

POSTPONED DECISIONS:

Petroleum Exploration on Canada's Western Continental Shelf

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FIFTY YEARS HAVE PASSED SINCE Canada granted the first permits to explore the western continental shelf for petroleum. In 1972, the government suspended those permits by taking actions known today as “the moratorium.” The current debate about proposals to build new oil pipelines or to expand existing lines between Alberta and the Pacific coast has overshadowed an earlier debate about the moratorium. Public perceptions then and now have a common root in fears about oil spills – fears that seem muted or absent on Canada’s east coast, despite the 2010 Louisiana blowout and resulting spill. Whether oil export proposals succeed or fail, a debate about resuming exploration will recur so long as the 1961 permits continue to be valid and so long as Canadians seem to accept the risks of exploration and production on Canada’s eastern and Arctic coasts.

The label “moratorium” bundles some complex issues and facts that, in order to be understood, need to be placed in context. This article describes the offshore and its ownership and explains Shell Canada Inc.’s exploration in the 1960s. It also describes the regulatory approach taken by the federal Department of Fisheries (now Fisheries and Oceans Canada and hereafter referred to as Fisheries) as revealed in declassified files, and it recounts government actions before, during, and after the enactment of the moratorium. It does not offer any insight into the obvious but difficult question: What are the chances of finding petroleum on Canada’s west coast?

This article also expresses my personal viewpoint. I describe what I learned while working offshore with Shell in the 1960s. I have remained interested in oil exploration ever since, which helped my research into BC’s offshore as presented in government files, peer-reviewed publications, and newspapers. I have been surprised by the fact that decades of public review and commentary on the moratorium have missed a key

point: when the federal government suspended the permits, it believed that the prospects for finding oil along BC's continental shelf were poor.

Today, academic and government petroleum scientists might be more optimistic. In the past forty years, new exploration tools and production methods (such as "fracking") have transformed the energy sector. The moratorium stands in the way of applying these new tools in a search for natural gas that might be liquefied and exported to hungry Asian markets. But industry might also regard the prospects of success to be so poor, and the consultation and approval process so daunting, that no company would want the risk. The moratorium and the original permits have been ignored over the last few years. This situation denies certainty to everyone: those who want nothing to do with petroleum on the west coast and those who want to resume exploration. The entire issue is certainly open to question.

THE SETTING

I refer to Canada's western continental shelf as BC's shelf, meaning land extending from shoreline to ocean depths of under five hundred metres. It comprises the sea floor extending seventy kilometres west of Tofino and the Pacific Rim National Park Reserve, all lands east of the two-hundred-kilometre distance between Cape Scott on Vancouver Island and Cape St. James at the southern end of the islands now known as Haida Gwaii, all of Hecate Strait, and the sea floor at Dixon Entrance between Langara Island and Prince of Wales Island in Alaska. It is almost absent off Quatsino Sound on northern Vancouver Island and along the west coast of the Haida Gwaii archipelago.

In the nineteenth century, Europeans searched the sedimentary rocks of the BC coast for coal and petroleum occurrences. The 1878 survey of Dr. George M. Dawson, a federal government geologist, reported hearing of seeps of "bitumen" on islands near Tanu.¹ Over fifty petroleum occurrences and the growing importance of petroleum encouraged speculative drilling on Graham Island as early as 1913.² The drillers hoped to find petroleum in Mesozoic-era sedimentary rocks hidden beneath much younger volcanic rocks. By convention, rocks formed 250 to 65 million years before the present (BP) are assigned to the

¹ Douglas Cole and Bradley Lockner, eds., *To the Charlottes: George Dawson's 1878 Survey of the Queen Charlotte Islands* (Vancouver: UBC Press, 1993), 37.

² P.K. Hannigan, J.R. Deitrich, P.J. Lee, and K.G. Osadetz, *Petroleum Resource Potential of Sedimentary Basins of the Pacific Margin of Canada*, Geological Survey of Canada Bulletin 564, Ottawa, 2001, pp. 13 and 23.

Mesozoic era, which is further differentiated into three periods. Most of Canada's petroleum originates in rocks dating from the Cretaceous period, from 145 to 65 million years BP.³ Rocks of this age outcrop on the Gulf Islands and along the east side of Vancouver Island. Some contain coal, which was mined at Fort Rupert, Cumberland, and Nanaimo until as late as 1967.⁴ The Haida Gwaii archipelago has outcrops of Mesozoic-era rocks, but the formations are comparatively thin and lack the carbon content that would suggest petroleum source rock.⁵ The four hundred kilometres of ocean separating Cretaceous rocks at Fort Rupert from those on Lyell Island cover a part of the shelf called the Queen Charlotte Basin, making the basin and Hecate Strait obvious exploration targets. Similarly aged sedimentary rocks do not outcrop on Vancouver Island's west coast, but isolated patches of younger, Cenozoic-era rocks do occur and could overlie older exploration targets. The unknown stratigraphy, or layering and structures, of these huge tracts attracted interest in the late 1950s, but the first problem was one of ownership: Were the lands federal or provincial?

JURISDICTION

The ownership of BC's offshore remains in dispute. Canada's provinces own minerals and petroleum within their borders and lands near shore, and Canada owns the offshore. An unresolved boundary between BC lands and federal lands is further complicated by assertions of Aboriginal rights on the part of BC's First Nations. Canada also owns all lands north of the sixtieth parallel, where its regulation of petroleum followed the 1920s discovery of oil at Norman Wells, Northwest Territories. Federal regulations have been revised to keep pace with exploration results and changing technology. In June 1961, the governor general in council enacted the Canada Oil and Gas Land Regulations, replacing earlier rules for petroleum exploration in Canada's North and on its three coastlines.⁶

³ R.J.W. Douglas, ed., *Geology and Economic Minerals of Canada* (Ottawa: Department of Energy Mines and Resources, 1968), 538. Since petroleum and gas can migrate, cretaceous hydrocarbons may occur in younger reservoir rocks and, in at least one case (e.g., Waterton, Alberta), in much older rocks.

⁴ Douglas, *Geology and Economic Minerals*, 522. The definitive publication is J.E. Muller and J.A. Jeletzky, "Geology of the Upper Cretaceous Nanaimo Group of Vancouver Island and the Gulf Islands, British Columbia," Geological Survey of Canada Paper 69-25, Ottawa, 1969.

⁵ P.D. Lewis, J.W. Haggart, R.G. Anderson, C.J. Hickson, R.I. Thompson, J.R. Deitrich, and K.M.M. Rohr, "Triassic to Neogene Geological Evolution of the Queen Charlotte Region." *Canadian Journal of Earth Sciences* 26 (1991): 854-69.

⁶ *Canada Gazette*, pt. 2, vol. 95, SOR 61-253, 6 June 1961, 805. These regulations, together with the Canada Oil and Gas Drilling and Production Regulations, replaced the 1960

The question of the offshore's ownership attracted political attention from the outset. In September 1961, a month after issuance of the Shell Oil Company of Canada Limited offshore permits (see below), H.W. Herridge, a BC MP, asked Walter G. Dinsdale, minister of northern affairs and natural resources, whether he could "effect a reconciliation of views" on ownership between the jurisdictions. Dinsdale replied that legal opinion held that the offshore is owned by Canada, not by the province.⁷ Both levels of government issued offshore exploration approvals. The ownership issue remained unsettled until 1967, when the Supreme Court decided Canada had jurisdiction.⁸ Following the 1968 change in federal leadership, Canada offered 50 percent of offshore earnings to the province, but this was declined.⁹ British Columbia then went its own way, asking its courts to determine jurisdiction over lands in the Strait of Georgia. On appeal, the Supreme Court decided in 1984 that those lands belonged to the province.¹⁰ Federal-provincial ownership disputes on the east coast resulted in the creation of joint offshore resource management boards.¹¹

SHELL CANADA PERMITS

Offshore oil exploration in Canada first started off the BC coast, with Shell Oil Company of Canada Limited (later Shell Canada Limited). In August 1961, it announced it would explore 11 million acres (4,452 hectares) of the BC shelf.¹² Later acquisitions by this company and others increased issued exploration approvals in 239 separate permits to 16,272,694 acres (6,585,326 hectares) as of April 1972.¹³ Although some

regulations. Applications for offshore exploration permits did not require public tender.

⁷ Parliament, *Debates of the House of Commons*, 24th Parliament, 4th Session, 11 September 1961, 8153.

⁸ Supreme Court, *Reports of the Supreme Court*. "In the Matter of Reference by the Governor General in Council Concerning the Ownership of and Jurisdiction over Offshore Mineral Rights as set out in Order in Council P.C. 1965-750, dated April 26, 1965," 1967, 792-822.

⁹ *Vancouver Sun*, 5 December 1968.

¹⁰ Supreme Court, *Supreme Court Reports*, "Ownership of the Bed of the Strait of Georgia," 1984, 388.

¹¹ See, for example, http://www.cnlopb.nl.ca/abt_mandate.shtml for the Canada Newfoundland-Labrador Offshore Petroleum Board.

¹² *Journal of Commerce Weekly*, 19 August 1961, 18. Vancouver Public Library's now defunct clipping files (ca. 1950-83), collected from this journal and BC newspapers. Clippings labelled "Shell Oil Company" and "Offshore Exploration" provide a source for some of the newspaper citations that follow.

¹³ Parliament, *Debates of the House of Commons*, 28th Parliament, 4th Session, 20 April 1972, 1508; reply to written question 322 from Tommy Douglas, MP, printed in the *Debates*, 13 March 1972, 1433. This area is close to the size of New Brunswick.

permits later lapsed, most remain valid today, as is shown on a BC government website.¹⁴

Shell has been part of Canada's industrial landscape longer than anyone can remember.¹⁵ Globally, and for over a century, the Shell Oil group of companies played a leadership role in utilizing science to find new sources of petroleum and natural gas. In the 1920s, Shell pioneered the use of seismic methods to find deeply buried rock formations as well as the study of foraminifera – microscopic fossils of protozoa – to identify the geological age and the ancient environment of sediments brought up as rock chips by its drills.¹⁶ In 1949, Shell was the first company to achieve offshore oil production in the Gulf of Mexico. When it turned its attention to Canada's western continental shelf, it owned hundreds of producing wells off the coasts of Texas and Louisiana.¹⁷ A research and development subsidiary based in Houston, Texas, designed and tested new seismic sources as well as the miniaturized recording equipment the company first used in its BC offshore seismic surveys.

When Shell applied for petroleum exploration permits, the federal government had no reason to refuse. Shell's knowledge surpassed anything then available in Canada, and it committed to train Canadian crews. The deputy minister of Fisheries, R.G. Robertson, recommended acceptance to his minister.¹⁸ The company started its ship-borne exploration program off the west coast of Vancouver Island in May 1963. Six years later, having drilled fourteen holes without any positive result, Shell announced plans to move its offshore exploration program to Canada's east coast.¹⁹ Shell's exploration results are now forty years old and, especially in the case of drill holes, present geological realities that appear discouraging. Shell found greener pastures on the east coast and today has set its hopes on the Beaufort Sea north of Alaska.²⁰

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My involvement with Shell's offshore work began in 1963. Shell was recruiting science students with marine experience. This description

¹⁴ British Columbia, Ministry of Energy Mines and Natural Gas, <http://webmap.em.gov.bc.ca/mapplace/minpot/offshore.cfm>.

¹⁵ Stephen Howarth, *A Century in Oil* (London: Weidenfeld and Nicholson, 1997), 92.

¹⁶ *Ibid.*, 127.

¹⁷ *Ibid.*, 244.

¹⁸ Memorandum, R.G. Robertson to Minister, 15 August 1961, Library and Archives Canada (hereafter LAC), RG 23 (Record Group of Department of Fisheries and Oceans), vols. 1 and 2, file 32-5-42 (Scientific Investigations – Seismic Surveys). The writer thanks LAC for its assistance in screening and releasing these files.

¹⁹ *Vancouver Province*, 1 April 1969.

²⁰ See <http://www.shell.com>, press release of 17 September 2012 (viewed April 2013).

fit me well enough to result in my being interviewed, hired, and sent to help operate part of the program's low-frequency radio navigation system from a tent at the foot of the lighthouse at Estevan Point and, later, from the top of Triangle Island (among other exotic places).²¹ I worked the following winter with a Shell seismic crew near the BC-Northwest Territories border and returned to the coast for the next two summers to help navigate three of Shell's exploration ships. Although the experience gave me a lot of insight into petroleum exploration, it does not inform any opinion I might have about the offshore's economic potential, which is a topic better explored in dozens of papers written by specialists.

SEISMIC SURVEYS AND FISH

Marine seismic surveys provide evidence for interpreting subsurface geology. They generate precisely timed pulses of low-frequency sound with enough energy to penetrate deep into bedrock and reflect back to receivers positioned in a long cable, or streamer, towed behind the instrument ship. Depending on its source and energy, the sound may cause environmental damage. The air guns of today's surveys use only compressed air in order to make sound energy capable of penetrating thousands of metres of rock. The returning signals – echoes, in a sense – are recorded digitally, filtered for noise, and analyzed along with previous and subsequent signals to derive a two- or three-dimensional picture of the subsurface.

In the 1960s, Shell detonated charges of ammonium nitrate sealed in large cans as its energy source to obtain two-dimensional slices of the subsurface. Explosions pose an obvious threat to fish and marine mammals so the company's program required the approval of the federal Department of Fisheries, whose scientists were already familiar with seismic exploration from their own experience as well as from that of US regulators. In 1959, Richfield Oil Corporation had approached Fisheries to conduct seismic exploration close to the beach on the eastern side of Graham Island. Fisheries consulted with the chief of the California Marine Resources Branch, who advised his Vancouver-based counterpart: "You can be sure that the losses to fish are real, and you can

²¹ Located fifty-two kilometres northwest of Cape Scott, Triangle Island later became a protected area for seabird nesting.

also be sure that when the first seismic geyser appears on the horizon, every fisherman in British Columbia will be pounding on your door.”²²

The director of Fisheries’ Pacific office, A.J. Whitmore, finally recommended approval of the Richfield program to his deputy minister. He had been uncertain about his authority to regulate the seismic survey at all, but his analysis balanced an expected fish kill against “an important value and need from the standpoint of the Canadian interest.”²³ Richfield then tested with a series of shallow explosions along the shoreline near Tlell and Tow Hill. The Fisheries observer, who had the authority to stop “excessive damage to fish,” reported on 9 July 1959: “The [total] fish kill was considered negligible ... 1 coho, 4 red snapper, 2,360 herring and 131 silver smelt.”²⁴ However, the Richfield tests used stumping power (i.e., black powder, or gunpowder), which produces a low-velocity shock wave. Later work used a faster explosive, ammonium nitrate, trade-named “Nitrone,” which was then receiving trials in seismic exploration in Alaska’s Cook Inlet.²⁵

In the same year, Canada’s Department of Mines and Technical Surveys informed Fisheries that it would use explosives to conduct underwater seismic surveys in Georgia Strait.²⁶ The results led to more tests in 1960, but this time Fisheries observers monitored the effects. Each of the thirty-one shots fired by the government geophysicists killed dozens of hake (or pollock) and rockfish, but, more ominously, fifteen to twenty minutes had to pass before fish casualties floated to the surface.²⁷ Those losses did not deter the government geophysicists, and, in November 1961, they detonated a single, three-thousand-pound (1360 kg) explosion on the sea floor in Brasseur Bay near Kelsey Bay. Fisheries observers could not count casualties because the shot occurred with the approach of darkness.²⁸

Shell held its first meeting with Fisheries officials in November 1962 to explain its program.²⁹ The area director, Rod Hourston, then sought an opinion on Shell’s plans from his Washington State counterpart,

²² Richard S. Croker, California Department of Fish and Game, to A.J. Whitmore, Director, Pacific Region, 15 April 1959, LAC, RG 23, vols. 1 and 2, file 32-5-42. Fisheries had frequent correspondence with its counterparts in Alaska, California, and Washington.

²³ Memorandum, 11 May 1959, LAC, RG 23, vols. 1 and 2, file 32-5-42.

²⁴ Memorandum, W.J. Schouwenburg, LAC, RG 23, vols. 1 and 2, file 32-5-42.

²⁵ Telegram, Fish and Wildlife Service, 8 May 1959, LAC, RG 23, vols. 1 and 2, file 32-5-42.

²⁶ Memorandum, 21 April 1959, LAC, RG 23, vols. 1 and 2, file 32-5-42.

²⁷ Report by F.C. Boyd, 26 May 1960, LAC, RG 23, vols. 1 and 2, file 32-5-42.

²⁸ Note to file, 31 October 1961, amended after 24 November 1961, LAC, RG 23, vols. 1 and 2, file 32-5-42.

²⁹ Minutes, LAC, RG 23, vols. 1 and 2, file 32-5-42. Shell representatives included R.R. Forseth, J.J. Hamilton, R.L. Comer, and G. Murphy; Fisheries representatives were R. Hourston,

Director of Fisheries G.C. Staslund, who advised: "It is our opinion that a capable observer with adequate equipment and complete authority to order shooting suspended when the presence of fish is detected is the best protection we can provide during seismic operations."³⁰ Hourston then wrote to his deputy minister for approval of the fish protection measures that he recommended: the shooting boat would have a fish scanner operated by a Fisheries employee whose salary would be paid by Shell and who had the power to stop the shooting. No shooting would occur within one mile (1.6 km) of any fishing boat, estuary, or the low tide line; explosive sizes of no more than 5 pounds (2.25 kg) were to be used in water shallower than 200 feet (61 m) and of no more than 25 pounds (11.3 kg) in depths over 200 feet; shots larger than 25 pounds (up to 300 pounds or 136 kg) would require special permission; and, finally, all shooting off the west coast of Vancouver Island was to end by 15 June each year.³¹

In a subsequent meeting held 16 January 1963, Shell agreed to these terms, with a significant and costly addition: a third ship would carry another Fisheries officer to observe the turbulence resulting from a shot and to identify and count any fish killed.³² Meantime, the Department of Mines and Technical Surveys notified Fisheries of plans for more seismic surveys in the Strait of Georgia. In May 1963, these were carried out by the Department of National Defence, which supervised six undersea explosions of three thousand pounds (1360 kg) each.³³ Nothing in the Fisheries file suggested the department wanted to apply similar controls to another government department, which may reflect Fisheries' uncertainty about its authority to do so. If Shell's team knew about, or was nettled by, this gross policy contradiction, it did not put a complaint on Fisheries' record.

SHELL'S SEISMIC PROGRAM

Shell began its survey in early May 1963 off Ucluelet, with trials that varied both the weights of explosive and their depth of detonation (see Figure 1).³⁴

R.E. McLaren, and D. MacKinnon. Forseth sent a follow-up letter to Hourston dated 16 November 1962.

³⁰ Letter, 19 November 1962, LAC, RG 23, vols. 3 and 4, file 32-5-42.

³¹ LAC, RG 23, vols. 3 and 4, file 32-5-42.

³² Minutes, LAC, RG 23, vols. 5 and 6, file 32-5-42. This ship also destroyed by sinking, any unexploded charges, this important safety reason is discussed below.

³³ Memorandum, 24 May 1963, LAC, RG 23, vols. 5 and 6, file 32-5-42.

³⁴ The explosion's depth was critical. Underwater explosions instantly create a gas bubble proportional to the explosive's size and depth, and its subsequent collapse creates a "bubble



Figure 1. The explosion of a seismic shot, a sixteen-pound (7 kg) can of “Nitrone,” or ammonium nitrate. Snow-capped mountains of Vancouver Island are barely visible on the horizon. This size of charge dangled an arm’s-length below balloons suspended by its electric blasting cap leads, which were also spliced to the armoured shot line trailing from the shooting boat. When a shot reached a safe distance, the shooter released the safety on his blasting machine. The instrument boat’s VHF radio signal triggered detonation and placed the “shot break” into the seismic recording with microsecond accuracy. Photo by the author.

That the shots would kill fish was expected – the numbers were not. The casualty list the Fisheries observer sent in for the first multi-day tour makes dismal reading: “20,000 herring, 6000 rockfish, 50 salmon ... [T]ests with 300 pounds at 40 feet killed 5000+ rockfish and 5000 to 15,000 herring.”³⁵ Even worse, the true numbers of fish killed appeared

pulse” that can ruin the seismic recording. This is why Shell had to experiment on its initial tours.

³⁵ Report by Roger Kearns, 17 May 1963, LAC, RG 23, vols. 5 and 6, file 32-5-42.

only after twenty or thirty minutes passed, the time needed for casualty fish to float to the surface. Shell quickly refined its methods and this level of slaughter did not continue; however, its work was repeatedly disrupted by Fisheries observers when they believed a fish kill was imminent or excessive. This decisive role of Fisheries regulators was well known at the time: a resolution of the Prince Rupert Fisherman's Cooperative Association "commended" the department for its vigilance.³⁶

Shell's eighth ten-day seismic tour ended the 1963 season. The Fisheries observer reported that 7.5 percent of 10,647 seismic shots killed fish, the total number of fish killed (presumably of all species) being 58,503.³⁷ Observer Roger Kearns, together with section head Forbes Boyd, published the results in a 1965 paper entitled "The Effect of Marine Seismic Exploration on Fish Populations in BC Coastal Waters."³⁸ Fisheries did not publish its observations for Shell's 1964 and 1965 tours.

A close look at Shell's offshore seismic program reveals the scale of the resources it applied to exploring BC's continental shelf, even before the company decided to make a massive investment in offshore drilling. Shell owned the instrument boat, the motor vessel *Miss Juanita*, which was brought up to this coast from Texas (see Figure 2). Curiously, it carried Bermuda registry and flew Bermuda's flag in order to sidestep some obscure Canadian restriction against importing US vessels.

Miss Juanita carried a huge reel on its stern for the streamer, a kilometre of clear polyethylene tubing containing twenty four clusters of hydrophones, or microphones, exquisitely sensitive to low, sub-audible frequencies. Light oil filling the streamer gave it neutral buoyancy to float ten metres below the surface and the noise of waves.³⁹ Equipment in the seismic observer's cabin amplified, filtered, and recorded each of the forty-eight hydrophone signals onto wide magnetic tape; only occasionally would the operator print a paper trace of the signals.⁴⁰ A low-frequency radio system kept all the ships positioned with five- or

³⁶ Letter and copy of the resolution, 23 December 1963, LAC, RG 23, vols. 5 and 6, file 32-5-42.

³⁷ Report by Kearns, 7 October 1963, LAC, RG 23, vols. 3 and 4, file 32-5-42.

³⁸ Roger K. Kearns and Forbes Boyd in *Canadian Fish Culturist* 34, 22 March 1965. Available in Vancouver Public Library periodicals. Copy in LAC, RG 23, vols. 7 and 8, file 32-5-42.

³⁹ The streamer was released so that it would be still for recording, and then it was wound in to prepare for the next shot.

⁴⁰ In 1964, Shell's operators prevented people from seeing the equipment because they said it was confidential and "hadn't been patented." I saw the unusually wide magnetic tape, but only recently learned that the recordings were analogue; Shell was comparatively late converting to digital. In December 2012 I wrote to Shell about this and other technical points; six months later Shell replied that it is "not in a position to respond to your request at this time."



Figure 2. Shell's instrument boat, the motor vessel *Miss Juanita*, was a converted American "Y" minesweeper (YMS), one of hundreds built during the Second World War and serving in both Pacific and European theatres. Jacques Cousteau's *Calypso* was another, as are the well-known BC ships *Uchuck III* and *Marabelle*. Photo by the author.

six-metre repeatability, even one hundred kilometres at sea, attaining a level of precision that rivals today's satellite (i.e., GPS) methods.⁴¹

The chartered shooting boat MV *M.J. Scanlon* carried a Fisheries biologist who monitored the Kelvin Hughes fish scanner. A second chartered ship, the *Joan Lindsay*, carried another Fisheries officer who watched for any dead fish surfacing after the explosion and who reported the result to the senior observer on the shooting boat. These two ships and the instrument boat worked as a small convoy whose shape was determined by the type of shooting: during reflection shooting, or stacking, they travelled together at slow speed; during refraction shooting, the shooting boat and observer vessel remained and dropped charges at one spot while the instrument boat slowly sailed away, towing its streamer.⁴² Progress obviously depended on the weather: calm seas

⁴¹ See Brian J. Evans, *A Handbook for Seismic Data Acquisition in Exploration*, Geophysical Monograph Series No. 7 (Tulsa: Society of Exploration Geophysicists, 1997), 204-6. Where GPS coverage is limited, the Decca Hi-Fix phase comparison method used by Shell is still employed today.

⁴² In general, reflection shooting provides clues about layering and structures in subsurface rock, while refraction shooting compares the velocity of sound in rock layers, which varies by rock density and therefore by kinds of rock (sound travelling slower in porous sandstone than in volcanic rock).



Figure 3. MV *Cedarwood* moored at Sewell Inlet, Moresby Island, in 1965. Built in Lunenburg, Nova Scotia, during the Second World War, the ship was later taken into service by the Canadian Navy as a survey vessel and was loaned to play a role in British Columbia's 1958 centenary celebrations. Note the derrick overhanging the stern, which supported the heavy weight and core barrel used in bottom sampling. Photo by the author.

enabled the ships and crews to work very long hours on ten-day tours that covered hundreds of kilometres of seismic lines.

Shell's fourth ship, was the chartered MV *Cedarwood* (see Figure 3). Being larger than the others, it could work in rougher seas and was capable of twenty-four-hour operation. It used seismic sources that had much less energy and therefore less penetration than conventional seismic sources, but it posed no threat to fish. Its sources allowed continuous mapping of the surface of the ocean floor and penetrated over one thousand metres below it.⁴³ This ship also collected bottom samples where its previous survey tracks revealed thin or absent sediments. Vitally important rock samples collected this way from "sub-crops" enabled Shell's geologists to determine the sea floor's age and paleoenvironment, giving information essential to defining the stratigraphy of the underlying rock layers.

⁴³ The sources were "sparkers" (high voltage electrode arcing several times a minute) and "gas exploders" (detonations of oxygen and acetylene contained in long, wide rubber tubes trailing behind the ship). Both methods were made obsolete by air gun sources and other advances in offshore seismic work.

THE SURVEY'S PROGRESS

Shell's seismic surveys continued in the 1964 and 1965 seasons with the same ships and methods. The ships had by then become better known along the coast, and some fishers became concerned. The president of the United Fishermen and Allied Workers Union wrote to Fisheries asking for a halt to seismic exploration.⁴⁴ The newly appointed Fisheries observer on the shooting boat reported rumours that Fisheries personnel were taking bribes from Shell.⁴⁵ For their part, Shell's managers left nothing to chance. They warned their staff of dismissal if a confrontation occurred with fishers, but they retained an expert to test the effectiveness of the *M.J. Scanlon's* fish scanner.⁴⁶

Shell did achieve a slight reduction in fish kills. By the end of the 1964 season, 1,099, or 6.3 percent, of 17,463 seismic shots killed a total of 47,415 fish of all species versus 7.5 percent of 10,647 shots and 68,503 fish killed the previous year.⁴⁷ The file does not contain a report on the 1965 season, and one may not have been prepared. Shell's interpretation of its 1963 and 1964 seismic survey programs was encouraging enough for the company to announce, at the start of the 1965 exploration season, that it planned to drill off the west coast.⁴⁸

The drilling decision pressured the company to complete its seismic coverage – and Fisheries to defend its oversight. In June 1965, off Clayoquot Sound and Barkley Sound, a single refraction shot killed 2,257 hake during a tour that saw Fisheries delete 296, or 26 percent, of scheduled shots.⁴⁹ Later, during ten days of shooting in Hecate Strait, Fisheries deleted 8 percent of shots, largely because when the small convoy sailed west towards the setting sun the observers could not see the boils.⁵⁰ Shell complained about these “shot point deletions” and asked that “the department consider a less conservative approach, in view of the economic value of a large proportion of the observed mortality, as well as the company's obvious monetary loss.”⁵¹ The subsequent July 1965 meeting did not include the Fisheries observer, but nothing in the file hints that he was asked to change his standards. When Shell met with Fisheries again in October 1965, it made a veiled complaint about the observers but

⁴⁴ Letter from Homer Stevens, UFAWU, 28 April 1964, LAC, RG 23, vols. 5 and 6, file 32-5-42.

⁴⁵ Note to file, F.C. Boyd, 25 May 1964, LAC, RG 23, vols. 5 and 6, file 32-5-42.

⁴⁶ Copy of letter, Peter A. Niblock P. Eng to Shell, 2 April 1965, LAC, RG 23, vols. 7 and 8, file 32-5-42.

⁴⁷ Memorandum, Kearns to McLaren, 13 November 1964, LAC, RG 23, vols. 7 and 8, file 32-5-42.

⁴⁸ Clipping, unknown source, 30 April 1965, LAC, RG 23, vols. 7 and 8, file 32-5-42.

⁴⁹ Memorandum from M. Riske, 21 June 1965, LAC, RG 23, vol. 9, file 32-5-42.

⁵⁰ Memorandum from M. Riske, 14 July 1965, LAC, RG 23, vol. 10, file 32-5-42.

⁵¹ Minutes, meeting of 22 July 1965, LAC, RG 23, vol. 9, file 32-5-42.



Figure 4. South East Drilling Company's SEDCO 135F under construction in early 1967. It could drill while resting on submerged tanks beneath each leg or while floating in water of depths to 135 fathoms (250 metres). When floating, the rig kept itself over the well head by increasing the tension of heavy cables that led to anchors, three at each corner. The rig enjoyed a ten-year ocean-spanning career, only to have a miserable end in the explosion and fire of the infamous January 1979 IXTOC blowout off Mexico. Photo by George B. McCandless.

went on to describe a small program in January 1966 that would conclude its seismic work in preparation for drilling by October 1966.⁵²

Shell had by then contracted with a Victoria shipyard (Victoria Machinery Depot [VMD]) to construct what was then the world's largest, semi-submersible drilling rig (see Figure 4).

This brought the company's exploration program into a new phase, which I do not discuss here. The steps leading to the planned drill program included significant fish losses due to explosives, but evaluating those losses against today's standards must give some weight to the 1960s context. Attitudes towards BC's ocean resources were quite different in the 1960s than they are today.⁵³ That decade also saw public acceptance of all frontier exploration, including drilling the first wells in the Arctic.⁵⁴

⁵² Minutes, meeting of 27 October 1965, LAC, RG 23, vol. 10, file 32-5-42.

⁵³ For example, in 1964, whales were still being killed and processed at Coal Harbour in Quatsino Sound; Fisheries patrol boats rammed and killed basking sharks after complaints of damaged gillnets.

⁵⁴ J. Dixon, G.R. Marshall and J.R. Dietrich. Part 1 of "Petroleum Resources of the Mackenzie Delta and Beaufort Sea," Bulletin 474, Geological Survey of Canada, Ottawa,

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Through my job on the *M.J. Scanlon*, the shooting boat, I saw Fisheries control the seismic program in the 1964 and 1965 seasons (see Figure 5). Previously I had worked for two tours on the *Miss Juanita* and was later transferred to the *Cedarwood*. I saw the massive resources Shell applied to map BC's continental shelf before drilling. The company's four ships included the three already mentioned and the *Joan Lindsay*, the observer's ship. Their total complement was over thirty men, which, combined with technicians at shore-based radio navigation stations, field management, support staff, and a team of geophysicists and students processing the raw data, brought the number of people engaged with Shell's seismic survey to about one hundred. The company kept a helicopter on charter to supply the navigation system shore stations. Its own single-engine de Havilland Otter on floats delivered mail, groceries, and other supplies, and it carried seismic records back to headquarters. Shell used its own DC-3 for crew changes after each tour, collecting the men at airports in Tofino, Port Hardy, Sandspit, and Prince Rupert. The West Coast had never before seen that level of investment.

During a typical seismic run, the three ships sailed slowly along a pre-plotted track, dropping charges every few minutes, often for hours at a time. Rough sea conditions meant that this relentless work had to be done while hanging on with one hand, everyone being acutely safety-conscious because of work with explosives. Being responsible for positioning, I serviced the moving chart that guided the *M.J. Scanlon's* helmsman, and I shared the wheelhouse with him, and the skipper, or the mate. The Fisheries observer, an Alberta-based biologist and college instructor named Morely E. Riske, was always present when shooting. As soon as he saw indications of fish on the scanner he would call over the intercom: "Hold it!" Everyone would stop in their tracks. Safety came first. The shooter would immediately pull the electric blasting cap for the next shot from its booster in the can of explosive and placed it in a thick steel block. Someone else on the shooter's crew would get a head start on inflating balloons; another might tidy things up by throwing empty boxes over the side; and one or two might grab a coffee from the galley. As five minutes of waiting for clearance dragged into ten or more, the crew's anxiety would increase. Soon the instrument boat would call up on the VHF radio to ask what was going on.

1994, 14. Arguably, public attitudes towards the North did not become protective until 1974-77, the years of the Mackenzie Valley Pipeline (Berger) Inquiry.



Figure 5. The *M.J. Scanlon* was built in Vancouver as a tugboat and freighter. Its forward hold carried about twenty tonnes of ammonium nitrate in cans ranging in size from five to fifty pounds (2 to 23 kg) packed in cardboard cartons; electric caps and cigar-sized “boosters” were stored separately in heavy steel boxes on deck. The canvas-covered area on the stern included the shooter’s cabin and stored enough charges for a day’s shooting. Photo by the author.

The shooter was a daily visitor to the *M.J. Scanlon*’s wheelhouse. Because radio transmissions may detonate electric blasting caps, the shooter started every day’s work by removing a plug or bridge in the ship’s radio antenna; this prevented transmission and any risk of inducing a spark. When fish conditions caused long delays, the exasperated shooter would climb up to see the fish scanner paper trace. This made the wheelhouse atmosphere somewhat taut: the work had very high stakes. Morely Riske would patiently show the shooter the spots made by the echoes traced on the sensitized paper roll. In 1963, hard experience had revealed these spots indicated schools of fish. Riske would always pencil in the date and time beside the spots, knowing it would later be checked by Shell’s geophysicists. The appearance of fish was never predictable and no trace on the scanner could be ignored. Shell did not want to kill tons of fish any more than Fisheries wanted to impede Shell’s efforts. Sometimes the little squadron had to give up, and the seismic operator on the *Miss Juanita* would order a move to a new line. At other times a whole day might pass without a missed shot, pleasing everybody.

The *M.J. Scanlon* was always followed by the *Joan Lindsay*, which carried another Fisheries officer whose job was to observe the turbulence and foam resulting from a shot and to record any fish casualties. If the kind and number of fish seen in a boil exceeded the agreed threshold, the shooting boat and its consort had to move along the survey's course before resuming. If the casualty was a salmon, a rare occasion, the *Joan Lindsay* would stop and wield a dip net to retrieve it for the galley or the freezer. The ship had another job, to burst the large yellow balloons suspending a charge that failed to explode – a very rare but extremely dangerous situation. The shooting boat would stop and watch while one of the *Joan Lindsay's* crewmen used a rifle to shoot the balloons and allow the charge to sink. His aim – or lack of it – caused lively comment on the VHF radio on the part of the shooter's crew, mostly farm-raised Albertans.

Even then I knew I was very fortunate to have a part in a program that was so big and so important. This memory is more than an exercise in nostalgia: it is relevant to the present analysis of the moratorium on exploration. I witnessed Shell's program and knew it was unique, massive, and thorough. Even today, its results may not necessarily be obsolete, but the moratorium allows Shell to withhold what it found.⁵⁵

* * * * *

About this time, a parallel but far more contentious seismic program was planned for the Gulf of Georgia, and this needs mentioning. The Gulf Islands include large areas of Cretaceous rocks of special interest as petroleum source rocks, or reservoirs, especially those of the Nanaimo group and its associated formations. The British American Oil Company (BA Oil, later Gulf Oil) wanted to explore the basin using marine methods and sixteen-pound (7.25 kg) seismic charges; it dismissed as “completely inadequate” alternative methods recommended by Fisheries. Fisheries told BA that the fish habitat was critical and that its proposed program would be “extremely sensitive from the point of view of public relations.”⁵⁶

By Christmas 1965, the company still lacked Fisheries' agreement and was running into time deadlines prescribed in its provincial exploration permits. The province solved BA's problem in February 1966 with a lieutenant-governor's order-in-council, which simply suspended the

⁵⁵ Magnetic tape deteriorates with time. If Shell has continually renewed its recordings, they could be digitized and reinterpreted, just as digitized 1960s 2D seismic records collected in northeast BC were reinterpreted to support current natural gas exploration programs.

⁵⁶ Meeting notes, 6 December 1965, LAC, RG 23, vol. II, file 32-5-42.

permits' time limits: "The life of said permits shall not run during the period of suspension herein provided."⁵⁷ The province was the first to use a moratorium to stop seismic exploration in the Gulf of Georgia. The federal government later applied a similar, overlapping exploration ban in the gulf, despite allowing exploration work to continue offshore. Some parts of BC's coastline became more important than others.

Shell drilled fourteen holes during a three-year program, and its results are outlined below. The company complied with the regulations of the day and released its drill logs a year after drilling ended. Anyone can read Shell's drill reports in federal government offices in Calgary.⁵⁸ But the company would have disclosed only what the 1961 permit conditions required. The federal moratorium suspended further obligations to reveal geological or geophysical information, to convert its permits to leases, to do more exploration work, or to pay annual fees.

THE MORATORIUM'S POLITICAL SETTING

The moratorium came about through actions that verge on misrepresentation. It seems likely that the federal government believed there was a low probability of finding economically viable quantities of hydrocarbons on the BC shelf, so it had little justification for bringing in enactments that preserve, to this day, the rights and obligations to explore that were granted in the 1961 permits. Frontier exploration of the BC offshore, Canada's Arctic, and the Alaskan slope was first encouraged by the March 1959 US Mandatory Oil Import Program, which favoured oil from its own territories, Canada, and Mexico.⁵⁹ The reason for later suspending exploration of the BC continental shelf also originated in the United States – due to the 1968 discovery of the Prudhoe Bay oil field in Alaska's North Slope, the largest oil field ever discovered in North America.⁶⁰ Production was never in doubt for this vast resource, but plans to deliver its oil to the "Lower 48" soon placed Canada and the United States in conflict. Canadians wanted an eighteen-hundred-mile (twenty-nine hundred-kilometre) pipeline built eastward over the North Slope and then south along the Mackenzie River valley, an obvious benefit to newly discovered gas and oil near the Mackenzie delta. The US Congress

⁵⁷ Copy of British Columbia order-in-council, 4 February 1966, attached to letter from BA Oil to Fisheries, 10 May 1966, LAC, RG 23, vol. 13, file 32-5-42.

⁵⁸ Natural Resources Canada, <http://www.neb-one.gc.ca/clf-nsi/rthnb/nrthffshr/frntrfrmtntff-eng.html>.

⁵⁹ Daniel Yergin, *The Prize* (New York: Free Press, 1992), 538.

⁶⁰ *Ibid.*, 571.

favoured a much shorter pipeline to the Gulf of Alaska, with US-flagged tankers delivering the oil to US Pacific coast refineries.⁶¹

The Prudhoe Bay oil discovery and planning for its delivery were soon overshadowed by the January 1969 offshore oil blowout near Santa Barbara, California.⁶² Shell's rig was at that time drilling its last hole, only twenty kilometres off BC's iconic Long Beach. At the start of Shell's drilling, BC newspapers reporting on its progress had downplayed possible risks. The Santa Barbara offshore spill soon sharpened their focus: it was as though they had discovered environmental issues for the first time. Later that same year, the federal and provincial governments reached agreement on creating Pacific Rim National Park Reserve, starting with Long Beach. Since the province's concurrence was essential to the land transfer, both governments recognized the coastline's value and, indirectly, shared an intent to protect it from oil spills – meaning spills from tankers, not drilling. Policy differences began to appear. The BC legislature had both drilling and tanker traffic in mind when, in early 1971, it debated a resolution to extend, over the outer shelf, the drilling ban in Georgia Strait that had previously been announced by the federal minister of fisheries, Jack Davis, a BC MP.⁶³

Delivering Alaskan oil to the Lower 48 became a very large issue in both countries. Many Americans favoured an all-land route because they shared Canadian fears of tanker spills (later justified by the 1989 *Exxon Valdez* disaster) and they saw the longer-term need for a Canadian corridor to allow Prudhoe Bay's abundant natural gas to reach market.⁶⁴ Others interpreted fears about tankers as a disguise for promoting a Mackenzie valley pipeline, especially since Canadians continued to accept risks of blowouts from offshore drilling.

Even if American oil tankers were seen as a threat, it was business as usual for offshore exploration, perhaps because Canada could not distinguish between the east and west coasts in applying offshore protection standards. In April 1971, Shell "farmed out" its permits to Chevron Standard Limited for more seismic surveys and drilling.⁶⁵ By October, Chevron reported completing 250 miles (400 km) of air gun seismic surveys over Shell's permits and planned to explore its own permits in the Strait of Juan de Fuca.⁶⁶ The federal government issued more offshore

⁶¹ "No Light at the End of the Pipeline," *Los Angeles Times*, 6 May 1972. See also *Vancouver Sun*, 3 February 1972.

⁶² Yergin, *Prize*, 569.

⁶³ *Vancouver Sun*, 9 February 1971.

⁶⁴ See note 61.

⁶⁵ *Victoria Colonist*, 5 May 1971; *Vancouver Province*, 1 May 1971.

⁶⁶ LAC, RG 23, vol. 20, file 35-5-42, 17 September 1971. See also LAC, RG 21, vol. 21, 20 January 1972.

exploration permits in December 1971, but by then the political climate had changed, and the province attacked the federal decision.⁶⁷

The new exploration permits and Chevron's plans for drilling received close media attention early in 1972. The federal government appeared conflicted, which undermined a court action that David Anderson, the freshly minted Liberal MP for Esquimalt near Victoria, had launched in US courts to stop the tanker traffic.⁶⁸ Jack Davis, by now Canada's first minister of the environment, blamed Ottawa bureaucrats for breaking a ministerial agreement to stop exploration. Blame was assigned to the former minister of the Department of Energy, Mines and Resources (now Natural Resources Canada). Conveniently, he had been ill at the time.⁶⁹ David Anderson asked the new minister, Donald S. Macdonald, to withdraw all offshore permits. In February, Anderson said he had received assurance from MP Davis that such permits would be "bought back or revoked."⁷⁰

Fortunately for the media and the politicians, but not for the ship and the environment, in March 1972 the freighter *Vanlene* wrecked itself on the west coast of Vancouver Island, spilling some of its bunker fuel.⁷¹ Minister Macdonald assured Parliament that he had raised heightened Canadian concerns about tanker traffic with US secretary of the interior Rogers C.B. Morton. But Macdonald did not extend those concerns to drilling. He later told Parliament that the government would continue to advance west coast offshore development outside of "sensitive areas" like Georgia Strait.⁷²

That summer's provincial election ignored the subject, but the offshore drilling problem remained of keen interest to Environment Minister Jack Davis. In a July 1972 memorandum to Dr. J.R. Weir, then assistant deputy minister of Fisheries, Davis outlined his approach to solving the tanker-versus-drilling dilemma.⁷³ The memo deserves to be quoted at length:

Energy Mines and Resources are pushing for a decision on the West Coast. Standard Chevron Oil [*sic*] is farming out some of its drilling rights off BC and is up against Energy Mines and Resources

⁶⁷ *Vancouver Sun*, 27 January 1972.

⁶⁸ Peter A. Coates, *The TAP Controversy* (Toronto: Associated Press, 1991), 235. See also, *Vancouver Sun*, 7 February 1972.

⁶⁹ *Vancouver Sun*, 29 January 1972.

⁷⁰ *Victoria Colonist*, 5 February 1972.

⁷¹ See <http://www.dfo-mpo.gc.ca/Library/54783.pdf>.

⁷² Canada, House of Commons, *Debates*, various mentions in March, April, and May 1972.

⁷³ LAC, RG 23, vol. 21, file 35-5-42, 14 July 1972.

deadlines. Specifically it wants to know whether it should place an order for a drilling rig in a Japanese shipyard or not. The deadlines in question are on the fiscal year 1973-74.

I must make it quite clear that I am opposed to this “self imposed” *hari kari* [*sic*]. Energy Mines and Resources should simply extend its deadlines. That would get us over (or at least part way over) our environmental difficulties with the US.

But, there is a more important aspect still. It is “zoning.” We must point out to Energy Mines and Resources what the environmentally sensitive areas are and where, by a process of exclusion, oil well drilling is “out” for the foreseeable future.

Please be careful. If in doubt, declare the area in question to be sensitive. *The prospect of finding oil in economic quantities off the BC coast is small in any case* and I am not interested in creating more jobs in Japanese shipyards. (Emphasis added)

Davis hoped to overcome cabinet’s divided view of BC offshore exploration. Just two weeks before the 30 October 1972 general election, Davis was assuring reporters that the government would refuse to allow Chevron to drill.⁷⁴ The subject of offshore drilling then seemed to lose media attention.⁷⁵ In August 1977, the first tanker carrying Alaska oil sailed down the BC coast and past Victoria to unload at Cherry Point in Puget Sound. They have been coming ever since.⁷⁶ Despite decades of worry by British Columbians about oil spills, the federal government has never banned tanker traffic.⁷⁷

LEGAL BASIS FOR THE MORATORIUM

Each of Shell’s 1961 permits conveys “an exclusive option to obtain an oil or gas lease” in an area defined by latitude and longitude. If petroleum was found, a permit could become a lease, but the resource ownership remained federal. Each permit had a term of three years, after which each could be renewed annually “not more than six times.”⁷⁸ After that, “the Minister may, upon application, renew the permit for such

⁷⁴ *Vancouver Province*, 22 October 1972.

⁷⁵ Not quite: Shell’s drill rig was SEDCO 135F, destroyed in 1979 (http://home.versatel.nl/the_sims/rig/ixtocr.htm); the rig Chevron planned for BC drilling was *Ocean Ranger* (http://www.heritage.nf.ca/society/ocean_ranger.html), which was lost with all hands off the Grand Banks on 15 February 1982.

⁷⁶ Coates, *TAP Controversy*, 255. The *Exxon Valdez* spill occurred in March 1989.

⁷⁷ See <http://www.tc.gc.ca/eng/marinesafety/menu-4100.htm#f>.

⁷⁸ *Canada Gazette*, part 2, *Canada Oil and Gas Land Regulations*, SOR 61-253, secs. 35 and 36.

term and subject to such condition and deposits as he may prescribe.”⁷⁹ The federal moratorium could be said to begin in October 1971 with cabinet’s enactment of the Shell Canada Limited Variation Order, which extended permit deadlines by one year.⁸⁰ Despite this, two months later, the federal government issued the last BC offshore permits.

The federal cabinet decision to postpone Shell’s time limits cleared the way for other postponements, which brought the moratorium into full effect.⁸¹ The Canada Oil and Gas Act, 1982, grandfathered the 1961 permits subject to Canada’s negotiating terms with permittees for re-summing exploration. Its subsequent replacement, the Canada Petroleum Resources Act, 1987, contains the same validation of the 1961 permits.⁸² A current Natural Resources Canada website states: “The moratorium continues to be maintained through government policy ... [T]here is no statutory impediment to carry out those negotiations (with 1961 permit holders).”⁸³ Meantime, the website of the provincial Ministry of Energy, Mines and Petroleum Resources hosts the province’s 2007 “Energy Plan,” in which, under the heading “Policy Actions – Oil and Gas,” we find the following: “The Province re-affirms its commitment to offshore oil and gas exploration and development, its request to Canada to lift the federal moratorium and reiterates that the provincial moratorium will be lifted at the same time.”⁸⁴

THE BC OFFSHORE’S POTENTIAL

So far, this analysis has provided the background to the events of 1972. The context of the moratorium requires a glimpse at what was learned about the rocks of BC’s shelf. Shell abandoned its west coast offshore exploration program because its drill program had discouraging results. Current opinion is of two views: (1) the shelf probably contains oil and gas but Shell drilled holes that were either too shallow or in the wrong places; (2) the shelf does not contain oil and gas, meaning it has a low probability of containing hydrocarbons in economically viable quantities.

In the decades since 1969, this question has troubled both levels of government, so they initiated geological, geophysical, and biological field studies; commissioned numerous specialist reports; and held public

⁷⁹ *Ibid.*, sec. 40.

⁸⁰ *Ibid.*, vol. 105, SOR 71-497, 13 October 1971, 1,735.

⁸¹ See, for example, SOR 72-452, 9 November 1972; SOR 73-585, 4 October 1973.

⁸² Canada, *Statutes*, 1986, chap. 45, 1,419.

⁸³ Canada, Natural Resources Canada, Energy Sector, Offshore Oil and Gas, Offshore British Columbia <http://www.nrcan-rncan.gc.ca/eneene/sources/offext/offcbextcb-eng.php>.

⁸⁴ See <http://www.energyplan.gov.bc.ca/>.

hearings in various settlements along the BC coast. In the 1980s and 1990s, BC residents put a lot of resources, effort, and passion into an increasingly polarized debate over the environmental risks and possible benefits of offshore exploration. This valuable work deserves recognition, but discourse about the moratorium seems dismissive of Shell's work as though its findings (as published) are obsolete, and assumes that companies are eager to resume exploration.

So what did Shell find? The oil industry is famous for its secrecy, but even as Shell was winding down its BC offshore drilling program, one rumour was that the company had found "great structures but tight sands."⁸⁵ This meant that Shell's seismic work had found structures that could act as reservoirs but its drilling showed that any possible reservoir rocks had poor permeability. The company published a single glimpse of its work in 1971, after filing its drill logs with the federal government.⁸⁶ It described beds of sedimentary and volcanic rocks nearly five thousand metres thick and dating from about 30 million years ago or younger (i.e., from the middle of the Cenozoic era). Below that is a boundary that suggests that older, Mesozoic rocks had been worn away by erosion, just as the Rockies are being worn away today. Younger rocks that might have acted as reservoirs for migrating hydrocarbons had mineral characteristics that made them "tight."

One of eight wells drilled in Hecate Strait and Queen Charlotte Sound found oil-stained sandstone, but a follow-up hole close by was dry. Of six holes drilled off the west coast of Vancouver Island, only two found natural gas "shows," or traces (see Figure 6). Shell's disappointing results explain why it escaped to the east coast. Today's methods of engineering and geophysical interpretation might cause a petroleum geologist to drill different targets than Shell did, or to drill to greater depths, but it is equally possible that companies would sooner apply the new methods to proven, on-land "plays" in the Arctic than take risks with frontier offshore exploration. Shell's work changed the odds of finding hydrocarbons off the BC coast from completely unknown to possible but doubtful. If the company knows more, it will keep this knowledge to itself.

⁸⁵ I remember Dr. J.W. Murray saying this at a UBC lecture during the 1968-69 term.

⁸⁶ David H. Shouldice, "Geology of the Western Canadian Continental Shelf," *Bulletin of the Canadian Society of Petroleum Geologists* 19: 405-36. This remains the only published summary of Shell's 1963-69 exploration.

NEXT STEPS

Opinions about the offshore's potential will not change without more seismic surveys and drilling. However, political opposition to this is well entrenched, especially since the 2010 Deepwater Horizon offshore blowout in the Gulf of Mexico has breathed new life into old worries. Risk refers to two things: the probability of an event happening and the consequences of that event. Traffic accidents cause injuries and even death, but we keep driving because we think the probability of such an event is low. Some have argued that finding economic hydrocarbons on BC's offshore would outweigh any possible risk of losses from spills, but this is a simplistic view. Reaching approval to resume exploration involves first cutting through four tightly knotted policy issues.

First, Canada and British Columbia must agree on management and profit sharing. This could follow east coast examples but would still require years to achieve. Second, companies would have to assign a higher probability of success to exploring BC's shelf than to applying new exploration and production methods in lower cost, better-known plays in northeastern British Columbia, the Mackenzie delta, and the Beaufort Sea. Third, companies used to a culture of secrecy would have to work under the scrutiny of a public obsessed with oil spill consequences yet dismissive of any low estimate of their probability. The current debate about fracking offers an example of how that scrutiny would present itself. Finally, adjacent First Nations would demand bilateral agreements with exploration companies that would anticipate advance payment as is usual in BC's mining sector. These issues may prove to be too difficult for government and industry to take on, aside from the enormous costs of modern offshore exploration.⁸⁷

The Government of British Columbia hopes to resume offshore exploration. A ministry website posts many maps, publications, and conference presentations regarding the offshore. Ten years ago, Shell made two public presentations in which it states that it regards BC's offshore resource potential as "highly uncertain." Even if exploration resumed, and economic petroleum resources were found, at least twelve years would be needed to achieve production.⁸⁸ The company listed criteria under which it might consider resuming exploration, implying

⁸⁷ See <http://www.shell.com/>. See also press release of 17 September 2012.

⁸⁸ Power Point® presentations by Shell Canada Limited, December 2002 and May 2003, are posted at <http://www.empr.gov.bc.ca/Mining/Geoscience/MapPlace/thematicmaps/OffshoreMapGallery/Pages/publications.aspx>.



Figure 6. SEDCO 135F moored in Mooyah Bay, Nootka Sound, as seen from MV *Uchuck III*. The rig was occasionally towed into deep sheltered harbours to make repairs. The size of the rig is indicated by the barely visible Bell 205 helicopter perched on the right-hand leg. Photo by George B. McCandless.

that taxpayers would be welcome to share the costs and the risks, but it kept silent about retaining its vast permit holdings.

CONCLUSION

This article outlines the history of petroleum exploration of the BC coast between 1961 and 1972 as well as the implementation of the current exploration moratorium. Shell and other companies received – and still hold – exclusive rights to any oil or gas that may be found. For eight years, Shell carried out a very large offshore exploration program in which I was involved. The program had discouraging, but not conclusive, results. Just as this program was finishing, fears of oil pollution off the BC coast after the Alaska oil discovery caused changes in federal and provincial policies. Today, new tools have greatly increased the continent's known reserves of petroleum and gas, which, along with a widespread intolerance of accepting even a slight risk of oil spills, have diminished almost to the vanishing point any interest in resuming

exploration of the BC shelf. Meantime, the 1960s exploration permits remain intact.

The federal cabinet created the moratorium through decisions that Parliament later set in legislation. The government suspended its own powers to collect geological information and fees from the permit holders who became like tenants who pay no rent. It could revisit a 1972 promise to revoke the permits and leave the question of compensating permit holders for Parliament to decide. This would free Canada and British Columbia to negotiate at their leisure the outstanding issues of ownership, Aboriginal rights, management, and environmental protection. Only then, and only if the political climate ever seems right, could a joint federal-provincial management regime offer new exploration permits by public auction. But there may be no bidders.