

# The Global Repercussions of the 1947 Symposium on Fish Populations in Toronto: Scientific Networks and the Over-fishing Question

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Article abstract

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**Résumé :** *Une réunion relativement petite, controversée et oubliée depuis longtemps, le Symposium de 1947 sur les populations de poissons, a eu des répercussions énormes durant des décennies sur la politique mondiale de la pêche. Organisé à Toronto par Archibald Gowanlock Huntsman, ancien directeur de la Station biologique de l'Atlantique, il a réuni des biologistes des pêches et des pêcheurs professionnels de premier plan en Amérique du Nord. En exposant le manque d'accord ou de compréhension sur la nature de la surpêche, cette réunion a rendu difficile pour les générations de scientifiques suivants de défier les politiques de pêche proindustrie. Les procédures publiées, en demande par un réseau serré de scientifiques halieutiques en Amérique du Nord et dans l'Atlantique Nord, ont garanti l'impact disproportionné et malheureux de cette réunion.*

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**Keywords:** A.G. Huntsman, fisheries, overfishing, fish populations, MSY

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TWO SCHOLARS HAVE RECENTLY OBSERVED that “Science is never just about science”, and “Fishing has always been about more than just catching fish”.<sup>1</sup> It follows from Ted Binnema’s and Carmel Finley’s expositions of the political dimensions of science and resource management, that fisheries science is particularly messy, affected by multiple agendas and external contingencies. Indeed, Finley argues that American geopolitical policies used loosely constructed ideals in fisheries biology to influence international scientific management policies, while warping the fisheries economy through massive shipbuilding subsidies to assist client states like Japan. In turn, this led to other nations ramping up subsidies for industrialized fisheries. At the 1955 UN International Technical Conference on the Conservation of the Living Resources of the Sea, the US diplomatic agenda, not science, became the foundation of the dominant post-war ‘paradigm’ of fisheries management.<sup>2</sup> This paradigm upheld exploiting fisheries at the highest possible—and yet supposedly sustainable—levels, to

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generate a 'Maximum Sustainable Yield' (MSY).<sup>3</sup> MSY in theory justified catching the maximum possible annual catch for each commercial fish population that would ensure that the fishery could be sustained at a similar high level in the future.

While in practice it was impossible to determine a sustainable maximum catch without actually exceeding that level—measurable after the fact by falling fish catches—American fisheries biologists apparently shared a conviction that MSY was scientific and achievable, and swayed other nations' scientists to their views. However, Finley's argument, that American policies were foundational for globalized overfishing and shambolic 'conservation' measures, should not allow other nations' scientists and policy-shapers off the hook. Ideas and ideals such as MSY cannot gain ground without an existing receptive intellectual milieu. In the case of MSY, that milieu was developed by a small, but highly influential, international network of British, Scandinavian, Canadian, and US scientific experts. It flourished in post-Second World War conditions, which embedded fisheries policies within the greater framework of industrialized resource extraction that marked the international race for modernity amongst developed nations.<sup>4</sup> The focus on post-war reconstruction and development superseded the earlier prioritization of the conservation of fisheries and other resources. It is within this context that a largely-forgotten international gathering, the Symposium on Fish Populations, was held in Toronto in January of 1947. Many participants arrived at this meeting armed with conventional pre-Second World War conservation ideals. This meeting shook their certainty in their concepts of 'overfishing', jolted their confidence in their ability to clearly link reduced catches to overfishing, and undermined support for effective conservation measures. The intellectual tremor amongst this small gathering, spread through the tightly woven international fisheries science network, was to contribute to a global tsunami of overfishing through the through subsequent restrictions on scientists, scientific research, and policies that favoured resource protection.

Much of this outcome was the intent of the man who convened the meeting, professor of fisheries biology and former director of the Atlantic Biological Station, Archibald Gowanlock Huntsman. Huntsman believed that fisheries biologists had a mandate to assist fishermen rather than support vague conservation goals.<sup>5</sup> Huntsman's intent was not to scientifically support a fisheries free-for-all that would lead to the collapse of fish stocks, but rather to see if a gathering of leading fisheries biologists could pin down the definition and indicators of overfishing for a commercial fish population. Huntsman was reacting against the emergence of fishing equations that would supposedly enable biologists to use catch statistics to model the demographics of fished populations, so as to estimate their condition and ability to withstand certain fishing levels. He did not trust such models, seeing them as turning away from biology. Instead, he wanted to arrive at a general recognition of the need for sound biology, based on life-histories, field studies, good evidence and



*Figure 1: Archibald Gowanlock Huntsman. University of Toronto Archives.*

reasoning. In fact, the meeting exposed leading fisheries scientists' high levels of uncertainty regarding their ability to gauge the status of the populations under investigation. The unforeseen outcome of the meeting, given the exposure of their scientific weakness, was that some of his more tangential ideas fell on fertile soil, none moreso than his equating of fished populations to managed forests. According to him, 'senile' fish were like fully-grown trees, which therefore add nothing further to the biomass and revenues, and become worthless unless harvested. In an era which valued fish populations purely according to their economic value, with no regard for their ecological context, such ideas, ironically, meshed well with emerging American economic justifications for making the determination of MSY for each commercial fish population the goal of fisheries science. Huntsman and the Symposium on Fish Populations helped to sway fisheries biologists towards attitudes that would enable the outcomes of the 1955 UN International Technical Conference on the Conservation of the Living Resources of the Sea.

To illustrate how far-removed post-war fisheries science became from the ideals upheld in the interwar period, it is necessary to look at the work and ideas of William F. Thompson (1888-1965), the most influential American fisheries biologist in the 1930s and 1940s. He trained under Charles Henry

Gilbert (1859-1928), a zoology professor and eminent early US fishery biologist. Thompson's first important investigations, beginning in 1914, focused on the Pacific halibut fishery. His intensive investigations of *Hippoglossus stenolepis* in British Columbia resulted in seven landmark papers.<sup>6</sup> He founded and became director of the California State Fisheries Laboratory under the California Fish and Game Commission in 1917. In 1924 he relocated to Seattle to direct the investigations of Pacific halibut for the International Fisheries Commission, founded to address the British Columbian fishing industry's concerns that the Pacific halibut catches were in serious decline. His research convinced the Department of Marine and Fisheries and US Pacific states to restrict the halibut fishing-season so as to sustain the fishery. Increases in catch rates thereafter convinced many scientists and politicians that overfishing had been the cause of declining catches before Thompson's regulations were in place. They concluded that fisheries restrictions had successfully conserved and preserved the fisheries.

In 1937, while continuing to lead the International Pacific Fisheries Commission, Thompson was appointed director of the International Pacific Salmon Fisheries Commission, and he also served as director of the School of Fisheries at the University of Washington from 1943 to 1947, before moving to head the university's Fisheries Research Institute from 1947 to 1958. Thompson's dedication to conservation through restricting the intensity or duration of fishing activities remained undiminished. His thinking was highly influential for the work of British fisheries biologists Edward S. Russell and his protégé Michael Graham, who were directors of the Fisheries Laboratory at Lowestoft from 1921-1945, and 1945-58 respectively, and who developed early iterations of fishing theory models in the 1930s based on Thompson's example.<sup>7</sup> Both, like Thompson, remained committed to the recognition that overfishing was real and had serious consequences for the economics of fishing, if not for the fish populations themselves.

Given these attitudes, it seems astonishing that some of Thompson's most prominent and important students championed fisheries practices that were instrumental in the overfishing and depletion of the world's major fisheries, through promoting fisheries exploitation as a tool of American Cold War diplomacy. These students included Wilbert Chapman, who never shared Thompson's views, but also the more scientifically-important Milner Bailey Schaefer (1912-1970), who worked for the Bureau of Fisheries, and then the Inter-American Tropical Tuna Association. Schaefer developed one of the three main mathematical models used by fisheries biologists from the 1950s onward to estimate the size of commercial populations, the effects of fishing, and to project what the maximum levels of fishing effort should be in future years. Schaefer's "Surplus Production Model" was preferred by Pacific fisheries scientists and managers. I argue here and elsewhere that the 1947 Symposium on Fish Populations was instrumental in shaping Schaefer's Surplus Production model. Schaefer championed catching the fish that were 'surplus' to a population's



reproductive requirements for sustaining a given population level, lest they be lost to the human economy and thus wasted.<sup>8</sup> Another of Thompson's students was William C. Herrington, who was instrumental with Wilbert Chapman and Milner Schaefer in designing American Cold War fisheries policies, and helped design the US abstention principle, which aimed to give Americans and their allies free and untrammelled access to the world's fisheries. The abstention principle opened the fisheries of national inshore waters to all nations, unless the nation could show evidence for scientifically managing the fisheries in these waters, as could the US in the case of its Bristol Bay salmon fisheries.<sup>9</sup>

Amy L. Toro has argued that Herrington's about-face—to the point that he criticized the North Pacific Fisheries Commission as being too narrowly focused on conservation—was due to the positions he held after the Second World War. He served as Chief of Fisheries of the Natural Resources Section of the Supreme Commander for Allied Power (SCAP), which governed Japan in the war's immediate aftermath, and from 1951 onward as the Special Assistant for Fisheries and Wildlife in the Department of State, where he was responsible for formulating resource policies. This political trajectory forced him to recognize that fisheries management had to balance economic, political, and social as well as biological conservation needs.<sup>10</sup> Herrington in Toro's account is like a fish being swept along by currents more powerful than he is. To some extent this is true, since the politics of modernization and development had, in general, overtaken and banished earlier policies that aimed to enshrine protective resource conservation for all kinds of natural resources. I argue here, instead, that outside of these policy currents, the Symposium on Fish Populations fundamentally reshaped the thinking and beliefs of many fisheries biologists—by challenging the foundations of their conservation practices and ideals—and helped to create the scientific and intellectual milieu that supported the emergence and spread of American Cold War fisheries policies.

The Symposium on Fish Populations was the outcome of the epistolary persistence of Archibald Gowanlock Huntsman (1883-1973), who demanded that his peers answer his question of how to define overfishing. Huntsman, who had a medical degree from the University of Toronto, was hired there as an instructor in 1907 and then as a professor of zoology in 1915. During summers from 1903 onward he was a visiting researcher at the Go Home Bay Biological Station on Georgian Bay and the peripatetic Atlantic Biological Station, both run by the precursor to the Biological Board of Canada.<sup>11</sup> After a permanent station was built at St. Andrews, New Brunswick in 1908, he was appointed its summer curator in 1911, 1913, and 1915-1919, and its first permanent director in 1919. He was 'removed' in 1934 because, without the authorization of the Biological Board, he rebuilt the station after a fire destroyed the main laboratory and library. Huntsman then was 'kicked upstairs' (as he liked to say) to serve as the Board's consulting director from 1934 to 1953; he also edited the newly-constituted Fisheries Research Board's publications from 1934 to 1949,

Huntsman's profound influence resulted from his roles as a provocative

thinker and as a teacher. Huntsman trained several generations of Canadian fisheries biologists, and was the most influential Canadian marine scientist during the interwar years. Huntsman's contributions as director of the Atlantic Biological Station were highly constructive, and included helping to professionalize marine science and hiring Canada's first professional oceanographer.<sup>12</sup> He liked to disagree with authority; he even challenged the scientist who trained him in the latest methods in fisheries biology during the Canadian Fisheries Expedition of 1914-15. He criticized the age determination method using the circular growth rings on fish scales, exasperating Johan Hjort, then the world's leading fisheries biologist, who had come from Norway to lead the expedition.

Hjort saw his scientific mission as expanding and modernizing Norwegian fisheries, and brought his modernizing mission to Canada. Hjort felt no need to dwell on the problem of overfishing, especially since he had discovered that fluctuations in fish catches were mainly due to the variable success of different year classes in surviving as eggs and larva to grow to sizes big enough to be fished commercially (known by fisheries scientists as 'recruitment'). While fishermen might blame a poor fishery on overfishing, Hjort interpreted variable catches in the light of natural and sometimes quite extreme population fluctuations, or variable migratory patterns owing to changing environmental conditions.<sup>13</sup>

With this introduction to fisheries science, it is not surprising that Huntsman saw no need to focus on overfishing as a cause of depletion. In any case, the Canadian Atlantic fisheries were only sparsely industrialized compared with the British and German fisheries, or North American Pacific fisheries, so conservation was not a priority in Atlantic Canadian fisheries policies.<sup>14</sup> On top of this, Huntsman's mentor had been 'Professor' Edward Ernest Prince (1858-1936), who became the Biological Board's director by dint of having been appointed Dominion Commissioner of Fisheries in 1893. Prince had trained under and assisted Professor Carmichael M'Intosh, the director of the marine biological station at St. Andrews, Scotland and the scientific expert for the Royal Commission on Trawl Nets and Trawl Fishing of 1883. The commission found no evidence that trawling was harming the inshore fisheries, based on M'Intosh's finding that fish eggs floated, and hence could not be harmed by bottom trawling. Both M'Intosh and Prince shared Huxley's conviction that the pelagic sea fisheries were inexhaustible given the sheer fecundity of mature female fish, each spawning hundreds of thousands or even millions of eggs. Prince brought this teaching with him to Canada.<sup>15</sup>

Unsurprisingly, with his intellectual heritage firmly rooted in Huxley and Hjort, Huntsman rejected the possibility that overfishing could be a real problem. Huntsman's views remained firm despite his engagement with leading North American and European oceanographers and fisheries biologists, some of whom had very different ideas about overfishing.<sup>16</sup> A founding member of the North American Council on Fisheries Investigations, he carried out a vigorous correspondence with England's F. S. Russell and Michael Graham at

the Fisheries Laboratory in Lowestoft, and Henry B. Bigelow, the first director of the Woods Hole Oceanographic Laboratory, whose research encompassed problems in fisheries oceanography. Huntsman, in fact, had the key connections that enabled him to form an important nexus of the existing network of Canadian, American, Scandinavian and British fisheries scientists who were at the forefront of their field and who shaped the science and informed the policies based on their findings.

Following his eviction as director of the Atlantic Biological Station, Huntsman was a scientist in search of an agenda, and in this era his work can sometimes be seen in a less-than-flattering light, especially given our knowledge that he was on the wrong side of history concerning the possibility of commercial overfishing. His later scientific contributions included his work on the life-cycles of salmon and salmon migrations. Ironically, his own research proved—despite his firmly rooted opposition to it, expressed during a rather abrasive debate with Pacific, Scottish and Norwegian salmon experts—the theory of salmon homing migrations. In 1941 his own salmon-tagging programme retrieved the first evidence that salmon migrate over tremendous distances before returning to their home streams, when a salmon tagged on the Margaree River in Cape Breton was captured by a scientist on the far side of Newfoundland, who sent its tag information back to Huntsman. This same salmon was later recaptured on the Margaree River.<sup>17</sup>

In addition to this, Huntsman battled emerging methodological developments in fisheries science. He disagreed with the focus of Thompson in Seattle, Russell and Graham at Lowestoft, and G. L. Kesteven in Australia, all of whom were developing mathematical formulations to estimate a commercial species' recruitment, growth, population size, natural mortality rates, and the proportion of fish removed by a fishery each year. Their goal was to find what Graham called the maximum steady yield, while at the same preventing fisheries depletion through overfishing.

Huntsman's opposition to mathematically-based fisheries population biology had a number of roots. Frankly, he did not have the mathematical capability or training to use calculus-based fishing equations. However, as he correctly maintained throughout his life, biologists simply knew too little about fish behaviour, life histories, and the impact of the environment on their survival to produce models that actually had any correspondence with reality. To base fisheries policy on these models he viewed as being preposterous: he argued this move would "crystallize" the scientific approach too soon.<sup>18</sup> His own shortcomings aside, however, he foresaw that fisheries biology would become less hospitable to biological research and more the province of mathematicians or the mathematically-inclined, who would base findings on parameters such as catch statistics and the age and length of captured fish. Correctly, he understood that it was hard to get accurate age determinations using fish scales, so getting an accurate understanding of the status of fish populations was unlikely.<sup>19</sup> Fisheries biology would become highly problematic



if it became the realm of desk-bound experts, who would use catch statistics to model the effects of fishing and estimate fish populations, without sufficient field research to understand their full biological context. They would lose touch with a visceral understanding of the fisheries and sources of traditional ecological knowledge—and would ignore the need to investigate how intensive fishing and environmental circumstances might actually affect real fish.<sup>20</sup>

One of Huntsman's strengths was his appreciation of the need for fisheries biology to incorporate new insights coming from field ecology. While Huntsman experienced universal failure in his attempts to introduce new terms and fields into the science of ecology—including “thanatology”: the study of the natural environmental limiting factors, behaviours, life-cycles and predation, that cause individuals in a species to die;<sup>21</sup> and biapocrosis, which he defined as “the response of an organism as a whole to what it faces where it lives”<sup>22</sup>—his attempts show his sensitivity to the limitations of his era's fisheries biology.

Despite his highly justifiable criticisms of the narrowing mathematical and management focus in fisheries science, Huntsman's scientific Achilles-heel remained his frank disbelief in the possibility that overfishing could seriously deplete the populations of a commercial species. To fortify his position that overfishing had never, in centuries of fishing, been scientifically documented—and that therefore claims for cases of overfishing were not scientifically proved—he convinced the Fisheries Research Board at its end-of-December annual meeting in 1941 to set up a Committee on Depletion. The purpose was to have a small committee prepare a brief report on how fisheries depletion should be defined and understood by scientists and fishermen alike. Besides Huntsman, the committee also consisted of A.W.H. Needler, director of the Atlantic Biological Station, R.E. Foerster, director of the Pacific Biological Station, and J. R. Dymond, the head of the Royal Ontario Museum of Zoology, who was also a Board member.<sup>23</sup> Needler predicted failure at the very outset: the committee would never come up with a definition of depletion that would achieve widespread acceptance.

Thus began a voluminous correspondence. Huntsman hounded his colleagues, hoping to get them to adopt specific terms he had coined to indicate different types of depletion. He coined words like ‘anoecia’—to indicate high mortality rates of spawning fish in certain areas; ‘dysgeny’—to indicate the death of large masses of eggs at certain stages of development; and ‘dysmegethy’—fish in a population not reaching the appropriate size.<sup>24</sup> One of Huntsman's dearest, but ultimately futile, wishes was to have one of the scientific Latin or Greek terms he coined adopted by mainstream ecologists. His attempts indeed led Needler to riposte at the Symposium on Fish Populations, that ‘an ecologist is a person who calls a spade a geotope.’<sup>25</sup>

The issue that these scientists were trying to address, however, was a real one, complicated by the juxtaposition of economic and biological considerations. As Foerster commented, the words ‘overfishing’ and ‘depletion’ were being used by some to indicate fishing that was leading to the extinction of the species, while

other fisheries biologists used these terms only to indicate a decline leading to a fishery's loss of economic viability. Foerster preferred the clarifying terms 'economic depletion' and 'biological depletion'. He wanted to delink 'depletion' from 'overfishing' since a depleted condition could arise without overfishing.<sup>26</sup> Dymond, however, argued that none of these terms were justifiable in light of the fact that 'under some economic conditions a slight depletion might make fishing unprofitable' but that economic conditions in themselves also might make a fishery unprofitable without depletion, if the price people were willing to pay dropped below the price at which a species could be fished.<sup>27</sup>

The Committee was disbanded in 1944 with the members unwilling to attach their names to a two-page article prepared by Huntsman, simply titled "Fishery Depletion" which was published by *Science* in its June 1944 issue.<sup>28</sup> Huntsman had also tried to get the committee to sign an article for publication in a popular trade magazine, like *Canadian Fishermen*. Dymond objected, commenting: "I wonder whether the fishermen to whom your article is addressed need to be persuaded that it is unwise to restrict fishing" since, as far as he could see, "the purpose [of Huntsman's argument] is quite obviously to cast doubt on the necessity for restricting fishing."<sup>29</sup> Several committee members concluded that since it would be so difficult to say when overfishing was occurring—or if depletion had occurred—the best practice would be to set quotas for a fishery and adjust these quotas in the light of experience.<sup>30</sup>

Despite their failure to agree with Huntsman's arguments, however, committee members agreed the exercise had unveiled the shortcomings of frequently used terms and exposed their inability to scientifically establish how human fishing activities affect a commercially-fished population's status at any given time.<sup>31</sup> The use of reason more than amply punched holes in claims that lower catches and catch rates were a clear sign of depletion, as was recognized by fisheries scientists elsewhere following the publication of Huntsman's *Science* article.<sup>32</sup>

Huntsman continued to complain that he had not been able to find a single case of a fishery becoming exhausted or extinct due to overfishing.<sup>33</sup> Since Huntsman's small committee had failed to reach a consensus, he decided to contact fisheries scientists and managers across the United States and Canada, including W.J.K. Harkness, director of the Ontario Fisheries Laboratory. Besides asking for concrete scientific evidence for a single case of the biological exhaustion of a species through overfishing, he also dragged them into his arguments for the need for a universal definition of overfishing. American scientists drawn into Huntsman's semantic net included: A.S. Hazzard, of the Institute for Fisheries Research in the Michigan Department of Conservation, who commented that Huntsman's 'ideas...crystalize the thinking of quite a few of use who have been interested in the supposed depletion of our fisheries';<sup>34</sup> Dr. T. H. Langlois, director of the Franz Theodore Stone Laboratory at Put-in-Bay, Ohio; Dr. W. E. Ricker of the Department of Zoology at Indiana University; Dr Paul W. Needham, Director of Fisheries for the Oregon State Game

Commission; John Van Oosten of the Fish and Wildlife Service of Michigan, Daniel Merriman, director of Yale University's Bingham Oceanographic Laboratory; and William C. Herrington, who was then in charge of the US Bureau of Fisheries' North Atlantic fishery investigations, based in Cambridge, Massachusetts. W. E. Ricker gamely proposed 11 different conditions possibly described as depletion that might develop within a fishery or fished population.<sup>35</sup> Huntsman convinced most of these scientists and the former Committee on Depletion members to form a new committee, which on May 10, 1945 he titled the Group on Fishery Depletion.

### The Symposium

Huntsman challenged the members of the Group on Fishery Depletion to define overfishing and depletion, and to come up with a single scientifically-documented case of the complete exhaustion of a fishery in North America. Very quickly, the daunting task of using correspondence for the ensuing debate became apparent. The Group on Fishery Depletion initially was composed of five American and four Canadian members; even as coordinated by Huntsman, who practically seems to have been able to write letters in his sleep, the task was too unwieldy. On October 3, 1945, Daniel Merriman suggested that an efficient and clear exchange of ideas would "not materialize through the medium of written propositions without first getting together."<sup>36</sup> From this, the idea of the Symposium on Overfishing was born.

Huntsman organized the two-day event, held on the 11<sup>th</sup>-12<sup>th</sup> January 1947 in the zoological section of the Royal Ontario Museum. To facilitate maintaining the veracity of scientists' comments and discussion, he had the entire conference recorded phonographically and the later proceedings typed out.<sup>37</sup> Of the forty-five participants, scientists from the United States and across Canada represented the Fisheries Research Board of Canada and fishery laboratories on the Great Lakes, Algonquin Park, and elsewhere. Some of the American scientists who had hoped to attend could not come because of the constraints of time and distance. There were faculty and students from the University of Toronto and faculty from other Canadian universities. The two members of the Royal Ontario Museum included J. R. Dymond, an original member of the Committee on Depletion, who helped Huntsman organize the conference. Also present were representatives of Ontario's Department of Lands and Forests. Finally, but not least, members of the Ontario Federation of Commercial Fishermen attended, some of whom entered the discussion. Huntsman's high regard for fishermen motivated his invitation to these men; he remarked after one of their comments that he wished fishermen would write down what they know, since they knew a lot more about the behaviour of fish around fishing equipment than did scientists. He later asked one participant, fisherman Carl F. Kolbe, for a critique and feedback on a draft of a paper that he was to give at the 1949 United Nations Economic and Social Council meeting 1949.<sup>38</sup>

Nine participants presented papers. Huntsman's opening paper dealt with

assessing fished populations; T. H. Langlois discussed North American attempts at fisheries management; J. R. Dymond described European marine fish population investigations; M. D. Burkenroad disputed Thompson's claims that the Pacific halibut recovery was due to fisheries restrictions; Daniel Merriman and H. E. Warfel gave a joint analysis of the winter flounder fishery and the population of winter flounder over the history of the New England fishery; A. W. H. Needler described methods for estimating the intensity of fishing efforts; and R. E. Foerster discussed the prospects for Canadian fisheries management. The final paper, given by W. C. Herrington, discussed various fishing theories and examples of factors that limit fish populations.

In a joint paper by W. E. Ricker and R. E. Foerster, Ricker described how to compute fish production.<sup>39</sup> Ricker was then at the University of Indiana, but his career straddled the US-Canadian border: he had worked with Foerster before on Cultus Lake salmon investigations, and he later became director of the Pacific Biological Station in Nanaimo, British Columbia. Ricker used the meeting to introduce his work on a series of fishing equations that he later elaborated into his spawner-and-recruitment model, used to manage the Pacific Salmon fisheries in subsequent decades, and still in use to this day. It is noteworthy that the discussion after his paper was virtually non-existent: Huntsman asked one question, on whether or not it was necessary to carry out tagging experiments on each fished body of water to get accurate estimates of production, which Ricker agreed would be useful but argued that general principles would likely emerge.<sup>40</sup> This argues that few of the scientists present had the mathematical experience to deal with this new approach to assessing fish populations.

There is no space here for a full description of the various papers, nor the discussions and arguments that followed. As with the Group on Fishery Depletion and the earlier Committee on Depletion, the meeting failed to create a consensus, but all participants agreed that it had been a valuable exchange of information and views. However, ideas introduced at this symposium had global reverberations, influencing how scientists thought about fish populations and developed subsequent fisheries policies. Huntsman's and Burkenroad's papers perhaps did the most to shake biologists' complacency in their ability to diagnose overfishing.

Huntsman presented seven different scenarios that could be interpreted (or in some cases, misinterpreted) as overfishing. He emphasized the importance of studying fish behaviour, and in particular, what he termed "zoapocrisis" (the fish's "response as a whole to what it faces where it lives" as related to movement and survival).<sup>41</sup> Herrington was highly critical of Huntsman's claim that intensive fishing had not caused a decline in over-all productivity in the North Sea, and that the Eastern Canadian and U.S. herring fisheries had resulted in an increased overall catch of smaller fish. In an argument that resonates today more than ever, he commented:

If you accept for the moment the argument that intensive fishing is not causing a decline in overall productivity in the North Sea, I think you should bear in mind that if you deplete a desirable species and an undesirable species takes its place there is still a loss as far as human needs are concerned. For instance, on Georges Bank if haddock were decreased and a less desirable species took its place, there would be an over-all loss even through the total poundage of all species landed remained the same.<sup>42</sup>

Huntsman's argument in this case was not to become particularly influential, since a number of fisheries biologists already shared Huntsman's ambivalence on overfishing. However, unlike other fisheries scientists, who drew analogies between the fisheries and annual agricultural harvests, and likened fish harvesting to cropping, Huntsman equated old, 'senile' fish (his term) to mature trees in a managed woodlot: they do not grow significantly once they have reached a certain age.<sup>43</sup> He argued this condition is no more desirable in the fisheries than it is in forestry management: too many mature fish compete with younger fish for limited resources, restricting the total biomass. A more productive fishery would result if these fish were removed, giving juvenile fish more food and resources to grow faster.

As I have shown elsewhere, Huntsman's ideas about the negative impact of 'senile' fish became influential, or even standard. For example, it was reproduced in a paper given by Eric M. Poulson, the secretary of the International Commission for the Northwest Atlantic Fisheries, to a global audience at the International Technical Conference on the Conservation of the Living Resources of the Sea held in Rome in April and May 1955.<sup>44</sup> This Living Resources of the Sea conference was of crucial importance because it enshrined the highly destructive policy that saw managing the fisheries at levels lower than a maximum sustained yield (MSY) as being wasteful,<sup>45</sup> and included arguments that mature fish were economically worthless and took up potential resources from faster growing younger fish.<sup>46</sup>

One of the fishermen present, Carl Kolbe, succinctly stated the heart of the problem with identifying conditions in which overfishing is occurring: "...you can only fish down to a level which is profitable, *whereas a change in natural conditions can take the fish down to any level whatsoever* [italics mine]."<sup>47</sup> Throughout the meeting, Burkenroad sided with Huntsman in favouring natural population cycles as the main explanation for apparent fisheries depletion. He clashed with William C. Herrington, the future architect of the American abstention principle, who was at that time a firm disciple of W.F. Thompson's fisheries science. Indeed Burkenroad and Herrington ended up disagreeing on most points regarding each other's papers.

Burkenroad's paper on his investigations of North Carolina's fisheries offered a rebuttal of the supposed outcomes of Thompson's International Pacific Halibut Commission's record. Thompson and his organization claimed to have managed the recovery of the Pacific Halibut fishery through severely restricting the fishing season. Burkenroad provided statistical evidence to back up his contention that a natural surge in the halibut population—which he argued experienced a 34-year cycle in abundance—and not fisheries restrictions, were



mostly responsible for the recovery of the Pacific halibut. Indeed, the catch increases were significantly greater than could be accounted for by simple restrictions. He argued that:

When a naturally fluctuating population reaches a dead low, it may be expected to increase in abundance thereafter. When a scarcity occurs, it is a stimulus to study of the fishery, and regulation of it. Consequently, one should expect to find regulations applied at low points in natural periodicities. Therefore, one would as a general rule find increases in abundance following regulation, even in fishing had nothing to do with the scarcity. An increase in abundance is thus not by itself critical evidence for a causal connection between the regulation and the increase.<sup>48</sup>

Needler commented that he saw Burkenroad's arguments being reduced to two main arguments that questioned the soundness of Thompson's research group's conclusions. Firstly, "the catch-per-unit-of-effort changed so much, fell off so much, that it would indicate reduction in the abundance of halibut several times greater than in the actual catch." Secondly, Thompson's restrictive measures had "saved a certain amount of halibut" but that calculations incorporating halibut natural mortality and growth "Still don't produce enough more halibut in the sea to account for the increase". He concluded, "I don't know any of the detailed data, but if these two propositions are sound it would certainly indicate that there are a number of other factors which are just as important as the fishermen."<sup>49</sup>

Given that Herrington was a student and protégé of Thompson's and quite convinced that Thompson had fixed the fishery, he was not happy with Burkenroad's conclusions. He urged Burkenroad to employ a finer-grained analysis of smaller areas where depletion was more evident. He argued that Burkenroad was not looking at the most heavily fished areas. Burkenroad admitted that the large-scale analysis he had already carried out had taxed his (presumably very limited) mathematical capabilities, but insisted that his findings were sufficient to cast doubt on the efficacy of Thompson's fisheries restrictions. Herrington also disputed Burkenroad's use of Thompson's estimate of a 10 per cent fishing mortality rate: "Whether or not somebody else uses it in making an estimate doesn't justify you in using it if you don't think it is correct." Burkenroad argued: "You yourself named that 10 per cent fishing rate. If you and Thomson are going to use that in coming to the conclusion that the fishery has been responsible for the decrease in abundance then it is legitimate for me to use it in an analysis of our conclusions."<sup>50</sup>

Herrington's paper, "Limiting Factors for Fish Populations: Some Theories and an Example" contended that "the management of a fishery usually is possible only through control of mortality caused by human activities in order to bring spawning stock and competitive stock into the most productive relationship" which required knowledge of recruitment and fishing mortality and population relationships.<sup>51</sup> He defended the benefits to be gained by building up a spawning stock through fishery restrictions. But Burkenroad remained unimpressed by Herrington's data, noting that he had no information

on the interactions between Georges Bank haddock stocks, their predators and their food-prey, and concluded:

It appears to me that what he has done today is to assume his original hypothesis as if it had been proven, and then to reconcile it with the more recent contradictory evidence by assuming changes in the food crops. In other words, he didn't get the expected increase in young when his spawning stock went up to what was thought to be the optimum level, and his explanation is that the amount of food produced by the ground has fallen off.<sup>52</sup>

Herrington and Burkenroad continued to spar, each asserting that the other had failed to provide evidence to support their explanations and conclusions.

Burkenroad's ultimate concern was revealed during the discussion after Ricker and Foerster's paper: "the price to the fisherman has been raised by management, because there is no evidence that it is the regulation that has improved the catch-per-unit-of-effort. The public is paying a higher price, relative to the availability of the fish."<sup>53</sup> It is important to highlight that economic considerations were consistently present in the discussion of overfishing at the Symposium. Huntsman, for example, commented that in 1947 they were repeating conditions that had followed the Great War, when wartime conditions during what fisheries scientists called the "Great Fishing Experiment" virtually ended fishing. The fish caught increased in both quantity and size. Most people saw that catches had rebounded, and included many larger fish. Most people saw that as a good thing, but Huntsman queried whether increased post-war fishing actually compensated for fisheries revenues lost during the war. He doubted it.<sup>54</sup> This is another example of how he and several other participating scientists challenged the conventional wisdom of Thompson, Russell, Herrington, and others.

Herrington's paper, the last of those presented, also received a large number of critical comments from other scientists present, including from Pacific Biological Station scientists A. L. Tester and J. L. Hart; Hart commented, regarding one of Herrington's data series, "I don't know how seriously Mr. Herrington is presenting his information on pilchards. I don't feel satisfied that the relationship between availability and abundance of spawners is close enough to warrant the assumption which I think he made."<sup>55</sup> Hart allowed Herrington's brief response to slide, since by this point the participants were weary and ready to finish their business.

F. E. J. Fry was more conciliatory throughout. Fry, a University of Toronto zoology instructor, two years later would introduce to fisheries science the new (and now universally used) tool of virtual population analysis. Toward the end of an earlier discussion, he remarked: "It's a little hard for a mere neutral person to get a word in edgewise. It would seem to me, listening to the managers and non-managers in the course of the last day and a half, the one thing you have not gotten down to is the actual application of the principle of limiting factors" that come into play when one or another limiting factor is reached. These include the possibility of "one fishery reducing the stock below

the minimum and thus getting it into this limiting range where it is going to affect the next year's crop. However, in this other fishery that is not so."<sup>56</sup> In other words, the circumstances encountered in two different commercial fish species and their fisheries might be quite different. Fry also stated that he found similar population curves (regarding a correlation between the size of the spawning stock and population recruitment) in lake fish to those discussed in Herrington's presentation on Georges Bank fish populations.<sup>57</sup>

### Aftermath

Energized by the symposium, both Burkenroad and Huntsman began a correspondence with W. F. Thompson, challenging the International Pacific Halibut Commission's interpretation of the effects of fishery restrictions on the populations of Pacific halibut. While Thompson replied with good grace to Huntsman's earlier efforts, Huntsman's persistent unwillingness to accept Thompson's evidence for a reciprocal relationship between fishing effort and population eventually got under Thompson's skin. In one handwritten missive, Thompson wrote "Maybe biologists just don't see that the constant [in his equation] is a necessary part of the reciprocal relationship. My mathematics friends do, automatically. And they see that I am defining this constant, which is wrt [with regard to] the legally, or otherwise, limited catch. Also that I am studying the derivations from the reciprocal relationships..."<sup>58</sup> However, Huntsman's arguments, like Burkenroad's, were based on the impossibility of clearly interpreting the upswing in the Pacific halibut catch as being caused solely by fisheries restrictions—a biological, not a mathematical, argument.

Burkenroad would go on to challenge Thompson in a series of published articles, beginning with his article "Fluctuations in abundance in Pacific Halibut" in the Symposium proceedings, and most notably with a 'book review' of a paper by Thompson that attempted to rebut Burkenroad and Huntsman.<sup>59</sup> Thompson's increasingly contemptuous responses and Burkenroad's refusal to be swayed marked the most famous scientific dispute in the history of fisheries science prior to the Cod Crisis of the 1990s.

The Thompson-Burkenroad debate has been the subject of a number of articles by fisheries scientists who have used a historical focus to rehash the debate. It should really be known as the Thomson-Burkenroad-Huntsman debate, since Burkenroad and Huntsman extended it into separate articles in 1953 in the *Journal du Conseil international pour l'Exploration de la Mer*.<sup>60</sup> While Thompson was widely considered at the time to have won the debate, and Skud in 1975 found the evidence lay in favour of Thompson, more recent evaluations find that the information and data available do not actually lead to a clearly defined conclusion. Natural population fluctuations and environmental effects can both be invoked to explain not only historical, but also current fluctuations in fisheries catches.<sup>61</sup>

Another of the Symposium's outcomes is that it likely inspired the ideas of the influential economist, H. Scott Gordon, who began the new field of

bioeconomics with his paper about fisheries economics. Gordon's interest in fisheries grew from by his service, while still an undergraduate, as a summer intern in the Department of Fisheries in Ottawa, his appointment doubtless due to the focus of the new Deputy Minister of Fisheries, the economist Stewart Bates (who served from 1947 to 1954).<sup>62</sup> The Symposium's discussion often dwelt on the economic aspects of fisheries policies; moreover, Gordon's paper showed familiarity with Huntsman's thinking not just on economics but on fish populations and ideas about overfishing. In fact, many of Scott Gordon's arguments completely echoed those made by Huntsman during the symposium, including Huntsman's demonstration that intensive fishing in the North Sea had not diminished its productivity. This deepens my conviction that Scott Gordon was influenced by the published Symposium proceedings. Scott Gordon's "The Economic Theory of a Common Property Resource: The Fishery" (1954) was an enormously influential article that was foundational to bioeconomics and was instrumental in bringing economists into the field of fishery management in Canada, Great Britain and elsewhere.<sup>63</sup>

Beyond this, the Symposium seems to have fuelled the trend among scientific fisheries experts to support large-scale, indeed global, industrialization of the fisheries,<sup>64</sup> a trend mirrored in the industrialization of natural resource extraction or production in many other sectors, including agriculture, in this period. For example, while William Herrington was very much W. F. Thompson's disciple at the Symposium on Fish Populations, the Symposium led him to question his stance on conservation measures. Seven years later, he devised the abstention principle, with the goal of helping Japan rebuild its economy and turn it into a strong American ally during the Cold War. It is almost unbelievable that this highly cynical fisheries management model could have been produced by Herrington, given his convictions on display at the Symposium. From the Symposium's recorded proceedings it is probably fair to say that Herrington's arguments were the most consistently challenged, which surely had its effect on his later thinking. At some point Herrington had to have experienced some reversal of his ideals, and the concerted disagreement amongst participants as to the reality of overfishing, its definition, and its management, must have softened his firm convictions concerning the impact of intensive fishing. Also, as I have argued elsewhere, it is very likely that M.B. Schaefer's surplus production model for establishing MSY fishing levels was influenced by Huntsman's ideas that old fish were surplus to production—unnecessary and even useless for the fishery itself and for conserving the fishery. The full implications of the negative impact of Huntsman's idea can only be understood in the light of science findings after the cod crisis that mature female fish ('big old fat fecund females,' or 'boffs') are critical to ensuring the reproductive resilience of long-lived fish species such as cod, halibut, and redfish.<sup>65</sup>

The Symposium's repercussions extended far beyond its influence on its participants and their subsequent actions, due to the publication of the symposium's proceedings. The Symposium influenced many scientists who, at

that time, were the most important shapers of fisheries conservation policies. This occurred at the very least within the English-speaking world, and likely beyond, due to the close networks of scientists in this field. While fisheries biology was to experience a huge post-war expansion, in the 1940s and 1950s, it still had a relatively small membership. Moreover fisheries biologists enjoyed close international linkages due to the field's trans-oceanic focus, and the resulting international cooperation in fisheries research through new organizations such as the International Commission for the Northwest Atlantic Fisheries (ICNAF), founded in 1949, and older organizations such as the International Council for the Exploration of the Sea. Daniel Merriman, as director of the Bingham Oceanographic Collection, oversaw the publication of the organization's Bulletin in which the Symposium proceedings appeared. Following a visit to British research stations in the summer of 1948, he was able to inform Huntsman that "everywhere I went in England the Symposium volume was much in evidence. Everyone was reading it, and it created considerable discussion."<sup>66</sup> In 1949 Merriman told Huntsman "Our symposium has had considerable influence...The demand [for reprints] has been tremendous both here and abroad, and requests continue to arrive in almost every mail."<sup>67</sup> Beyond this, Huntsman had Merriman send a copy to Donovan. B. Finn, who had served as the Deputy Minister of Fisheries from 1939 to 1947.<sup>68</sup> Finn (1900-1982), a Fisheries Research Board of Canada scientist, left Canada to serve from 1947 until 1965 as the director of the Fisheries Division of the Food and Agriculture Organization (FAO) of the United Nations. The FAO founded several dozen international fisheries commissions for scientifically managing fisheries around the world, including ICNAF, and continues to oversee and coordinate these commissions. In addition, the International Technical Conference on the Conservation of the Living Resources of the Sea, held in Rome in April and May 1955, was conducted through the auspices of the FAO.

American moral and political suasion was crucial for formulating MSY as the goal of international fisheries management, under the umbrella of the FAO and its many international scientific fish commissions. The work of Chapman, Herrington and other American fisheries scientists, however, was not in itself sufficient for enabling the post-war fisheries policies that frequently led to disastrous results. The specific geopolitical goals formulated by US government agencies, for which MSY was a useful tool, were designed to assist the US attempt to sway international opinion away from the Soviet Union. By promoting prosperity as an outgrowth of capitalism, however, American goals and policies meshed well with the European and UN focus on rebuilding war-torn nations around the world, assisting the growth of national economies and the development of impoverished nations, and promoting global food security through increased productivity.

The 1947 Toronto Symposium on Fish Populations, although largely forgotten, led to the sharing of ideas and theories that were to disturb the seemingly settled understanding of fisheries depletion due to overfishing, and



that rippled through fisheries research stations, academic institutions, and fish commissions around the world. The Symposium reassured fisheries biologists that reduced catches could be interpreted as resulting from natural cycles and normal environmental causes. The Symposium at the same time led scientists to question the evidence—and softened their support—for the conclusion that fisheries restrictions had enabled heavily fished populations to rebound. Ideas promoted by Huntsman and Burkenroad, and others at the meeting, prepared the way for the global acceptance of MSY as a policy for progress and development, and in general helped to amplify post-Second World War industrializing ideals.

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## Endnotes

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- 22 A.G. Huntsman, "Method in Ecology: Biapocrisis", *Ecology* 29:1 (1948): 30-42: 30.
- 23 For brief biographies of some of the Canadian scientists who were involved in this discussion and the subsequent Symposium on Fish Populations, please see Kenneth Johnston, *The Aquatic Explorers: A History of the Fisheries Research Board of Canada* (Toronto: University of Toronto Press, 1977).
- 24 A.G. Huntsman, letter to the members of the Committee on Depletion, 1 April 1942. Huntsman Collection, University of Toronto Archives, B1978-0010 Box 69 File 6. I am sure that the date is a coincidence, despite Huntsman's very dry sense of humour.
- 25 Symposium on Fish Populations, p. 17.
- 26 Letter from R.E. Foerster to A.G. Huntsman, 25 February 1942. University of Toronto Archives, Huntsman Collection, B1978-0010 box 69 file 6.

- 27 Letter from J.R. Dymond to A.G. Huntsman, 6 February 1942. University of Toronto Archives, Huntsman Collection, B1978-0010 Box 69 File 6.
- 28 See, for example, the letter from J.R. Dymond to A.G. Huntsman, 21 January 1944. University of Toronto Archives, Huntsman Collection, B1978-0010 box 69 file 6.
- 29 Letter from J.R. Dymond to Huntsman, 19 January 1944. University of Toronto Archives, Huntsman Collection, U of T Archives, B1978-0010 box 69 file 6.
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- 31 Letters from R.E. Foerster to A.G. Huntsman, 27 January 1944, and W.J.K. Harkness to A.G. Huntsman, 28 October 1944. University of Toronto Archives, Huntsman Collection, U of T Archives, B1978-0010 Box 69 File 6.
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- 37 The use of a phonograph, the recordings to later be used by a stenographer for transcribing the proceedings, is indicated in A.G. Huntsman's introductory comments for the Toronto Symposium on Fish Populations. Sadly there is no trace of these recordings at the University of Toronto Archives. This information is missing from the published Symposium proceedings, as are several perhaps sarcastic interjections, and a few scientifically risky observations made during the discussion. See the mimeograph of "Symposium on Fish Populations, Royal Ontario Museum of Zoology, January 10th and 11th, 1947", University of Toronto Archives, Huntsman Collection Acc. B1978-0010 Box 69 File 8.
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- 40 "Discussion", *A Symposium on Fish Populations held at the Royal Ontario Museum of Zoology, Toronto, Canada January 10 and 11, 1947: Bulletin of the Bingham Oceanographic Collection, Peabody Museum of Natural History, Vol XI, Article 4* (New Haven, Connecticut: Peabody Museum of Natural History, Yale University, 1948), p. 211. For more information on Ricker, who became one of Canada's most important fisheries biologists in the post-war period, see David L.G. Noakes, ed., *Bill Ricker: An Appreciation* (A.H. Dordrecht, The Netherlands: Springer, 2006).
- 41 A.G. Huntsman, "Fishing and Assessing Populations", *A Symposium on Fish Populations held at the Royal Ontario Museum of Zoology, Toronto, Canada January 10 and 11, 1947: Bulletin of the Bingham Oceanographic Collection, Peabody Museum of Natural History, Vol XI, Article 4* (New Haven, Connecticut: Peabody Museum of Natural History, Yale University, 1948), p. 22.

- 42 “Discussion”, *A Symposium on Fish Populations*, p. 25.
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- 48 “Discussion”, *A Symposium on Fish Populations Zoology, Toronto*, p. 126.
- 49 “Discussion,” *A Symposium of Fish Populations*, p.125.
- 50 “Discussion,” *A Symposium of Fish Populations*, pp.123-5.
- 51 William C. Herrington, “Limiting Factors for Fish Populations: Some Theories and an Example” *A Symposium on Fish Populations held at the Royal Ontario Museum of Zoology, Toronto, Canada January 10 and 11, 1947: Bulletin of the Bingham Oceanographic Collection, Peabody Museum of Natural History, Vol XI, Article 4* (New Haven, Connecticut: Peabody Museum of Natural History, Yale University, 1948): 229-279: 249.
- 52 “Discussion,” *A Symposium of Fish Populations*, p.279.
- 53 “Discussion,” *A Symposium of Fish Populations*, p.225.
- 54 Huntsman, “Fishing and Assessing Populations”, pp. 7-10.
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- 56 “Discussion,” *A Symposium of Fish Populations*, p.227.
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In *Fisheries, Quota Management and Quota Transfer: Rationalization through Bio-Economics*. Ed. Gordon Winder. Centre for Maritime Studies: *Mare Publication Series* 15. Springer Nature: Switzerland: 31-62.

- 64 The best analysis of the development and abuses of industrialized fisheries and the role of scientists in that development, apart from Carmel Finley's compelling oeuvre, is Alan Longhurst's *Mismanagement of Marine Fisheries* (Cambridge: Cambridge University Press, 2010). See especially his introductory discussion "From certainty to doubt in fishery science" pp. 1-15, and his description of global fisheries pp. 134-154.
- 65 I am indebted to Carmel Finley for drawing my attention to this science. For a fuller treatment of the history of such scientific ideas in fisheries science, see Alan Longhurst, *The Mismanagement of Marine Fisheries*, and Jennifer Hubbard, "Fisheries Science and its Environmental Consequences", *Oxford Research Encyclopedia of Environmental Science* (May, 2017), <http://environmentalscience.oxfordre.com/view/10.1093/acrefore/9780199389414.001.0001/acrefore-9780199389414-e-370>.
- 66 Letter from Daniel Merriman to A.G. Huntsman, 29 September 1948. University of Toronto Archives, Huntsman Collection, Acc. B1978-0010, box 69 file 8.
- 67 Letter from Daniel Merriman to A.G. Huntsman, 10 September 1949. University of Toronto Archives, Huntsman Collection, Acc. B1978-0010, box 23 file 4.
- 68 Letter from A.G. Huntsman to Daniel Merriman, 27 September 1948. University of Toronto Archives, Huntsman Collection, Acc. B1978-0010, box 69 file 8.