David
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Oil and Water Don't Mix

– Keeping Canada's West Coast Oil-Free –

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SOLUTIONS ARE IN OUR NATURE

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Preface

This publication is a comprehensive examination of the implications of opening up Canada's unspoiled northern west coast to oil and natural gas development. Unlike the many government-sponsored reports on this issue, it is written from the perspective of someone who is not involved in the energy industry, shipbuilding, government, or engineering.

Because of this, you will not find approving details of the modern technologies that are alleged to overcome the hazards of exploring and drilling for oil and gas in this wild and fragile marine ecosystem, or claims that this can be done safely and without harming the environment.

Such claims do not stand up to rigorous examination. Drilling for oil and gas is risky, expensive, dangerous, and inherently polluting. Despite the efforts of the best engineers, equipment can malfunction or fail to withstand the worst that nature can fling at it. Accidents and oil spills are commonplace in the energy industry, especially in offshore oil and gas development.

The premise of this report is that the natural marine ecosystem of British Columbia's northern west coast is inherently valuable not only as possibly the last unspoiled stretch of the North American coastline but also as a resource that has great spiritual, cultural, and, more important, economic value in its own right for many people, coastal communities, and First Nations.

Unfortunately, the natural environment cannot coexist on equal terms with the energy industry. The consequences of an oil spill or a natural gas blowout are so severe and far-reaching that the damage caused to marine plants and animals can persist for many generations. Some species never recover from a severe onslaught and eventually become extinct.

In these pages you will find many reasons why we should not open up British Columbia's west coast to fossil fuel exploration and development, or to oil tanker traffic. Each reason is backed up by scientific research, and in almost every instance you will find a link, valid at the time of writing, to where the background material can be found on an Internet Web site.

This report is not easy reading. It raises issues that must be taken seriously if we are collectively to preserve this invaluable, world-class natural resource for ourselves, for our children, and for all future generations.

I hope the information in this report will be useful in furthering the educated public discussion that must take place before any decision is reached on whether or not to lift the existing ban on offshore oil and gas exploration and tanker traffic on B.C.'s beautiful and unspoiled west coast.

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Overview

British Columbia's coastline is one of the most magnificent in the Pacific region, stretching almost 30,000 kilometres. The marine environment here is a natural treasure teeming with precious sea life and natural resources. It is a major cradle of marine life for the entire west coast of North America, and is recognized internationally as globally significant.

To consider risking this natural splendour with industrial oil and gas drilling is reckless, especially when the products of such exploration will further contribute to marine and air pollution and global climate change.

The ecological value of Canada's Pacific marine ecosystems was recognized in 1972 when the federal government banned offshore oil and gas exploration and tanker traffic off British Columbia's majestic coast. In 1989, the British Columbia government declared a moratorium on oil and gas exploration in offshore regions controlled by the province.

The waters off B.C.'s northern coast – the Inside Passage and Hecate Strait – are especially spectacular and a highlight of the breathtaking cruise voyage from Vancouver to Alaska that is enjoyed by nearly a million visitors every spring and summer. Besides noting the effects of oil and gas drilling on the ecological riches of BC's marine ecosystems, this report examines the potential for disasters, implications for climate change, economic issues, legal and ethical issues, the role of politics and the oil and gas industry, and the need for marine parks and preserves. For example:

- While the government of B.C. and some federal officials promote oil and gas production for economic reasons, the industry itself shows little interest in pursuing offshore development in British Columbia because it is considered to be too speculative and expensive.
- The promise of jobs for economically depressed coastal communities is deceiving as, for most of the work, companies would bring in experienced crews from other projects, limiting possibilities for local people. This industry is specialized, global, and competitive in nature, and few local residents have the required training and experience in offshore surveying, exploratory drilling and production, or specialized facility construction.
- The inherent risks and uncertainty of offshore oil and gas activity jeopardize employment in tourism and in sport and commercial fishing. Investment in renewable energy and energy-efficiency projects would be more prudent.

- The waters of the Hecate Strait and Queen Charlotte Sound are the stormiest and most seismically active in Canada, and the area has a history of major earthquakes and ocean tsunamis. Such severe natural disturbances will certainly continue and it is unlikely that any manufactured structure set in the water would escape damage, including oil wells, pipelines, and shipping facilities.
- Burning oil and gas causes climate change. Canada has committed to implementing the Kyoto Protocol on climate protection, yet the B.C. government is pressuring Ottawa to expand oil and gas production – including perilous offshore exploration. We need energy efficiency and clean energy sources, not more oil and gas, if we are to address climate change successfully. All government analysis to date has completely ignored the issue of climate change and the greenhouse gas emissions associated with oil and gas production and use.

The government of Canada is on the verge of deciding whether it will revisit lifting a moratorium on oil and gas exploration and tanker traffic. The last time the issue was seriously considered was in 1986, when the West Coast Offshore Exploration Environmental Assessment Panel set out 92 conditions that had to be met before the ban could be lifted. Then, on March 23, 1989, the *Exxon Valdez* ran aground in Prince William Sound, releasing 200,000 barrels of unprocessed Alaska crude oil that devastated the marine environment, killing marine mammals, sea birds, and myriad fish and invertebrates.

Ironically, the world's most ecologically damaging oil spill helped to protect British Columbia's northern waters from possible damage by the oil industry. The *Exxon Valdez* disaster stopped plans to lift the federal moratorium and led the province to establish one. Then in July 2001, the newly elected British Columbia government declared it wished "to explore the enormous opportunities of offshore oil and gas" and to appoint a scientific panel to determine whether drilling could be conducted in a scientifically sound and environmentally responsible manner.

While the B.C. government and some federal officials are eager for oil to flow in B.C. waters, industry is less enthusiastic because of the risk and expense involved when there is no proof that any potential reserves are economically viable. An October 2001 report commissioned by the B.C. government concluded that there are "no unique fatal flaw issues" to prevent offshore oil and gas development here, but it cited many of the known damaging effects of exploration and recovery and cautioned that there are gaps in the scientific knowledge concerning the offshore environment.

The Canadian Association of Petroleum Producers has identified three specific concerns, aside from the moratorium, that would need to be addressed before its members would consider resuming activity off the B.C. coast:

- There must be a clear, integrated federal/provincial regulatory framework to govern all activity.
- All related First Nations land claims issues must be resolved.
- All ecologically sensitive areas of the region must be clearly identified in advance and set aside.

There is significant opposition to lifting the moratoria from First Nations, the fishing and tourism industries, and a majority of British Columbians. The concerns of First Nations are especially critical because several from B.C.'s north coast lay claim to offshore and seabed resources, and their aboriginal land claims have not been settled. Any move towards exploration and drilling would result in lengthy court battles.

This report shows that the risks of opening up offshore activity in British Columbia waters far outweigh any possible rewards. And, in light of the energy alternatives that could be pursued, it is foolhardy to take such risks in these sensitive waters.

1
The West Coast Marine Ecosystem

British Columbia's coastline stretches 29,489 km. It makes up 11% of Canada's ocean shoreline and is one of the richest and most diverse marine environments on the planet.

The offshore water is cold, its temperature ranging only from 6°C to 14°C over the year. This plus a plentiful supply of nutrients carried on the moderate to strong tidal flows (2.5 m/sec to 4.0 m/sec) result in a rich and diverse array of marine life.

Pelagic (floating in the water) and benthic (bottom-dwelling) flora and fauna include algae, plankton, mollusks, echinoderms, and crustaceans. Kelp forests provide food and shelter for fish. Cold-water sponges create unique cold-water sponge reefs in the deeper areas – the only known living hexactinellid sponge reefs existing today.[1]

More than 400 different species of fish abound in the offshore waters. West coast fish are quite distinct from their east coast cousins. They include rockfish, Ling cod, Irish Lords, Greenlings, Kelpfish, and five species of Pacific salmon. Over 3,800 marine invertebrate species, more than three times the species on the Atlantic coast and a significant 3.5% of the world's total marine invertebrates, thrive here.

Migrating cetaceans – Gray, Minke, Humpback, and Orca whales, Harbour and Dall's porpoises, and Pacific White-Sided dolphins – move through the area on ancient migration paths. Harbour Seals and Steller Sea-lions can be found in most areas, while California Sea-lions and Sea Otters inhabit a few favoured localities.

The area is especially significant for the world's sea bird populations. Twenty-five percent of the Rhinoceros Auklets, 40% of the Ancient Murrelets, and 70% of the Cassin's Auklets feed on the abundant sources of food. However, many of the coastal sea bird species are threatened, or Blue- or Red-listed.[2]

In 1991 over 5.6 million sea birds were estimated to be nesting in 503 colony sites along the B.C. coast, many in high-density sites containing several species.[3]

Because so many migratory and resident species depend on the ecological integrity of our northern offshore waters, any environmental disaster such as the sinking of a major oil tanker or the blowout of an oil or gas well would

send repercussions rippling along the entire North American marine ecosystem.

Under the Hecate Strait

The Hecate Strait includes the waters between Haida Gwaii and the mainland. It is about 55 km wide at the northern end, widening to roughly 120 km between the mainland and Cape St. James at the southern tip of Haida Gwaii.

Partly because of its climatically changed elevation, the underwater topography of the Hecate Strait is complex. A broad and deep valley forms a trench just off the mainland coast, channelling outflowing river waters and strong oceanic tidal flows around shallow banks before turning west to meet the Pacific Ocean in several outlets.

In the north, Dixon Entrance is a broad east-west channel separating Graham Island from the islands of the southern Alaska Panhandle. Its depth varies from 400 m where it meets the Pacific Ocean to 200 m on the mainland side. At its seaward end, Dixon Entrance is divided into two deep channels by a large shoal called Learmonth Bank that rises to within 35 m of the surface.[4]

Rose Spit, an extensive and dynamic feature that extends 12 km northeast from Rose Point on Haida Gwaii, separates Dixon Entrance from the Hecate Strait. The Hecate Strait includes the waters between Haida Gwaii and the mainland. It is about 55 km wide at the northern end, widening to roughly 120 km between the mainland and Cape St. James at the southern tip of Haida Gwaii.

Much of the western half of the Hecate Strait consists of two shallow areas: Dogfish Bank to the north and Laskeek Bank to the south, where the water is less than 40 m deep. An underwater valley runs along the mainland side, deepening from 50 m in the north to 300 m in the south, where it turns westward to the Pacific Ocean through troughs on either side of the North Bank in Queen Charlotte Sound.[5]

Queen Charlotte Sound includes the waters south of the Hecate Strait to the north end of Vancouver Island. Three major troughs up to 400 m deep cut across the sound. Between them are Cooks Bank, Goose Bank, and North Bank. Fish are plentiful on all the marine banks, where the water can be as shallow as 31 m.

The underwater topography of the region is complex. It is also subject to the scouring action of the vigorous tides and fierce wind-driven storms that sweep through the strait. It has been mapped to some extent, but more accurate underwater mapping would be needed to identify potential drill sites that avoid underwater hazards.[6]

Interdependent marine ecosystem

The B.C. coast has two main ecosystems: the *nearshore* and the *continental shelf*. The nearshore ecosystem includes the shallow waters next to the shoreline, which reach into estuaries, mud flats, and shallow bays. In the warmest months of the summer, this water can heat up to a more swimmable 18°C to 20°C soon after high tide.

Shallow waters allow sunlight to illuminate the nearshore ecosystem, providing energy for photosynthesis of kelp and algae, which are food for many marine animals. In the deeper and darker waters of the continental ecosystem, phytoplankton (unicellular diatoms and microscopic algae) forms the basis of the food chain.[7]

Ecosystems are an interdependent unity. The various plants and animals (flora and fauna) that make up an ecosystem do not exist in isolation from each other; nor is the nearshore system separate from the continental shelf. A change in the numbers or distribution of one species can affect the security of many others.

Case Study: Orcas, Sea Otters, Sea Urchins, and Kelp

A 1998 report in the journal *Science* [8] relates how Orca whales suddenly began hunting Sea Otters off the Alaskan coast. Until recently, the Orcas had preferred to hunt pinnipeds such as seals and sea-lions, which have high-energy fat insulation. One medium-sized Orca would have to eat 1,825 fatless Sea Otters a year to survive.[9]

The reason for the sudden change in Orca diet is thought to be that overfishing plus changes in ocean currents and sea temperatures, possibly due to global warming and the El Niño effect, have thinned the pinniped population.

Sea Otters have never regarded the Orca as an enemy and have no inbuilt survival mechanism to guard against Orca attack. Otters float characteristically on their backs unconcerned as Orcas pass by. From an estimated 53,000 Sea Otters in an 800 km stretch of the Aleutian archipelago during the 1970s, now only 6,000 remain.

Only the Sea Otter eats the spiny sea urchin, which is its favourite food. The collapse of otter populations has allowed sea urchins to multiply out of control. The sea urchins have in turn devoured vast swaths of kelp forests.

Kelp is food for herbivorous invertebrates. It prevents coastal erosion and creates prime fish habitat by calming tidal flows. U.S. researchers now fear that 3,300 km of sea floor off the western Alaska coast is in danger of becoming entirely barren.

On Canada's west coast, the Sea Otter, which was hunted almost to extinction until it was protected in 1911, from 1969 to 1972 was reintroduced to a remote part of the northwest coast of Vancouver Island. By 1996 there were more than 1,500 on this stretch of coast, and the species was downlisted from Endangered to Threatened.[10]

The Orca whale, which has practically become the primary symbol of B.C.'s rich marine environment, is already on B.C.'s Blue List as vulnerable.[11] Sea Otters are on B.C.'s more critical Red List.[12] If the delicate ecological balance in our offshore waters is upset, Sea Otters and many other marine species could also face an uncertain future.

Fish and whale migration

Many species of fish and marine mammals, including salmon and herring, have evolved migration patterns that are essential for their survival. Large marine mammals including Gray and other whales also make annual migrations each year.

The Hecate Strait, Queen Charlotte Sound, and Dixon Entrance are a migration corridor for hundreds of millions of juvenile and adult salmon. Salmon move between the Gulf of Alaska and breeding sites on the B.C., Washington, and Oregon coasts.

Approximately 12,000 Gray Whales migrate almost 22,000 km each year from the warm waters of Mexico's Baja Peninsula to the Bering Sea and back again. Gray Whales pass close to the B.C. coast in spring and fall, often accompanied by a fleet of whale-watch boats. Other whales migrate between the northwest coast and the Arctic Ocean.

There is considerable evidence that human activity such as seismic surveys as well as exploratory and production drilling can affect marine animal migration patterns.[13] Loud noise can directly interfere with fish stocks, especially if the source is in a breeding area.[14] Embryos and young fish can be killed by seismic blasts.[15]

Migrating whales show obvious and dramatic avoidance responses when exposed to seismic air gun arrays.[16] Bowhead Whales in Alaska almost totally avoid coming within 20 km of seismic air gun activity.[17] Sound travels effectively underwater and seismic explosions off Canada's east coast have been detected over 100 km away.[18]

Because we know little about the migration paths of the different marine animals, we really cannot say what the short- and long-term impacts of seismic exploration and well drilling will be on the migration habits of many important marine animals.

If we are to apply the precautionary principle, we must first understand where and when these migrations take place so that we can predict the effect exploration may have on marine species. Ecologically important areas must be identified and put aside.

We must have sufficient data before we proceed to change the marine ecosystem and animal behaviour in ways that perhaps cannot be restored after the damage is done. Otherwise, we will have moved ahead in ignorance and without due caution.

Marine animals under stress

Marine mammals have acute hearing. They have evolved in an environment in which sound can travel great distances. Although the ocean would appear to be silent, research has revealed that it is filled with the sounds of fish and other animals.[19]

Marine animals communicate through sound. Some use sound to locate prey. If a marine animal loses its ability to hear, most likely it will die.[20] At the very least, it may change ancient patterns in response to the noise of human marine activity.[21]

The underwater noise produced by ships and offshore drill rigs can be very loud – loud enough to affect the hearing of fish and convert the natural underwater environment into the equivalent of a noisy industrial factory zone.[22]

Concern also is emerging that even the use of sound to map the sea floor (sonar) is contributing to the buildup of a constant and ongoing stress on marine mammals. Whales and dolphins, which have evolved sophisticated biological sonar systems to sense objects underwater, can experience great distress from modern sonar.[23]

The more powerful the sonar, the greater the distress. Suspicion is growing that new top-secret U.S. Navy sonar that emits constant, ultra-high-energy sound impulses may be inducing extreme distress in whales. Military sonar testing may have been responsible for recent large-scale whale strandings in the Bahamas and other areas.[24]

Recognition is growing that underwater sound energy is a form of pollution, and that according to the precautionary principle, it is the duty of the polluter to prove that their action will not have an adverse environmental impact.[25]

Sound is not the only new stressor in the marine environment. Pollution from oil spills such as the *Exxon Valdez,* or indirect poisoning from toxic substances released by coastal pulp mills, sewage systems, and urban runoff that bioaccumulate in the larger animals at the top of the food chain, also contribute to marine animal stress.

West coast Orca whales contain PCBs and dioxins well above levels of concern. The west coast Orca are now considered the most toxified cetacean in the world – even more toxic than Beluga whales in the Gulf of St. Lawrence in eastern Canada.[26]

Toxics such as PCBs and dioxins attach to animal fats and move through the food chain. They stress the immune system of animals such as salmon, seals, and whales. Depleted food resources from human overfishing, or resulting from a sudden imbalance in the ecosystem as with the example of Sea Otters (see above), also add to animal stress.

Extracting natural resources at an unsustainable rate, be they fish or fossil fuels, will increase the stress on the marine environment. Opening B.C.'s offshore waters to oil and gas exploration and oil tanker traffic can only continue that trend.

2
Four Phases of Exploitation

Finding and extracting hydrocarbon deposits from deep under the seabed is a complex, dangerous, expensive, and uncertain business. It is highly intrusive, pollutes the marine environment, and threatens and can even kill large numbers of fish, sea birds, and marine mammals. There are four distinct phases of resource exploitation. Each presents specific threats to the local and global ecosystems. The four phases are:

- Exploration
- Development
- Production
- Decommissioning

The four phases normally follow each other approximately in this order, although it is possible for several phases to be taking place simultaneously in a producing oil or gas field. Here is an overview of the damaging effects of each of the four phases.

Exploration

The search for commercial hydrocarbon deposits has three aspects, which normally occur in this order:

- Seabed mapping
- Seismic survey
- Exploratory drilling

Seabed mapping

Geophysical maps contain accurate topological information that serves as a baseline for probing beneath the earth's surface. Although almost all the planet's dry land is now mapped in great detail, much of the seabed remains to be accurately surveyed. This is especially true in the Hecate Strait, where three major troughs and two shallow banks as well as strong currents pose specific hazards to drilling operations.[1]

The process of undersea mapping is called **bathymetry**. The Canadian Hydrographic Service (CHS) has charted the area using older data collected in the 1970s, and in some areas as far back as the 1940s. CHS charts are generally accurate to only 1% of water depth.[2]

The federal departments of Fisheries and Oceans, National Defence, and Natural Resources are working on an initiative called **SeaMap**, which will accurately chart all Canadian offshore, coastal, and aquatic lands using sonar (sound waves).[3] According to the Whitford Report, SeaMap currently is only a proposal before the federal cabinet, although the Queen Charlotte Basin is considered a priority area.[4]

SeaMap will take advantage of the latest **swath** or **multibeam bathymetry.** Instead of using just one downward-pointing beam as in a marine echo sounder, multibeam sonar uses a fan or swath of 127 beams to paint a digital, 3-D picture of the sea floor.

Little is known about how modern high-intensity sonar devices impact marine animals. There is growing concern that they may interfere with and perhaps directly damage fish, seals, whales, or dolphins, which are highly sensitive to sound.[5]

Seismic survey

To "see" into the earth, explosive charges are detonated at the surface, sending sound waves into the underlying strata. Sensitive seismic instruments detect the echoes and feed that information into computers. Experienced geologists must then interpret the output to guess where large pools of oil or gas might be located.

The damaging effects from the use of sonar to map the seabed pale into insignificance compared with the explosive impact of a seismic survey, which can generate underwater sounds pulses as loud as 255 decibels, equivalent to an undersea volcanic eruption.[6] Although air guns have replaced old-fashioned explosives in modern underwater seismic testing, the effect can be equally devastating to marine animals.

Fish in the immediate vicinity of seismic explosions can be killed instantly when their swim bladders explode from the sudden overpressure.[7] Fish larvae are harmed, affecting their survival rate and the security of fish stocks.[8] Whales, dolphins, and schools of fish will divert migration paths away from the source of the sound, which they hear many kilometres away. Seismic testing can extend over many months.[9]

Fish and large marine animals can be permanently deafened by the extremely loud noise generated by seismic air guns. This is crucial, as marine animals rely extensively on their hearing to survive. A recent Australian study found extensive physical damage to the inner ear of wild pink snapper after exposure to seismic air gun blasts. Although fish have the capacity to repair damage to their auditory hair cells, the Australian scientists found evidence

that not only did the air gun sound badly damage the sensory hair cells but the cells did not grow back even after two months.[10]

The effect of a large-scale seismic survey can be permanent. Suspicion is growing that the sudden decline of codfish stocks on the east coast of Canada could have been partly due to the extensive seismic testing conducted for the Hibernia offshore oil field.[11]

The damaging effects of seismic surveys on the coastal marine environment must not be underestimated — and this is before the first drill bit has hit the ocean floor.

Exploratory drilling

After the results of seismic testing have been analyzed, exploratory wells are drilled into potential hydrocarbon deposits. Although the days of blind wildcat drilling are over, the exploratory well success rate for this area is estimated at only one in nine.[12]

Exploratory drilling is hazardous, as the actual formations being opened up are unknown. Although there has been only one recorded blowout in Canadian offshore waters, blowouts can happen if the newly opened reservoir pressure is too high.[13]

An exploration well blew out off the coast of Brazil in April 2001. This incident followed the sinking a month earlier of the world's largest oil rig following an explosion and fire, also in Brazilian waters.[14]

Drilling for oil and gas is a messy business that disturbs the environment. Even if great care is taken, drilling muds and bore tailings can pollute the seabed.[15] Drilling and supply ship engines and generators would create underwater noise and air pollution. Helicopter flights would disturb bird and whale migration paths.[16]

Even during drilling, ongoing seismic surveys will add to the undersea din. What was once a pristine offshore marine environment will become a noisy industrial zone. In the words of Dr. Christopher Clark, Director of the Bioacoustics Research Program at Cornell University, New York, and an expert on the marine acoustic environment:

> *In every case throughout my 25 years of working with whales and observing other marine organisms ... there has been a conflict between the basic needs of the natural world and human demands to exploit deposits of hydrocarbons that lie beneath the sea ... The consequences cannot be determined with any reasonable certainty, yet the potential harm is immeasurable, and irreversible.*[17]

Development

If commercially significant amounts of oil or natural gas are located, next comes the decision to proceed with the development phase. This is not a decision to be taken lightly as substantial amounts of capital must be committed.

Once this step is taken, the original natural environment is relegated to history. There would be no turning back: our "Supernatural" north coast would be changed forever.

The development phase consists of four stages that occur in this order:

- Design and engineering
- Production platform construction
- Production well drilling
- Marine and onshore infrastructure

The first two stages have economic rather than environmental implications (see Section 5, "Negative Economics"). Production wells and infrastructure will further degrade the environment.

Production well drilling

In shallow waters, fixed oil rigs would be used. Where the waters are deeper, rigs mounted on barges or large fixed or floating production platforms are put in place. These would be constructed off-site and transported to the intended location.[18]

Once the oil rigs or platforms are in place, production begins. Seismic surveying would continue and more wells drilled to increase output. If a centralized production platform is used, a network of underwater pipelines must connect the wellheads. Alternatively, lateral wells would be drilled to fan out from a production platform.[19]

Well drilling throws up sea floor sediments so that a cloudy plume drifts kilometres away. Toxic tailings and drilling muds collect around the wellheads.[20] The noise of drills and motors disturbs marine animals. Contaminated production water brought up from underlying strata is discharged untreated or lightly treated into the ocean.

Atmospheric pollution, previously completely absent from the area, would start to become noticeable. Flaring of excess or sour natural gas would send toxic byproducts into the air to mix with the pollution from diesel generators and ship engines. Light pollution from bright lighting and gas flares would distract migrating birds and fish.

Each well drilled adds another potential risk of blowout or contamination due to spills and equipment failure. Transport of oil to the mainland brings the risk of spills during transfer or from the constant tanker traffic in coastal waters. Gas finds would necessitate underwater pipelines, further disturbing the marine environment.

Infrastructure

Not only the marine environment would be changed. In addition to new onshore marine and aviation operation and maintenance facilities, extensive onshore hydrocarbon storage and processing infrastructure would be required.

Tanker facilities for oil and gas processing plants or compressor and storage facilities for liquefied natural gas (LNG) would likely be built. Pipelines would have to be constructed to connect to the existing inland natural gas transmission network.

Each new landside facility would have an environmental impact, increasing pollution and putting greater pressure on the natural environment and animal habitat.

Production

It can take many years to bring a major oil or gas field to full production. By the time the first product is brought to shore, major damage will have been done to the marine and onshore environment from the preceding exploration and development phases.

The production phase brings the greatest economic benefits to the main onshore supply community. It also begins a long period of environmental vulnerability, during which spills, accidents, or natural catastrophes can occur, either in the area itself, onshore, or at sites elsewhere along the coast.

Although billions of dollars would have been spent to develop the offshore field, its output may in the long run not amount to more than the equivalent of a few months of additional oil supply for energy-squandering North America.

But the effect of the new supply would be to increase B.C.'s output of global-warming greenhouse gases while delaying our transition away from fossil fuels to sustainable energy sources, greater energy efficiency, and non-polluting transportation.

Effect on marine life

The production phase can last for a decade, or longer. It may even be shorter if the field proves to contain only limited reserves. During production, further exploration and development activities will be taking place, with all the impacts they cause.

The longer the field is in production, the greater the chance of damage to the marine environment, reduced fish stocks, and increased mortality rates of marine animals. It may hasten the extinction of coastal salmon,[21] Orca whales,[22] and Sea Otters.[23]

The presence of long-term production rigs and platforms can have the effect of permanently changing the breeding and migration patterns of fish and whales.[24] Because we have little reliable data on fish and mammal behaviour in the area, we cannot accurately predict the outcome of this conflict between man and nature.

The marine environment is a tightly integrated ecosystem, especially when it comes to the interactions between marine mammals. Reductions of fish stocks affect those animals that feed on them, forcing them to turn to other species for food.

For example, scientists believe that the collapse of salmon stocks off the Alaskan coast since 1990 has resulted in Orca whales attacking and eating Sea Otters. This in turn resulted in a proliferation of sea urchins, which are normally eaten by the otters. The explosive growth of sea urchin numbers resulted in widespread destruction of kelp, and scientists now fear that 3,300 kilometres of coastal seabed may become barren.[25]

Ongoing pollution

Studies on oil extraction in the Gulf of Mexico reveal that the drilling tailings around exploration or production wells do not dissipate over the years. Islands of pollution are formed around each wellhead, from which toxic and persistent heavy metals, including mercury, can make their way into the marine food chain.[26]

Besides seabed pollution, production activities create continuous air pollution from rig and ship engines and generators in the form of greenhouse gases and particulates.

A major marine impact is the "produced" water associated with oil and gas pools released into the ocean, along with contaminated wash water from equipment, decks, galleys, and onboard sanitary systems. Produced water contains traces of hydrocarbons, as well as toxic chemicals from the muds used to lubricate the drill bits.[27]

Gas flaring results in light and air pollution, and minor and major leaks and spills of diesel fuel and lubricating oils add to the overall toxic loading on the environment.

Onshore facilities built to process and transport the oil or gas will also contribute their share of pollution. If a polluting facility is located near the ocean, it's likely that any toxic releases will make their way to the sea through critical coastal intertidal habitat.

Transportation

About half of the oil produced in the world today is transported across the globe by oil tanker. World oil production has been rising steadily from just under 5 billion barrels of oil in 1950 to just under 25 billion barrels of oil in 2000.[28] Production is expected to grow by about 1% each year and peak at around 75 million barrels per day in 2010.[29]

Unfortunately, much of that oil finds its way into the world's oceans. Estimates of the global spillage of oil into the ocean from all sources vary widely, from a low of 7.3 million tonnes a year to as high as 20 million tonnes. However, some experts believe that oil tanker accidents may be responsible for up to half of this pollution.[30]

During the past decade, over 1 billion gallons (4.5 million m^3) of oil and petroleum products were spilled worldwide from oil tankers and marine vessels.[31] The main causes of tanker accidents include running aground on shores or reefs, collisions with other vessels or oil terminals, and onboard explosions and fires.

Heavily used oil transportation routes experience much higher oil pollution. More than 5 million tonnes of oil each year is spilled from tankers and ships in the Arabian Sea, and up to half of the 1 million tonnes of oil that enters the marine environment in the Caribbean is believed to come from oil tankers and other vessels.[32]

Although tanker accidents are responsible for more than 86% of the total amount of oil released into the ocean by the oil industry, it is believed that spills from offshore oil and gas rigs account for the remaining 14% of the industry total.[33]

A producing offshore oil field contributes to local oil pollution. Twenty-eight percent of North Sea oil pollution in 1987 was attributed to offshore oil and gas facilities. Other offshore areas account for similar percentages.[34]

The 1971 moratorium against energy exploration on our west coast was put in place to prevent Alaskan tanker traffic from fouling Canadian waters. If the moratorium were to be lifted now, all those transportation risks would

return, plus the new risks from seismic exploration, drilling, and production that we have outlined above.

Decommissioning

The life span of an oil or gas field can be significant, but there comes a time when the field is played out. Two issues then come into play:

- Removal of the structures
- Cleaning up of the drill sites

Past difficulties with the decommissioning of old oil field structures have resulted in more attention being paid to designing for eventual ease of removal.[35] In some cases, the structures are left in place to form artificial reefs.

A more vexing question will be how to clean up the mess that will be left behind. Costly new technologies will have to be developed to clean up the contaminated environment. Heavily contaminated areas on land and under the sea will have to be specially treated or abandoned completely. Attempts will have to be made to reintroduce species to replace those lost during the years of industrial production.

In the decommissioning phase, those resource-based businesses and communities that have come to depend on oil and gas activity will now be faced with the difficult adjustment to the downside of the energy industry's "boom-and-bust" cycle.

Perhaps it would be better not to open up this Pandora's box of environmental and social impacts, but to leave whatever globally destructive fossil fuel resources there may be to rest quietly under the restless and storm-tossed waters of the Hecate Strait.

3
Potential Disasters

By definition, accidents are unplanned, unwanted, and unforeseen. They happen despite our best intentions. They are caused by natural events, lack of knowledge, poor design, equipment failure, or, more often, human error.

Disasters are accidents that have a major impact. Sometimes human lives are lost when disaster strikes. More often, however, wild animals and the natural environment pay the price for our mistakes. What amounts to no more than a minor glitch in production for an offshore operation can spell suffering and a slow death for animals and ecosystems.

We have yet to make a device or technology that will never go wrong. The laws of chance tell us that it's not a question of whether an accident will happen, but when. Unfortunately, our offshore waters offer great potential for both human-caused and natural disasters. Blowouts, spills, storms, and earthquakes are the major concerns, but cumulative damage from chronic small leaks and spills may be the worst hazard.

Blowouts and Spills

The possibility of massive environmental damage due to a major oil spill is the biggest fear surrounding offshore oil and gas development. A second fear is of an uncontrollable blowout that releases a plume of oil or gas into the environment. A third fear is the loss of a production platform or the sinking of an oil or gas tanker.

Blowouts happen when the pressure inside the drill stem becomes too great to be contained by any safety device. The oil or gas gushes out of the well, often destroying the wellhead and sometimes the entire rig. Blowouts are more likely to happen during exploration, when previously undrilled formations are penetrated.

Although blowouts occur only relatively rarely, their environmental consequences can be severe. Oil or natural gas enters the marine environment, killing fish and asphyxiating or poisoning birds and marine mammals. They also die from hypothermia due to loss of insulation from oiled feathers or fur.

Depending on the damage, containment generally means forcing a new wellhead onto the damaged pipe. If the pressure is too high for this to be successful, a relief well must be drilled into the damaged well. This is required in 3% of blowouts.

The offshore energy industry has a history of major blowouts. An exploratory well blowout in the Gulf of Mexico in 1979 resulted in the world's largest oil spill. More than 3.5 million barrels of oil gushed into the ocean for nine months before it could be contained. The entire south Texas coast and coastal estuaries were damaged by oil.[1]

The U.S. Minerals Management Service, which supervises safety in the oil industry, investigated 36 blowouts on U.S. east coast and Gulf of Mexico offshore facilities between January 1995 and February 2002. Fire accompanied five of these incidents.[2]

There were major gas blowouts in the Sea of Azov in Russia in 1985 and 1992. Methane from the blowouts dissolved in the seawater, killing thousands of fish.[3]

There has only been one blowout to date in Canadian waters. In 1984 the Uniake-G72 well off Sable Island released 1,500 barrels of condensate into the environment.[4]

Oil in the water

A complex process of physical and chemical changes starts when oil is spilled into the ocean. Within 10 minutes, a spill of one tonne of oil will form a slick 10 mm thick over an area 100 m in diameter. It will continue to spread, eventually covering an area of over 12 km^2 with a layer of oil 1 mm thick.[5]

The lighter fractions of the oil evaporate in the first days after the spill. Water-soluble hydrocarbons dissipate first, while photochemical reactions powered by ultraviolet light oxidize some of the floating oil into products that have increased water solubility and are more toxic than the original spill.[6]

The remaining oil fractions are more viscous, slowing the spreading action. Solid aggregates are formed. These are adsorbed onto suspended organic material and deposited on the seabed. After the slick has thinned to around 0.1 mm, it breaks into sections, which drift downwind or are carried by tides into even more distant areas.

Storms and active turbulence speed slick dispersion and emulsification. A large proportion becomes fine droplets that can be transported far from the spill site. Stable water-in-oil emulsions appear after strong storms, especially if the water is cold. These "chocolate mousse" emulsions containing 30% to 80% water can persist for over 100 days.

Oil-in-water emulsions are much less stable and chemical emulsifiers are often used to stabilize them so that the oil disperses into fine droplets, speeding slick breakup. Unfortunately, these emulsifiers can be very toxic to the marine ecosystem.[7]

Oil suspended in the water column undergoes intense chemical and microbial decomposition. However, once oil particles reach the seabed, the rate of decomposition drops abruptly. Oxidation processes slow down in the oxygen-free benthic environment. Heavy oil fractions accumulated in sediments can persist for many years.

After a while, an oil slick aggregates into sticky grey, brown, or black pelagic tar balls. These consist of heavy residues that have not been broken down by evaporation, emulsification, dissolution, or chemical or microbial transformation. Pelagic tar can persist for years in the open ocean and can wash up on beaches anywhere.

The ultimate fate of sedimented oil is dependent on microbial activity. About a hundred known species of bacteria and fungi can use oil hydrocarbons as food. The proportion of this type of organism is generally 0.1% to 1.0% of all marine bacteria. In oil-polluted areas, the proportion of this type of bacteria can increase 10- to 100-fold.

Eventually, the sea will break oil down into carbon dioxide and water, but this process of decomposition can take decades. By then many toxins will have been released into the environment, damaging fragile ecosystems and killing marine animals.

Natural gas in the marine environment

A gas blowout would be a major disaster in the shallow and organism-rich waters of the Hecate Strait or Queen Charlotte Sound. As well as posing a direct danger above the sea, the toxic underwater plume could destroy large swaths of the marine environment.

If an underwater blowout occurs, the natural gas does not just bubble up through the sea and dissipate harmlessly. A significant portion of the various gases, mainly methane and its derivatives, dissolve to form a solution highly toxic to marine life.[8]

Fish react very quickly to the presence of natural gas in the water. It penetrates the body, damaging gills, skin, eyes, and chemoreceptors. It fills up the swim bladder, making it impossible to control buoyancy. The fish sink down or float helplessly on their sides.

Fish start to sense gas at concentrations of 0.02-0.05 mg/L, showing signs of disturbance and moving away. At concentrations above 1 mg/L most fish become alarmed within seconds, then disoriented and unable to flee. Within 15 to 20 minutes they show signs of acute poisoning, and die within one to two days of exposure.

Various factors influence the sensitivity of different fish species to dissolved natural gas. Immature and young fish are most vulnerable. Increased

temperature intensifies the toxic effect due to more active fish metabolism. Sublethal winter concentrations can become lethal during the summer, especially as gas trapped in sediments is released.

Shellfish are killed by exposure to dissolved gas. Zooplankton (animal plankton and the egg and larval stage of most fish and marine invertebrates) and phytoplankton (vegetable plankton) can tolerate slightly higher concentrations than mature fish or shellfish. They die at concentrations between 2 and 5 mg/L of dissolved natural gas.

Measurements taken at natural gas blowouts in the Sea of Azov registered methane concentrations of 4 to 6 mg/L near the source. Two hundred metres away, levels of 0.07 to 1.4 mg/L were recorded. Patches up to 0.35 mg/L appeared up to 500 m downwind.

Methane and its homologues can remain in the marine environment for a long time and spread for a considerable distance. Test around drilling rigs in the Gulf of Mexico showed extremely high concentrations of methane and ethane in the local area.

High methane levels disturb the benthic (bottom-dwelling) ecosystem. Bacteria and other microorganisms that use oil and gas hydrocarbons multiply. Bivalve mussels show changes in enzyme systems due to close symbiosis with methane-eating bacteria. In very highly toxic areas, benthic biomass declines due to mollusk mortality.

Platform fires and sinkings

Enormous floating or fixed production platforms are used to house offshore drilling and processing equipment and crews. They also store oil before transportation. Despite their huge size and design safeguards, production platforms are not unsinkable.

In 1980 the first platform to be lost was the Norwegian *Alexander Keilland.* A stress fracture caused it to capsize and sink in a North Sea storm, drowning 123 workers.

On February 20, 1982, a huge wave smashed a window in the control room of the oil platform *Ocean Ranger* during a storm off Canada's east coast. Water poured in and the flooded balance controls stopped working. The *Ocean Ranger* quickly capsized and sank, drowning 84 crew members. A similar accident almost occurred in the North Sea in 1998.[9]

In 1988 the *Piper Alpha* platform burned in the North Sea, killing 167 workers.

In March 2001 the Brazilian *P-36,* the world's biggest semi-submersible platform, exploded and sank in the offshore Rocandor field. Eleven workers

died and over 1.5 million litres of crude oil and an unknown amount of gas escaped into the ocean.[10]

If a platform should sink, wreckage may destroy the wellhead, releasing oil or natural gas into the ocean and making it very difficult to bring under control. It could also rip out the network of pipelines that connect the wellheads to the production platform.

Liquid hydrocarbons, including oil, oil/water mixtures, and gas condensate, are frequently stored on production platforms. Other toxic chemicals, including methanol, are often kept in large (up to 50,000 m^3) underwater storage tanks. These could be ruptured in a platform fire or sinking, releasing their contents into the ocean.[11]

Production platforms and rigs can also catch fire. Chevron rigs in the Gulf of Mexico have suffered 65 fires or explosions between 1956 and 1995. Twenty-eight of these were attributed to natural gas equipment.[12]

The U.S. Minerals Management Service investigated 228 fires on U.S. east coast and Gulf of Mexico offshore facilities between January 1995 and February 2002.[13]

Tanker accidents

Oil spills and tanker sinkings continue to occur at an alarming rate. The International Tanker Owners Pollution Federation (ITOPF) recorded 407 major (over 700 tonnes) and 1,167 intermediate (7 to 700 tonnes) oil tanker spill incidents in the three decades between 1970 and 2000. These incidents released more than 5.32 million tonnes of oil into the world's oceans.

However, ITOPF records do not include the many thousands of small oil spills of less than 7 tonnes that occur each year.[14] Minor accidents during loading and discharging account for over one-third of all oil spilled from tankers. These usually happen in sensitive coastal waters, either at an onshore loading terminal or an offshore production platform or rig.[15]

ITOPF points out that improved construction and operating practices have decreased major tanker spills from an average of 25 per year during the 1970s to an annual average of seven during the past decade. Still, major catastrophic incidents such as a supertanker catching fire, going aground, or breaking up in a storm, account for most of the oil spilled. Three-quarters of the 346 oil releases over 7 tonnes during the 1990s were spilled in just 10 incidents, accounting for a total of 830,000 tonnes of oil.[16]

Major supertanker sinkings releasing over 100,000 tonnes of oil include, in order of magnitude:

- *Atlantic Empress* (1979, 297,000 tonnes, West Indies)
- *ABT Summer* (1991, 260,000 tonnes, Angola)
- *Castillo de Bellver* (1983, 252,000 tonnes, South Africa)
- *Amoco Cadiz* (1978, 233,000 tonnes, Brittany)
- *Haven* (1991, 144,000 tonnes, Italy)
- *Odyssey* (1988, 132,000 tonnes, Nova Scotia)
- *Torrey Canyon* (1967, 119,000 tonnes, Scilly Isles)
- *Sea Empress* (1996, 72,000 tonnes, UK)
- *Urquiola* (1976, 100,000 tonnes, Spain)[17]

By comparison, the now-infamous *Exxon Valdez* spilled only around 37,000 tonnes of oil into Prince William Sound in Alaska in 1989, killing thousands of marine animals and sea birds, devastating communities, and causing extensive environmental damage that persists to this day.

Although most tankers carry oil and its derivatives, special tankers transport liquefied natural gas (LNG). Compressed gas leaking from a ruptured LNG tanker can spread over a wide area. If ignited, a deadly "flameless explosion" can kill everything in a region up to 400 km^2.[18]

Floating time-bombs

Two recent tankers sinkings off the European coast, the *Erika* (France, December 1999, 30,000 tonnes) and the *Prestige* (Spain, November 2002, 67,000 tonnes), vividly demonstrated that the majority of the world's tanker fleet is aging, poorly maintained, and in need of replacement. They have been called floating environmental time bombs.[19]

Nearly 60% of the world's tankers were built before 1970. They have a single, thin steel hull that is rusting away. Currently, only 6 of 25 oil tankers carrying Alaskan oil down the B.C. coast to refineries in the Juan de Fuca Strait and sometimes on to California are double-hulled.[20]

Both the *Erika* and the *Prestige* were old and corroding. Both split open and broke in two in heavy winter weather. Both were registered and inspected in countries where regulations are lax, a common practice for owners of older tankers. *Prestige* was owned by a Liberian company and registered under a flag of convenience in the Bahamas. *Erika* was Italian-owned but was registered in Malta and operated by a Maltese company.[21]

The effect of the sinking of the *Prestige* was particularly devastating to the coastal environment and communities. One thousand kilometres of coast, including vital Galician fisheries, was closed just before the height of the fish and shellfish season. More than 15,000 sea birds died, including rare and protected species.

The wreck of the *Prestige* is still leaking oil at about 33,000 gallons per day from 14 cracks in the bow and stern. Experts estimate that the *Prestige* could go on releasing its remaining cargo of 20 million gallons – approximately twice the *Exxon Valdez* spill – possibly until 2006.[22]

Coastal spills the worst

Most of the major tanker disasters take place on the high seas, so that much of the oil dissipates or sinks before it reaches land. Spills close to shore are more devastating to marine life, which is highly concentrated along the food-rich marine margins.

Spills close to a shore pollute local beaches, bays, and estuaries. They kill thousands of helpless marine animals and sea birds and can destroy coastal ecosystems.[23]

Although the *Exxon Valdez* (1989, 37,000 tonnes, Alaska) was the worst tanker spill in North America, it ranks only 34th in tonnage lost. It is estimated that the oil killed 2,800 Sea Otters, 250,000 sea birds, 1.9 million salmon, and 12.9 billion herring.[24]

Ten years after the *Exxon Valdez* disaster, herring stocks have not fully recovered. Sensitive intertidal areas remain affected and oil can be found under gravel banks. Other coastal disasters, such as the *Braer* (1993, 85,000 tonnes, Shetland Isles) and the *Erika* (1999, 20,000 tonnes, Brittany), were equally devastating to the local environment.

Charles Darwin's historic visit to the Galapagos in 1835 inspired his famous theory of evolution. This remote archipelago, which comes under the protection of Ecuador, supports many unique species. It was declared a World Heritage Site in 1996.[25]

An ecological disaster was only just averted on the Galapagos Islands during the 2001 grounding of the small supply tanker *Jessica*. Strong ocean currents washed the 240,000 gallons of heavy bunker and diesel fuel oil out to sea, where it evaporated.[26]

If a major spill were to occur in our offshore waters, considerable stretches of the B.C. coastline would be engulfed in oil and its fragile but vital marine ecosystem wrecked.

Canadian coastal spills

Canada has had its share of environmental damage by spills from tankers and barges. In 1970 the *Arrow* wrecked on the Nova Scotia coast, spilling 9,000 tonnes of bunker C oil. Around 2,400 loons, grebes, diving ducks,

and other waterbirds washed ashore. Another 4,800 birds, mainly Dovekies and Murres, were caught in offshore oil slicks.[27]

The size of a spill has little to do with the damage it causes. In March 1970, the barge *Irving Whale* spilled 30 tonnes of bunker C oil off southern Newfoundland after a hatch came loose in a storm. The slick drifted into an eider feeding area and oiled 5,000 birds, almost as many as oiled by the *Arrow* sinking but in a spill one-tenth the size.[28]

On the west coast, in December 1988 the barge *Nestucca* and the tug *Ocean Service* collided at the mouth of Greys Harbour, Washington state. Eight hundred ninety tonnes of bunker C oil was released. Between 30,000 and 40,000 oiled Murres and Cassin's Auklets were washed ashore along the coasts of Washington and British Columbia.[29]

In February 1999 the bulk carrier *New Carissa* lost anchor during a storm and broke in half when it grounded outside Coos Harbor, Oregon. Most of its 1,490 tonnes of bunker fuel was deliberately burned off, but 268 tonnes leaked from the wreck.[30]

Lifting the moratorium on offshore exploration and drilling would only increase the frequency and possibly the severity of such events.

Wind and Waves

The west coast can be a harsh environment for a large production platform or for an oil or natural gas tanker. With its potential for high winds, high waves, and swiftly changing weather, the Hecate Strait is one of the most severe marine areas in Canada.

The waters surrounding Haida Gwaii are the windiest in this country. The fiercest wind recorded by an instrument in Canada was 177 km/h at the Cape St. James lighthouse during a storm in January 1951. The lighthouse keeper estimated, however, that the storm reached a steady velocity of 200 km/h and gusted to as much as 220 km/h.[31]

On average, published statistics show that winds in the Hecate Strait exceed 56 km/h at least 20% of the time during January, November, and December. Significant ocean waves vary from an average of 1.5 m in June to around 4 m in January. The tallest waves can be almost twice as high during that time.[32]

In the Dixon Entrance area, the tallest waves tend to come from the southwest in January while the strongest winds are from the south and southeast, making for difficult sailing conditions. In the Hecate Strait, tall waves tend to come from the south and southwest, while the strongest winds come up from the south and southeast.[33]

However, the information presently available for maximum potential wave height for the area is based on a technique called "hindcasting." Sea conditions are estimated using a combination of numerical modelling and other techniques. These simulated data are used to estimate the very tallest (100-year) waves that may be encountered.[34]

A wave hindcasting study for the B.C. coast was completed in 1992 for the Canadian Atmospheric Environment Service. It calculated 100-year waves to be in the order of 13 m. However, the methodology used was based on deep-water conditions. The effects of shallow water and strong currents on wave heights were not analyzed.[35]

Two automated buoys in the Dixon Entrance, two in the Hecate Strait, and three in Queen Charlotte Sound monitor wave conditions. Maximum wave heights were reported at around 16-18 m. According to one report, however, waves higher than a 10-story building have sometimes overwhelmed these remote measuring systems.[36]

The study noted that hindcasting tended to underestimate the extreme waves encountered, and that there is evidence that in very severe storms waves in the Hecate Strait are affected by bottom topography. It also noted that the effects of global climate change in producing more severe storms should be studied further.[37]

Thus, we have no definitive information as to the maximum height of waves that could be encountered in B.C. offshore waters. This is vitally important, as at times sea and weather conditions can combine to create rogue or monster waves that suddenly appear and that can overwhelm even the largest vessel or production platform.

Monster waves

Marine engineers at the University of Berlin recently confirmed that unusually high waves could be created when slow-moving waves are overtaken by a succession of faster-moving waves. This can happen when strong winds, not necessarily hurricane force, blow steadily over a long ocean reach. The overtaking waves add to the height of the slower waves, creating rogue or monster waves of enormous proportions.[38]

In 1933 the *USS Ramapo* reported the largest ocean wave accurately measured to date. Encountered in the Pacific Ocean, it was 32 m high. In 1942 the liner *Queen Mary* was struck by a huge wave off the coast of Scotland. The huge ship rolled on its side. Luckily for the 15,000 soldiers it was carrying, the venerable ocean liner righted itself.

The results of even a large vessel encountering a monster wave can be disastrous. A ship may plunge into an oncoming monster wave and be

instantly swamped, or the sheer weight of water smashing down on its structure can destroy parts of the hull.

In 1965 a 25-metre section of the bow of the heavy cruiser *USS Pittsburgh* was torn off by a huge wave. In 1966 the passenger ship *Michelangelo* was struck by a monster wave. It broke windows 25 m above the waterline and flooded the bow section. Two crew members and a passenger were killed.[39] In 1995 the luxury cruise ship *QE2* barely survived a direct hit over the bow by a huge wave estimated to have been over 30 m high.

Oceanographers now believe that some of the 200 supertankers and container ships that have disappeared during the last 20 years may have been sunk by monster waves. Depending on the ratio between the wavelength (the distance between two successive wave peaks) and the ship's overall length, a monster wave can break up a large vessel. So much of the hull is lifted out of the water that it snaps under its own weight.

In 1973 the 132,000-ton *Neptune Sapphire* broke in half on its maiden voyage after it was hit by a freak wave off the coast of South Africa. The next year in the same area, the 132,000-ton Norwegian tanker *Wistar* fell into a huge trough and then was hit by a huge wave. Its bow was torn off. In 1976 the oil tanker *Cretan Star* was struck by a huge wave off Bombay and never heard from again. Its crew barely managed to send off a brief radio message before foundering. The only sign of the vessel's fate was a 6 km oil slick.[40]

On November 11, 2001, waves more than 25 m high struck offshore oil installations in the Norwegian Heidrun field of the North Sea. The wind was only storm force but a stable direction all the way from Iceland is thought to have caused the incident.[41]

Monster waves are now recognized as an infrequent natural phenomenon. Lack of specific wave data and the sea conditions of the B.C. offshore demand that rogue waves be taken into account in any consideration of whether to open up our coast to tankers.

Earthquakes and Tsunamis

The Queen Charlotte fault is a major transition boundary between the North American and Pacific tectonic plates. It runs 10 to 20 km west of Haida Gwaii and has a history of generating large earthquakes centred 9 to 15 km below the sea floor.[42]

The biggest recorded earthquake in Canada took place on the Queen Charlotte fault. On August 22, 1949, a huge shock measuring 8.1 on the Richter scale knocked people and animals off their feet on Haida Gwaii. It

swayed buildings and shattered windows in Prince Rupert and was felt as far south as Vancouver and Seattle.[43]

An earlier 8.4 magnitude quake occurred in 1899 on the northward extension of the Queen Charlotte fault in Yakutat Bay, Alaska. It caused a 15 m displacement along the fault line, compared with an 8 m displacement caused by the 1949 quake.[44]

On Good Friday, March 27, 1964, the most severe earthquake ever recorded in North America jolted the state of Alaska. Centred 25 km deep at 90 km west of Valdez and 120 km east of Anchorage, this massive 9.2 shock caused the greatest amount of vertical uplift ever measured. It was the largest recorded earthquake in the world.

Shaking lasted four minutes and movement of the ocean floor caused a tsunami wave that reached a height of 67 m (220 feet) in Valdez Inlet at Shoup Bay. One hundred twenty-three people died and property damage was valued at $300-400 million in 1964 U.S. dollars.[45]

The aftershock zone was about 250 km wide. It extended 800 km from Prince William Sound to the southwest end of Kodiak Island. On the first day, there were 11 aftershocks with a magnitude greater than 6.0; in the next three weeks, there were nine more. Thousands of smaller aftershocks were recorded in the months following the main shock. Smaller aftershocks occurred for more than a year.[46]

Some areas were uplifted 4 to 9 m while others dropped 3 m. The resulting sea waves caused loss of life in Alaska, Oregon, and California. Seiches, a sloshing effect, were observed as far away as Louisiana, where a number of fishing boats were sunk. The Earth "rang like a bell" and seismic waves travelled around the world for several weeks. States as far away as Florida and Texas saw earth motions of 5 to 10 cm. Oscillations in the height of water wells were reported as far away as South Africa.

A much earlier and almost unimaginable mega-quake estimated at well over 10 on the Richter scale took place somewhere in this zone on January 26, 1700. It sent tsunami waves across the Pacific Ocean to Japan, while in British Columbia huge tsunami waves raced 1,500 m up coastal mountains, ripping out whole forests.[47]

This megathrust event is estimated to have occurred along 1,000 km of the undersea Cascadia fault, approximately from mid Vancouver Island to northern California. Geological evidence suggests that such mega-quakes have occurred at least 13 times in the last 6,000 years. They can be expected to strike every several hundred years.[48]

The ever-present risk

Hundreds of smaller earthquakes occur along the Queen Charlotte fault every year. These shallow events are also caused by movements along smaller faults in the area.

Area faults include the Rennel Sound fault through Moresby Island and the Sandspit fault from south of Sandspit to north-central Graham Island. Louscombe Inlet fault extends from the south end of Graham Island north to the Rennel Sound fault. Other faults include the Grenville Channel, Kitkatla, and Price Laredo faults on and near the mainland coast and an unnamed fault through the centre of the Hecate Strait.

Small earthquakes can be handled by proper platform or rig design. However, a major or mega-earthquake likely would overload any manmade offshore structure, wreak havoc with underwater pipelines and installations, and fracture well casings.

The Canadian Geological Survey estimates that the 1-in-475-year earthquake peak horizontal acceleration (PHA) in the Hecate Strait is between 0.32g and 0.4g (the acceleration due to normal gravity). However, changing this to the 1-in-2,500-year standard proposed for the Canadian Building Code would lead to a PHA of between 0.8g and 1.2g. Maximum forces on a structure would be three times greater.[49]

Seismic activity anywhere on the west coast can generate ocean tsunamis that travel at several hundred kilometres an hour. Tsunamis from the Aleutian Islands can reach B.C. waters within minutes. Earthquakes also cause landslides that trigger tsunamis. Onshore cliffs, submarine slopes, and enclosed basins are most vulnerable.[50]

A landslide during a 1958 earthquake on the Fairweather fault crashed into Lituya Bay. It generated 30 m waves that stripped trees to an elevation of 520 m on the opposite shoreline. Landslides are not always caused by earthquakes. A submarine landslide destroyed part of Skagway Harbour in Alaska in November 1994.[51]

As well as being exposed to local disturbances, the north coast can be hit by tsunamis originating thousands of kilometres away. A study of the Pacific region suggested that a large landslide in the Hawaiian Islands could create a 30 m tsunami in the western margins of the Dixon Entrance and Queen Charlotte Sound.[52]

Earthquakes and tsunamis are an ever-present risk in B.C.'s offshore waters. Major and even massive seismic events are historical facts. It is not a question of whether such events will occur, but when. Delicate offshore oil or gas wellheads, pipelines, and offshore infrastructure cannot withstand the effects of a major earthquake.

The possibility of recovering a little more fossil fuel must be measured against the risk of adding large and possibly uncontrollable oil or natural gas blowouts to these natural disasters.

Ongoing Pollution

We do not know exactly how much oil is spilled in the world's oceans each year. Estimates vary from 2.4 million tonnes per year (GESAMP 1993) to 7.3 million tonnes per year (Panov et al. 1986; GESAMP 1994). Others believe that the annual total oil input to the marine environment could exceed 20 million tonnes (Konovalov 1995).[53]

Although industrial and urban discharges (37%) and vessel operations (33%) are thought to be by far the largest sources of marine oil, researchers estimate that the oil and gas industry is responsible for at least 14% of the total annual spillage.[54]

The four main sources of oil from offshore oil and gas facilities are:

- Produced water from underground sources
- Leaks and spills during transportation
- Hydrocarbon deposition caused by flaring
- Deck and equipment wash water

Of these, produced water is the most significant, followed by transportation and handling leaks. Hydrocarbon deposition from flaring can also be significant.

Produced water

Produced water includes water from the drilled formations as well as chemical-containing injection water pumped into the wells to intensify extraction. It is possibly the main ongoing source of pollution from offshore exploration and production.

Produced water is contaminated by hydrocarbons, trace metals, and chemicals. It must be treated before discharge, usually into the ocean. Special separation units on the rigs or production platforms remove excess oil. The treated water may also be injected into a disposal well or transported to land for further treatment and disposal.[55]

Even with treatment, discharged produced water is contaminated. Oil separators mainly remove particulates and dispersed oil, leaving dissolved hydrocarbons in concentrations from 20 mg/L to over 50 mg/L to be discharged overboard.

Produced water is very highly mineralized, containing sodium, potassium, and magnesium as well as chloride and sulphide ions. It is usually more mineralized than the local seawater. Elevated levels of heavy metals from drilling muds and chemicals used in drilling are present, and in some cases radioactive elements from deep strata.

As a hydrocarbon reservoir is depleted, the amount of produced water increases. More water must be injected into an aging well to maintain the rate of flow. The oil/water ratio declines until only water is produced and the well is abandoned.

Thousands of tonnes of oil can enter the marine environment each year from an oil or gas field.[56] Calling produced water "one of the biggest ticking time bombs of the North Sea environment," a recent report estimated that 1 million tonnes of produced water is dumped into the North Sea *each day* from oil platforms.[57]

North Sea oil companies must separate oil from produced water, but not other chemicals. Researchers believe that endocrine disruptors present in produced water mimic female fish hormones, causing a three-week delay in North Sea cod spawning. Norwegian Fisheries minister Svein Ldvigsen called for an end to these emissions.[58]

Flaring

Excess natural gas and gaseous hydrocarbon is frequently burned off, especially during well testing and development. Each tonne of oil contains around 300 m^3 gas, which bubbles off as the oil is depressurized. Continuous flaring is used to dispose of this, as well as gas from storage tanks and pressure control systems.[59]

The plume from flares contains toxic combustion products, which include nitrogen and sulphur oxides (NO_x and SO_x), carbon monoxide, fine particulates, and complex products of incomplete combustion (PICs). These interact with sunlight and airborne volatile organic compounds (VOCs) to form smog and acid rain.

During well testing in the Canadian zone of the Beaufort Sea, oily hydrocarbon residues deposited on surrounding ice provided clear evidence of pollution from flaring. Oily surface sheens are often observed around offshore production rigs.

In addition to the toxic products mentioned, testing and production flaring creates large amounts of carbon dioxide, the primary greenhouse gas. Unburned methane is also released. Methane is considered to be 21 times more potent than carbon dioxide in its effect on the global climate, while nitrous oxide is 310 times more potent.

Further atmospheric pollution from oil and gas production facilities is contributed by the many generators and engines used for electrical power, heat, and lighting.

Small spills add up

Mega-spills attract public attention, but the cumulative effect of thousands of small spills each year at offshore oil and gas production facilities and onshore terminals can pollute the environment even more than a devastating mega-spill.

The overwhelming majority of spills from oil tankers and barges are small. Eighty-five percent release less than seven tonnes of oil, mainly when loading, discharging, or bunkering. These generally occur while a vessel is tied up or manoeuvring at an oil or gas terminal. Often, such spills are not accounted for in annual oil spill statistics.[60]

The U.S. Government Accounting Office (GAO) estimated in 1996 that 46 million gallons of oil and petroleum products are spilled each year into U.S. waterways – more than four times the amount spilled by the *Exxon Valdez.* According to the GAO, an average of 8,000 spills each year take place during loading or unloading of oil.[61]

In U.S. waters alone, 8,354 incidents spilled over 3,250 tonnes of oil during 2000, 96% of which were small spills off less than a third of a tonne. One big spill, the 1,250 tonnes of crude oil spilled from the oil tanker *Westchester* after it ran aground in the Mississippi River near Buras, Louisiana, accounted for 38% of the U.S. total spillage in 2000. This was the largest oil spill in U.S. waters since 1996.[62]

Any exploration or production facilities located in the area, plus the associated loading terminals, will pollute the local environment. The constant low-scale release of oil inevitably will result in more oceanic tar washing up on B.C. beaches.

A polluting industry

Exploring for, producing, processing, and transporting oil or natural gas creates pollution. Fossil fuels are burned and toxic substances are released at every stage of the process. Huge volumes of global warming greenhouse gases are released when the hydrocarbon products are burned in vehicles, buildings, factories, and power stations.

Overall, the industry's environmental record is not good. Driven by legislation, litigation, and adverse public opinion, it has made some successful efforts to clean up its act. But the drive for production and the laws of chance run counter to any suggestion that oil and gas exploration and

production in the offshore waters of British Columbia can take place without environmental damage on some scale.

Blowouts and spills can be catastrophic or minor. With good planning, adequate monitoring, and plain good luck, major environmental disasters might be avoided. But the ongoing pollution endemic to the industry will change our pristine coastal environment in ways that we cannot at present predict or possibly later undo.

4
The "Resource" that Grew

Geological Basins

Several geological formations of interest to the energy industry extend under the offshore waters of British Columbia. These include the Queen Charlotte, Winona, Tofino, and Georgia basins.[1] Of these, the Queen Charlotte, Tofino, and Georgia basins are thought to contain significant hydrocarbon resources, especially natural gas.[2]

The Queen Charlotte Basin especially intrigues hydrocarbon-seekers. A geologically complex region, it extends down to 6 km beneath the seabed between Haida Gwaii and the mainland, minus a strip several kilometres wide along the mainland coast. Some geologists include the two main islands of Haida Gwaii and parts of the narrow and steep outer continental shelf as part of the Queen Charlotte Basin.[3]

Because it forms the boundary between the North American and Pacific tectonic plates, the area is very active seismically. It includes the Queen Charlotte fault on its western edge, B.C.'s equivalent to California's famous San Andreas Fault.

Four continental plates with their related major fault lines collide under the offshore ocean, making this by far the most earthquake-prone area in Canada.[4] Frequent movements have broken the area into complex geological blocks. Four major fault lines run through the Hecate Strait roughly parallel to the coastline. The earth's crust is estimated to be only 23 km thick beneath the Hecate Strait.[5]

There is considerable evidence that more than half the width of the Hecate Strait was dry land up to 13,000 years ago. During the last Ice Age, sea levels were at least 100 m below their present level. At the same time, the weight of the huge ice sheets depressed the mainland up to 200 m below its present elevation. This tilted the west end of the Hecate Strait upwards to form dry land, with rivers and lakes.[6]

After the ice retreated, sea levels rose again. The mainland, free of the weight of ice, floated upwards once more and Haida Gwaii lost its upward tilt. The Hecate Strait was submerged, but evidence of the former prehistoric landforms can still be found today.

The Resource that Just Grew

The original impetus towards lifting the moratoria on B.C. offshore oil and gas exploration came from a 1983 Geological Survey of Canada report. It estimated that 300 million barrels of oil (BBO) and 3 trillion cubic feet (TCF) of natural gas could lie beneath the offshore B.C. seabed.[7]

Although this estimate was based on geological theory and was no more than an educated guess, the Geological Survey's numbers have since been growing steadily. In 1995 the Survey raised its offshore estimates to 2.6 BBO and 20 TCF of natural gas.[8]

As if by magic, by 1998 the Survey's estimates of west coast offshore oil and gas had grown yet again, up to a total 9.8 BBO and 43.5 TCF of natural gas in all the west coast basins. The same report estimated B.C.'s undiscovered offshore reserves at 9.8 BBO and 25.9 TCF of natural gas in the Queen Charlotte Basin, plus another 9.4 TCF of gas in the Winona and Tofino basins.[9]

To be fair, the Survey took pains to point out that its numbers are no more than a "probabilistic assessment" of the theoretical maximum oil and gas potential of the area. The 1998 report stated: "No reserves have been established in the area; 100 percent of the resource quoted remains to be discovered."[10]

In other words, this theoretical oil and gas has not yet been found and may not exist. Perhaps it should not even be called a "resource," as this suggests that it actually exists and can be recovered. But the B.C. government and other offshore exploration boosters are using these theoretical maximum potential estimates to suggest that vast offshore riches lie under the coastal seabed, just waiting to be exploited.

Not everyone agrees with the Geological Survey's estimate. Rob Woronuk worked for Shell Canada in the 1960s. He helped drill Shell's exploratory wells in the Hecate Strait and Queen Charlotte Sound. Woronuk is a member of the Canadian Gas Potential Committee (CGPC), a voluntary group of 50 geologists, geophysicists, mathematicians, and engineers who donate their time to develop unbiased and realistic assessments of Canada's marketable fossil fuel reserves.[11]

"In the Hecate and Queen Charlotte basins there were 18 wells drilled (and) nothing (was) found," Woronuk explains. "If you look at the well logs, they're not very encouraging. I think it would be a mistake to assign too much likelihood of there being significant amounts of oil and gas there," he concludes.[12]

It is very likely that the value of B.C. offshore resources is way less than the $100 billion originally quoted in the media.[13] They are not going to be double those of Hibernia, nor will they ever return billions annually to B.C. government coffers.

Perhaps it's time that a sense of proportion was restored to the debate on lifting B.C.'s offshore drilling and tanker passage moratoria.

Conceptual Plays

To form a commercially significant oil or natural gas field, layers of organic material must be deposited during a warm interglacial period, then trapped between layers of impermeable rock. After millions of years, the immense pressure of the overlying strata changes the organic material into bitumen, oil, or coal. Natural bacteria will break down some of these hydrocarbon deposits to form sweet or sour gas, which is often trapped in basin-like geological formations created by folds in the earth's crust.

Three main sedimentary layers in western Queen Charlotte Sound – Jurassic source, Cretaceous potential reservoir, and Tertiary seal – form the type of geological basin in which hydrocarbon deposits are most likely to be found. Earlier exploratory drilling penetrated only the Tertiary structures and did not reach the Cretaceous zone.[14]

Estimates of the potential of a basin are developed as conceptual "plays," a group of prospects forming a common geological population linked by one or more factors such as stratigraphy, structure, reservoir type, or source-rock type. A conceptual play exists only on paper. Essentially it is just an educated guess. A conceptual play suggests where exploration might be successful. It is by its nature an optimistic assessment.

To arrive at its 1998 estimates, the Geological Survey of Canada developed 10 conceptual plays for the four west coast basins. These were analyzed to estimate their resource potential, using several assumptions that included the possible distribution of pool sizes, the number of prospects, and the probable risk factors.[15]

The Survey developed plays in the Pliocene (sediments deposited between 1.8 and 5 million years ago[16]) and Miocene (deposited 5 to 23 million years ago) gas plays in the Queen Charlotte Basin, eastern Graham Island, and the offshore shelf areas of the Dixon Entrance. It also believes that the Tertiary period structural gas play (1.8 to 65 million years ago) in the Tofino Basin potentially contains resources.[17]

The Geological Survey's west coast conceptual plays rest on the estimate that at least 40% of the Queen Charlotte Basin Tertiary fill was deposited within

the earth's prehistoric oil and gas window. It points to equivalent geological structures in the Cook Inlet Basin in Alaska and the southern California offshore continental basin, where commercial quantities of oil and gas have been found.[18]

Nominal or Marketable?

Despite advances in geological science, exploration is still a hit-and-miss affair. Even though an area theoretically might contain hydrocarbons, it does not follow that commercially significant pools of oil or natural gas will be found there.

Trapped hydrocarbons must be discovered in sufficient quantities to justify the capital costs of exploration and development. The geological traps in an oil or gas field may, however, be too small and scattered to give good returns. Drilling may find only small pools, or miss them entirely. Earth movements, including the upward tilting of the Hecate Strait in prehistoric times, may have allowed any oil or natural gas to escape.

Resources are gas-in-place volumes; **reserves** are quoted in marketable volumes. **Nominal reserves** acknowledge that some of the undiscovered oil or gas may be in parks or other restricted areas, while some will be in pools too small to be economic. Not every undiscovered accumulation will be found.[19]

Recoverable resources consist of gas in place reduced by a recovery factor, which varies according to the geology of a particular field. Byproducts such as hydrogen sulphide, carbon dioxide, and gas liquids must then be stripped out of the recovered resource.

Called **surface losses**, they reduce recovered volumes to **marketable reserves**, which are hydrocarbons that can actually be sold. In the case of natural gas, some of this marketable reserve is used to power the compressors needed to push it through hundreds or even thousands of kilometres of pipeline to its ultimate destination. **Transmission losses** are due to this and to leakages along the transportation system.

According to the Canadian Gas Potential Committee, at the end of 1998 the total estimated nominal remaining marketable natural gas potential of the entire Western Sedimentary Basin (B.C., Alberta, and parts of the Northwest Territories) was 142 TCF. The CGPC estimates B.C.'s remaining marketable plus undiscovered nominal marketable gas at 22 TCF.

This does not include any potential resources in B.C. west coast or interior basins, as nothing has been discovered there, so there are no data on recovery factors or surface loss to enable a calculation of estimate of marketable

reserves. The CGPC believes that there may be around 14 TCF of gas in place in these two areas, which it classifies as non-established conventional resources.

That's a significant amount, but it's an order of magnitude less than the Geological Survey of Canada's estimate of 9.8 BBO and 43.5 TCF of natural gas in just the offshore west coast basins.

Experience bears out CGPC's approach. Even if a commercial gas field is developed to production, marketable reserves may not meet their estimated potential. Recently, the partners in the Sable Island natural gas development off the Nova Scotia coast were forced to cut 1 TCF, or almost 27%, off their marketable reserves.[20]

In February 2002, Chevron Canada and its partners decided against developing the Hebron-Ben Nevis heavy oil field east of Newfoundland due to economic and technical challenges. The field is estimated to contain approximately 600 million barrels of recoverable heavy oil reserves. Chevron stated that oil prices would have to rise, technology improve, and costs fall to justify investment in the resource.[21]

Boosters' Bonanza

In spite of the considerable uncertainty attached to the figures, both the offshore exploration business boosters and the B.C. government are promoting the Geological Survey's maximum theoretical potential estimates as if they were established reserves. This paints a picture that an offshore resource actually exists.

One B.C. Ministry of Energy and Mines publication designed to attract investment to the province's energy industry labels the Geological Survey's estimates as "Total Estimated Energy Resources,"[22] while another publication calls the same estimates "undiscovered potential." The ministry lists B.C.'s estimated remaining reserves in 1999 at only 25 million cubic metres of oil and 237 billion cubic metres of natural gas.[23]

A letter to the editor from the president of the B.C. Chamber of Commerce states unequivocally that "there are over 9.8 billion barrels of oil and 40 trillion cubic metres of natural gas waiting beneath the sea floor," and that "over 70% of coastal residents expressed their support" for offshore drilling. Neither statement is entirely accurate.[24]

The only way to raise the level of confidence about the existence of hydrocarbon resources is by extensive seismic survey plus exploratory drilling, both of which can damage the marine environment. (See Section 2, "The Four Phases of Exploitation.")

Clearly, the claims of the offshore exploration boosters both in business and in government must be viewed with skepticism. The difference between theoretical resources and marketable reserves must be made clear. Theoretical estimates must be identified as such, and not viewed as revenues just waiting to be collected.

5
Negative Economics

The impetus behind the current push to lift the offshore moratorium is economic. The B.C. government wants to boost its provincial oil and gas revenues. In 2000 these totalled almost $1.3 billion, a 120% increase over the $587 million collected in 1999.[1]

As well, the provincial government and northern business lobbyists want energy-related employment to replace lost jobs in fishing and forestry. Recent public-sector cutbacks will impose further stress on B.C.'s hard-hit coastal communities.

But will lifting the moratorium lead to economic recovery? Unfortunately, the bright economic future as a result of offshore oil and gas development may prove to be an illusion. There are many reasons why the promised bonanza may not materialize.

A Global Industry

Although some business boosters believe there will be a rosy economic future once exploration begins, it is unlikely that local residents will be hired for this phase of the work. Globalization of the offshore industry means that specialized ships or floating drill rigs would be brought in complete with crews. These would perform the initial seismic surveys and drill the expensive and speculative exploratory wells.[2]

In 1985 Chevron estimated that its then proposed three-year exploration program in B.C. offshore waters likely would employ only 27 locals out of a total workforce of over 200, since locals did not posses the requisite skills.[3]

If there were local hiring, residents would have to compete with experienced roughnecks and other industry personnel from northeastern B.C., Alberta, and the Maritimes.

The possibilities of B.C. firms receiving contracts for design and engineering is low. Even if governments were able to offer tax breaks and subsidies, B.C. engineering firms at best stand to receive only small design contracts related to the huge offshore production platforms that would be needed. There are four reasons for this:

- B.C. engineering companies lack design experience for modern offshore rigs or production platforms. This knowledge has been globalized, and people with these skills tend to move to where they are in demand, which

has not been in this province. B.C. does not have an oil rig or offshore platform construction industry.

- There is international competition for such contracts, and price is a major factor. It would be foolish to believe that B.C. engineers would be able to undercut experienced offshore design firms in countries where engineering is cheaper.
- It is even doubtful whether the B.C. government would be able to dictate where the design and engineering contracts could be placed. The Newfoundland and federal governments could only approve a development plan for the heavily subsidized Hibernia development, and then apply political and moral persuasion to try to have the contracts stay in the region.[4]
- Finally, this would be a form of economic discrimination that is not allowed under World Trade Organization and NAFTA rules. Hibernia was specifically excluded from NAFTA, but subsequent projects cannot receive any special privileges from government, such as requiring a company to hire locally, except in exchange for a subsidy.[5]

Similarly, the likelihood is that the huge production rigs or platforms will not be constructed in this province, or even in Canada. There are no technical reasons to prevent their construction in any part of the world that has a shipbuilding industry.[6]

British Columbia shipyards simply cannot compete on the basis of either cost or experience with countries such as South Korea, which has large-scale shipbuilding facilities, a history of constructing offshore facilities, and much lower labour costs. The prospect of resurrecting the B.C. shipbuilding industry through offshore oil and gas development is no more than a shimmering chimera held out to fool the gullible.

Finally, the decommissioning phase is not a major employment generator. Coastal communities would have little to look forward to once the oil or gas is gone.

Corporate Disinterest

Although 10 onshore and 8 offshore exploration wells have already been drilled in the Queen Charlotte Basin between 1913 and 1969, plus another 6 in the Tofino Basin, only hydrocarbon shows were encountered. No significant pools were found.

Meanwhile, other oil and gas resources have been developed in Alberta, Alaska, and northeastern British Columbia. Huge new pools of natural gas have been identified in the Canadian and U.S. Arctic, and proposals have

been put forward for one or more major pipelines to bring Arctic natural gas through Canada to the United States.[7]

The multi-billion-dollar price tag on these projects means that major energy industry players will have significant capital and other resources tied up for many years. Energy industry experts doubt whether the major players will want or even be able to commit further capital resources to the more speculative and expensive B.C. offshore.

Although Chevron Canada, Petro-Canada, Union Oil, and Ranger Oil hold offshore oil and gas leases in the Queen Charlotte, Winona, and Tofino basins,[8] none have any plans to proceed with exploration at this time, even if the moratorium were lifted.

A spokesperson for Petro-Canada, which holds drilling rights to over 2.4 million hectares in the Queen Charlotte Basin, has stated that First Nations land claims, identification of ecologically sensitive areas, and a regulatory framework must all be resolved before any exploration would be contemplated by his company.[9]

This leaves the smaller energy industry players, which lack the ability to raise the required capital and generally have no experience in dangerous offshore exploration. And because of the high cost of exploring for and producing offshore oil and gas, it will be uncompetitive compared with land-based and existing offshore production.[10]

Energy industry watchers believe that economic viability is a major fatal flaw that will stand in the way of west coast offshore exploration and development. With the impetus to lift the moratorium coming from the government and local boosters, costly federal and provincial subsidies would be needed to attract private investment.

"As a purely private sector endeavor, producing oil and gas in the Queen Charlottes won't make the grade," wrote industry analyst Brent Jang. "Based on the cards on the table now, Queen Charlottes drilling is a lost cause."[11]

Substantial Subsidies?

Substantial financial incentives would be needed from both the federal and provincial governments to attract the capital required for offshore oil or gas exploration. These could be grants, loans, tax and royalty incentives, or direct investment of public funds.

The B.C. government already offers substantial incentives to the fossil fuel industry. Provincial royalties for natural gas extracted in B.C. are based on the price producers receive for their marketable production. Royalty rates are reduced when natural gas prices are low. The cost of gathering and

processing the royalty share is deducted from the share's value, and a 36-month exemption is granted for new pool discoveries.[12]

The province is investing $113 million in infrastructure and services in northeastern B.C. under a 10-year agreement with the Peace River Regional District. It has set up a $5 million environmental fund for areas affected by oil and gas activity, and is paying to upgrade roads and highways to improve access to remote drilling areas.[13]

Other B.C. government expenditures are designed to assist the fossil fuel industry. The province is investing $1.56 million over two years to develop plans for drilling in environmentally sensitive special management zones. It will spend $750,000 over five years to develop an archeological database to streamline permitting. The government contributes $700,000 to run a northeastern B.C. geological research facility and in 2001 gave $655,000 to the Geological Survey of Canada for research.[14]

The B.C. tax regime has been changed to benefit energy corporations. B.C. sales tax is waived on machinery and equipment used for oil and gas activity. Starting in 2002, the provincial corporate income tax was reduced to 13.5%, the same rate as energy-rich Alberta. The corporate sales tax was halved in 2001 and eliminated on September 1, 2002.[15]

The Hibernia Experience

B.C.'s potential offshore oil and natural gas resources have been compared to the Hibernia oil field off Newfoundland. Hibernia was intended to be built and operated without government help. To date, however, governments have directly invested over $2 billion in the project and have granted tax exemptions worth over $190 million.[16]

The federal government and the province of Newfoundland also gave grants of $11 million to ensure that Newfoundland engineers were used to design the offshore structure, plus another $95 million to build the Bull Arm construction facility. The joint Canada-Newfoundland Offshore Petroleum Board, which regulates offshore activities in the area, costs the two levels of government $2.6 million each year.[17]

Because considerable concessions were made in the royalty structure, the basic royalty will total only $1.5 billion over the estimated 10-year life of the project – less than the direct investment by the two governments. Net royalties will be paid only if the project's revenues exceed its allowable costs, which include a 15% rate of return for the private Hibernia Management Development Corporation (HMDC). HMDC partners can use expenditures on other projects to reduce or eliminate corporate tax obligations.[18]

Based on these figures, the exploration and construction phase of the Hibernia project created only 5.5 person-years of employment per million dollars invested (JPM). In 1998, the first year of operation, $299 million in investment led to 960 jobs (3.2 JPM). The next year, another $321 million investment created 2.5 JPM. Overall, Hibernia produced only a dismal 5.5 JPM, or 7.5 JPM if multiplier effects are included.[19]

Even if the B.C. government wanted to offer the same level of public subsidy, it would be better advised to put public funds into energy efficiency programs, or for research and development of sustainable energy sources. It is estimated that renewable energy creates 60% more jobs than conventional energy projects, while energy efficiency and conservation create almost five times more jobs than offshore oil and gas.[20]

Fouling the Fisheries

The fishing industry is vitally important to the B.C. economy. In 1999 salmon, herring, groundfish, wild shellfish, and other fisheries landed over 210,000 tonnes valued at over $300 million. Recreational sports fishing in tidal areas accounted for $315 million in 1999, providing 3,400 seasonal jobs for over 800 charter operations.[21]

Until recently, fishing was the economic lifeblood of B.C. coastal communities. Along with logging, it was the most important human activity in many remote and beautiful areas of B.C.'s west coast. In recent years all this has changed. Fishing fleets have been drastically reduced by government order. Fishing boats have been sold or sit idle.

Seasonal employment in B.C. commercial and recreational salmon fisheries dropped from 26,000 in the early 1990s to 18,000 in 1997, a loss of 8,000 jobs. At the same time, forest industry employment fell 16% (6,800 jobs) between 1995 and 1998. This was doubly felt in resource-dependent coastal communities, where fishers traditionally turned to forestry for employment during the off-season or in low-fish years.[22]

In the wake of reduced catches, coastal fish canneries and processing plants have closed. Fishers and process workers have been forced to retire, take lesser-paid work, or attempt to develop new skills in government retraining programs. The federal government committed $25.9 million to such programs from 1996 to 1998.[23]

Salmon under Stress

West coast salmon and other fish are under pressure. Their habitat is being destroyed by logging, urban development, and reduced river flows below hydroelectric dams. Overfishing, industrial and urban pollution, and water temperature changes due to global warming are reducing annual survival rates. As a result, stocks are shrinking.

Salmon are a culturally significant west coast icon. They are part of our heritage and economy and once were abundant in B.C. waters. After spawning and with the help of the bears, they bring vital marine nutrients to enrich ancient coastal forest ecosystems. Over 840 B.C. salmon stocks are threatened with extinction or are now extinct, however.[24]

Only chum and pink salmon stocks are stable or increasing. A significant number of sockeye, coho, chinook, and steelhead stocks are now extinct or are of special concern. A 1996 study found 13% of cutthroat trout stocks to be extinct, 32% of steelhead stocks are of special concern, while 18% of coho and 13% of chinook face moderate to high risk of extinction. Of 142 stocks surveyed, 3% had already become extinct.[25]

There are big gaps, however, in our knowledge of the state of west coast salmonids. Of the approximately 10,000 stocks assessed in the study, the status of 80% of cutthroat trout, 51% of chinook, 50% of coho, 48% of steelhead, 40% of sockeye, 31% of pink, 29% of chum, and 43% of salmon stocks was unknown. They may already have gone.[26]

As well as salmon, the Hecate Strait is a major breeding ground for crab, halibut, sole, rockfish, and other species. Western Queen Charlotte Sound is rich in perch, yellowtail rockfish, reedeye, and boralis, some of the world's oldest species of fish.

Many of these important fish stocks are threatened. Pacific halibut, rock, English, and petrale sole, yellowtail rockfish, and Pacific hake have declined significantly in recent years. Pacific cod stocks dwindled until 1996, followed by a slight increase until 1998. Herring stocks have increased since 1986, but are expected to shrink in the long term.[27]

Oil and Gas Pressure

Reduced fish stocks have already caused severe economic hardship in many coastal communities. Opening offshore waters to oil and gas development would further stress fragile fish stocks and hasten the demise of the west coast fishing industry.

Offshore exploration interferes with fishing. Explosions from air guns used in seismic survey damage fish and affect fish breeding and migration. Some fish

stocks in the North Sea declined 50% after seismic surveys. Fishers report that reduced catches on Canada's east coast followed seismic activity to open up offshore oil and gas fields.[28]

Seismic testing can also reduce fishing time. East coast fishers complain of having to haul out nets at short notice when survey vessels track across fishing grounds.[29] Offshore platforms pose a navigation hazard for fishing vessels and must be avoided. Ocean-floor installations can damage trawl nets. Tether cables can snag anchor lines.

In the U.K. between 1971 and 1987, North Sea fishers made over 1,200 compensation claims for damage to gear and lost fishing time caused by oil-related debris. By 1993 Norwegian fishers had made 101 claims for similar reasons.[30]

Ongoing pollution from drilling and production activities can harm fish larvae and reduce survival rates. This is especially noticeable in fish breeding areas damaged by a major oil release. Spawning herring still produce significantly fewer normal larvae in previously oiled sites in Prince William Sound after the *Exxon Valdez* spill.[31]

Catastrophic damage from a major oil spill or natural gas blowout would exterminate millions of fish, tens of thousands of sea birds, and many hundred marine mammals. One major spill, or just the cumulative effect of chronic pollution from both offshore installations and onshore infrastructure, could be the last straw for many fish species.

Is the prospect of limited financial benefits to one city worth the risk of eliminating forever the ecologically and economically important species on which the onshore fisheries, the economic and cultural lifeblood of many coastal communities, depend?

Turning Off Tourism

Tourism is vital to B.C. In 2001, 22.3 million tourists contributed just under $5.4 billion to the provincial economy, 4.8% of the $111 billion 2001 gross provincial product.[32] Ocean tourism is most important to B.C.'s coastal communities. This includes sport and recreational fishing, cruise ships visits, recreational boating and kayaking, whale watching, diving, surfing, windsailing, and marine ecotourism.

Ocean tourism in B.C. increased from $654.9 million in 1988 to $867.7 million in 1996, an average annual growth of 3.5%. This includes cruise ship tourism, saltwater sport fisheries, and other coastal tourism.

Of these, cruise ship tourism is the most valuable. Cruise ship passengers increased from 324,300 in 1988 to 701,500 in 1996, a 9.6% annual growth. In

1988 they spent $81.4 million, rising to $192.1 million in 1996 – an average annual increase of 10.4%.[33]

Fresh- and saltwater sport fishing from lodges looms large in the economic life of some coastal communities. The prosperity of this industry depends to a large measure on the continuing survival and return of fish stocks. With the decline of salmon stocks and freshwater fishing restrictions, this has been significantly reduced.[34]

Although the number of Pacific saltwater sport fishers declined by an average 3.7% annually from 1988 to 1996, their expenditures actually grew 2.2% annually, rising from $454.8 million in 1988 to $540.5 million in 1996. Coastal tourism revenues and investment increased from $113.7 million to $135.1 million, also an annual increase of 2.2%.

Like sport fishing, ocean ecotourism needs an unspoiled natural environment. Adventure tourism and ecotourism are growing rapidly. A 1998 study found that ecotourism in B.C. generated around $892 million in revenue in 1997 and employed over 13,000 people. This sector had increased by a vigorous 11% over the previous year.[35]

Although the ocean tourism industry is a significant and growing part of the economy of B.C. coastal communities, no studies have been done into the impact of oil and gas exploration and development on this burgeoning economic sector. These activities may be incompatible. In a worst-case scenario, they could be mutually destructive.

The Whitford Report deals in one sentence with the possibility of loss of tourism opportunities to oil and gas development: "How oil and gas exploration activities could affect the trend towards tourism and ecotourism in the area is unknown, as is the manner in which the industries could complement each other in community economic development."[36]

The potential loss of millions of dollars of relatively environmentally benign income each year and thousands of sustainable jobs in B.C. coastal communities deserves a more thoughtful response.

Social Dysfunction

Employment benefits would be felt primarily in the community chosen as the main supply base for the offshore. Most likely, this would be Prince Rupert. However, a social price would accompany any potential local economic uplift.

The supply centre would experience the "boom-and-bust" cycle that inevitably accompanies the resource industry. Speculation would drive up

housing and living costs. Drug- and alcohol-related problems might increase, requiring costly government services.[37]

Observers of offshore oil field development in Louisiana noted increased social problems in local communities where oil workers lived or recreated. These included increased incidence of drugs, gambling, prostitution, and all types of crime.[38]

In a 1998 report, the San Luis Obispo Chamber of Commerce complained that the full socio-economic costs of adjacent offshore oil field development were not taken into account in a federal offshore economic study. "The impact of oil and gas development in our county is already profound. From loss of property values, to loss of business to environmental and social impacts, we have been harmed," the report stated.[39]

Other coastal communities would not benefit significantly from offshore energy development. On the contrary, they may suffer losses. Some residents of smaller communities would leave to try to find employment in the main supply centre.

The socially disruptive effects of a major oil spill or a natural gas blowout would include much more than measurable economic losses. When the social fabric of a community is ripped apart by a catastrophic event, psychological suffering increases.

As a result of the *Exxon Valdez* spill, the small community of Cordova suffered economic and social turmoil. An epidemic of severe psychological depression, domestic violence, and crime ensued. In the year following the spill, reports of domestic violence increased 118% and arrests rose by 123% in the town of Valdez.[40]

Direct losses to commercial fishers are estimated to have reached $155 million (U.S.) in the two years following the 1998 spill.[41] Although the victims of the spill won a 1994 court ruling against Exxon assessing $5 billion in punitive damages, the company has yet to pay one penny in compensation. Payment is stayed pending legal appeals.[42]

It's All About Politics

With no proponent, unsupportive economics, possibly negative community impacts, and large question marks about the existence of commercially significant reserves – why the push to lift the moratorium on exploratory drilling off B.C.'s west coast?

The answer is politics. Business promoters want to make money, and the provincial government, which recently announced the biggest deficit in

British Columbia history, wants to increase the revenue it receives from energy activities.

In an address to an industry conference in December 2001, Premier Gordon Campbell spoke of wanting "aggressive growth" in the provincial energy industry, including doubling the number of oil and gas wells in B.C.'s part of the Western Sedimentary Basin.[43]

The premier announced that he would shrink down the oil and gas approval process, with streamlined approval times from a single-window, full-authority permitting agency, along with "performance-based permitting and compliance and enforcement."

The $1.9 billion a year in provincial energy revenues pays for 12 out of 20 provincial government ministries, the premier said. Increased private sector investment in energy would enable his government to provide "better public services."

If the report of the scientific panel on offshore oil and gas exploration is positive, the premier promised "a very exciting consultative process across the North ... (and) with companies, the scientific community, and the environmental community."[44]

This overriding drive for increased energy revenues could put the provincial government in a conflict of interest when it comes to environmental protection and jurisdictional matters. It also could compromise negotiations with First Nations.[45]

This means it's going to be up to each of us to ensure that government pays attention to all the issues before rushing ahead into a course of action that could damage the marine environment and stress marine animals yet not provide the promised bonanza for northern coastal communities.

6
Legal and Ethical Issues

Several vexing legal issues cloud the ability of governments to lift the moratorium on BC offshore oil and gas. These are:

- It is not clear whether the provincial or the federal government has jurisdiction over offshore areas of greatest interest for exploration.
- First Nations may have legitimate claims to some of the offshore.
- The Canadian and B.C. governments may be liable for cleanup costs.
- A new west coast regulatory agency would have to be created.
- Conflict of interest questions may sully any regulatory framework.
- The Canada/U.S. boundary in the Dixon Entrance is unresolved.

Who Has Jurisdiction?

Jurisdiction over B.C.'s offshore resources has never been entirely clear. In response to a challenge from the province, in 1967 the Supreme Court of Canada ruled that the seabed and its resources from the mean low water mark to the 12-mile territorial limit then in force was within the exclusive control of the federal government. This decision did not sit well in Victoria, and the province sought a more favourable ruling from the Supreme Court of Canada. Based on an 1866 definition of the western border of B.C. as the Pacific Ocean, in 1982 the Supreme Court decided that the seabed under the Queen Charlotte, Johnson, Georgia, and Juan de Fuca straits falls within provincial jurisdiction.[1]

Unfortunately, the Supreme Court was not requested to answer which level of government controls the resources under the Hecate Strait and Queen Charlotte Sound. Thus there is no binding authority on whether these are federal or provincial waters.[2] This is important, as ocean fisheries in provincial waters are administered by the federal government. Even if it was clear that the Hecate Strait and Queen Charlotte Sound come under provincial authority and any resource revenues accrue to the province, the federal government may still be liable for damages to shipping or the fishing industry from provincially licensed oil and gas activities.[3]

The B.C. government clearly controls any resources accessed from land, which includes the Queen Charlotte Islands. In theory, land-based directional drilling could avoid the need for offshore installations. But this opportunity would be removed if the courts were to grant ownership of Haida Gwaii to

the Haida Nation. In any case, the federal government would still be responsible for any maritime compensation.

The legal situation of the continental shelf west of Vancouver Island and Haida Gwaii is more straightforward. This comes under federal jurisdiction, except where it may be claimed by a First Nation. Based on recent rulings, however, offshore or land-based exploration may be prohibited while such claims are before the courts.

First Nations Claims

Unresolved land claims are a major obstacle to future B.C. offshore oil and gas exploration. Depending on the outcome of a court challenge by the Haida Nation, First Nations land claims may rule out offshore development in the Hecate Strait.

On March 6, 2002, the Haida Nation filed a claim in the B.C. Supreme Court to all 5,800 km^2 of the Queen Charlotte Islands and the surrounding waters. The claim followed a favourable B.C. Court of Appeal ruling of a week earlier that the B.C. government and Weyerhaeuser Corporation had breached a legal duty to consult with the Haida on logging activities in Block 6 of Tree Farm Licence 39.[4]

The 241,00 hectares of TFL 39 cover almost a quarter of the surface area of the Queen Charlotte Islands. Block 6 contains old-growth red cedar, a culturally significant tree traditionally used by the Haida to make totems, weavings, canoes, and longhouses.

The B.C. Court of Appeal ruling supported a previous B.C. Supreme Court judgment. In finding for the Haida two years earlier, Justice D.A. Halfyard ruled that "there is a reasonable possibility that the Haida will be able to establish aboriginal title to at least some parts of the coastal and inland areas of Haida Gwaii," including Block 6.[5]

There is considerable evidence that the Haida have inhabited the Queen Charlottes for over 10,000 years. New information has come to light that suggests they may also be able to claim prior occupation of the seabed under the Hecate Strait. During the last Ice Age, the western part of the Hecate Strait was raised up and became dry land.

In May 1998 a joint exploration by Parks Canada and the Geological Survey of Canada recovered a basalt stone tool from a drowned river delta 53 m below the ocean surface off southern Haida Gwaii. The artifact indicated that the area was inhabited at least 10,200 years ago. The find was made in Juan Perez Sound off Moresby Island.[6]

First Nations opposed

The Haida Nation is firmly opposed to any offshore oil and gas exploration and development. After presenting his claim to the B.C. Supreme Court, Haida president Guujaw made it clear that the Haida believe that offshore oil and gas cannot be safely extracted. "The technology doesn't exist and we are not prepared to see offshore oil and gas drilling within a 200-mile limit surrounding Haida Gwaii," Guujaw said.[7]

The Haida are not the only coastal First Nation opposed to offshore drilling. In 2001 Heiltsuk councillor Phillip Hogan of Bella Bella explained his people's concerns to a Simon Fraser University conference on the future of offshore development. "If there is an oil spill, it could totally destroy some of the things we rely on, like herring," Hogan informed the conference. "We do not see that it is worth taking the risk."[8]

At the same conference, Grand Chief of the First Nations Summit Edward John pointed out that court decisions have created an obligation for governments to consult with coastal First Nations before considering any offshore development.

"Consultation is the legal requirement – it is not something that is by the political will of government," Chief John stated.[9] He pointed out that the Coast Salish, Kwagiutl, Nuu-chah-nulth, Heiltsuk, Haisla, Tsimshian, and Haida nations must all be consulted. The recent ruling of the B.C. Court of Appeal has elevated this into law.

Chief Garry Reece of the 2,700-person Lax kw'alaams Band of Port Simpson, north of Prince Rupert, told the SFU conference that his people would want to conduct its own investigation into the risks and benefits to them before it would contemplate allowing any development to proceed. Lax kw'alaams would require revenue sharing agreements and equal decision-making status before it would reconsider its stance.[10]

"For us, the sea is not an 'industry,' it is our life," Chief Reece explained. "We fish commercially; it is our largest source of employment." But, he continued, "It is still the basis of our culture. Its value cannot be measured in money." Chief Reece suggested that oil companies and governments spend as much money trying to understand First Nations' use of the sea as on geology, the environment, and technical challenges.

The Haida, Nuu-chah-nulth, Kwagiutl, and Coast Salish were seagoing peoples before Europeans came to what is now British Columbia. Even today, both their traditional cultures and contemporary prosperity are closely connected to the ocean. Whatever marine claims they make likely will be seen as worthy of serious legal consideration.

The 1992 B.C. Treaty Commission Agreement established a three-way, six-stage land claims negotiation process. Throughout B.C., 49 First Nations are taking part in 40 different negotiations. The Haida are at stage 2, the Nisga'a have completed final agreement, and 42 other nations are at stage 4. At this time, however, progress has stalled.

The impact of the proposed provincial referendum on land claims negotiations in B.C. is not known at this time. One thing is clear: the offshore moratoria may be lifted but there will be no offshore exploration unless coastal First Nations first give their consent. Negotiations will take a long time and may not conclude in agreement.

Government Liability

Responding to and cleaning up a major oil spill, natural gas blowout or leak, or a rig or tanker accident are costly. Cleanup costs for the *Exxon Valdez* spill exceeded $2 billion. Another $6.5 billion was awarded against Exxon by the courts. The bill for removing oil spilled from the *Prestige* from Spanish and French beaches in 2001 could amount to hundreds of million dollars as oil continues to leak from the submerged wreck, but the owners of the *Prestige* carried cleanup insurance for only $25 million.[11]

International maritime law established by the 1992 Civil Liability Convention (CLC) limits a shipowner's liability for cleanup costs to a formula based on the tonnage of the vessel. The International Oil Pollution Compensation Fund, funded by signatory nations, will pay up to an additional $270 million towards cleanup, but governments are then responsible for any costs over the insured amount. The maximum amount payable by the fund is set to increase to about $400 million in November 2003.[12]

Canada's 2001 *Marine Liabilities Act* ratified the convention. Part 6 confirmed that the responsibility for responding to marine oil spills lies with the shipowner. Levies on oil shipments were initiated to finance private oil spill response organizations, and it became a legal requirement for all ships over 400 tones and shippers of all types of oil to have a contractual arrangement with a response organization for cleanup.[13]

Section 77 of the *Marine Liabilities Act* established a further source of compensation, the Ship Source Oil Pollution Fund (SOPF). SOPF offers up to $135 million of additional compensation and in some circumstances can be a claim of first resort.[14]

Who pays for cleanup?

A 1995 report prepared for the Enforcement and Environmental Emergencies Branch of the B.C. Ministry of Environment, Lands and Parks raised the disturbing possibility of B.C. government liability for oil spill cleanup.[15] The report quoted the conclusions of a study prepared for the same ministry that year on B.C.'s financial preparedness for an offshore oil spill, considering the funding available to pay for response to a spill as well as compensation for environmental or property damage.[16] The report found that:

- Although under the *Canada Shipping Act* oil tankers and major vessels must contract with a response organization to provide response services, there is no legal obligation for the owner to fund or use the these services following a spill.
- In Canada, the combined amounts of two international compensation schemes, the Canadian Ship Source Oil Pollution Fund and the private-sector oil tanker compensation insurance are insufficient to compensate for the cost of cleaning up a major maritime oil spill, let alone any environmental damage costs.
- Although in the U.S. the level of financial responsibility for oil pollution damage by a vessel owner is almost 10 times that of Canada, there is no treaty or other legal obligation to access this money to compensate for any costs incurred by any level of Canadian government or for any environmental damages.
- Canada has neither an environmental damage assessment requirement nor the capability to estimate economic and social losses due to a maritime oil spill.[17]

This suggests that the B.C. government may be faced with having to pick up a large proportion of the cost of cleaning up a major oil spill, particularly if it originated outside Canadian waters from a U.S. oil tanker or from any other foreign-flag vessel.[18]

Offshore drilling exempted

Part 6 of the *Marine Liabilities Act* specifically exempts drilling ships and floating storage units, apparently negating any shipowner liability and forgoing possible compensation from the International Oil Pollution Compensation Fund. It reads:

> *49. (1) This Part does not apply to a drilling ship that is on location and engaged in the exploration or exploitation of the sea-bed or its subsoil in so far as a discharge of a pollutant emanates from those activities.*

49. (2) This Part does not apply to a floating storage unit or floating production, storage and offloading unit unless it is carrying oil as a cargo on a voyage to or from a port or terminal outside an offshore oil field.[19]

This is extremely disturbing, as considerable quantities of oil are often stored on drilling platforms or directly offloaded to storage barges for transportation to shore. Drilling platforms can catch fire and even sink, and transportation barges, which are not required to have a double hull, can be holed in collisions or sink.

The government of Canada suffered a major setback in 1998 when the Federal Court ruled that the Irving companies, the federal Ship Source Oil Pollution Fund, and the International Oil Pollution Compensation Fund did not have to pay the cost of raising the huge *Irving Whale* oil barge, which had sunk in 1970 in the Gulf of St. Lawrence.

The federal government had sued the owners for the $42.4 million it spent to raise the sunken barge – the largest maritime salvage operation in Canadian history. In this case, the court ruled that the government had waited too long to sue. The *Irwin Whale* sank in 1970, and the law requires compensation to be pursued within eight years.[20]

With the changes introduced by the 2001 *Marine Liabilities Act* and described above, however, it is doubtful whether the Canadian or B.C. governments could even approach these funds should an *Irwin Whale* type of disaster happen on Canada's west coast.

Damage to fisheries

Canadian courts consider a fishing licence simply as a permit to catch fish, not a constitutional or other right to fish. Fishers are without recourse to sue for damages should this permission be withdrawn. However, the situation may be different if a government does something that it knows will cause harm to fish stocks.

By granting fishing licences for as much as $10,000 a year, enforcing a quota system that uses transferable quotas, and shifting a large part of the cost of enforcement onto the shoulders of the fishing industry, the federal government may have created a *fiduciary obligation* to its commercial offshore fishing licence holders.

In a fiduciary relationship, the fiduciary (in this case the government) has a special duty to act with the licence holder's best interests in mind. This obligation may be breached if the government allows industry to explore for and produce offshore oil and gas, activities that it knows have a very good chance of damaging fish stocks.

The commercial west coast fishing licence holders may decide that they have grounds to sue the federal government for economic damages caused by offshore seismic mapping or resource extraction. Whether or not such a lawsuit is successful, it could tie the government's hands for many months while the case is before the courts.[21]

Who Would Regulate Activity?

Federally, Natural Resources Canada (NRC)[22] and the National Energy Board (NEB)[23] have jurisdiction over oil and natural gas. NRC is the lead federal agency for natural resources. These include energy, minerals and metals, and forestry.[24]

NEB regulates interprovincial and international pipelines and power lines, and energy exports. It monitors the energy market and oversees the exploration and development of oil and gas resources in Canadian offshore and Arctic regions.[25]

A multitude of federal departments and agencies are involved with marine regulations:

- The Canadian Environmental Assessment Agency (CEAA)[26] administers the *Canadian Environmental Assessment Act* (CEA)[27] and its regulations.
- The Department of Fisheries and Oceans (DFO)[28] regulates fishing and performs fish-related research activities in ocean and inland waters.
- The Canadian Coast Guard[29] enforces the *Navigable Waters Protection Act*.[30]
- Industry Canada[31] oversees the *Radicommunications Act*.[32]
- Parks Canada[33] administers the *National Marine Conservation Areas Act*.[34]

Several B.C. government ministries and agencies are charged with managing B.C.'s interests in offshore areas under provincial jurisdiction, and oil and gas activities:

- The Ministry of Energy and Mines[35] has overall oil and gas responsibility.[36]
- The B.C. Oil and Gas commission (BCOGC)[37] regulates oil and gas drilling.
- The Ministry of Sustainable Resource Management[38] performs land and coastal planning.
- The B.C. Environmental Assessment Office[39] directs environmental reviews.

- The Ministry of Water, Land and Air Protection[40] supervises environmental protection.
- B.C. Parks[41] manages marine parks and ecological preserves.

Many of these agencies will be involved in offshore regulation. However, the two provincial agencies that could regulate offshore environmental protection have serious drawbacks that in all likelihood would rule them out of consideration. These are the B.C. Oil and Gas Commission and the B.C. Environmental Assessment Office.

B.C. Oil and Gas Commission

The B.C. Oil and Gas commission (BCOGC) regulates oil and gas activity in British Columbia. Headquartered in Fort St. John in the heart of the northeastern B.C. oil and gas region, it is an agency of the Ministry of Energy and Mines.

The commission's mandate is to "efficiently expedite the review process for oil and gas sector applications, and to ensure that environmental, economic and social impacts are taken into account before any development activities are undertaken."[42]

Thus the commission is charged with the dual task of both assisting the oil and gas industry to develop, and overseeing its activities. To achieve these perhaps conflicting goals, it is moving to a streamlined, performance- and results-based, self-administered permitting process based on the Alberta model. In February 2000, BCOGC released a discussion paper for comment on the new process.[43] It received only six replies.[44]

Drilling companies would conduct public consultation with local residents according to a formula, and would file a report electronically with the commission. If all issues have not been resolved, the parties could move to a dispute resolution process.[45]

Self-administered consultation is biased towards industry. It removes the possibility of a comprehensive, public assessment in which all aspects and views of a proposal can be aired before an unbiased panel. Confined to activities already regarded as allowable, it does not allow for discussion as to whether or not those activities should take place.

Because offshore oil and gas is a different type of drilling activity, it is doubtful that the processes, expertise, or staffing of the BCOGC would be sufficient for it to act as the regulatory body for any proposed offshore oil and gas exploration or development.

B.C. Environmental Assessment Office

The B.C. Environmental Assessment Office (BCEAO)[46] coordinates provincial environmental reviews of major project proposals. It reports to the Minister of Sustainable Resource Management.[47] Set up under the 1996 B.C. *Environmental Assessment Act (BCEAA),*[48] it now is governed by a new act passed on May 30, 2002.[49]

A list of projects that qualify for assessment was described in the 1996 Act. It was amended in 1998 by raising some thresholds,[50] but was essentially retained by the current act.[51] Oil and gas pipelines, natural gas process plants, marine port and offshore oil and gas facilities are listed as qualifying projects, which suggests that the BCEAO must be involved in any assessment of offshore oil or gas proposals.[52]

However, the new environmental assessment act completely changes for the worse the original ground rules and procedures for environmental assessments in B.C.

The 1996 Act

The 1996 Act set up a three-stage process. In Stage 1, representatives of provincial ministries, federal departments, First Nations, local governments, and neighbouring jurisdictions would be invited to form a Project Review Committee, which reviews the application and recommends approval or rejection, or requests a project report.

Stage 2 included issuing draft specifications of the project report for public comment. The proponent was required to prepare a comprehensive report based on the final specifications. After public review, the Project Review Committee would advise the minister to approve or reject the application, or move to a Stage 3 public hearing.[53]

Timelines were given for government responses, but there were no time limits for proponents.[54] A total of 41 projects – 21 energy, 4 industrial, 9 mining, 4 assorted, and 3 water management – were approved by the BCEAO under the original legislation.[55] Although two projects were listed as terminated, no project was ever rejected by the BCEAO. This suggests either that all the projects were environmentally benign or that the agency has leaned more towards permitting than environmental protection.

In June 2000, the B.C. Supreme Court overturned the B.C. government's approval of the Tulsequah Chief mine.[56] The Tlingit First Nation was concerned about plans to build a 160 km access road through a pristine wilderness area in northwestern B.C. However, on January 31, 2002, the B.C. Court of Appeal ruled that the proposal be sent directly to the ministers for decision.[57] The newly elected B.C. Liberal government

granted approval in December 2002, subject, among other conditions, to locks being put on the access road and involvement of the Tlingit First Nation in the project.[58]

Reduced resources

Although concerns existed as to the level of environmental protection offered by the 1996 Act's assessment processes, the policy directions contained in the Ministry of Sustainable Resource Management's 2002-2005 service plan do nothing to assuage these fears.[59]

The service plan outlines the redesign of the former environmental assessment process. The new legislation shifts from a prescriptive to an enabling statute that introduces "broad flexibility" and "greater certainty." Customized, streamlined, and cost-effective processes minimize government administration and increase a project proponent's procedural options. "Performance-based standards" now "enhance the alignment between environmental assessment and permitting/ licensing."[60] What this political jargon actually means in practice is difficult to fathom.

The BCEAO's average environmental assessment budget will be reduced from its 2001/2002 $3.27 million to $2.38 million in fiscal 2004/2005. Project review expenditures will fall from an estimated $317,000 to $217,000 by 2005. Staff will be reduced from 43 to 27. Capital expenditures will fall from $198,000 in 2001/2002 to $62,000 in fiscal 2004/2005.[61]

However, the plan notes that "an environmental assessment approval can be an important marketing and financial asset. British Columbia has a strong reputation for environmental integrity ... and will need to preserve this in the future."[62] Just how this will be achieved with fewer staff and financial resources is not fully explained.

The 2002 Act

The 1996 Act set up a three-stage assessment process under a Project Review Committee that included First Nations involvement. It laid down strict timelines for government responses and provision for public consultation and appeals to the minister. The new act does away with all these safeguards. The director of the BCEAO now decides its application and custom-designs its processes. Thus under the new act, there is no certainty that an environmental assessment even will be conducted for a reviewable project. That decision is now entirely at the discretion of the director.

Project committees and First Nations involvement are abolished and the director will decide in each case the assessment process to be used, which in any case must be completed within six months. There is no guarantee of public access to project documentation, and the director's decisions must be based on current government policy rather than any objective assessment of environmental concerns.

The West Coast Environmental Law Association (WCELA), a service group of environmental lawyers funded by the B.C. Law Society, concluded that the 2002 *Environmental Assessment Act* is a dramatic step backward for environmental assessment in British Columbia. Specifically, WCELA charges that:

- The new act is not open, accountable, or neutral.
- Its application will be discretionary and could be subject to significant political interference.
- It eliminates existing guarantees of participation by communities, First Nations, local governments, or the public.
- It enables the government to decide that economic interests will prevail over environmental protection.
- It provides no certainty or consistency, either for proponents or the public.[63]

WCELA believes that this new act will create a whole new set of problems in B.C.: "It will be a ticket for environmental degradation, and clearly puts short-term economic development over long-term environmental protection."[64]

Unlikely agency

Canada and British Columbia have agreed to cooperate on environmental assessment. Under a 1997 agreement, the B.C. review process will be used. Federal agencies will "participate actively" to ensure that their requirements are met.[65]

However, this agreement was based on former BCEAO processes. Now that these are changed significantly and for the worse, they may not comply with the requirements of the CEAA. This plus the staffing cuts outlined in the agency's service plan make it unlikely that the BCEAO will be suitable as the regulator of B.C. offshore oil and gas.

The dictates of the current legislation suggest that the BCEAO will most likely approve any exploration permit application after only a token assessment. There would be no guarantee that due consideration would be given to environmental protection.

New offshore authority

The most likely scenario is that the two senior levels of government will agree to share both the regulatory responsibilities and any B.C. offshore revenues. They may even offer a revenue share to First Nations as an incentive to settle land claims.

On the east coast, Atlantic Accords were negotiated with two Maritime provinces. This created the Canada-Newfoundland and the Canada–Nova Scotia Offshore Petroleum Boards, which are charged with managing and regulating offshore activity. Following negotiation of a Pacific Accord between the federal government and B.C., a Canada-B.C. Offshore Petroleum Board (C-BCOPB) would be modelled on these.[66]

This would get around the difficulties we have suggested that the two B.C. regulatory agencies would have in managing west coast offshore resources. It would also allow the province to upload a large part of the regulatory costs to the federal government.

However, this solution would not remove the possibility that the environment would take a back seat to financial revenues at a time when the B.C. government is reducing environmental protection. Experience on Canada's east coast suggests that this is exactly what might happen.

Conflict of Interest

The east coast experience

Environmentalists and fishers on Canada's east coast have become concerned that the federal/provincial offshore petroleum boards set up to oversee oil and gas activities are putting offshore development ahead of environmental protection. The central issue is that these boards are both the offshore regulator and the licensing authority.

Although the Hibernia oil field has been in operation only since 1997, over 97 minor spills have been reported.[67] Fishers have complained that the boards have ignored complaints of interference and damage to fisheries caused by oil and gas activities.[68]

An acid test of the boards' ability to perform both roles equitably is unfolding at this time. In October 2000, the federal government ordered a public review of the leases granted by the Canada–Nova Scotia Offshore Petroleum Board (C-NOPB) to Hunt Oil and Corridor Resources to explore near the east and west coasts of Cape Breton. The review was ordered after questions about the way in which the permits were issued.

The Canadian Council of Fish Harvesters expressed concern that exploration could have proceeded without study in some of the most productive and sensitive fishery on the entire east coast. Cape Breton fishers questioned the credibility of the C-NOPB conducting its own review. The Maritime Fishermen's Union pointed out that a 12-year moratorium had been put in place for the productive Georges Bank area.[69]

The federal fisheries parliamentary standing committee cited the issue as one of the most serious that had come to light during its 2001 review of the *Ocean Act.* It called for an exploration moratorium in the southern Gulf of St. Lawrence and Sydney Bight.[70]

Even before the review had begun, various national and local groups complained that the process was unnecessarily restricted and rushed. Only 250 days were allowed from final terms of reference to the finished report. The Sierra Club of Canada suggested that the terms of reference did not qualify it as a CEAA environmental assessment.[71]

Public hearings were held only during three weeks in January 2002. Speakers were limited to 15 minutes each.[72] Written evidence was disallowed from an internationally recognized expert on the effects of seismic and underwater noise on marine animals. Dr. Christopher Clark is research program director at Cornell University.[73]

Possibly the most damning evidence was a DFO report that described the lease areas as highly productive and biologically sensitive. They contain important spawning and nursery grounds for many species of fish and marine invertebrates. Some important fish stocks are very fragile. The DFO believes that the shallow, enclosed environment and the high biomass would amplify the effects of oil and gas exploration.[74]

In March 2002, review commissioner Teresa MacNeil announced that the ban would be extended on petroleum exploration for the inland waters surrounding Cape Breton Island. In May the Canada–Nova Scotia Offshore Petroleum Board ordered further study of the issue. It appointed an advisory group that included a broad cross-section of stakeholders to recommend how or even if it should allow exploration in the island's sensitive coastal areas.[75]

C-NOPB released the report of the advisory group exactly one year later. It suggested that the proposed seismic acquisition should be conducted only between November 1, 2003, and February 28, 2004. Other recommendations included that a fisheries representative and a trained biological observer must be on board the seismic vessel to assist the operator with marine mammal observations.[76]

The report pointed out that considerable gaps exist in the scientific knowledge of the east coast marine ecosystem. There was no consensus in the advisory group that the suggested measures would offer sufficient protection for the marine environment.[77]

Environmental protection

The concerns and experiences of fishers and environmentalists on Canada's east coast do not bode well for equitable jurisdictional solutions on the west coast. The same elements are in play, so what is happening there now could soon be happening here.

Offshore oil and gas is invasive and damaging to the environment. It can change and destroy ecosystems. But governments are increasingly looking to offshore oil and gas as a growing revenue source. The regulator benefits from the activity it is regulating.

Governments look good if resource revenues let them spend money while keeping taxes low and incomes high. Politicians are simply trying to further their careers – so why are we so shocked when legislation is relaxed or regulations applied leniently?

The answer is that government is the only counterbalance to unbridled pollution. Citizens acting alone cannot make laws, set standards, or force polluters to clean up. Citizens can use the courts, but the courts must look to the letter and meaning of the law as it exists. Only governments can make laws and set regulations.

A government has a duty to protect its citizens. But when this is seen as standing in the way of fiscal income, that government is failing in its role as protector.

Right now, many governments are in a severe conflict of interest when it comes to public and environmental health and ecological safety. Through global warming, we are in danger of losing all the advantages we have enjoyed since the Industrial Revolution. Yet governments have consistently refused to act to correct this imbalance.

The only way to ensure that offshore oil and gas does not destroy the fragile and vital British Columbia marine environment is to maintain the moratoria on offshore drilling and tanker traffic that have protected us so far.

Nothing less will suffice.

The A-B Line

In 1903 the border between Canada and the United States was set at latitude 54°40′ along the northern extremity of the Dixon Entrance. This marine boundary is called the A-B line. In the early 1990s, however, the U.S. began seizing and harassing Canadian fishing boats south of this line to protect the entrance to the Back Island nuclear submarine testing facility, 90 km north of the border.[78]

This A-B line dispute is still unresolved, particularly over fishing rights. In 1977 the two countries agreed that each would enforce its fishing rules on its own vessels in the disputed area. However, in 1980 Canada took enforcement actions against U.S. trollers, claiming that the agreement did not apply to non-traditional fisheries.[79]

In 1997 Canadian fishers blockaded an Alaska Marine Highway ferry in Prince Rupert harbour in protest over U.S. fishing south of the A-B line. In July 1999, the Canadian Coast Guard seized a U.S. vessel fishing for sablefish in the Dixon Entrance. After diplomatic protests, the vessel was released a day later with just a warning.[80]

In 1984 a similar dispute with the U.S. on the east coast over Georges Bank went to the International Court of Justice, which precisely set the international boundary.[81]

Although most of the supposed reserves are purported to lie south of this line, should the moratoria be lifted, the A-B line dispute may resurface. Once again, British Columbians would be faced with the possibility of unwieldy and often single-hulled supertankers carrying Alaskan oil in our busy, narrow, and turbulent coastal waters.

7
Double-Hull Tankers

Single-hull vessels are essentially floating oil tanks. Just one thin layer of steel only about 4 cm thick separates the oil from the ocean. Single-hull tankers can be holed at the sides by a collision, or from the bottom by running aground or onto a reef. They also can break apart from flexing, especially when the welded steel seams become corroded after years at sea.

Following the *Exxon Valdez* disaster, in 1973 the International Maritime Organization (IMO), a United Nations agency, formulated a Convention for the Prevention of Pollution from Ships, followed by a protocol in 1978.

Known as MARPOL 73/78, it requires tankers completed after 1982 to have segregated ballast tanks (SBT) behind 30% of their hull surface area. Filled with seawater or left empty, SBT would reduce the chance of oil release should the outer skin be ruptured. A maximum size of oil tank was also stipulated to reduce the potential volume of oil release. However, only 40% of the world's tankers currently qualify as MARPOL-compliant.[1]

Three more recent design approaches offer greater safety than the 1978 MARPOL standard:

- Double bottom
- Mid-deck
- Double-hull

A double bottom running the entire length of the vessel offers some protection against hull penetration from below. Sixty-five percent of the total volume of oil spilled from tankers in the U.S. has been lost due to grounding.[2] Although some tankers can be modified to this design, a double bottom is difficult to inspect and does not protect the tanker sides in a collision.

Mid-decks have been suggested by Japanese naval architects as a way of reducing to the total amount of oil lost. An additional deck would run the entire length of the main tank, dividing it into two stacked tanks and ensuring that the upper would remain intact in a grounding incident. Full-length side ballast tanks would offer protection in a collision.

Double hulls offer the best protection against spills but are the most expensive to build. Essentially, it creates a "tank within a tank." MARPOL 73/78 dictates a minimum 2 m space between the inner and outer hulls for all new tankers larger than 65,000 dead weight (empty) tonnes (Dwt). This enables easy access for inner and outer hull inspection by crew.

A 1992 IMO study estimated that an inner hull would have prevented spillage in 84% of all the groundings worldwide,[3] while the U.S. National Research Council in 1991 calculated that double hulls would halve the annual spillage of oil from tankers in the U.S.[4] Clearly, double hulls are the best protection against spills following oil tanker hull damage.

Two other protective measures have been suggested as improvements on the MARPOL 73/78 standard. These have been adopted on some tankers.

Hydrostatically Balanced Loading (HBL) is a procedure in which the tanks are filled only to a certain level. Due to the lighter density of oil relative to water, should the bottom be holed, seawater would enter instead of oil spilling out. However, hydrostatic loading requires properly trained crews and reduces the carrying capacity of the tanker, requiring more round trips.[5]

Protectively Located Spaces are a variant of SBT in which smaller-ballast tanks are distributed around the vessel to reduce the chance of an oil tank rupture. Some west coast operators have adopted both this and HSL as an operating convenience, but essentially they are only Band-Aid solutions.[6]

U.S. Tanker Legislation

Formulated in the aftermath of the *Exxon Valdez* disaster in Alaska, the 1990 U.S. *Oil Pollution Act* (OPA 90) lays out strict rules for tankers operating in U.S. waters. It gives the U.S Coast Guard authority to set and administer standards for new tanker construction as well as a mandatory retirement schedule for existing single-hulled tankers calling at U.S. ports.

As well, under the 1920 U.S. *Jones Act,* any vessel that transports oil between any two points in the United States must be built and registered in the United States, and must be owned and operated by U.S. citizens.

Although the IMO believes that mid-deck layouts offer protection equivalent to a double hull, the U.S. Coast Guard has rejected this design in favour of requiring a double-hull for all new tankers. The Coast Guard points out that mid-deck tankers would spill oil during a low-speed grounding.

OPA 90 prohibits single-hull oil tankers of 5,000 gross tonnes or over from entering U.S. ports from 2010, apart from those modified with a double bottom and double sides. These can continue to trade to the United States through 2015, depending on their age.

An exemption to the 2015 deadline allows single-hull vessels less than 30 years old to use deepwater ports and offshore areas for transferring oil to another vessel. As well, tankers between 80,000 Dwt and 200,000 Dwt over 23 years old without double hulls were barred from U.S. ports after 2000.[7]

Because of the age of the world's tanker fleet and the importance of the U.S. market, most single-hull tankers will be replaced by 2015 and almost all tankers transporting oil to the U.S. should have double hulls by 2020.

However, there is concern that due to the reluctance of owners to build expensive new vessels in a depressed and competitive oil tanker market, this deadline may not be achieved. Double-hull tankers are only now coming into service on the Alaska route, way behind schedule.[8]

Canadian Regulations

Canada has adopted IMO's MARPOL 73/78 standards for new tanker construction. This requires all tankers built or substantially modified after 1993 to be double-hulled to operate in MARPOL-compliant national waters. The international MARPOL fleet is supposed to be composed entirely of double-hull vessels or approved alternatives no later than 2023.

Following IMO rules, after July 1995 any tanker older than 25 years without segregated ballast tanks must be replaced or have a new double hull fitted. Tankers with SBT are allowed to be 30 years old before requiring an upgrade. A single-hull IMO-regulated tanker can call at MARPOL ports only until 2007 in the case of a tanker with no segregated ballast tanks, or 2025 in the case of tankers with this added protection.

Canada adopted the U.S. regulations for small tankers and oil barges in which single-hull oil barges less than 10,000 Dwt do not have to be retired until 2015. No Canadian tank barge currently on the west coast exceeds this; their average size is only approximately 2,000 Dwt.

As over half of the larger tankers were built during the early 1970s, if the MARPOL 73/78 standard is enforced, most of the world's tanker fleet should have been forced to retire by now and certainly should all be retired by the end of 2025 under the MARPOL, *Canada Shipping Act* (CSA) and U.S. *Oil Pollution Act* (OPA 90) schedules.

There are fears, however, that some owners of older tankers have been getting around the law by instructing their captains not to enter MARPOL-regulated harbours but rather to drop anchor offshore to offload, refuel, or pick up supplies. Owners of older tankers have been contracting maintenance work to shipyards in countries where costs and inspection standards are low.

Under existing Canadian legislation, should oil and gas development be allowed to proceed in the near future on the B.C. west coast, single-hull tankers could once again could be traversing offshore Canadian waters.

8
More Gas for Global Warming

Prior to the Industrial Revolution of the 18th and 19th centuries, the proportion of carbon dioxide in the global atmosphere averaged about 280 parts per million (ppm). It had remained steady at this level for many thousands of years.

Due to our burning of massive amounts of fossil fuels, however, atmospheric carbon dioxide levels are now around 368 ppm – and climbing. Today's carbon dioxide levels are 23% higher than at any time over the past 420,000 years.[1]

Following current trends, atmospheric carbon dioxide is expected to be twice pre-industrial levels sometime between 2030 and 2050. This will result in a rise in average global temperatures of between 1.1°C and 3.1°C. In some areas, including the Canadian Arctic, average temperatures will increase by as much as 10-12°C.[2]

Canada has signed but not ratified the Kyoto Protocol, which requires greenhouse gas (GHG) emissions to be reduced to 6% below 1990 levels between 2008 and 2010. Our national GHG emissions are currently 20% higher than the Kyoto target. If current trends continue, they will be 44% above the Kyoto target by 2010.[3]

Canada is the fifth largest energy producer in the world, and the single largest non-domestic source of energy for the U.S., the world's biggest energy consumer. We are major energy users in our own right. Canada consumes as much energy as India, which has a population of over one billion people.[4]

In 2000, Canada exported around 99 billion cubic metres of natural gas to the United States. By 2008, that figure is projected to grow to 1.25 trillion cubic metres.[5] In 2000, B.C. exported 14.7 billion cubic metres of natural gas, most of that to the U.S.[6]

Clearly, increasing the available supply of natural gas in B.C. is going to do nothing to help to reduce the impact of global warming on the world.

Exploration Creates Greenhouse Gas

The exploration, production, processing, and delivery of oil and natural gas are a major source of GHG emissions. Petroleum and diesel fuels are burned by ships, helicopters, and trucks. Oil rigs need diesel fuel for power generators and lighting. Infrastructure construction consumes resources and

energy. Gas flares and system leakages release natural gas and gaseous byproducts. Pipeline compressors are powered by natural gas.

According to one study, on average the production and transmission of each 1,000 m^3 of natural gas results in the emission of the equivalent of 351 kg of carbon dioxide. Using the natural gas adds the equivalent of another 1,904 kg.[7]

In 1990 Canadian oil and gas production released 80 megatonnes of GHG equivalent emissions out of a national total of 612 megatonnes. By 1998 this had grown to 98 megatonnes out of a total of 692 megatonnes.[8] In 2000, 4.5 billion cubic metres of natural gas was consumed in the production of 28.6 billion cubic metres of gas in B.C.[9]

As existing conventional oil and gas fields are used up, the productivity of each new well is less.[10] This fall-off in production returns raises the cost of finding new oil and gas. Eventually, frontier and offshore sources start to become economically attractive.

But the contribution to global warming is proportionally greater for offshore energy. Finding and bringing out any oil or gas from under the seabed takes much more energy than doing the same from an onshore field. Offshore rigs and platforms are large and complex. They consume more energy and materials to build and transport to an offshore site.

Leaving aside economics, this means that the global environmental price we must eventually pay for each new barrel of oil or cubic metre of natural gas is steadily rising.

As long as we continue to ignore the environmental costs of global warming, it makes economic sense to recover oil and gas from wherever, when the price is right. But it will never make environmental sense to increase marginal frontier energy supply.

Do We Need More Fossil Fuels?

The B.C. oil and gas industry is booming. According to government statistics, oil and gas sales hit a record $4.6 billion in 2000, more than double the previous year's sales. Industry expenditures increased 17% in 2000, to $2.7 billion, while the number of oil and gas wells drilled in the province increased 21%, from 620 in 1999 to 753 in 2000.[11]

Natural gas supply in B.C. almost doubled in the last decade, from 14.2 billion cubic metres in 1990 to 26.6 billion cubic metres in 2000, 60% of which is exported. Crude oil and condensate production rose from 1.96 billion cubic metres in 1990 to 2.68 billion cubic metres in 2000, an increase of 37% in that

decade. Seventy percent of B.C. oil in 2000 was exported to non-B.C. refineries, compared with just over 11% in 1990.[12]

The B.C. government aims to double provincial oil and gas supply over the coming decade through tax incentives, changes to the royalty structure, streamlining of the approvals process, and investment of over $100 million in northeastern B.C. roads.[13]

With the massive Ladyfern gas field in northeastern B.C. now on stream and increased exploration and production in existing oil and gas fields, there does not seem to be a compelling reason to throw open our offshore waters to oil and gas exploration.

Production from a single well in the Ladyfern field is equal to 5% of all the natural gas recovered in the province. Ladyfern has raised B.C. natural gas production by 25%.[14]

As well, government publications boast of B.C.'s potential of up to 89 trillion cubic feet (2.5 trillion cubic metres) of coalbed methane, which is pure, sweet natural gas.[15]

There are many non-polluting alternatives to increasing the global-warming burning of fossil fuels. The David Suzuki Foundation has proposed that instead of pouring money and resources into additional fossil fuel exploration, the government adopt broad-based policies for energy efficiency, cleaner air, and climate protection.

All it would take are intelligent foresight and the political will to make this happen.

9
Marine Parks and Preserves

Marine reserves can do much to protect species. Population densities in protected areas are on average 91% higher, biomass 120% greater, the average organism 31% larger, and species diversity 23% more compared with equivalent unprotected areas.[1]

British Columbia – indeed the whole of Canada – lags behind other jurisdictions in protecting our marine ecosystems. At this time, only 2% of B.C.'s ocean environment comes under any form of legislated protection. This includes areas closed to fishing for part of the year, protected salt marshes, and bird and wildlife sanctuaries.[2]

There are currently two government programs to create marine reserves in Canada: the federal National Marine Conservation Area Program and the federal/provincial Marine Protected Areas strategy. These programs are moving disappointingly slowly.

National Marine Conservation Areas

The National Marine Conservation Area Program is a federal initiative that seeks to protect representative ecosystems in Canada's Atlantic, Pacific, and Arctic oceans and in the Great Lakes. National marine conservation areas (NMCAs) are managed for mixed sustainable use but can contain smaller zones with higher protection.[3]

NMCAs are currently established under the *National Parks Act.* Bill C-8, *A Marine Conservation Areas Act,* was presented to the federal parliament in 1999. It reached the report stage but did not receive a third reading and thus did not become law.[4]

According to Parks Canada, National Marine Conservation Areas will be managed on a holistic ecosystem concept that "recognises the interactive nature of ecosystems and their finite capacity to recover from stress due to human activities."[5]

NMCAs are protected from ocean dumping, oil and gas exploration and development, and undersea mining. They include the seabed, the water above it, and any inhabiting species. They may also take in wetlands, estuaries, islands, and coastal lands. Parks Canada's goal is to preserve representatives of each of Canada's 29 marine regions.

There are at present only three NMCAs: Saguenay–St. Lawrence Marine Park in Quebec, Fathom Five National Marine Park in Georgian Bay, Ontario, and

Gwaii Haanas National Marine Conservation Area off the Queen Charlotte Islands in British Columbia.

Gwaii Haanas National Marine Conservation Area

Gwaii Haanas National Marine Conservation Area is a coastal sanctuary of 138 islands in Haida Gwaii. Of these, Anthony Island is already recognized as a World Heritage Site.

In 1997 the four major oil companies with petroleum exploration rights around the Queen Charlotte Islands announced that they would voluntarily relinquish 130,000 hectares of rights to enable the establishment of Gwaii Haanas.[6]

Gwaii Haanas will represent the Hecate Strait and Queen Charlotte Islands shelf marine regions in Canada's system of national marine conservation areas. The Haida Nation, which has been resident in the area for over 10,000 years, will play a large role in its management. At Nan Sdins, a World Heritage Site in Gwaii Haanas, mortuary and memorial poles and longhouses can be seen weathering back into the earth.

In 1998 a basalt stone tool was recovered from a drowned river delta 53 m below the surface of the ocean off southern Haida Gwaii in the proposed conservation area. This was further evidence that the western half of Hecate Strait was once dry land.

It is expected that an exploration exclusion zone will be established around Gwaii Haanas conservation area once it is fully established. However, as oil spills can travel many kilometres in calm waters, there is no guarantee that this would buffer the area from a major oil spill should exploration be allowed in the Hecate Strait.

Marine Protected Areas

A Marine Protected Area (MPA) consists of one or more "no-take" zones in which fishing, hunting, or resource extraction of any kind is not allowed. No-take areas may be surrounded by a less restrictive buffer zone.[7]

A recent poll showed that 75% of British Columbians support the creation of provincial MPAs, with 60% indicating strong approval. But while respondents thought that 16% of our marine environment was protected, in fact, less than 0.01% of the total offshore B.C. marine environment is legally safeguarded.[8]

In 1994 various provincial and federal agencies created an intergovernmental steering committee to develop a Marine Protected Areas strategy for B.C.,

plus a network of west coast protected zones.[9] Progress is being made, but very slowly.

In September 2000, Race Rocks near Victoria was declared Canada's first MPA. Three other proposed federal MPA pilot sites are Bowie Seamont and Endeavour Hot Vents off Vancouver Island, and Gabriola Passage in the Georgia Strait.[10]

At this slow pace, it is unlikely that the stated goal will be attained of a network of MPAs to be in place by 2010 in each of the six west coast offshore planning regions. The protected areas may also be too small to guarantee ecosystem continuity.

It is vital that significant and representative marine areas be identified and protected before any thought is given to opening up our offshore waters to energy exploration. Otherwise, there is great danger that vital ecosystems and species will be lost forever.

10
It's All About Politics

At this time, our coastal waters are protected from oil and gas exploration. Both federal and provincial moratoria are in place that prohibit offshore drilling or tanker passage in the dangerous and ecologically sensitive west coast marine environment.

By 1970 concern was growing about the potential for disastrous oil spills from tankers carrying Alaskan oil to refineries in Washington state. British Columbians, including soon-to-be M.P. and now federal Minister of Environment David Anderson, lobbied the Canadian government to bar U.S. oil tankers from our coastal waters.

Their efforts were successful. In 1972 the federal cabinet imposed a moratorium preventing U.S. tankers from crossing Canadian waters. Subsequent federal orders-in-cabinet extended the moratorium indefinitely, including a ban on offshore drilling.

In 1982 the Supreme Court of Canada ruled that the Johnstone, Georgia, and Juan de Fuca straits are under the jurisdiction of British Columbia. The B.C. cabinet then pressured Ottawa to set up a special panel to determine the terms under which offshore exploration in the waters north of Vancouver Island could proceed.

In 1986 the West Coast Offshore Exploration Environmental Assessment Panel set out 92 conditions that it believed would enable northern offshore exploration.

Saved by the *Exxon Valdez?*

The stage was set for lifting of the moratorium – except that on March 23, 1989, the supertanker *Exxon Valdez* ran aground in Prince William Sound, releasing 200,000 barrels of unprocessed Alaska crude oil to devastate the local environment.

Ironically, the world's most ecologically damaging oil spill ever helped to protect our northern waters from possible damage by the energy industry. With the sinking of the *Exxon Valdez,* plans to the lift the federal moratorium were quietly put aside and the province imposed its own moratorium on offshore activity in the waters it controlled.

The July 24, 2001, Speech from the Throne stated that the B.C. government would "explore the enormous opportunities of offshore oil and gas," and appoint a scientific panel "to ascertain whether those resources can ... be

extracted in a way that is scientifically sound and environmentally responsible."[1]

A recent statement by a spokesperson for Environment Minister Anderson suggests that the Canadian government would look at lifting the federal moratorium "if a serious proposal to drill were put forward by industry."[2] Previously, Anderson had stated emphatically he would not support lifting the moratorium "until it's clearly shown that the reasons for having it in the first place are no longer valid."[3]

However, federal Natural Resources Minister and minister responsible for B.C. Herb Dhaliwal may be more open to lifting the offshore ban. "If we can have resource development and do it in a sustainable way, we should be open to it, to help stimulate the economy and create jobs," Dhaliwal stated during a January 2002 visit to Calgary.[4]

Is the stage being set to lift the federal and provincial moratoria and open British Columbia's pristine northern waters to energy exploration?

Looking for a Green Light

Faced with such tempting numbers, in 1998 the B.C. government commissioned a report by AGRA Earth and Environmental Ltd., a Newfoundland-based consultant, to update the 1986 Panel Report by reviewing the latest technology. Contending views within the NDP cabinet of the time prevented consensus, and AGRA's cautionary yet generally favourable 82-page assessment has not been released by the government.[5]

In August 2001, the newly elected Liberal government commissioned Jacques Whitford Environment Ltd. of Burnaby, B.C., to update the 1998 AGRA report. The Whitford Report, delivered on October 19, 2001, found "no unique fatal flaw issues that would rule out exploration and development activities," although it noted: "The cost of facilities required to protect the environment may make the economic justification ... questionable."[6]

If you think that by now the B.C. government has commissioned enough panel and consultant reports to justify lifting the moratorium, think again. A caucus committee of northern MLAs was sent to test public opinion towards offshore exploration. To their surprise, they found that many communities and all First Nations were opposed to lifting the moratorium.

And finally there is the Scientific Review Panel announced in the Throne Speech. Although the panel noted that there were many gaps both in baseline data and in our understanding of the long-terms effects of chronic pollution on the marine environment, it concluded that "there is no inherent or fundamental inadequacy of science or technology, properly applied in an

appropriate regulatory framework, to justify a blanket moratorium on such activities."[7]

However, the panel did not provide any reasoning to support this assertion, which seems to contradict much of the scientific evidence contained in the review. In a display of circular logic, the panel asserted that the moratoria caused the lack of scientific understanding and baseline data on the marine environment, and that to provide the data on whether to lift the moratoria would necessitate first lifting the moratoria!

Perhaps we should not be surprised that a government-appointed scientific panel should conclude that the explicit desires of that government are supported by science.

Should the B.C. government ask Ottawa to lift the 30-year-old moratorium on west coast energy exploration? We believe that it should not, for the many reasons contained in this report.

Notes

Section 1

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Section 10

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