"AS FREE OF FISH AS A BILLIARD BALL IS OF HAIR": *Dealing with Depletion in the Pacific Halibut Fishery, 1899-1924*[1]

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In 1992 two of the twentieth century's leading fishery scientists, Carl Walters and Raymond Hilborn, lamented the uncertainties surrounding the Pacific halibut fishery. In some ways *Hippoglossus Stenolepis* seemed to stand as a parable for the difficulties of fishery science since, in their assessment, "one [could] explain the history of the halibut stock equally well as changes due to the environment or as changes due to fishing," and this despite "what is arguably the best fisheries data set in the world."[2] Here fishery science stares into the abyss. Several generations of serious scientific engagement with this fishery – literally decades of data collection and careful theorizing – have been almost for naught. We know far more about Pacific halibut biology than anyone did a century ago, but the sum of this knowledge seems to highlight how little we really know. In this situation, precision is hard to find and confidence hard to claim, while resource management remains an exercise in doing the best one can in the circumstances. Ironically, risk and uncertainty abound, even in one of the most intensely studied fisheries on the planet.[3]

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[2] Carl Walters and Raymond Hilborn, *Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty* (New York: Chapman and Hall, 1992), 56.

[3] Donald McCaughran, "Seventy-Five Years of Halibut Management Success," in *Developing and Sustaining World Fisheries: The State and Science of Management*, ed. D.A. Hancock (Collingwood: CISRO, 1996), 680-90.

Building on recent work in fishery management and conservation history, this article considers early twentieth-century efforts to understand and address the effects of fishing on Pacific halibut in order to gain some perspective on the aforementioned murky picture. I focus on the period before 1923, when legal arrangements placed the fishery under the cooperative control of Canada and United States. These arrangements were widely celebrated and encouraged international approaches to fishery problems; however, I argue that they were merely the beginning of a new chapter in an already long and contested story of societal interest, scientific study, and environmental change in the halibut fishery. When Canadian and American politicians first came together to consider the fishery in 1918, they avowed an interest in preserving halibut stocks, but scientific uncertainty, powerful economic interests, and political expediency combined to shape an agreement that favoured expansion and exploitation over restraint and restoration. A second strand of my argument concerns the precedent set by the 1923 treaty. The agreement established an important scientific agency, encouraged international approaches to management, and has helped keep halibut stocks healthy. Few ocean fisheries have been as fortunate in the attention afforded to them.[4] And yet, as I show towards the end of this article, the treaty also deflected research and management away from serious engagement with critical questions about the population dynamics of exploited fish stocks.

Pacific halibut are among the largest fish in the sea. Most are between twenty-five and thirty-five pounds, but 600-pound specimens are not unheard of and the historical record is full of reports of fish weighing from 200 to 400 pounds. Halibut are found on the Continental Shelf of the North Pacific Ocean and Bering Sea from Santa Barbara, California, to Nome, Alaska, and along the Asiatic coast from the Gulf of Anadyr, Russia, to Hokkaido, Japan. However, the largest concentrations, and the largest fisheries, have always occurred along the northwest coast of North America, where sandy, pebbly bottoms in relatively shallow water afford halibut ample food and protection from all but human predation. Early in the twentieth century, these concentrations largely lay in international

[4] The literature on fishery problems is enormous. J.R. McNeill provides historical perspective on fishery problems in his *Something New under the Sun: An Environmental History of the Twentieth-Century World* (New York: W.W. Norton and Company), 237-52. On recent developments, see: Kevern Cochrane, "Reconciling Sustainability, Economic Efficiency, and Equity in Fisheries: The One That Got Away?" *Fish and Fisheries* 1, 1 (2000): 3-21.; D. Pauly, "Towards Sustainability in World Fisheries," *Nature* 418, (2002): 689-95; C. Safina, "The World's Imperiled Fish," *Scientific American* 273, 5 (1995): 46-53.

waters, which made their conservation a challenging problem.[5] Canada and the United States had to cooperate in order to conserve.

Commercial production of Pacific halibut began in the late 1880s and early 1890s when transcontinental railways opened up large marketing opportunities in eastern Canada and the United States. But as economists James Crutchfield and Arthur Zellner noted, "initial efforts at opening a trade with the East were not wholly encouraging."[6] Freight rates were high and ice obtained from any of the few ice dealers on the Coast was prohibitively expensive. Some halibut fishers collected ice themselves from the glaciers of Alaska, hundreds of miles away from the principle fishing grounds in Puget Sound, but this only partially hid the high costs involved.[7]

Poor shipping and handling across the continent further exacerbated the problem of getting halibut to eastern markets. Looking back on the early days of the halibut fishery, Samuel Chesbro, an East Coast fish dealer, recalled that, "in or about the year 1889, Benjamin and West received a carload of West Coast halibut, the first ever to cross the continent. They [the fish] were packed in all sorts of packages, dry goods boxes, shoe boxes, soap boxes, even cigar boxes for in those days [fishers] found pretty crude conditions on the West Coast and they had to use whatever packages they could get their hands on."[8] In fact, three of the largest schooners in the fishery were driven out of the halibut trade by repeated failures to profitably place fresh halibut on eastern markets. "At the close of 1889 the outlook for the continuance of the Pacific halibut fishery as an industry of any considerable importance is decidedly unfavorable" noted one US federal fisheries authority. "There is every prospect that it will be abandoned or at least reduced to a scale only sufficient to supply the limited local demand."[9]

By 1915, however, the fishery had been transformed. Aggregate annual landings increased forty-fivefold from fewer than one and one-half

[5] In the 1910s, international ocean law recognized a narrow three-mile territorial sea within which coastal states could regulate fisheries. On the evolution of ocean law, see: Francis T. Christy and Anthony Scott, *The Common Wealth in Ocean Fisheries* (Baltimore: Johns Hopkins Press, 1965), 153-214; Lawrence Juda, *International Law and Ocean Use Management* (New York: Routledge, 1996); Jozo Tomasevich, *International Agreements on Conservation of Marine Resources* (Stanford: Food and Research Institute, 1943).

[6] James Crutchfield and Arnold Zellner, *Economic Aspects of the Pacific Halibut Fishery* (Washington: United States Department of the Interior, 1962), 6.

[7] William Thompson and Norman Freeman, *History of the Pacific Halibut Fishery* (Seattle: International Fisheries Commission, 1930), 18.

[8] Quote comes from Thompson and Freeman, *History*, 19.

[9] United States Fish Commission, *Report of the Commissioner for 1889* (Washington: Government Printing Office, 1900), 267.

million pounds in 1888 to some sixty-nine million pounds by 1915 (see Figure 1). Key to this growth was the commercial collapse of the Atlantic halibut fishery.[10] East Coast capital and labour rushed to the West Coast in the 1890s in search of new prey and profit. The Boston-based New England Fish Company (NEFCO) established a Vancouver office in 1894, and in 1909 it purchased the Canadian Fishing Company. By 1914 NEFCO had constructed several large cold storage facilities and had as many as eighteen steamers, each carrying up to fourteen dories and forty crew members, fishing for halibut all along the coast of British Columbia and the eastern Gulf of Alaska. Steamers were incredibly efficient. The largest of them could catch over 300,000 pounds of halibut in a single trip, and together they accounted for half or more of total landings in the years preceding 1914.[11] The number of independent fishers operating sail- and (after 1903) gasoline-powered schooners also increased dramatically as

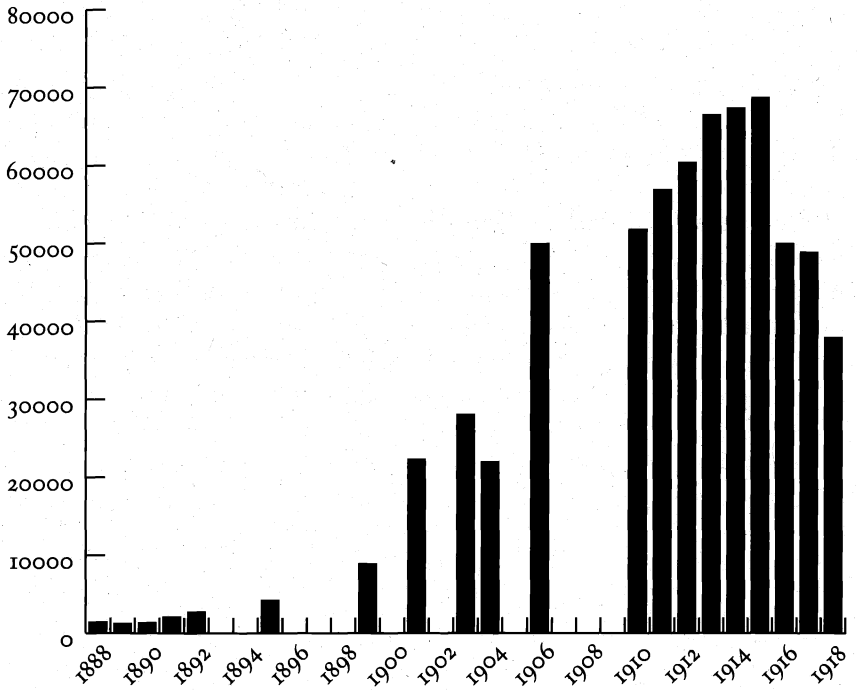


Figure 1: Aggregate Annual Landings in the Halibut Fishery, 1888-1918 (thousands of pounds). F. Heward Bell, Landings 1888 to 1950, and Catch According to Areas of Origin (Seattle: International Pacific Halibut Commission, 1952), 10.

[10] See G. Browne Goode, "A Brief Biography of the Halibut," *American Naturalist* 19, 10 (1885): 953-69.

[11] "Halibut Review," *Pacific Fisherman Yearbook for 1915* (1916): 75-80.

pelagic sealing came under increasing international control and Canadian and American schooners began converting to halibut fishing.[12]

Rapid market expansion after 1890 proved profitable for most West Coast halibut producers, but it also raised fears of overfishing and increased international political tension. As early as 1899, Richard Rathbun, an ichthyologist with the United States Fish Commission (USFC), warned that near shore banks were showing signs of depletion and recommended that "some limit should be placed on the quantity of fish caught."[13] Early in the twentieth century, similar reports of depletion on the northern banks between Cape Scott at the north end of Vancouver Island and Rose Spit at Dixon Entrance near the Alaska-British Columbia boundary began appearing in trade journals and were almost daily fare in British Columbia newspapers. In 1906, for example, in *The Pacific Fishermen*, a regional trade journal published in Seattle, it was stated that

> a recent close inspection of the northern halibut banks has revealed the fact that many of the grounds have been depleted. Banks which half a dozen years ago were bountiful in their yield of halibut were found as free of fish as a billiard ball is of hair, while others known to have been fine fishing grounds in the past where large fish were numerous were found to carry nothing but the smallest of fish.[14]

Opinions differed about the cause of the decline and, indeed, whether there had even been one. In Canada, where reports of "American poaching" in "Canadian waters" received almost continuous coverage in the local (and even national) press, arguments about overfishing often took on nationalistic overtones. "Americans are a menace to the halibut fishery," railed one BC fisher in 1909.[15] "They've cleaned up all the big fish in Hecate Strait and Dixon's Entrance," claimed another in 1905.[16] Occasionally, though, arguments about overfishing pitted

[12] On changes in the halibut fishery, see: F.H. Bell, *Pacific Halibut: The Resource, the Fishery* (Anchorage: Alaska Northwest Publishing Company, 1981); Frank Millerd, "Windjammers to Eighteen Wheelers: The Impact of Changes in Transportation on the Development of British Columbia's Fishing Industry," *BC Studies* 78 (1988): 28-52; Dianne Newell, *Tangled Webs of History: Indians and the Law in Canada's Pacific Coast Fisheries* (Toronto: University of Toronto Press, 1993), 181-8; Thompson and Freeman, *History*.

[13] Richard Rathbun, "A Review of the Fisheries in the Contiguous Waters of Washington and British Columbia," in *Report of the United States Commissioner of Fish and Fisheries for 1899 1889*, (Washington: Government Printing Office, 1900) 264.

[14] Quote comes from E.E. Prince, *Report and Recommendations of the Dominion-British Columbia Fisheries Commission, 1905-1907* (Ottawa: Government Printing Bureau, 1908), 42.

[15] "Americans Are a Menace to Halibut Industry," Anonymous, *Victoria Daily Colonist*, 17 February 1909.

[16] "American's Rob Fishing Banks," Anonymous, *Vancouver Daily Province*, 3 November 1905. Other examples include: "Americans Get Best of Fishing," Anonymous, *Victoria Daily Times*,

small-scale independent producers against large-scale producers like NEFCO and, thus, represented economic rivalries within the international fleet. Independent fishers in both countries criticized the steamer fleet, which they alleged caught and discarded large quantities of immature (and some very large mature) fish because they were worth less in the marketplace, a process known as high-grading. For their part, some steamer captains argued that halibut were every bit as plentiful as in the past but had simply migrated offshore into deeper water, where only the largest vessels could catch them.[17]

Of course it was clearly in the interest of large-scale producers – who, at least for the moment, were having no problems procuring their product – to deny that there had been a decline in the fishery. And no doubt all halibut fishers high-graded their catch to some extent. Moreover, the evidence for overfishing was far from straightforward. Although the percentage of small and potentially immature fish in the catch had increased dramatically in recent years, aggregate annual landings in the fishery were increasing, not decreasing. At some fifty million pounds in 1907, they were more than double those of just two years before. Indeed, despite Richard Rathbun's ominous 1899 assessment of the resource, a survey carried out by "fishery expert" A.B. Alexander for the USFC used rising yearly landings to support an argument stating that reports of depletion in the fishery were overblown. "The investigation points to opportunity for development of the halibut fishery much beyond its present limits," argued Alexander. "The phenomenal catches landed in the last few years suggest no stringency of supply on the grounds now fished."[18]

Unconvinced by Alexander's optimistic appraisal of the resource, and possibly under pressure from Canadian fishers to address "American overfishing" in Hecate Strait, in 1914 John Pease Babcock of the BC Department of Fisheries (BCDF) hired William F. Thompson to further study the halibut fishery. At twenty-six, Thompson was already an accomplished, if not well-known, ichthyologist.[19] Between 1910 and 1913, he co-authored ten papers on fish taxonomy with David Starr Jordan, his graduate advisor and one of late nineteenth-century North

15 November 1905; "Deep Sea Fishing Discussed," Anonymous, *Vancouver Daily Province*, 17 November 1905; "Kestral Destroyed Illegal Lights on Northern Coast," Anonymous, *Vancouver Daily Province*, 21 November 1905.

[17] Prince, *Report*, 42.

[18] A.B. Alexander, *Preliminary Examination of the Halibut Fishing Grounds of the Pacific Coast* (Washington: Government Printing Office, 1912), 56.

[19] Jean Richard Dunn, "William Francis Thompson (1888-1965): A Preeminent Fishery Biologist of the Early and Mid-Twentieth Century," *Marine Fisheries Review* 63, 2 (2002): 1-4; Richard VanCleve, "William Francis Thompson 1888-1965," *Journal of the Fisheries Research Board of Canada* 23, 11 (1966): 1790-3.

Figure 2: William Thompson conducting clam research for the Department of Fisheries on the BC coast in 1912. Source: William F. Thompson Papers, School of Aquatic Fishery Sciences, University of Washington.

America's foremost fishery experts (Figure 2).[20] Thompson was also acutely aware of international advances in procedures for stock assessment, and, unlike Alexander, he understood that aggregate annual landings data were poor indicators of stock health. In the North Sea, for example, scientists working under the auspices of the International Council for the Exploration of the Seas (ICES) found that strong market demand, expansion of the fishing grounds, and even subtle changes in harvesting technology and practices had enabled fishers to maintain and even increase catches of plaice, a species of flatfish similar to halibut, long after stocks had begun to decline.[21] Following the lead of ICES scientists, Thompson ignored total landings and concentrated on changes in fishing effort and the biological composition of sample commercial catches.[22]

[20] Kurkpatrick Dorsey discusses Jordan in *The Dawn of Conservation Diplomacy: Canadian-American Wildlife Protection Treaties in the Progressive Era* (Seattle: University of Washington Press, 1998), 51-104.

[21] On problems assessing North Sea fisheries, see: William F. Thompson, "The Scientific Investigation of Marine Fisheries," *State of California Fish and Game Commission Fish Bulletin* 2 (1919): 3-27. For a comprehensive study of ICES research, see Helen Rozwadowski, *The Sea Knows No Bounds: A Century of Marine Science under ICES* (Seattle: ICES and University of Washington Press, 2002). On early ICES research, see: Susan Schlee, *On the Edge of an Unfamiliar World: A History of Oceanography* (New York: E.P Dutton and Co., 1973), 206-43; Tim Smith, *Scaling Fisheries: The Science of Measuring the Effects of Fishing, 1855-1955* (Cambridge: Cambridge University Press, 1995), 110-62.

[22] On the development of twentieth-century fishery science, see: Elmer Higgins, "Fishery Biology: Its Scope, Development and Applications," *Quarterly Review of Biology* 9, 3 (1934):

By December 1914 Thompson's first paper from his BC research, "A Preliminary Report on the Life History of Pacific Halibut," was ready for publication (Figure 3).[23] In it he argued that halibut were especially vulnerable to depletion, and he provided some compelling, if ultimately inconclusive, evidence that the stock's capacity to reproduce was being undermined by too intense a fishery. For one thing, he argued that halibut were relatively non-migratory. Time (and possibly budget) constraints prevented Thompson from tagging fish to track their movements, but there seemed to be ample indirect evidence to show that halibut rarely ventured off the banks on which they were born, thus forming subpopulations, or "races."[24] He noted, for example, that fish from the Gulf of Alaska had larger heads than did fish from the BC coast. Thompson also found that growth rates were consistent within areas but varied considerably between them. An eighteen-pound male from Kodiak Island in the western Gulf of Alaska was approximately the same age as was a thirty-pound male from Frederick Island to the south and a forty-five pound fish from Hecate Strait. According to Darwin's theory of evolution, this could only happen if reproduction and growth occurred in relative isolation, and it indicated that, once found, a subpopulation could be fished to a very low level of abundance, or "played out," as halibut fishers put it.

Thompson also found that halibut matured very slowly. Only half the females examined were mature by age twelve, and there were still immature fish at age fifteen. The implication was obvious: an intense fishery could easily exceed the stock's capacity to reproduce. Indeed, already there were signs that this was happening, particularly in Hecate Strait, where Canadian and American commercial fishers had been pursuing halibut in earnest since the mid-1890s. Only 14 percent of the

275-91; Arthur Kendall and Gary Duker, "The Development of Recruitment Fisheries Oceanography in the United States," *Fisheries Oceanography* 7, 2 (1998): 69-88; J.L. McHugh, "Trends in Fishery Research," in *A Century of Fisheries in North America*, ed. Norman G. Benson (Washington: American Fisheries Society, 1970), 25-56; Larry Neilsen, "The Evolution of Fisheries Management Philosophy," *Marine Fisheries Review* (1976): 15-23; E.S. Russell, "Fishery Research: Its Contribution to Ecology," *Journal of Ecology* 20, 1 (1932): 128-51; Smith, *Scaling Fisheries*.

[23] William F. Thompson, "A Preliminary Report on the Life History of the Halibut," in *Report of the British Columbia Commissioner of Fisheries for 1914* (Victoria, British Columbia: King's Printer, 1915): 76-99.

[24] For an overview of fish tagging, see G.A. McFarlane, Richard, S. Wydowski, and Eric D. Prince, "Historical Review of External Tags and Marks," in Fish Marking Techniques (American Fisheries Society Symposium) 7 (1990): 9-29. For "races," subpopulations, and evolutionary thinking in fishery science, see: M. Sinclair and P. Solemdal, "The Development of 'Population Thinking' in Fisheries Biology between 1878 and 1930," *Aquatic Living Resources* 1 (1988): 189-213; Smith *Scaling Fisheries*, 81-3.

Figure 3: William Thompson examining halibut aboard the vessel James Carruthers, 1914. Source: William F. Thompson Papers, School of Aquatic Fishery Sciences, University of Washington.

fish in Thompson's sample from the area had reached twelve years of age at the time of capture, and only 5 percent had reached sixteen years of age. Less grievously, but almost equally startling, only 31 percent of the fish from the Kodiak Island grounds had reached their twelfth year, and only 12 percent had surpassed their sixteenth. Such statistics seemed self-explanatory – and terribly unsettling – to Thompson: halibut were being heavily overfished. And yet Thompson carefully avoided drawing

such stark conclusions, noting only that "it is evident that a large majority of the fish caught do not reach maturity."[25] He needed more proof.

In contrast, Canadian Fishing Company president and general manager Alvah Hager had all the proof he needed. In a letter to D.N. McIntyre of the BCDF, Hager applauded Thompson's efforts to work out the halibut's life history. In his mind "there [was] absolutely no question ... that our Halibut banks are fast becoming depleted as a result of overfishing, and as the artificial propagation of Halibut seems to be impossible, it then becomes necessary to make certain regulations that will not injure legitimate business interests, but at the same time assist in the preservation of the supply."[26]

Starting from the position that "during the months of December, January and February all Halibut Schooners and Steamers operate at a financial loss," Hager argued for an internationally sanctioned closure of the winter season in order to conserve the fishery. This, said Hager, would prevent the capture of mature spawning fish. "It is our observation that Halibut taken during these months have large overgrown heads, condition of flesh in poor shape and the unusually large pokes completely filled with spawn," he wrote. "These fish," he continued, "should be left undisturbed as they are at best only a #2 article and the taking of these Halibut in this condition means the very rapid depletion of the Halibut." A winter closure would also prevent the continued destruction of the spawning grounds through lost gear, a "condition [which] is very bad as no kind of fish will inhabit waters where gear, offal or other refuse is deposited." Finally, a winter closure would aid in the orderly disposal of fresh and, especially, frozen fish. "It is our experience," explained Hager, "that the catching of fresh Halibut during these months means that the trade throughout the country has just enough fresh fish offered to them to materially hinder the proper merchandising and profitable sale of the large packs of frozen Halibut which are packed annually." A winter closure would not only rationalize the fishery but also restore it.

Or so it seemed to Hager. Writing to McIntyre in early December, Thompson warned that a winter closure "would be clearly advantageous only to the owners of the cold storage plants" and would not sustain fish stocks.[27] The advantage of allowing fish freedom from capture during the spawning season, he explained, accrued mainly in short-lived species

[25] Thompson, "Preliminary Study," 93.

[26] University of Washington Archives, William Francis Thompson Papers, accession no. 2597-77-1, box 1, file 51, Alvah Hager to D.N. McIntyre, 26 November 1914.

[27] University of Washington Archives, William Francis Thompson Papers, accession no. 2597-77-1, box 1, file 51, William Thompson to D.N. McIntyre, 4 December 1914.

in which the value of the first spawning season was disproportionately great. In the case of long-lived species like halibut, which might breed for ten or more years, any single spawning season contributed a relatively small fraction of lifetime fecundity. Removal at any time during the year – in the winter when spawning or in summer when not spawning – or at any stage in the lifecycle meant the complete loss of all future spawning seasons. In Thompson's considered assessment, "the case resolves itself into this, how are we to preserve the numbers of the species, if possible favouring the females?" More tangibly, Thompson feared that a winter closure would result in a more intense open season on the already badly depleted BC banks, which would only further exacerbate the decline in fish stocks:

> The establishment of a winter closed-season would immediately have the effect, as the Canadian Fishing Company suggests, of placing each vessel on a paying basis throughout the whole period of its operation. This would [allow] a smaller catch per diem than is at present the case, in other words would allow of the fishing of the banks much nearer to depletion, with profit. The consequence of this would be the temporary cessation of trips to the Alaskan banks and the more complete depletion of those in British Columbia.[28]

A winter closure was not the best (and to Thompson's mind might even be the worst) conservation measure available to fisheries officials. It would help Hager sell his frozen fish, but it would not sustain halibut stocks.

This early exchange between Thompson and Hager complicates conventional conclusions about the early era of international fishery conservation. Some historians have suggested that North American society's initial struggle to sustain fish stocks stemmed in part from an inability to reconcile the long-term ecological interests of science with the short-term economic interests of industry.[29] Yet, as Joseph Taylor noted in a recent review of Kurkpatrick Dorsey's *The Dawn of Conservation Diplomacy*, "the dichotomy fails on both accounts ... There was no sharp divide between conservation and anti-conservation but rather a spectrum of opinions on how to conserve, each of which reflected long-term concerns for both fish and people."[30] Similar conclusions can

[28] Ibid.

[29] Two studies that make this distinction are: Margaret Bogue, *Fishing the Great Lakes: An Environmental History, 1783-1933* (Madison: University of Wisconsin Press, 2000); Dorsey, *Dawn of Conservation Diplomacy*.

[30] Joseph E. Taylor, "Negotiating Nature through Science, Sentiment and Economics," *Diplomatic History* 25, 2 (2001): 336, 337.

be drawn from the halibut fishery. Hager wanted an international treaty regulating the fishery; he was not anti-conservation. Nor were his interests simply short-term economic ones; his argument also incorporated elements of halibut biology and at least an awareness of the possible longer-term consequences of polluting fish habitat. Thompson also wanted international regulation for the fishery. And yet his opposition to policies favouring a few large fishing companies clearly indicates that his interests extended beyond biology; social threads ran through his science. In truth both men wanted to save halibut stocks; they simply disagreed about how best to do it and who should benefit.[31]

Uncertainty about the state of halibut stocks surfaced again early in 1916 following the Biological Board of Canada's publication of Arthur Willey's "Investigation into the Pacific Halibut Fishery."[32] Willey was convinced that reports of overfishing had been exaggerated. "Recommendations to curtail the fishery are easily made but they would be entirely ineffective unless there happened to be a clear case for the immediate enforcement of rigid restrictions," he wrote. "The fact is that there is no such pressing call for drastic action."[33] Indeed, he continued, "up to a certain point the thinning of the banks by the capture of surplus fishes must be beneficial to the numbers and quality of those that remain." Willey did not reference Thompson's suggestive life history study and did not offer evidence in support of his thinning theory.[34] Nor did he appear to be aware of recent methodological advances in stock assessment. The crux of his argument, echoing A.B. Alexander's assessment, was the simple fact that "aggregate catches do not yet show any sign of diminution."[35]

Thompson – who, in private, described Willey's paper "as obviously simply a review of the literature on the subject and an attempt to advance certain surmises as to the life history of the halibut" – was convinced otherwise.[36] Later that year the BCDF published another of his papers,

[31] Joseph Taylor describes a similar situation in "'Well Thinking Men and Women': The Battle for the White Act and the Meaning of Conservation in the 1920s," *Pacific Historical Review* 71, 3 (2002): 357-87.

[32] Arthur Willey, "Investigation into the Pacific Halibut Fishery," *Contributions to Canadian Biology* 38 (1916): 1-17.

[33] Ibid., 15.

[34] The thinning theory is rooted in the researches of Danish scientist C.G.J. Petersen and holds that removing older larger fish from a population frees up food supplies and increases growth rates in younger smaller fish. Willey simply surmised that something like this might apply to the halibut fishery. On Peterson, see: Schlee, *On the Edge*, 216-20; Smith, *Scaling Fisheries*, 113-24.

[35] Willey, "Investigation," 15.

[36] University of Washington Archives, William Francis Thompson Papers, accession no. 2597-77-1, box 1, folder 51, William Thompson to John Pease Babcock, 24 February 1915.

this one a statistical analysis of the halibut population showing that it was indeed being seriously depleted. "The most immediately important conclusion reached in this paper is the fact of depletion," Thompson declared confidently. "The intense fishery has, it is evident, made its influence felt throughout the whole biological appearance of the species and in doing so has rendered precarious the future of the banks."[37] Halibut was being depleted and Thompson believed that he now had the evidence to prove it.

Catch rate data from the logs of five large company-owned steamers suggested a precipitous decline in the fishery beginning sometime around the turn of the century. Between 1906 and 1912, the number of fish caught per unit of gear fell 50 percent, from an average of 42.8 to 21.9. But on certain banks, the decline was much worse. Data from the Rose Spit and Twin Peaks banks, for example, suggested a decline in abundance closer to 90 percent, from 56.7 fish per unit of gear in 1902 to just 7.9 in 1914. The average weight of fish also declined dramatically, from 25.1 pounds in 1902 to 12.3 pounds in 1914. Not surprisingly, as fish became fewer and smaller, fishers had to work harder, fish longer, and travel further to obtain a paying cargo. In 1902 the average summer fishing trip lasted two days, whereas in 1914 it lasted 10.2 days. The average winter fishing trip also increased from 4.2 days in 1902 to 10.6 in 1914. But Thompson did not stop there. By comparing data from different areas, he was able to show how progressive the process of overfishing had been. Thus the oldest banks in Puget Sound were more depleted than were those in Hecate Strait, which, in turn, were more depleted than were the more recently exploited banks in the Gulf of Alaska. All of this evidence, along with his earlier observation that fewer and fewer fish were reaching maturity, convinced Thompson that halibut were being overfished. Yet the situation was more complicated than he realized.

Fishery scientists have long suspected that oceanographic conditions influence fish stocks. Working with statistics from Norwegian sea fisheries, for example, Thompson's contemporary, Johan Hjort, discovered that more than half of the herring harvested between 1907 and 1913 came from an unusually large cohort born in 1904, and he speculated that similar fluctuations also occurred in salmon, cod, and haddock stocks.[38] Thompson suspected there were minor seasonal

[37] William F. Thompson, "Statistics of the Halibut Fishery in the Pacific: Their Bearing on the Biology of the Species and the Condition of the Banks," in *Report of the British Columbia Commissioner of Fisheries for 1915* (Victoria, British Columbia: King's Printer, 1916), 67.

[38] Johan Hjort, "Fluctuations in the Great Fisheries of Northern Europe," *Rapports et Proces-Verbaux* 20, (1914): 1-228.

changes in availability of halibut but did not believe the decline in abundance detected in catch rate data was natural in origin (nor did anyone else at the time).[39] However, history has shown that halibut recruitment is highly cyclical. The causes of these fluctuations are still being studied. Recent work in fisheries oceanography has connected them to an El Nino-like pattern of climate variability known as the Pacific Decadal Oscillation.[40] Aware of this latest science, Walters and Hilborn concluded that "Thompson was almost surely wrong in his original argument about overfishing, since the largest recruitments of halibut [during the twentieth century] have come from the smallest adult biomass levels."[41]

Thompson discounted natural fluctuations in considering his evidence for halibut depletion, but his ideas on the regulation of the fishery, which he wrote down in 1917 before leaving the BCDF to become the California Fish and Game Commission's chief biologist at San Pedro, reveal that he was not entirely close-minded about the possibility of natural variability.[42] He began by ruling out the two most popular tools of late nineteenth- and early twentieth-century fishery conservation: closed seasons and artificial propagation.[43] Closed seasons – whether in winter or summer – were essentially incompatible with halibut biology and would only "intensify the fishery." Artificial propagation was also unsuitable because halibut ova develop gradually and are discharged over

[39] Thompson, "Scientific Investigation of Marine Fisheries," 19-27. It should be noted that none of Thompson's colleagues contested his interpretation.

[40] Nathan J. Mantua and Steven Hare offer an overview of the PDO in "Pacific Decadal Oscillation," *Journal of Oceanography* 58 (2002): 35-44. For PDO impacts on halibut, see: William G. Clarke and Steven R. Hare, "Effects of Climate and Stock Size and Growth of Pacific Halibut," *North American Journal of Fisheries Management* 22 (2002): 852-62; William G. Clarke, Steven R. Hare, Ana M. Parma, Patrick J. Sullivan, and Robert J. Trimble, "Decadal Scale Changes in Growth and Recruitment of Pacific Halibut," *Canadian Journal of Fisheries and Aquatic Sciences* 56 (1999): 242-52. For an overview of climate impacts on northeast Pacific Ocean ecosystems, see: R.C. Francis and S.R. Hare, "Effects of Interdecadal Climate Variability on the Oceanic Ecosystems of the Northeast Pacific," *Fisheries Oceanography* 7, 1 (1998): 1-21; R.C. Francis and S.R. Hare, "Decadal-Scale Regime Shifts in the Large Marine Ecosystems of the Northeast Pacific: A Case for Historical Science," *Fisheries Oceanography* 3 (1994): 279-91. Note that "decadal" means "inter-decadal" in that it refers to time scales of five to fifty years For climate impacts on the politics of fishery conservation, see: Arthur McEvoy, *The Fisherman's Problem: Ecology and Law in the California Fisheries, 1850-1980* (Cambridge: Cambridge University Press, 1986); Joseph Taylor, "El Nino and Vanishing Salmon: Culture, Nature, History, and the Politics of Blame," *Western Historical Quarterly* 29, 4 (1998): 437-57.

[41] Walters and Hilborn, *Quantitative Stock Assessment*, 56.

[42] William Thompson, "The Regulation of Halibut Fishery of the Pacific, " in *Report of the British Columbia Commissioner of Fisheries for the Year ending 1916* (Victoria, British Columbia: King's Printer, 1917), 24-34. On Thompson in California, see: J. Richard Dunn, "William Thompson and the Dawn of Marine Fisheries Research in California," *Marine Fisheries Review* 62, 2 (2001): 15-24; McEvoy, *Fisherman's Problem*, 158-66, 180-2.

[43] Nielsen, "Evolution of Fishery Management Philosophy."

an extended period of time. Mature females would have to be caught and then kept alive in big, costly brooding enclosures to enable fisheries personnel to obtain an entire yield of eggs. Indeed, argued Thompson, "in the face of the wholesale reduction of the numbers of halibut on the banks, the establishment of hatcheries cannot be regarded as anything but exceedingly expensive experimental work." "We come then," he continued, "to a consideration of the closure of large areas for a period of years." The first step to achieving such a plan was to divide the coast into six areas corresponding to the conditions found on the banks, as is shown in Figure 4. Areas 1, 5, and 6, for example, were least depleted, while areas 2, 3, and 4 were the most depleted. Alternately, the next step was to open and close fishing areas:

> Areas 2 and 3 could be alternately closed and opened, 2 closed for five years, then 3 for the next five years and so on alternately. Areas 1, 4, 5 and 6 could be closed at the same time as either 2 or 3, their closure being subject to the discretion of conferees appointed by the two Governments: provided that, unless otherwise agreed upon by these conferees, Areas 1, 3, and 5 would be closed together, and Areas 2, 4, and 6. Each area would thus be closed five out of every ten years. This arrangement would allow sufficient latitude of time to overcome any differences in the productive powers of the areas, and at the same time obviate any danger of placing any particular port under a disadvantage.[44]

One of the strengths of Thompson's area-based approach was that it corresponded with the best scientific information available at the time. If indeed the halibut population was composed of several non-migratory subpopulations reproducing in relative isolation, and if the banks were as unevenly depleted as the data suggested, then an area-based approach to the problem was most appropriate. An area-based approach also made sense from a management point of view. In *Forest Dreams, Forest Nightmares*, historian Nancy Langston shows how US Forest Service scientist Frederick Ames attempted to embrace uncertainty and ecological complexity by advocating an "adaptive" approach to research and management in the Blue Mountains of Oregon.[45] Thompson too promoted an experimental approach to management. The opening and closing of large areas, for example, provided a critical basis for broadly comparative work on halibut population dynamics. Indeed, a key part of his proposal

[44] Thompson, "Regulations," 33.

[45] Nancy Langston, *Forest Dreams, Forest Nightmares: The Paradox of Old Growth in the Inland West* (Seattle: University of Washington Press, 1995), 137–41.

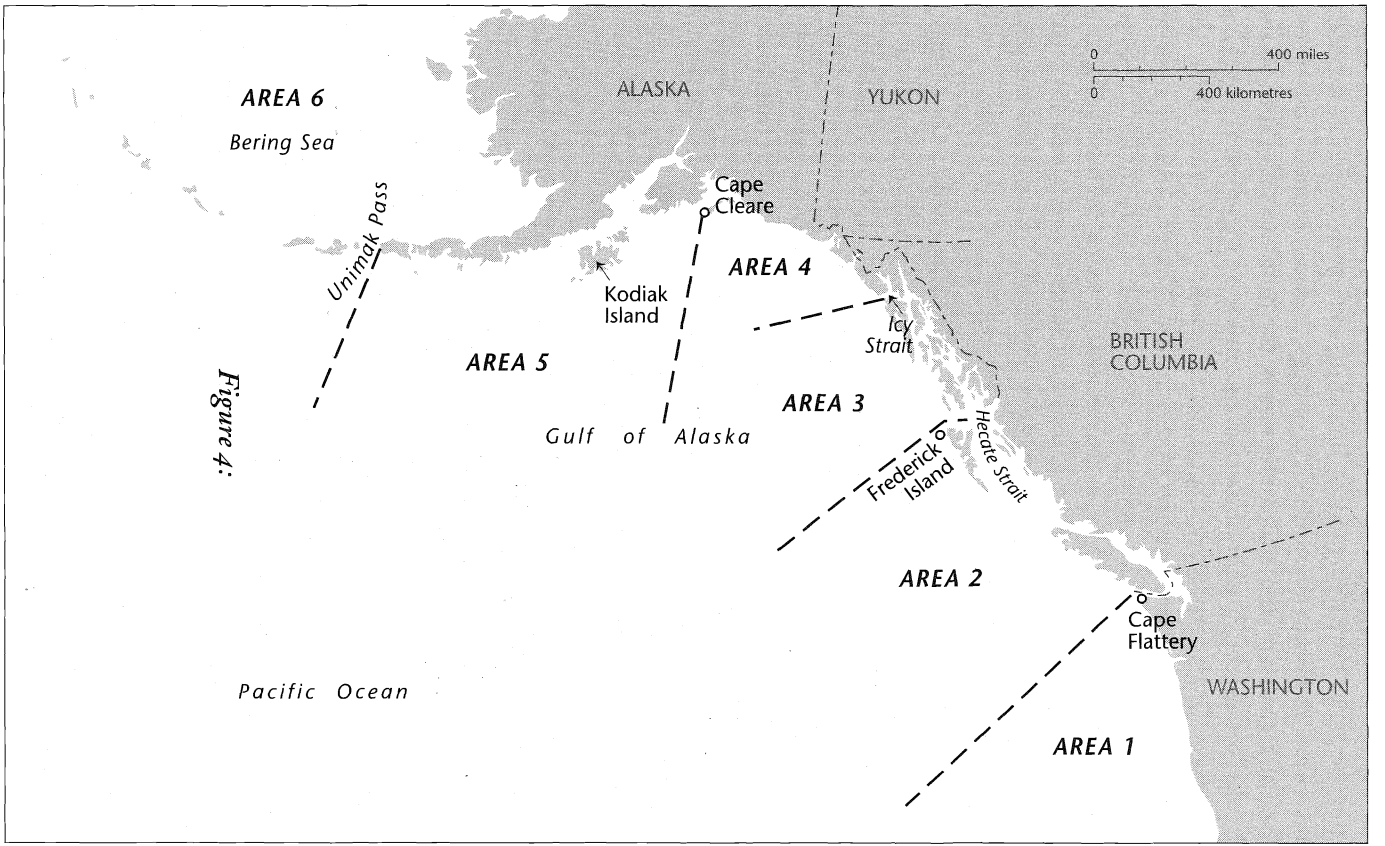


Figure 4: Thompson's Area-Based Approach to Halibut Conservation.

involved the ongoing collection of catch rate and other biological data by area from standardized logbooks. These would allow fisheries officials to follow the effects of the program and to modify it as knowledge and conditions in the fishery changed. Freed from the strain of the fishery, halibut stocks could recuperate. But if herring-like fluctuations were at work in the fishery, then an area-based approach would expose them to fisheries officials. It was a scientifically sound conservation strategy.

In 1918, amid calls from both coasts for conservation of fish stocks, Canadian and American politicians indicated that they were ready to cooperate. The setting was an international fisheries conference chaired by US secretary of state William C. Redfield and chief justice for the Dominion of Canada John D. Hazen. All outstanding international fisheries issues were on the table: tariffs; port privileges; restoration of sockeye salmon, lobster, sturgeon, and whale stocks; and protection for the Pacific halibut fishery.[46] At public hearings in Vancouver and New Westminster in May, Hazen and Redfield heard Alvah Hager's plea for a closed season, but they also reviewed Thompson's area-based proposal. Provincial fisheries officials remained hopeful that Thompson's plan would be adopted. But Hazen and Redfield were much more concerned with the political and economic implications of Thompson's proposal than they were with its biological merit since "the method is opposed by all fishing interests."[47]

Starting from the position that "remarkably little investigation into the halibut has been made anywhere in the world," Hazen and Redfield reviewed recent changes in the biology and economic structure of the fishery.[48] In doing so they found four faults with Thompson's ideas. First, Hazen and Redfield argued that implementation of Thompson's recommendations would be incredibly costly because, if the plan were to work, funds for ongoing research and for extensive patrolling to prevent poaching in closed areas were absolutely crucial.[49] Second, they insisted that "halibut fishing would become so centralized and concentrated on the open areas that the good effects of the close time would be more than offset."[50] Third, Hazen and Redfield argued that "the end in view

[46] J.D. Hazen and William C. Redfield, *Report of the 1918 American-Canadian Fisheries Conference* (Washington: Government Printing Office, 1919).

[47] Ibid., 34.

[48] Ibid., 33.

[49] Ibid.

[50] Ibid., 35. This was an unusual argument for them to make since the whole point of Thompson's plan was to prevent spatial and temporal concentration in the fishery, particularly on the BC banks, where the decline in the stocks was worst and where the fishery was already heaviest during the summer months.

would not be achieved unless all fishing was prevented in an area, and this would very seriously retard the development of fishing for other species of fish."[51] Fourth, and finally, Hazen and Redfield argued that an area-based approach would force small-boat operators out of the halibut fishery, something they were loathe to facilitate since, in their view, "the greatest promise for development in the fisheries on the Pacific coast of both countries [lay] in the growth of this small-boat fishery operating out of local ports."[52] Thompson's area-based approach was not only unpopular but, in the eyes of the 1918 conference, it was also inimical to fisheries development. Ultimately, the conference commissioners endorsed an internationally sanctioned, three-month winter closed season "so as to protect spawning fish" and called for the creation of a scientific commission to further study halibut biology.[53]

Babcock could barely contain his incredulity. "Thompson disclosed enough of the life history of the halibut to warrant his plan being adopted," he lamented in a letter to American fishery official Henry O'Malley.[54] Yet there is nothing unusual about the commission's decision. As Joseph Taylor noted in his environmental history of Columbia River salmon fisheries, "science has been mediated by any number of factors and politicians have regularly embraced or ignored research depending on what best served their immediate purposes."[55] Indeed, even Thompson – who, after 1918, emphasized "the necessity for compromise between what is adequate and what is feasible to have adopted" – understood that fishery policy followed the imperatives of political economy.[56] The state listened to science, but it stood by capital.

After 1918, halibut conservation became a purely diplomatic problem. The Hazen-Redfield draft halibut treaty collapsed because it contained tariff and port privilege provisions that were unacceptable to the

[51] Ibid. The co-chairs provided no further explanation on this point but were probably alluding to the fact that long-line gear was also used to catch several species of pacific flounder, all of which were beginning to find markets. What was to stop people from pursuing the more valuable halibut under the guise of, say, black cod or flounder fishing? The answer to this (aside from banning long-line gear, which Hazen and Redfield were unwilling to do since it would stall development of other fisheries) is "not much."

[52] Ibid. Most of the smaller boats, they argued, could not operate profitably or safely beyond a radius of 200 miles. Thompson did not think this was a problem. See Thompson, "Regulation," 34.

[53] Ibid., 33.

[54] British Columbia Archives, GR1378, BC Commercial Fisheries Branch, box 2, file 2, John Pease Babcock to Henry O'Malley, 6 June 1922.

[55] Joseph Taylor, *Making Salmon: An Environmental History of the Northwest Salmon Crisis* (Seattle: University of Washington Press, 1999), 220.

[56] British Columbia Archives, GR0435, British Columbia Department of Fisheries, box 145, file 6, William Thompson to John Pease Babcock, 17 December 1920.

American Congress.[57] It did, however, clear the way for a second, and much simpler, halibut treaty in 1923. The first-ever agreement on joint management of a high seas fishery provided for a winter closed season and for the creation of an international fisheries commission to study halibut life history and to make recommendations for future regulations, as necessary. Reaction to the signing was overwhelmingly positive, particularly in Canada. One BC newspaper, the *Victoria Daily Times*, considered the treaty a "landmark" for conservation.[58] Nationally, the *Globe* seized on the fact that, contrary to standard imperial practice (and two recent Canadian-American wildlife treaties), the halibut agreement did not have a British signatory and, as if to spite the entire empire, spun the story out as one more step in the Dominion's drive towards autonomy in foreign affairs.[59] Yet no one was more pleased about the signing than Alvah Hager. "The news that a closed season is now assured is very gratifying to every person directly interested in the industry," Hager declared triumphantly. "It means that the vast schools of these splendid fish will no longer be depleted and threatened with extinction through continued fishing."[60] Nothing could have been further from the truth, but that seemed to matter little now. The "long hoped-for, fought-for, long-prayed-for halibut treaty" – or "Hager Treaty" as James H. Conlon, editor of *The Canadian Fisherman*, put it – had been signed.[61] The treaty was ratified in October 1924, after a year-long debate between Canadian and British diplomats over the Dominion's decision to enter into an international agreement without imperial consent, and the first closed season came into effect the following November.[62]

[57] Tomasevich, *International Agreements*, 143.

[58] "Fisheries Pact a New Landmark," Anonymous, *Victoria Daily Times*, 3 March 1923.

[59] "Convention Signed on Halibut Industry by Hon. E. Lapointe," Anonymous, *Globe*, 3 March 1923. For the Pacific Fur Seal and Migratory Bird treaties, see Dorsey, *Dawn of Conservation Diplomacy*, 105-238.

[60] "Halibut Treaty Meets with Approval," Anonymous, *Vancouver Daily Province*, 3 March 1923.

[61] James H. Conlon, "Where and When to Compromise," *Canadian Fisherman*, March 1923: 57.

[62] On the significance of the halibut treaty in Canadian political history, see: Donald Creighton, *Canada's First Century, 1867-1967* (Toronto: Macmillan, 1977), 181-6; C.B. Stacey, *Canada and the Age of Conflict: A History of Canadian External Policies*, vol. 2 (Toronto: University of Toronto Press, 1981), 49-56; John Herd Thompson and Stephen J. Randall, *Canada and the United States: Ambivalent Allies* (Athens and Georgia: University of Georgia Press, 1994), 104-5; Philip Wigley, *Canada and the Transition to Commonwealth* (London: Cambridge University Press, 1977), 175-85.

CONCLUSIONS

Fisheries scholars have tended to interpret the 1923 halibut treaty in the light of subsequent events. In these accounts the agreement appears as a rational scientific response to a pressing environmental problem that set a precedent for international approaches to fishery management.[63] These assessments are not so much wrong as historically and critically inadequate. First, standard accounts of the fishery fail to historicize science. In consequence, they overlook both the extent to which Thompson's views on conservation were coloured by his exchange with Alvah Hager and the air of scientific uncertainty that clouded political discussions of halibut conservation policy. Second, standard interpretations of the fishery simply cannot account for the final content of the 1923 treaty. Thompson insisted that a winter closed season was incompatible with halibut biology, and he repeatedly warned that, if it were adopted, it would exacerbate the decline in the fishery. Alvah Hager and federal politicians supported it anyway. The result was an agreement that favoured expansion and exploitation of the stock over restraint and restoration. Third, orthodox accounts overemphasize the political precedent set by the 1923 treaty. The halibut treaty established an important scientific agency, eased the way for subsequent international fishery agreements, and has helped sustain halibut stocks. And yet it also deflected research and management away from paths that Thompson had identified, and time has confirmed, as important. Writing of the history of fishery science, scientist and historian Tim Smith has observed that "the economic and political forces that have determined which problems would be studied, and that have too often redirected studies before the answers were obtained, have worked against the development and testing of a comprehensive theory of the effects of fishing."[64] This is precisely what happened in the Pacific halibut fishery in 1918. Had Hazen and Redfield embraced Thompson's area-based approach to fisheries management, they would have freed fish from capture while providing a basis for important comparative studies of halibut population dynamics. Instead, they opted for a politically

[63] For broad treatments, see: Clinton A. Atkinson, "Fisheries Management: An Historical Overview," *Marine Fisheries Review* 50, 4 (1988): 111-23; W.A. Carrothers, *The British Columbia Fisheries* (Toronto: University of Toronto Press, 1941), 85-108; J.A. Crutchfield, "Common Property Resources and Factor Allocation," *Canadian Journal of Economics and Political Science* 22, 3 (1956): 292-300; Juda, *International Law*; Anthony Scott and Philip Neher, "The Evolution of Fisheries Management Policy," in *The Public Regulation of Fisheries in Canada* (Ottawa: Minister of Supply and Services Canada, 1981), 9-20; Tomasevich, *International Agreements*.

[64] Smith, *Scaling Fisheries*, 2.

passable, minimum-regulation-more-research approach to management – a pattern repeated, for example, in 1937 when Canada and the United States ratified a Pacific salmon convention.[65]

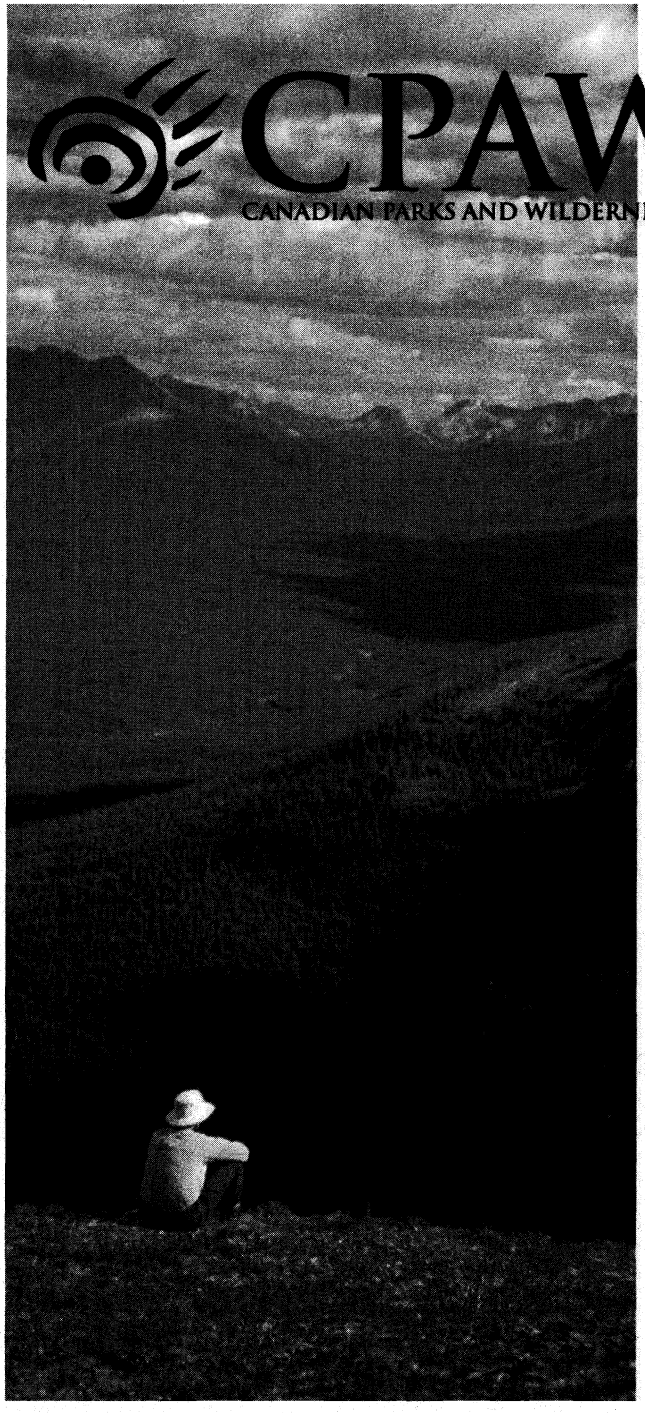
Finally, standard interpretations of the halibut fishery regularly ignore the role of nature in history. Explicit connections between climate and halibut population dynamics have been made only in the last ten years, but scientists have debated the role of natural factors in the fishery since the 1940s.[66] As Walters and Hilborn write, "the debate is perhaps more mature now – we question the relative importance of environmental conditions and fishing – but the essence of the debate remains the same." Moreover, "we will likely be very slow about resolving the debate, because it will continue to be prudent for managers to respond to declines by assuming that fishing may be responsible, so we will continue to get data where the effects of management and environment are statistically confounded (both effects present in the data)."[67] This poses an intractable problem for fishery management: "should adult biomass levels be kept low in hopes that large recruitments will be consistently produced," ask Walters and Hilborn, "or should stock recovery be promoted so as to buffer against the effects of a cyclic decline in juvenile survival due to environmental factors?"[68] These discussions defy simple stories about the perils of unregulated fishing (which are many) and the promise of scientific management (which is great). They underline the complexities and uncertainties that surround science and environmental history.

[65] On the research program established under the 1937 Pacific Salmon Convention, see Matthew Evenden, "Remaking Hells Gate: Salmon, Science, and the Fraser River," *BC Studies* 127 (2000): 47-82. For an overview of Pacific salmon science and diplomacy, see Joseph Taylor, "The Historical Roots of the Canadian-American Salmon Wars," in *Parallel Destinies: Canadian-American Relations West of the Rockies*, ed. John Findlay and Ken Coates (Seattle: University of Washington Press, 2002), 155-80.

[66] See, for example, Martin Burkenroad, "Fluctuations in the Abundance of Pacific Halibut," *Bulletin of the Bingham Oceanographic Collection* 11, 4 (1947): 81-123; William Thompson, *The Effects of Fishing on Stocks of Halibut in the Pacific* (Seattle: University of Washington Press, 1951).

[67] Walters and Hilborn, *Quantitative Stock Assessment*, 55. These problems are further developed in Donald Ludwig, Raymond Hilborn, and Carl Walters, "Uncertainty, Resource Exploitation, and Conservation: Lessons from History," *Science* 260, 5104 (1992): 17-26.

[68] Ibid. For management implications see: R.B. Deriso, S.H. Hoag, and D.A. McCaughran, "Two Hypotheses about Factors Controlling Production of Pacific Halibut," *International North Pacific Fisheries Commission Bulletin* 47 (1986): 167-74; A.M. Parma, "In Search of Robust Harvest Rules for Pacific Halibut in the Face of Uncertain Assessments and Decadal Changes in Productivity," *Bulletin of Marine Science* 70, 2 (2002): 423-53. Daniel Botkin offers a wider discussion of uncertainty in resource management in his *Discordant Harmonies: A New Ecology for the Twenty-First Century* (New York: Oxford University Press, 1990).



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