



The Fighting Fish

*An historical review of our relationship
with Pacific herring in British Columbia*

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“The herring is the most baffling fish we have. For every mystery in the herring’s life we solve, two new mysteries appear.”

— DR. ERIK POULSEN

Secretary of the International Commission for the Northwest Atlantic Fisheries, Summer, 1943

Introduction

Like the foundation of your house, Pacific herring (*Clupea pallasii*) form the foundation on which the north Pacific marine ecosystem is built. Herring are an important link between tiny plankton and larger animals and exist as the primary food source for many species including chinook salmon which, in turn, are the primary food source for endangered Southern Resident killer whales. During herring-spawning season, species from the rainforest and the ocean meet at the tide line to feast. The connection between herring and people here is older than the cedar trees; historically, as a food source, herring may have been relied on more than salmon. Only during the last century, since the beginning of the commercial herring fishery, did this critically important forage fish drastically decline and begin to collapse in many places along the north Pacific coast.

For many years, Pacific Wild has amplified the call for an immediate moratorium and future reorganization of management. The herring fishery is unsustainable and stocks need time to rebuild. Imperiled species that depend on herring can come back from the brink of extinction and a locally-managed spawn-on-kelp fishery can once again flourish—without killing the herring.

Pacific Wild has combed through more than 5,000 archival documents to create this historical review of our relationship with Pacific herring. The evidence, compiled herein, is irrefutable; this species is collapsing and this is borne out, not just on paper, but in the oral storytelling of Indigenous leaders, in the data collected by scientists, in the waters and along the shores of our northern coast and in the plummeting censuses of other species here that rely on herring to survive.

Without an immediate moratorium placed on the commercial herring fishery until such time that herring numbers can rebound and the known science surrounding this foundation fish can be updated and more fully understood, we are all on the brink. What we do at the edge of this crisis will be the subject of stories that get told about us and this #BIGLittleFish for generations to come.



A Condensed Life-History of Pacific Herring

Pacific herring (*Clupea pallasii*) are a small, bony, oily fish with a strong smell. They measure 20.32 cm to 25.4 cm in length and have silvery sides and dark greenish-blue backs¹. Their mouth is large for their size, with a lower jaw that is slightly projected (a distinguishing feature)¹. The tail of herring is comprised of a deep fork¹. Herring are closely related to sardines (i.e., pilchard). The age of herring can be determined by certain growth rings located on the loosely attached scales of the fish. On average, herring live for 8-10 years and can spawn multiple times in their life cycle¹.

The waters of British Columbia are turned milky white between February through June each year as herring spawn. Also known as a “herring ballet,” spawning season peaks between mid-March and early April, a period that is arguably one of the natural history wonders of the world¹. During this time, mature female herring lay vast numbers of sticky eggs along the shoreline where they adhere to rocks, various plants (such as kelp and eel grass), and sandy, pebbled substrates. Once the eggs are laid, males fertilize the eggs by releasing enormous amounts of sperm into the ocean waters, turning the entire area a milky white².



Figure 1. Adult herring in the waters of the Pacific central coast.

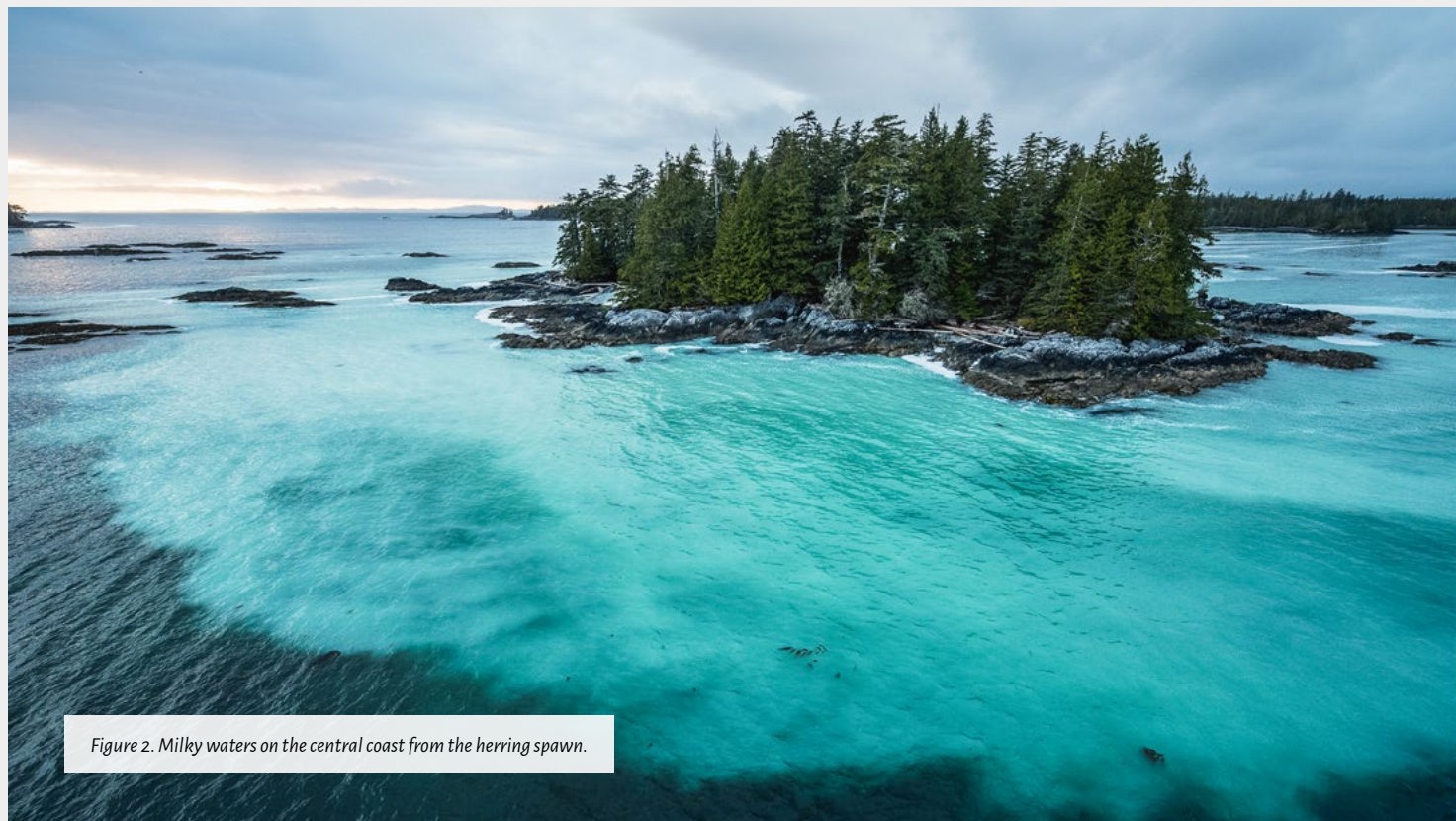


Figure 2. Milky waters on the central coast from the herring spawn.



Figure 3. Close up photo of herring eggs.



Figure 4. Seabirds feeding at the surface on a 'herring ball'.

A female herring can lay upwards of 20,000 eggs a year and a single square inch section of seaweed can contain 1,000 eggs. Eggs can be laid in various thicknesses and typically hatch within 21 days of being fertilized (depending on water temperature). However, because of natural predators and low survival rates during the incubation stage, only 20-30% of fertilized eggs survive to hatching¹.

Once hatched, around the end of April annually, larval herring are almost completely translucent and measure a mere 0.635 cm. Their head is unusually large, they have no scales, and they can barely swim. At this stage in their life, larval herring are most vulnerable with an estimated 1% survival rate. For those that do survive, over the next eight weeks the small larva will grow to 3.81 cm and begin to resemble a tiny herring¹.

Sheltering in quiet bays, the hatched juvenile herring transition into active feeding, preying on small ocean organisms such as phytoplankton when they are young and zooplankton as they grow older. As a major prey species for Chinook salmon, Coho salmon, lingcod, sea lions, harbour seals, seabirds, dogfish, and a host of other marine predators, herring are a key component of the food chain for their entire lives. Only one herring out of every 10,000 eggs will ever return to spawn¹.

Although some adult herring populations have migratory behaviours (i.e., leaving inshore waters for offshore feeding grounds and returning annually to spawn), Indigenous oral history and historical government research documents show that resident herring populations (i.e., non-migratory fish that stay in local waters all year long), have lived in coastal British Columbia waters for millennia.

In their first summer of life, young adult migratory herring leave protected inshore waters for offshore feeding areas along the west and north coasts of Vancouver Island. Adults remain offshore for their first few years until they reach breeding maturity between three to four years of age. Once mature, herring return inshore to spawn. After spawning, migratory herring can head back to sea, returning each year thereafter to spawn again¹.

For non-migratory herring, their entire lives are spent in a single location, often sheltered bays and waters (such as Nanaimo Harbour, Buckley Bay, Fanny Bay and other areas along the B.C. coast). Similar to herring that migrate, non-migratory herring have long supported a complex system of marine food webs and human socio-economic and cultural relationships.

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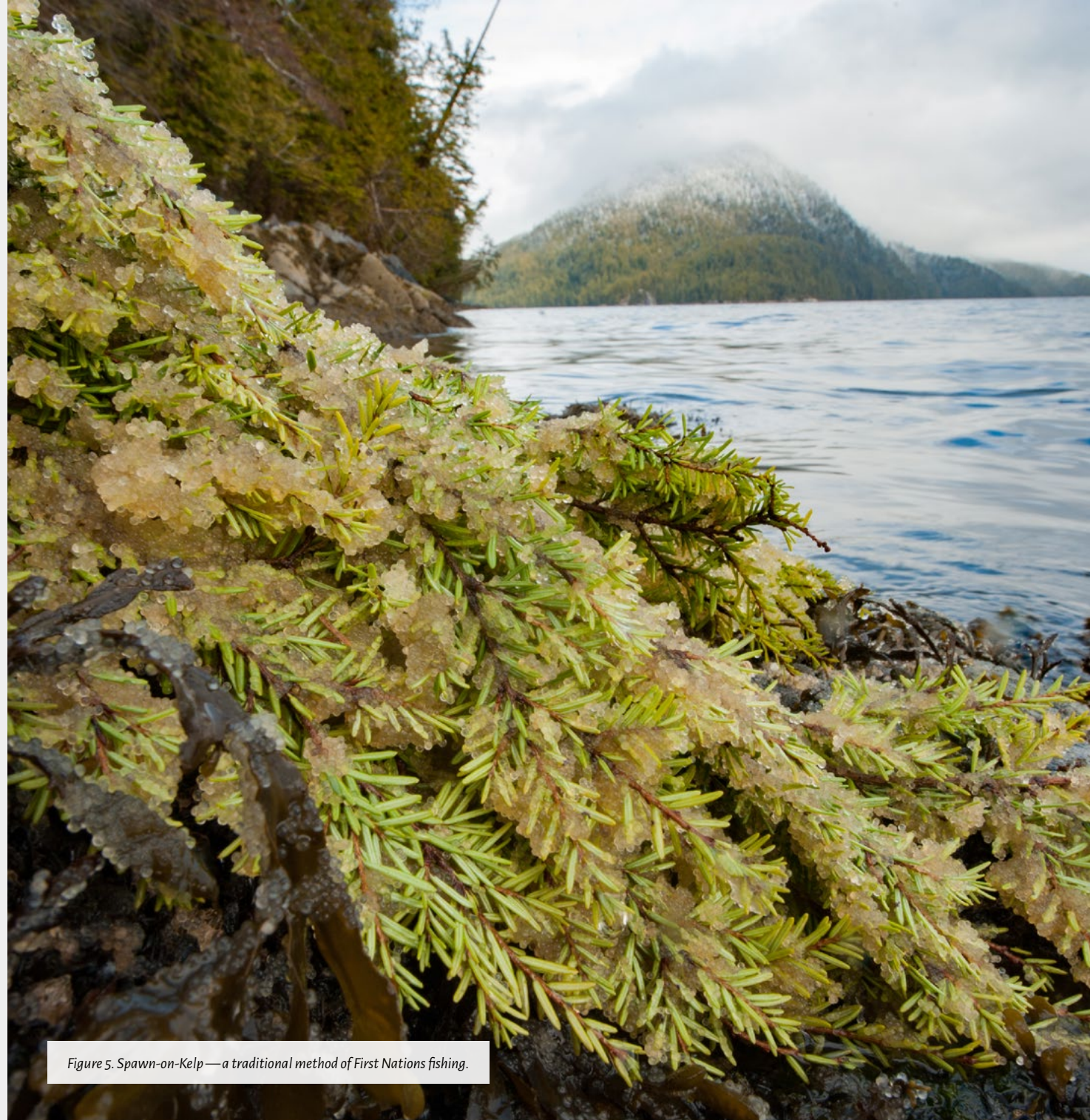


Figure 5. Spawn-on-Kelp—a traditional method of First Nations fishing.

Herring in European History

In etymology, the word *herring* is believed to derive from the ancient Germanic tribe known as the Teutons. In early Teutonic, “heer” was used to describe an army, and had a literal meaning of “army” in many cases. In old German, “heri” was used to describe a “host multitude.” Eventually, the Saxons, Dutch, and most Germanic languages would adopt various spellings. Eventually, the word *herring* developed as a noun describing this small fish that traveled like an army in large numbers³.

Archeologists have found evidence of herring in various European coastal communities that pre-date written human history. For example, in a special publication⁴ authors with the Canadian Department of Fisheries and Oceans noted archeological evidence that herring were a food source of early Danish settlements dating back to 3000 B.C.. In addition, archeological evidence from Yarmouth, England dates the use of herring by English settlements as early as 500 B.C.⁴.

The use of herring as an easily transported high-protein food source has also found its place in military history. On February 12th, 1429, *The Battle of the Herrings*, took place in France during the height of the Hundred Years War—a series of battles between the French and English (1337-1453) over the right to rule French territory. During the battle, approximately 300 English wagons carrying cannonballs, arrows, and large quantities of barreled herring were attacked by 4,000 French soldiers while attempting to re-supply English troops that had laid siege to the city of Orleans, France³. The herring were being sent as rations because Lent was approaching and soldiers

were forbidden to eat meat during this time. Using the herring wagons as a makeshift fortification, the English commander was successful in defending the convoy. However, in April 1429, only a few short weeks later, Joan of Arc would arrive at Orleans and successfully assist French forces in raising the siege on May 8th, 1429⁵.

The use of herring as a food ration in this instance is of particular historical significance. There is little doubt that early humans used herring as a food source, items of trade, strategic military rations, and as an opportunity for employment in early merchant fishing fleets⁶.

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Herring on Canada's East Coast

On Canada's East Coast, Atlantic herring (*Clupea harengus*) has long been the subject of Canadian commercial fisheries. The Atlantic herring fishery developed alongside the early cod fishery.

More than a half-century after *The Battle of the Herrings*, European exploration of Canada's eastern coastline began during the period of Columbus' exploration (circa 1492). Early accounts of European sailors (1497) state that herring were so dense off the coast of Newfoundland they could simply dip a basket and remove them from the ocean. However, European exploration and written accounts post-date Viking presence by about 500 years, with Vikings likely landing sometime around 1000 BC. Before this period, fish were a staple of First Nations east coast cultures since time immemorial.

While little is known about the East Coast herring fishery between the 1500s and 1800s, the Spanish, Portuguese, French, and British, all fished in the waters off Newfoundland. Various washing, salting, and drying techniques were used to preserve the catch for transportation to Europe⁷.

For over 100 years the French dominated a migratory transatlantic fishery, carrying some 20,000 fishers each year to the East Coast fishing grounds. Seasonal colonies were established along the coastal areas of Labrador and Newfoundland and the French Navy was assigned to secure the fishery products while in transit to Europe. However, the French hold on the area began to change in the 1700s. Beginning with The War of Spanish Succession (1702-1713), *The Treaty of Utrecht* saw France surrender certain North American areas to Britain⁸. The treaty prohibited the French from establishing colonies or settlements on Newfoundland but allowed seasonal fishing to continue albeit under the authority and jurisdiction of the British Crown⁸.



Figure 6. Demonstration Against French Fishing, 1890. An illustration of a demonstration in St. John's against French fishing. The heading under the drawing read "The Fisheries Question in Newfoundland. Demonstration against the French Fishing in British Waters". Source: Graphic Newspaper Vol 41, 1890

Disputes continued during the Seven Years War (1756-1763), with the *Treaty of Paris* resulting in the French surrendering most of their North American territories to the British, although they again maintained seasonal fishing rights. The American Revolution (1775-1783) caused continued tension between the British and the French, with French migratory fishers suspending annual travel to the grounds. Fish again found their place in treaty negotiations in the *Treaty of Versailles* (1783) when boundaries of fishing rights again shifted on the eastern coast in peace-making negotiations. Following the treaty, migratory seasonal fishing resumed. The reprieve was short lived⁸.

The French Revolution (1789-1799) again disrupted seasonal fishing along the east coast of what is now Canada.

The Napoleonic Wars (1803-1815) resulted in a complete suspension of migratory fishery travel until France resumed its fishing following 1815. However, because of the long absences during the war periods noted above, its migratory fishers returned only to find English settlers and fishers dominating the area's waters, including its restricted treaty fishing spots⁸.

In response, the French government not only began forced eviction of English settlers, but also paid subsidies to its fishers. These subsidies allowed French fishers to sell their catch on the European markets at significantly reduced prices, thereby providing a perceivably unfair advantage. Continued military actions and economic advantages resulted in the renewal of flared tensions.

Canada was founded on **July 1, 1867**. On this date, the colonies of Canada, New Brunswick, and Nova Scotia linked to form the sovereign dominion of Canada in a process called Confederation. At this time, Upper Canada and Lower Canada became Quebec and Ontario. The British retained Newfoundland. By 1890, there were large scale English protests in the streets of Newfoundland⁸.

Following a series of naval battles and fisheries disputes during this period, the *Entente Cordiale* (a series of agreements between the British and French) was signed in 1904. In this agreement, the French relinquished all exclusive land claims to the Newfoundland fishing grounds in exchange for certain land rights in West Africa. The agreement was seen as a form

of peace treaty that ended almost 1,000 years of conflict between the countries. The agreement saw the French give the British exclusive control to set regulations and fishing laws in the north Atlantic. The French also agreed to leave the land-based area referred to as the “Treaty Shore”. Certain fishing rights were maintained by the French government on behalf of its people, but within its island territorial waters off the coast of Saint Pierre and Miquelon (small French territorial islands off the coast of Newfoundland)⁸.

Between 1904 and the early 1940s, with the British now in full control of the East Coast fishery, industrialization of the fishing process was well under way. Mcleans magazine⁹ recounts a story from World War II (1943) in which Norwegian refugees coming to Canada saw herring in deep offshore Canadian waters. Upon reaching shore, the Norwegians wanted direction to the Canadian offshore trawler fleet in order to notify them where the catch was located. At this time little was understood about Atlantic herring spawning habits, life cycle, maturity, and behaviour – leading many to believe the fish simply disappeared after spawning. Various research expeditions were launched during the war years in order to locate these stocks (indicative of the lack of understanding of herring spawning habits at the time)⁹.

During WW2, merchant navies were continually attacked by German U-Boats. A shortage of military food rations for Allied forces was a continual problem. On the East Coast (and the Pacific Coast, as we discuss later), herring were seen as part of the answer. As Creighton (1955) noted in Mclean’s Magazine:

“When science first took a look at Atlantic herring, however, the reason was more urgent. This was in 1944 and wartime food shortages were beginning to be felt. Fats and protein were urgently needed both at home and for allies. If the movement of the huge herring schools in the Gulf of St. Lawrence alone could be plotted, the result might help meet an international emergency ... Toward the close of 1944, fish

packers and marine scientists from the Maritimes, Quebec and Newfoundland met at Halifax with two experts of the federal Department of Fisheries ... They decided to set up the Atlantic Herring Investigation Committee, which launched a herring hunt ...” (p. 38)⁹.

The war ended a year later (1945). The team, now dubbed the “Herring Squad,” continued their research to locate the elusive offshore schools of Atlantic herring. The objective of this team was to “...make possible a year-round, stabilized herring fishing industry that will provide work afloat and ashore for a larger number of Maritimers ...”. Commenting on the potential of a new economy, Creighton (1955) stated:

“Was it a glimpse of the ultimate potential? In deep water, somewhere off the Atlantic coast, might lie untapped resources that could support a fleet of trawlers. If this was so, a chain of processing plants could be developed and supplied the year round” (p.38)⁹.

By 1953, after almost ten years of annual fishing, the Herring Squad had adopted offshore nighttime drift netting and had continually landed larger and larger catches for consecutive years, leading many to believe that they were on the verge of discovering the final hiding place of the adult Atlantic herring. As one of the lead Herring Squad scientists, Noel Tibbo, stated to Mcleans in 1955:

“In Canada it’s still the newest business we have. It’s going to be interesting watching it grow into an industry from a small scientific project.”⁹

Creighton, (1955) ended his article in Mclean’s by adding:

“Brian Meagher, Nova Scotia’s optimistic Director of Fisheries, stoutly predicts that within a few years there’ll be as many as fifty offshore herring boats operating. It looks as though the great herring mystery is just about solved” (p. 38)⁹.

A herring industry did indeed emerge. The 1960s and 1970s saw various issues with fisheries mismanagement on the East Coast, particularly the collapse of the cod fishery (which also targeted Atlantic herring). By the 1990s, a ban on commercial cod fishery was instituted and a significant reduction in the commercial herring fishery had been implemented, specifically to protect the spawners⁹. By 2019, however, the commercial herring fishery was again back on the rise. This brought forward new concerns about the outdated management habits that had led to the collapse of the cod fishery. Still, the federal government insists current Atlantic herring numbers are significant enough to support a commercial fishery, while other marine scientists question their motives and data. This is a narrative and quota-establishing pattern eerily similar to the plight of Pacific herring and the federal government’s management of the West Coast fishery.

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⁹Creighton, N. (1955, June 11). The great herring mystery. *Macleans*. Retrieved from: <https://archive.macleans.ca/article/1955/6/11/the-great-herring-mystery>

BY NORMAN CREIGHTON

For a few hectic weeks the herring run in their countless millions. Then they vanish.

Why? Where?

If their deep-sea grounds could be found

it should add millions to

Maritimes incomes. Here's how a group of

determined scientists set out to solve

The great herring mystery

This is what the Maritimes herring men would like to see. On the Pacific coast, purse seining is possible and highly profitable in sheltered deep waters.



Figure 7. The Great Herring Mystery article. Source: Mclean's Magazine 1955



As Capt. L. J. Lewis takes the Harengus out into the Gulf of St. Lawrence, Noel Tibbo (left) searches for herring on a sea scanner and ship's mate S. Lelievre checks the echo sounder.

AMONG the crews bringing a blacked-out convoy warily toward Halifax in the summer of 1943 were those loneliest among our allies—Norwegians who had escaped to England and now were fighting the battle of the convoys without a port of their own to come home to. On a moonless night near the Canadian coast they saw a nostalgic sight: all around the ships the sea glowed with a ghostly radiance. On a dozen ships Norwegians leaned over the rails, read the message of the phosphorescence, and called softly to each other: "Herring!"

When they reached Halifax some of the Norwegians asked to be directed to the docks where the deep-water Canadian herring trawlers moored. There, they felt, they would find men of their own kind. Well they remembered the good fellowship that abounded at the wharves of Floro and Aalesund where the deep-sea herring boats tied up deck-to-deck for a mile and more.

It was some time before officials and interpreters could convince the Norwegians that Halifax had no fleet of herring trawlers. That, in fact, on all its long eastern coastline Canada had no offshore herring fishing industry whatever.

When they finally understood, the Norwegians shrugged and ascribed this apparent indifference to wealth to Canadian eccentricity. That was somewhat astray of the truth. It was not the Canadian fishermen who were eccentric—it was the Canadian herring. There is probably no more plentiful living creature in the Canadian sphere. And no more elusive. For instance

A ship fitted with an echo sounder was nosing about off the coast of Newfoundland on a herring-hunting mission for a United States fishing company. It wasn't trying to catch fish, just to chart the presence and extent of herring schools. In Newfoundland's Bay of Islands the ship's echo

sounder registered a heavy concentration of fish down below. On and on steamed the vessel and the sounder sent back the same clear message: "Herring, herring, herring." The school continued for eighteen miles. When it finally thinned out, the skipper ordered turnaround, to double-check this remarkable concentration of fish.

On the return trip the sounder encountered nothing between the keel and the ocean bottom but thin salt water. Incredible, the captain set a zigzag course at top speed, sweeping the miles of sea that minutes before had been thick with herring. Not a single "blip." Millions of fish had vanished without trace.

Dr. Erik Poulsen, secretary of the International Commission for the Northwest Atlantic Fisheries, declares, "The herring is the most baffling fish we have. For every mystery in the herring's life we solve, two new mysteries appear."

The major mystery of the herring, where the adult fish go after spawning, has been under systematic scientific attack for some years now. Kingpin of the search is Dr. A. H. Leim, senior scientist at the Atlantic Biological Station, St. Andrews, N.B. In sea boots and sou'wester Leim spends much of his time in a plunging Cape Island motorboat in the Gulf of St. Lawrence. Other scientists are tangle with such problems as the nourishment value of various samples of sea water or the relative number of bones in a herring's spine.

What these men have learned so far about the undersea migration of herring may place Canada on the verge of a new year-round industry when still-missing pieces of the jigsaw puzzle fall into place.

Already the findings of the scientists are being followed up commercially by one company. Fishermen from England's famed herring ports of Great Yarmouth and Lowestoft are in the Gulf of St.

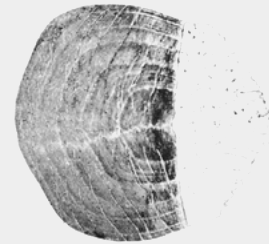
Lawrence manning the boats of a new Canadian company, Mercury Fisheries Ltd. This trail-blazing venture is headed by Paul Stockhamer, of Great Yarmouth, who controls several British fishing companies. The Nova Scotia Government has loaned him \$367,700 to help buy five North Sea herring drifters.

"None of the Nova Scotia fishing companies consulted wanted to tackle it," says John Bigelow, Nova Scotia's Deputy Minister of Trade and Industry. "It's a completely new field. The techniques are highly specialized. These Great Yarmouth men have centuries of experience behind them, both in fishing and processing. But more important, they have the market connections. Most of the fish will go to Europe."

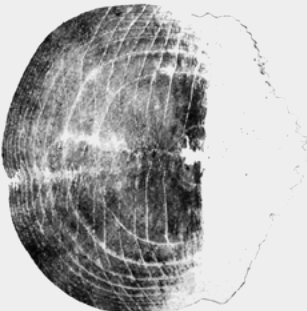
So far, Canadian fishermen have adopted a wait-and-see attitude toward offshore herring, on the grounds that it is an expensive business and success depends on many unknown factors. For instance, is there any chance that Canadians will eat more herring enough to provide a profitable market in addition to the export demand? There's some sign that arrival in Canada of large numbers of Europeans since World War II has stimulated the demand for herring products. In such districts as the Bloor-Bathurst area of Toronto ordinary grocery stores now carry imported herring packed in wine, and other gourmet varieties. But Canadian fishing interests maintain that "someone will have to do for herring what fish sticks are doing for the white fish varieties" before a substantial national market for uncanned herring develops.

There is no doubt that there are vast quantities of herring in Canadian waters. And one of the paradoxes of the herring mystery is that Canada already reaps a huge harvest of the fish—but only during the hectic six weeks each year when the herring is in its countless

Continued on page 38



By counting the rings on a herring scale you can tell the age of a fish. This one was six.



MACLEAN'S MAGAZINE, JUNE 11, 1955



Dr. A. H. Leim (r) with his Herring Squad. From left: Dr. L. Lauzier, Dr. L. R. Day, S. Noel Tibbo.

SCIENCE AND BRAINS COMBINE TO TRACK DOWN THE ELUSIVE ATLANTIC HERRING

The Atlantic Biological Station at St. Andrews, N.B. is home port for the Harengus. Her crew totals nine.

Electronic devices developed for sea warfare help the search. Radio-telephone supplies shore contact.



Herring on Canada's West Coast

As a foundation species, Pacific herring play an important role in maintaining a balanced marine ecosystem. Healthy populations of Pacific herring also ensure the continuation of historical Indigenous harvesting practices as well as the various socio-ecological relationships that have evolved between humans and the natural world.

EARLY PEOPLES

Indigenous Peoples on Canada's Pacific coast have harvested herring for generations. Archeologists sampled fish bones from 171 ancient Indigenous sites in B.C., discovering that herring bones comprised the majority of the fish in 99% of samples taken. For each individual site, herring bones comprised 80% of the individual site samples. The age of the sites varied, but comprise a history of herring that dates continuously for at least the last 2,500 years¹⁰.

A secondary method of traditional harvesting involves the collecting of eggs that have been deposited on kelp or hemlock branches suspended near the shore. This practice allows spawning herring to live on and spawn again or be eaten by other marine predators, therefore maintaining the herring's critical ecosystem function¹⁰.

Indigenous oral history and place names are factually and sequentially linked to the presence of herring in the daily lives of their communities. Indigenous Peoples have called the waters *Teeshoshum*, "milky waters from herring spawn;" and *K'i:na?a*, "herring guts on rocks;". Other more direct names are also noted by anthropologists, ethnographers, and archeologists such as *Yaaw Teiyi*, "Herring Rock," the sacred place where

the first herring arrived; *Shaan Daa* "White Island," also known as "Fish Egg Island," named for the whiteness created by the spawning activity each spring; and "Silver Bay," because in the winter, there were so many herring "if you looked at it in the moonlight you'd see the backs of the herring ... and it would look silver."¹⁰

Pacific herring supported early Indigenous social-ecological and socio-economic systems. Compiling archeological and modern population estimates, McKechnie, et al (2013) argue that Pacific herring populations are declining, largely due to industrialized overfishing¹⁰. Other historical records support the contention that overfishing of herring has occurred on Canada's west coast.

The role of herring within traditional Indigenous communities found its place at the front and center of a legal battle in the mid 1990s when two members of the Heiltsuk Band in British Columbia were charged by a fisheries officer for selling herring eggs contrary to legislation at the time. In *R v. Gladstone* [1996], the legal position of the parties was quite simple - the Heiltsuk had harvested and traded herring eggs long before European contact. Herring were an important part of Heiltsuk traditional life and Indigenous culture and socio-economic practices¹¹.

The case made it to the Supreme Court of Canada. Writing for the majority, Chief Justice Lamer concluded in a detailed analysis:

26 The facts as found by the trial judge, and the evidence on which he relied, support the appellants' claim that exchange of herring spawn on kelp for money or other goods was a central, significant and defining feature of the culture of the Heiltsuk prior to contact. Moreover, those facts support the appellants' further claim that the exchange of herring spawn on kelp on a scale best characterized as commercial was an integral part of the distinctive culture of the Heiltsuk. In his reasons Lemski Prov. Ct. J. summarized his findings of fact as follows:

It cannot be disputed that hundreds of years ago, the Heiltsuk Indians regularly harvested herring spawn on kelp as a food source. The historical/anthropological records readily bear this out.

I am also satisfied that this Band engaged in inter-tribal trading and barter of herring spawn on kelp. The exhibited Journal of Alexander McKenzie [sic] dated 1793 refers to this trade and the defence lead [sic] evidence of several other references to such trade" (emphasis added in the original).

Following a detailed discussion on legislation and indigenous rights, Chief Justice Lamer concluded:

51 I would allow the appeal to the extent of confirming the existence of an aboriginal right of the Heiltsuk to sell herring spawn on kelp for sustenance purposes. I would order a new trial in order to decide whether that right has been infringed, and if so, whether such an infringement has been justified (R. v. Gladstone, 1996 CanLII 160 (SCC), [1996] 2 SCR 723 at para 26, 51)".

The *Gladstone* case continued in court for another 10 years, with the parties' prosecution eventually being stayed and payment to the parties for the government sale of their herring eggs. The interest on the monies withheld from the parties became another legal battle. The case ended up back in the Supreme Court of Canada almost a decade later (2005), the government's liability was reversed, and they did not have to compensate the Heiltsuk members for interest related to the government sale of their herring eggs. The court found:

1 The issue in this appeal, on an agreed statement of facts, is whether the appellant Crown in Right of Canada owes interest, or some other amount, to the respondents on the basis that funds belonging to the respondents were held by the

Crown during a period of litigation as the result of a legal seizure. I conclude that the Crown does not owe interest, or any other additional amount in this case. The appeal is allowed without costs.

2 On April 28, 1988, the respondents, Donald and William Gladstone, were arrested for attempting to sell 4,200 lbs. of herring spawn on kelp ("spawn") in violation of the Fisheries Act, R.S.C. 1970, c. F-14. On June 9, 1988, the Department of Fisheries and Oceans, having lawfully seized the spawn, sold it pursuant to s. 58(3) of the Fisheries Act for the net sum of \$137,079.50. This was deposited to the credit of the Receiver General of Canada at the Bank of Canada pursuant to s. 58(4) of the Fisheries Act and became part of the Consolidated Revenue Fund.

3 The respondents were convicted. However, a new trial was ordered by this Court: *R. v. Gladstone*, 1996 CanLII 160 (SCC), [1996] 2 S.C.R. 723. On December 13, 1996, the Crown decided against a new trial and stayed proceedings. On December 19, 1996, the net proceeds of \$137,079.50 were paid to the respondents but the appellant refused to pay interest, or any other additional amount (*Gladstone v. Canada (Attorney General)*, 2005 SCC 21 (CanLII), [2005] 1 SCR 325 at paras 1-3)".

The weight and validity of Indigenous oral history, cultural practices and rights continues to be significantly undervalued today in the management of the commercial herring fishery. This is especially apparent in the government's failure to recognize the relationship to sensitive non-migratory resident herring populations that have supported Indigenous culture and trade for millennia".

EUROPEAN EXPLORATION OF THE WEST COAST

One of the earliest European references to Pacific herring in B.C. dates back to 1792 when herring were purchased from First Nations for food by sailors aboard the H.M.S. Discovery (under the command of captain George Vancouver). Just over eight decades later (1877) the first commercial catch of herring would be recorded in B.C. at 75 tons. Other early references to Indigenous use of herring can be found in explorer journals from 1793 and 1834 during interactions with the Heiltsuk. Other early records also exist in archival journals from trade with various Nuu-Chah-Nulth tribes along the west coast of Vancouver Island.

EARLY YEARS OF THE HERRING FISHERY (1901-1938)

With commercial fishing of herring increasing towards the end of the 19th century, the catch would steadily rise over the decades, varying between 130 and 160 tons of landed fish per year. A dry salted herring product was developed by 1904 for export to Asia, with an annual catch of approximately 30,000 tons, largely caught by drift netting and beach seining. Industrialized purse seining techniques were introduced by 1913.

Simultaneously, the economic value of the fishery was becoming evident while concerns were being raised about the potential of overfishing. To address both, the British Columbia provincial government decided that more needed to be known about Pacific herring, their population size, their life cycle, and spawning habits. In 1916, the provincial *Report of the Commissioner of fisheries* contained a significant appendix report titled *A contribution to the life-history of the Pacific*

herring: Its Bearing on the condition and future of the fishery. Authored by William Thompson, the report investigated the life-history of Pacific herring specifically to confirm or deny the possibility of overfishing¹².

Significant contributions to the understanding of herring were made within the Thompson report (1916), including the practice of aging fish by their scales, identifying spawning habits, maturation, and age classes¹². Ultimately, the investigation concluded that overfishing of the species was present in the Nanaimo area (i.e., Strait of Georgia) based on the difference in fish size and age classes between fished areas and untouched areas. This was corroborated by Indigenous oral claims that Nanaimo Harbour once contained vast amounts of herring. Only younger, smaller fish were being found in the heavily fished areas, while older and larger fish were found in other areas along B.C.'s coast. While recognizing that further research needed to be conducted, Thompson (1916) concluded:

"The principal object of this report has been to ascertain whether there is evidence of depletion, and to give some basis upon which the future of the fishery may be judged. However, far from attainment this yet is, certain observations and records of value are given. The decreased range in size of the population at Nanaimo and Nanoose Bay as compared with that at Kildonan, accompanying the lack of older fish, is the first clear evidence of overfishing to be obtained." (pg. 43)¹²

Thompson's alerts went unheeded. By 1919 purse seining of Pacific herring in B.C. was in full swing for the export of dry-salted herring, with some 85,000 tons of Pacific herring being removed annually from coastal waters.

During the 1920s, markets continued to develop for herring. Noting the economic value of herring over the previous ten years, the 1930 provincial report of the fisheries commission states:

*"The average value of the herring-catch for the ten years between 1920 and 1929 was in the vicinity of \$970,000; hence neither the Dominion nor the Province can afford to allow the fishery to be materially reduced by overfishing or faulty direction."*¹³

A herring investigation began in 1929, focusing on herring migrations and the "tendency to return to the vicinity" of their spawning origin. The importance of understanding migration was specifically noted by the commissioner in the 1930 provincial report of the fisheries commissioner:

*"For only when the character and the extent of the migrations are known can an estimate be formed of the likelihood of the depletion of the whole region by concentrated fishing at one or two places..."*¹³

By 1934, Barkley Sound and Nootka Sound were experiencing herring declines, with the fisheries commissioner noting, "The spawning-beds in some districts on the west coast, however, cannot be said to be satisfactory".

The year 1934 was one of the most productive years for what was then fairly cutting-edge herring research. Multiple studies and research on the species were conducted. The Nanaimo Biological Station (a DFO research center), had identified the existence of local, non-migratory herring populations based on the difference between sizes and ages in various fishing grounds. It was also identified that herring form the base for a complex food-web and that overfishing could have serious consequences to other marine life and by extrapolation, to the province. Citing Tester (1934), the commissioner identified this in the 1934 provincial fisheries report:

"... the intensity of the fishing in any area must not be permitted to endanger the perpetuity of the local stocks. In conclusion the author says: 'Local and general depletion must be avoided at all costs, for not only is the fishery itself a great

*asset, but the intermediate role of the herring as food for other species is of inestimable economic importance to the Province.' In this connection Mr. Tester points out that it is essential that overfishing be guarded against, especially in respect to a non-migratory species such as the herring, as such species is more quickly depleted and the consequences more disastrous than in the case of a migratory species."*¹⁴

Oral Indigenous history was taken more seriously in 1934 by lead scientists for the Nanaimo Biological Station. Resulting from the anecdotal stories shared by Elders and the multiple complaints being made that pertained to the herring fishery in Nanaimo, Tester conducted a case study to determine the effects fishing may have had on the local Nanaimo Harbour herring population. Tester (1934) recounts:

"In the early years of the fishery there is no doubt that herring were extremely abundant in Nanaimo Harbour. In 1903-04 the 'run of herring at Nanaimo was very large. The water of the harbour was so full of them at one time that large numbers were washed upon the beach by the waves of a passing steamer' ... Another reference states that 'only last January, near Nanaimo, the coast was for 2 miles knee-deep with herrings; they were simply crowded on shore by millions more, on their way to the spawning-grounds. The people were at their wits end as to what to do with them..." (pg. 98)¹⁴

Tester (1934) continued his case study of Nanaimo Harbour herring in order to determine if there were natural population fluctuations contributing to decline or if "the intensive fishing activities of the last twenty years may have been partly responsible for certain downward trends..." He concluded that early intense fishing prior to 1910 had been "centered at Nanaimo Harbour and Departure Bay." After 1910, fish began to disappear until:

*"...herring no longer returned to these areas in their former abundance. At the present day they are no longer piled "knee-deep" on the shores of Nanaimo Harbour and Departure Bay at spawning-time. There is but little doubt that the agency of man has either caused a partial destruction of the run or has caused a large part of the herring which formerly frequented these waters to spawn elsewhere." (pg. 99)*¹⁴

Based on his findings in the Nanaimo Harbour, Tester (1934) advanced a detailed discussion on the importance of understanding the extent of migratory patterns of Pacific herring. It was hypothesized that extensive intermingling of local stocks could potentially save local populations from decline during intensive fishing. However, over time, he noted that even if there were intermingling on a large scale, "Overfishing in one locality would gradually drain the stock of herring in all waters and would gradually result in a general depletion." In the reverse, Tester concluded:

*"If, on the other hand, extensive migrations do not take place and herring in each general fishing area are more or less localized, overfishing in a particular area would be manifested more quickly by a local depletion, as the local supply would not be replenished by the immigration of fish from adjacent waters."*¹⁴

Tester posited that where overfishing of migratory species, over time, resulted in a decline, that simply continuing to fish until insufficient catches are made, would result in a condition of economic extinction due to an inability to exploit the species in a profitable manner. In the case of non-migratory species, he found:

"...the more accessible populations would first be fished to the point of economic extinction; gradually the fishery would expand to include the less accessible stocks; in the meantime the old fishing-grounds would be traversed again and again

and the remaining schools gradually captured until finally a condition of, or approximating, biological extinction would be reached.”¹⁴

Tester (1934) went further and identified B.C. herring as non-migratory based on other research he had conducted in 1933, stating:

“Recent research by the author (Trans. Amer. Fish. Soc., Vol. 63, 1933) has demonstrated that the herring of British Columbia is essentially a non-migratory species. Extensive migrations up or down the coast do not take place. The run to each locality tends to form a ‘local population’ which is sometimes distinct in many ways from similar local populations in adjacent areas. Therefore, it is essential that overfishing be guarded against, for, as pointed out above, such a species is more quickly depleted and the consequences may be more disastrous than in the case of a species of the migratory type. The condition of the fishery should therefore be investigated with this in mind.” (pg. 100-101)¹⁴

The 1934 provincial report of the fisheries commissioner suggests that the fishing fleet should focus its efforts in more northern waters:

“With regard to the herring-fishery of British Columbia, it seems highly probable that the fishing-grounds are capable of considerable expansion to the northward. There are several areas which have not been exploited commercially to any great extent as yet and which offer many possibilities. Of these might be mentioned the region between the north-east coast of Vancouver Island and the mainland, the coastal waters between this region and Prince Rupert, and the west coast of the Queen Charlotte Islands.”¹³

However, it was also noted that herring provide an important function in a complex food-web and by extension should be protected for the benefit of other marine species.

“Local and general depletion must be assiduously avoided, for not only is the fishery itself a great asset, but the role of the herring as a food for other species is of inestimable economic importance to the Province.”¹³

The 1934 fisheries report also captured the results of the *Herring Investigation* which had begun in 1929. Herring populations along southern Vancouver Island and the West and East coast of Vancouver Island were categorized and identified as separate populations. The commissioner commented directly on the research of Dr. Tester stating:

“In 1929 a scientific investigation into the herring and pilchard fisheries of the Province was undertaken by the Biological Board jointly supported by the Federal and Provincial Departments of Fisheries ... Dr. Tester points out that the runs of herring to the various localities on the British Columbia coast tend to form local populations and that very little intermingling takes place.

It is also shown that the herring of British Columbia are essentially non-migratory. These points are of very great importance in relation to the regulation of the fishery.

...until the necessary information is available it is pointed out that it seems advisable to guard against intensive fishing similar to that in force between 1925 and 1929.”¹³

The fisheries commissioner (1934) went on to address research findings which showed that intense fishing continually targeted 3-year-old herring, which were due to spawn for the first time. As a result, there was a high likelihood that the numbers of incoming young would be continually reduced until economic extinction occurred. The commissioner concluded:

“Such a possibility should be foreseen and guarded against until the optimum level of fishing has been determined by scientific research.”¹³

By 1935 dry-salt herring markets had declined due to various economic and political climates in China. British Columbia became concerned about the economic impacts that the loss of the herring fishery would have on the provincial economy. As a result, beginning in 1935, a reduction fishery (i.e., allowing herring to be reduced to oil and meal) was introduced to open up new market opportunities. The government began reporting on a herring reduction fishery in B.C. starting in 1936, with a set catch of 40,000 tons for the West Coast and 25,000 tons for the East Coast:

“The West Coast was divided into sub-districts and allotted catch-limits as follows: Barkley Sound, 15,000 tons; Clayoquot Sound, including Sydney Inlet, 5,000 tons; Nootka, including Esperanza Inlet, 10,000 tons; Kyuquot, 10,000 tons; Quatsino, 5,000 tons. The catch-limit for Barkley Sound was increased to 20,000 tons later in the season, as it was found that the run of herring to this area was very heavy and that the increase would in no way endanger the future supply.”¹³

Presumably resulting from previous fisheries reports suggesting the fleet should move north, in 1936 Namu, Bella Bella, and Ocean Falls saw “considerable activity in the herring fishery” as the area has:

“...never been fished extensively for herring ... No catch-limits have been placed on fishing in this district, but close observations are being maintained.”¹³

As the reduction fishery continued and certain local herring populations appeared to be collapsing in places on both the east and west coasts of Canada, a newfound debate emerged questioning the fishery’s impact on local, non-migratory herring stocks:

*"In conjunction with the reduction fishery, the previous findings of Tester pertaining to non-migratory stocks were questioned and a herring tagging project funded."*¹³

Between 1937 and 1938, the herring tagging project continued, along with expanded fisheries in the northern waters.

*"The most noteworthy feature of the herring-fishery has been its continued development in the areas north of Vancouver Island. The rapid growth would appear to call for an intensive study of the herring in the area to provide information to facilitate the most advantageous method of exploiting the resource..."*¹³

It was also during these first few years that preliminary observations from the tagging work were noted to be in favour of the concept of local populations. Although some wandering and intermingling of fish was reported, evidence seemed to suggest that approximately 80% of herring populations on the West Coast were estimated to be local, non-migratory.

*"... The results give partial support to the conclusions based on racial studies that there is a tendency for separate populations to be formed on the west coast..."*¹³

As the 1930s came to an end, not only were herring at the center of a scientific battle over their non-migratory nature and whether conservation of their local spawning populations was necessary, but the species was also in the spotlight as a potential leading source of protein for feeding militaries during times of war. This prompted the Georgia Strait Cannery (now a Canadian national historic site) to later coin Pacific herring as the "fighting-fish".



Figure 8. The Georgia Strait Cannery (now a Canadian national historic site) coined Pacific herring as the "fighting-fish". Source: The Georgia Strait Cannery.

THE WAR YEARS (1939-1945)

Canada entered WW2 in September 1939, prior to the winter herring fishery. As the war efforts increased, so too did the pressures on herring, prompting the fisheries commissioner to make direct reference to the fishery in his 1939 report:

*"During the past three years there has been a great expansion of the herring-fishery into the waters of the central and northern coastline and the Queen Charlotte Islands. This expansion has been accompanied by the construction of new and the renovation of old reduction plants ...The total catch for the 1938-39 season reached an all-time record of over 100,000 tons, of which about 60 per cent was taken in the central and northern areas."*¹³

The tagging work continued during the war. It was also expanded into the new northern fisheries around the (then) Queen Charlotte and Alert Bay fishing grounds. The goal of the tagging project was to develop an understanding of "the extent of intermingling and migration of herring runs by means of the insertion and recovery of internal tags" (presumably to ascertain the maximum harvest possible during the war).

Although intermingling between west coast herring populations was again noted, by the end of 1939 it was found that there was a *population interdependence* between the herring in Deepwater Bay (north end of the Strait of Georgia) and herring along the south-east coast of Vancouver Island.

By the outbreak of WWII, the tagging project was producing preliminary results which were at odds with the increase in the herring fishery activities. Although it was again

noted that a “small amount of mixing” did take place between local herring populations (especially on the west coast of Vancouver Island), the concept of non-migratory herring populations, was beginning to hold water with the 1939 fisheries report citing:

“It has been shown that there is but a negligible degree of mixing between the runs to major areas.”¹³

“... it is clear that the majority of the tags appear to have been recovered within the general area in which they were inserted. For four major fishing areas, the east coast of Vancouver Island, including Deepwater Bay; the west coast of Vancouver Island; the central coastline; and the northern coastline, the recovery of “local” tags amounts to 99, 98, 99, and 93 per cent, respectively. This, therefore, supports the conclusions derived from racial investigations (Tester, 1937; Boughton, 1939) and those derived from previous tagging-work that the runs to the major areas tend to form distinct units.”¹³

Although local herring populations were being confirmed, previous cautions against overfishing and the effects this could have on other marine life were ignored during wartime. Instead, the herring fishery would continue to increase in order to feed Allied troops deployed in Europe, putting pressures on local herring populations. As the fishery continued to increase, the idea of local herring populations would continue to be challenged by industry and opposing scientific views.

A year later (1940), WWII was raging across Europe. The 1940 fisheries report is clear about the impacts the war was having on fisheries in Canada and showed a clear increase in fishing pressures:

“The British Columbia herring fishery has continued to expand and has assumed increasing economic importance, particularly in relation to the need for canned fish-food and other fishery products created by the present wartime emergency.

In 1939-40, the total catch was the largest in the history of the fishery and amounted to over 150,000 tons, of which 31 per cent. was taken on old-established fishing-grounds on the east and west coasts of Vancouver Island, 13 per cent from newly exploited areas in the vicinity of Discovery Passage and Queen Charlotte Sound, and the remaining 56 per cent from recently established fishing-grounds along the central and northern coastlines and on the east coast of the Queen Charlotte Islands.”¹³

“The herring tagging investigation ... has been continued actively and has been instrumental in increasing knowledge concerning the habits of herring. The results of former years, indicating the definite segregation of the herring populations of major fishing areas, and the partial segregation of herring on fishing grounds within major fishing areas have been confirmed...”¹³

Various population interdependencies were noted in the tagging data. These interdependencies showed a strong correlation between the fishery in Discovery Passage and herring that spawned in the Strait of Georgia. Other tagging results concluded the fishery in the Queen Charlotte area was a localized population that was independent from other fishing areas. It was again confirmed that herring form stable local populations.

“The one year's tagging results present strong evidence for believing in the practical independence of the fishing grounds of the Queen Charlotte Sound area from those of other major areas...”

The results of the herring tagging and recovery programme during the past year are in keeping with those of former years in indicating a tendency for herring to form rather stable populations in each of the major fishing areas...”¹³

By the end of 1941 the results of the tagging project were confirming a preponderance of local herring populations. The large increase in fishing activity also assisted in the recovery of tags and development of data during this time. This only confirmed earlier findings of localized and independent herring populations along the B.C. Coast, especially in the Strait of Georgia:

“In this programme, work was concentrated on two of the more accessible major areas, the Strait of Georgia and Queen Charlotte Strait...”

The results again showed that the populations in major areas may be considered to be practically independent, and that within major areas there is limited mixing of particular runs.”¹³

“The results of the herring-tagging and recovery programme in 1942-43, in general, agree with those of previous years in showing the relative independence of the populations in major areas... As in past years, within major areas there was a tendency towards segregation of populations. This was the case in the Strait of Georgia, where fish in the northern part were relatively independent of those in the southern part. In general, it was also the case on the west coast of Vancouver Island...”¹³

“The results of the herring-tagging and recovery programme agree in general with those obtained in previous years. They establish the relative isolation of the major fishing areas. On the whole these may be regarded as 96 per cent independent. The results also show that within major areas a certain amount of segregation of populations takes place, and this may occur even between closely associated contiguous areas. There is evidence of heterogeneity in regard to the fishing grounds supplied by the different spawning populations of the Strait of Georgia...”¹³

In order to meet demands from Great Britain, British Columbia began placing restrictions on the use of herring as non-essential food, intending to divert as much herring as possible into canning for human consumption. As a result of these restrictions and the “increased effort on the part of the fishermen,” B.C. began to produce over one million cases of canned herring annually for military rations:

“In 1939, principally on account of hostilities in Europe and the demand for a high-protein food, the canning of herring assumed the proportions of a major industry and in that year 418,021 cases of herring were canned in British Columbia. The continued demand from Britain for a low-cost high-protein food has resulted in elevating the herring-canning industry from a minor role to that of a major industry...”

In 1941 twenty-three canneries operated and produced a pack of 1,527,350 cases. In 1942... eighteen operated plants produced in 1942 a pack of 1,253,978 cases of canned herring.”¹³

As early as 1942, the fisheries commissions (and presumably others in industry) were looking ahead towards the end of the war and the possibility of the continuance of the herring fishery in B.C.. The fishing fleet was in full swing, the canneries were at capacity, and herring were being harvested in record catches, prompting the commissioner to state:

“In the pages of this Department’s report for 1941 it was stated that the requirements of Great Britain for a low-cost high-protein food during war-time was an ideal opportunity for the herring packers of British Columbia to demonstrate to the British consumer their ability to supply canned herring in large quantities and also, that if the operators insist on maintaining a high standard of quality, there would seem to be no good reason why a very large portion of this trade could not be retained after the war.”¹³

In 1943 the herring tagging project had identified less than 20 per cent incidence of intermingling between herring populations. Concluding, “...these conform with the results of previous years in showing the essential independence of runs of herring to major areas...”¹³

The fisheries report for 1943 covered extensive tagging data and identified the two major travel routes of herring. For fish spawning in Discovery Passage, they would travel to summer feeding grounds via the Johnstone Strait and on their return would supply herring populations in Deepwater Bay and Deep Bay.

The Strait of Juan de Fuca was found to be the primary travel route for fish which spawned along the south-east coast of Vancouver Island. On their return from summer feeding they were found to augment herring populations “from Satellite Channel to Nanoose Bay.” Some intermingling with west coast herring was noted as possible but varying in nature:

“Of the herring which spawn along the north-east and north-west shores of the Strait of Georgia, part use the northern and part the southern route...The exact situation is one of considerable complexity, perhaps even more so than is indicated in the foregoing explanation, and will doubtless vary from year to year.”¹³

By the end of 1943, fisheries staff had redefined the intermingling of non-migratory herring as “limited mixing”¹³. “Limited” was further quantified as an identified maximum intermingling of 16 per cent during summer feeding travel. The 1943 report is also the initial research that suggested that some herring never leave their home area to feed at all, but rather stick to local feeding grounds. At this point in history, it is clear that fisheries scientists believed herring were primarily a non-migratory species and had a tendency to form localized independent populations. While sometimes these populations did travel for food, intermingling was limited. In addition, it was specifically noted that some herring never leave their area:

“The 1943-44 results agree with those of previous years in showing that mixing between the populations of major areas is limited in extent [detailed definition of limited included in original] ... It is subject to both modification and amplification by the addition of further data. For example, sufficient information is not yet available to include a comprehensive discussion of those fish which do not migrate from the area but which spend the summer on local feeding grounds such as Point Grey, Active Pass, etc. These form an unknown percentage of the Strait of Georgia population.”¹³

At the height of WW2 (1944), there were 22 canneries operating full time on B.C.’s coast.

“Practically the whole of the herring-pack is each year taken over by the Federal Government for the account of the British Ministry of Food.”¹³

Only an eight percent intermingling was noted in the 1944 fisheries report regarding tagging data, resulting in a correlation with previous years, “...in showing that the extent of mixture between the herring populations of major areas is small.”

Also, during 1944, the herring fishery at Nanoose Bay completely failed and certain areas off the west coast of Vancouver Island were closed (namely Matilda inlet) due to the absence of fish. Although some areas were indeed closed to the commercial herring fishery, the war continued to place pressures on the other populations of Pacific herring along the B.C. coast.¹³

As with many other industries and technologies during WW2, in 1945 there were advances made in the area of fish tags and tag detectors. The herring investigation team subsequently developed and adopted the use of lighter and thinner tags. This year also marked the tenth year of the herring investigation and tagging project, that had amassed consid-

erable information regarding the various herring populations along the B.C. coast, their intermingling potential, and their tendencies to form stable local populations. The new tagging technology, however, only continued to confirm previous findings:

*"There was no significant difference in percentage recovery between thin, light tags used in the spring of 1945 and tags of the usual dimensions and weight used in other years ... As in previous years mixing between the fish of major areas was limited in extent, amounting to about 6 per cent on the average."*¹³

THE POST WAR YEARS (1946-1960)

Following the end of WWII in 1945, the fisheries commissioner didn't shy away from the economic objective of maintaining an intense fishery on the West Coast. With a robust cannery infrastructure already in place, sustaining jobs and the economy became the focus of fisheries management practices. The fishery produced over one and a half million cases of canned herring in the year following the end of the war, setting a record:

*"Herring have been canned in British Columbia for a number of years previous to the war, but in the pre-war years the canned herring-pack was comparatively small...At the outbreak of hostilities the demand for canned herring increased enormously. This war-stimulated demand enlarged the herring-canning industry of the Province from a comparatively insignificant branch of our fisheries to one of the Province's most important...each year since then the annual pack has been over 1,000,000 cases...In 1946, the year under review, twenty operating plants produced 1,634,286 cases of canned herring."*¹³

The 1946 report of the fisheries commissioner made it clear that the goal of the fishery was to continue to take the maximum available stock. It is precisely here that the discussion about herring management shifted in the post war years from identifying travel patterns and independent localized herring populations, to rationalizing the continuance of intense fishing:

*"...It is pointed out that, in order to formulate a management policy which will assure maximum utilization of the stock... the average minimum spawning population necessary to produce maximum yield must be determined..."*¹³

For the first time since reporting began on herring in 1916, and for the first time since fisheries reporting began in 1901, the report of the fisheries commissioner (1946) seems to contradict itself and the known science gathered up to that point, by choosing instead to downplay the previous fisheries closures and depleted herring populations that were recognized prior to wartime fishing. Relying on the notion of "annual fluctuations," the fisheries report for 1946 stated that there was no evidence of overfishing during the war years:

*"A recent survey of the results for the west coast of Vancouver Island (Tester, MS.) has produced no conclusive evidence that this population, actually a series of intergrading units, has suffered a progressive decline in abundance as a result of past fishing effort...Apart from annual fluctuations, the catch has been sustained under a relatively high fishing effort, but not necessarily at or approaching the maximum yield of the population."*¹³

Later in this 1946 report, the premise that all was well, was repeated:

"As there was no conclusive evidence that the minimum spawning stock had been exceeded, or even approached, by

*the intensive fishing of recent years, it was recommended that restrictions be relaxed to allow a further increase in fishing effort and that the effect of the decreased spawning on recruitment be carefully studied. It was pointed out that a certain risk of "overfishing" was involved..."*¹³

However, with no quota restrictions, record catches were landed that year; and yet, within the same report the commissioner recognized that there had been poor fishing in some locations:

*"A record herring-catch of almost 59,000 tons was made in the 1946-47 season. Good catches in Area 23 (Barkley Sound) in late November and in December were followed by excellent fishing in Area 25 (Esperanza Inlet) in early January. Quota restrictions were removed on January 9th, but the sub-district was closed on January 25th after several days of poor fishing..."*¹³

The report (1946) went to great lengths to describe the intense fishery that had occurred during the war. This description, and with little evidence presented to suggest this had caused any negative impacts to the stock, seems to justify a continuance of this intense fishery. Ultimately, the report argued that a maximum yield fishery (MSY) could be established so long as the spawning population of a given area could continually resupply new young fish. A statement about annual fluctuations in spawning size and numbers was provided:

*"In other words, the goal of maximum sustained catch will be reached when fishing effort is such that the spawning stock is kept at the minimum number necessary to produce an approximately constant supply of new recruits to the fishery... Determination of the causes of variation in the survival of young is one of the most difficult yet one of the most important problems facing fisheries investigators."*¹³

It was also recognized in this report that “as fishing effort increases and the spawning stock decreases” (presumably because increasingly younger fish are caught each year) there could eventually be a situation where the fishery caused a decimation of the targeted herring population. It is interesting to note here that this scenario had been identified in previous reports by the fisheries commissioner as *economic and biological extinction*. This more dire outcome appears to have been glossed over in the 1946 report:

“The level of fishing effort which will allow the spawning stock to approach but not to exceed this critical minimum is the optimum for yielding maximum sustained catch...there is the possibility on the one hand of wasting thousands of tons of fish and millions of dollars by over-restriction of the fishery and on the other hand of allowing a progressive dwindling of the stock by under-restriction.”¹³

This comparative study between quoted and unrestricted fishing grounds was intended to produce a research product/population estimation model that could be generalized to apply to all herring populations in B.C., with the primary goal of maximum exploitation of herring, rather than the conservation of the species:

“This is the first in a series of annual reports giving the results of an intensive investigation of the west coast of Vancouver Island herring population. The primary objects of the investigation are to determine the causes of natural fluctuations in abundance and to ascertain the average minimum spawning population necessary to produce maximum sustained yield. The ultimate object is to formulate a management policy for all herring-fisheries of British Columbia which will assure maximum utilization of the stock.”¹³

1948 marked a notable turnover in herring research staff and a renewed mandate within the government to max-

imize catch. For the next ten years, the fishery research staff would see continually decreasing catches. Between 1947-1957, government staff explained the decline, not as a concern with population abundance, but rather as an issue with juveniles not making it to the fishery grounds in time for the annual opening of the fishery. In so doing, the commission failed to recognize and acknowledge early signs of an economic extinction of the population as the delineating line beyond which loomed the potential for biological extinction:

“...most of the efforts of the herring investigators were directed to the study of the west coast of Vancouver Island herring population, which since 1946 has been subjected to practically unlimited fishing. Conditions in this population are being compared with those in the lower east coast of Vancouver Island population, where rigid adherence to a fixed quota has been maintained...”¹³

“Large catches, greatly in excess of what would have been allowed under quota, have been taken on the west coast, and the quota has been easily reached on the lower east coast.”¹³

“In each of the three years, fishing on the west coast stopped prior to the closure date because of lack of fish on the fishing-grounds. On the other hand, evidence pointed to considerable quantities of fish remaining in the lower east coast when the quota was taken...although the lack of quota restrictions on the west coast was followed by spawnings of average size, restricted catch on the lower east coast resulted in above-average spawnings in the last two years...”¹³

As catches continually declined, the reality of reduced spawning in areas with no quota fishing should have appeared to foreshadow the beginnings of population decline, although government fisheries staff continued to explain the decline for reasons other than intense fishing:

“The 1949-50 fishery on the west coast yielded the smallest catch (37,300 tons) in the four-year period of the study...Fishing effort was higher and availability was lower than in the previous year.”¹³

“This decrease in the number of herring found on the fishing-grounds does not necessarily mean an over-all decrease in population abundance...would indicate that the initial population abundance was greater this season but that many of these fish did not move inshore in time to be taken by the fishery.”¹³

In a curious response, instead of immediately adopting a precautionary principle as the data began to show declines in both spawning and catches in non-quota fishing areas, fisheries staff instead appeared to imply that the lower east coast of Vancouver Island might have had too many fish and so quotas therefore may be restrictive:

“A review of the results accumulated in the first three years of the present study indicated that during this period of high population abundance the population under quota restrictions [that of the lower east coast of Vancouver Island] had above-average spawnings, whereas the population with practically unlimited fishing [that of the west coast of Vancouver Island] showed average spawnings. Further study is needed to determine whether or not, in view of these findings, fixed quotas imposed upon the catch are unduly restrictive.”¹³

By 1950, the herring fishery on the west coast was recording the lowest catches since unrestricted fishing had been allowed. This was explained, not because of fishing, but again because of the late inshore movement of fish prior to the opening date of the fishery:

“The west coast catch in 1950-51 amounted to 25,200 tons, the smallest fishery of the five-year period since quota restrictions were removed...”¹³

"The small catch was considered to have resulted from the late inshore movement of the Area 25 (Esperanza Inlet) runs..."¹³

"The strong evidence indicating that in the past two years availability of herring to the fishing fleet has been unusually low in one fishing area of the west coast (Area 25) suggests that natural limitations to catch have essentially the same effect as if catch quotas were applied..."¹³

More broadly, 1950 also marked a red flag year in the provincial totals of landed catches (i.e., all fishing areas in B.C.) with record low catches being made. However, this was explained by government staff as resulting from a reduction in fishing, not a reduction in herring populations.

"The total herring-catch in British Columbia in 1950-51 amounted to 187,300 tons, about 1,900 tons less than the record catch taken in 1948-49. Intensive fisheries developed in the northern and central sub-districts... For the first time in nine years a fishery developed in the Queen Charlotte Island sub-district..."¹³

"...The 1950-51 west coast fishery yielded the smallest catch in the five-year period. However, it seems unlikely that the decrease in catch in the past season reflected a decrease in population abundance... The marked decrease in fishing effort strongly suggested that the smaller catch was directly caused by restricted fishing effort..."¹³

With the above citations, the report again appears to contradict itself in at least one key area. How can an intense fishery expansion into a new, northern area be construed as a lack of fishing effort? It is noteworthy that, despite adding a new northern herring

fishery, the overall provincial totals still tabulated all-time lows. This likely suggests that there was no reduction in

fishing effort but rather a broader issue with declining herring populations. This line of investigation was not pursued by the fisheries staff because the average number of fish in a seine net (often called a unit of effort), when hauled in, was roughly the same as previous years, with the exception of the central coast of Vancouver Island, where the average seine net haul was actually reduced. Still, there was an almost reprimanding hypothesis advanced by fisheries management that if effort had been increased, there would have been a higher landed catch to record.

Fishing techniques and efficiency of catch have increased over the decades. This increase in fishing efficiency should have been considered when assessing the ability to continually land full nets of fish. If effort is the only indicator used to determine the abundance of fish, this method would negate or mask any underlying decline in herring populations.

"In each of these sub-districts, the extent of spawning in 1951 showed a decrease over that in 1950, but the reduction in each case was not great..."¹³

"The upper east coast of Vancouver Island catch amounted to only 3,900 tons, well below the 10,000-ton quota. The quota on the middle east coast of Vancouver Island (10,000 tons) was reached, but only half of the 4,000-ton extension was taken... Catch per unit of effort on the middle east coast was considerably smaller... suggesting that population abundance was lower. The extent of spawning was less than last year on the upper east coast..."¹³

Despite continued declines and consistent concerns being raised over the years, in 1950, staff at the fisheries research station in Nanaimo, B.C. reviewed the previous eight years of herring data and concluded:

"...unrestricted fishing on the west coast had not affected population abundance adversely, and the fixed quota on the lower east coast had not stabilized the abundance there..."¹³

One year later (1951), the annual report of the fisheries commissioner recognized that population issues with herring were present within the west coast unrestricted fishery and that these population decreases were now placing increased pressures on the northern fisheries:

"For the first time since the present study began, there was a definite indication of a decrease in population abundance on the west coast. The slight increase in the west coast catch in 1951-52 over that of the previous year occurred in spite of a pronounced reduction in the abundance of the southerly west coast stocks (Area 23), and only because of a greater exploitation of the runs in the more northerly section..."¹³

The results of the 1951 annual fisheries report to the commissioner appeared to paint a fairly dire picture for the future of herring in B.C., identifying small catches, reduced spawning, and overall declining populations. The ultimate contributing factor of population decline continued to be explained as differences in recruitment of various age classes of fish into the herring grounds:

"The west coast fishery in 1951-52 (30,000 tons) produced the second smallest catch of the six-year period. Average catch per unit of effort was almost as high as in the years of greatest catch, a result considered to be due to exceptionally efficient fleet deployment rather than great population abundance. Extent of spawn deposition on the west coast in 1952 suggested that the amount of fish that escaped the fishery was less than in any year since 1947. Thus it appeared that population abundance was considerably reduced... Spawning data indicated that the main southern west coast stocks (Area 23) suffered relatively greater reduction than the more northerly west coast runs (Area 25). More intensive exploitation of the Area 25 runs occurred in 1951-52 than in the two previous years, principally because of the ten-day extension of fishing past the regular closure date of February 5th..."¹³

There was a major labour strike in 1952 among unionized fishers and various corporations. For this reason, although 1952 did have a record low catch, it cannot be said to have occurred solely due to population abundance issues – there were substantially less fishers on the water. Those that were on the water focused heavily on the southern east coast of Vancouver Island. This decision seems to have been largely driven by later seasonal movement of herring into the west coast fishing grounds and resulted in a heavier focus within the quota areas of the east coast populations:

“Exploitation has been consistently heavier on the lower east coast than on the west coast in spite of the catch quota regulations applied to the former sub-district. The low west coast exploitation is partly attributable to natural limitations to catch imposed by late inshore migration of runs to Area 25.”¹³

Due to the limited nature of intermingling within east coast populations and their inability to recruit substantial numbers of young fish from other transitory locales, fisheries staff made a point to comment on the potential for having protective measures for the east coast populations.

“Argument is advanced that some type of restriction may always be required on lower east coast catch (in addition to the official closing date prior to spawning) to maintain sustained production...”¹³

The labour strike was lifted by 1953 and fishing resumed with record high catches made in B.C. waters, especially within the Queen Charlotte Islands northern fishery.

“A record herring-catch of 210,210 tons was taken in 1953-54 in British Columbia waters...The non-quota fishery in the Queen Charlotte Islands sub-district was about two and a half times as great as in the previous best year (1951-52).”¹³

As the west coast fishery declined and the northern fishery continued to be subjected to intense fishing, rationales for possibly taking more fish from the east coast of Vancouver Island quota protected areas began finding their way into annual reports to the commissioner, despite a clear recognition that the east coast populations were vulnerable to overfishing:

“On the lower east coast, the present fixed quota has not apparently been effective in stabilizing population abundance...”¹³

“...there is...some evidence that suggests that some form of restriction may be necessary to conserve this population. The single inshore migration route, together with the early time of migration, may render this population particularly vulnerable to fishing.”¹³

“It was pointed out that the single migration route and early inshore migration render this population vulnerable, and that exploitation could readily be increased, possibly to a point detrimental to the stock.”¹³

Significant fisheries management changes took place in 1954. A change in research staff resulted in the termination of the west coast unrestricted fishery experiment. In addition, the annual provincial catch was at an all-time low, resulting in the expansion of the fishery into new areas, as well as a quota extension along the east coast of Vancouver Island in an attempt to raise the landed total catch:

“The herring-catch in British Columbia waters in 1954-55 amounted to 169,163 tons, the smallest catch since 1946-47. The catch on the west coast of Vancouver Island was the lowest since 1943-44. In the northern sub-district the quota was not taken or approximated for the first time since 1947-48. In the central sub-district the quota was not taken

for the second year in succession, and the catch was less than in 1953-54. In the upper east coast sub-district the catch was the largest since 1940-41, and resulted primarily from the exploitation of new fishing-grounds in Seymour Inlet and Nugent Sound. Quota extensions of 15,000 tons were granted in both the middle east coast and lower east coast of Vancouver Island sub-districts. In the non-quota fishery in the Queen Charlotte Islands sub-district, almost the entire catch came from Skidegate Inlet, where a major fishery developed for the second year in succession...”¹³

After nearly a decade of unrestricted fishing (1946-1955), it was determined that the obtained results were unsatisfactory—therefore the study was abruptly ended in 1954:

“...The ultimate aim of the research is to gain vital information on fundamental fisheries problems with a view to enabling a closer approach to maximum sustained yield of herring resources... Specific information is required on how much the spawning stock can be reduced without decreasing eventual recruitment, on what natural limitations are imposed on the exploitation of herring... Furthermore, potential benefit to the fishing industry is seen in the development of a sound basis for prediction of population abundance, and in the investigation of factors influencing the availability of herring to the fishing fleet...”¹³

“...it was thought better to end this study and to institute at a later date, and in an area where higher fishing intensities could be more readily obtained, a controlled experiment designed to produce the desired results in a more definite period of time.”¹³

“...In both populations it was found that no direct relationship existed between the amount of spawn deposited and the size of the resulting year-class and that the fluctuations in year-class strength were more readily explained by variations in natural factors affecting survival than by any effect of fishing...”¹³

Between 1955 and 1957, the Queen Charlotte Islands (now Haida Gwaii), would be subjected to continued intense fishing, producing record catches. Simultaneously, the lower central, middle, and lower east coasts, and upper west coasts of Vancouver Island would continually experience poor herring catches. By 1957, the fisheries commissioner reported, “In 1956-57 the total catch was 177,087 tons, the lowest since 1947-48, a decrease of 29 per cent from the record catch of 1955-56.”¹³ The low level of herring populations was determined, not to be the result of overfishing, but rather a result of poor contributions of three and four-year-old fish, broadly speaking. (i.e., those just reaching sexual maturity). Some areas were described as having an average population strength.

CUMULATIVE EFFECTS ON POPULATIONS BEGIN TO SHOW (1960S-EARLY 1980S)

It took another decade (1957-1967) of intense fishing and technological advancements to fishing practices to decimate herring populations (figure 9). As fishing techniques advanced, so did the landed catches:

“In 1962-63, record catch of 264,000 tons was taken, followed by a near record 260,000 tons in the following season. (The previous record of 251,000 tons was set in 1955-56 when an isolated incidence of phenomenal abundance in the Queen Charlotte Islands produced a catch there of 92,000 tons).”¹³

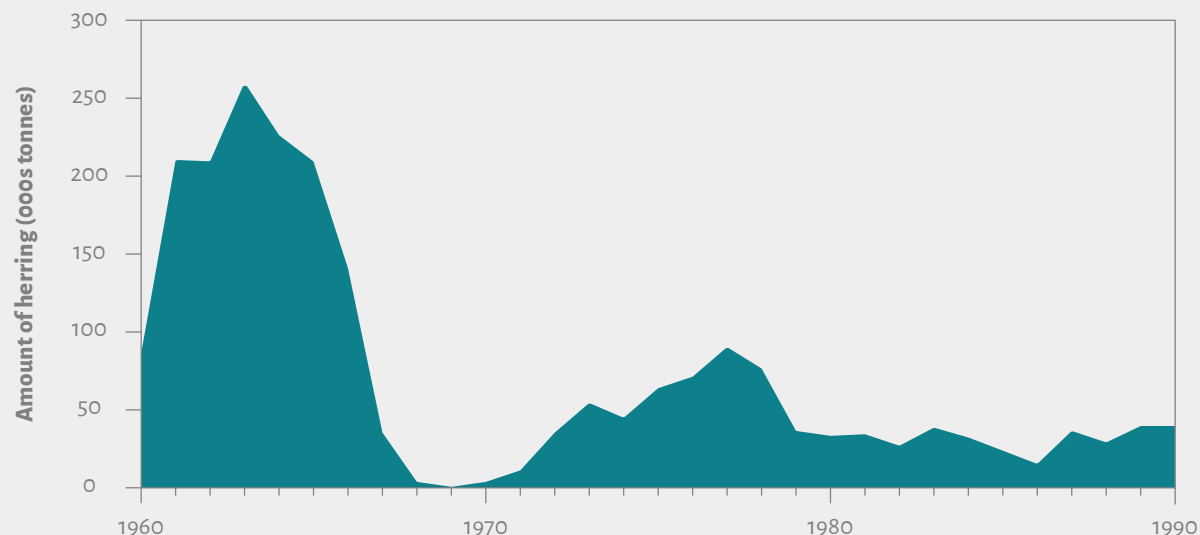


Figure 9. Commercial catch of Pacific herring stocks (1960-1990). Source: Fisheries and Oceans Canada, Nanaimo, BC

“During most of the 1964-65 season, a good catch (241,000 tons) was taken, but the fishermen had more difficulty in locating quantities of fish. Spawn deposition was down somewhat (especially for the heavily exploited stocks on the Lower East Coast of Vancouver Island). This trend continued for the following two seasons, when the catches were 181,000 and 135,000 tons, respectively.”¹³

However, by 1967 herring populations had collapsed in most places and the fishery was closed. Fisheries managers at the Nanaimo Biological Station specifically noted a reluctance to recognize early warnings of population decline:

“The proportion of small, immature fish in the catch rose noticeably. In spite of these ominous indicators, there was a reluctance to believe that these herring populations could be

overfished since they had supported large and almost unrestricted catches for over two decades...

...However, fishing efficiency had increased to the point where a sharp decline in abundance resulting from the recruitment of a series of poor year-classes in the mid-1960s had relatively little effect on the ability of the fleet to maintain catches at their former levels. Finally, when the downward trend continued in 1967-68, the fishery was closed early in the season.”¹³

Previously, this paper introduced the metric referred to as a *unit of effort*, and illustrated how advancement in fishing techniques could lead to a false perception that herring populations were stable, when in fact they were declining. Put simply, just because a fisher hauls up roughly the same number of fish in a net, does not mean there are the same

number of fish in the sea, particularly when the technology evolved during this time. To place this into perspective, the use of high-powered lights during the late 1950s-early 1960s, as herring populations were declining, coupled with larger nets and faster hydraulic drums, resulted in an increase in catch, and consequently an increase in unit of effort. However, the increase in catch was not due to a surge in population abundance—the grim reality was quite the opposite:

“Trawling for herring commenced in the 1950’s. Innovations in fishing techniques that have increased fishing efficiency include the use of echo sounders and radiotelephones in the 1940’s, powered hauling blocks in the 1950’s and drum seines and powerful lights to attract herring in the 1960’s. Throughout the years the number and size of the vessels have also increased. This increased efficiency resulted in a higher exploitation rate which coupled with the appearance of a series of poor year classes caused a sharp decline in the abundance of stocks in the mid-1960’s. The decline continued and resulted in the closure of the reduction fishery in 1967–68.”¹³

“As demand increased, the fleet ranged farther afield and by 1940, virtually the entire coast was being extensively fished. The introduction of echo sounders and radio-telephones in the 1940s, powered hauling blocks in the 1950s, and sonar, drum seining, and mercury arc lights (to attract fish) in the 1960s, increased the catching capacity of the fleet. In addition, larger, faster vessels decreased the amount of time lost for travel and weather.”¹³

The reprieve that herring received from commercial exploitation was indeed brief. Although some Indigenous food and traditional roe on kelp fishery continued during the 1960s closure, herring as a food fish dramatically changed between 1946 and 1967 as the fishery switched from a wartime food fish to herring roe as a delicacy overseas. By 1971, a shortage of herring throughout the world resulted in a high price for herring roe in Japan:

“Herring roe is considered to be a great delicacy by the Japanese people and commands a high price. Consequently, during the 1971 season, in addition to the small traditional food and bait fishery that was allowed to continue operating throughout the closed period, a new fishery became established for roe herring.”¹⁵

“The herring food fishery is overshadowed by the very lucrative and dramatic roe fishery. Landed price for food fish have generally been one-fifth of prices paid for roe fish.”¹⁵

For more than a decade (1971–1981), the roe fishery would target spawning herring in shallow sensitive spawning habitat, not for fish meat but for eggs and only to service the overseas delicacy market:

“To satisfy the Japanese market, herring roe must be at the right stage of ripeness. This stage occurs just prior to spawning and lasts only for a few days. Consequently, roe fisheries are conducted on or adjacent to spawning grounds.”¹⁵

“The main advantage of fishing roe herring by gill net is that the nets can be set near spawning grounds, intercepting only ripe herring about to spawn ... The main advantage of the seiners is their ability to catch large quantities of fish in a short time in a small area. Consequently, gill nets are most effective when spawning is spread over a longer distance of coastline and continues for several days (e.g. the east coast of Vancouver Island).”¹⁵

As the herring roe fishery advanced in the early 1970s, so too did the methods of catch and market pressures overseas, resulting in an ever-increasing roe fishery catch. The carcasses of the fish, once stripped of their eggs, would be sent for reduction and turned into chicken food:

“The need for shallower seines and quicker sets has brought drum seiners (Fig. 13) into prominence, although table seiners with power blocks are also quite effective. Seiners usually take between 50 and 150 tons in a set but sets of up to 500 tons are taken occasionally.”¹⁵

“Gill nets are fished from aluminum skiffs developed especially for this fishery... Improved technology has produced larger skiffs with powered pullers and shakers and their own fish finding, radio telephone, and other electronic aids. Such skiffs may take 8 tons over a 24 h period when fishing is good.”¹⁵

“In the 1st yr of the roe fishery (1971) 11,000 tons was landed. The catch increased to 38 000 tons in 1972 and to 56 000 tons in 1973. It remained in the 50,000 ton range over the next 2 yr and then jumped to 87,000 tons in 1976. In 1977 and 1978, the roe catch declined to 81,000 tons and 70,000 tons, respectively, as catches by other fisheries on these stocks went up. In 1979, the catch dropped to 45,000 tons following a period of low survival during the early stages of the life history.”¹⁵

“The carcasses remaining after extraction of the roe are processed into fish meal, mostly for use as poultry food. Up to 9,000 tons of meal are produced from this source annually.”¹⁵

COMPLEX FISHERIES MANAGEMENT STRUCTURES (1980S-PRESENT)

When archival context is considered, there is little doubt that conservation concerns have been raised from nearly the beginning of the Pacific herring fishery, but these concerns have been sidelined in B.C. fisheries management practices in pursuit of maximum catch for over a century. In the early 1900s and 1930s, fisheries managers were directly responsible for the fishery and had wide latitude to raise conservation concerns and recommend closures in official government reports. Even during wartime, when quotas were eliminated to oblige the need for military rations, herring research and spawn monitoring continued under the direct line-of-sight management of fisheries staff. However, even though the post-war years showed continually declining populations, conservation took a back seat to mounting industry pressures to maintain the maximum possible catch – not for food, but for overseas delicacy markets. Arguably, justifying commercial exploitation during clear population declines became an ever-increasing difficult task for industry and government personnel.

Simultaneous to the advancement and continuance of the herring roe fishery during the 1970s and 1980s, the modern computer age and corporate management structures began to form and found their way into the herring fishery with working group reports beginning to include computer simulated herring models in 1986.¹⁶

By March 1986, herring fishery management in B.C. had become so complex that discussions with fisheries managers in working groups concluded that no one person was responsible for the fishery anymore; rather it had become a complex system of integrated government bureaucracy and industry personnel, resulting in complex field processes:

"The herring fishery in British Columbia is based on the harvest of a fixed quota of 20% of the forecast run ... The dissemination of necessary information to and shared

responsibility of those involved in every aspect of the fishery are vital in managing the fixed quota ... Difficulties which have existed in the management of this fishery have largely been related to lack of communication and understanding between field staff, managers and researchers responsible for stock assessment...

The fixed quota determined pre-season and area-specific licensing obviated the latter difficulty; the isolation of management groups was a greater problem and was addressed by the formation of the three herring groups. Meetings between researchers and senior management had been part of the planning process; but the formalizing of these groups in 1982 with their more diverse representation and the greater involvement of the herring coordinator marked the beginning of the system developed to date.

The individuals comprising the Stock Assessment Committee (S.A.C.), Herring Working Group (H.W.G.), and Herring Industry Advisory Board (H.I.A.B.) come from sectors each with

*its own area of responsibility and interest (Fig. 1). Fishery officers, district staff, management and research biologists and industry representatives participate in the process overseen by the Herring Coordinator [Fig. 2 flow chart removed for space]. The Herring Coordinator is responsible for organizing the process; he must be knowledgeable about every aspect of the fishery, credible to industry and able to maximize the talents of management staff. It is the consensus from these many perspectives along with the responsibility of each group for its task which are the backbone of the management system."*¹⁶

The 1986 herring management structure report went on to provide a complex and detailed description of each role and position within the various herring groups. The complexity of herring management would continue to grow through the 1990s.

However, in the 1990s, a major shift took place. A major research project was sponsored by the federal government which reviewed and synthesized all herring tagging informa-

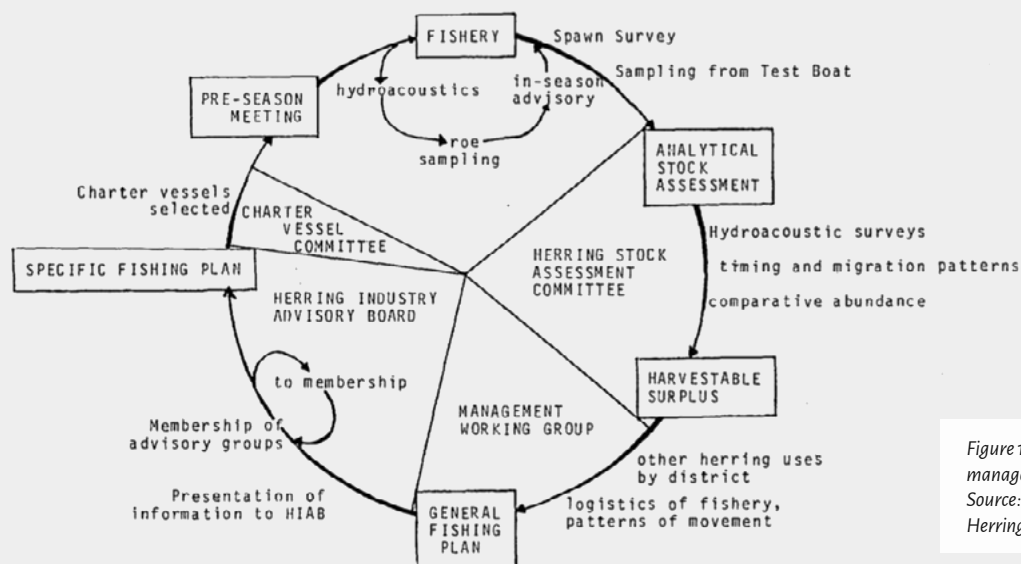


Figure 10. Structure of herring management in British Columbia. Source: Figure 1 in the 1982 Herring Stock Committee Paper.



Figure 11. Almost every herring fishery in British Columbia has been closed due to population abundance concerns. The Strait of Georgia fishery along the east coast of Vancouver Island continues to be the exception.

tion between 1936 and 1992.¹⁷ The report *Pacific herring tagging from 1936-1992* was published in 1999 and advanced the concept that some herring do not migrate and then back “home”, but rather, that for some populations they may in fact never actually leave their area – resulting in a true non-migratory population that requires special protective measures.

“Presently, there are concerns that [sic] may be distinct stock units within the 5 major assessment areas used to manage the B.C. herring roe fishery...is [sic] also seems clear that a few herring do not move. Some individuals were re-captured in the same sections or even locations years after they were released into those same areas. This implies a very high fidelity rate for some individuals...may reflect the life history of a non-migratory or sedentary fish that never really leaves the area...may reflect the movements of ‘migratory’ fish versus ‘non-migratory’ fish.”¹⁷

“The issue of the status of non-migratory herring may be the most significant problem for current herring management. Although recent stock sizes and spawn deposition is high... there has been a marked reduction in the amount of herring spawn in some areas...and an apparent decline in the numbers that spend summers in the SOG [Strait of Georgia]. One potential explanation for this is that non-migratory herring represent distinct biological stocks, perhaps genetically differentiated, and that their numbers have declined...”¹⁷

In addition to the above comments, the discussion section of the report advanced alternative theoretical concepts in an attempt to explain population declines. Ultimately, the authors concluded that further research needed to be conducted into non-migratory herring populations and the possibility that adverse effects to non-migratory species were taking place. The authors found that regional boundaries may be incorrectly excluding non-migratory populations from management estimates thereby inappropriately allowing non-migratory herring to be overfished.

In late 1999, the Pacific Scientific Advice Review Committee (PSARC) reviewed the paper and declined to intervene:

“The Subcommittee does not recommend any changes to the stock assessment boundaries based on this paper. More work from other studies is required, and therefore it would be premature to adjust boundaries at this time.”¹⁸

Despite this missed opportunity, a summary of reviewer comments is available in the PSARC discussion paper and is of interest, with blind reviewers noting that the concept of non-migratory herring is a worthy research pursuit:

“...concluded that the paper dealt more with the broader question of stock structure and management units...Reviewer A felt that the suggestion of migrating and non-migrating herring within areas is significant, and that it requires more research...Reviewer B indicated that because of a discussion about the management implications of non-migratory versus migratory herring stocks, the authors should provide specific analysis and examples that address this issue in the results section. He implied that this was an important point...”¹⁸

The roe fishery was maintained through the early 2000s and continues today under complex management system structures known as Integrated Fisheries Management Plans (IFMP). These plans are largely similar in format to their 1980 precursors, with various industry representatives and a large array of subcommittees, reviewers, and other processes all providing input into what becomes a fairly complex annual document.

Throughout the early and mid 2000s, intense fishing pressure continued. As of the date of this paper (2021) almost every herring fishery in British Columbia has been closed due to population abundance concerns. The Strait of Georgia fishery along the east coast of Vancouver Island continues to be the exception.

CONCEPTS OF FISHERIES MANAGEMENT

There are two main underpinning conceptual frameworks at play in historic and modern fisheries management planning. One principle is known as the best use principle formerly referred to as the principle of maximum sustainable yield (MSY). The other more modern principle is called the *precautionary principle*. Federal fisheries staff in the 1980s based their harvesting of herring on the concept of 'best use'. Research, quotas, cut-off levels, and stock assessments were founded by this principle. Fisheries staff, Hourston & Haegele (1980) provided a synthesis of the conceptual framework underpinning the historical and 1980s herring management efforts:

*"Prior to the closure of the reduction fishery, the fisheries on Canada's west coast herring resource were managed on the principle of maximum sustainable yield (i.e. to take as great a tonnage of fish as possible on a continuing basis). As the stocks recovered from their decline in the mid-1960s, this approach was replaced by the "Best Use" principle. The new approach was concerned with maximizing the value to the Canadian economy (by processing the annual catch into quality products which demand a high price on world markets), diversifying the markets for the products (to provide more stability to the industry), and promoting jobs for Canadians (by increasing the amount of processing done in Canada)."*¹⁵

Current fisheries management planning is still conducted under various complex annual processes which produce a yearly IMFP. These modern planning processes are now based on the precautionary principle. As of 2020, the precautionary principle is described as:

"The Department follows the Sustainable Fisheries Framework (SFF), which is a toolbox of policies for DFO and other interests to sustainably manage Canadian fisheries in order to conserve fish stocks and support prosperous fisheries... In general, the precautionary approach in fisheries management is about being cautious when scientific knowledge is uncertain, and not using the absence of adequate scientific information as a reason to postpone action or failure to take action to avoid serious harm to fish stocks or their ecosystem... Applying the precautionary approach to fisheries management decisions entails establishing a harvest strategy that:

- ◆ *identifies three stock status zones—healthy, cautious, and critical—according to upper stock reference points and limit reference points;*
- ◆ *sets the removal rate at which fish may be harvested within each stock status zone; and*
- ◆ *adjusts the removal rate according to fish stock status variations (i.e., spawning stock biomass or another index/metric relevant to population productivity), based on pre-agreed decision rules."*¹⁹

The intention of the IFMP precautionary principle is to provide a framework that, in theory, is reflective and adaptive in nature (i.e., responding to changes as they occur). It is recognized that nature and environmental factors are not always predictable with computer models:

*"...to keep the removal rate moderate when the stock status is healthy, to promote rebuilding when stock status is low, and to ensure a low risk of serious or irreversible harm to the stock. A key component of the Precautionary Approach Framework requires that when a stock has declined to the Critical Zone, a rebuilding plan must be in place with the aim of having a high probability of the stock growing out of the Critical Zone within a reasonable timeframe..."*¹⁹

However, the predicating factor in both the Precautionary and Best Use principles is still designed to fish the maximum possible catch each year. If fisheries managers fail or refuse to recognize non-migratory populations as genetically or behaviourally distinct, then those populations get lumped into the larger census for modeling and quota determination, and don't need to be "managed" as distinct. Put more simply, you cannot manage a population that is not recognized as existing in the first place. With this approach, another principle comes into play here—the *out of sight out of mind principle*. As a result of neglectfully ignoring the existence of localized, non-migratory populations of Pacific herring, Fisheries and Oceans Canada has managed to skirt the need for implementing rebuilding plans, avoided needing to report these stocks as being low or in some cases, decimated, and it has fundamentally given permission to say there can be no irreparable harm because they do not exist.

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Conclusion

From literal warzones, to court room battles and the frontlines of scientific debate, herring have played a pivotal role in the development of human society and progression of acceptance and understanding of Indigenous cultural practices and rights. Despite the big role this little fighting fish has played, herring need our help to fight for their survival now. Currently, we are managing herring to economic and biological decimation. Fisheries managers continue to ask the question “how much can we keep taking, what is the maximum we can take?” The concept of *science* is being reduced to the consideration of the pursuit of identifying the maximum possible damage a population can sustain. Fisheries managers are not asking novel questions about the species or individual fish that make up non-migratory populations. Managers don't ask questions like “Do non-migratory herring speak to migratory cousins when their populations are approaching extinction?” Or, “as intense fishing is experienced in one area and populations deplete, do the fish try to speak to each other and recruit individuals in order to survive?” Nor do managers ask, “is population intermingling correlated to fishing pressures from previous years? Do fish discuss their survival and the needs of other marine predators with each other?”

A critical fisheries management approach based on true precautionary principles would focus back on the fish instead of continually trying to identify the “maximum yield” or “maximum escapement” for human benefit. Focusing back on the fish and adopting true precautionary principles would seek to manage herring for “maximum population presence” along the B.C. coast. The use of scientific method should not be co-opted solely for industrial gain. Fish science should pursue novelty of the unknown, and to be certain there is much we do not know about non-migratory Pacific herring, B.C.'s fighting fish.

As this paper has revealed, the archives and fisheries management's own historical records substantiate that non-migratory herring do exist as specialized local populations with minimal mixing with other localized populations and should therefore require specialized management considerations. The fisheries documents excerpted in this paper also show that managers have long been aware of the management implications, both economically and environmentally, should non-migratory populations ever be formally recognized.

In 2020 only one small area between Hornby and Denman islands in the Strait of Georgia—only one spot along the northern Pacific Coast from Puget Sound to Alaska—a distance spanning 1,000 nautical miles, was deemed by DFO to have enough population abundance, to be opened for a commercial herring kill fishery. And even in this instance, DFO ignored the recommendation of its own scientists who were calling for the 20% quota to be halved to 10% this year, all in the economic pursuit of maximum catch.

As long as governments and industry continue to use IFMPs, only count Pacific herring as one population, and program their computer modeling to perpetuate a flawed one-goal model



Figure 12. A black bear feasting on herring eggs.

to maximize annual catch, herring along Canada's west coast will teeter on the edge of complete collapse. Without determining Pacific herring's full value as a foundational species in the marine ecosystem, without understanding and fully evaluating its correlation to the endangered status of Chinook Salmon and orca whales, the writing is on the proverbial wall for the future of the north Pacific marine ecosystem.

For more than 100 years, this species has been tagged, studied, chased, targeted and hunted to the precipice of extinction. Without immediate, drastic conservation measures which must include a complete moratorium on the kill fishery—at least until populations have rebounded and science has had a chance to catch up, Pacific herring will remain in peril as will every other species in the marine food chain that relies on herring for its survival. The future management of fisheries must be overhauled and recalibrated to utilize an holistic analysis of the entire ecosystem vs the species by species approach, and the valuation of a species cannot be calculated solely for its commercial economic exploitation. We need to scientifically measure and know how many herring Chinook salmon need to survive. We need to scientifically measure and know how many Chinook salmon need to be left in the ocean for orcas to survive. We need to methodically wrestle these questions and be scientifically satisfied with the answers before we fish the ocean to extinction.

References and Further Reading

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