GEORGES BANK REVIEW PANEL REPORT

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NATURAL RESOURCES CANADA

NOVA SCOTIA PETROLEUM DIRECTORATE

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Summary

Historical Background
Georges Bank, widely regarded as one of the world's most productive fishing grounds, has played an important role in Canadian fishing history since the mid-1800s. A century later, in 1964, the Canadian government issued the first petroleum exploration permits in the Georges Bank area. In 1969, the United States informed Canada that it too claimed territorial rights on Georges Bank. The United States proposed a drilling moratorium in the Gulf of Maine pending establishment of an international boundary, although that country did permit two exploratory wells to be drilled in 1976-77 on the undisputed American portion of Georges Bank. A further eight-well program was conducted in 1981-82. All 10 American wells were dry.

The Canada-U.S. boundary dispute was eventually submitted to the International Court of Justice at the Hague, and was settled in a 1984 decision that gave Canada jurisdiction over the northeast portion of the Bank. The United States then placed a moratorium on oil and gas leases on its side of the boundary.

In 1986, Texaco started a local consultation program preparatory to exploration drilling on the Canadian side of Georges Bank. Local fishing interests and residents opposed these plans, and in response to their concerns the governments of Canada and Nova Scotia enacted the *Canada-Nova Scotia Accord Acts* in 1988. This legislation placed a moratorium on petroleum activities in the lands described in the Acts, encompassing the Canadian portion of Georges and small sections of adjacent areas, until January 1, 2000.

The legislation also required that a public review of the environmental and socio-economic impacts of exploration and drilling be conducted by an independent panel. In 1996, the Ministers of Natural Resources of Canada and Nova Scotia appointed this three-person Panel. The Panel was required to submit its report on the results of the public review by July 1, 1999. The responsible Ministers must take a decision on the future of the moratorium by January 1, 1999.

In the United States, the moratorium on offshore petroleum activities was enlarged in area and extended several times by executive order. In 1998, President Bill Clinton extended the moratorium until 2012.

The Review Process
This review was not of any specific project, but rather of drilling and exploration activities on Georges Bank. Thus, no proponent was responsible for providing an environmental impact statement (EIS) in this review. To address the public need for information and to encourage participation, the Georges Bank Review Panel established an extensive four-phase public review process. Introductory meetings, information sessions, and community workshops served as preparation for the final stage of public hearings. (See Chapter 1 for details.) The Panel also published four editions of a newsletter, commissioned a number of studies, and set up a web site on which was posted an extensive bibliography of material related to Georges Bank.

Seven public introductory meetings were held in October, 1996 to introduce the proposed review process and the Panel members. Like the other public events in the review, these sessions took place in various locations in southwest Nova Scotia and in Halifax. The Panel also met with municipal councils and regional development authorities. In the fall of 1997, six information sessions were held to provide the public with basic information relevant to the review. Community workshops were conducted in the spring of 1998 to give review participants the chance to discuss issues and exchange information directly with one another prior to the hearings. The workshops were led by a two-person team of facilitators, and the Panel also invited a number of resource people to provide information as needed on such topics as scientific research findings; the fishery; oil and gas experience in the North Sea and the Gulf of Mexico; and offshore petroleum regulation. In the fall of 1998, the Panel also attended a meeting in St. George, New Brunswick, to explain hearing procedures and discuss concerns.

Public hearings were held in January, 1999 in Yarmouth, Shelburne, Lunenburg, and Halifax. These hearings were conducted in a non-judicial but structured manner. Presenters were questioned by the Panel, but there was no questioning or cross-examination by other participants. Those who made a presentation or written submission could also submit a written closing statement or comments to the Panel within 10 days of the close of the hearings. No intervenor funding was available for participants.

There were 91 participants during the 11 days of the hearings, as well as eight written submissions and five closing statements. Participants included representatives of the fisheries sector; the petroleum industry; environmental groups; government departments and agencies from Canada and the United States; Chambers of Commerce and other business organizations and companies; elected officials from all three levels of government; scientists from the Department of Fisheries and Oceans; consultants; academics; and interested citizens.

Georges Bank Today

Georges Bank is a large, shallow bank of over 40,000 square kilometres on the outer continental shelf of Eastern North America; Canada's portion of the Bank is about 7,000 km^2.

Although its hydrocarbon potential is not clearly known, the estimated probability is 85% or greater that any hydrocarbon finds on the Canadian side of Georges Bank would be natural gas, and 10-15% that discoveries would be light oil or condensate. The Geological Survey of Canada estimates that there might be some 60 million barrels of oil, and about 1.3 trillion cubic feet of natural gas, with speculative estimates of larger volumes (possibly up to about 2 billion barrels of oil and more than 10 trillion cubic feet of natural gas).

In terms of biological productivity, biodiversity, and habitat, Georges Bank is exceptional and in some respects unique. Ecologically, northern and southern assemblages of fish and plankton overlap on Georges. The geology of the Bank and strong tidal currents create vertical mixing of the water on the Bank, although there are also areas of near-surface convergence and a persistent current that flows in a clockwise gyre around the Bank. This gyre intensifies in the summer and becomes more retentive (less "leaky"), keeping fish larvae and other floating organisms on the Bank. Georges is unusually biologically productive, with high phytoplankton production and fish productivity two to two and half times higher than in comparable areas. It is a spawning and nursery area year-round, and supports a distinctive benthic (bottom-dwelling) community, notably corals, clams, lobsters, and very extensive beds of deep sea scallops. Many marine mammals, including the endangered right whale, use Georges as a migration corridor, feeding area, and nursery, and large assemblages of seabirds are found there in winter and summer. Many species of fin-fish, including pelagic fish such as swordfish, tuna, herring, and mackerel – and other commercial species such as cod, haddock, pollock, and yellowtail flounder – are present.

Georges Bank supports a valuable and highly-productive fishery. The Canadian portion of Georges Bank in 1997 provided employment for approximately 1,000 people involved directly in fishing and harvesting, and another 650 people in processing ashore. In southwest Nova Scotia, the fishery is the single largest source of industrial employment and income. The product value in the period 1990-1997 has ranged from $57 million to $148 million annually. The largest fishery, in terms both of (in-shell) catch weight and landed value is scallops, but lobster, cod, haddock and other groundfish, as well as high-value swordfish and bluefin tuna, are caught on Georges.

Exploration and Drilling

The methods used by the petroleum industry to delineate geological features under the seabed in order to determine whether hydrocarbons might be present include seismic surveys and exploration drilling. Several presentations focused on technological advances in both seismic surveys and drilling that in the last decade or so have reduced impacts from these activities, in many cases by improving their effectiveness so that fewer operations are required. Presenters from the petroleum industry stated that an initial program of exploration on Georges would probably involve one to three exploration wells, drilled consecutively.

The main potential impacts of concern are lethal, sub-lethal, and behavioral effects of seismic activities on marine organisms; the effects of drilling discharges, especially muds and cuttings; accidental discharges from spills and blowouts; loss of fishing access from seismic surveys and drilling activities; disturbance of marine organ-isms, especially birds, mammals, and fish, from light and sound; market impacts on the fishing industry, including perception of tainting; and the cumulative impacts of exploration drilling.

Seismic surveys use pressure (sound) waves from air guns to bounce off the layers of rock under the ocean. The pattern of echoes is recorded on hydrophones (microphones) mounted on very long streamers towed behind the survey vessel; this recorded pattern can then be interpreted for indications of hydrocarbons. The survey vessel operates at about five knots, 24 hours a day. The array of streamers is four to seven kilometres long and about 800 metres in width, and is towed at a depth of six to twelve metres. A typical seismic program takes place over a period of several months.

The pressure waves are lethal to fish larvae within about six metres, and can also injure fish with swim bladders; these physical effects diminish with distance. However, studies on larvae and fish eggs are few in number and not comprehensive enough to provide confidence limits and statistical power. There was no information presented on the possible effects of seismic surveys on spawning behavior, on the behavior of adult lobsters or scallops, or on pelagic fish. Based on a small number of studies and some observed behavior, there were also unresolved questions about whether seismic surveys cause reduced catches of fish because the animals move away from the area, hide, or change their migration patterns. There was also very sparse information presented on the effects of seismic on marine mammals. A number of the studies referenced were on other species than those found on Georges.

Exploration drilling is used to determine the properties of the rocks and the actual presence of hydrocarbons in the rock layers. In the relatively shallow waters of Georges Bank, the most likely type of drilling rig would be either a jack-up rig, which is usually used in water depths of less than 130 metres and rests on its legs on the bottom, or a semi-submersible rig, which is anchored and has large diameter cylindrical legs that provide flotation.

During drilling, a continuous flow of drilling fluid, or mud, is circulated in the well to lubricate the drill bit, contain pressures and keep the hole from collapsing, and to carry the rock chips and cuttings back up to the surface. Drilling muds can contain clay (bentonite), barite (a heavy mineral), oil or water, and various chemical additives. Muds are usually categorized as "oil-based" or "water-based"; there is also a new family of muds based on synthetic oil-like substances.

Under Canadian regulations, companies can discharge water-based drill muds and

drill cuttings; however, after December 31, 1999, the oil content in cuttings will be limited to 1% by weight, which virtually eliminates the release of oil-based muds and cuttings in the offshore. Muds and cuttings make up the largest bulk of discharges during exploration drilling, with up to 3200 cubic metres (m^3) from each exploratory well. Other discharges may include small amounts of formation water, which is naturally occurring salt water trapped within the rock formations, and incidental wastes such as deckwash and wastewater.

In the immediate vicinity of a well, there would be smothering of benthic organisms from discharged muds and cuttings. One study suggested lethal effects of water-based muds on fish larvae occurred only from very high concentrations that might be found locally near the source. Other studies of drilling muds on adult scallops found sub-lethal effects on growth within a plume extending up to 40 kilometres from the well. Bioaccumulationa and impacts on other species and the larger ecosystem have not been fully investigated.

Considerable evidence indicated that large releases of hydrocarbons from blowouts or spills are rare events. Depending on the circumstances, all ecosystem components could be affected, and fisheries closures, loss of access, or market impacts from tainting would be a possibility.

Regulations require an exclusion zone around a jack-up rig of 500 metres in radius, while a larger zone is needed for a semi-submersible, extending up to about 1,000 metres depending on anchor locations. For each exploration well, a drill rig would be on site for three to four months. After drilling, the infrastructure would be removed and fishing would again be possible on the site. Many presenters said that the fishing grounds on Georges are already crowded, that there are specific fishing areas for many species, and that moving gear and vessels elsewhere is not really an option.

The discussion of cumulative effects in this section of the report noted that there are already impacts on fish stocks and marine mammals from fishing activities, marine traffic, and land-based pollution, and that petroleum activities would add incrementally to existing stresses. Direct economic benefits from an initial three to four year exploration program involving seismic operations and three wells were estimated at $53 million to $70 million, with additional indirect economic benefits and opportunity for economic diversification. There would be some 240 to 320 direct jobs created for Nova Scotians.

Related Issues

The Panel heard many comments on topics related broadly to questions about the future of oil and gas activities on Georges Bank. Participants generally agreed about key social goals, but disagreed on whether petroleum activities would support or undermine a vision of the future that included protecting the fisheries and ecology of Georges Bank; developing more local jobs and economic benefits; and maintaining local communities. The achievement of each of these priorities was considered in some detail in relation to petroleum activities. A number of subjects were introduced into this discussion, including cumulative impacts, health and environmental problems, and the management of human activities in the offshore.

An important issue was whether the ecology of Georges Bank could be protected through the existing offshore petroleum regulatory regime or, alternatively, required some form of zoning of human activities through extension of the moratorium or the designation of a Marine Protected Area.

The future fisheries potential of Georges was extensively discussed. A number of fish stocks appear to be rebuilding; there are questions about the future of certain fisheries; and still others, such as the extremely valuable deep sea scallop fishery, appear to be stable. With effective management and a goal of resource sustainability, presenters on the topic believed that today's yields could be maintained indefinitely. In the case of herring and groundfish (perhaps excluding cod), some presenters said harvests could increase with good management, providing additional jobs and economic growth in the region. The fisheries are now of major economic, social, and cultural importance to the communities of southwestern Nova Scotia. Conflicting views on the potential contribution of the petroleum industry to jobs and economic development were presented, with the Sable Offshore Energy Project (SOEP) pointed to as an example. Local companies are benefiting from that project. However, some participants said that on Georges Bank, any natural gas would be piped directly to New England markets without coming to Nova Scotia, so economic benefits would not be as great as in the Sable project.

Cumulative impacts of exploration and drilling include the potential for hydrocarbon development and production. Cumulative effects from those activities in total could be much more significant than impacts from the initial stages of seismic and exploration drilling. One specific impact of concern to presenters in this context was formation or produced water, which for a production site becomes the highest volume of discharge. In a recent laboratory study of produced water from a Scotian Shelf well, concentrations ranging from .9% to 22% of produced water caused death in half the fish larvae, and fertilization success of scallop eggs was significantly affected at concentrations of produced water of 1% and above. Other cumulative and remote impacts mentioned included bioaccumulation, tanker or pipeline spills, and toxic effects of flaring and natural gas use. Greenhouse gas emissions were also considered; the Panel commented that whether natural gas increases or reduces such emissions depends on specific circumstances.

An additional benefit of petroleum activities in the offshore, now and in the future, was the increased capabilities for medical assistance and search and rescue at sea that the presence of rigs provided.

Further related issues involved different aspects of Canada-U.S. relations. Some participants suggested that it was inappropriate to subject American fisheries and resources to risks from petroleum activities when the United States had extended its own moratorium until 2012. Finally, a number of issues in offshore petroleum regulation were raised, including the stringency of environmental requirements, consultation, and

compensation for damage.

Approaches to Decision-Making

Many participants on both sides of the issue expressed strong opinions on how to approach a decision on the moratorium. Views on analytical and ethical aspects of the question were often of central importance in presentations. Topics included the role of science and the burden of proof in regulatory decisions; legal and moral rights; the principles of sustainable development; fairness and need in the context of risk; and the use of priorities and scenarios in decision-making.

A key issue was whether it was appropriate for decisions about petroleum activities on Georges Bank to be made within the existing offshore petroleum regulatory regime, in which the "default assumption" is that regulated activities will usually proceed unless scientific information clearly demonstrates harm. Much comment about this subject concerned the Precautionary Principle and the uses of and limitations, on the role of science.

In discussing rights, some presenters said that humans have a moral obligation to protect the existence, habitat, and health of other species, and that these considerations should be brought into the decision. Legally, mineral rights and rights to regulate fishing in Canada both belong to the Crown, but there are potential and actual conflicts about the interpretation of rights in the offshore. These and related issues are currently under discussion between representatives of the petroleum and fishing industries.

Many presenters saw sustainable development as a touchstone concept for human society. In that context, a number of presenters believed that protection of renewable resources should take precedence over the exploitation of non-renewable resources. Many stated that, in balancing the interests of the petroleum industry and the fishery on Georges, the higher need is to protect biological resources, and that those interests should carry greater weight in decision-making.

Much comment centred on risk, and the ethical issues related to it, including who would gain and who might lose.

Economic development, revenues, and jobs from petroleum activities were acknowledged to be important by most presenters. Many, however, also pointed to the great value of the fishery – and to its present
vulnerable state due to rebuilding fish stocks and the economic stresses which the sector has undergone in adjusting to new conditions. They stated that it would be unfair to add further potential risks to the industry in these circumstances. Others discussed weighing the need for energy from Georges Bank against the possible risks. Petroleum officials cited projected energy demand and markets in the United States; other presenters said that there were other areas for exploration and no foreseeable shortage of hydrocarbons. The great ecological value of Georges and the unacceptability of any harm there were seen by many presenters as more significant to the discussion of risk than the low probability of any major damaging event. In a related argument, some presenters discussed risk in terms of the costs of being wrong in choosing whether to lift or extend the moratorium. They stated that if the moratorium were retained but that concerns about potential harm proved unfounded, the fishery would remain undisturbed. The petroleum industry would lose a present opportunity, though the resources would remain in place for the future. On the other hand, if the moratorium were allowed to expire based on assurances that adverse effects would not occur, yet these did happen, potential losses to the fishery could be large.

1 Background and Process

1.1 BACKGROUND

Georges Bank, widely regarded as one of the world's most productive fishing grounds, has played an important role in Canadian fisheries history since the mid-1800s. A century later, in 1964, the Canadian government issued the first petroleum exploration permits in the Georges Bank area to Texaco Exploration Company (Texaco Canada Inc.). Subsequent permits were issued to Chevron Canada Resources Ltd., Dome Petroleum Ltd., and Prodeco Oil and Gas Ltd. However, the United States formally objected to Canada's assertion of jurisdiction in 1969, and informed Canada that it too claimed territorial rights in the area. In 1969, the United States proposed a moratorium on drilling in the Gulf of Maine until after an international boundary had been drawn and regulations to protect the fishery had been formulated. Initial bilateral negotiations to resolve these issues were unsuccessful.

The United States did permit two exploratory wells to be drilled in 1976-1977 on the undisputed U.S. portion of Georges Bank. An eight-well drilling program was carried out in 1981-1982 in uncontested American waters. All 10 wells were dry.

On November 29, 1981, a Canada-U.S. treaty was signed to submit the boundary dispute to the International Court of Justice at the Hague. A decision on the maritime boundary was issued by the Chamber of the World Court in October, 1984. The international decision gave Canada jurisdiction over the northeast portion of the Bank, and United States jurisdiction over the remainder. In the same year, the United States placed a moratorium on oil and gas leases on the American side of Georges Bank.

> ***...with massive help from our Foreign Affairs Department and all of the other elements that went into that decision, the fishing industry in my opinion played a key role in the establishment of [the Hague Line].*** *(Fishermen's association representative)*

> ***It was our fishermen who ended up being one of the reasons why Canada retained one-fifth of Georges Bank, the richest and most lucrative economically...*** *(Municipal official)*

Following the World Court decision, Texaco expressed an interest in drilling on the Canadian portion of Georges Bank. In 1986, the company initiated a consultation program with the people of southwestern Nova Scotia. Local fishing associations, fish processors, and residents of the area formed the interest group NORIGS to oppose Texaco's proposal.

In response to those concerns, the governments of Canada and Nova Scotia enacted the *Canada-Nova Scotia Accord Acts* in 1988 (Appendix 1). This legislation placed a moratorium on all petroleum-related activities on the Canadian portion of Georges Bank and

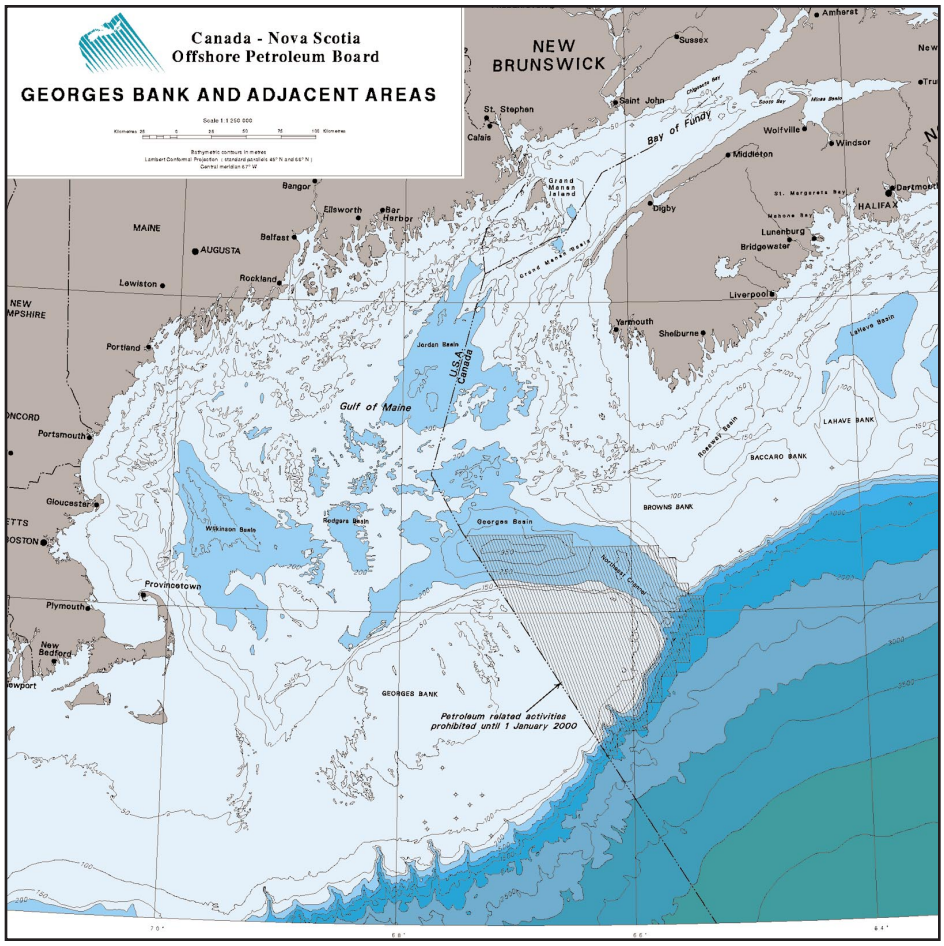


Figure 1. Georges Bank Moratorium Area and Adjacent Areas from: *Canada-Nova Scotia Offshore Petroleum Board*

other offshore areas described in the Acts. (See Figure 1.) The legislation stipulated that a public review of the environmental and socio-economic impact of exploration and drilling be conducted by a Panel appointed for that purpose. In 1996, the Ministers of Natural Resources of Canada and Nova Scotia appointed this inde pendent, three-person Panel.

The legislation required that the Panel prepare a report on the results of the public review, including recommendations, for submission to the Minister of Natural Resources Canada and the Nova Scotia Minister responsible for the *Canada-Nova Scotia Accord Ac*t before July 1, 1999. The Ministers are required to make a decision on the future of the moratorium by January 1, 2000.

> ***We hope that we can provide enough information to the Panel that you can have confidence in a recommendation that allows the moratorium to expire.*** *(Oil company representative*)

In the United States, the area covered by its ban on exploration was enlarged in 1988. In 1990, President George Bush announced by executive order a moratorium until 2002 for several U. S. offshore areas, including the American side of Georges Bank. In 1998, President Bill Clinton extended the moratorium until 2012.

1.2 REVIEW PROCESS

Communications and Information
The Panel faced many challenges in conducting the review, and none was more important than the need to engage the affected communities in a joint learning process leading up to hearings in 1999. A communications plan to gather and disseminate relevant information was clearly needed.

A newsletter was started and a Georges Bank web site established to provide information about the review process itself. Four editions of the *The Georges Bank Newsletter* were produced and distributed to all households in southern Nova Scotia. The text of the newsletters and other pertinent information were posted on the web site, which was supported by the Yarmouth Community Net.

In typical environmental assessment panel reviews, in both federal and provincial jurisdictions, a proponent defends a specific project. The proponent must also produce an environmental impact statement (EIS). The EIS would describe such things as the environment as it presently exists and the effects of a proposed development, including benefits, alternatives, and measures to mitigate any negative impacts. In the Georges Bank Review, there was no specific project being considered and no proponent. The challenge of providing crucial information – to both the Panel and the interested public – was met in several novel ways. Even before the Panel was appointed, a consultant was hired to assemble a comprehensive bibliography. After the Georges Bank web site was up and running, the bibliography was posted and continuously updated by the Panel. The bibliography eventually consisted of 1,400 titles of books and articles related to Georges Bank, with full abstracts of some 200 of the most relevant articles.

This review Panel also had the good fortune to be heir to an extraordinary body of new scientific information. Following the 1988 legislation stipulating that a public review would be conducted in the late 1990s, a directed research program was developed and undertaken to help illuminate scientific questions related to the review. Scientists from the Federal Department of Fisheries and Oceans at the Bedford Institute of Oceanography led this effort, in consultation with representatives of the fisheries sector and the petroleum industry. Extensive observational studies were made of currents, nutrients, plankton, and the dispersion and settling of drilling muds. In collaboration with American scientists, a three-dimensional model of Georges Bank currents was developed. Meanwhile, laboratory bioassay tests were conducted for the effects of drilling muds on adult scallops. All of this research came together in a model of the fate and effects of discharged drilling muds on adult scallops on Georges Bank (further discussed in Chapter 3). This work was presented publicly in the community workshops and at the hearings, as well as at several meetings convened by the Department of Fisheries and Oceans.

The Panel also commissioned a number of studies to address the information gaps, and to update or summarize background information. These studies are listed in Appendix 2; summaries have also been posted on the Georges Bank web site.

Finally, two of the four stages of the public process (the information sessions and community workshops) were devoted to disseminating and discussing information related to the issues of the review.

Figure 2. Table of Public Events

PHASES	DATES	LOCATIONS
Introductory Meetings	October, 1996	Digby, Saulnierville, Yarmouth, Barrington, Liverpool, Lunenburg, and Halifax
Information Sessions	October, 1997	Digby, Yarmouth, Barrington, Liverpool, Lunenburg, and Halifax
Community Workshops	June, 1998	Yarmouth, Shelburne, Bridgewater, and Halifax
Public Hearings	January, 1999	Yarmouth, Shelburne, Lunenburg, and Halifax

Public Events
The public review included four series of meetings between 1996 and 1999, as shown in the Figure 2.

The Panel conducted a series of **introductory meetings** in southwestern Nova Scotia and Halifax during the fall of 1996. These gave the Panel an opportunity to meet the public. In addition, the Panel met with municipal councils and regional development authorities. The Panel presented information on the background issues, the *Accord Acts* legislation, and the nature and purpose of the review. Advice was sought and received on the proposed four-phase review process; knowledge and information gaps; the need for additional studies; information requirements; and a continuing communications plan. While the turnout was small, the Panel was told that good communication with the public was a key to the success of its work. The distribution of information pertinent to the review was also seen as a crucial undertaking. These suggestions resulted in the development of an Internet web site for the distribution of information and the exchange of ideas. A copy of the Agenda is included in Appendix 3.

Information sessions were conducted in southwestern Nova Scotia and Halifax in the fall of 1997. Scientists from the Bedford Institute of Oceanography provided the public with background information on the physical and biological features of Georges Bank. A fisheries consultant outlined the economic value of the Georges Bank commercial fishery. Representatives of the Canadian Association of Petroleum Producers spoke on petroleum exploration and drilling. And the regulation of offshore petroleum activities was explained by an official of the Canada-Nova Scotia Offshore Petroleum Board. The presenters also responded to questions from members of the audience. These sessions were chaired by Mr. Andrew Nickerson, Q.C., a lawyer practising in Yarmouth. A copy of the agenda is included as Appendix 4.

In the spring of 1998, **community workshops** were conducted in southwestern Nova Scotia and Halifax. These workshops provided participants with an opportunity to discuss issues from a community perspective and to exchange information to help prepare for the hearings. A two-person facilitation team led the workshops. As with the information sessions, the Panel was present at all sessions as observers rather than participants. The day-long program was built around four fundamental questions:

What has changed since 1988?
- in the fishery
- in local communities
- in our understanding of the environment of Georges Bank
- in offshore oil and gas activities and technologies

What are the possible risks and benefits of oil and gas exploration on Georges Bank?
- for the ecosystem
- for the fisheries
- for local communities

What principles should guide the review process and decision?

What process needs to take place in local communities to ensure good input to the decision?

A copy of the agenda is in Appendix 5.

The Panel also invited a number of resource people who provided information on topics such as scientific research findings; the economics of the fishery; oil and gas experience in the North Sea and the Gulf of Mexico; risk-benefit analysis; offshore petroleum regulations; and the overall energy picture. A report summarizing the Workshops titled ***Georges Bank Review - Community Workshops*** was prepared by the facilitators and distributed to all workshop participants. The Panel also attended a meeting in St. George, New Brunswick, to discuss concerns and to explain hearing procedures.

Public hearings were held in January, 1999 in Yarmouth, Shelburne, Lunenburg, and Halifax. Before the start of the hearings, the Panel adopted procedures (Appendix 6) for the conduct of the hearings which were advertised in the provincial daily and weekly newspapers 90 days prior to the start of hearings. As the procedures indicate, the hearings were conducted in a non-judicial but structured manner. Presenters were questioned by the Panel with no questioning or cross-examination by other participants. Participants were given the opportunity to schedule the amount of time required for their presentations. As well, those who made a presentation or submission to the hearings could submit a written closing statement or comments to the Panel within 10 days of the end of the hearings.

Ninety-one participants made presentations during the 11 days of hearings. The Panel also received eight written submissions and five closing statements. Participants included representatives of the fisheries sector; the petroleum industry; environmental groups; government departments and agencies from Canada and the United States; Chambers of Commerce and other business organizations; elected federal, provincial and municipal officials; scientists from the Department of Fisheries and Oceans; consultants; academics; and interested citizens. A complete list of the hearing presenters and submissions is included in Appendix 7.

At the close of the hearings, the Panel commented on the high quality of the presentations despite the fact that no intervenor funding was provided. The Panel was also impressed by the respect and civility displayed by the participants.

2 Georges Bank Today

This chapter provides a description of the Georges Bank area to serve as background for understanding the issues voiced in the hearings. The chapter summarizes information from oral and written submissions to the hearings, published scientific papers, and other documents. It reflects both scientific evidence and the experience-based knowledge of witnesses who appeared before the Panel.

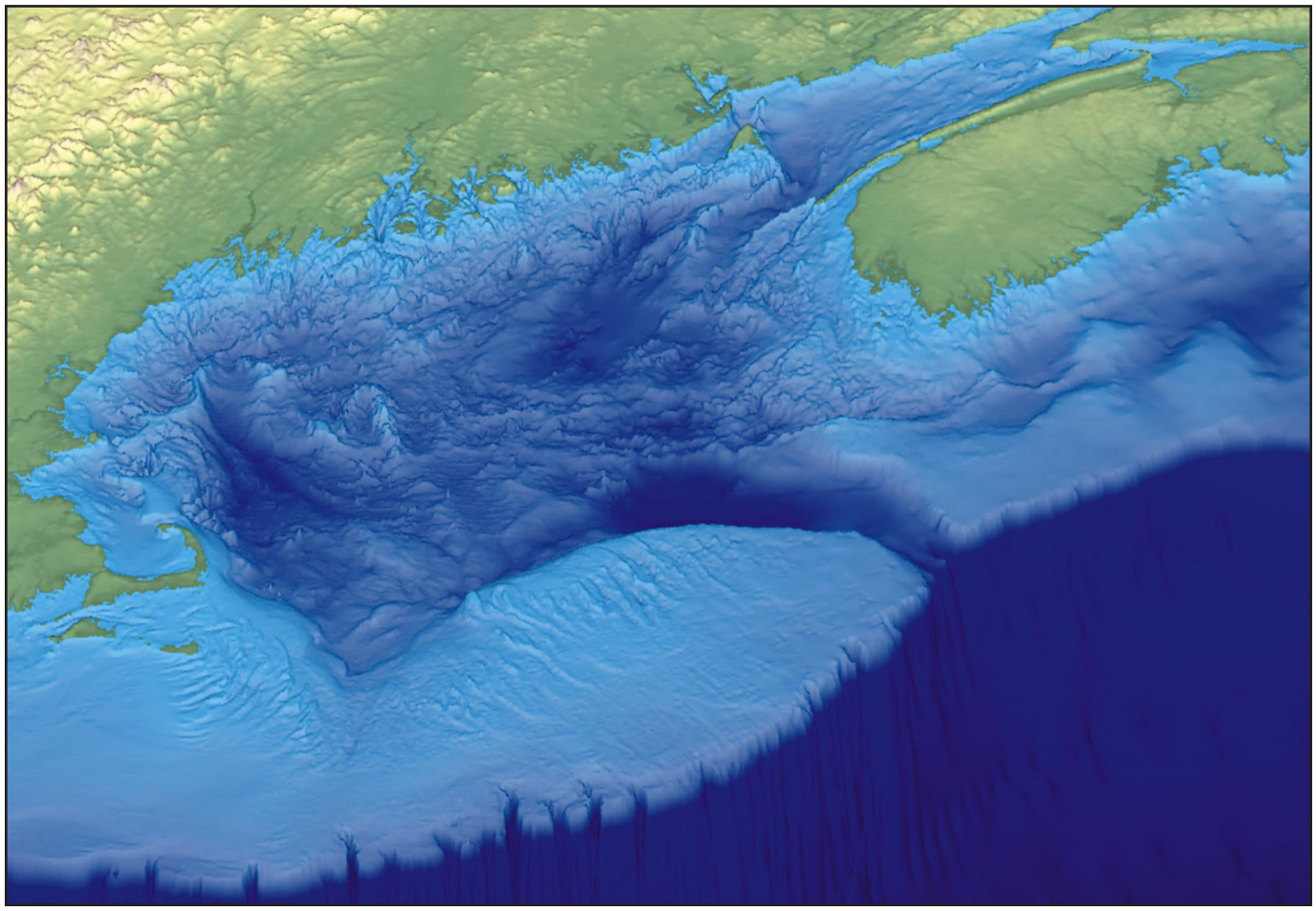
2.1 PHYSICAL STRUCTURE

Geology

Georges Bank is a large, shallow submerged bank located in a chain of banks along the continental shelf of eastern North America (Figure 3). On the seaward side the Bank meets the continental slope; several canyons cut into this side-face. It is separated from the Scotian Shelf and Browns Bank by the Northeast Channel, and from the Nantucket Shoals by the Great South Channel. Georges is a broad, relatively flat-topped bedrock feature which projects above the surrounding seabed. Its plateau and sloping sides cover an area of more than 40,000 km^2; the Canadian sector includes the Northeast Peak and has an area of 7,000 km^2.

> ***....15 submarine canyons ... they would compare scientifically with the most impressive canyons of the world. Throughout these canyons are 'pueblo villages' – holes in the rock walls that are home to many kinds of fish and shellfish. Fishing gear can't reach these animals that live here, so their numbers have never been seriously threatened with fishing.*** *(Fishermen's representative)*

Figure 3. Gulf of Maine Image. *Created by Northern Geomatics, Inc. for the Undersea Landscapes of the Gulf of Maine education poster, courtesy of the Maine Coastal Program/State Planning Office.*



The flattish top of the Bank reaches close to the surface (60 metres or 33 fathoms), so that the mixed waters there are frequently penetrated by sunlight. In contrast, the depth of the Northeast Channel reaches 250 m or 137 fathoms. The steepness of the northern edge contributes to the strong clockwise circulation of water in that area (see §Water Masses and Currents).

The Bank's ancient landscape features have been modified by geological processes such as erosion and weathering. In more recent times, glaciers acted on Georges Bank and the surrounding area. As a result of glacial scouring, the sea-floor of the northern and eastern edges of Georges Bank is relatively smooth and steep along the northern edge. (Water depths are between 50 and 100 metres in this area.) Glaciers deposited the sediments which make up the surface of the Bank.

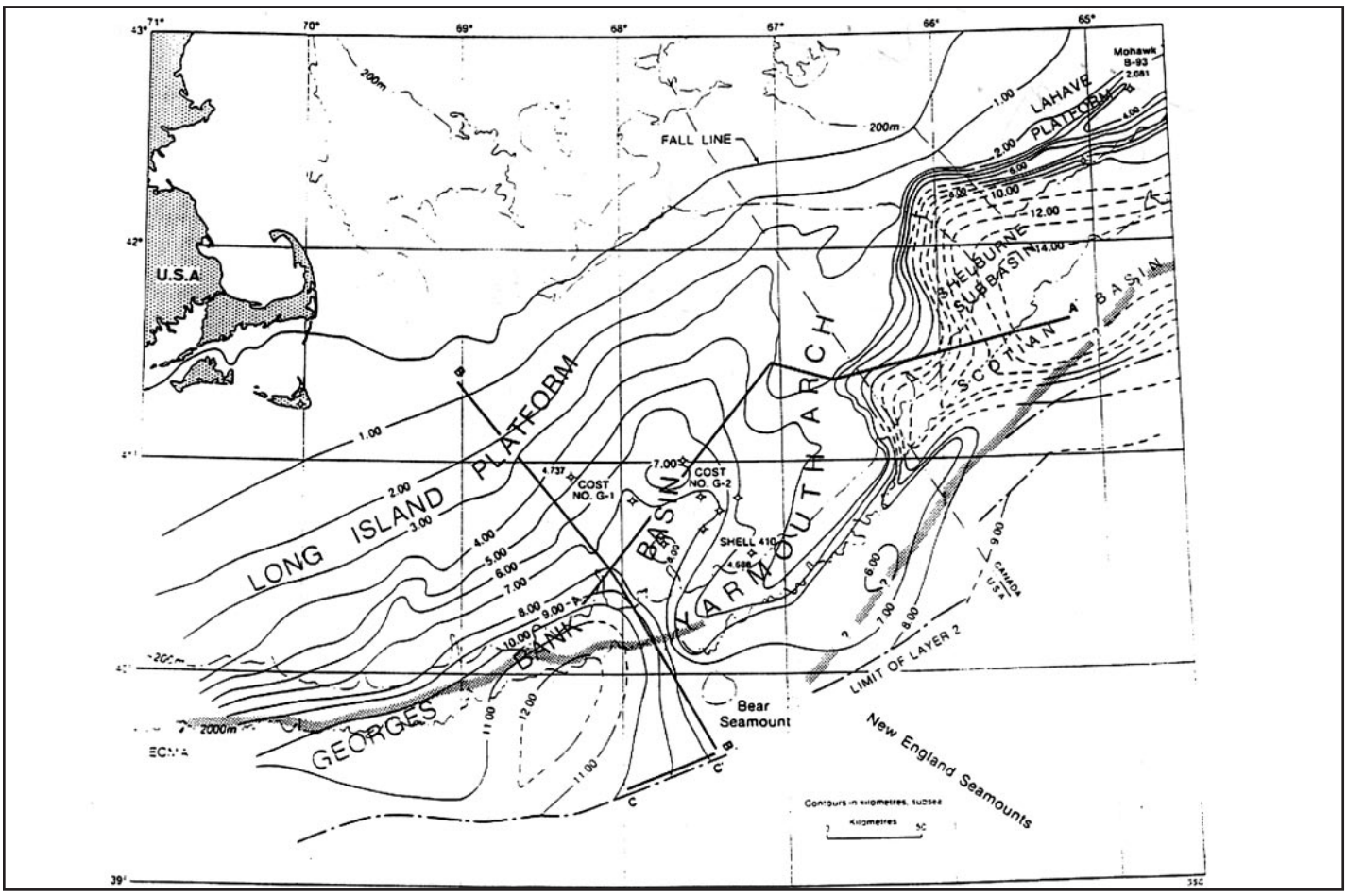
Three geological features occur in the subsurface, Georges Bank Basin, Yarmouth Arch, and Long Island Platform (Figure 4). Georges Bank Basin is the name given to a semi-enclosed Jurassic area of deposition beneath the central and southwestern part of Georges Bank and the adjacent continental slope. Its western flank is known as the Long Island Platform, and the Yarmouth Arch represents its eastern limit. The Georges Bank Basin is composed of Jurassic through Tertiary sediments, overlying a block-faulted basement. The most rapid period of development occurred during the Early and Middle Jurassic periods, when more than four kilometres of sediments were deposited. These were overlain byfour to five kilometres of younger sediments (Wade and MacLean, 1990). Hydrocarbons, such as oil and natural gas, are potentially borne in these sediments.

The Georges Bank Basin, which extends beneath the U.S. portion of the Bank, was initially considered to have a high potential for hydrocarbons. However, all 10 wells drilled between 1976 and 1982 were dry.

On the basis of the exploration activity to date, it would appear that the hydrocarbon potential in this area of Georges Bank is low. There has been no drilling on the Canadian side of Georges Bank, though preliminary seismic surveying has been carried out. The Scotian Basin, on the eastern side of Georges Bank, is thought to have a geological setting similar to the Sable Island area.

Based on the seismic surveys, the Geological Survey of Canada estimate (Procter et al, 1984) for petroleum potential is, with high confidence, 0.1 x 10^8 m^3 (62.9 million barrels); with average confidence, 1.7 x 10^8 m^3 (1.06 billion barrels); and at a speculative level, 3.5 x 10^8 m^3 (2.2 billion barrels). For natural gas (in addition), the high confidence estimate is 0.37 x 10^{11} m^3 (1.3 trillion cubic feet); the average confidence estimate is 1.5 x 10^{11} m3 (5.3 trillion cubic feet); with a speculative potential of 3.1 x 10^{11} m^3 (10.8 trillion cubic feet).

Figure 4. Geophysical Elements of the Georges Bank Area from: *Wade and MacLean, 1990*



Based on seismic data available, Georges Bank appears to be geologically analogous to Sable Island area and accordingly, based on drilling to date, there is an 85% or greater likelihood that any hydrocarbons are natural gas, with a 10 to 15% probability of them being light oil. *(Petroleum industry representative)*

For comparison, the Hibernia project has an estimated 0.6 billion barrels of oil. The Sable Island project has an average expected quantity of raw recoverable gas of three trillion cubic feet.

Sediments

Sediments on Georges Bank are mostly sandy, including sand ridges and sand waves, but with coarse gravel and boulders on the northern margins. The strong currents there have winnowed out most of the sand, leaving gravel deposit. Shells of clams and scallops are abundant. The proportion of finer sediments increases in water deeper than 100 m. The Northeast Channel is floored with silty sand (Envirosphere, 1997).

...one of the important reasons that Georges Bank is special is because of its geology....A five-year average of herring spawning grounds, essentially a count of egg beds... herring eggs... were attached to the gravel areas....virtually all of the juvenile cod are found here...So this gravel pavement plays an extremely important part in the biology of Georges Bank. *(Fishermen's representative)*

2.2 ECOLOGICAL SIGNIFICANCE

Georges Bank lies between latitudes 41 and 43°N on the outer continental shelf of eastern North America. Ecologically, Georges is at the northern edge of southern assemblages of plankton and fish, and at the southern edge of northern assemblages. Both assemblages occur on Georges, so there is more biodiversity here than in areas to the north or south. The system appears to be at its most productive on the Northeast Peak. Geology, location, and water masses and currents underpin this ecosystem.

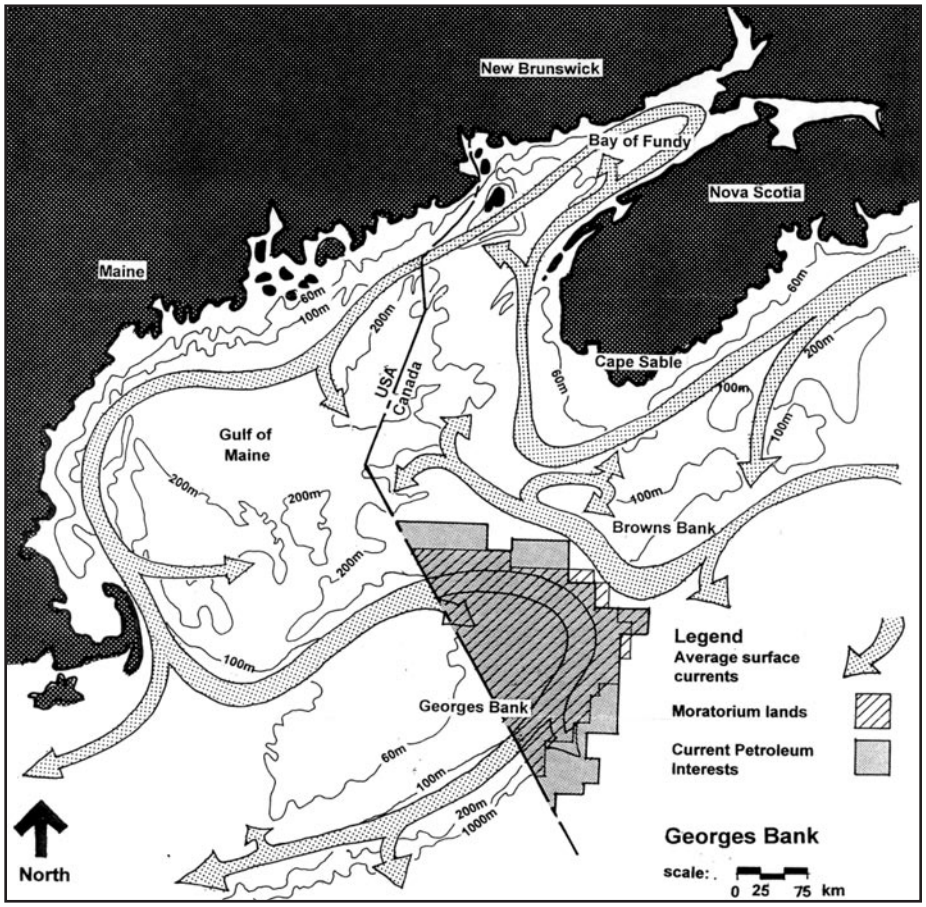
Water Masses and Currents

Approaching Georges Bank from the Atlantic Ocean, warm-core rings or eddies, "pinched" off from the Gulf Stream into the slope water, have been known to occasionally collide with, and even drift over, Georges. The "slope water/shelf water front" is a more consistent feature which is aligned along the outer (eastern) slope of Georges. (Slope water is a mixture of shelf water and Gulf Stream water.) However, the dominant physical factor on Georges Bank is the strong tidal action in the Gulf of Maine/Bay of Fundy system.

The strongest currents on the Bank are associated with the lunar tide cycle, which lasts 12.4 hours (Boudreau, 1998). This tidal component is amplified by being at a near-resonance condition in the Gulf of Maine and Bay of Fundy. (Resonance occurs because the time for the Bay of Fundy to fill with the tide and empty again is also about 12 hours, hence the tide is magnified, like a sloshing wave in a bath-tub.) Tidal current speeds range from about 0.2 metres per second in the deeper water around the Bank's perimeter to 1.0 m/s on its central plateau. As a result of the tidal currents, water parcels undergo twice daily excursions in the shape of an ellipse ranging in diameter from a few kilometres in deeper water to over 15 km on the Bank's plateau. Buoyant material that is continually released into the water column from a fixed point on the Bank is distributed within hours over an area comparable to that of the tidal ellipse.

Strong tidal currents on the central plateau are a major cause of the vertical mixing that prevails there. (Vertically-mixed water mixes from top to bottom.) As a result of this tidal mixing, the bottom temperatures on the Bank warm up to 9 to 15 degrees in summer, making it the area with warmest bottom temperatures off Atlantic Canada's continental shelf. This is particularly significant to the growth of biological organisms, since many physiological rates depend on temperature. Horizontal dispersion is relatively high in general. However, in the near-surface convergence

Figure 5. Georges Bank Area Currents



zones – located in the frontal zone or in the central portion of the Bank – this dispersion is reduced to below-typical levels compared to other shelf areas.

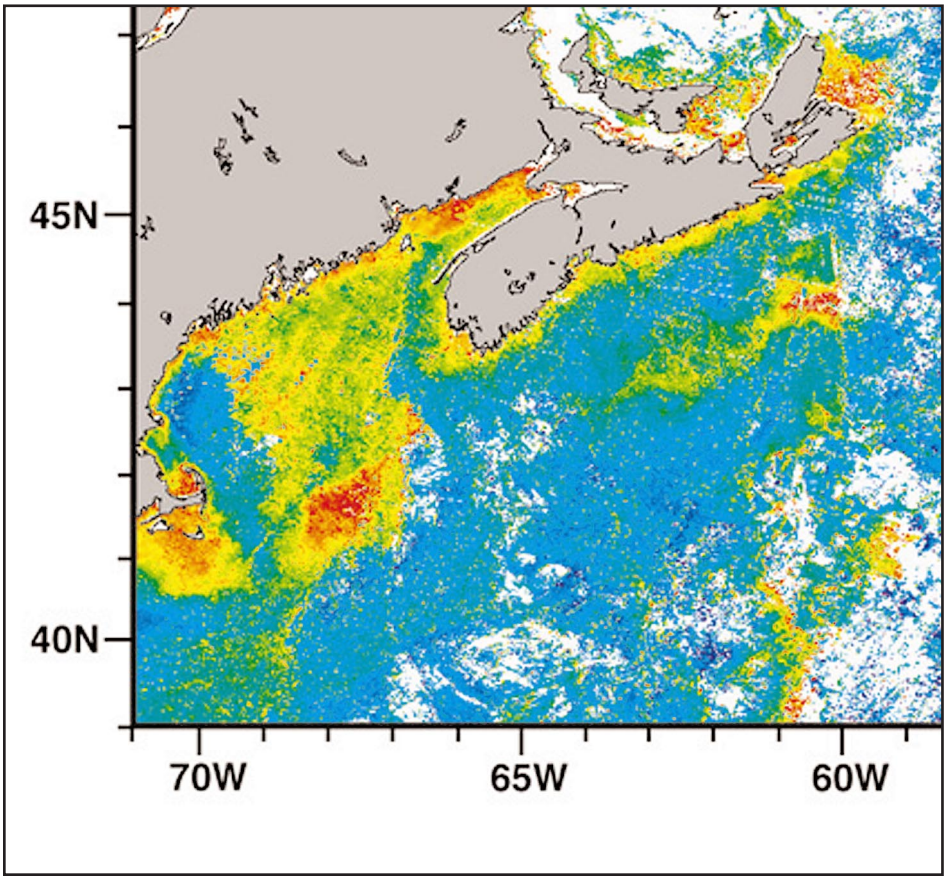
On the shoulders of the Bank, strong tidal currents and the steepness of the northern edge have a different effect: a portion of the tidal current becomes "rectified" from a back-and-forth current into a persistent clockwise current around most of the Bank. This is known as the Georges Bank gyre (Figure 5). The gyre current flows at 0.1 to 0.2 m/s around most of the Bank, and at 0.2 to 0.4 m/s around the Bank's northern edge. On Browns Bank, gyre speeds are in the range of 0.05 to 0.15 m/s (Smith, 1983). As a result of strong layering of the water column which develops around the edges of Georges Bank due to freshwater runoff and solar heating, the gyre around the Bank intensifies in spring and early summer. It also becomes more retentive (less "leaky"), although it can be temporarily disrupted by events such as storms or Gulf Stream rings. Residence times on the Bank for particles, eggs or larvae are estimated to be longest for particles released on the central Bank, in the lower water column, and in the frontal zone (see below) in summer. In this season, the gyral circulation inside the 70 m (38 fathom) depth contour tends to be closed with a recirculation time of 20 to 80 days.

> ***On Georges Bank, we have a unique situation where there is a current flow going around the Bank continuously which picks up warm nutritious waters from the Gulf Stream and spreads it to the Bank. These nutritious currents relate to some of the most productive waters in the world. The warm water forms a gyre that is mostly captive to the shoal area of the Bank. Any material that is released on the bank seemed to drift in this gyre for a period of time before dissipating. I know of no other place in the world's ocean that have this type of phenomena....***
> *(Fisherman/fish processor)*

From late spring to early fall, the tidal-mixing front (different from the slope water/shelf water front) surrounds most of the Bank between the 60 m to 80 m depth contours. It lies at the interface between the mixed waters on top of the Bank and surrounding, seasonally-layered waters. Nutrient concentrations show strong differences across the front – a condition associated with the supply of nutrients onto the Bank. A feature of this front that can be important to the retention and concentration of floating materials is a surface convergence zone, where parcels of water move towards each other, and then downward toward the bottom. The downward flow conveys materials (e.g., particles) in the water toward the bottom. As the season progresses, the tidal front migrates on-bank in association with the jet-like flow of the gyre. (Boudreau, 1998.)

> ***... Georges Bank is 100 miles out to sea. On the northern edge of Georges is one of the strongest tides in the world, just like the Bay of Fundy.... It's not uncommon to have 100 mile an hour winds in the wintertime on Georges Bank on days when it's not forecasting very much on shore.***
> *(Fisherman and fish processor)*

Figure 6. Satellite Image of Chlorophyll in the Georges Bank Area from: *NOAA*



Georges Bank is on one of the major storm tracks from the United States seaboard. A study commissioned for the Panel on wind statistics over the period 1946-1991 (Coastal Ocean Associates, 1998) provided two new findings about Georges Bank winds: 1) there has been a long-term trend toward increasing wind speed; and 2) for a given year, monthly mean wind stress can be as much as eight times greater than the long-term mean value for that month.

The occurrence of a tsunami is a remote possibility. However, because earthquake epicentres and subsurface slumps have been recorded in the area, the occurrence of a tsunami can not be discounted (COGLA, 1986).

Plankton

On Georges Bank, there is evidence that a flow of nutrients crosses the tidal-mixing front toward the central area of the Bank. Partly as a result, phytoplankton production continues through the summer, while production decreases in other areas due to lack of nutrients (see Figure 6 and Figure 7).

	Georges Bank	Gulf of Maine	Scotian Shelf	North Sea
Phytoplankton	3,342	2,556	2,280	2,280
Microzooplankton	285	367	216	214
Macrozooplankton	202	207	195	186
Meiobenthos	13	-	-	25
Macrobenthos	98	98	82	100
Fish	52	26	21	24

Figure 7 Generalized production estimates (kCal m^{-2} y^{-1}) for various food-web components of the Georges Bank and comparable continental shelf ecosystems. (Boudreau, 1998)

The most important producers at the base of the food-web are the phytoplankton, microscopic green plants that require sunlight and nutrients (primarily nitrogen, phosphorus and silicon) to grow. Phytoplankton production tends to be high where sunlight and nutrients are plentiful. Tidally-mixed areas usually exhibit high production, and on the top of Georges Bank this is so. Vertical mixing carries the phytoplankton down, away from the sunlight, but not significantly. In stratified areas, such as in the deeper water surrounding Georges Bank in summer, production is usually low because, there, nutrients become exhausted and are not replenished. Frontal areas mark the transition, and generally provide a favourable balance of light and nutrients. (Boudreau, 1998.)

In March there is a diatom bloom on top of Georges Bank, and a different species of diatom blooming along the southern slank; these events occur about six weeks earlier than in the central Gulf of Maine. In the late spring, though diatoms are still present in the central area of the Bank, dinoflagellates become important in the stratified areas. In summer these flagellates become the dominant group. They maintain production at a relatively high level until October on Georges Bank. These features make Georges considerably more productive of phytoplankton on annual average than the Middle Atlantic Bight, the Gulf of Maine, the Scotian Shelf, or the North Sea (Figure 7, DFO, 1998).

During the time of the spring diatom (phytoplankton) bloom, the large copepod zooplankton in the Gulf of Maine come up onto Georges and circulate with the gyre. Later there is a shift from large copepods to small copepods, in parallel with the shift from diatoms to dinoflagellates in phytoplankton. That is, zooplankton species follow a seasonal pattern of succession as do the phytoplankton. Successive development stages can be traced in a clockwise pattern around the Bank - the animals grow and age as they drift in the gyre.

In spring, the zooplankton (e.g., large copepods) under-utilize the phytoplankton production. Much of it sinks toward the bottom to be transported off the Bank, where very high concentrations of krill may be feeding on it. In summer the phytoplankton production of the Bank is fully used by many species, including small copepod organisms living in the water column. Curiously, the production of zooplankton is not thought to be appreciably higher than that of comparable regions (Boudreau, 1998).

Occasionally a Gulf Stream ring (warm-core, rotating clockwise) will drift over the Bank. This has been known to bring the southern fauna all the way around to the northern edge of the Bank.

Georges Bank is a more productive continental shelf than most. And why is it so full of life? Because it's a mixing spot that no team of experts could ever think of designing, let alone working. It's a spot where nutrient-rich arctic waters combine with warm Gulf waters, creating a spinning current or "water lasso" that encircles much of the Bank and corrals these elements. The sun beats down on the shallow waters of the Bank creating a forest of microscopic phytoplankton, sometimes called "grass of the sea". These microscopic plants are a vital part of the marine food chain and grow on Georges Bank at a rate... higher than on any other continental shelf, attracting an entire ecosytem of marine animals. *(Fishermen's association representative)*

Benthos and Fish

On Georges Bank, fish productivity is two to two and half times that in other comparable areas (Figure 7). It is not known why it is so much higher, when secondary production values appear to be comparable to those elsewhere (Figure 7 and 9). It has been suggested that the trophic linkages (i.e., from prey to predator) from the primary production to the fish are through the benthic population on the Bank. (For example, it is suggested the scallops eat the phytoplanton and the cod eat the scallops.) Or, fish could also obtain a large portion of their food during migrations off the Bank. It could also be that the present understanding of food-web dynamics is deficient. (Boudreau, 1998)

Georges Bank fish spawn at various times throughout the year, as shown in Figure 8 (Boudreau, 1998). After spawning, their larvae drift, metamorphose, and feed for varying lengths of time. Spawning times are characteristic for each species and are likely to be suited to the typical patterns of food distribution and currents on which larvae depend. Young stages of fish can be found on Georges at most times of the year. Supported by the year-round productivity, many species co-exist because their spawning activities are staggered throughout the year.

Benthos

A large variety of benthic organisms including worms, crabs, clams, corals, lobsters, and scallops live near, on and in the sediment. They feed on phytoplankton, zooplankton, and detritus and, in turn, are preyed upon by fish. The structure of this benthic community is distinctive, and not directly comparable with other areas.

> For instance, there is a greater predominance of filter feeders on Georges Bank compared to other areas where deposit feeders are the major component of the ecosystem. It is important to note that benthic filter feeders dominate the commercial landings. (Boudreau, 1998.)

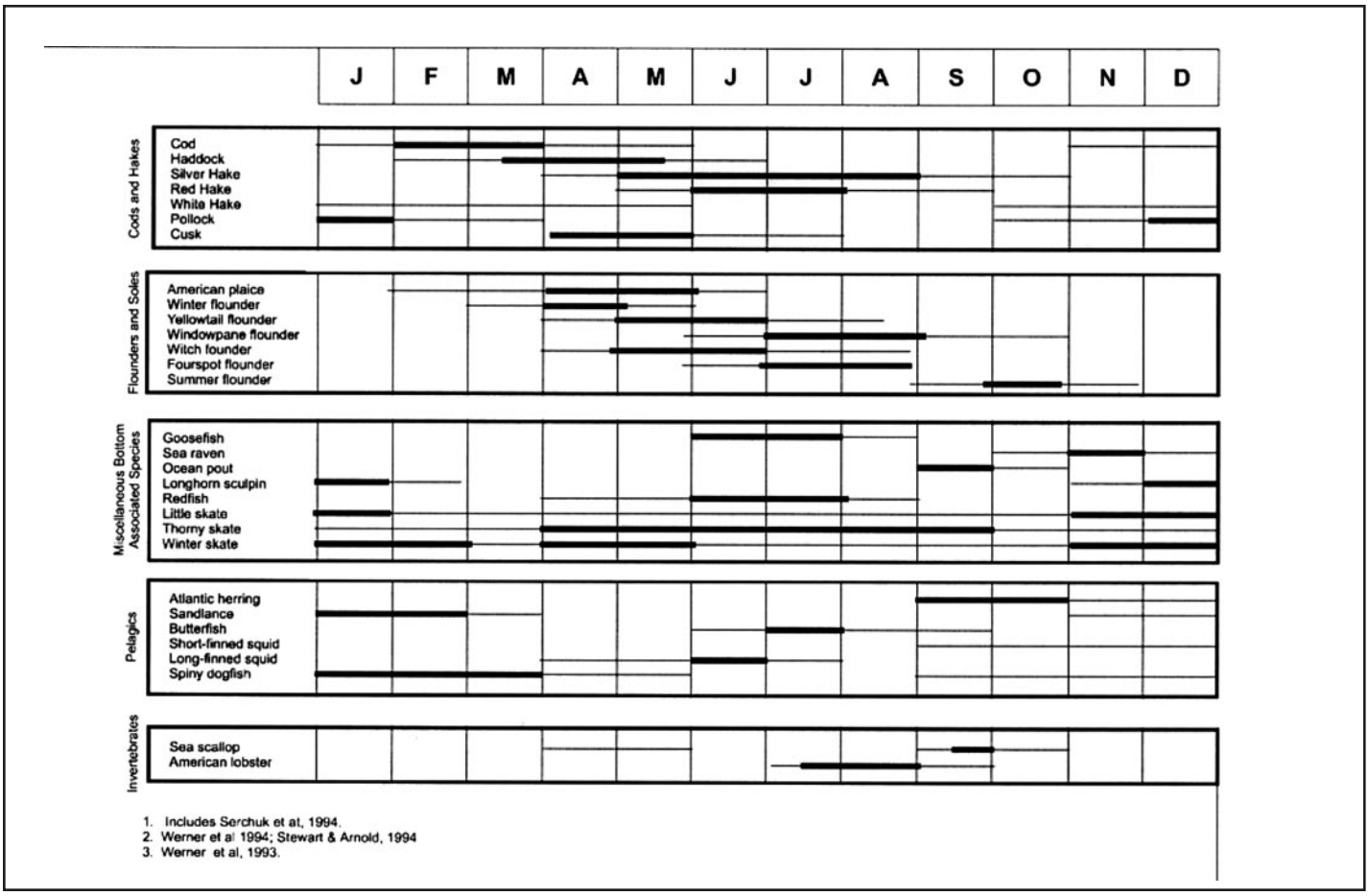
The sea scallop is found in patches called beds in the northwest Atlantic from Cape Hatteras to Labrador. It is the most abundant of the benthic fauna on Georges, and the largest component of the benthic biomass (86%). The Northeast Peak in the Canadian sector yields the most productive fishery (DFO, 1998).

> ***We have some smaller ...deep sea scallop fisheries on the Scotian Shelf.... There is a very minor one in the Gulf of St. Lawrence, but Georges Bank, any way one might look at it, is by far the most important one.*** *(Fisheries scientist)*

Scallop larvae drift for approximately 40 days before settling to the bottom, preferably on a sandy, gravel bottom.

Lobsters occur in greatest concentrations in the canyons along the Bank's outer slope, and along the northeastern edge. In summer the majority of mature lobsters migrate to the shoal waters of the Bank where they moult, mate, and hatch their

Figure 8. Spawning periods on Georges Bank for various species.



eggs. The eggs drift in the water column to the bottom.

Corals, which are filter feeders, are distributed in canyons along the edge of the continental shelf and in deep channels between fishing banks. The Northeast Channel between Georges and Browns Bank is a key area for corals; they are also found on the northeast tip of Georges and on the southern tip of Browns Bank. Corals are long-lived, slow-growing species which provide habitat for fish. Corals are sensitive to changes in sedimentation in the water column, temperature, and currents, and are therefore believed to be useful indicator organisms for detecting environmental deterioration (Breeze et al., 1997).

Fin-fish

Brief descriptions of the life history of selected species follow, based on the *Habitat Status Report* (DFO, 1998).

Georges Bank cod prey on fish, crustaceans, and molluscs. They grow rapidly compared to cod in other areas (Figure 9). The adults are concentrated on the Northeast Peak in spring. Considerable exchange occurs with the southern Scotian Shelf. Spawning activity peaks in February and March. The larvae drift for several months. Recently there have been fewer cod and this remains a puzzle.

Haddock are bottom feeders. They concentrate on the Northeast Peak in spring. Most spawning occurs from March to April; eggs and larvae drift for approximately four months.

Pollock feed on krill (zooplankton), herring, sand lance, and silver hake. Georges Bank pollock are part of a population that extends from southern Georges and the Bay of Fundy to the Scotian Shelf. The drifting eggs are most prevalent on the northern edge of the Bank.

Yellowtail flounder, a bottom-fish feeding on invertebrates, occurs mostly in the southern portion of the Northeast Peak. Spawning peaks in May. Their eggs are buoyant.

In recent years, herring have been observed to spawn in the central portion

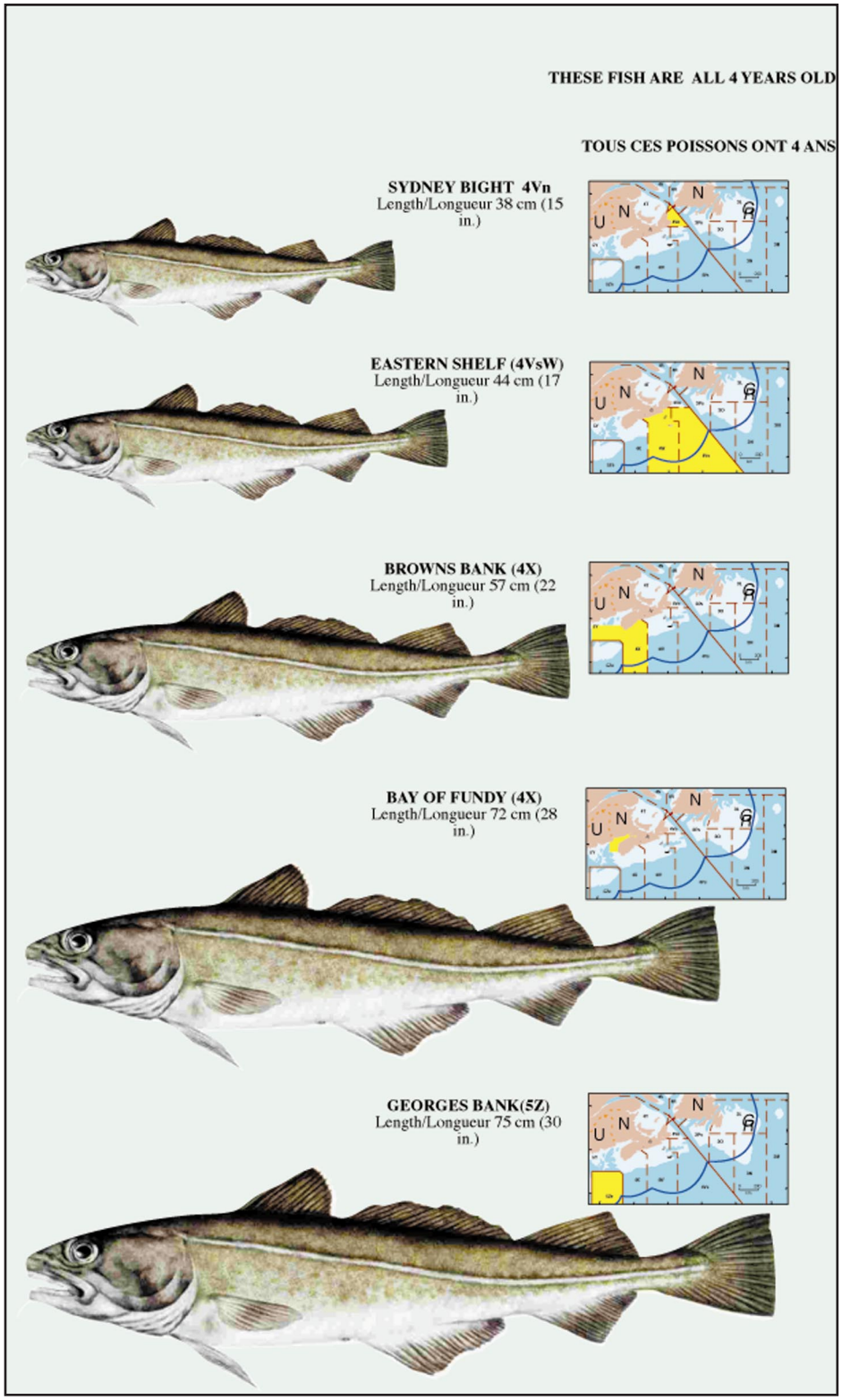


Figure 9 Size of 4-yr old cod from various stocks in Atlantic Canada

and the northeastern edge of the Bank. Their eggs adhere to the gravel/cobble substrate. Afterwards, eggs and larvae can be found in the water column, the latter for four to five months.

Mackerel occupy Georges Bank for about a month in the spring, and again in the fall as part of their annual migration to the Gulf of St. Lawrence.

Sharks utilize Georges Bank for most of the year; porbeagle sharks in winter and early spring; spiny dogfish from spring to fall; and basking sharks in summer.

Tuna and swordfish forage along the edge of the shelf in the vicinity of Georges Bank, taking advantage of the plentiful prey.

The Fishery

Humans participate in the Georges Bank ecosystem by taking fish for food. This influences the balance of the various trophic levels. The human fishery harvest and the estimated consumption by cetacean species (whales) are each in the order of 100,000 tonnes per year (Backus, 1987).

Intense fishing activity by domestic and foreign fleets in the 1960s and 1970s left many stocks near collapse. Recently both Canada and the United States, following establishment of their 200-mile economic zones and settlement of the international boundary, instituted management programs to rebuild the stocks. In general, scallop and lobster stocks appear to be in good condition. The herring stock is rebuilding, while groundfish stocks remain in a depleted state. Conservation measures such as gear modifications, vessel size limitations, low quotas, closed seasons, spawning season closures, and at-sea and dockside monitoring are being applied to facilitate the rebuilding of the biomass of these species.

Although scallop and lobster are fished in all seasons, other target species are fished seasonally. Groundfish are primarily caught from June to October to avoid spawning and bad-weather periods. Tuna and swordfish are harvested in summer when their feeding migration brings them to the Bank. Fleets with various fishing gear-types share access to the resource space (Figure 10). For example, groundfish are pursued by trawlers, gillnetters, long-liners and handliners. They also share the richest area with tuna and swordfishing boats.

> ***In fact the gillnetters and long - liners have traditionally stayed tied to the wharf while others complete their trips, just so they can take over their berths.*** *(Fisherman)*

The socio-economic aspects of the Georges Bank fishery are summarized below in §2.3 Socio-Economic Significance.

Marine Mammals

The Georges Bank area serves as a feeding ground, nursery, and migration corridor for more than two dozen whale and four seal species. Grey seals (pinnipeds) are common on the Bank, where they forage in summer and fall. Whales and porpoises (cetaceans) reach peak abundance on Georges Bank in spring – many of them are there to feed on the zooplankton peak. The northern right whale, an endangered species (COSEWIC, 1999), transits Georges Bank and is vulnerable to collisions with vessels and entanglement in fishing gear. The United States considers other whale species found on the Bank to be endangered as well – fin, humpback, sei, and sperm whales. As fall advances, many animals migrate to more southerly or offshore grounds, although most if not all the species continue to live on the Bank (Backus, 1987).

> ***...the eastern part of Georges Bank is an important habitat for whales and dolphins...in all four seasons as well as for different groups of whales and dolphins, for endangered species, for fish-eating animals, for plankton-eating animals and as well as for squid-eating animals.*** *(Cetacean biologist)*

> ***Georges Bank supports the lives of much wildlife, the whales. I've seen mostly every type of whale since I'm going to Georges, the humpback, the right whale, the sperm whale, the fin back, the minke whale, and one rare whale that I've seen four years in a row. Not last year, however. It's a beaked whale and there was a pod of about a dozen whales that I got close enough to count. It's a place where the endangered leatherback turtles swim. Last year I seen four or five. It's a nice place for birds. It's a bird-watcher's dream to be on Georges Bank.*** *(Fishermen's association representative)*

Seabirds

Seabirds are abundant on Georges Bank at all times of year although very few of the species breed there. Arctic-breeding birds are predomimant in the winter, while birds which breed in the southern hemisphere predominate during summer months. The northern and eastern flanks of the Bank consistently have the greatest concentrations of seabirds. (Environment Canada, 1999)

> ***Whales and seabirds are part of our marine heritage in this region. They are an important example of what we offer to the thousands of tourists who visit this region every s ummer.*** *(Fishing industry association representative)*

Georges Bank is a feeding ground for seabirds. The processes that keep water well-mixed and productive throughout the year are apparently also important for maintaining a transfer of energy through the food-chain from primary production to birds. Georges supports a greater density of birds (14-50 birds/km^2) than the Gulf of Maine (8-23 birds/km^2), and a greater bird biomass (13 31 kg/km^2 compared to 7-24 kg/km^2). The peak concentrations of seabirds on Georges occur in summer. (Backus, 1987).

Fulmers and auks are the main winter residents. They breed in Newfoundland and Labrador, and in the Arctic. The summer seabirds include shearwaters and storm-petrels. The world population of Greater Shearwaters passes along Georges Bank on their clockwise migration around the North Atlantic before they return south in November to breed. The entire North American population of gannets passes across the Georges Bank area twice yearly on migrations to and from their wintering range off the eastern United States.

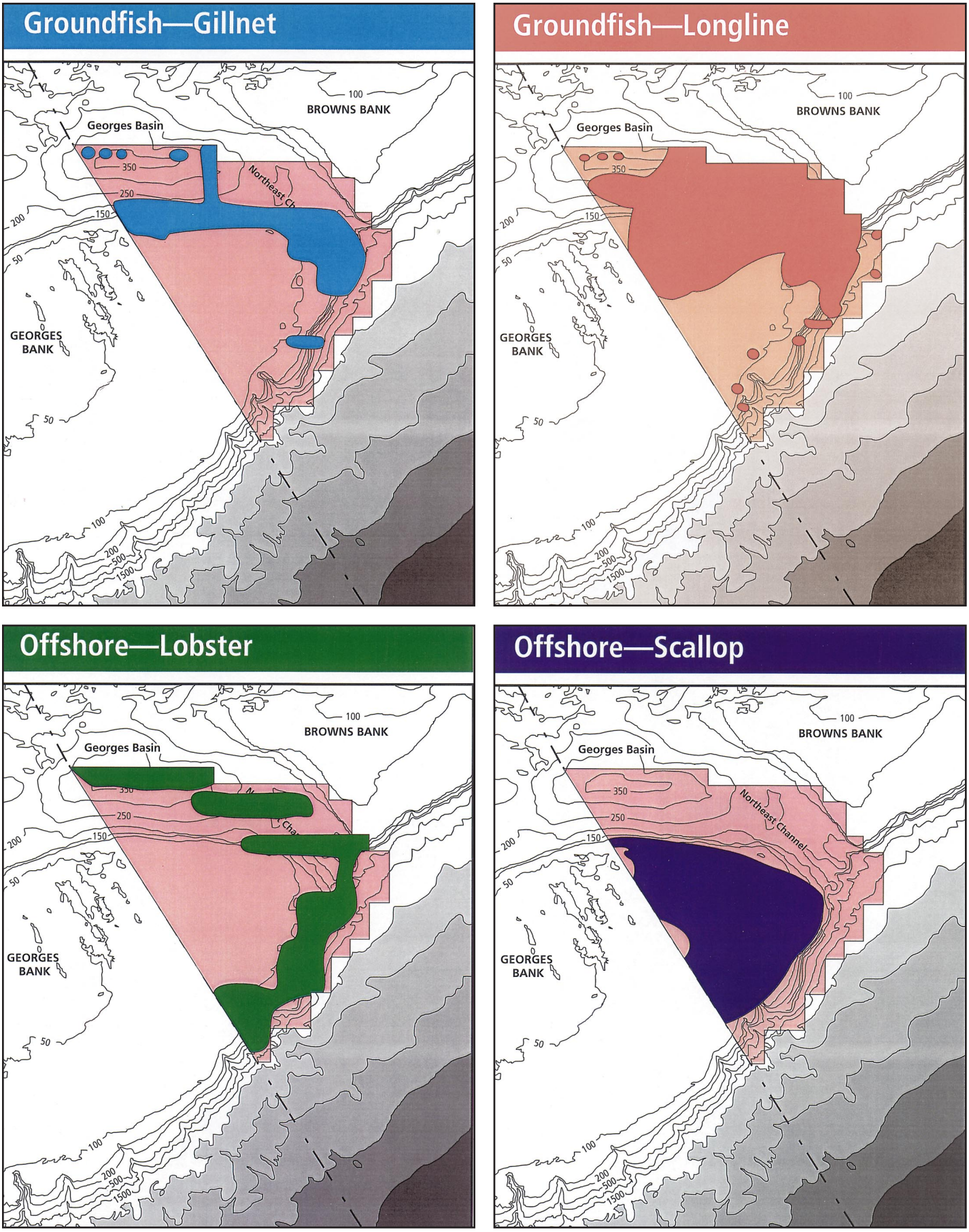


Figure 10. Fishing activities overlapping spatially.

Phalaropes are abundant on Georges along the shelf edge in spring. They have traditionally gathered to feed on plankton concentrations in the mouth of the Bay of Fundy, but changes in plankton numbers and distributions in the 1980s have contributed to a dispersal of these flocks (Environment Canada, 1999).

Ecosystem Features
An ecosystem perspective is emerging gradually. In the following sections, ecosystem stability and uniqueness are addressed.

> ***There is a growing and rapidly maturing public recognition that we must conserve and maintain whole ecosystems. The certain knowledge that we do not possess the technology to successfully re-build degraded ecosystems is driving a public reassessment of...progress itself.*** *(Citizen)*

> ***In 1985, the Department of Fisheries and Oceans position paper on Georges Bank concluded... "DFO presently considers all of that Canadian portion of Georges Bank to be critical habitat."*** *(Researcher for fisheries group)*

Stability
The Panel commissioned a study (Kerr, 1999) on the stability of the Georges Bank area ecosystem. The results can be interpreted as indicating that the basic structure of the production system was stable over the 1987-1998 period. This interpretation of stability of biomass density and average fish size is made in spite of the fact that there were marked changes in species composition during those years. There was a continued decline in cod, haddock, and flounder, for example, and increased abundance of dogfish and skates – "...although the community remained stable, its components did not." There is also some assurance, based on earlier work, that this apparent stability of the Georges Bank community overall is not a recent phenomenon. Results from the Scotian Shelf are similar – the biomass remained quite stable over the period 1970-1991 despite complex changes in the underlying species composition.

The North Sea production system appears, however, to have been less stable and to have undergone a major transient (sharp decrease followed by sharp increase) in its production characteristics.

Uniqueness
The Habitat Status Report (DFO, 1999) lists the characteristics which make Georges Bank unique. They cite many distinct physical oceanographic and biological features. The distinctive physical oceanographic features include:

- the broad, shallow plateau influenced by subpolar and subtropical water masses and organisms, resulting in high biodiversity of species [of both subpolar and subtropical assemblages]; and
- the strong tidal currents resulting in high mixing rates, nutrient supply and dispersion, as well as a strong partial gyre;
- the gyre that, when intensified as a result of summer layering of the water column, provides a mechanism for recirculation and extended residence time of drifting particles and organisms;
- an associated seasonal frontal system with enhanced nutrient supply and hence phytoplankton productivity on the central portion of the Bank, and with surface convergence zones that may concentrate particles and organisms.

The biological features which combine with the physical ones to make Georges Bank, and especially the Northeast Peak, unique are:

- high and persistent productivity of phytoplankton;
- high productivity of fish sustained for a very long period of time;
- a relatively high number of commercial fisheries on the Northeast Peak; and
- the co-occurrence on the Northeast Peak of spawning and nursery areas for many fish species.

> ***I've fished on a lot of banks and I've never fished on a bank that quite comes up to Georges and areas where you can go back to constantly year after year and if you go on them particular spots that the fish are there....*** *(Fisherman)*

> ***... Georges Bank is considered sacred ground, not only for its lucraive groundfish and shellfish stocks but because of its unique ecosystem which is unequalled by any other fishing and spawning ground in the world.*** *(Fish Processor)*

Further Contributions from Participants
This section consists of summaries of participants' knowledge, opinions, and experience on such topics as environmental hazards like tides, winds, and tsunamis; rare and endangered species; spawning seasons for various fish; shared use of the fishing grounds; restraints on harvesting; the value of this renewable resource; an ecosystem approach; and productivity and biodiversity.

Physical Structure
Geology - One presenter spoke of a tsunami risk due to an earthquake epicentre in this area. He also referred to a report of a recent earthquake centred on the border of Massachusetts and New Hampshire, a few miles inland from the coast.

Ecological Significance
Water Masses and Currents - Participants from the fishing industry emphasized the strength of the tides, the common occurrence of severe storms and strong winds and the fact that Georges is on the storm track for the frequent storms travelling north along the eastern seaboard. They also said that early winter storms in November and December curtail fishing activity.

Benthos and Fish - Participants said that, on the basis of traditional knowledge, deep-sea corals are less abundant now than they were a few decades ago. They attributed this change largely to the impact of mobile fishing gear.

Many presenters said that, from their knowledge and experience, spawning activity takes place year-round on Georges Bank, and that spawning activity for several species occupies more extended seasons than those summarized by DFO (DFO 1998). They also stated that it was obvious from larvae surveys that it was very difficult to predict the location of larval concentrations from year to year.

The Fishery - A fishing industry representative stated that the northern edge is probably the most lucrative place in the world for cod. He also said that gillnetters catch 99 %of the pollock in a small area of the northern edge known as "the rips", that a distance of a few hundred feet here can make the difference between no catch or a good catch, and that boats have been known to go out and wait one to three days just to get a berth in this small area.

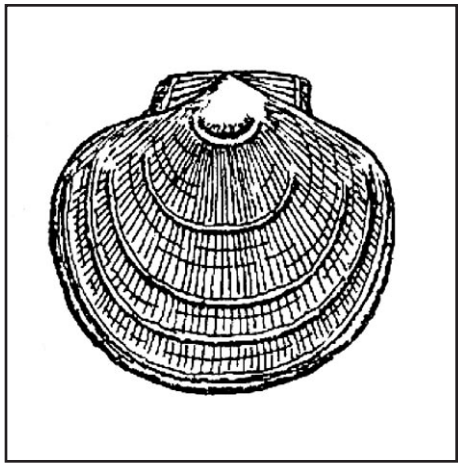
Several presenters stated that there are a large number of gear sectors fishing on Georges – "longliners, handliners, gillnetters, mobile gear, scallop, lobster, crab, swordfishermen, tuna fishermen, shark fishermen, herring and more" – sharing the Bank over a short season of approximately four and a half months.

Industry spokespersons stated that there are more management controls on Georges Bank, including spawning closures, than in any other Canadian zone including Newfoundland, the Gulf of St. Lawrence, and Area 4X (Figure 11); that this is the only viable ground fishery on the East Coast; and that these two points are related. A fishery scientist said that the spawning closures are reasonable precautions though they are not based on scientific evidence.

One fishing industry representative stated that some processors are noticing the rather poor condition of cod in regard to weight and length for the given age. He also said that DFO scientists are now estimating the natural mortality of groundfish to be as high as 50-60% per year in comparison to the traditional 20%. Yet a DFO scientist said that natural mortalities were not increased. On a related topic, a processor stated that handline gear tends to harvest a larger fish than a method which scoops up all sizes, because the hook automatically precludes catching very small fish.

Many presenters emphasized that the fishery is a renewable resource and, if well managed, is sustainable indefinitely. They also emphasized the need for time, for example until 2012, to allow fishery stocks on Georges Bank to recover to their former levels. A fisheries scientist remarked that a combination of a good conservation ethic and a fortunate set of biological circumstances makes Georges an ideal place to make fisheries recovery work. He reported positive signs of stock rebuilding in yellowtail flounder and haddock.

Several submissions emphasized the need for an ecosystem approach to fisheries



management. Some argued that more scientific study is required as the ecosystem approach is limited by the current lack of information on many groups of organisms.

An oil company representative expressed the opinion that there aren't many scallops on top of Georges, and that this area is not fished for scallops. A scallop biologist said that scallop larvae are distributed all over the Canadian portion of the Bank, and that juvenile scallops sometimes settle in habitats not recently occupied by the species. Georges was said to be one of the best habitats for the deep-sea scallop, and that the Canadian side of Georges is self-seeding. Scallops were held to be an example of a stock that is being managed sustainably, in spite of the fact that winter storms can cause severe mortalities of very young scallops.

Participants said that herring play a central role in the marine food system as a prey species; that stocks were almost rebuilt; and that there is a need for co-operation with the United States in harvesting them sustainably.

Presenters said that the lobster population that spawns on Georges Bank in summertime has a greater percentage of large, older, more fecund animals than populations that spawn on other grounds. An inshore lobster fisherman stated that before-and-after observations of V-notched lobsters confirmed the release of their eggs from November to January, in addition to the recognized season of July to October. A lobster industry representative noted that since the mid-1800s lobster landings in (inshore) District 34 have been greater than in any other district on the Atlantic coast. At least five fishermen attested to the migration of lobsters and the importance of the larval drift to the inshore lobster fishery – "Lobsters travel 300 km in any direction." They stated that fishermen for generations have maintained that the inshore stock is replenished by lobsters migrating from deep waters or offshore waters for the purpose of moulting; and that lobster larvae which remain near the surface for the first two weeks of their life are driven by currents, tidal flow, and prevailing winds to renew the stocks of District 34. A DFO fisheries biologist acknowledged the leakage of larvae from Georges Bank. He also said it is not known what portion of the larvae on the Bank is retained by the gyre, and what portion migrates off the Bank.

The Panel also heard testimony on pelagic species. The Panel heard it is commonplace to have 50 to 70 kilometres of swordfish gear drifting 25 to 50 kilometres in a single night's set; that harpoon swordfish vessels are capable of utilizing the entire area of Georges Bank; and that there could be as many as 100 harpoon vessels steaming through the area. A tuna fishery spokesperson described one particular niche, the Hell Hole, which tuna have occupied as a summer and fall feeding ground since 1988. He said that any changes in the food supply or environmental conditions could cause blue fin tuna to feed elsewhere. This could be disastrous for Canadian tuna fishermen, but

beneficial to tuna fishermen in the Azores and Iceland.

Many fishermen, environmental organizations, and elected representatives (Canadian and American) referred to several endangered species of marine mammals and turtles on Georges Bank. Many submissions commented on the part played by marine mammals and birds in the rich diversity on Georges Bank. Whales and seabirds were acknowledged to be important to ecotourism. In addition to the Canadian endangered status for the right whale and the leather back turtle, others pointed to the American endangered status for the fin, humpback, sei, and sperm whales, and for the loggerhead, Kemp's Riley, and green turtles. A marine biologist reported on American surveys showing that the eastern portions of Georges Bank are important for whales and dolphins in all four seasons. This area is said to constitute the second most important habitat off the northeast coast of the United States for these species.

Ecosystem Features - Many participants drew attention to the high level of productivity on Georges Bank, and to the dynamics of currents, nutrients, and plankton which contribute to this production. Descriptions of the ecosystem frequently included terms such as "extraordinary", "unusual", "unique", "unequalled", "of worldwide significance", "special" and "sacred."

> ***The oceans are vast but they're not uniformly productive biologically...I call the places that have both high abundance and high diversity special places biologically....They have world fame and they need to be approached, from a government perspective, as a trustee of something that has world-wide significance. And I think that lends a certain burden to the process.*** *(Environmental organization representative)*

Several people emphasized linkages between Georges Bank, the Gulf of Maine, and the Bay of Fundy. One presenter noted the oceanographic and ecological interconnectedness of Georges Bank, the Gulf of Maine, and the Bay of Fundy. It was suggested that primary productivity in the spawning and nursery habitats is critical to the overall productivity, biological diversity, and success of the fisheries of the Gulf of Maine/Bay of Fundy. Another presenter drew attention to the "rather spectacular" phytoplankton blooms on Georges Bank in a satellite photograph which, he said, demonstrated how the entire Gulf of Maine was dependent on Georges Bank. Many presenters emphasized that the Canadian and United States sectors of Georges Bank are ecologically linked. To remove the drilling moratorium on the Canadian side of Georges would be to compromise the entire ecosystem.

Some presenters emphasized the importance of the "critical habitat" designation given to the Canadian portion of Georges Bank by the Department of Fisheries in the 1980s. A presenter described the need to plan and establish an adequate system of marine protected areas in the Gulf of Maine to protect biodiversity. The presenter added that this would help ensure that the Gulf of Maine marine environment recovers from the excessive impacts of the recent past. It was also stated that the New England Fisheries Management Council has recently designated Georges Bank as Essential Fish Habitat for managed species. *The Oceans Act* was mentioned by nine presenters as the emerging mechanism for the integrated management of ocean activities, encompassing sustainable development and the Precautionary Principle.

2.3 SOCIO-ECONOMIC SIGNIFICANCE

Georges Bank is widely regarded as one of the world's most productive fishing grounds. The significant role played by Georges Bank in Canadian fisheries history can be traced at least as far back as the mid-1800s. It supports a very diversified and valuable fishery. The Canadian Georges Bank fishery in 1997 provided employment for approximately 1,000 people at sea harvesting, generating direct income of $32 million, and 650 people in processing ashore, with direct income of six million dollars. Support services are also provided for the 180 active vessels and the processing sector. The value to the regional economy, the product value, has ranged from $57 million to $148 million annually in the period 1990-97 (Gardner Pinfold, 1998). Figure 12 shows the average catch and its landed value for the commercial species from NAFO area 5Ze although the moratorium lands also include a small portion of NAFO area 4X (Figure 11).

> ***The fishery in the Southwest Nova region is a sustainable industry because it is based on a renewable resource. Our regional economy should be able to count on the fish ery for as long as good management practices prevail and as long as we avoid exposing our precious marine resources to man-made environmental damage.*** *(Fishing industry representative*)

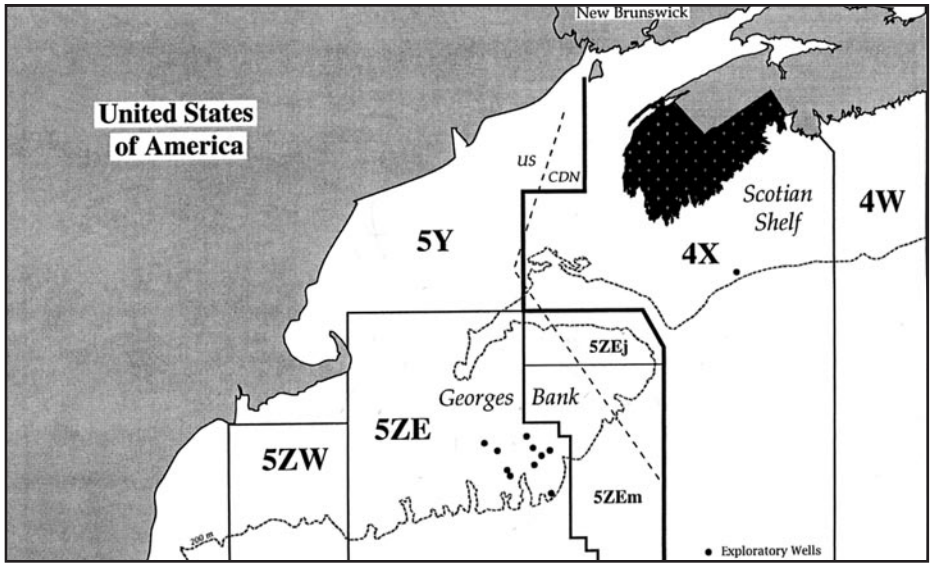


Figure 11 NAFO subareas on Georges Bank. Moratorium Lands superimposed.

We all know it's the richest fishing bank in the world, and we feel good about that, that we're lucky enough to be here being able to fish in Southwest Nova and Georges Bank....it means a lot to us to be able to keep fishing Georges Bank. *(Fish processor)*

Georges Bank accounted for about 16% of the total value of landings in the Southwest Nova region (Digby, Yarmouth, Shelburne, Queens, and Lunenburg counties) in 1996. These landings are distributed over 60 port communities in the region. For all participating fishermen and vessels there are no alternatives to Georges Bank. All fisheries on the East Coast are fully utilized (Gardner Pinfold, 1998).

From Figure 12, the scallop fishery is the largest, both in terms of round (in-shell) weight caught and in terms of average annual landed value.

....the offshore scallop industry has operated with sound policies and practice to nurture healthy stocks on Georges Bank, which is undeniably one of the richest ocean ecosystems in the world .... *(Fish processor representative)*

Significant landings of cod and haddock are harvested. Lobster, swordfish, and tuna are harvested at high values per tonne. About 25% of Canadian landings of swordfish, and 35% of Canadian landings of tuna, have come from the Georges Bank area (Boudreau, 1998).

Southwest Nova Scotia's relative dependence on the fishery is best illustrated by the fact that the fishing industry is the single largest source of industrial employment and income (Gardner Pinfold, 1998). Fish products have consistently been the single largest source of private sector export earnings for Nova Scotia. Fish harvesting and processing sectors in Nova Scotia lead all other private sector industries in employment and economic contribution (Oceans Institute of Canada, 1998).

Further Contributions from Participants

Although the recent downturn in the fishery was widely acknowledged, spokespersons for the fishing industry, municipalities, Chambers of Commerce, and community and environmental organizations – in addition to elected representatives and interested citizens – testified to the importance of the Georges Bank fishery as the "backbone" of the regional economy.

A municipal official said that landings in southwest Nova Scotia account for 25% of the total Canadian landings; that the Nova Scotian fishery is the most valuable in Canada; and that 20% of southwest Nova Scotia landings come from Georges Bank.

One fisherman explained the attraction of Nova Scotia fish products by commenting that "customers buy our products because our fish come from the cold pristine waters of the North Atlantic." He said that more seafood and dollar value is landed in the coastal region from Lunenburg to Digby

Figure 12. Comparison of amount of fish caught and landed value of catch for different species groups in Area 5Ze that corresponds roughly to Georges Bank. Landed values are averages for years 1992-1997. (Adapted from Boudreau, 1998)

Species Group	Avg. Annual Catch (metric tonnes)	Average Annual Landed Value ($)	Value/tonne ($)
Scallops	36,800 round weight (4,400 meat weight)	$44,180,000	$1,200 round weight ($10,000 meat weight)
Cod	5,240	$6,700,000	$1,300
Haddock	3,100	$4,700,000	$1,500
Swordfish	200	$1,640,000	$8,600
Other Groundfish	1,700	$1,490,000	$900
Pollock	2,300	$1,430,000	$600
Yellowtail	900	$1,280,000	$1,400
Lobster	160	$1,090,000	$6,800
Tuna	40	$290,000	$7,000
Herring	480	$91,000	$190
TOTAL	51,000	$63,000,000	

than in the rest of Atlantic Canada combined. Another person said that in many places such as southwestern New Brunswick, the fisheries are the only economy. There aren't any economic alternatives, particularly on the islands of the Bay of Fundy, that could substitute for the fisheries.

A fishing industry representative said that the Nova Scotia offshore scallop industry is responsible for 1,800 jobs, when spin-off employment is included. It was also pointed out that the landed value of the Georges Bank fishery does not include the economic multiplier effect, the landing of species like mackerel that swim across the Bank each year, and the economic value of other species like shark, tuna and swordfish that migrate across the Bank to be caught in other areas. One participant said that the St. Margaret's Bay trap net fishery for mackerel and tuna generates two million to three million dollars per year in economic activity. These species are also vital to communities in the Cape Sable Island, Pubnico, and Chedabucto Bay areas.

A fisherman said that 99% of Shelburne fishing boats under 45 feet are built locally, and that riggings are manufactured in local welding shops. Electronic gear is purchased locally, as are fishing gear, food, bait, and clothing. The maintenance and repair of boats and gear constitute an important local industry. It was said that local people are employed as dockside monitors, at-sea observers, fish plant workers, trawl baiters and truck drivers. Another person said that almost every business and job in southwest Nova Scotia depends on the fishery directly or indirectly, and that almost all the money from the fishery circulates in the area. He also stated that the income from this primary industry is multiplied in the communities by a factor of seven.

One participant said that the Georges Bank fishery is key to socio-economic and community sustainability; that it provides an economic base that enshrines cultural values, social cohesion, and sense of community. He said that these social and community benefits are often neglected in simple accounting processes but are still in need of stewardship. Another person spoke of the need to sustain a "way of life."

2.4 PANEL'S COMMENTS

The Panel concludes that:

- **This ecosystem is highly diverse, highly productive, and exceptional in its combination of special features; and**

- **Georges Bank has a significant and fully-exploited fishery and is heavily used.**

3 Exploration and Drilling

The petroleum industry delineates geological features under the ocean to determine whether hydrocarbons may be present. The methods used include seismic surveying and exploratory drilling.

This chapter addresses potential effects of seismic surveys, discharges and other impacts from exploratory drilling. Cumulative effects and economic benefits are discussed in this chapter as well as in Chapter 4. Most information in this chapter is drawn from participants' contributions and other material received by the Panel. The Panel's comments appear after some sections.

3.1 SEISMIC SURVEYS

The following description of seismic surveying is taken from a number of sources, including a summary report produced for the Panel (CEF Consultants Limited, 1998).

Seismic surveys are used to enable the petroleum industry to get a picture of rock formations under the ocean floor. Pressure waves are generated by the release of high-pressure compressed air from an array of air guns (4 to 20 individual units) towed at a depth of about 6 metres behind a specialized seismic vessel. The guns fire about every 10 seconds or 25 metres. The guns are highly pressurized and the air bubble released into the water causes a sound wave to travel down through the ocean water to the sea floor. The pressure waves bounce off the layers of rock under the ocean and back to the surface where they are recorded on hydrophones (sensitive microphones). The time lapse of each echo allows seismologists to delineate the shape and location of underlying geological features.

The hydrophones are mounted on long cables (streamers), which are also towed behind the seismic vessel at depths of 6 to 12 metres. Streamers are from 4 to 7 kilometres long, and several centimetres in diameter. A typical vessel tows up to 12 streamers in an array about 800 metres in width.

Seismic vessels are usually 60-90 metres long; move at a speed of approximately 5 knots; and operate 24 hours a day. Because of the length of the streamers towed behind the vessel, it is very difficult to stop it quickly or change its direction.

The potential impacts of seismic surveying discussed in more detail in the following sections include mortalities in a number of species and at a number of life stages; interference with fish spawning; decreased catches due to scaring of fish; possible changes in the movements or marine mammals; and space or territorial conflicts with ongoing fishing activities (Boudreau, 1998).

Potential Physical Effects on Fish and Fish Larvae

The effects include potential physical damage or mortality due to the pressure (sound) wave from the air guns.

There is general agreement in three areas:

- near the air guns there is a lethal zone for eggs and larvae, and a zone of damage to fish with swim bladders; these effects, estimated to extend out to six metres, diminish with distance;
- the observations which have been made are consistent in that they do not indicate a significant physical effect beyond the six metre zone described above;
- the studies are few in number and not comprehensive enough to provide confidence limits and statistical power.

At the hearings, two perspectives emerged on the potential effects of seismic activity on fish and fish larvae: that the risk of impact on fish species is acceptable and seismic surveying should proceed; and, alternatively, that the risk is unacceptable and a cautious approach is appropriate. The basic issue was the degree of confidence provided by the limited information available on which to base a conclusion.

The petroleum industry stated that studies have shown seismic effects to be a minor, local, and short-term disruption to fisheries and the environment, and contended the risks were acceptable. A consultant to the petroleum industry stated that fish eggs and larvae are susceptible to seismic damage, and that seismic pressure waves within a distance of about one and a half to six metres from the airgun could cause mortality of the eggs and larvae. However, he added that, based on an estimate for the Scotian Shelf, fewer than one perscent of eggs and larvae are likely to be within this distance of air guns, so that there would not be any measurable impact on overall spawning success from a modest number of seismic programs. No particular species was identified; this was an estimate of impact on generic eggs and larvae.

In a report about seismic on the Scotian Shelf, the consultant implied that the one perscent estimate mentioned above was based on a uniform distribution of larvae (as distinct from patchiness in space and time). In response to questions, the consultant said that the 1% estimate had not been adjusted to take into account the convergences (i.e., concentration of larvae) on Georges. However, he added that near sea-surface larvae, located above the air guns, would not be susceptible to mortality from the air guns.

Commenting on the strength of the information base, the oil industry

consultant said that in an environmental assessment, very few predictions are based on what normally would be considered acceptable levels of scientific data. He added that there has been no research done in Canada on the effects of seismic activity on fish or fish eggs. The consultant said the two available studies on this issue seemed to reach similar conclusions – i.e., that no lethal effects on larvae were shown beyond six metres of air guns. However, it was implied that these studies did not include confidence limits.

A representative of the herring fishery stated that his membership would support a partial modification of the moratorium to permit seismic exploration on Georges Bank to establish whether there are viable geological targets for exploratory drilling. He said this seismic program should be combined with a careful analysis of the impacts of seismic activity on all types of fishing activity, including herring purse seining on the Bank.

The Habitat Status Report (DFO, 1998) states that there is relatively little scientific knowledge available on the potential impacts of seismic activity on marine organisms, and notes that this was the subject of a recent scientific conference. DFO did not draw specific conclusions. It did say that the practice of scheduling seismic activity to avoid peak spawning periods should minimize potential impacts, but added that "... this approach would have to be used with caution on Georges Bank where spawning occurs throughout most of the year on various parts of the Bank ...."

A representative of the fishing industry emphasized that Georges Bank is home to spawning activity 12 months of the year; that seismic shocks are lethal to larvae and damaging to adults with swim bladders in close proximity to the array of equipment; that sub-lethal effects on fish and larvae at greater distance from the equipment are largely unknown; and that at certain times of the year, larvae and eggs on Georges are swept into convergence zones such that seismic activity through these zones could affect the recruitment of certain species in future years. He also said that seismic activity takes place both during the initial exploratory stage and during the production stage of a development project; thus seismic activity is not a one-season risk factor.

Ten other representatives of the fishing industry, three elected representatives, a union representative, a citizen, an environmental organization, and a presentation from the State of Massachusetts reinforced these concerns. Several of these people stated that the existing body of scientific knowledge is inadequate in a nursery area such as Georges. The environmental organization pointed out the difficulty of detecting impacts.

Panel's Comment

The two perspectives outlined above, that seismic surveying should proceed because the risks are acceptable, or else that caution should be exercised because the risks are too high, were articulated in the hearings. These perspectives differ in terms of the level of information deemed appropriate, the assessment of risk, and the appropriate action. To reduce uncertainty, there does appear to be a need for more comprehensive observations of the effects of seismic surveys on particular species of larvae on Georges Bank.

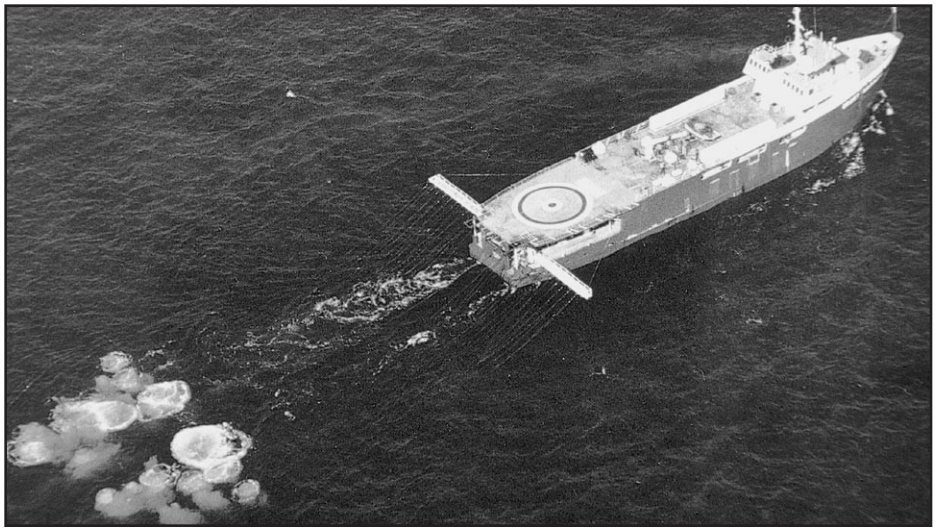
Potential Effects on Fish Behaviour

The main issue discussed was the extent by which catches would be reduced because the animals move away from the area, hide, or change their migration patterns. No information was provided about whether seismic affects spawning behaviour.

Representatives of the petroleum industry described advances in seismic technology which result in fewer, lower impact surveys: 3-D surveys; better positioning information; lower air gun pressures; and "soft starts." (In soft starts, air guns are fired at lower pressure and random phase to give animals time to adjust.)

A petroleum industry consultant described the information base on catchability/avoidance as consisting of a few studies that, with one exception, showed no more than a short-term disruption. The exception was a study, conducted by Norwegian researchers in the Barents Sea north of Norway, which showed a major decline in the catchability of cod and haddock in an area of seismic activity. The catch rate of the fish went down during the seismic survey, and stayed low during the post-seismic control period, contrary to expectation. The suggestion was made that these fish could have been in migration, and that this study was an outlier (an anamoly). In summary, it was said that impacts of seismic exploration on the catchability of demersal and pelagic fish on Georges Bank are likely to be very minor and limited to small areas.

Participants from the fishing industry, however, reported that catches were interrupted during and after seismic work. For example, a trawler was displaced from its fishing grounds on two occasions by seismic operations and twice experienced reduced catches of cod and other fish for a day or so afterwards. The fish caught during this period were said to exhibit



unusual agitation. In another case, participants said the swordfish fleet was driven as much as 50 miles away from where they were fishing and catches dropped dramatically for days. Participants also stated that in the case of the bluefin tuna fishery, considerable efforts have been made to make quieter and quieter fishing boats that do not produce vibrations. It was said that if either the tuna or their prey, mackerel, were induced to avoid an area, this would significantly affect catchability in the tuna and mackerel fisheries.

> ***Improved technology, in particular the 3-D seismic method, allows for more accurate well locations. This implies higher success rates, fewer well locations and fewer seismic surveys. Ultimately, this results in fewer interactions with the fishing industry and less impact on the environment.*** *(Petroleum company official)*

A consultant to the fishing industry pointed out that, unlike on the Scotian Shelf, there is no window of opportunity to conduct seismic surveys on Georges when neither fisheries nor spawning are underway. He went on to discuss the above studies on fish behaviour. He pointed out that some of the results, showing only a short-term disruption caused by seismic activity, involved species of fish foreign to Georges Bank. The fish studied were territorial by nature, as distinct from cod and haddock on Georges. The distinction is between territorial fish, who tend to hide from disturbance but remain in their home area, and wide-ranging or migrating fish, who tend to move away from disturbance. He pointed out that the Barents Sea study, referred to above as an outlier study in its results, was a large-scale, properly designed experiment involving groundfish. Recognizing the possibility that the low densities of fish present after seismic surveying arose because these fish were migrating, he nevertheless advised that some reliance be placed on the Barents Sea results.

Panel's Comment
Participants did not present information or identify studies on the possible effect of seismic surveying on spawning behaviour, on the behaviour of adult lobsters or scallops, or on pelagic fish.

Some presentations contended that seismic activity posed an acceptable level of risk in terms of affecting fish behaviour; for others, the risk was too high. There is some credible evidence, which may be applicable to Georges, of a significant adverse effect of seismic on fish behaviour.

Potential Effects on Marine Mammals
The unresolved questions are the degree to which Georges Bank marine mammal species are susceptible to hearing damage, and whether their behaviour is affected by seismic surveying. There are uncertainties and risks, and two perspectives – that the risks are acceptable, and that they are not.

A seismic consultant said that seismic noise can be heard by whales as far as 50 to 100 km away, but that at shorter distances, e.g., 5 to 15 km, disturbance effects and avoidance actions occur. If the animal is very close to the seismic array, the possibilities of temporary hearing loss and permanent physical damage arise. It was said that whales do avoid the close approach of seismic vessels. But this was said to be a short term effect, and that there has been no evidence of long-term displacement in response to seismic activities. The consultant added, however, that in many cases this effect has not been studied either. His conclusion was that, although reactions to seismic pulses have not been studied in any detail in most of the baleen whale species that occur on Georges Bank, the predicted acoustic impacts on baleen whales (right, humpback, fin, sei, and minke) and seals are judged to be minor, local, and short-term.

Dolphins were reported to ride the bow waves of seismic vessels. The question was asked, might marine mammals be attracted to new sounds, e.g., to ramping up air guns? The seismic consultant responded that the answer is not known.

Many participants expressed concern for marine mammals, of which the right whale is of most concern because it is "one of the most endangered large animals on the planet" and especially vulnerable to collision with ships and gear. This whale transits the Bank and uses areas in the vicinity of the Bank. A biologist whose specialty is whales stated that there have been no direct studies on the effects of oil and gas exploration on any of the cetaceans off eastern Canada and that this is cause for concern. Studies were all short-term, restricted, and sometimes contradictory in their results. He stated that very little is known.

> ***How do you detect impacts? If a right whale's hearing is damaged by seismic or some other impact, ...if they are driven out of a feeding area for four or five days and it's choppy water so that they're really not that visible at the surface, how would we know?*** *(Environmental organization)*

Panel's Comment
The available information on the effects of seismic on marine mammals from Georges Bank is sparse, and often inferred from information on other species in other places. Some of the mammalian species of Georges are listed as endangered (see Chapter 2).

Effects on Access and Crowding
There was agreement that, because seismic vessels with their trailing arrays have limited manoeuvrability, marine regulations to prevent collisions at sea have the effect that fishing cannot be carried on in the same area. The issue here is the degree to which fishing activities will be curtailed due to seismic surveys. There are two opinions: "we can work it out through co-operation," and "the berths (or time and space slots for fishing operations) are filled to capacity now."

> ***At the risk of summary, we believe the studies have shown seismic effects are expected to be minor, local, and short term. While this is good news, achieving positive coexistence with fishing fleets will be challenging. The degree to which we succeed will depend on the effectiveness and consultation with the fishery in planning and conducting the seismic survey. With consultation and interaction with the local marine industry, fisheries and the public issues concerning seismic interference with other vessels can and will be minimized.*** *(Petroleum company official)*

Petroleum industry participants said that a typical initial seismic program would begin one year after the moratorium was lifted and would involve one vessel for two to three months, doing one to several surveys. Their preferred season is spring to fall, which happens to coincide with the peak season for fisheries. They said that a modern seismic vessel can carry 6 to 12 streamers 4 to 7 kilometres long, occupying a width of as much as 800 metres.

> ***[The streamers] must remain [in] absolutely fixed position down the line in order for the data to be valid. This means that you've got essentially an immovable object that's three miles long, and it has a turning radius of about three or four miles as well. This is like putting a giant air craft carrier on Georges Bank. It can't turn, it can't move, it can't get out of the way, and the only thing it does is it has a chase boat in front of it to make sure that the fishermen are not in the area.*** *(Fisheries consultant)*

Other participants explained that a fishing berth is a drift or steaming path starting from a particular location at a specific stage of tide. They said that, in the period June to October, Georges Bank is heavily and fully utilized temporally and spatially by the fishing industry, so that vessels displaced from one area will contribute to overcrowding in another area if there is room at all, or will be completely displaced in the case of site-specific fisheries, e.g., the Hell Hole.

> ***Seismic is not going to be all front-end. Seismic is going to be taking place there throughout the life of the project.*** *(Fishing industry representative)*

Panel's Comment
There is overlapping demand for access from the fishing and petroleum industries, apparently in excess of the time and space available. In contrast with other topics, there is little uncertainty about the existence of the effect of seismic surveys on access to fishing grounds: seismic surveys in progress will cause some inconvenience and disruption to the patterns of fishing.

3.2 EXPLORATORY DRILLING

The following description of exploratory drilling is taken from a background paper commissioned by the Panel by CEF Consultants Limited (CEF, 1998).

> "Although seismic surveys and geological knowledge can paint a picture of the rock structure, the properties of the rocks, as well as the presence of hydrocarbons, can only be determined by drilling into the rock layers. This is known as exploratory drilling.
>
> Exploratory drilling in the offshore is carried out by mobile drilling platforms. Of the many types of mobile drilling platforms, two in particular – jack-up and seemi-submersible rigs – are likely to be used if drilling were to take place on Georges Bank. Mobile platforms are ideal for exploratory wells because they can be easily moved from one location to another. Jack-up rigs consist of self-contained legs lowered to contact the seabed and are typically used in water depths less than 130 metres. Semi-submersible drilling rigs, which rival a battleship in weight, are platforms, which have large-diameter cylindrical legs that provide flotation; they permit exploratory work in deeper water. They use anchor systems and thrusters to maintain their position while drilling.
>
> *Drilling Basics*: The drill is a string of threaded sections of pipe with a drill bit mounted at the end. Motorized equipment rotates the drill pipe, causing the bit to cut into the rock. Different bits are available for different types of rock; a bit can wear out in only hours if hard rock is encountered.
>
> During drilling, geologists on the drilling platform routinely examine fragments of rock to assess the location of the bit and characteristics of the rock. The drill can also be equipped to recover columns of rock, known as cores, to provide more detailed information on rock characteristics.
>
> The first 60 to 1,200 metres of a well is drilled directly into the sediments and rock, with no casing, in a process known as spudding. [At this stage, muds and cuttings are discharged directly into the ocean.] Later, the drill string is removed and a pipe-casing inserted into the well. As drilling progresses, the well is lined with additional casing to prevent rock from crumbling into the hole and to contain any high pressure gases and liquids.
>
> The well also contains blow-out preventers – devices on the top of the casing that can close off the well in the event of uncontrolled pressures. Each new section of well casing is smaller in diameter; typically the diameter of the hole decreases with depth. Sensors inserted in the drill pipe monitor conditions in the well.
>
> During drilling, a continuous flow of drilling "mud" is circulated in the well. This mud is actually a thick mix of clay and chemical additives in water or mineral oil, as well as barite (barium sulphate), which adds weight. Drilling mud lubricates the bit, contains pressures, keeps the hole from collapsing and flushes rock chips and drill cuttings to the surface.
>
> *Drilling Fluids*: Two basic types of drilling fluids, or muds, are used in offshore exploration and production: water-based and oil-based muds.
>
> Water-based mud is made up of clay (bentonite) and water; it may include barite, a heavy mineral used to add weight. Chemical additives are mixed in to stabilize the drilling fluid during use, and to reduce corrosion and bacterial activity. Some chemicals, called coagulants, thicken and others, known as anticoagulants, thin the mud. Water-based mud is increasingly used for most offshore wells and in the shallower parts of deep wells.
>
> Oil-based mud is a mixture of barite, mineral oil, and chemical additives. Oil-based muds are used for deeper well sections, and in cases where the well is drilled at an angle (directional drilling), where there is an increased

likelihood that a drill pipe will stick. Oil-based mud is more expensive and has more negative environmental effects than water based mud.

A new family of synthetic-based muds has become available in which the mineral oil component is replaced by artificial oil-like substances. These new muds were developed in the hope of better environmental performance than oil-based muds. However, they are not widely used because they are expensive, and because it is still unclear whether their performance meets expectations.

Drilling Discharges: Drilling an exploratory well introduces various materials into the marine environment. What and how much is released depends on the characteristics of the well, such as the depth drilled and types of rock penetrated. In shallow wells and in the upper portions of deep wells, the main discharges are water-based drilling mud and rock cuttings.

Under Canadian regulations, companies can dump water-based mud. Usually the mud is dumped in single large discharges (bulk discharge) of typically 500 m^3. A single well may discharge 6,000 m^3 of cuttings and mud. Mud is dumped when it is no longer suitable for drilling.

Drill cuttings are small pieces of rock generated by the crushing action of the drill bit. Typically they are about the consistency of sand or of finer materials, such as silt and clay. Additional material can slough off the drill hole wall, commonly referred to as "washout."

All rock removed from a well is deposited on the seabed. For an average well, this is equivalent to a column 5,000 m deep, with a diameter of 90 cm at the surface, to about 20 cm at the bottom. Volumes of rock cuttings from a typical well can range from 300 to 1,200 m^3 and the volume of mud and cuttings combined can reach 3200 m^3 from each exploratory well, although the amount is usually lower. The cuttings are continuously dumped during the drilling process.

Some drilling fluids also enter the environment along with the rock cuttings. Solids-control equipment on board the rig separates the cuttings from fluids, usually with 90% efficiency for water-based mud and 75% for oil-based mud. However, some fluids still adhere to the rock.

Many drill rigs have a large diameter pipe or caisson reaching below the water surface. The cuttings are discharged into the caisson, allowing for the washing of cuttings and further recovery of oil, if oil-based muds are in use.

Currently under Canadian regulations, no oil-based mud can be dumped over the side, and consequently oil-based muds are shipped to land for disposal, or reinjected into the well. However, cuttings drilled with oil-based muds can be dumped at sea as long as the level of mineral oil in the cuttings is less than 15% of the dry weight.

The Canada-Nova Scotia Offshore Petroleum Board has announced that after December 31, 1999, the oil content in cuttings will be limited to one percent by weight, which virtually eliminates the releases of oil-based mud and cuttings in the offshore. The one percent tolerance allows for small amounts of oil taken into water-based muds in unusual circumstances, for example, to free a stuck drill pipe.

Formation Water: Salt water trapped within rock formations containing hydrocarbons often reaches the surface along with the hydrocarbons during production tests on exploratory rigs. This water, known as formation water, contains nutrients and occasionally dissolved metals, and may have low concentrations of radioactive material from rock formations.

The amount of formation water released during exploration tests is small; it dilutes rapidly in the volume of ocean water around the well. Formation water is often known as "produced" water when it comes from an operating well.

Other Drilling Rig Discharges: With few exceptions, all wastes from operations on offshore drilling rigs must be returned to shore for disposal. However, many incidental discharges may occur and are allowed under current regulations.

Such incidental wastes include muds and associated chemicals released along with drill cuttings; fluids such as salt solutions, polymers and various additives used to prevent damage to the well bore while the well is being prepared for production; deck drainage; domestic sewage; and wastewater from crew facilities. Deck wash may contain small quantities of oil from the well and from lubricants of various kinds (e.g., greases, hydraulic fluids, and incidental fuels) used on the drilling rig. Before it goes overboard, it is run through a process to remove oily hydrocarbons.

Other wastes produced by offshore drilling operations include: desalination water (from the freshwater drinking system); blow-out preventer fluid (if the blowout preventer is activated); wastes from onboard laboratories, bilge and ballast water; mud, cuttings and cement at the sea floor released when the drill is removed from the sea floor; uncontaminated seawater such as cooling water; water used to clean out boilers; excess cement slurry from equipment wash down; filter materials such as diatomaceous earth; waste from painting such as sandblast sand, paint chips and paint spray; accidental discharges of materials such as cement and drill muds; strainer and filter backwash for procedures using water; and test fluids from the wells during drilling."

Impacts of Exploratory Drilling

From Boudreau (1998), the potential impacts of drilling may result from: discharges – mortality, sublethal effects

and tainting; loss of access – fishing interruptions; and infrastructure – ship movements, anchors, cables, debris, domestic discharges, light and sounds. Approaches for mitigation include more benign muds; transporting muds and cuttings elsewhere for disposal; and recovering anchors, cables, and debris from the seabed.

Participants have considered any exploratory drilling program on Georges to include from one to three wells, and, if these prove successful, the potential for additional exploratory wells. Other scenarios are discussed in Chapter 4.

Muds and Cuttings

> ...operational discharges have two major components: muds and cuttings. Muds tend to be finer, less dense material while cuttings are generally coarser and heavier pieces of rock about the size of sand grains. Once [or when] discharged there are a number of different processes that act on them and that determine their fate and potential impacts on the environment. (Boudreau, 1998)
>
> Field observations...indicate that roughly 10% of the discharged wastes is neutrally buoyant and forms a surface plume... (Boudreau, 1998)
>
> Drilling fluids and cuttings discharged into moderate to highly energetic environments tend to separate into two plumes: most solids descend rapidly in a lower plume, leaving a lighter upper plume containing approximately 5-10% of the discharged solids. (Neff, 1987)
>
> In many cases, the finer components of the discharge may flocculate to form larger particles with higher settling velocities than the original material. ... Observations ... around the PanCanadian CoPan oil field on Sable Island Bank have confirmed that discharged drilling wastes flocculate, settle rapidly and concentrate in the benthic boundary layer. On certain occasions during developmental drilling, fine particulates from drilling wastes were present up to 8 km from the platform. Field observations on Georges Bank indicate the presence of elevated levels of natural suspended matter in the benthic layer but the absence of fine particulates... (Boudreau, 1998)

During the course of the hearings, participants identified several potential impacts from the discharge of mud and cuttings: smothering, lethal effects, sub-lethal effects, and bioaccumulation. The issue here is the potential significance of these effects. Differing perspectives – that the risk is acceptable, and that it is not – were developed.

A representative of the petroleum industry said that water-based muds would be used in the Georges Bank area and described a scenario where used muds and cuttings would be discharged there. Another person from the petroleum industry said that options for remote disposal of cuttings either onshore or offshore, although costly, would be examined. In the scenario where muds and cuttings would be discharged at the drill-site, presenters from the petroleum industry described the constituents of muds that would likely be used, e.g., water-based muds with high-grade barite to minimize concentrations of associated heavy metals, and, in the case of a stuck drill, synthetic muds rather than oil-based muds.

One presenter referred to the Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) report and quoted the following statistics on discharges of muds and cuttings:

Exploratory Sites (single well)

Drilling muds	periodically 15 to 30 tonnes
Bulk at the end	150 to 400 tonnes
Cuttings (dry mass)	200 to 1,000 tonnes

According to a presenter from the fishing industry, the three or four wells exploratory drilling scenario assumed by DFO is very narrow – approximately 150 wells have been drilled on the Scotian Shelf.

General Concerns - A petroleum industry representative said that experience offshore to date has shown that water-based muds and associated cuttings discharged from single wells into a high energy environment have not caused lasting or extended biological effects.

Twenty participants (including the fishing industry, an elected representative, environmental organizations and the Massachusetts congressional delegation) expressed concerns over the possible effects of drilling discharges on marine organisms. One said that drill cuttings may contain naturally occurring radioactive material and heavy metals. The option of disposing of cuttings and drilling muds on-shore was viewed by some presenters as costly, and siting a receiving landfill would be problematic.

Many presenters said that even if water-based and synthetic muds are used, the potential exists for smothering benthic organisms; that sub-lethal and chronic long-term effects of these kinds of discharges can only be estimated; that not enough is known about the food webs in this highly productive ecosystem to allow these types of discharges to take place; and that the risks are too great.

A petroleum industry submission stated that there would be physical smothering under the cuttings pile, limited to the area immediately around the discharge, and that the cuttings pile would be expected to gradually disperse.

A fisheries researcher said that water-based muds, in addition to containing barite and bentonite, contain minor constituents such as inorganic salts, surfactants and detergents, corrosion inhibitors, lubricants such as diesel and mineral oil (pills), biocides, and heavy metals – mercury, chromium, zinc, cadmium, copper, lead, and nickel.

Based on the indication that the greatest potential impacts of drilling muds may occur in the relatively deep, stratified region (DFO, 1998), a tuna fishery spokesperson expressed concern because the relatively deep stratified region includes the Hell Hole – an important area for tuna. An environmental organization pointed to research indicating the adverse impact of drilling muds on the survival and viability of corals.

Potential Lethal Effects - In response to the expectation that larvae were the most sensitive life stage, laboratory studies of the effects of water-based muds on larvae

of scallops, lobster, and haddock were commissioned by the Panel. The results did not establish lethal effects except from high local concentrations which might occur around the source (Cranford *et al.*, 1998).

Potential Sub-lethal Effects - Laboratory bio-assay studies were combined with a benthic boundary layer transport model driven by observed and simulated Georges Bank currents to predict effects on adult scallops of bentonite and barite in discharged muds. The results of these simulations – the effects of bentonite and barite from water-based muds discharged from one well – indicate a loss of growing days within a plume extending up to 40 kilometres from the rig. Although the overall effects on scallop populations were not determined conclusively, these lost growing days could lead to reproductive loss, which could affect the strength of future year-classes of scallops (Boudreau, 1998). Also, it was said that there are no chronic toxicity data for most of the many additives in drilling muds.

> ***Overall, the low toxicity of water-based muds coupled with the high energy bottom environment on Georges Bank limit the potential effects of drilling discharges to being highly localized and temporary. Widespread and/or long term effects would not be expected.*** *(Petroleum company offucal)*

On the subject of drilling muds, the *Habitat Status Report* (DFO, 1998) stated:

> The dispersion of drilling mud in the ocean is a complex phenomenon which is not fully understood and for which there are not adequate observations to validate a dispersion model in any rigorous sense. Thus, there is a small chance that drilling mud concentrations could be higher than predicted by the present dispersion model, but this is considered unlikely except for deeper areas away from the scallop beds.
>
> There is uncertainty about the full range and nature of impacts of drilling discharges on the ecosystem. Extensive studies have been conducted on the acute and sub-lethal toxicity of drilling muds to adult scallops and limited testing has been done with early life stages of sea scallop, lobster, and haddock. These species and life stages are expected to be the most sensitive. However potential lethal and sub-lethal impacts of operational discharges on other marine resources, and the overall ecosystem structure and function, on Georges Bank have not been investigated.
>
> Much of this review deals with average conditions of physical oceanography, biological populations and weather. In reality, there can be significant deviations from the mean that would affect the assessment of potential impacts.

Can we quantify and predict the potential harm drilling muds might actually cause on Georges Bank? Any objective analysis of the existing body of knowledge would say no. *(Fish processor representative)*

Bioaccumulation - Some participants expressed concern about the bio-accumulation of contaminants in predators higher in the food web. A DFO scientist said that bioaccumulation had not been discussed in the DFO assessment because it was not expected in a short exploratory phase, but that it would arise in a production phase. (See Chapter 4 for a fuller discussion of bioaccumulation.) A representative of the petroleum industry summarized a scientific report that noted that monitoring of scallops near a well site on Sable Island Bank found uptake of metals in the viscera rather than in the adductor muscle, although some elevation of zinc was found in the adductor muscle. Overall his conclusion was that the potential for uptake of bioaccumulation of heavy metals appears to be limited.

Panel's Comment
Presentations from the petroleum industry were based on an assumption that used muds and cuttings would be discharged from the rig into the marine environment, but the possibility was raised that they could be disposed of remotely, either offshore or onshore. This is not a regulatory requirement.

Alternative perspectives on whether risks are acceptable, or not, arise where uncertainties are prominent. For drilling wastes discharged from a rig on or near Georges, the probability that significant, harmful effects would occur cannot be discounted.

Accidental Discharges – Spills and Blowouts

The record on spills and blowouts was presented by consultants for the petroleum industry. Statistics show large oil spills from exploratory drilling blowouts to be rare. Further, although the distinction might not be clear in the public mind, the record for tanker spills is much worse than for the offshore oil exploration/production industry. Tanker spills account for 45% of total petroleum input to the world's oceans, compared to one and half percent for drilling blowouts. Nevertheless, on a local basis in the vicinity of the petroleum exploration/production facilities, the latter percentage could be higher.

Documentation was presented by the petroleum industry to show that the world-wide blowout record includes only one extremely large oil spill from exploratory drilling – the Intox-I spill in Mexico in 1979. For blowouts involving gas or small discharges of oil, the blowout frequency in the United States has been one blowout for every 180 exploration wells drilled. In the Gulf of Mexico, 21% of blowouts were controlled within one hour, 58% within one day, 84% within one week, and 95% within one month. Information was also

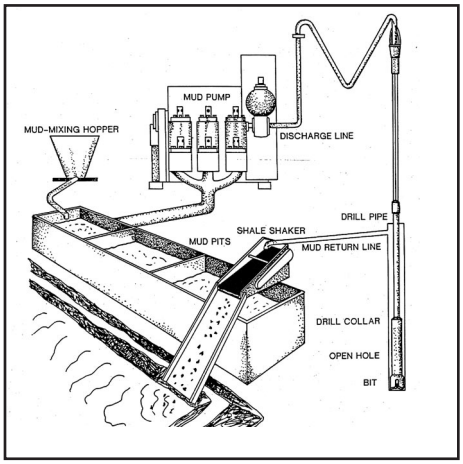
presented on surface and subsea blowouts of predominantly gas, as well as on procedures to prevent blowouts by monitoring well conditions while drilling. A distinction was made between blowouts comprised mostly of gas, and those comprised mostly of light oil. On the subject of shallow gas, participants said that the improvements in shallow seismic survey equipment and techniques have enhanced abilities to detect shallow gas formations, and therefore to help avoid potential shallow gas blowouts. They also pointed out the inherent advantages in planning the response to a rig accident compared to an "instantaneous" tanker spill: the site and conditions at the site are known in advance; the release is likely to be at a lower rate over a longer time; and the petroleum is likely to be in a fresh, non- viscous state amenable to skimming.

Two other participants expressed concern about geological over-pressure zones, due to the age and thickness of sediments along the Scotian Shelf including Georges Bank, which provide increased potential for blowouts. A petroleum industry representative said existing data does not indicate the presence of abnormal pore pressures on Georges Bank. As well, the petroleum industry risk consultant said that the statistics on blowouts do not appear to vary geographically, e.g., between gas fields and oil fields.

A consultant to the fishing industry said that blowout preventers in shallow gas cases rarely work; that many operators now design systems for the primary purpose of providing time to evacuate the rig; and that petroleum companies do not plan to leave personnel on rigs to attempt to control shallow gas blowouts.

One participant said there have been two blowouts on the Scotian Shelf to date (from approximately 150 wells drilled). The Uniacke blowout in the Sable Island area was a surface blowout. It was noted as being a reference used for modelling concentrations of hydrocarbons. Based on an analysis of a small number of demersal fish, some contamination was observed. Consultants for the petroleum industry said that the most serious risk from either surface or subsea blowout spills was to seabirds; and that risks to marine mammals, pelagic fish, demersal fish, shellfish, phytoplankton and zooplankton were negligible. Where actual observations are lacking, as is often the case, these assessments are based on "first principles" and extrapolations. Environment Canada, in a written statement, classed the Uniacke blowout as major; noted that any major spill on Georges could require international response involving the United States; and pointed out that since pelagic birds have evolved with delayed sexual maturity and a small clutch size – usually one egg – they are vulnerable to catastrophic spills and especially to chronic releases of relatively small spills from marine traffic and offshore petroleum activities.

The effects of spills and blowouts on fisheries were said by the petroleum industry to be of three types: restricted access to fishing grounds because of the presence of slicks; closure of a fishery due either to contamination of the stock, contamination of the environment, or



tainting of the fish; and other damage to the stocks themselves. In a written submission from a petroleum consultant, it was stated that the potential effect on fisheries was considered to be "slight," an assessment that arises from the likelihood of small, short closures.

General concern about the potential effects of spills and blowouts on marine organisms was expressed by many presenters. A fisheries consultant said that Growler and Hunk Dory sites, proposed for drilling in the 1980s, are located in areas where impacts on fishing would be considerable. *The Habitat Status Report* (DFO, 1998) summarizes the risk of spills or blowouts as follows:

> As with any drilling operation, exploration or production, there is a small chance of a large release of hydrocarbons into the environment as a result of a well blowout. Although all precautions against such an event are recommended, the probability still exists. In such an event, all ecosystem components are expected to be at risk. Due to the concentration of some life stages of certain species on the Northeast Peak and the presence of convergence zones, there is a chance that even a relatively small blowout could result in impacts on a significant portion of the population....

Panel's Comment
The probability of a large blowout is low based on experience to date. There is concern about potential impacts of blowouts and spills that could result in contamination of the marine environment and damage to marine populations.

Tainting
Many presentations from the fishing industry expressed great concern over the potential loss of markets due to any consumer perception that fish products are tainted and/or contaminated by petroleum and waste discharges. They said that any significant discharge or spill event will have far-reaching market implications for all Canadian fish products, wherever they are harvested. Tuna, for example, are sold on an auction market at which perception of "freshness" is a key factor. Therefore, the perception of tainting was said to be a major concern. A written submission from the petroleum industry said that water-based drilling fluids and cuttings do not contain the type of organic material that causes tainting in seafoods.

> ***The Canadian industry does have an advantage over many of our seafood competitors elsewhere in the world in terms of the reputation...for pollution-free seafood.... On a couple of occasions where we have had incidents involving taint of seafood or other food-related tainting issues, we've seen a devastating impact on***

our markets. *(Fish processor representative)*

Panel's Comment
The perception of tainting – triggered, for example, by reports of spills, blowouts, or operational discharges – is a major concern for the fishing industry.

Loss of Access and Crowding
The regulations require that the exclusion area around a jack-up rig is a circle 500 metres in radius. For a semi-submersible, a larger exclusion zone is required, extending to about 1,000 metres depending on the depth of water and anchor locations. A petroleum industry representative said that infrastructure would be effectively removed after drilling – that the well stem would be sealed and cut off below the seabed, and that fishing would again be possible on the site.

Twenty-two presenters drew attention to the potential for economic loss and hazard to safety arising from loss of access to areas around the drill rigs, and crowding in remaining areas. For example, it was said that:

- The Canadian portion of Georges Bank is a relatively small area; the peak fishing activity is during July to September and includes 100-180 vessels at a time; the grounds are often crowded in this period when longliners, scallopers, draggers, gillnet vessels and seiners are vying for the best fishing spots; and fleets harvesting migratory species, including swordfish, require access to specific areas of the Bank as they follow the migratory patterns of the fish.
- A rig would be on-site for three or four months for each exploration well.
- Some gear types need an extensive area to play out their gear.
- Fishing activity is restricted due to closures, weather, and tidal conditions. Gear conflicts and area by-catch restrictions are further limitations.
- Fish are where they are because of favourable habitat. Moving vessels and gear is not really an option.
- Loss of access is a real concern, the full impact of which is unknown because of uncertainty surrounding potential petroleum activity scenarios.

With all the various gear sectors trying to get the most productive grounds into a short period of time, we end up with a heavy burden on a small bank. *(Fisherman/fishermen's association representative)*

The study commissioned by the Panel on the economics of the fishery stated that the Georges Bank stocks are fully utilized, and there is little or no scope to shift areas of fishing effort on the Bank without causing overcrowding and creating inefficiencies and gear conflicts (Gardner Pinfold, 1998).

Some participants related that, in practice, fishing vessels are contacted and warned off long before they get close to exclusion zones, so that the practical zone is larger than the regulation exclusion zone itself.

I think the biggest nightmare for a swordfish harpooner would be to wake up in the morning and you want to do a spiritual meditation and thank God for the beautiful day you're having, and you look and all of a sudden here you are, ooh, a big oil rig, a monster, just a few miles from where you are. ...flood tide (or) ebb tide...unless you (are able to) stay with each fish as you pick them up, you're going to end right in the oil rig. They're going to catch in the anchors and the ropes and everything. That would be complete devastation. *(Fisheries association representative)*

Panel's Comment
Exclusion zones would be part of any drilling program. The Canadian portion of Georges Bank is an area of intense fishing activity. Much of this activity moves with the tide. A fixed exclusion zone in the midst of this dynamic would cause some inconvenience and disruption.

Other Impacts
Participants mentioned other emissions with potential impacts besides drilling muds, lubricants, and cuttings. These include noise, light, traffic, flaring residues, formation water, ballast water, and chemical fluids.

An environmental organization said that venting releases methane while flaring produces methane, carbon dioxide, and a complex mixture of over 250 compounds, some of which are known carcinogens. They also pointed out that chronic, long-term effects on fish, marine mammals, and seabirds are difficult to detect.

In a written submission, it was noted that the current National Energy Board Offshore Waste Treatment Guidelines, particularly with respect to the release of petroleum-contaminated wastes, represent a minimal standard and no longer reflect good industrial practice (Environment Canada, 1999).

A presenter, representing fishermen using passive gear (fish traps), described a possible scenario of concern: pelagic fish such as tuna, which vary their migration routes from time to time, could further alter their migration patterns to avoid areas of increased activity – noise, lights, chemical discharges, etc. – and then not come to the fish traps.

3.3 CUMULATIVE EFFECTS

This discussion is limited to the effects of exploration and drilling of one to three wells in the Georges Bank area over a three to four year period. A discussion of cumulative effects over a longer time scale is given in Chapter 4.

A representative of a petroleum company said that on Georges Bank, contaminants would be rapidly dispersed, and that it is very hard to see any kind of overlapping effects in time and space that would give rise to concerns about drilling one to three exploratory wells.

Other participants said that cumulative effects would arise from adding petroleum exploration activities to existing fishing operations, marine traffic, and land-based marine pollution. It was said that petroleum activity could have adverse effects on several fish stocks that are now rebuilding. Northern right whales, already suffering mortalities from ship strikes and entanglement in fishing gear, could be adversely affected by the incremental effects of seismic surveys, exploration wells, increased vessel traffic, and chemical pollution.

Some fish stocks are in a fragile state of recovery and the addition of risk factors associated with oil and gas development could inhibit or endanger that recovery. *(Fishing industry representative)*

Environment Canada drew attention to the possibility that seabirds migrating along the eastern continental shelf of North America will encounter offshore petroleum installations on Georges Bank, Sable Island Bank, and then the Grand Bank, with each constituting a separate and definite hazard. They urged a cautious approach to petroleum development on Georges.

3.4 ECONOMIC BENEFITS OF EXPLORATION AND DRILLING

A consulting economist for the petroleum industry said that the seismic surveying and exploratory/drilling program proposed by petroleum companies would result in an expenditure in the order of $150-200 million over a three to four year period (seismic surveying $10-20 million, and exploratory drilling $135-180 million). Of this total, 85% or $128-170 million would be spent on materials and services, and 15% or $22-30 million would be expended on wages and salaries. He further estimated that 27% of materials would be sourced in Nova Scotia ($35-46 million), and that 80% of the jobs would be Nova Scotian ($18-24 million), creating 240-320 jobs for Nova Scotians. Total Nova Scotian content would be 35%, or $53-70 million. In addition, there would be a spin-off of 480 to 750 person-years of work at $30,000 per year; opportunities for entrepreneurship; training in new skills; and support services in areas including transportation, communications, medical care, and accommodations.

Panel's Comment
A three to four year exploration and drilling program has been credibly estimated to generate about $53 million to $70 million in direct economic benefits, and create 240 to 320 jobs for Nova Scotians. In addition, there would be indirect benefits and some opportunity for further economic diversification.

4 Related Issues

In addition to material specifically concerned with seismic work and drilling, the Panel heard many comments on topics related broadly to questions about the future of oil and gas activities on Georges Bank. Basically, these submissions dealt with participants' desires to ensure certain priorities in the future, and with various views on what these goals would imply for the management of human activities on Georges. The first part of this chapter considers this set of key priorities identified by participants, and related issues, perspectives, and suggestions. Except for the Panel's comments, the substance of the chapter is drawn almost entirely from submissions and presentations to the Panel in the hearings.

As well as having various perspectives on the future of Georges, some participants also expressed views on more specific related subjects, including potential cumulative and remote impacts. Certain health and environmental problems were raised, as was the issue of safety at sea, and the need for cooperative relations between Canada and the United States.

A number of participants also made comments and recommendations about managing or regulating human activities related to Georges or the offshore which they thought should be considered whether or not the moratorium is lifted. Issues addressed included the offshore regulatory regime; compensation for fishermen and the fisheries sector; and consultation involving the petroleum industry, regulators, fishermen, and other members of the public.

4.1 PRIORITIES FOR THE FUTURE

Participants differed sharply on the future uses of Georges Bank, specifically whether the moratorium should continue. However, there was a widely shared consensus about key priorities. These included the importance of:

- maintaining high biological productivity and habitat on Georges Bank;
- safeguarding the health of fish stocks and the various commercial fisheries dependent on them;
- sustaining well-functioning local communities;
- creating and maintaining jobs; and
- promoting local and provincial economic benefits.

Virtually every submission touched on all or most of these priorities as crucial social goals that must be taken into account in making the moratorium decision. In the language of environmental assessment, these can be considered "valued ecosystem components" or VECs[1]. They were usually treated by participants as essential, interrelated aspects of a desirable future that was tied to a scenario for the future of Georges either with or without the extension of the moratorium. In other words, it was widely agreed that this "package" of social goals should be the outcome of any scenario relating to human activities on Georges. Moreover, participants believed that this set of goals would be affected by the presence or absence of petroleum exploration and development in the moratorium lands. The disagreement was whether petroleum activities would support or undermine the achievement of this vision of the future.

Development Scenarios and Their Regulation

Two related issues emerged under this heading. First, there is the question of the scale of the activities being reviewed and whether it is realistic to consider seismic and drilling activities by themselves (i.e., separate from the total or cumulative effects of petroleum development). The second issue was whether it is appropriate to allow questions of future petroleum activities on Georges to be addressed solely by the offshore regulatory agency, the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB).

> ***I am greatly concerned about the truncated nature of the question at hand. It seems at best illogical to me to deal with the impacts of exploration separate from the impacts of production.*** *(Fishermen's representative)*

Scale of Activities and Realism of Reviewing Seismic and Exploratory Drilling Alone - Some oil company officials asserted that the number of wells drilled in the exploration phase would be in the order of one to three, and that this review was concerned only with the impacts of seismic and exploration drilling. For its Regional Advisory Process (RAP) report (Boudreau 1998), the Department of Fisheries and Oceans (DFO) stated that it most often assumed a scenario of one rig drilling three to four wells consecutively. In the presentation of their scientific studies, DFO officials stated that these studies detailed the impact of drilling discharges from just one well, though noting the possibility of cumulative or additional effects with more drilling. However, a petroleum company official indicated that, in the case of the Cohasset-Panuke (COPAN) production on the Scotian Shelf, which is nearing its scheduled close,
development is being followed by further exploration activities. A petroleum industry association representative said that about 150 wells have been drilled to date on the Scotian Shelf. A fishing industry representative noted that seismic activities

[1] In environment assessment practice in Canada, VECS often include components of the socio-economic system. That definition is used here, although some practitioners use Valued Socio-economic Components or VSCs.

could take place throughout the time span of any commercial development in a large producing area, and a seismic expert indicated that activity is usually iterative. A number of presenters from environmental groups and the fisheries sector asserted that seismic and exploration activities would continue at the same time as development and production activities in the event of commercial hydrocarbon discoveries. They said it was therefore unrealistic to isolate seismic and exploration drilling from the cumulative impacts of hydrocarbon development and production. (See the further discussion in 4.2 on cumulative effects.)

Panel's Comment
If the moratorium were lifted, it would only be initially that environmental assessments could consider seismic and exploratory drilling activities alone. In the event of a commercial discovery, further exploration activities would likely overlap with development and production. Spatially and temporally, additive and cumulative effects from these additional exploration activities would be difficult or impossible to separate from development and production impacts.

Petroleum Activities on Georges and the Mandate and Role of the CNSOPB - Many presenters, mainly though not exclusively from the petroleum industry, strongly believed that the Georges Bank fisheries and environment could and would be effectively protected if the moratorium were lifted and the CNSOPB assumed its mandated responsibilities for regulating any proposed petroleum-related activities in the moratorium lands. Several oil company presentations noted that the existing regulatory regime was not functioning at the time the moratorium was imposed. In the event the moratorium were lifted, many regulatory requirements would have to be met before any seismic or other exploration activities were permitted. At the earliest, it would be more than 10 years before production could occur, since there would be further regulatory requirements at every step of the process. Several presenters also pointed out that the detailed assessment of petroleum activities that the CNSOPB requires, which permits site-specific solutions to problems, could not be carried out at the general and hypothetical level necessitated by the terms of the Georges Bank review. Moreover, some asserted that the CNSOPB, a relatively new regulatory body, has implemented very progressive approaches to offshore regulation. The conclusion from these assertions was that the existing regulatory regime was best suited to make appropriate decisions about petroleum activities on Georges.

> ***That "Why Now and Not 2012" presentation is going to revolve primarily around why we think the regulatory framework as it exists is appropriate now and there's no need to wait until 2012.*** *(Petroleum industry representative)*

On the other hand, presenters pointed out that the CNSOPB has a mandate that includes addressing safety and environmental protection, as well as requiring plans for industrial benefits from offshore petroleum activities. A few presenters stated that these responsibilities might constitute an inherent conflict. Many others indicated that, no matter how effectively the CNSOPB carries out its mandate to regulate these activities, it is not in a position to stand back and consider the broader question of whether there should be petroleum activities on Georges at all.

> ***...not one representative from oil companies or the very knowledgeable representatives from the United States Department of the Interior could name one example of a successful exploration stage that didn't go forward into production worldwide....What that says to me is...there is no regulatory force on the planet that can stop development and production once exploratory wells indicate that there is commercial viability there****. (Citizen)*

Panel's Comment
Any future petroleum-related activities in the moratorium lands would fall under the petroleum regulatory regime now in place, which is quite comprehensive and addresses, among other things, environmental protection, worker safety, and industrial benefits.

The context for this regulatory regime is the management of offshore petroleum activities with appropriate forethought; its purpose and approach is to permit petroleum development while requiring that negative impacts be mitigated and reduced, rather than to impose total bans on activity.

Conservation: Approaches to Protecting Productivity and Habitat
Implicitly or explicitly, maintaining the biological productivity of Georges Bank and the habitats that help make it possible were high priorities for most participants. At issue was whether this productivity could be maintained while permitting petroleum (and other) activities but constraining them by regulatory requirements. An alternative would be establishing some form of zoning that would restrict certain activities from taking place at all in specified areas.

Offshore industry and oil company representatives indicated their interest in habitat protection and discussed their industry's cooperation with scientists, the fishing industry, and environmentalists in supporting environmental studies in Alberta, Nova Scotia, and elsewhere. Several presentations and also one of the Panel's background studies (Meltzer 1998) noted that in some places, notably in the Gulf of Mexico and the North Sea, rigs and pipelines had been known to attract fish by providing a sheltering habitat for them. The Panel heard several presentations from the petroleum sector describing technological advances in the last decade that had improved both economic and environmental performance and had reduced risk (see Chapter 3). A number of presenters emphasized that pollution from offshore petroleum activities was a very minor source of oil in the oceans, and that the offshore petroleum industry existed alongside long-established commercial fisheries in many jurisdictions. In the past 10 years in much of the world, regulatory requirements related to environmental protection became more stringent. A petroleum industry spokesperson noted with approval the acceptance of the concept of integrated resource management as a framework for regulating areas with a number of different resource users. These presenters

concluded that the CNSOPB regulatory regime was appropriate to decide upon and enforce restrictions to protect the productivity and habitat of Georges Bank, and opposed restricting petroleum activities by extending the moratorium.

> ***The moratorium...therefore suspends the regulatory process that we have in Canada. It's an extraordinary instrument that prevents the constructive analysis of the things that we are all interested in– environmental impact, economic benefit, and coexistence. It is, in effect, a statement that the regulatory processes we have in Canada, the Offshore Boards, the National Energy Board, the Canadian Environmental Assessment Agency, somehow don't work, whereas we suggest that the opposite is true and that in fact, the regulatory frame-work that we have in Canada is a model to the world.*** *(Petroleum industry representative)*

By contrast, presenters from the fisheries sector and environmental groups preferred an approach that eliminated the possibility of exploration and drilling activities on Georges Bank, either for a specified period (often until 2012) or permanently. Some of these participants treated the extension of the moratorium as a special case of restrictive zoning for unusual circumstances, while others were more interested in incorporating this approach into the overall management of human activities in the marine environment.

Many presenters from the fishing sector indicated that the existing regulatory regime has not been in place long, and that an extension of the moratorium until 2012 would not only correspond to the American moratorium period but would also buy time for Canadian regulators to gain experience and build public confidence. As well, extending the moratorium for that period would permit the continued development of better technology, and would provide time to allow the herring and groundfish stocks to rebuild without adding new stresses to a severely reduced population. The Panel heard also that many organizations in the fisheries sector are not opposed to petroleum activities *per se* – indeed, they have not opposed offshore projects on the Scotian Shelf – but do consider Georges Bank a special case. Some presenters pointed out that the "closed area" approach represented by the moratorium is used in reducing the environmental impacts of many human activities, including fishing. Indeed, fishing activities on Georges are restricted during certain periods.

Some academics, environmental groups, and others supporting the extension of the moratorium were interested in preventing negative environmental impacts in the marine environment, and were concerned about fisheries impacts, including overfishing, as well as petroleum-related activities. In this context, many marine species were described as under stress from a multitude of sources: corals were noted as suffering damage from fishing gear; marine birds were said to be particularly at risk from oil pollution from all sources; and marine mammals, especially the endangered right whales, were vulnerable to disturbance and injury from ship traffic. Some presenters advocated an extension of the moratorium into other areas, including Browns Bank, German Bank, and the Bay of Fundy. Several supported a permanent moratorium which might be part of an offshore management regime that included areas or zones of variously restricted activities and Marine Protected Areas (MPAs). They noted that the MPA program mandated by the new *Oceans Act* was still in its very early stages. One petroleum company official said that the possibility of adding new moratorium lands put a worrying burden of uncertainty on the offshore petroleum industry. However, he added that the industry accepted that there could be some places ruled off limits to oil and gas activities, if a process for designating such areas were science-based.

> ***At present, the staff [of the DFO section planning marine protected areas] are still struggling with fundamental matters like selection criteria, management standards, consultation procedures and research planning. It will probably be several years before lines representing even the core of an effective system of Marine Protected Areas can be drawn on the map....Adding a new major resource exploitation industry with its distinctive impacts, before precautionary plans have been made, would create an untenable situation.*** *(Biology professor)*

Panel's Comment

The protection of marine ecosystems– the world's oceans–is an urgent matter. Such initiatives are significantly less advanced than attempts to protect terrestrial ecosystems, in terms of the science, public awareness, the development of effective management tools and approaches, and above all, in how recently this has become a priority. In this context, regulation based on permitting or licensing mandated activities and the designation of some areas in which certain activities are banned outright, including but not limited to Marine Protected Areas, should be complementary approaches, both of which are necessary. (Potentially curtailed activities could include not only petroleum-related ones, but also fishing, vessel traffic, dumping, and even recreational activities such as whale-watching.) The Panel supports increasing the coordination among the many agencies and jurisdictions involved in marine protection, as well as efforts to improve the science and better incorporate it into decision-making. At the same time, recognizing that the development of a system of protected areas has only just begun, and that the relevant ecological science is limited, it is preferable to lean toward protective action rather than require definitive scientific proof that such action is the best way to proceed.

Fish Stocks and Fisheries

The Panel heard a great deal of comment on the status and potential of various of the Georges Bank fish stocks, as well as on fisheries management. These comments came mainly from scientists and from fishing sector participants, and generally were not directly challenged. However, taken together, they provided insight into the projected significance of the Georges Bank fishery for the future of southwestern Nova Scotia. (Information on the present state of fish stocks and the value of the fishery is discussed in Chapter 2.)

The agenda of these large companies is profits and when the profits are not there, neither are the companies.... That's unlike the fishermen, who have our whole lives tied up in our communities and our families. When we face hard times, we dig our heels in and survive. We stay. *(Fishe-rman/ fisherman's association representative)*

Virtually everyone who touched on these topics underlined the cultural, social, and economic importance of the fishery to these communities. Contrary to recent stereotypes of Atlantic Canada, the fishery here is not dead. Very much alive in terms of its economic contribution to the region, it is also a way of life involving knowledge, activities, and skills that are much-valued and a source of personal identity and pride. Many, including some young entrants into the business, pointed out that a properly managed fishery would provide a significant number of direct and marine- related jobs that would sustain this way of life in perpetuity. Scallops on Georges are managed now with conservation of the stocks as a priority, and Georges Bank herring have rebounded after a near-complete collapse. Many asserted that in their own experience, the attitude of most Nova Scotia fishers has become much more conservation-oriented. As well, a number of presenters from many different parts of the fisheries sector described quota cuts, down-sizing, and new costs that have been borne by the industry in an effort to ensure its long-term economic viability and conservation of the stocks on which it depends.

We have seen many changes in the fishery in the last few years, and Georges Bank is no exception. We have gone from being able to fish... year round to a season starting June 1st....and with drastic groundfish quota cuts. DFO has limited the number of boats....But even through all this, we've maintained a lucrative fishery.... There's longliners, handliners, gillnetters, mobile [gear], scallops, lobster, crab, swordfishermen, tuna fishermen, shark fishermen, herring, and more. *(Fisherman)*

In groundfish alone...we're spending several hundreds of thousands of dollars conducting research. This is something we didn't do in the past, primarily because the Government of Canada was responsible, or we felt was responsible for it. But one has to go through a crisis like northern cod to realize that you really can't depend on a third party to provide you with...information. You have to get out there and get it....You can't simply say, you know, government says there's 400,000 tons of fish there and go out and catch it. You have to make sure that you believe that. *(Fish company official)*

Several DFO fisheries scientists discussed the future economic potential of various stocks from Georges Bank. Figure 13, which is drawn from DFO presentations to the Panel and from the Panel's commissioned study by Gardner Pinfold (Gardner Pinfold, 1998) presents this information in summary form for the most important species economically. (However, many other species are also fished, including pollock, hake, monkfish, shark, and halibut.) According to DFO and Gardner Pinfold, several things should be noted about uncertainties in predicting the future potential of the fisheries. First, landings of various species have varied widely in recent decades, due primarily to changes in fisheries management, including the extension and clarification of Canada's regulatory and legal jurisdiction, and to fluctuations in stock abundance related to fishing pressure and other factors. Over-fishing by both domestic and foreign fleets gave years of high catches for some species, followed by dramatically reduced yields. In recent years, many total allowable catches (TACs) have been kept low to allow rebuilding of stock. As a result, historic catch rates are a questionable guide to the sustainable potential of the fisheries resources in the future.

Figure 13. Summary of Estimated Future Fisheries Potential from Georges Bank
This table is a summary of estimates given to the Georges Bank Review Panel in the Department of Fisheries and Oceans presentation at the hearings and from Gardner Pinfold's study (Gardner Pinfold, 1998)

Species	Present Yield (t)	Potential Yield (t)
Cod	3,500 (USA & Canada combined) – 1997	5,000 (w/ present low recruit ment); up to 20,000 if stocks recover (USA & Canada com-bined)
Haddock	2,900 (USA & Canada combined) – 1997	30,000 - 45,000 (USA & Canada combined)
Yellowtail Flounder	1,800 (USA & Canada combined) – 1997	13,700 (USA & Canada com-bined)
Herring	79 (Canada) – 1997	100,000 (USA & Canada com-bined)
Swordfish	189 (Canada) – 1997; 25% or more of Cdn landings from Georges	Unknown sustainable yield for Western Atlantic stock
Bluefin Tuna	11 (Canada) – 1997; 35% of Cdn landings from Georges	Unknown sustainable yield for Western Atlantic stock
Scallops	4,250 (Canada – meat weight) – 1997	TAC varies year by year; est. 5,000 - 6,000 sustainable range (Cdn)
Lobster	720 TAC (Cdn offshore TAC, on ave. 93% caught) – 1997	Offshore Cdn TAC has remained the same since 1986; little scien-tific information on stock population

It appears that some Georges Bank groundfish stocks are recovering slowly, although for undetermined reasons cod is experiencing poor recruitment and is not recovering. Herring is showing significant signs of recovery. The large pelagics (swordfish and bluefin tuna) are now managed for entire regions of the western Atlantic by the International Commission for the Conservation of Atlantic Tunas (ICCAT). Canada's present TAC for these species is below historic catch levels, and the stocks appear to be declining. Offshore lobster and scallops fisheries are within Canadian jurisdiction and appear to be fairly stable. In the case of scallops, the industry and government have a joint scientific monitoring program which is used to help set and adjust catch levels; the most important variables appear to be the year-by-year factors affecting the strength of stock populations. For offshore lobster there is little information about the status of the population, but with an enterprise allocation system and only eight licenses, the fishing effort has moved away from Georges and the TAC has remained unchanged since 1985-6.

Not all presenters were happy with present fisheries management. The Panel heard a number of statements criticizing the loss of traditional fishing access (mainly by former inshore fishermen) that came about as a result of restructuring the way various fisheries are managed. In addition, a number of presenters from environmental groups and the fisheries sector commented on the ecologically damaging impacts of some present-day fishing practices, due both to the technology used (notably bottom trawls) and to over-harvesting. As noted in Chapter 2, one presenter emphasized that the 1985 DFO designation of Georges Bank as "critical habitat" had not to his knowledge been changed; criteria for that designation included areas of notably high productivity and fishing use. The conclusion of that DFO discussion paper was stated to be that oil and gas exploration was acceptable within the Gulf of Maine except for those areas defined as critical habitat.

Panel's Comment

The fisheries are a vital economic, social and cultural component of the communities of southwest Nova Scotia, and the protection and sustainable management of these fisheries is a crucially important challenge for the future.

Communities, Jobs, and Economic Development

Presenters agreed on the importance of sustaining the region's long-established local communities, and of providing sufficient economic opportunities, training, and jobs to give young people a chance to stay in southwest Nova Scotia. Many presenters were keenly aware that this would not be easy. The main issue was generally defined in terms of the possible impact of petroleum activities in the future: would the potential benefits outweigh the potential risks to the fisheries and related industries? In presenting evidence in support of their conclusions on this question, participants commented on the great importance of the fisheries; on weighing the risks (discussed in Chapter 5); and on the possible number of jobs and benefits involved, which will be considered in the following paragraphs. These comments included discussions of the permanence or impermanence of jobs; direct economic benefits of petroleum activities; indirect economic benefits, including royalties, business and training opportunities; the municipal tax base and infrastructure; and access to potential energy resources from Georges.

Jobs - No one attempted to quantify the number of jobs associated with potential petroleum exploration, development, and production. For initial seismic and exploration drilling, an economic consultant to the petroleum industry stated that about 15% of the projected expenditure of $150 to $200 million was for wages and salaries. This would mean some 300-400 jobs. With the projected 80% local capture rate, this would mean 240-320 jobs for Nova Scotians, with an additional spin-off of 480-750 jobs in the province. Stated another way, one job would be created in the province for about every $600,000 in spending and an additional two-and-a-half spin-off jobs would be created in a multiplier effect.

> ***The nature of the offshore work cycle provides employment opportunities for our people anywhere in the province. It doesn't matter where you live in the province when you're working in the offshore phase of a project; if you're going out for two weeks at a time, a four-hour or a six-hour ride to the heliport is not a big deal compared to a one-hour one.*** *(Offshore industries association representative)*

These estimates were not directly challenged. However, other presenters expressed scepticism about whether people in the local communities in southwest Nova Scotia would have the skills to benefit from these employment opportunities. Several oil industry participants emphasized that the industry prefers to hire locally for a number of practical reasons; that the CNSOPB requires companies to have an approved industrial benefits plan; and that actual experience on the Scotian Shelf backed up these assertions in that the percentage of Nova Scotian employees and suppliers has steadily increased from almost nothing at the beginning to a significant proportion now. A petroleum company official noted that, for their most recent Scotian Shelf operations, rig crews are nearly 80% Nova Scotian and direct employment in total is about 70% Nova Scotian.

> ***So how do we get [local] content up?....First of all, the number and size of nearby projects. The more projects there are and the larger there are nearby, the better we'll do.... It takes time. We have to build relationships....getting experience and getting one contract and then a second and third is very, very important....Entrepreneurs. Entrepreneurs is the biggest question mark in terms of identifying who they are or where they are but it's also the single most important variable.*** *(Petroleum economics consultant)*

A number of presenters, especially from the fisheries sector and from environmental organizations, stressed the desirability of jobs based on renewable resources like fish, as opposed to depletable resources like oil and gas. They said that with sound management, jobs could be sustained indefinitely in the

renewable resource industries. Several participants cited the early closure of the East Kemptville tin mine as an example of the insecurity of jobs dependent on far-away decisions and fluctuating commodity prices. The significance of protecting resources that are renewable was noted by one environmental group representative as being especially important in sustaining many parts of rural Atlantic Canada, whose communities have few realistic economic options besides the mainstay of primary resources. Others mentioned the growing world demand for fish, increasing global population, and the long-term value of jobs in a renewable-based industry that supplies essential human needs.

> ***What happens on Georges Bank matters to the coastal ecosystems of New Brunswick and Downeast Maine...and it matters to the coastal communities there whose economic well-being depends on the inshore fisheries primarily....the future of our coastal communities in southwestern New Brunswick depends on those fish coming inshore within reach of the fixed-gear fishermen who fuel the local economies...particularly the juvenile herring which are the backbone of the sardine industry.*** *(Environmental organization representative)*

However, several participants from the petroleum sector stated that jobs in the East Coast oil and gas sector could be expected to last 20 years or longer and that in today's economy these were indeed permanent jobs. They said that jobs and opportunities in a local offshore industry depended on the development of skills and relationships over time, a process that was already well under way in Nova Scotia. One offshore marine industry official described a company-sponsored cadet sailing program, which was undertaken in part to attract young people into a PPrapidly-growing business that needed more workers.

Some participants expressed serious concern about future job prospects in their own areas. Representatives from Chambers of Commerce and local municipal governments commented on the present adverse local employment conditions, noting that unemployment is very high and that a number of businesses that had been large employers have now closed. New jobs are needed to provide the tax base to support existing infrastructure. An academic fisheries policy analyst said that more job creation could be accomplished by reducing the fleet of capital-intensive fisheries vessels to create a more conservationist, small-boat industry. Some noted that the fisheries are particularly labour-intensive and provide substantial spin-offs to other local businesses. But a fishing industry representative stated unequivocally that a sustainable fishery alone could not generate enough employment to provide jobs for all who needed them.

> ***If you live in Shelburne County today, you are more than twice as likely to be self-employed than residents of any other county in Nova Scotia....Notwithstanding this annual bounty from the sea, and our high levels of entrepreneurship, unemployment rates continue to be amongst the highest in Canada. In recent years, a number of industries have closed their doors, not only reducing employment opportunities, but also seriously constricting the local tax bases and increasing the tax burden on local residents. Speak to anyone who lives in a small town on this shore.*** *(Local Chamber of Commerce*)

Local Communities and Economic Development - A theme touched on by a number of local industry representatives was the opportunity that offshore petroleum activities provided for local businesses to develop and grow. An estimate by a petroleum economics consultant of the Nova Scotia content that might be expected in the initial stages of seismic and exploration drilling was about 35%, or a capture of somewhere between $53 and $70 million of the projected $150 to $200 million investment. A local industries representative noted that, in the case of the Sable Offshore Energy Project on the Scotian Shelf, which is still in its early stages, 95 companies have won 120 contracts above $50,000, including a number of firms based in smaller communities such as Sheet Harbour and Liverpool. One official from a Halifax-based marine company recounted the history of that business, which started out with one vessel in the early 1980s to work in the fledgling East Coast offshore sector. Using the oil and gas offshore activities as a springboard to grow and diversify, the company now operates 17 vessels worldwide, employs 500 people, 90% of whom are Nova Scotians, and presently gets about 60% of its work in the oil and gas sector. A local airport manager and other business representatives commented that their businesses can and do serve both offshore petroleum and fisheries-related customers. Oil companies stressed that it was not a question of "fisheries versus oil" but a situation in which they would like all existing industries to flourish, along with their own.

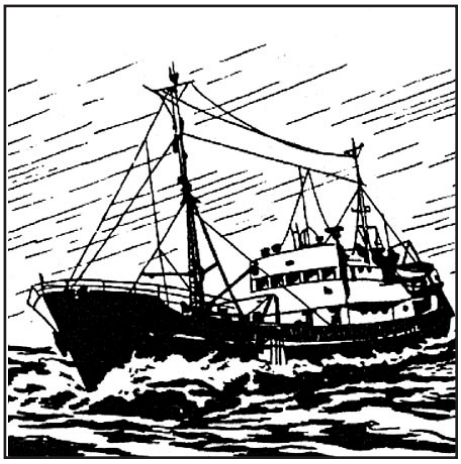
> ***The $50,000 limit is really [only] a threshold value that we monitor. A far greater number of our members win many smaller supply opportunities....There's a gas station in Goldboro on the road to the Goldboro [gas] plant which used to open at nine a.m. It now opens before six a.m. and sells twice as much gas as before....There's a cooperative of fishing boats in the Country Harbour area which have been retained to do environmental monitoring....There's a small company that was contracted here in the city to create a system to organize electronically stored photographs and they're now getting ready to market their software to the world.*** *(Offshore industries association representative)*

The topic of potential local benefits from the availability of offshore oil or gas from Georges Bank was addressed by a few presenters. While some hoped that this might be a source of economic benefit by attracting industry, most expressed the opinion that if natural gas were found, it would most likely be transported directly to markets in New England. Petroleum industry representatives did not address this topic in their submissions, or noted that any such discussion was highly speculative at this point. Only a few presenters mentioned royalties as potential benefits.

Finally, a number of presenters on both sides of the moratorium question acknowledged that both the fisheries and the oil and gas industry had valuable roles to play in the region's economic future. Participants from the petroleum sector and other businesses were confident that oil and gas activities should and could co-exist with the fishery, the existing backbone of the economy. As discussed earlier, many from the fisheries sector welcomed the petroleum industry's contribution to regional employment and economic development, but said that this did not mean that all areas of the offshore, and in particular Georges Bank, had to be open to exploration and development.

Panel's Comment
Jobs and economic development are much-needed in southwestern Nova Scotia and in the province generally. While jobs based on the fishery and other renewable resources have the potential to continue to provide a solid permanent base for communities, the challenge of managing those resources sustainably is formidable, although there are some encouraging signs about the growth of a conservation ethic. However, jobs and economic development are based not only on the availability of resources, but are critically related to many other economic factors, including access to markets, prices, the skills and training of the labour force, and the development of entrepreneurial capabilities. In this province, economic sectors based on renewable and non-renewable resources alike have in the past seen periods of major setbacks, and these have been related both to resource depletion and to the functioning of markets and the economic system. Effectively addressing the problem of unemployment and community economic decline is certainly related to managing all resources for maximum long-term benefits, but also requires attention to many other economic factors.

Petroleum activities have a real contribution to make to economic development in the province. However, the local economic benefits from seismic and exploration on Georges would be limited. Development and production would of course increase total benefits, although it seems unlikely that the natural gas (if any) would come ashore in Nova Scotia, and thus some of the potential benefits would be less than in the case of the Sable development. However, oil and gas activities elsewhere in the province, both onshore and in the offshore, also will offer some ongoing opportunities for employment and economic development for people in southwest Nova Scotia.



4.2 CUMULATIVE AND REMOTE IMPACTS

Most participants who provided detailed presentations focused primarily on exploration and drilling impacts, although many who supported the extension of the moratorium believed that cumulative impacts from all future hydrocarbon-related activities should be relevant to the decision. Some specific cumulative and far-distant impacts identified by presenters are considered below. Topics include bioaccumulation of contaminants; formation and produced water; transportation of hydrocarbons by pipeline or tanker; greenhouse gas emissions; and natural gas and environmental illness. General socio-economic benefits from exploration and development together are discussed in sections of 4.1.

Cumulative Effects and Environmental Assessment Practice
The Panel's mandate was "to conduct a review of the social, economic, and environmental effects of exploration and drilling on Georges Bank." In all environmental assessments, the spatial and temporal boundaries of possible effects – how far away and how far into the future the effects extend – must be determined. In general, these boundaries are often based on the length of time contaminants persist and the distance they travel. For other types of impacts, boundaries are determined by how far away the effects can be perceived. Although this is a matter of judgment, not a precise formula, practitioners can usually make a common-sense decision about these boundaries for most projects. As well, in present day environmental assessment practice, a review of cumulative impacts is also required. For these effects, a determination must be made about what related activities could reasonably be foreseen or even hypothesized if the proposed project went ahead, and about the combined impacts from all of these activities. In this case, successful exploration would lead to development and production from the field that was discovered, and some potential impacts are discussed below.

In environmental assessment practice in this country, proponents of a major project are generally required to provide an environmental impact statement which predicts the effects of a project, including cumulative impacts. This was not the case in the Georges Bank review, since no actual project was being considered. As a result, cumulative impacts were not discussed systematically.

Petroleum industry officials argued that the appropriate forum for decision-making was the existing regulatory regime, and in the main did not address the question of cumulative effects at all. Most other presenters' discussion of cumulative and remote impacts was limited to pointing out the potential for various risks and benefits.

Several presenters commented that cumulative effects from past and continuing fishing, shipping, and land-based marine pollution can be observed now, and that any new petroleum activities would be superimposed on present levels of environmental stress. As an example, it was said that the northern right whales are already suffering mortalities from ship collisions and entanglement with fishing gear. In addition, the possibility was mentioned that these animals might be s

uffering sub- lethal effects of chemical pollution.

As discussed in 4.1, many participants commented that it would be difficult to separate initial exploration impacts from impacts from further development. (These impacts are discussed in detail in Chapter 3.) Many presenters also stated that successful exploration would inevitably lead to development and production, and that the most relevant impacts and potential risks for the moratorium decision were the total or cumulative effects of all of these activities on the biology and fisheries of Georges Bank. Similarly, although a few participants made careful distinctions between the economic impacts from seismic and drilling and subsequent hydrocarbon development, many participants discussed potential economic benefits in general terms. They considered the relevant positive impacts to be the long-term jobs and economic development that successful exploration and development could bring.

> ***I guess the thing that really strikes me about the very difficult decision that's in front of you is that if we permit drilling on Georges Bank, then we are de facto, I think, implicitly/explicitly agreeing that if there is a discovery of significance that is economic, we are prepared to permit production. I don't think there is any other way of interpreting where we are. (****Independent consulting marine geologist)*

Panel's Comment

In the absence of any specific project proposal, precise quantification of impacts, whether of seismic and exploration drilling or of cumulative effects from further development, would necessarily be theoretical or speculative. Moreover, although the Panel was told that on the Canadian side of Georges Bank the most likely hydrocarbon discoveries would be natural gas or light condensates rather than heavier crude, in the absence of exploration data there is no way of knowing for certain what, if any, hydrocarbons are actually present. Markets and transportation options are significantly different for gas and oil, as are the related environmental risks as well as the economic benefits from production. The consideration of the potential effects of hydrocarbon development and production in this context of cumulative impacts is therefore quite general and hypothetical. Nevertheless, the review of cumulative impacts from exploration does include the possibility of development and production, and these cumulative effects in total could be much more significant than impacts from the initial stages of seismic and exploration drilling.

Bioaccumulation

A few presenters expressed concerns about the concentration of contaminants through bioaccumulation, especially in the large pelagic species like tuna. (In precise terminology, bioaccumulation refers to the fact that some substances that are dispersed in the environment become concentrated in the tissues or organs of different species after intake by those organisms; bioconcentration refers to concentration through water uptake alone.Bio-magnification means that the bio-accumulation of a substance in organisms increases at every step of the food chain, with top predators carrying the greatest body burdens.) A DFO scientist said that bioaccumulation had not been discussed in the DFO assessment because it was not expected in a short exploratory phase, but that it would arise in a production phase. An oil company environmental official stated that in monitoring some of the effects of the wells drilled on the American side of the Bank, no heavy metal uptake was found in clams and flounder, and one investigator's conclusion was that in such a dispersive environment it was unlikely to be a problem. He also said that the barium itself in the barite used in drilling muds was not likely to bioaccumulate or bio-magnify, but that heavy metals associated with some barium deposits could be of concern. Selecting a high grade of barite would avoid the potential problem.

Formation or Produced Water

Formation water is naturally occurring water that is associated with the layers of rock (the geological formations) that might contain gas or oil deposits. It is briny and may have various concentrations of natural contaminants, including heavy metals, radionuclides, and hydrocarbons. In exploration drilling, little if any of this water would be discharged, although some could be released in the event of a blowout. However, in production significant quantities of this water (often referred to as produced water) are pumped up out of the well and are usually released; this represents the highest volume of discharges from offshore operations. One presenter, referring to the report by the Joint Group of Experts on the Scientific Aspects of Marine Pollution (the GESAMP Report), quoted that for a production site (with 50 wells drilled over 4 to 20 years) about 1,500 tonnes/day of produced (formation) water are discharged. An offshore industry spokesperson said that these discharges could be monitored and treated or reinjected if the regulatory authority so required.

Many presenters cited a study (Cranford *et al*., 1998) on the effects of produced water from the COPAN site on haddock, lobster, and scallop eggs and larvae. For haddock eggs and larvae, the concentration of produced water which caused half the exposed organisms to die (the lethal concentration of 50% or LC_{50}) was 10% - 22% produced water; for first stage lobster larvae, the LC_{50} was .9% produced water; and for scallop larvae, the LC_{50} was 20.8%. Fertilization success of scallop eggs was significantly affected at concentrations of 1% produced water and above. Because these very important commercial species spawn on Georges, many of these presenters expressed concerns about the study results.

Transportation Impacts: Tankers and Pipelines

Presenters frequently expressed concerns about cumulative impacts related to transporting oil or gas by pipeline or tanker.

Tankers - If a commercial oil discovery were made, it is possible that the liquids would be transported to shore by tanker, as is done in the COPAN project on the Scotian Shelf. The presenters on this topic agreed that many of the largest oil spills have been from tanker accidents. A risk analyst for the petroleum industry association noted that tanker spills are 10 or more times as frequent as blowout spills. He also noted that blowouts and

tanker spills have quite different characteristics, in that tanker spills tend to release most of the oil in a very short time, whereas blowouts have a comparatively low discharge rate that persists over hours, days, or weeks. Tankers also can have a spill anywhere, while blowouts occur from wells at fixed and known locations; emergency response planning can therefore more easily be done for well blowouts than for tanker spills. A consultant to a fishing organization stated it was indicated in the compendium volume *Georges Bank* (Backus, 1987) that any development on Georges would most likely increase tanker traffic, and that the tankers would be smaller than supertankers. He commented that these smaller vessels are known to have more spills than the larger tankers, which will soon be required to be double-hulled.

Pipelines - Many participants from the fishing industry expressed concerns about damage from laying pipelines and the loss of fishing access in their vicinity. As noted in an earlier section, some research has indicated that some fish species tend to congregate along pipelines, thus providing a good fishing area (Meltzer, 1998), though only if it is permissible to fish that close to the pipeline. Several presenters noted the lack of information available on the ability and willingness of lobsters to cross an operating pipeline, a matter of concern since there is evidence that lobsters travel considerable distances. Petroleum company officials said that typically pipelines have some sections trenched and thus there would be some access, but that in any case, a solution could be worked out.

Greenhouse Gas Emissions and Climate Change

Burning any fossil fuel releases carbon dioxide (CO_2), a gas which, along with methane and others, is contributing to anthropogenic (human-caused) changes in the composition of the Earth's atmosphere which many scientists believe are resulting in global effects on climate. These projected changes include warming of average global temperatures and more extreme events and conditions (storms and winds). It is thought that additional impacts could include a rise in sea levels, effects on many species, and, according to one presenter, greater climate instability that could result in another ice age. Canada undertook international obligations in the December 1997 Kyoto Protocol to reduce so-called greenhouse gas emissions by six percent below its 1990 levels by the period 2008-2012. However, Canada's present levels of greenhouse gas emissions are well above the 1990 baseline so the cuts required to meet this commitment are quite a bit greater. It is of interest, though not adding to definitive evidence of climate change, that a study commissioned by the Panel on extreme winds and currents on Georges (COA, 1998) found an analysis of derived wind speed from 1946-1991 showed a long-term trend toward increasing wind speed.

For a number of presenters, the fact that any company was contemplating exploring for hydrocarbons from a new field, especially for export, was seen as a negative step in the control of Canada's greenhouse gas emissions. However, one representative from a large environmental organization said natural gas as a transitional fuel could reduce dependence on coal and oil, which produce more CO_2 than natural gas. He also supported Canada's further development of its natural gas, although not on Georges Bank.

Panel's Comment

Leaving aside questions about the merit or adequacy of the Kyoto agreements, just responding effectively to the international commitment that Canada has now made to reduce greenhouse gas emissions is a complex problem. There are many important economic and equity implications that must be taken into account, and it will take time: major changes in energy supply and demand cannot occur overnight. It is also important to recognize that the role any fuel has in contributing to greenhouse gas emissions depends on exactly what energy sources it displaces or competes with in given markets. And the demand for different forms of energy in turn depends on what technologies are available and economically competitive to deliver the services that energy supplies. In general, natural gas can be seen as a useful transitional fuel away from coal and oil, although it still results in greenhouse gas emissions. More precise analysis depends on specific circumstances; however, there is no necessary conflict between aggressive policy measures to stimulate use of renewable energy sources, energy efficiency and overall reduction of energy use in order to reduce greenhouse emissions and some new hydrocarbon development. All forms of energy, including renewable sources, have environmental effects of varying significance; greenhouse gas emissions, it should be noted, are not the only energy-related impacts of concern.

Natural Gas Use, Flaring, and Environmental Toxicity

The toxicity of combustion products from natural gas was discussed by a few participants. Presenters said that the use of natural gas in the home will significantly increase indoor air pollution from such combustion products as nitrogen dioxide, carbon monoxide, fine particulates, poly-cyclic aromatic hydrocarbons, and volatile organic compounds including formaldehyde. They pointed out that this is of particular concern for those with environmental illness, asthma, and allergies. As well, a number of presenters raised questions about the toxic effects from flaring gas on ocean ecosystems, and pointed to recent concerns about animal and human illness and miscarriages in Alberta, which some feel are associated with sour gas wells and the flaring of natural gas.

4.3 SAFETY AND ASSISTANCE AT SEA

Several oil industry presentations addressed questions of present day rig safety, along with some ancillary benefits from having drill rigs offshore. One presentation focused on the extensive planning for emergency response that one oil company now carries out. It emphasized that personnel training, along with detailed planning for just what should be done in an emergency, minimizes the risk of human injuries, loss of life, and environmental damage.

> ***I think it's really very important to reinforce here that human safety and environmental protection are***

paramount in...our emergency response plans. They come first and foremost. If losses can be minimized, they will. But never at the sacrifice of either safety to the workers involved, the public, or the environment....I think it's fair to say that over the last 10 to15 years, partly as a result of some unfortunate accidents in the offshore...the industry has come a long way in...systematizing our plans to rigorously evaluate the risks that we face. *(Petroleum company official)*

Benefits from having rigs present in the offshore included the availability of helipads and fuel for search and rescue operations, and greater ability to deal with medical emergencies occurring on vessels in the area by transporting sick or injured people to the rig for emergency medical aid.

4.4 CANADA-UNITED STATES RELATIONS

The Canada-U.S. boundary on Georges Bank is a line dividing political jurisdictions, not ecological features. What happens physically and biologically on one side of the international line will affect the other side. This is particularly the case because the seasonal gyre around the Bank sweeps in a clockwise fashion from the Canadian side to the American portion of Georges and back. The Panel heard many comments about the implications of the Canadian moratorium decision on Canada-U.S. relations. Almost all of these comments were from presenters who supported the extension of the moratorium. In general, the petroleum industry and others opposing the extension did not address this topic. A number of participants from the United States also made presentations or written submissions that touched on this subject.

Canadian participants' remarks centred on three main points. First, a number of presenters thought that the Americans had made an assessment that petroleum activities were too risky on Georges Bank, and said that Canadians had no reason to think differently. However, an offshore company official believed that the extension of the American moratorium was not a decision based on scientific evidence, but rather was politically motivated. One American environmentalist who strongly supported the extension of the moratorium on both sides of the Bank also said that the American moratorium was extended because it could be done without putting that country at any strategic disadvantage in terms of oil and gas production. He said the U.S. decision was largely a matter of political expediency rather than careful analysis.

Secondly, there was the issue of being good international neighbors: was it appropriate to subject the Americans to whatever risks there might be from petroleum activities on the Canadian side of the Bank when the Americans themselves had extended their own moratorium until 2012? Some presenters raised questions about whether international cooperation on unrelated issues, such as fisheries management, would suffer if Canada lifted its moratorium. A university-based medical doctor said that the moratorium was a golden opportunity to initiate regional resource management, a point echoed by a Massachusetts coastal zone management official.

...the New England Fishery Management Council has recently completed the designation of certain areas as "essential fish habitat" (EFH)....essential fish habitat for several of the most economically valuable species, including Atlantic cod, haddock, sea scallops, and yellowtail flounder abuts the Hague Line....The National Oceanic and Atmospheric Administration (NOAA) administers the ...Stellwagen Banks National Marine Sanctuary in the Gulf of Maine to the west of Georges Bank....Although the exploration for and development of oil and gas are banned in the sanctuary, sanctuary resources may be harmed by petroleum spills in surrounding areas, including Georges Bank. *(Senior United States Department of Commerce official*)

Finally, many representatives from the fishing sector emphasized the importance of the American market to their industry. They expressed concerns about the potential losses of that market if Nova Scotia fish were perceived by Americans to be unsafe or tainted; and they raised questions about potential retaliatory economic measures by the Americans if their own fishing industry was in any way harmed by Canadian petroleum activities. However, another presenter from the industry was skeptical about these fears, stating that the demand for fish was strong and that Canadian fish were needed in the Boston and other American markets. Nevertheless, there is a persistent fear on both sides of the border that fish stocks, fish quality, and marketability could suffer from many factors that are beyond the control of fishermen.

The material I've given you relates to the problem we had in the late '80s with domoic acid in mussels...When you have an opportunity to look at it, you'll see that it clearly indicates that the impacts went far beyond mussels, went far beyond shellfish, and related to all fish generally. A significant number of people actually stopped eating fish altogether as a result of a particular problem, a naturally occurring problem, with mussels in one particular area. *(Fishing industry association representative)*

The American submissions and presenters, all of whom opposed lifting the moratorium, added other dimensions to this discussion. While all acknowledged that it was Canada's sovereign right to make its own decision, most pleaded for sensitivity to the value of the shared biological resources of Georges. One Massachusetts official noted that, because of prevailing currents, Canada stood to gain whatever economic benefits might flow from petroleum activities, but that American fishermen would be likely to experience the brunt of any negative impacts. An American conservationist indicated that his organization saw Canada's new *Oceans Act* as providing an example of excellent leadership in its emphasis on marine conservation and protected areas. He stated that Canada's moratorium provided political support for conservation efforts in the United States, particularly since the American moratorium was by executive order and could, therefore, be lifted at any time.

As you are well aware, Georges Bank supports...valuable commercial species. Endangered species including the right whale, humpback whale and sei whale rely on Georges Bank and the surrounding area for feeding and as a migratory pathway....(NOAA), the federal agency charged with protecting marine resources, has warned that oil and gas exploration in either the Canadian or the U.S. portion of Georges Bank threatens these commercial and endangered species....We fully support the U.S. moratorium on oil and gas exploration on oil and gas exploration in the U.S. portion of Georges Bank, which President Clinton has extended until 2012. *(Massachusetts Congressional delegation)*

4.5 PRESENT PETROLEUM REGULATION AND VOLUNTARY INITIATIVES IN THE OFFSHORE

Regardless of the outcome of the moratorium question, the offshore of the East Coast is seeing considerable petroleum activity, and a regulatory regime is in place and has now been functioning for about a decade. The Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) is the principal regulator of petroleum activities in the offshore. When natural gas comes ashore other regulators become involved, including the Utilities and Review Board in Nova Scotia and the National Energy Board. The Panel heard comments about the offshore regulatory regime concerning three themes: the stringency or effectiveness of regulatory requirements and the science on which decisions are based; consultation and liaison practices; and compensation issues.

Regulatory Effectiveness

Several participants, both from the fishing sector and the oil industry, supported the general approach and effectiveness of the CNSOPB.

The vast difference between 1987 and '88 and the situation today in 1999 is the regulatory mechanism that was in place....Today with the CNSOPB it's a totally different scenario. They bend over backwards to try to communicate with the fishing industry. *(Representative of the fishing industry)*

The Panel also heard comments from many presenters about certain specific issues. For example, it was said that oil-based drilling muds would be largely phased out by 2000. Most welcomed this. Others also said that re-injection of muds, cuttings, and produced water should be considered by the CNSOPB. Several wondered why petroleum company participants had not presented more possibilities for restricting discharges from a rig by re-injection or land-based disposal. One drilling rig company official stated that some rigs now operating in Nova Scotia had been designed to be "zero discharge" rigs. However, petroleum company officials raised concerns about cost, safety of personnel, increased rig time on location, additional marine traffic, and the difficulty of siting areas for remote disposal. They added that in the case of exploration drilling, it was not technically feasible to reinject muds and cuttings.

A number of drilling rigs, such as the Rowan Gorilla II and the Rowan Gorilla III operating here in Nova Scotia, have been designed to be "zero discharge." This can involve no discharge of drill muds and cuttings or the installation of drip pans, scuppers, and a variety of other structural features to capture all runoff and spilled materials on the platforms. All such material is temporarily stored on the rig and then transported back to shore for disposal. *(Drilling rig company official)*

A number of participants, however, noted that the CNSOPB was designed to mandate and control offshore activities, not to limit them (see discussion in 4.1).

...I talked to a biologist...who's responsible for assessing the impact of oil and gas development [in the North Sea] and they're asked to review, well, what will be the impact of this one rig on this one piece of ocean bottom. And they look at it and say, well, no, I guess we have no records of herring spawning there, that's not a known cod feeding ground; therefore I guess we can't cite any major impacts. And so that project's approved and a hundred other ones are approved. Then somebody comes along with a proposal to extract sand and gravel, and they can't point to any particular, specific impact that that might have....But what you end up with, assessing all these individual projects....one day you wake up in the morning and you've got a degraded ecosystem and you wonder how you got there. *(Environmental organization representative)*

Some presenters singled out the need for more ecosystem-based fisheries research to develop a better understanding of potential impacts. One fishing association representative gave the example of the need to better understand the food webs and the impacts of petroleum activities on non- commercial species, such as the sand lance, in order to better understand potential effects on commercial species that feed on it. Others discussed the urgent need for better marine science based on an ecosystem approach in the context of making regulatory decisions.

Eighty-five percent of ocean pollution is land based, highlighting the need for an ecosystem approach. There are major gaps in the basic biologic knowledge of most marine species. There is no complete marine ecosystem classification, meaning that marine ecosystem science is poorly understood....The crisis of knowledge in oceans science means there is a crisis of knowledge in environmental review. *(Medical doctor)*

Panel's Comment

More ecosystem-based research is needed to manage not only petroleum activities but approaches to fisheries management and conservation planning in the marine environment.

Consultation and Liaison

A number of presenters recognized that the CNSOPB had made considerable efforts to

consult with environmentalists, fishermen, and others, and had set up specific committees to do so. This was widely seen as a positive step.

However, all has not gone smoothly. Several presenters from the fisheries sector were unhappy about the cancellation of the fisheries observer program at the COPAN site. One environmental group representative talked about the demands of unpaid CNSOPB committee work, and of keeping the environmental community informed about such work. A fishing sector representative also acknowledged that neither fishing interests nor the petroleum companies had been particularly good at keeping local communities informed about actual experience in Nova Scotia with offshore activities. Several oil company officials discussed their own companies' extensive efforts to consult with people in southwest Nova Scotia, pointing to, for example, bringing in fishermen's representatives from Scotland who had had experience with offshore oil and gas activities. Most presenters acknowledged that efforts at consultation are better now than in the past.

Compensation

The ongoing negotiations for a voluntary compensation regime for damages from petroleum-related activities are currently under way between fishing industry representatives and the Canadian Association of Petroleum Producers (CAPP). CAPP has indicated that it is ready to set up an agreement not only for damage attributable to a particular company or incident, but also for damage from an unknown source. However, a number of issues remain contentious, notably compensation for loss of fishing access and for damage to resources from spills and discharges. These programs would not cover seismic operations done by an independent operator who was not a member of CAPP. A union leader for fishplant workers expressed concern about the availability of compensation for laid-off workers, as distinct from fish plant owners, in the event of a fisheries closure from a spill.

5 Approaches to Decision-Making

In addition to information on Georges Bank and the fisheries, on petroleum activities and their effects, on the "valued ecosystem components" (VECs), and on related issues identified by participants in the review, the Panel heard a great deal of comment on how to approach the question of the moratorium. This chapter focuses on the approaches and principles put forward in presentations and submissions on this topic, and also provides discussion and comment by the Panel. It should be noted that the term "decision-making" refers to the general process of reaching a conclusion, regardless of whether this is done by the Ministers, the Panel, or the participants in this or any review. The actual decision about the Georges Bank moratorium, however, will be taken by the responsible Ministers, as discussed in Chapter 1; the Panel's role is advisory.

Determining an approach to decision-making–that is, how to frame the issues and how to consider and weigh information – is not a question unique to this review. The environmental and socio-economic assessment process, of which the Georges Bank review is a special and unusual example, began more than 25 years ago in Canada. Environmental assessment of projects (which today includes socio-economic as well as environmental impacts) is intended as an aid to decision-making that systematically considers the effects of a proposed activity in a particular location. It has thus become a flexible, site-specific supplement to environmental laws that impose across-the-board controls on products, emissions, or activities. In addition to project reviews, other applications of environmental assessment have included reviews of all activities of a certain type (generic or class reviews); reviews of conceptual proposals, such as the federal review of deep geologic disposal of high-level nuclear waste; and policy reviews, which are rare.

Despite many years of fine-tuning these assessment processes, no rules for coming to conclusions about recommendations or making decisions have been laid down. Panels and other decision-makers have considered their conclusions individually, without any decision rules such as, for example, those used in civil law that require the plaintiff to prove the case on the balance of probabilities. This flexibility is consistent with the Canadian approach of tailoring environmental assessments to many different circumstances. In the Georges Bank review, which was designed to help Ministers address a policy decision, many participants on both sides of the question expressed strong opinions on how to approach that decision. Since much of the factual material on exploration and drilling impacts was fairly general, these views on analytical and ethical approaches were often centrally important in presentations.

However, only a few participants made lengthy, sustained arguments about the best approach to decision-making. Instead, such comments tended to be embedded in statements and observations, and sometimes were expanded upon in response to questions by the Panel. This chapter is thus based on themes observed by the Panel, rather than clear and pointed disagreements. The approaches discussed are just that: they are not mutually exclusive, but they do represent distinct "takes" on appropriate ways to approach this and similar decisions. And while this chapter attempts to draw out and categorize these perspectives in a manner that makes sense for this review in particular, the Panel hopes that the discussion may also prove generally useful.

5.1 SCIENCE, REGULATORY DECISION-MAKING, AND THE BURDEN OF PROOF

The Georges Bank review is unique in that it addresses what should happen after the expiry of the legislated moratorium in January 2000: should petroleum activities be allowed under the existing regulatory regimes, or should petroleum activities on Georges be approached differently?

Whether a regulated activity proceeds depends on what might be called the burden of proof in that particular regulatory situation, and there is a continuum of these different regulatory contexts. For many kinds of activities, especially those involving permits or licenses such as building permits, the requirements are clearly laid out and if they are met the permit will be issued automatically. For other regulatory decisions, such as the licensing of new drugs or the decisions of regulatory agencies like the Nova Scotia Utility and Review Board or the Canadian Radio, Television and Telecommunications Commission, the outcomes of specific applications are more a matter of judgment. However, even for these latter examples, the regulatory regime permits these activities in general to go forward. It nearly always takes a deliberate political decision to ban regulated activities.

In other words, in routine environmental and other regulation, the "default" assumption (to use the language of computers) is that the regulated activities are allowed. In the case of environmental project assessments, it is extremely rare to reject a project outright. Usually, scientific evidence pointing to potential damage from the regulated activities must indicate substantial harm and be conclusive or at least powerfully suggestive in order to overcome the "default" assumption and

halt the application. Presenters from the petroleum industry supported the present regime for regulating petroleum activities. However, a number of other presenters argued that the normal regulatory regime would not place an adequate "burden of proof" on the proponents of petroleum exploration on Georges.

> ***I am concerned we will be unable to find that path to wisdom...as a consequence of the way the debate itself is framed....The underlying assumption is that, in the natural course of events, oil and gas exploration followed by drilling and field development will, and indeed should go ahead....Make no mistake about it, the moratorium is an aberration, a departure from the normal operating procedure in resource development. The exploitation of untapped resources promotes economic growth and, of course, this is progress. I am not against progress. But equally, I am not convinced that, in this instance, this type of progress either promotes or serves the public's interest.*** *(Citizen)*

In the Georges Bank review, the Panel heard a number of presentations that reviewed or were based on the results of scientific studies. The Panel was also told by a number of presenters on both sides of the moratorium question that the decision should be based on science.

> ***My recommendation...is that you turn a deaf ear on politics and emotions across the border, and that in coming to your decision you focus on good science, fact, and the real, not imagined, risks associated with offshore oil and natural gas development.*** *(Offshore company official)*

> ***Does oil and gas exploration affect in any negative way the rights of fishermen to sustain their livelihood?...this question, I believe, can only be properly answered by having long-term, unbiased, scientific studies and analysis done by experts in the field.*** *(Member of Parliament)*

At issue is just exactly how science can be used in the decision. Scientific research by its nature narrowly defines the question under study. There is strict adherence to drawing only tentative and limited conclusions that do not go beyond the data that is generated, and this attitude is a fundamental part of the culture of science. However, this makes the usefulness of scientific studies to policy decisions more limited and complex than many would like to assume.

> ***Now I am a scientist...and I understand the limitations of the work that I do....The problem...isn't who does the research but that between formulating a question and arriving at a conclusion [in a scientific study], there are many subtle points by which the conclusion may, in fact, be invalidated or, even more, it may be made inapplicable to a particular policy decision.... Something about the way the question was structured, the way the data was collected, prevents us from using the conclusion in the public decision-making arena.*** *(Scientific consultant to the fishing industry)*

> ***I would also suggest that opinions regarding the moratorium are quite polarized, because the best available scientific information regarding the impact of oil and gas activity contains too many uncertainties to allow a clear consensus to emerge.*** *(Fish company official)*

Besides the inherent limitations of scientific studies, some presenters were concerned about the lack of scientific research that looked at the ecosystem, along with impacts on it, as a whole.

> ***I would stress that most research work on the risks of offshore oil and gas activity have been of two types: first, acute, short-term toxicological studies limited to a few targeted species; second, laboratory models of the effects of drilling muds on selected life stages of a few species. Long-term studies are lacking on the effects of seismic activity, flare residues, and operational discharges. In biological systems, these long-term studies are often the most important....The major criticism, however, is the lack of an ecosystem or holistic approach to marine research.*** *(Medical doctor)*

In this context, many participants said that it would be appropriate to invoke the Precautionary Principle that was articulated in the Rio Declaration and is also referenced as a strategy principle in the *Oceans Act*. Many presenters invoked this principle, and argued that it was preferable to err on the side of caution and extend the moratorium, in the face of a lack of definitive scientific information proving that petroleum activities would cause no harm to the biodiversity, productivity, and fisheries of Georges.

5.2 PROCEEDING FROM FIRST PRINCIPLES

Many participants discussed or mentioned their views on the rights of different resource users (fishermen and the petroleum industry in particular), or their perspectives on priorities concerning resource exploitation. In essence, this approach was about asserting the priorities and the legal and/or moral rights of actual or potential users of Georges Bank as critical determinants of whether the moratorium should be lifted or extended.

Legal and Moral Rights

Both mineral rights and the regulation of the rights to harvest marine biota belong to the Crown in Canada. In effect, this means that both oil and gas exploitation and fishing start from a position that these industries have basic rights to be

considered in determining the future uses of Georges Bank.

Several presenters pointed out that humans are part of the natural world, and that this implies to a moral obligation for societies to protect the existence, habitat, and health of other species, as well as self-interest in maintaining the ecosystems that support human populations.

> ***...how did you ask for consent among the actual permanent residents and those whose livelihood really depends on the Georges Bank? And I'm talking about the living things who live there full time, the seabirds, the whales, the fishes, the clams, even the plankton. These living beings, this is actually their home....I believe that it's in the best interest of humans to, instead of always asking what is in the best interest of humans or even one group of humans versus another, that we develop a process of decision-making that looks at what is the best for the entire system of life.*** *(Environmental and health advocate)*

The oil and gas industry asserted that it did indeed have a right to exploit mineral resources on Georges, but that it was its practice and intention to consult and co-operate with other interests. Its use of the Bank would bring jobs, economic benefits, and more diversification to the region and would, overall, be in the larger public interest.

> ***And since 1990,...both industries have continued to build a solid foundation for peaceful co-existence within the marine environment. And today, as a result, there exists an extensive and effective process for inter-industry liaison in Atlantic Canada. This bilateral process is predicated on the assumption that...both the fishing industry and the petroleum industry are legitimate users of the sea and the seabed, an acknowledgment that they share a common interest in achieving a successful co-existence.*** (Consultant to the petroleum industry)

Many fishermen and other representatives of the fishing sector, however, pointed out that their industry was there first and that, in the 1984 decision on the Canada-U.S. boundary dispute, the historic use of Georges by Canadian fishers was a major factor in the International Court of Justice's decision to award the northeast portion of the Bank, with its lucrative fishing grounds, to Canada. As well, a fishing industry consultant stated that legal tradition accords rights to existing activities, and that a new activity must accommodate itself to ones that are already there. That same consultant noted that in the ocean, fishing is treated as being based on a common property resource that involves rights of use ("usufructuary rights") rather than the kind of freehold ownership rights that landowners have over their legally owned property. He also stated, however, that fishers should have rights of access to the marine resource based on prior traditional use. A number of other presenters also pointed out that equal rights for the fishing and petroleum industry would mean in practice that fishers would have to give up access and rights they now have. In fact, there was considerable discussion about ongoing efforts to come to an agreement by the two industries on the issue of compensation for loss of fishing access, though this has not yet been resolved. It was pointed out that the existing compensation agreements are voluntary and do not cover this issue.

> ***...both the Hibernia and the Sable agreement have recognized that both industries have a right to exploit and be involved in the marine environment. Notwithstanding that fact, because of the established traditional rights of the fisheries and because of the nature of those activities being extensive as opposed to site-specific [as is the case] for a petroleum company, the Atlantic Accord Acts have recognized that if offshore oil activities result in actual economic loss to a fishing company or to any marine stakeholder, presumably, then compensation would be due...*** *(Consultant to the petroleum industry)*

]

Despite the ongoing discussions being held by the petroleum industry and the fisheries sector in the Atlantic offshore under the auspices of Fishery Liaison Committees (FLCs), the nature of the two industries' respective rights has not been settled.

> ***With respect to principles, we did sort out a set of principles in the SOEP [Sable Offshore Energy Project] context. Those principles do not speak to the respective rights of the two sectors, the fisheries and the petroleum sectors. We have not reached agreement...on principles. And the reason we have not...is primarily because of this rights question....*** *(Fishing industry representative)*

Finally, one presentation focused on the impacts of a spill or other accident on the fish processing sector, and said that, even with compensation programs, rights to financial protection in such an event are lacking for fish plant workers.

Sustainability

A frequent theme of many presenters was that sustainable development should be a touchstone concept for human society; and indeed, many noted that it is cited as one of the strategy principles in the *Oceans Act*. Often defined in terms of "meeting the needs of people today without compromising the ability of meeting people's needs in the future," its core values emphasize that economic development must maintain environmental integrity while addressing poverty and human needs. Basic economic principles are that renewable resources must be managed sustainably, and that the depletion of non-renewable resources like oil and gas must proceed no faster than substitutes can be found.

However, some interpreted these sustainable development principles concerning resource use to mean that non-renewable resources should be replaced by renewable ones, although without addressing the vital issue of the time scale that would be required for this substitution.

> ***...in terms of natural resources, the basic principles that are accepted in ecological economics are that with***

non-renewable resources like oil and gas a depletion of that resource should occur no faster than the potential to find renewable resources to replace that non-renewable resource. *(Economic researcher)*

Presenters from the petroleum industry did not discuss the sustainability of resources, but emphasized the creation of a corporate culture that considered social and environmental values in its business decisions.

...we created a program called "Protecting People and the Environment." This is not just some fancy slogan, but it's the basis for...detailed operating philosophy....The program is designed to achieve health and safety leadership and environmental excellence. It sets a common structure for our operating systems worldwide. It emphasizes continuous improvement....We take this responsibility extremely seriously... we stake 50% of our employee bonuses on implementing this system and on overall safety performance. *(Petroleum company official)*

A number of presenters also said or implied that the fact that the biological resources of Georges should be sustainable indefinitely means that, in any balancing of the interests of the petroleum industry and the fisheries, the higher need is to protect the biological resources.

Because of the renewable nature of the fisheries resource, it must have a higher order of significance as a legitimate economic pursuit than one which has a limited, finite...potential. *(Fishing industry representative)*

Renewable resources, in other words, ought to take priority. For many presenters, those interests should also, therefore, carry greater weight in reaching a conclusion about the moratorium.

5.3 RISK, EQUITY, FAIRNESS, AND NEED

Other intertwined themes in approaching the moratorium question were related to risk, fairness, and the public rationale or need for hydrocarbon development on Georges. Although no participants said that a formal cost-benefit or risk-benefit analysis would be particularly useful in making a decision, an informal weighing of potential benefits and risks with considerations of equity and need was part of many presenters' thinking.

Risk

Risk is defined as *hazard times probability.* What this means is that risk is a product of two factors. The first is the *hazard*, or the harm or damage that could potentially happen; this can be economic as well as environmental or physical harm. Hazards are often discussed in terms of an *event* and its *consequences*. The other factor is the *probability*, or the statistical likelihood that that particular damage will actually occur. Probability estimates are based on how often the hazard has been observed to occur over a given period of time. Risk analyses, in which the components of risk in a specific situation are formally identified and calculated, are particularly useful in engineering, in financial decision-making and auditing, and in the insurance industry.

An understanding of the concept of risk can also help to illuminate the choices involved in various situations. For example, planning for prevention and mitigation would probably be significantly different for a risk with a high probability of occurring, but with minor environmental consequences, than for a low probability event with major consequences. Risk-benefit analysis identifies and sometimes attempts to quantify both the risks and the benefits associated with a particular course of action. Its use is most straightforward when both the risks and benefits affect the same actor, for example in choosing a course of medical treatment or in making an internal decision in a company. As discussed in the following sections, the ethics and acceptability of risk are usually seen differently when there are different sets of players who are affected.

As well, it should be noted that the consequences of identical events with identical probabilities of occurring can still vary. With environmental risks, for example, the consequences of the same event can be significantly different if it takes place in a highly sensitive environment, or if it affects different species or life stages of animals. Similarly, the impact of the failure of a particular company on investors who have the same dollar-value of investment at risk can be dramatically different, depending on their individual overall assets. In business ethics, a distinction is made between pay-off risks, in which a portion of income is at stake, and capital risks, which involve the risk of a firm's assets. Capital risks are ordinarily considered unacceptable ("never bet the company") because of the importance of the potential loss, regardless of either its low probability or, conversely, of the possibility of high gains (Di Norcia, 1998). A number of presenters discussed the risks from petroleum exploration primarily in terms of the magnitude of the potential impacts in this particular situation.

...fishermen are finding it [hard] to pay the costs of going fishing when their landings have been cut to fractions of their historic levels....Boat payments, crew incomes, the sheer cost of doing business...when it comes to rigging the boat, keeping the boat, paying for the boat, are very, very high and they have not gone down. Livelihoods are precarious. Future is at risk if even the smallest changes occur. *(Fishing industry representative)*

In a related discussion, some presenters also made the argument that the costs of being wrong in choosing whether to lift or extend the moratorium were very unequal. They stated that, if the moratorium were retained but that concerns about potential harm proved unfounded, the fishery would remain undisturbed. The oil and gas industry would lose a possible present opportunity, but any petroleum resources would remain in place for the future. On the other hand, if the moratorium were lifted on assurances that adverse effects would not occur, yet these did happen, the potential losses to the fishery could be large.

Equity and Fairness

A point that was frequently commented on related to who would bear the risks and who would gain the benefits if petroleum exploration were to proceed on Georges.

Some presenters, as noted in Chapter 4, emphasized the need for new local jobs and economic development in order to maintain existing community infrastructure, and said that petroleum activities could help achieve these benefits for local people and communities. However, many from the fishing industry pointed out that they would have to bear the risks, along with the communities that depend economically on the biological resources of Georges and related industries. They asserted that allowing new risks to their industry, especially when it was recovering from recent stresses related to overfishing, downsizing, and new management practices, was not a fair burden to put on the most important local industry in southwestern Nova Scotia.

> ***...to put the livelihoods of so many people on the South Shore and Southwest Nova at risk for something we don't need at this time and something the fishing industry and fishermen will receive no benefit from seems to be unfair...*** *(Fishing sector representative)*

Many presenters stated that the main beneficiaries of hydrocarbon exploration would be the offshore and petroleum industries, and that, in the event that natural gas were discovered, most of the local economic benefits would flow to New England, where the gas would be likely to come ashore by pipeline. It was also noted that those who would have to bear potential economic risks would include communities in New Brunswick and the New England states, and that the American National Marine Sanctuary area of Stellwagen Bank would be at increased environmental risk.

Need

Both Nova Scotia's and Canada's environmental assessment legislation require proponents to address alternatives to proposed undertakings. In the case of the federal law, which applies to government agencies, there is thus some onus on the government department involved to look for less environmentally damaging ways of accomplishing its ends. Since these ends involve public policy which is, overall, intended to further the public good, it is possible to review whether one goal of public policy – environmental protection – was adequately considered by the proponent in determining that there was a need for that particular project. The trade-offs all involve various broad public policy objectives, such as lower cost to taxpayers versus a higher level of service. However, in assessing private sector activities it is harder to address this question of need meaningfully, since the purpose of most projects under discussion is to make a profit. So long as what they are doing is legal, companies are entitled to make their own decisions about how best to run their businesses. For this reason, consideration of "alternatives" usually refers in this case to project design alternatives, rather than to the more fundamental question of the need for that specific project.

Those favouring the lifting of the moratorium discussed this issue of need in terms of markets and projected demand for energy.

> ***Our exports of oil and gas are strong and they are set to grow further.... With respect to the potential growth of that market...projections for U.S. natural gas consumption are that between now and the year 2020, U.S. consumption will grow from current levels of 23 trillion cubic feet to 27 trillion cubic feet. It's clear...that a significant portion of that natural gas will need to come from Canada.*** *(Petroleum industry representative)*

Presenters also pointed to community economic benefits that could flow from oil and gas activities, and a few thought these benefits could be very important to the future of the province and local communities.

> ***However, after careful consideration of all the issues...and if those benefits can be obtained after sufficient information is generated [for] a proper evaluation of the risks,...then the potential exists to enhance the overall economic viability of the province of Nova Scotia, and that opportunity, in our view, should not be denied to those who are unable to share in the benefit of the water column marine resources.*** *(Fishing industry representative)*

However, although the subject of the need for these petroleum activities was touched on by many presenters who supported extending the moratorium, there was only general discussion with little precision about what "need" would mean in this context. It was usually implied that it referred to a clearly discernible and overriding public need. Many stated that there was no existing or foreseeable shortage of hydrocarbons on the world market, that other areas for exploration were available, and that there was no national or international crisis affecting supply. For these reasons, they felt, public need was insufficient to outweigh public risks.

> ***In our view, the highest and best use of these areas [of high productivity, like Georges Bank]...is related to their biological potential, not their geological past...We believe it's irresponsible to put this renewable***

biological engine at any risk in the absence of two interrelated justifications, first, a compelling, overriding public interest and, second, no practicable alternatives for a source [of energy].
(Conservation organization official)

5.4 PRIORITIES AND SCENARIOS

Key values and priorities, particularly when used to develop checklists, benchmarks, and indicators, are used in many formalized decision-making processes. The use of scenarios as aids to decision-making is not new, but it is probably more widely used now than in the past in part because of the power and ease that modern computers bring to scenario development. However, these two approaches – checklists of priorities and scenarios – involve quite different analytical stances and thought processes, though they can be used together. Presenters frequently alluded to scenarios, priorities, and values, but the following discussion is drawn from the Panel's observations on these subjects.

Priorities
A classic use of priorities to structure decision-making is the use of "valued ecosystem components" – VECs – in many environmental assessments. This standard approach involves identifying the VECs, and then going through the various impacts of the proposal on the checklist of VECs to identify potential harm and mitigation possibilities. This requires assumptions about cause and effect, but the interactions it describes are discrete rather than synergistic, complex, or cumulative.

However, values, benchmarks, priorities, or VECs can also be used in other ways to aid decision making: specifically, to assist in the construction of scenarios for the future.

Scenarios
Scenarios involve painting a picture of the future. In classic environmental assessment theory concerning projects, there are two futures that are implied, if not actually described – the future with the proposed project, and the future without it. Environmental assessment of projects is thus related to predictions about those futures, and scenarios can be used to help develop these predictions in detail.

Scenarios, however, can also be used to describe possible desirable or undesirable future states, or they can be exploratory "what if?" constructions. The importance of scenarios as a tool here relates more to the mental approach required to envision the future, rather than to any formal processes to create fully developed scenario descriptions. This approach is quite unlike going down a checklist, which is linear, hard-edged, and analytical. Using scenarios in decision-making means actively trying to find more coherence or a "better fit" with the body of existing information, lack of information, argument, and identified values. It also means trying to draw out as many connections and interactions from the available information as possible. To get inside a scenario and make sense of its overall implications and consistency requires an intellectual act of construction; it is grounded in a kind of logical thinking that is similar to that used in some new technology. Using scenarios as a tool thus employs a different set of skills from the objective, rigorously skeptical approach that focuses on clear evidence to test or disprove separate assertions of fact.

Both approaches are of course useful in evaluating choices, but, as many presenters pointed out, valid, objective, and definitive evidence is usually rare. When information is patchy, incomplete, and inconsistent, which is often the case in public policy decisions, an approach that also uses scenarios to consider how the existing information comes together or "adds up" can be quite useful. This is also true when many various possibilities for the future need to be examined, as, for example, with cumulative environmental effects.

5.5 PANEL COMMENT

All of the approaches discussed in this chapter have some important insights that are relevant to conclusions and recommendations on the future of the moratorium.

Conclusions

The Panel's conclusions in this section are structured to correspond to the five chapters of the report. For a more detailed listing of topics and information presented to the Panel and discussed in the report, please refer to the Table of Contents.

BACKGROUND AND PROCESS
The Panel had the task of conducting a public review of the environmental and socio-economic impacts of petroleum exploration and drilling on Georges Bank. The main issue that formed the background for the public review was whether the existing legislated moratorium, which ends on January 1, 2000, should be extended or allowed to expire.

Although there was no environmental impact statement (EIS), there was nevertheless a great deal of available information from experience and research on Georges Bank. Scientists from the Department of Fisheries and Oceans (DFO) and officials from the Canadian Association of Petroleum Producers (CAPP) and the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) assisted in making a body of research and other relevant material available to the Panel and the public. The Panel also commissioned a number of studies and short summaries of information.

Panel's Conclusions:
- The review engaged a broad cross-section of individuals and organizations in the process, especially in the hearings; participants were keenly attentive and the quality of the briefs was outstanding.
- In terms of norms and requirements for an effective public review, the Panel is confident that issues were well-canvassed and that, generally speaking, participants were well-prepared to understand the issues and to make their views known.
- A substantial majority of presentations from people in the communities of southwest Nova Scotia expressed significant concerns about petroleum activities on Georges and recommended extending the moratorium, though accepting petroleum activities elsewhere in the Atlantic offshore.

GEORGES BANK TODAY
Georges Bank is a large, shallow, biologically diverse and highly productive bank on the outer continental shelf of eastern North America. Canada and the United States share jurisdiction over Georges; about one-sixth of the Bank lies on the Canadian side of the boundary and includes the northeast portion known as the Northeast Peak. The Bank is heavily exploited for a number of commercial species of fish.

Although its hydrocarbon potential is not clearly known, the probability that any hydrocarbon finds would be natural gas is 85% or greater, and 10-15% that discoveries would be light oil or condensate. The Geological Survey of Canada has estimated that there might be some 60 million barrels of oil, and about 1.3 trillion cubic feet of natural gas, with the possibility of larger reserves.

Panel's Conclusions:
- Georges Bank is an area of exceptional ecological value.
- Its valuable and fully-exploited fishery is of very great economic, social, and cultural significance to southwest Nova Scotia.
- Other important fisheries that are carried out elsewhere than on Georges Bank are based on fish stocks that are ecologically connected to Georges.
- Georges Bank requires special consideration for measures to ensure its conservation and protection.

EXPLORATION AND DRILLING
The methods used to delineate geological features under the seabed to determine whether hydrocarbons might be present include seismic surveys and exploration drilling.

Panel's Conclusions:
- The available information on the impacts of seismic surveys is generally sparse; there is some credible evidence that fish catchability can be affected. Caution is called for.
- There are potential conflicts with fishing during seismic survey operations; for any period of seismic and drilling operations, there would be inconvenience and temporary disruption to fishing patterns.
- Drilling muds and other discharges pose some hazards to marine life and productivity.

RELATED ISSUES
Participants identified a number of issues related broadly to the future of oil and gas activities on Georges, including, among others, a set of widely accepted priorities related to the future of Georges; cumulative and remote impacts of petroleum activities; and Canada-U.S. relations.

Panel's Conclusions:
- Conservation and protection of habitat and of biological diversity, productivity, and resources, especially the fisheries, should be the highest priority for Georges.
- Georges Bank, or portions of it, could be a candidate area for Marine Protected Area status.
- It would be more difficult to initiate new conservation approaches that involve the zoning of activities if petroleum activities were allowed on Georges.
- Cumulative effects of exploration include field development and

production, which, should these occur, could have significant impacts on the biota and fisheries of Georges.
- If commercial quantities of oil or gas were discovered, development and production would eventually follow; it would be inappropriate to permit the associated risks on Georges.

APPROACHES TO DECISION-MAKING

"Decision-making" in this context refers to the general process of reaching a conclusion, regardless of who makes that determination. The actual decision concerning the moratorium will be made by the responsible Ministers. Many presenters expressed views and constructed arguments about the ethical considerations or other fundamental concerns involved in taking that decision.

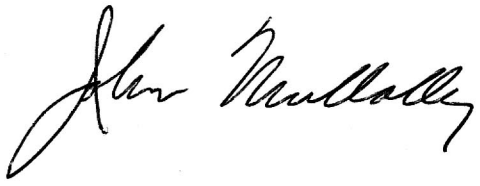
Panel's Conclusions:

- In considering risks to Georges Bank, the unacceptability of potential harm is the most important factor.
- The arguments that point to the great value of Georges Bank, ecologically and as a fishery, weighed against a lack of public need for and limited benefits from petroleum exploration are persuasive.

Recommendation

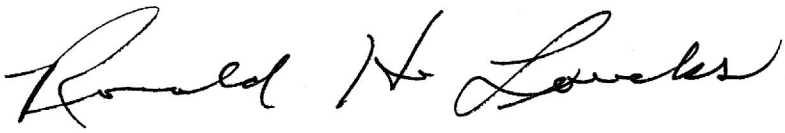
PANEL RECOMMENDATION:

The Panel recommends that action be taken to have the moratorium on petroleum activities on Georges Bank remain in place.



John Mullally

Susan Holtz



Ron H. Loucks

Glossary
of Acronyms, Words, and Phrases

Barite - A heavy mineral commonly used in drilling muds

Benthic - Related to the sea floor or bottom-dwelling

Benthos - Plants and animals living on or in the bottom of a lake or sea

Bentonite - A clay mineral that is used in drilling muds

Bioaccumulation - The concentration of a contaminant that is dispersed in the environment in the organs or tissues of organisms in that environment

Bioconcentration - Bioaccumulation of a contaminant through water uptake alone

Biodiversity - Biological diversity, i.e., the existence in a particular location of a wide variety of species of plants and animals

Biomagnification - Bioaccumulation in which the concentration of the contaminant increases at every level of the food chain

Biomass density - The total mass of all the organisms in a given location

Burden of proof - A legal term referring to the obligation to prove a statement or argument

CAPP - Canadian Association of Petroleum Producers

CNSOPB - Canada-Nova Scotia Offshore Petroleum Board

Condensates - The lightest liquid fractions of petroleum

Confidence limits - The probability that a result of a stated precision will occur. If the confidence limit is 95% that the mortality in a bioassay is between 50% and 60%, then this outcome is likely to be repeated nineteen times in twenty, i.e., this observed effect is likely real and not a "false alarm"

Convergence (surface) - the meeting of two water bodies, often accompenied by a down flow

COPAN - Cohasset-Panuke project near Sable Island, producing light oil

Copepod - A type of zooplankton which is a small crustacean

Cuttings - In drilling, the small pieces of rock produced by the crushing action of the drill bit, typically with particles the size of sand grains and smaller

Demersal fish - Fish living on or near the bottom of the sea or lake

DFO - Department of Fisheries and Oceans

Dinoflagellate - A type of phytoplankton, usually a one-celled organism

Drill cuttings - See Cuttings

Drill or drilling rig - In the offshore, the moveable vessel and equipment used to drill wells for hydrocarbon exploration, development, and production

Drilling fluid or mud - In drilling for hydrocarbons, a mixture of materials including clay, lubricants, chemical additives, and barite which is circulated down and back up the drill hole; it is used to lubricate the drill bit, maintain pressure, and carry the drill cuttings to the surface

EA - Environmental assessment; usually includes socio-economic components as well

EIS - Environmental impact statement

Exclusion zone - The area around an offshore drill rig in which other vessels are not permitted; in the Canadian offshore, it is 500 metres in radius for jack-up rigs and about 1000 metres for semi-submersible rigs, depending on water depths and anchor location

Filter feeders - Animals such as scallops and corals which feed by straining tiny particles from the surrounding water

Flocculate - Clump together (e.g., particles)

Formation water - Briny water, often with various naturally-occurring contaminants such as heavy metals, in the rock formations which may also contain hydrocarbons

Front - As applied in oceanography, refers to a sharp boundary between water masses of different properties

GESAMP - The Joint Group of Experts on the Scientific Aspects of Marine Pollution

Greenhouse gas - Any of a number of gases in the Earth's atmosphere which together trap heat; the concentration of these naturally-occurring gases is increasing in the atmosphere due to human activities, including through burning fossil fuels, which releases carbon dioxide, and through the release of methane in natural gas production

Groundfish - Fish which mostly live and feed on the sea bottom, such as cod, halibut, and flounder

Hazard - Harm or damage; a component of risk

ICCAT - International Commission for the Conservation of Atlantic Tunas

Jack-up rig - A type of drilling rig which is used in relatively shallow water and which rests on its legs on the bottom

Jurassic - The geologic period which extended between 139 and 190 million years ago

MPA - Marine Protected Area, as established in the *Canadian Oceans Act*

NAFO - North Atlantic Fisheries Organization

Neutrally buoyant - A degree of buoyancy which permits floating at whatever water depth the object is positioned

NOAA - National Oceanographic and Atmospheric Agency (United States)

Oil-based muds - Drilling muds that include mineral oil

Pelagic - As applied to organisms, those which swim or drift in the water column, as compared to benthic organisms

Phytoplankton - Tiny photosynthesizing (plant-type) organisms that drift in the water

Precautionary Principle - Originally formulated in the global political debate about controlling greenhouse gas emissions, its statement in that context was, "When there is a threat of significant or irreversible harm, scientific uncertainty should not prevent taking action which is otherwise economic to prevent that harm"; more recent formulations are that, in the face of scientific uncertainty, it is preferable to err on the side of caution

Probability - The statistical likelihood of something happening; it is one factor in defining risk

Produced water - Formation water which, in a producing oil or gas field, is pumped out of the well and eventually becomes a very large-volume discharge as the hydrocarbon reservoir is produced

Risk - Technically defined as hazard times probability

Seismic or seismic survey - The use of pressure (sound) waves from air guns to bounce off the layers of rock beneath the ground or seabed in order to detect the possible presence of hydrocarbons. In the offshore, the air guns are fired from arrays towed by a survey vessel. The pattern of returning sound waves is picked up by microphones towed on long streamers behind the vessel, and is interpreted for indications of oil or gas

Semi-submersible rig - A drilling rig that uses large cylindrical rigs for flotation, and is kept in position by anchors and thrusters

Statistical power - A measure of the likelihood that a particular sampling program can in fact detect an effect of a certain strength, should it occur. For example if the statistical power is 80% for detecting an effect of 30% mortalities in a bioassay, then the experimenter is not very likely to miss detecting such an effect; if the statistical power in this case were only 40%, then the effect could more easily go undetected

Stratified - As applied in oceanography, water that has layers of different temperature or salinity

Synthetic-based muds - Drilling muds based on an oil-like substance

TAC - Total allowable catch

Tainting - In the context of a fishery, contamination of the product that is detectable by taste

Tertiary - The geologic period extending from 65 million years ago to 2 million years ago

Tsunami - A wave arising, for example, from an undersea earthquake

VEC - "Valued ecosystem component," a term used in environmental assessment to describe a specific aspect of the social, economic, or natural environment that has been identified as desirable to protect

Vertical mixing - Mixing of water throughout the water column

Water-based muds - Drilling muds based on water rather than oil

Zooplankton - Tiny animals, including fish eggs, larvae, and single-celled animals, that float or drift in the water
(see phytoplankton)

Figures and Sources

Figure #	Title and Sources
1	Georges Bank Moratorium Area and Adjacent Areas from: *Canada-Nova Scotia Offshore Petroleum Board*
2	Table of Public Events
3	Gulf of Maine Image Created by *Northern Geomatics, Inc.* for the *Undersea Landscapes of the Gulf of Maine education poster*, courtesy of the *Maine Coastal Program/State Planning Office.*
4	Geophysical Elements of the Georges Bank Area from:*Wade and MacLean, 1990*
5	Georges Bank Area Currents
6	Satellite Image of Chlorophyll in the Georges Bank Area from: *NOAA*
7	Estimates of Biological Productivity from: *Boudreau, 1998*
8	Spawning Periods from: *Envirosphere*
9	Size of FourYear Old Cod from: *Marine Fish Division - DFO, 1985-87*
10	Georges Bank Fishing Activity Areas from: *Norigs 2000*
11	NAFO Subareas from: *Gardner Pinfold*
12	Landed Values Average 1992-1997 Adapted from *Boudreau, 1998*
13	Estimated Future Fisheries Potential from: *Gardner Pinfold, 1998*

Other photographs and sketches supplied kindness of BIO/DFO; Nova Scotia Petroleum Directorate; and Nova Scotia Departments of Education (Museum Complex), Economic Development & Tourism, and Fisheries and Aquaculture. Illustration by L.B. Jensen.

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Panel Biographies

JOHN MULLALLY

John Mullally is retired from the Public Service of Nova Scotia. He was born and educated in Prince Edward Island. His first job was with the fishing industry on the Island for six years.

He entered public service in 1963 and worked for the federal and Prince Edward Island governments until appointed Deputy Minister of Fisheries in Nova Scotia in 1974. He subsequently served as Deputy Minister of Municipal Affairs, Lands & Forests and Natural Resources until his retirement in 1993.

John and his wife, Claire, have five adult children and six grandchildren.

SUSAN HOLTZ

Susan Holtz is a private consultant who specializes in energy, environment and sustainable development policy. She also works on related issues as a mediator and a facilitator.

She has served on many advisory bodies and boards, including the Auditor General of Canada's Panel of Senior Advisors; the Canadian Environmental Advisory Council and the Canadian Environmental Assessment Research Council. She was the founding Vice Chair of both the National and Nova Scotia Round Tables on the Environment and the Economy. As an adjunct professor, Ms. Holtz teaches in the Environmental Planning Department of the Nova Scotia College of Art and Design.

Ms. Holtz lives in Ferguson's Cove, Halifax Regional Municipality and is married with two adult daughters.

RONALD H. LOUCKS

Ron Loucks is President of R.H. Loucks Oceanology Ltd., a company incorporated in 1975. He holds graduate degrees from the University of British Columbia (M.Sc.) and the University of Michigan (Ph.D.). He has 30 years of experience in physical oceanography and watershed systems projects, initially as a research scientist at Bedford Institute of Oceanography (1964-74) and then as a consultant in the private sector.

Ron is author and co-author of several scientific publications in aquatic science involving estuarine and coastal oceanography, and water quality modelling. He participated in reconnaissance and oil drift predictions for the Arrow spill and the Irving Whale.

He and his wife, Ruth, have three adult children

Appendix 1

The Acts

NOVA SCOTIA

Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act

CHAPTER 3 OF THE ACTS OF 1987
amended 1988, c. 56; 1992, c. 12; ss. 1-27; 1993, c. 16, ss. 1-6

Prohibition in offshore area in Schedule IV

134A (1) Notwithstanding Section 134, no person shall, before the first day of January, 2000, engage in exploration or drilling for or the production, conservation, processing or transportation of petroleum in that portion of the offshore area described in Schedule IV.

Prohibition for further period

(2) On or before the first day of January, 2000, and after considering the report of the review panel referred to in Section 134B, the Minister and the federal Minister may jointly, for such further period of time after the first day of January, 2000, as they may determine, prohibit exploration or drilling for or the production, conservation, processing or transportation of petroleum in all or any part of that portion of the offshore area described in Schedule IV.

Notice

(3) The Minister shall give notice in the Royal Gazette of a prohibition made pursuant to subsection (2). 1988, c. 56, s. 2.

Public review by review panel

134B (1) A public review of the environmental and socio-economic impact of exploration or drilling for petroleum in that portion of the offshore area described in Schedule IV shall be conducted by a review panel established not later than the first day of January, 1998, in accordance with this Section.

Composition of review panel

(2) The review panel shall consist of not more than five members.

Appointment of review panel
(3) Two members of the review panel may be appointed by the Minister, two members of the review panel may be appointed by the federal Minister and a chairman is to be appointed by both the Minister and the federal Minister.

Failure to agree on chairman

(4) Where the Minister and the federal Minister fail to agree on the appointment of a chairman of the review panel within sixty days of the appointment of the first member of the review panel, the chairman shall be selected by an arbitration panel, constituted in accordance with Section 43, within thirty days of the appointment of the chairman of the arbitration panel unless the Minister and the federal Minister sooner agree on the appointment of a chairman of the review panel.

Report of review panel

(5) The review panel shall make recommendations in a report containing the results of the review and shall submit the report to the Minister and the federal Minister on or before the first day of July, 1999. 1988, c. 56, s. 2.

SCHEDULE IV

AREA REFERRED TO IN SECTION 134A

(All latitudes and longitudes referred to in this Schedule are determined according to the NAD 27 datum. All parallels of latitude referred to in this Schedule are to be determined in such manner that they are parallel with boundaries of grid areas as provided in the Canada Oil and Gas Land Regulations in force on May 13, 1988.)

COMMENCING at the intersection of latitude 42 30' 00" N and the geodetic line from point C to point
D of the Single Maritime Boundary between Canada and the United States of America, at approximate
longitude 67 27' 05" W, said Boundary constituted by the judgment of the Chamber of the International
Court of Justice at The Hague on October 12, 1984, said point C being at latitude 42 31' 08" N and
longitude 67 28' 05" W and said point D being at latitude 40 27' 05" N and longitude 65 41' 59" W as
shown in said judgment;

THENCE easterly along latitude 42 30' 00" N to longitude 66 30' 00" W;

THENCE south along longitude 66 30' 00" W to latitude 42 25' 00" N;

THENCE easterly along latitude 42 25' 00" N to longitude 65 45' 00" W;

THENCE south along longitude 65 45' 00" W to latitude 42 20' 00" N;

THENCE easterly along latitude 42 20' 00" N to longitude 65 37' 30" W;

THENCE south along longitude 65 37' 30" W to latitude 42 10' 00" N;

THENCE easterly along latitude 42 10' 00" N to longitude 65 30' 00" W;

THENCE south along longitude 65 30' 00" W to latitude 42 05' 00" N;

THENCE easterly along latitude 42 05' 00" N to longitude 65 22' 30" W;

THENCE south along longitude 65 22' 30" W to latitude 41 50' 00" N;

THENCE westerly along latitude 41 50' 00" N to longitude 65 30' 00" W;

THENCE south along longitude 65 30' 00" W to latitude 41 40' 00" N;

THENCE westerly along latitude 41 40' 00" N to longitude 65 37' 30" W;

THENCE south along longitude 65 37' 30" W to latitude 41 35' 00" N;

THENCE westerly along latitude 41 35' 00" N to longitude 65 45' 00" W;

THENCE south along longitude 65 45' 00" W to latitude 41 25' 00" N;

THENCE westerly along latitude 41 25' 00" N to longitude 65 52' 30" W;

THENCE south along longitude 65 52' 30" W to latitude 41 15' 00" N;

THENCE westerly along latitude 41 15' 00" N to longitude 66 07' 30" W;

THENCE south along longitude 66 07' 30" W to latitude 41 05' 00" N;

THENCE westerly along latitude 41 05' 00" N to its intersection with said geodetic line from point C to
point D, at approximate longitude 66 13' 33" W;

THENCE northwesterly along said geodetic line to the point of commencement.

1988, c. 56, Sch. IV.

CANADA

Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act
1988, c. 28
[C-7.8]

An Act to implement an agreement between the Government of Canada and the Government of Nova Scotia on offshore petroleum resource management and revenue sharing and to make related and consequential amendments

[Assented to 21st July, 1988]

Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

Short title

1. This Act may be cited as the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act.

Prohibition

141. (1) No person shall, on or before January 1, 2000, in that portion of the offshore area described in Schedule IV, explore or drill for or produce, conserve or process petroleum or transport petroleum produced in that portion of the offshore area.

Public review by panel

(2) A public review of the environmental and socio-economic impact of exploration and drilling activities in that portion of the offshore area described in Schedule IV shall be conducted by a panel that is to be established for that purpose, in accordance with this section, on or before January 1, 1996.

Panel

(3) The panel referred to in subsection (2) shall consist of not more than five members.

Appointment of members and chairman

(4) Two members of the panel referred to in subsection (2) may be appointed by the Federal Minister and two by the Provincial Minister, and the chairman of the panel is to be appointed by both the Federal Minister and the Provincial Minister.

Appointment of chairman where Ministers fail to agree
(5) Where the two Ministers fail to agree on the appointment of the chairman of the panel referred to in subsection (2) within sixty days after the first appointment of a member of the panel, the chairman shall be selected by an arbitration panel, constituted in accordance with section 47, within thirty days after the appointment of the chairman of the arbitration panel,
unless at any time prior thereto the two Ministers agree on the appointment.

Panel to prepare report

(6) A report containing the results of the public review conducted pursuant to subsection (2), including any recommendations of the panel made in respect of those results, shall be prepared by the panel referred to in that subsection and submitted to the Federal Minister and the Provincial Minister on or before July 1, 1999.

Prohibition for further period

(7) On or before January 1, 2000, the Federal Minister and Provincial Minister may, after consideration of the report submitted to them pursuant to subsection (6), jointly issue a written notice prohibiting, for such further period as is specified in the notice, in all or any part of that portion of the offshore area described in Schedule IV, the exploration or drilling for and the production, conservation and processing of petroleum and the transportation of petroleum produced in that portion of the offshore area.

Publication of notice

(8) The Federal Minister shall cause a copy of any notice issued pursuant to subsection (7) to be published in the Canada Gazette forthwith after the notice has been issued.

Appendix 2

Panel's Recommended Studies

Research Topics

- Sensitivity of Larvae to Petroleum Drilling
- Hazard and Risk/Benefit Assessment of Drilling on Georges Bank
- Georges Bank Ecosystem Structure, Stability and Resilience
- Historical Review of Petroleum Regulations and Technology
- Map(s) – Physical Characteristics and Biological Resources of Georges Bank
- Extreme Winds and Currents in the Area of Georges Bank
- Economic Significance of Georges Bank Resources

Short General Summaries

- Biophysical Description of Georges Bank
- Socio-Economic Overview of the Biological Resources of Georges Bank
- Hydrocarbon Resources of Georges Bank
- Offshore Oil and Gas Exploration
- Offshore Production, Storage and Transportation
- Offshore Regulations
- How We Use Energy
- The Energy Context
- Global Environmental Implications of Petroleum Production
- Community Adaptation to Change

Appendix 3

Georges Bank Review
Introductory Public Meetings

Fall 1996 Sessions 7:00 - 8:30 PM

Agenda

- Welcome and Introductions
- Purpose of the meeting
- Background - What brings us here
- Steps in this review process
- Questions and discussion
- Information gaps - studies
- Continuing communications
- Closing

Appendix 4

Georges Bank Review
Information Public Meetings
October, 1997

Agenda

1. Opening Remarks – Chairman Mr. Andrew S. Nickerson, Q.C.

2. Biological and Physical Features of Georges Bank –
   Bedford Institute of Oceanography:
   Dr. John Loder
   Dr. Don Gordon
   Questions

3. Profile of the Economic Value of the Commercial Fishery on Georges Bank (1986-96) –
   Walsh, Worden, Lee Business Consultants Inc.:
   Ms. Debora Walsh
   Questions

4. Petroleum Exploration and Drilling –
   Canadian Association of Petroleum Producers:
   Mr. Chris Peirce
   Mr. Ian Scott
   Questions

5. Regulations for Offshore Petroleum Activity –
   Canada-Nova Scotia Offshore Petroleum Board:
   Mr. Andrew Parker
   Questions

6. Closing Remarks – Chairman

Appendix 5

Georges Bank Review
Community Information Workshops
June 4, 5, 6 and 8, 1997

8:30	Welcome – John Mullally, Chair Georges Bank Review Panel Introduction: Lesley Griffiths and Marty Janowitz, Facilitators
9:00	What has happened since 1988? Facilitated group-generated survey – Fisheries Coastal Communities
10:00	Coffee break
10:20	Environmental Understanding
11:00	Offshore Oil and Gas Activities
11.45	Parked Topics and Agenda Check
12:00	Lunch
1:00	Overview: Protecting Renewable Resources on Georges Bank
1:30	Risks and Benefits of Oil and Gas on Georges Bank – What risks are we concerned about? What benefits are we interested in?
2:00	Risks: (How determined, measured, how are they changing, can they be mitigated, level of certainty, long-term community impacts in likely and worst cases?) Benefits: (What is their nature – economic, social, local, regional; how can they be optimized; what is level of certainty?)
3:00	Coffee Break
3:20	Risks and Benefits – continued if necessary. Decision and process topics.
4:00	Wrap-up topics as/if necessary. Closing comments: John Mullally
4:45	Adjourn (latest)

Appendix 6

Procedures for Hearings

The mandate of the Georges Bank Review Panel is included in provisions of the Canada-Nova Scotia Petroleum Resources Accord Implementation Acts (Accord Acts). According to the legislation the Panel is mandated to conduct a public review of the environmental and socio-economic impact of exploration and drilling activities on that part of Georges Bank and environs described in the Accord Acts. No additional terms of reference were issued by the federal and provincial Ministers of Natural Resources, who jointly established the Panel.

These procedures were developed by the Panel to assist all those wishing to participate in the Georges Bank hearings. They outline how the Panel plans to conduct the hearings.

General

1. The Panel will notify the public of the hearing schedule, giving a minimum of 60 days' notice.

2 The Panel will conduct hearings which will focus on the environmental and socio-economic impact of exploration and drilling activities on that portion of Georges Bank and environs described in the Accord Acts. These hearings will provide an opportunity for participants to present their views on these matters.

Hearings

3. The hearings will be conducted in a non-judicial but structured manner that is consistent with this document and any supplementary hearing procedures that may be issued by the Panel. The Chair will have discretionary powers in moderating the hearings to ensure an effective use of time and exchange of information.

4. Anyone wishing to participate in the public hearings will be invited to register in advance of the hearings and to indicate if they wish to make a presentation at the hearing, provide a written submission, or attend as an observer. Registrants who wish to make a presentation at the hearing will be asked to state their preferred location and date, and the amount of time they will require for their presentation. Subsequently these presentations will be scheduled for a specific session. To the extent possible, every effort will be made to schedule presentations according to the participants' preferences.

5. Participants making a written submission to the hearings are required to provide five copies to the Panel Secretariat before January 5, 1999.

6. Persons making presentations using visual aids such as slides and overheads are required to provide five paper copies of the visual aids to the Panel Secretariat.

7. The Chair will commence each hearing with opening remarks.

8. The Chair will confirm the presentation schedule for the day at the beginning of each session.

9. Participants shall, at the opening of their presentation, identify who they are and what, if any, organization they are representing.

10. Where a written submission is to be presented orally, the Chair may direct the presenter to summarize orally the main points in his or her written submission rather than read directly from the written submission.

11. Persons who are not registered and who wish to make a presentation will be allowed to do so, time permitting, at the discretion of the Chair.

12. The Chair has the discretion to restrict discussion or presentations that are outside the focus of the review, or that are repetitive or irrelevant.

13. Presenters may be questioned by the Panel during and following their presentation. There will be no direct questioning or cross-examination of presenters by other participants. Participants who have made presentations or submissions may also submit a written closing statement or comments to the Panel Secretariat with in 10 calendar days of the close of hearings. No information will be accepted after that.

14. The proceedings will be conducted in the English language, but presentations may be made in either official language. Translation services will be provided.

15. All materials provided to the Panel as part of the public hearing process will be on file at the Panel Secretariat Office and will be available for public viewing.

16. Transcripts will be prepared and available for public viewing at the Panel Secretariat Office.

Those wishing further information or wishing to register to make submissions or presentations at the Hearings should contact the Georges Bank Review office at:

Phone: Petroleum Directorate
902-424-4575

Appendix 7

Presentation, Written Submissions and Closing Submissions

PRESENTATIONS

Monday, January 11, 1999 - Yarmouth, N.S.

Denny Morrow	Nova Scotia Fish Packers Association
Chris Peirce	Canadian Association of Petroleum Producers
Richard d'Entremont	Acadian Fish Processors
J. Donald Doucette	Nova Scotia Fishermen's Association, Scallop Sector
Donald Cunningham	John's Cove Fisheries
Neil LeBlanc	Member of the Legislative Assembly
Keith Davidge	

Tuesday, January 12, 1999 - Yarmouth, N.S.

Phil Milford	Chevron Canada Resources
David Lincoln	Massachusetts Fishermen's Partnership
John Deveau	Member of the Legislative Assembly
Terry Zinck	Canus Fisheries
Sterling Belliveau	LA 34 Lobster Advisory Committee
R.G. Stewart	Atlantic Herring Fisheries Marketing Co-op Ltd.
Kent Blades	NORIGS 2000
James Wooder	PanCanadian Petroleum Limited
Claude d'Entremont	Inshore Fisheries Ltd.

Wednesday, January 13, 1999 - Yarmouth, N.S.

Kevin Williams	Chevron Canada Resources
Kerry Cunningham	Seastar Seafoods
Bob Frelick	
Ted d'Entremont	Wesmar Electronics Canada Limited
Wayne Spinney	West Nova Fishers Coalition
Brian Giroux	Scotia-Fundy Mobile Gear Fishermen's Association
Fraser Howell	Yarmouth Airport Commission

Thursday, January 14, 1999 - Yarmouth, N.S.

Paul MacMillan	Chevron Canada Resources
Ted Spearing	Chevron Canada Resources
Gordon Tidmarsh	Texaco Canada Petroleum Inc.
Mark Butler	Ecology Action Centre
Bill Bridgeo	
Yvon Thibault	Atlantic Groundfish Association
Ms. Jan Slakov	Enviro-Clare

Monday, January 18, 1999 - Shelburne, N.S.

Ed Cayer	Shelburne & Area Chamber of Commerce
Frank Swartz	ARA Consulting Group for Canadian Association of Petroleum Producers
Sarah Huskilson	Mayor, Town of Lockeport
Dr. Paul Boudreau	Fisheries & Oceans Canada
Dr. John Loder	Fisheries & Oceans Canada
Dr. Garett Harding	Fisheries & Oceans Canada
Dr. John Neilson	Fisheries & Oceans Canada
Dr. Peter Cranford	Fisheries & Oceans Canada

Tuesday, January 19, 1999 - Shelburne, N.S.

Gary Dedrick	Shelburne County Fixed Gear Quota Group
Richard Nickerson	Maritime Fishermen's Union (Local 9)
Evan Walters	Scotia-Fundy Inshore Fishermen's Association
George Rennehan	Nova Scotia Fixed Gear Association
Ron Newell	South West Fishermen's Quota Group
Clifford Hood	South West Seiners Limited
Sarah Huskilson	Eastern Shelburne Fishermen's Association
Ron Wolkins	South West Fishermen's Rights Association
Franklyn d'Entremont	Swordfish Harpooners Association
Gerald Keddy	Member of Parliament, Southshore
Lewis M. (Milton) Jackson	
Donnie Davis	

Thursday, January 21, 1999 - Lunenburg, N.S.

D. Laurence Mawhinney	Mayor, Town of Lunenburg
Jack Wentzell	Warden, Municipality of the District of Lunenburg
Jim Mosher	Scotia Trawlers
David Knickle	Adams & Knickle Ltd.
Doug Hill	Lunenburg Board of Trade
Marilyn Crook	CAW Local 1944
Michael Baker	Member of the Legislative Assembly

Monday, January 25, 1999 - Halifax, N.S.

Peter Stoffer	Member of Parliament
Sam Ellsworth	Sambro Fisheries Limited
Dr. Rolph A. Davis	LGL Limited for Canadian Association of Petroleum Producers
Graham Curren	Secunda Marine Services
Dr. Hal Whitehead	Dalhousie University Biology Department
Shawn Denstedt	Bennett Jones for Canadian Association of Petroleum Producers
Dr. Ginette Robert	Fisheries & Oceans Canada
Dr. Paul Boudreau	Fisheries & Oceans Canada
Eric Rowe	Clearwater Fine Foods Inc.
Paul Kelly	Rowan Companies Inc.
Alan Ruffman	Geomarine Associates Ltd.

Tuesday, January 26, 1999 - Halifax, N.S.

Sy Ross	S.L. Ross & Associates for Canadian Association of Petroleum Producers
Ken Trudel	Canadian Association of Petroleum Producers
Patrick Moriarty	Coalition for Responsible Economic and Environmental Development
Helen Lofgren	Sable Gas Intervention Coalition
David Wimberley	Sable Gas Intervention Coalition
Dr. Ed Kinley	
Glen Wadman	D.B. Kenny Fisheries Ltd.
Peter Shelley	Conservation Law Foundation
Brian Giroux	Scotia-Fundy Mobile Gear Fishermen's Association
Michael O'Connor	National Sea Products Ltd.
Captain Symes	National Sea Products Ltd.

Wednesday, January 27, 1999 - Halifax, N.S.

Mark Butler	Ecology Action Centre
Erin Rankin	Ecology Action Centre
Tim Church	Ecology Action Centre
Don Chard	Member of the Legislative Assembly
James Mood	Mood Fisheries
Don Aldous	South West Nova Tuna Association

Harvey Pockrant	Chevron Canada Resources
Debora Walsh	Canadian Association of Petroleum Producers
Strat Canning	Canning, Pitt & Associates for Canadian Association of Petroleum Producers
David Coon	Conservation Council of New Brunswick
Roger Stirling	Seafood Producers Association of Nova Scotia
Robert Conrad	Nova Scotia Mackerel Association
Dr. Ron Colman	GPI Atlantic
Dr. Tony Charles	GPI Atlantic

Thursday, January 28, 1999 - Halifax, N.S.

Inka Milewski	World Wildlife Fund
Margaret Brady	Massachusetts Coastal Zone Management Office Executive Office of Environmental Affairs
Yvon Thibault	Municipality of the District of Clare
Derek Wells	NORIGS 2000
Trevor Kenchington	Gadus Associates on NORIGS 2000
Dr. Martin Willison	Dalhousie University Biology Department
Douglas Gerrits	Offshore Technologies Association of Nova Scotia
John Davis	ECO-Nova Multimedia Productions Ltd.
Dick Lyon	Chevron Canada Resources

WRITTEN SUBMISSIONS

Environment Canada (Atlantic Region)

Robert A. Durand, Executive Office of Environmental Affairs, Commonwealth of Massachusetts

Clare Chamber of Commerce

Arthur Bull, The Coastal Communities Network

D. James Baker, United States Department of Commerce

Massachusetts Congressional Delegation:
Senator Edward M. Kennedy
Senator John F. Kerry
Representative William D. Delahunt
Representative John F. Tierney
Representative Barney Frank

R.J. Iuliucci, Bear Cove Resources

Tusket River Environmental Protection Association

George D. Lapointe, Commissioner, Marine Resources, State of Maine

CLOSING SUBMISSIONS

Jack S. Wentzell, Warden, Municipality of the District of Lunenburg

Offshore Technologies Association of Nova Scotia

Dick Lyon, Vice-President, Chevron Canada Resources, for Canadian Association of Petroleum Producers

Trevor J. Kenchington, Gadus Associates, for NORIGS 2000

Denny Morrow, Nova Scotia Fish Packers Association