do not occur within the area of influence of the project has not been satisfactorily substantiated.
- (4) The project is planned to be operated on a year-round basis. Environmental studies were generally conducted during the summer and are therefore not considered adequate for the prediction of impacts which might occur during other seasons.

- (5) The hydrology of the streams has not been studied sufficiently, with the result that the effects of extremely high flows on the integrity of the pipeline cannot be adequately assessed.
- (6) In several instances (e.g. South coast of Bathurst Island, West coast of Greenland) proposed tanker routes cross areas which recent surveys have indicated may present hazards to tanker traffic. Further hydrographic investigations are needed.
- (7) The preferred tanker route and several alternatives pass through areas of great iceberg density and also areas of known ringed seal breeding habitat (between Lowther and Griffith Islands in Barrow Strait). Serious consideration should be given to alternatives which avoid these areas.
- (8) Interactions with vessel traffic could have adverse effects upon marine mammal populations.
- (9) The impacts of shipping routes South of 60° N and construction and operation of a southern terminus have not yet been addressed.

III. DFO POSITION

The Department of Fisheries and Oceans finds the Arctic Pilot Project to be conditionally acceptable.

While a number of information gaps have been identified, the concerns expressed do not warrant opposition to granting an approval-in-principle for the project. Given the necessary environmental information, proper design and mitigative measures can be expected to keep environmental impacts within tolerable levels. DFO wishes to be assured that appropriate terms and conditions will be applied throughout the approval process to ensure both the provision of adequate information on which to base final designs and the proper application of this information in project design. Such terms and conditions should accommodate the concerns identified above.

It has been proposed that a joint industry/government advisory committee be formed to review additional study requirements. DFO will wish to be involved in establishing the committee's terms of reference, its composition and operating methods so as to ensure that the Department's concerns are properly addressed.

The impact of shipping routes South of 60° N and the construction and operation of a LNG terminal should be the subject of a full environmental assessment and review.

D.4 DFO Opening Statement - Arctic Pilot Project Panel Hearings,
23 April 1980, Resolute Bay, NWT.

DFO OPENING STATEMENT - ARCTIC PILOT PROJECT PANEL HEARINGS

23 APRIL 1980 RESOLUTE BAY, NWT

The Department of Fisheries and Oceans has participated, along with the Department of the Environment, in a review of the Arctic Pilot Project environmental impact statement, throughout its various stages of development. While a number of information gaps have been identified and it is apparent that a number of environmental impacts are poorly understood, the Department of Fisheries and Oceans does not consider that, subject to well-defined mitigation, the concerns expressed warrant opposition to a conditional approval of the Arctic Pilot Project.

The Department of Fisheries and Oceans is charged with the responsibility under the Fisheries Act of Canada to ensure the protection and management of the fishery resources (including marine mammals) and to protect fish habitat from disruption or degradation. Should approval-in-principle be given to the Arctic Pilot Project, conditions should be applied to ensure that critical gaps in the environmental data base are filled. Such conditions are perceived as being prerequisite to the proponent's commitment to adequate project design, impact recognition and mitigation.

The Department intends to highlight those areas requiring priority attention from the proponent and wishes to obtain through the course of these hearings, a commitment from the proponent for the timely execution of studies which will provide such information. As outlined in the earlier submission prepared by this Department and forwarded to the Federal Environmental Assessment and Review Office, major DFO concerns include:

1. lack of sufficient information pertaining to Bridport Inlet water circulation and biota variability;
2. lack of sufficient design information regarding the mitigation of impacts resulting from major accidental spillages and from hydraulic erosion and borrow operations on the Mechem River;
3. lack of sufficiently detailed, quantitative information pertaining to anadromous fish populations;
4. absence of environmental information on Bridport Inlet winter biology;
5. lack of information pertaining to marine mammal/vessel interaction throughout the shipping season.

...2

Of similar concern to the Department are the information gaps which are of a more operational concern:

1. the requirements for further hydrographic information along portions of the proposed shipping route.
2. the selection of portions of the shipping route through areas of extreme iceberg density is a major concern and requires discussion by the Department.

The position which DFO has developed regarding production and shipment of liquefied natural gas on a pilot scale should not be construed as a reflection of departmental concerns or policy with regard to shipping in general in the Arctic or, in particular, the transport of oil by tanker in the Arctic. Nor should it be seen to prejudice any future departmental position relating to this project South of the 60th parallel, as we have been requested to restrict our assessment of concerns solely to the project North of 60°.

Owing to the pilot nature of this project it is recognized that many of the expected impacts cannot be properly identified. In most cases we must rely upon the proponent's judgement, as to the nature and extent of impact, since the literature is sparse. Consequently we are concerned that a number of unexpected effects of this project will occur, such as: high ringed seal mortality resulting from the preferential selection by both pupping seals and tanker captains for the same quality of ice surface; and whales and other sea life not becoming habituated to tanker traffic and consequently effectively suffering significant habitat losses. In this light we urge that prior to any project actions being taken identified information gaps be filled to the satisfaction of DFO. The level and kind of further information required should not only satisfy the need to predict impacts, but also to mitigate them.

The possibility of future escalation of industrial development in the Arctic should also be taken into account in the design of impact assessment studies and the identification of mitigative needs.

In closing, the Department of Fisheries and Oceans does not oppose an approval-in-principle decision providing that full recognition is given and appropriate actions taken by the initiating department and proponent on DFO's recommendations for the prerequisite environmental studies to ensure the recognition and diminution of impacts and maximum operational security.

This Department is most interested in questions of regulatory control. It is our opinion that many aspects of this project could impinge on fish and marine mammals and their habitat and as such we would ask that the initiator and proponent be mindful of the pertinent requirements of the Fisheries Act. We would expect to participate directly in any industry/government endeavour to design and implement the above mentioned prerequisite studies.

Finally we welcome the proponent's strong statement in the support of Research and Development and we would like to see the Panel follow up on this by recommending a joint government/industry effort in this direction.

D.5 DFO Closing Statement - Arctic Pilot Project Hearings,
Resolute Bay, 29 April 1980.

DFO CLOSING STATEMENT

ARCTIC PILOT PROJECT HEARINGS

RESOLUTE BAY - APRIL 29/80

Having heard the Arctic Pilot Project's (APP) presentations throughout the course of the Hearings, the Department of Fisheries and Oceans (DFO) recognizes the high level of corporate environmental awareness displayed by the Arctic Pilot Project. DFO is concerned that insofar as is possible, the APP should accommodate the environment in which it will be conducted. In this respect, DFO feels that additional effort could usefully be expended by the Proponent following up on Allen Milne's suggestion with respect to the postulation of realistic scenarios, which involve relevant physical, biological, industrial, social and economic concerns and hence enable one to visualize better how the entire project fits into the overall Arctic development scenario.

The Department considers that the potential for disruption to marine mammals as a result of vessel operations in ice-infested waters to be a major concern. The essence of our presentation regarding this subject was that there exists a fundamental contradiction between the Proponent's policy of shipping along a route of least resistance and their intention to minimize the effects of shipping on marine mammals through avoiding concentrations of them. The solution to this problem goes beyond giving guidance to the ship's master to veer away from areas of major marine mammal concentrations. In this light, the Department is pleased that the Arctic Pilot Project has expressed its intention to perform an integrated analysis of all elements of the physical and biological environment as necessary to delineate on a monthly basis a shipping route through Lancaster Sound. The objective of the analysis being to minimize vessel/marine mammal interaction, while sustaining security of the vessels, its cargo and crew. For Project impact assessment, route selection should not be seen as a single point in time analysis, but should be a subject of continued refinement and improvement as more definitive information is obtained in future studies relating to the distribution, biology and behaviour of marine mammals to vessels. We suggest that it would be of benefit to both DFO and the Panel to await the results of their integrated analysis of ship routing in order that Panel recommendations to the Minister even grossly reflect the marine environmental consequences of the Project.

It is also recommended by DFO that to minimize disruption to ringed seals along Barrow Strait, consideration be given to a shipping route that is as narrow as possible, is a safe distance from shore and does not vary significantly in location from year to year. It is speculated that such a route may restrict vessel disruption to a local level and will not cause a regional impact on the seals.

Presentations were given and discussions ensued regarding the assessment of project impacts at the Bridport Inlet area. The Department was pleased to hear the Proponent's commitment to monitor carefully project effects on the Bridport ecosystem. We support the Proponent's decision by stating that in the face of increased open water, increased siltation, temperatures and salinity, the task of identifying and monitoring impacts will require a year-round baseline of the Bridport ecosystem. Studies to establish this baseline should commence in the very near future so as not to jeopardize the effectiveness of the proposed monitoring program.

Discussions which took place this week did not resolve the Department's concern that the discharge of ballast water into Bridport Inlet may lead to the successful colonization of the Inlet and beyond of undesirable fish parasites. In view of examples of this phenomenon from other parts of the world and the potential for irreversible effects on Arctic fish species (esp. cod) the Department continues to seek verification of the problem (or lack of it) through on-site studies. A more detailed submission on this subject will be forwarded to the Panel and Proponent prior to the end of May. The Department also wishes to see from the Proponent, a more thorough assessment of the possible utilization of the Mehan River by sea-run char.

Concerning hydrography, the expressed intentions of the Arctic Pilot Project to confer with the Dominion Hydrographic Service personnel were well received. In the interest of a safe, secure operation the Proponent is encouraged to obtain the most up to date hydrographic data from the Service and to relay to them their future hydrographic requirements.

In somewhat the same regard and with operational safety in mind, the Proponent's decision to avoid transits through iceberg infested Melville Bay, and to keep the ships route a minimum of 45 km from the Greenland coast, are evidence of prudent judgement.

Considerable discussion has taken place over the past few days, regarding the possible effects in both the fall and spring of ice breaking on the fast ice edge across Lancaster Sound. The Proponent's assessment of the problem, supported by the presentation of Dr. Mueller, leads one to believe that the risk of such an incident is low. If the potential effects on the living resources resulting from ice-edge deformation were equally as low, there would be little need for concern. However, because the potential for environmental disturbance exists, we recommend that the effects of tanker penetration on the fast ice edge be monitored, especially in light of potential increases in tanker traffic in future years.

In summary, the Department's concerns regarding environmental impacts of the Arctic Pilot Project have not changed over the course of the Hearings, however regarding the Proponent's commitment to operate a Project that is compatible with the environment and to identifying and mitigating impacts, our concerns have been reduced. We look forward to future cooperation with the Arctic Pilot Project as it endeavours to identify and avoid or reduce the environmental impacts of this project.

The Department of Fisheries and Oceans wishes to encourage the Arctic Pilot Project to enter into early dialogue with government scientists on topics to be addressed through the proposed Research and Development Programme, especially with respect to experiments designed to assess the implications of underwater noise on marine mammals, and considers it desirable to establish a forum for discussion of wildlife concerns with ships' masters operating in the high Arctic. With respect to those needs for continued environmental research in the Arctic, DFO lends support to the proposals brought forward by the ITC and others concerning Inuit employment in research oriented field programs.

As previously stated, DFO supports the Research and Development plans proposed by the proponent and recommends that a mechanism be developed whereby the findings of research programs be effectively implemented into future project design to ensure optimal impact mitigation. Consideration should also be given to the structuring of an annual project review and assessment procedure to assist in the evolution and implementation of impact mitigation measures.

D.6 DFO Supplementary Comments on the Arctic Pilot Project EIS,
May 1980.



MEMORANDUM

NOTE DE SERVICE

TO
À

J. KLENAVIC
CHAIRMAN, EAR PANEL ON THE
ARCTIC PILOT PROJECT
FEARO, OTTAWA

FROM
DE

M. LAWRENCE
BIOLOGIST, RESOURCE IMPACT DIVISION
FISH HABITAT SECTION
DFO, WINNIPEG

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE / NOTRE RÉFÉRENCE
YOUR FILE / VOTRE RÉFÉRENCE
DATE MAY 28, 1980

SUBJECT
OBJET

SUPPLEMENTARY COMMENTS ON THE ARCTIC PILOT PROJECT EIS

Attached please find written submissions on subject areas which were discussed at the Hearings and represent some concern to the Department of Fisheries and Oceans. The topics addressed herein do not of course encompass all the concerns as identified in our closing statement, but include only those subject areas which I believe required some further amplification.

The use of tanker route selection criteria which will minimize marine mammal disturbance, remains the Department's major concern. This topic was well covered in Brian Smiley's presentation at the Hearings.

With regards to the Drake Point facilities, I have found that information is deficient concerning the assessment of the fish habitat and fishery potential (specifically sea run char) afforded by Caribou Lake and its outflowing river. Concerns there are similar to those expressed re the Meham River.

I hope that these comments will be of value to you and the Panel in your deliberations. I remain at your disposal should you require further elaboration on any Fisheries and Oceans concerns.

M. J. LAWRENCE

MJL/bc

Att.

cc: G. H. Lawler, DFO, Winnipeg
R. McV. Clarke, DFO, Winnipeg



MEMORANDUM

NOTE DE SERVICE

TO
A

J. KLENAVIC
CHAIRMAN, EAR PANEL, ARCTIC PILOT PROJECT
FEARO, OTTAWA

FROM

M. J. LAWRENCE
BIOLOGIST, RESOURCE IMPACT DIVISION
FISH HABITAT SECTION
DFO, WINNIPEG

SECURITY - CLASSIFICATION - DE SECURITE
OUR FILE /NOTRE REFERENCE
YOUR FILE /VOTRE REFERENCE
DATE APRIL 17, 1980

SUBJECT
OBJET

MECHAM RIVER - ANADROMOUS CHAR

The proponent has proposed to install river training works near the mouth of the Mecham River and has also briefly described extensive borrow operations in the lower Mecham River channel and floodplain both of which operations could impede the movement of migrating fish should they be present in the river.

Aside from a concern that the proponent should conduct works in the river course that will not significantly alter its hydraulic geometry (resulting in high sediment transport, thermal niching, etc. etc.), the Department of Fisheries and Oceans wishes to review plans which have the potential of disrupting fish habitat or restricting fish passage.

The proponent's initial assessment indicates that sea run fish do not utilize the Mecham River and that the fish which reside in Polynia Lake (on a tributary to the Mecham) are land-locked. While the Department agrees that this is a believable assumption for the proponent to make, based upon the limited field work performed, we are asking that the Panel recommend studies which would produce more conclusive evidence that in fact the Mecham River is not fish habitat. This Department has in the past and will continue to require that fish species which are now existing at the limits of their geographical ranges will be ensured protection from extinction in those localities.

The Mecham River system affords the potential for migration between the sea and an overwintering lake which is an extremely rare event on Melville Island and hence deserves considerable attention to ensure that its biological significance is not jeopardized by this project.

M. J. LAWRENCE

MJL/bc

TO
A

MEMO TO FILE

FROM
DE


M. J. LAWRENCE
BIOLOGIST, RESOURCE IMPACT DIVISION
FISH HABITAT SECTION

SECURITY - CLASSIFICATION - DE SECURITE
OUR FILE / NOTRE RÉFÉRENCE
YOUR FILE / VOTRE RÉFÉRENCE
DATE APRIL 22, 1980

SUBJECT

EFFECT OF TANKER PENETRATION ON ICE EDGE DEFORMATION -
TELEPHONE CONVERSATION WITH BRIAN NICHOLLS, OAS BEDFORD -
TUESDAY, 15 APRIL 1980

Dr. Nicholls stated that he had discussed the above issue with Dr. Needler and they could confirm their concern as outlined in earlier submissions. It was Dr. Needler's opinion that while the proponent's assessment of the problem was believable, it was primarily an intuitive assessment. There still exists a real concern whether or not tanker traffic will deform/displace the fast ice edge across Barrow Strait - a concern which should be addressed through research before and during LNG carrier operations - and the results of which should be made available to MOT and OAS.


M. J. LAWRENCE

MJL/bc

DISCHARGE OF DAVIS STRAIT BALLAST WATER INTO
BRIDPORT INLET (VISCOUNT MELVILLE SOUND)

The proponent's Arctic Pilot Project proposal indicates that during the return passage of tankers from the east coast to Melville Island, ballast water will be taken on upon entering ice-infested areas to increase draft and achieve a more efficient shape for ice breaking.

The Department of Fisheries and Oceans is generally opposed to the widespread introduction of exotic species into areas where the consequences of such introductions are poorly or not at all understood. The Department is concerned that the procurement of ballast water in Davis Strait could lead to the possible introduction of flora and fauna (pelagic stages of benthic invertebrates, fish larvae, parasitic copepods etc.) to Bridport Inlet and the subsequent establishment of new and potentially undesirable species in the Bridport Inlet area.

While it may be argued that the possibility exists that waters from Davis Strait and Baffin Bay will mix naturally with the waters of Viscount Melville Sound and that consequently the organisms present in Davis Strait have the opportunity to colonize areas in Viscount Melville Sound, as estimated by Dunbar (1960) the Arctic Ocean outflux through Davis Strait is in the order of 1.35 million m³/s. Hence the transport of ballast water as proposed goes counter to the major water movements in the Arctic Archipelago.

It is of interest to note that the presence of the Chinese Mitten Crab, *Eriocheir sinensis* in Lake Erie (Nepszy and Leach 1973) is attributed to ballast water discharged by ships and it is believed this species was

Discharge of Davis Strait Ballast Water into Bridport Inlet
(Viscount Melville Sound)

introduced to Europe in a similar manner (Peters and Panning 1933). The codworm, *Phocanema decipiens*, is a nematode which in its adult stage is a common parasite of Pinnipedia (Margolis 1977) and exhibits a marked geographic variability in its abundance.

Although at present the first intermediate host of the codworm is not known in nature, movement of waters from Davis Strait to Bridport Inlet could conceivably result in establishing a high incidence of this parasite in the Bridport Inlet area. *Phocanema decipiens* is known to infect arctic cod, *Boreogadus saida*, in the waters around Newfoundland. Furthermore fish fillets with an excess of four worms per 15 lb are rejected as being "unwholesome" under Section 6.1(a)(A) of the Fish Inspection Regulations. In Iceland the worm burden per pound of fillet exceeds 200 (R. Khan pers. comm.) and the cost of worm removal from fillets destined for market results in an increase of \$2.00 per pound of fillets.

Phocanema decipiens has been recorded from 26 fish species on the Atlantic coast and hence the far reaching economic implications of this parasite are substantial. While Canada does not presently commercially utilize *Boreogadus saida* this species is taken by the Soviet Union and the long term potential exists that one day Canada may also wish to commercially exploit arctic cod.

It is of particular interest that studies by the proponent have indicated the presence of *Mya pseudoarenaria* in Bridport Inlet. This species is considered rare in the Canadian arctic archipelago, and its distribution is in need of further study. The occurrence of *Mya pseudoarenaria* in Bridport Inlet focuses attention on the fact that present

Discharge of Davis Strait Ballast Water into Bridport Inlet
(Viscount Melville Sound)

knowledge of natural distributions of arctic marine organisms is scant. Disruptions of natural communities through introduction of exotics should be avoided until such time as existing faunal distributions are better understood.

Mitigation

To offset the potential problems which may arise as a result of release of Davis Strait ballast water in Bridport Inlet, the proponent is encouraged to explore ways of avoiding the introduction of exotic species. Mechanisms for filtering the ballast water during transit should be investigated.

Summary

In view of the foregoing concerns, the Department of Fisheries and Oceans considers it a prerequisite to the granting of conditional acceptance of the Arctic Pilot Project that the proponent prepare lists of the occurrence and incidence of fish parasites endemic to the Bridport Inlet area, and the anticipated area in which ballast water will be collected. In addition samples of water from the proposed locale of ballast water acquisition should be sampled monthly and analyzed to determine the species of organisms present therein.

References

- Dunbar, M.J. 1960. Dept. of Northern Affairs and National Resources. NCRC-60-1. Ottawa, 22 p.
- Margolis, L. 1977. Public health aspects of "codworm" infection: a review. J. Fish. Res. Board Can. 34: 887-898.
- Nepszy, S.J., and J.H. Leach. 1973. First records of the Chinese mitten crab, *Eriocheir sinensis*, (Crustacea: Brachyura) from North America. J. Fish. Res. Board Can. 30: 1909-1910.
- Peters, N., and A. Panning. 1933. Die Chinesische Wolland krabbe (*Eriocheir sinensis* H. Milne Edwards) in Deutschland. Zool. Anz. (Suppl.) Vol. 104: 1-180.

BRIDPORT INLET - STUDIES ON THE MARINE ENVIRONMENT

Subsequent to review of the information provided by the proponent on the marine ecology of Bridport Inlet, the Department of Fisheries and Oceans foresees the following additional studies and monitoring as a prerequisite to conditional acceptance of the Arctic Pilot Project as presently proposed. The studies outlined are seen as essential to ensure a good baseline of environmental information, without which assessment of the impacts of the development upon marine biota would be impossible. While the information provided to date describes the Bridport Inlet biota in the open water phase, information is lacking on the seasonal variability during other periods of the year. Owing to the year round operation of the proposed Arctic Pilot Project, studies on the marine biota in Bridport Inlet are needed during periods of ice cover at which time heated effluent discharges, ice breaking activities and disturbance to water circulation patterns may have the most pronounced effects.

Studies which are considered a necessary part of the granting by DFO of conditional acceptance to the Arctic Pilot Project include:

1. Detailed examination of the existence (or lack thereof) of an anadromous population of arctic char ascending the mouth of the Mecham River.
2. Studies of seasonal variability in the primary production of Bridport Inlet.
3. Studies of variation in the composition of the fish fauna utilizing Bridport Inlet throughout the year.

E. HUDSON BAY

E.1 A Summary of DFO Concerns and Recommendations Associated with the Disposition of Lease Acreage in Hudson Bay, 1980.

A SUMMARY OF DFO CONCERNS AND RECOMMENDATIONS
ASSOCIATED WITH THE DISPOSITION OF
LEASE ACREAGE IN HUDSON BAY

Prepared by
Department of Fisheries and Oceans
Western Region
Winnipeg, Manitoba

February 1980

INTRODUCTION:

Through the Resource Management Environmental Committee the Department of Energy Mines and Resources (EMR) requested the Department of the Environment (DOE) and the Department of Fisheries and Oceans (DFO) to undertake an environmental review of acreage in Hudson Bay for possible disposition under Section 30 of the amended Canada Oil and Gas Land Regulations. In conducting the review, comment was also provided on areas outside the designated acreage where it was felt that potential existed for significant living resource disturbances as a result of any exploration or development activity.

The results of the review were forwarded to R. H. Weir by N. Tywoniuk on February 8, 1980. The following is a brief summary of DFO concerns by area (see attached Map 1; specific locations, as numbered in the text, appear on Map 2). In all cases the recommendations are those stated in the joint DFO/DOE review.

1. Area A:

DFO Concerns

- a) Arctic Char Fishery. Rivers in the vicinity of Chesterfield Inlet, Rankin Inlet, Whale Cove and Eskimo Pt. support a commercial arctic char fishery totalling - 280,000 lbs per year.
- b) Marine Mammals. Beluga, walrus, and rare bowheads may occur at all times of the year in the vicinity of Whale Cove, Marble Island and Baker Forelane (N.W. Hudson Bay), when open water is available.

Recommendation

It is recommended that exploration activity (marine seismic and exploratory drilling) not be permitted in Area A.

1. Area B:

DFO Concerns

- a) Belcher Islands IBP Site. Walrus, harp, ringed and bearded seals are found in the marine waters surrounding the Islands and capelin are common inshore in summer.
- b) Twin Islands IBP Site, James Bay. Beluga whales winter in the offshore leads around the islands.
- c) Cape Henrietta Maria. Several hundred walrus haul out on an island 25 miles to the northwest of the Cape, in the summer.

- d) The scattered, small Islands, 10 to 20 miles south of the Belchers provide habitat for small numbers of walruses. These walruses are assumed to be related to those at Cape Henrietta Maria and others at the Sleeper Is.
- e) Sleeper Is. and Macropeet Is. Up to several hundred walruses have been seen here.
- f) Great Whale River (Poste-de-le-Baleine). The area between here and Belcher Is. has good fast ice cover. The density of ringed seals probably is greater here than elsewhere in Hudson Bay. Capelin occur here in the summer.
- g) The Hopewell Islands unit encompasses the summer range for small numbers of Beluga Whale.
- h) Ringed seal habitat is extremely good in this area, and Beluga Whales are found along the coast line. Anadromous Arctic char and Brook Trout streams occur in this area.

Recommendations

Because of the sensitivity of the Hudson Bay lowland coast, the abundance of known important and/or critical habitat to many species, it is recommended that Area B not be considered for disposition at this time.

Before lands in this area are considered for disposition an IEE should be prepared.

Area C:

DFO Concerns

- a) Ottawa Islands: Walruses have been observed in this area in summer.
- b) Harp Seal Migration Route. Small numbers of harp seals migrate through or nearby this area each year. Harp seals have been observed as far south as the Belcher Islands.

Recommendations

It is recommended that disposition of lease Area C be conditional upon the acquisition of marine mammal observations during the course of seismic surveys so that the effects of any escalated activity may be properly assessed. This information should be utilized in the preparation of an IEE which should be assessed before drilling is considered.

4. Area D:

DFO Concerns

- a) Resource Use Conflicts. There is less potential for disturbance of marine mammals in the offshore Hudson Bay than in the previously described coastal area. It is however not known whether or where any concentrations of mammals may occur. In the face of near total ice cover during the mid-late winter months, it is unlikely that many mam-animal conflicts will arise during this time.

Recommendations

In order to identify potential problem areas it is recommended that, as one of the conditions of permit acquisition, the proponents of exploration be asked to make observations on marine mammals from seismic vessels and aircraft and to collect environmental data relevant to exploration activities. This information will be of considerable importance in future exploratory application processes.

5. Area E: Outside of Proposed Lease Acreage

DFO Concerns

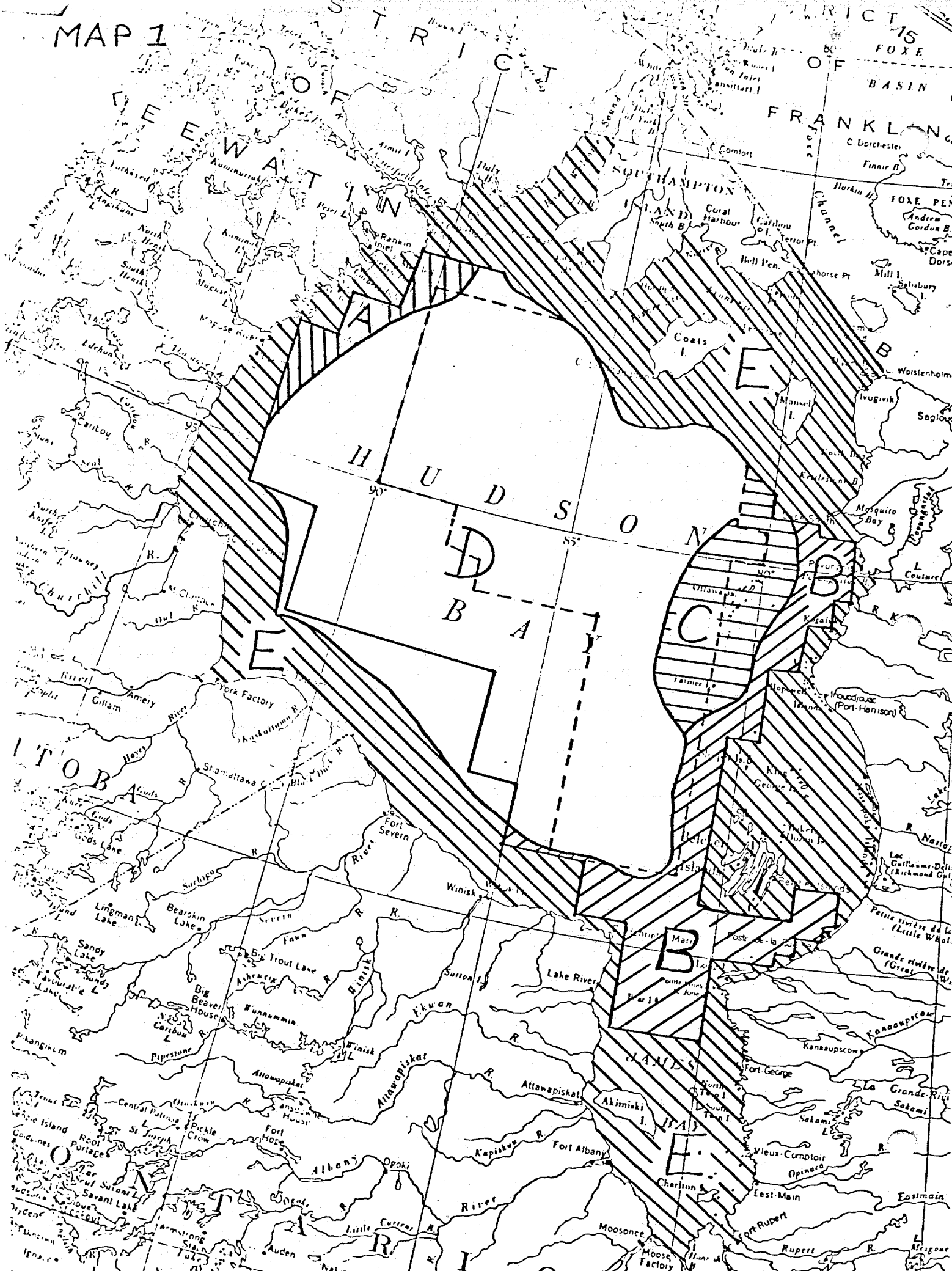
- a) The importance to marine mammals of the frequent open water in the Roes Welcome Sound area and the presence of a number of IBP sites and walrus haulout areas in the Southampton-Coats Island areas are good reasons to closely restrict and regulate human disturbance to the area.

Recommendations

While it is recognized that this area is not being considered for oil and gas exploration per se - it is recommended that any exploration related activities (shore bases, ship and air traffic) be regulated in this region.

Any proposed development in this area (E) should come under the scrutiny of the EAR process.

MAP 1



1:50,000

H
U
D
S
O
N
B
A
Y

C

B

J
A
M
E
S
B
A
Y

L
A
B
R
A
D
O
R

Q
U
E
B
E
C

N
O
R
T
H
W
E
S
T
T
E
R
N
T
E
R
R
I
T
O
R
I
E
S

S
O
U
T
H
A
M
P
T
O
N
I
S
L
A
N
D

F
R
A
N
K
L
I
N
B
A
S
I
N

F
O
X
E
P
E
N
I
N
D
I
A

A
T
T
A
W
A
P
I
S
K
E
T

F
O
R
T
A
L
B
A
N
Y

M
O
O
S
E
F
A
C
T
O
R
Y

G
R
A
N
D
E
R
I
V
E
S
E
K
E
M
I

E
A
S
T
M
A
I
N

R
U
P
E
R
T

MAP 2



175
102 L

FRANKLIN BASIN

NEW BRITAIN

HUDSON BAY

SOUTHAMPTON ISLAND

3a)

3b)

2h)

2g)

2e)

2a)

2f)

2d)

2c)

JAMES BAY

2b)

Eastmain

Eastmain

