The Salt Cod Saga: Examining Drivers of Decline in the Pacific cod Fishery (1915-1940)

by

Karoline I. Moore

B.A., Capilano University, 2020

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We acknowledge and respect the Lək^{w}əŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək^{w}əŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

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Abstract

Marine historical ecology and environmental history aim to reconstruct past fisheries to reveal ecological changes and human-ocean relationships. Most existing research emphasizes prominent fisheries with lasting economic and cultural impacts, often overlooking lesser-known fisheries, such as the early 20th-century Pacific salt cod fishery. This fishery operated in the shadow of the dominant Atlantic cod, failing to gain similar significance, and has remained largely understudied.

This research investigates the sociopolitical factors influencing the decline of the Pacific salt cod fishery in the 1930s, while also examining the changing relative abundance of Pacific cod during its operation. Utilizing the historical journal *Pacific Fisherman*, which documented contemporary fishery operations, this research identifies key constraints: limited markets, shifting consumer preferences, and high operational costs hindered mechanisation and product competitiveness in a changing societal landscape. Furthermore, localized depletions and a trend of decreasing fish body size occurred during the fishery's lifespan. The results suggest that the fishery's failure was profoundly shaped by its societal, political, and temporal contexts, particularly as it declined while other fisheries industrialised. This thesis addresses the gap in literature concerning the decline of the Pacific cod fishery and contributes to the understanding of lesser-studied, pre-industrial fisheries. It offers valuable insights into the importance of reconstructing historical fisheries data, especially when such data are scarce.

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Dedication

In cherished loving memory, this thesis is dedicated to my mother-in-law, Mary Haskell Harris.

"How lucky am I to have someone that makes saying [see you later] so hard?"

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Chapter 1: Introduction

"The dawn is beautiful up here, air is fresh and the sun comes up in a blaze of color, it tints the water lavender and pink and a pretty shade of green. About the time one starts to contemplate nature and all her beauties, a [fish] hooks up on one's line and there one is!"
– Donald McInturf, radio operator of the *Wawona*, 1936.[1]

Lutefisk, klippfisk, bacalhau, baccala, morue, buljol – cod fish cured in salt is known by people of varying cultures, languages, economic statuses and regions. labels attributed to salt cod, spanning diverse linguistic and cultural contexts, attest to its global significance. The historical importance of salt cod spans centuries, evidenced by its presence in Basque folklore, historical literature, traditional dishes and folk music (Kurlansky, 1997; Narváez, 1997; Francis, 2022). Cod has been memorialised in people's minds globally, but much of the product we remember as 'salt cod' is Atlantic cod (*Gadus morhua*). Salt cod was also produced in the Pacific, but few fisheries have been able to attain parallel notoriety and societal reverence as Atlantic cod.

The Vikings and Basques are considered the early European pioneers of cod production; in the barren landscapes of Greenland and Iceland, drying the low-fat fish by wind enabled their lengthy expeditions, while the Basques cured the fish with salt and created a product more suitable to trade (Kurlansky, 1997:22). In medieval England, cod catches increased in roughly 1000 CE, and 13th-century London saw a marked increase in cod imports (Barrett *et al*., 2004; Orton *et al.,* 2014). In 1497 when John Cabot opportunely stumbled upon Newfoundland, Canada and "claimed" it for the British, he reported the abundance of cod as evidence of the value of this 'New Found Land' (Kurlansky, 1997:28-29). Salt cod is mentioned in *Don Quixote*, an influential early

[1] McInturf, D. (1936:19). This quote comes from the diary he kept as the radio operator aboard the Wawona in 1936. Access provided by Northwest Seaport Maritime Heritage Center.

17th-century novel, and Alexandre Dumas' *Le Grand Dictionnaire de Cuisine*, written in 1873. Salt cod even played a part in the expansion of the Transatlantic slave trade in the Caribbean as an affordable food product to feed enslaved Africans (Francis, 2022). While many enslaved people in the Caribbean harvested sugar cane, some in Barbados harvested salt, the resource that was used in the Northwestern Atlantic cod fisheries to cure the cod sent to the West Indies, feeding the very people who had harvested the salt in the first place (Kennedy, 2007:217). When the Northwestern Atlantic cod fishery collapsed in the 1990s, musicians in Newfoundland poeticised their communities' response to the fishery's collapse – an industry which had been woven into their social and economic fabric – through traditional folk songs like Shelley Posen's 1996 "No More Fish, No Fishermen" (Narváez, 1997). In his song, Posen narrates the difficulty experienced by coastal Newfoundland communities following the fishery's collapse: "What will become of people now? / Try to build a life somehow / Hard, hard times are back again / No more fish, no fishermen" (Posen, 1996). The history of Atlantic salt cod is an extensive tale of consumer demand for shelf-stable, Lent-friendly, and affordable food, the reality of coastal communities being culturally entwined with and economically dependent upon a single resource, and retrospectively, a warning: integral fisheries collapse when the species is overfished, leaving decades of socioeconomic and ecological ripples in their wake.

Atlantic cod is invariably an example of a successful fishery, evidenced by its cultural and economic value and its prominence in research. Atlantic salt cod has been the focal point of several books (Innis, 1954; Kurlansky, 1997; Rose, 2007). Particularly popular of these has been Mark Kurlansky's, *Cod: A Biography of the Fish that Changed the World* (1997), which traces the global significance of the Atlantic cod fisheries and their role in shaping economies and cultures. Atlantic salt cod has also been explored in chapters within environmental, cultural and linguistic history

books (Ryan, 1980; Sutton, 2011; Test, 2011). In a book on early modern English literature (ca. 1550-1700), Edward Test's chapter on Shakespeare's *The Tempest* explores how the beastly 'Caliban' – a half-human, half-fish creature – would have easily been recognized by a contemporary audience as a salted cod fish (2008:201). The Atlantic salt cod fishery has similarly been explored in numerous academic publications (Lear, 1998; Schijns *et al.*, 2021; Welker & Quintana Morales, 2022). Beyond the fishery, Atlantic cod are well-studied: In a study of over 10,000 species, Donaldson *et al.* (2017) found that Atlantic cod were among the most-studied fish species, and similar studies have found that the most frequently studied group of marine fish species are Salmonidae, followed by Atlantic cod (Jarić *et al.*, 2012; Aksnes & Browman, 2016).

In contrast, scholastic research into Pacific cod (*Gadus macrocephalus*) is relatively limited. A Scopus search for 'Pacific salmon' retrieves 2,420 results, and 'Atlantic cod', 4,527 results; in contrast, searching 'Pacific cod' retrieves 526 results. Although Pacific cod are not entirely neglected – in particular, palaeoecological, archaeological and biological aspects have been thoroughly examined (e.g., Alderdice & Forrester, 1976; Moss, 2011; Betts *et al*., 2011; Bian *et al*., 2016) – there is a notable gap in the research on its 20th-century history, specifically using written documents. Modern catch data from the National Oceanic and Atmospheric Administration (NOAA) dates to 1977 (NOAA Fisheries, 2022), but the commercial fishery began in 1865 (Cobb, 1916; Mackovjak, 2019), creating a century-long gap in the record. Several historical reports have offered valuable insights into the Pacific cod fishery (Bean, 1880; Cobb, 1916; Cobb, 1927), and modern books have synthesised these accounts with contemporary literature to explore changes in the fishery over time (Shields, 2001; Mackovjak, 2019). However, research specifically addressing the salt cod era (1865 to 1950) constitutes only a small portion of the broader body of Pacific cod research. When the quantity of Pacific cod research is considered against research on species

supporting globally recognized fisheries, an evident trend emerges: well-known fisheries receive more scholastic attention.

Studying the early 20th-century salt cod fishery in the Pacific is important because the fishery experienced an unexplained decline in landings in the 1930s. Because Pacific salt cod had a much smaller, geographically limited economic impact, there is limited understanding of the historical fishery. Uncovering historical precedents in this fishery is relevant to creating a holistic understanding of the fishery's operations today, particularly following the series of marine heat waves in Alaska in the 2010s known as 'The Blob'. An estimated 100 million cod died as a result and abundance decreased by 67 per cent; because of this, the total allowable catch in the fishery was reduced by 80 per cent, and the fishery experienced a temporary closure in 2020 (Seung *et al.*, 2021). Therefore, exploring historical precedents of fishery decline (and the preceding events that led to the decline) has become more important than ever.

In this thesis, I examine the sociopolitical drivers behind the decline of the Pacific cod fishery in the 1930s, as well as discuss evidence of cod population depletions between 1915 and 1940, through a mixed-method approach using articles in the historical fishing journal, the *Pacific Fisherman*. This journal was published between 1903 and 1966 to share information about West Coast fisheries with key stakeholders – notably, fishermen and fishery managers. Historical texts situated within a fishery's temporal setting have proven to be a valuable resource in reconstructing past fisheries and ecosystems (see Lotze & McClenachan, 2013). My work aids in filling the gap that exists in the scholarship on the historical Pacific salt cod fishery, particularly in understanding historical precedents of fishery decline, and adds to the growing body of literature on fisheries that collapsed prior to industrialisation. Chapter 1 introduces fisheries research in marine historical ecology and marine environmental history, its focus on globally successful fisheries, and how

contextual social and climatic dimensions – or the absence thereof – contribute significantly to a fishery's success or failure. My thesis fills a gap in the literature on the fishery's salt cod era decline and contributes to the literature on lesser-studied fisheries with important insights into the interplay between environmental and social factors that influence fishery sustainability.

1.1 Environmental History of Fisheries

W. Jeffrey Bolster says, "The ocean has a history, [and] those histories are worth reconstructing" (2006:570). This is the common sentiment in marine environmental history, where scholars seek to reconstruct past human relationships with one another and the ocean itself. Concern over environmental change has existed for centuries, but the role that humans have played in changing our environments developed significantly in the 20th century, particularly following Rachel Carson's 1962 book *Silent Spring*. Environmental history as a discipline, which examines historical human interactions with our environments, is cited to have begun in 1972 following the publication of Roderick Nash's *American Environmental History: A New Teaching Frontier* (Locher & Quenet, 2009). Within environmental history, marine research has been a lesser-explored area which centres upon human relationships with marine ecosystems over time and the social dimensions of fisheries (Rozwadowski, 2013). Marine environmental historians contribute valuable insights into human-ocean relationships and how historical fishing practices have shaped marine ecosystem changes over time. One of the most significant contributions of marine environmental history is in deconstructing the historical opinion that, unlike terrestrial landscapes, oceans are eternal, inexhaustible, and unchanging, holding infinite bounties that can be harvested without repercussion (Carson, 1951; McEvoy, 1990; Bolster, 2012). Unfortunately, by the time this fallacy had been recognized, marine ecosystems had already undergone centuries of extensive restructuring, in part due to climatic change, but also largely due to human interaction. Although

historical changes to terrestrial ecosystems have been well studied, in part due to their visibility, historical changes to marine ecosystems have received less attention. Herein lies the importance of marine environmental history: reconstructing past relationships between humans and the ocean increases our understanding of where, why, and how marine ecosystems were changed in response to human needs.

Several recent works underscore the interconnectedness of marine resource exploitation and environmental change, but historical research has often been conducted from disparate disciplines. Bolster, a maritime historian, highlights the unique value that historians add as appreciators of archival documents, particularly when fisheries managers are tasked with rebuilding depleted marine populations solely with recent data (2006). From the literature on the environmental history of fisheries, several works have stood out as foundational. Arthur McEvoy's *The Fisherman's Problem* (1986) examines legal, cultural and ecological factors in California's historical fisheries, and how policy has influenced the state of marine environments. *The Fisherman's Problem* is considered ground-breaking because, rather than conducting his research from one disciplinary point of view, McEvoy examined how the cultural, economic and scientific facets of fisheries are inextricable and mutually reinforcing. Joseph Taylor's *Making Salmon* (1999) includes an in-depth examination of the environmental and sociopolitical factors leading to the modern-day depletion of Pacific salmon, known as the Pacific salmon crisis. Bolster's *The Mortal Sea* (2012) is a comprehensive analysis across several centuries of the ecological impacts in the Atlantic Ocean caused by fishing. While there are many other works which discuss the environmental history of fisheries, these specific works provide a foundation for my research and underscore the importance of historical context in understanding the sustainability and resilience of fisheries. The aforementioned authors demonstrate the value of incorporating a fishery's

sociotemporal context in examining how past human activities and ecological shifts inform contemporary challenges in marine conservation. In particular, Taylor says that "in popular usage, we tend to extract fishing from its social and ecological context," when fisheries research must be contextualised by a fishery's sociotemporal and ecological settings (1999:66).

While these works have made valuable contributions to the field, the scholastic disparity formerly mentioned is tangible. Well-known fisheries like Atlantic cod and Pacific salmon have taken centre stage, while lesser-known fisheries with minimal economic or cultural impact have faded into the literary background. "McEvoy and Taylor start with an *a priori* assumption," says Glenn Grasso in his exploration of the historical Atlantic halibut fishery, "that the fish populations in question already possessed market desirability" (2008:68). Grasso's research diverts from the mainstream because Atlantic halibut was not economically significant long-term, regulatory structures came after the fishery's nascence and death, and mechanisation, which he calls "the usual bogeyman of overfishing," did not contribute to the fishery's decline (2008:67). This history mirrors that of the 20th-century Pacific cod fishery, but also points toward a larger issue: subjective human valuation of nature – where resources are either considered "valuable" or "worthless" – shapes how landscapes are altered, and resources are exploited. Valuable resources become subject to "enthusiastic harvesting," while 'worthless' space becomes intentionally altered to have perceived value, like areas sacrificed for landfills (Grasso, 2008:67). This valuation has become similarly apparent in fisheries scholarship: "valuable" fish are enthusiastically examined, while fish that receive little extractive attention also receive less scholastic attention.

Within the literature on the environmental history of fisheries, several recurring themes emerge. First, various works echo the sentiment that marine fisheries, despite efforts to manage them, exist within uncontrollable environments (McEvoy, 1986; Bolster, 2006). McEvoy

highlights that “some environmental changes that impinge on the productivity of fisheries occur in nature without reference to human activity, as when currents shift or the weather changes” (McEvoy, 1986:7) Change below the surface has historically been invisible, and the complexity of marine food webs – where multiple species occupy the same trophic level – further complicates the identification of direct and indirect effects of fishing. Similarly, marine ecosystems today have undergone centuries of ecological restructuring through both direct (i.e., fishing) and indirect (i.e., climate change) human interactions, and as such, have been subject to both natural and anthropogenic change. Identifying an ecologically viable yield for a species’ harvesting can be challenging when a marine ecosystem undergoes change separate from human influence. Marine environments are in constant flux, and as such, determining a sustainable yield from a marine fishery is more like “predicting the weather… [than] the sustainable yield of guppies from a well-managed aquarium” (McEvoy, 1986:7). In other words, the ocean is largely uncontrollable – constant change is a facet of marine ecosystems – and as such attempting to determine the number of fish to be removed that will not interfere with a marine ecosystem’s function is a challenge.

Marine environmental historians have also inferred that humans have exceptionally poor long-term memory (Taylor, 1999; Bolster, 2006). As new generations of fishermen take to the seas, the composition of former ecosystems becomes forgotten. Some have referred to ecologist Garrett Hardin’s 1968 essay *The Tragedy of the Commons* to illustrate the invisibility of marine ecosystem degradation (McEvoy, 1986; Taylor, 1999). In this vein, the collapse of a fishery or species is sometimes viewed as an event, rather than the culmination of a sequence of decisions leading to depletion. “The inability to see decline as a process,” says Taylor, “let alone a complicated process, has everything to do with natural resource politics” (1999:26). Once nearshore marine populations became depleted, fisheries moved further from land to offshore

banks which obscured the extent of environmental degradation. But, as McEvoy notes, “nature is a very careful accountant” – marine ecosystems have evolved to possess a careful balance, and when change occurs in one part of the food web it will inevitably affect all other parts (1986:9). This is seen in the Gulf of Maine (GoM) ecosystem shift: following the overharvesting of groundfish, invertebrate species like lobster are now booming, and perceptions of what constitutes a ‘natural’ GoM are reflecting this shift (McClenachan and Neal, 2023). Throughout the literature on marine environmental history, it is apparent that core concerns about resource depletion have persisted for centuries. Although fisheries research has evolved largely since the mid-19th century, East Coast fishermen from the 1820s onwards were already expressing worries over the future of marine resources, with the volume of concerns intensifying by the 1850s (Bolster, 2012:188). The value of historical records, which form the foundation of marine history, is well-recognized as they offer a venue for understanding past fishermen’s concerns and the historical social settings of fisheries.

Another significant theme highlighted in the literature is the challenge of managing oceans and marine populations as a shared resource within capitalist frameworks. Aligning with the historical assumption that oceans are vast and mystifying, they also defy simple allocation of ownership. Attempting to apply accountability for the depletion of marine resources and responsibility for their management to one enterprise or group complicates efforts to enforce sustainable practices and address the causes of ecosystem collapse. While nearshore ecosystems can legally be claimed, marine species have yet to concern themselves with human political boundaries and as such mobile species may come and go as they please. Anthropologists in the 1960s and 1970s who examined fisheries debated how the competitive nature of fishing “might not be a generic failing of the human species, but rather the specific historical consequence of the

social changes that followed the advent of modern capitalist modes of production and social organization" (McEvoy, 1986:12). In other words, the possession of private property (or ownership) is a key tenet of capitalism, but no one "owns" the ocean. Sharing collective responsibility for marine ecosystem health is diametrically opposed to the global capitalist framework, and the blame for marine species collapses is deflected or distributed in ways that fail to address the root causes. Within a capitalist system, conflict has emerged between conservation-minded groups who grieve depleting marine resources and those who argue in favour of free enterprise, insisting on the allowance of harvesting the very marine resources that are depleting (Bolster, 2012). Beyond accountability, the true problem is that fishing gear does not predict a species' collapse, but rather "the animated spirit behind [fishing]," along with the common assumption that oceans are shielded from anthropogenic change (Bolster, 2012:335). Taylor echoes this within the context of the Pacific salmon crisis, where "many have wanted to save salmon, but few have been willing to accept responsibility and bear the costs of recovery" (1999:27). Attempting to place blame for collapsed species is moot; the larger problem that exists is the lack of recognition that oceans are shared resources, and human interactions with marine ecosystems have long-lasting effects, both regionally and globally. Ultimately, the challenge lies in recognizing that oceans are shared and require collective stewardship; without this, efforts to address and mitigate the impacts of human activities on marine ecosystems will remain fragmented and insufficient.

In summary, contextualising fisheries research in marine environmental history reveals a complex interplay between human activity and marine ecosystems over time. Trends within the literature on marine environmental history emphasise how human dynamics have contributed to the restructuring of marine ecosystems (such as systems of valuation and ownership) and

underscore the value of integrating historical documents into ecological research, particularly concerning human relationships in historical resource extraction. However, there are also significant gaps in the field: a larger focus on economically significant fisheries like Atlantic cod (and the subsequent understudying of economically insignificant fisheries, like Pacific cod) mirrors the very problem of valuation raised by marine historians. While much research has been conducted on Pacific cod archaeologically and biologically, there is a gap in the literature on the salt cod fishery, particularly on causes of decline. Marine environmental history research emphasises the value of integrating historical perspectives into fisheries research, as many lessons can be learned from examining past human-ocean relationships.

1.2 Historical Ecology

Marine resources have sustained coastal societies across the planet for millennia, but the effects of overfishing are often subject to time lags spanning decades or centuries, quietly leading to permanently altered marine landscapes and, in some settings, ecological collapse (Jackson *et al*., 2001). In 1995, biologist Daniel Pauly coined the term 'shifting baseline syndrome', which reflects the phenomenon where marine scientists, fisheries managers and coastal citizens identify a 'natural' ecosystem as that which was present in their lived memory, leading to the loss of knowledge of past ecosystem conditions. In the decades following these two publications, the field of marine historical ecology (MHE) has grown substantially. MHE grew from the recognition that historical perspectives were needed to fully grasp how marine ecosystems have changed over time. Because historical perspectives have only recently (since the turn of the 21st century) begun to be integrated into marine ecology, there are gaps in our knowledge surrounding the extent to which humans have altered our marine ecosystems. As such, MHE seeks to integrate historical research with modern-day ecological principles to reconstruct past marine ecosystems across various time

scales. Research conducted within MHE is "highly diverse in terms of the questions asked, the time scale and spatial scale of focus, the sources chosen for interrogation and the analytical techniques used" (Thurstan, 2022). MHE is distinct from marine environmental history: MHE examines how marine ecosystems used to look, contextualising how current ecosystems have been shaped, while marine environmental history involves the broader socio-historical context of human interactions with marine environments. In other words, MHE looks at historical change to marine environments, and marine environmental history looks at how humans have interacted with (and shaped) these marine environments. While related, they are distinct in that marine environmental history is rooted in the humanities, whereas MHE is rooted within natural sciences (e.g., palaeoecology and ecology), and research timeframes can span millennia. Like marine environmental history, key themes also emerge from the literature on MHE. These themes include the problems that arise from a lack of historical baselines, the pervasiveness of fishing in marine ecosystem shifts, and the value of drawing from various disciplines and diverse data sources to examine unknowns about the past.

Growing from Pauly (1995), marine historical ecologists have highlighted the lack of historical baselines used in marine planning. Andrea Sáenz-Arroyo *et al*. suggest that "a pre-requisite for trying to manage marine ecosystems should be to put together early testimonies on how the seascape once looked," but this is not common practice, nor is it easily feasible for many data-poor fisheries (2006:129). Until recently, those tasked with managing marine ecosystems have largely relied on climate records and monitoring data from the last several decades – oftentimes because formal records beyond the last few decades often do not exist – unintentionally excluding historical reference points that extend to the origins of fishing practices (Lotze & Worm, 2009; Campbell *et al.,* 2009; Steneck & Pauly, 2019). This omission can lead to misguided

conservation efforts, misperceptions of 'natural' environments, and unsustainable fishery quotas (Pauly, 1995; McClenachan *et al.,* 2012; Soga *et al.,* 2018). As such, MHE is used to uncover this information to better equip marine planners. These baselines can be extended several centuries into the historical record (see Rosenberg *et al.*, 2005) or several millennia through palaeoecological and archaeological studies (see Finney *et al.*, 2002 and McKechnie, 2007). MHE broad applicability and relevance to policymaking highlight its importance in capturing the ecological, social, and temporal contexts of fisheries (Engelhard *et al.*, 2016; Caswell *et al.*, 2020).

The role of overfishing in marine ecosystem alteration has been well-examined in the MHE literature, particularly stemming from Jackson *et al*. (*2001*). The term 'overfishing' is cited to have been coined in 1854 by fishery investigator John Cleghorn to describe the decline of British herring fisheries (Taylor, 1999). Foundational to this field, Jackson *et al.* stated that "ecological extinction caused by overfishing precedes all other pervasive human disturbance to coastal ecosystems" (2001:629). Their 2001 article synthesised patterns across time and space – from northeastern Pacific kelp forests in the late Pleistocene, to Indigenous fishing on western Pacific coral reefs 40,000 years ago, to the eutrophication of oyster beds in estuaries in the 1950s, all these settings hold the common thread that human interaction, no matter the era, fundamentally altered these marine ecosystems. Since 2001, increased research efforts have emerged to examine the role that overfishing has played in marine ecosystems across time. Palaeoecological studies have been able to reconstruct past ecosystems across millennia, like Finney *et al.*'s study of fisheries productivity in the Northeastern Pacific across 2,200 years (2002). Historical studies have also been used to track changes to marine species abundances, such as Rosenberg *et al.*'s study using historical documents to reconstruct and model cod biomass on the Scotian Shelf in 1852 (2005). In data-poor fisheries, ethnographic and archival research has aided in reconstructing 290 years of sea

turtle fishery data (see Early-Capistran *et al.*, 2018). These three examples highlight the scopes of temporal settings in MHE research, from examining change across several millennia (Finney *et al.*, 2002) to pinpointing the historical biomass of a species in a single year (Rosenberg *et al.*, 2005).

A valuable aspect of MHE is the interdisciplinarity and diverse data sources used to uncover information about the past. Standard sources of data like interviews and written documents are commonplace, but so are unconventional data sources – like restaurant menus and personal photographs – which have been used to track changes in seafood dietary preferences and fish sizes (see Van Houtan *et al.*, 2013 and McClenachan, 2009). Like their use in marine environmental history, historical documents have been invaluable in reconstructing past relationships between humans and marine ecosystems – for example, fishermen's logbooks have been used to understand the role that human decision-making plays in impacting marine fauna (Alexander *et al*., 2009). While historical ecology enables scholars to draw on strengths from different fields, it also has no articulated disciplinary principles nor a conceptual framework through which methods can be standardised and research can be unified (Beller *et al.*, 2017). Nevertheless, historical ecology as a discipline, and particularly within marine contexts, is valuable because research conducted within these contexts can help to reconnect human relationships with oceans, challenge popular but inaccurate perceptions (like the notion that the ocean is immortal) and uncover tales of caution from past catastrophes (Thurstan, 2022).

While it is known that overfishing has been a primary driver of marine ecological change, there are several areas that merit further critical discussion. First is the discourse on the term 'overfishing' and the implicit biases within the term. Taylor highlights that the term is "freighted with social and political connotations that… lump together several processes that are difficult to

separate" (1999:66-67). This reflects the discussion of the need for social and economic factors to be examined alongside ecological and biological research. Examining the extent to which fishing has altered marine populations, and the sociopolitical undertones existing within a fishery, is critical. Similarly, it is sometimes assumed that overfishing – driven by the industrialisation of fishing vessels and methods – precedes declining fish abundance, but archaeological and historical studies have demonstrated how pre-industrialised fisheries have also led to marine species population declines (McKechnie, 2007; Hardt, 2009; Braje *et al.*, 2017). Despite the reality that fisheries often decline due to industrialised overfishing, this is not ubiquitous across all fisheries. Several fisheries have declined before mechanisation (see Grasso, 2008), and others have declined due to reasons other than primarily overfishing, as was seen in the climate-driven decline of the Pacific cod fishery of the 2010s (Seung *et al.*, 2021). While it is known that humans have been altering marine ecosystems for centuries, what is less clear is the extent to which we have done so and the reversibility of these changes (Thurstan, 2022).

Compared to other historical fisheries, the Pacific salt cod fishery is a unique story: its boom and bust occurred prior to industrialisation and overfishing may not have been the primary cause of its decline. Much retrospective research has been conducted on Pacific cod archaeologically due to their prevalence in northern Pacific archaeological deposits (Maschner *et al*., 2008; Betts *et al.*, 2011; West *et al.*, 2022), but relatively little has been conducted using the documentary record. MHE is a particularly suitable field within which to conduct my research because its cross-disciplinarity ensures that the fishery's ecological, social and temporal contexts are adequately captured, and my research can be conducted using both quantitative and qualitative methods to best explain the data. The integration of historical and ecological research through MHE offers a valuable perspective on understanding past marine ecosystems and their

transformations. This field highlights the limitations of relying solely on recent data, emphasising the need for the inclusion of historical and archaeological records to fully grasp the extent of human impacts on marine ecosystems. The ongoing challenge lies in bridging the gap between historical insights and contemporary management practices to ensure well-informed, sustainable marine resource management.

1.3 Fishery Success: Social and Environmental Predictors

Successful fisheries management is a well-explored topic, but the metrics that are used to label a fishery as 'successful' have yet to be formally defined. This definition may be implicit – profitable fisheries which produce culturally important, in-demand products are considered successful, but this gap has not been assessed extensively enough to procure a thorough definition. The uneven focus within the literature on fisheries suggests that successful fisheries are remuneratively profitable, culturally significant, and that the fished species or product can be successfully marketed globally. For example, in British Columbia there exists a market for both Pacific salmon and Atlantic salmon, inferring that both are successful fisheries which satisfy differing consumer needs. The productivity of fisheries is also temporally limited: while they can be considered successful in one decade they may suffer collapse in the next. In the 1840s, Atlantic halibut were considered "troublesome pests" that interfered with the larger cod fishery, but by the 1890s, halibut had become a valuable commodity which was showing signs of depletion (Grasso, 2008). A fishery dependent on one species will inevitably collapse if the species is fished at a faster rate than it can naturally repopulate, after which a fishery develops around the next best marine faunal alternative. An example of this lies in the Atlantic cod fishery: before its collapse, it generated immense profit, contributed to the expansion of European colonisation in the Americas, and became woven into the social and economic fabrics of coastal fishing communities and

consumer societies alike. Following the 1992 moratorium on cod fishing in Newfoundland, the snow crab fishery developed and now comprises 25 to 90 percent of the province's annual fisheries revenue (Mullowney *et al.*, 2020).

Finally, climatic conditions can also support fishery productivity. Specific oceanographic and climatic regimes support a fished species' population growth within a region accessible to a shore-based fishery. For Pacific salmon, environmental shifts associated with anthropogenic climate change (such as increased drought and flooding events and warming waters) are contributing to declining salmon abundance (Lichatowich, 2001; Nelson and Turris, 2004). These environmental changes are reflected in decreased landings and the restructuring of former salmon fishing protocols (Taylor, 1999; Walters *et al.*, 2019; North Pacific Anadromous Fish Commission, 2023). While modern warming is drastically impacting fisheries productivity across the planet, this phenomenon has historical precedent; for example, the Early Twentieth Century Warming (ETCW) – a warming event from roughly 1920 to 1940 that coincided with the 1930s Dust Bowl (Donat *et al.,* 2016; Meehl *et al.*, 2022), also increased Arctic temperatures by an average of 1.7°C, increased Arctic inflow into the northern Atlantic Ocean, and decreased sea ice (Bengtsson *et al.,* 2004; Johannessen *et al*., 2004; Drinkwater, 2006). Known effects of climatic dynamics on fisheries productivity exist from studies of Atlantic cod in this period (Hutchings & Myers, 1994; Lilly *et al.*, 2013; Engelhard *et al.*, 2014), as well as through time (Mieszkowska *et al.*, 2009). Yet, the role that climatic conditions played in the Pacific cod fishery's success have yet to be assessed. Although historical climate data for Alaska before the Second World War (WWII) are limited, this presents an opportunity for future investigations to better understand the role of climate in fisheries declines and successes.

1.4 Environmental History of the Pacific Salt Cod Fishery

Pacific cod have been fished by the Unangax̂[2] (or Aleut people) for millennia, particularly in areas where salmon was less abundant (Mackovjak, 2019). Sixty per cent of Aleut diet came from sea mammals and fish (Unger, 2014, as cited in Corbett & Hanson, 2023). Pacific cod bones dominate archaeological assemblages in the Aleutian Islands, leading scholars to believe that cod were a staple food for the Unangax̂ (Corbett & Hanson, 2023:66). Similarly, Sanak Island in the Gulf of Alaska has been occupied for 6,000 years, and Pacific cod bones – some of which are 4,500 years old – dominate midden sites (Maschner *et al.,* 2008). Those along the Aleutian Islands would fish from dories or *iqya˜x* (kayak, in Aleut), while those further north on St. Lawrence Island, where the sea was frozen for parts of the year, fished through holes they had dug in the ice (Moore, 1923). Central to Aleut fishing was the relationship of respect between humans and animals, a common thread across Arctic spirituality (Corbett & Hanson, 2023). This was accompanied by the understanding that animals gave themselves up willingly to hunters; in return, the hunters or fishers treated the animal with gratitude and reverence (Corbett & Hanson, 2023). This foundation differs greatly from the settler-colonial commercial Pacific cod fishery in the mid-19th century, where fishermen and managers alike were primarily motivated by profit rather than moral obligation to the fish.

While the Atlantic salt cod fishery can be traced back to the 10th century, the documented history of Pacific-caught salt cod is much shorter. Commercial production began in 1865, inspired by the success of Atlantic producers. In 1857, Captain Matthew Turner and his crew sailed from San Francisco to Nicolaevsk-on-Amur, Russia; finding the Amur River full of ice, the crew began

[2] The term 'Aleut' is of Russian origin and was historically used as a blanket term to identify all people of the Aleutian Islands. There is ongoing discourse over the replacement of the term 'Aleut' with Unangax̂ (see Corbett & Hanson, 2023:14). In support of people who consider themselves both Unangax̂ and Aleut, this thesis uses both terms.

fishing with hand lines over the railing of the vessel to pass time, serendipitously catching abundant codfish. Turner knew of the market value of salt cod, and the growing population on the West Coast brought a growing demand for food. He made two more trips between 1859 and 1863 to fish for cod and explore the possibility of salt-curing them for sale in San Francisco. In 1864, he returned to the Strait of Tartary to fish, the vessel stocked with salt, catching 100 tons of cod. Turner was soon accompanied in the Okhotsk and Bering Seas by other American vessels – six in 1865 – interested in making a profit selling salt cod (Cobb, 1916; Mackovjak, 2019). These early cod fishermen had become afflicted with 'Codfish Fever', a term describing the craze of Californian fishermen in the 1880s who, upon hearing of Turner's success, sailed up the coast to Alaska to engage in cod fishing and sell salt cod to the masses of hungry San Franciscans (Mackovjak, 2019). In 1889, American ichthyologist Tarleton Bean wrote an article in the journal *Forest and Stream* where he emphasised the value of Turner's discovery: "The Gulf of Alaska [GoA] and Behring [*sic*] Sea have the largest species [of cod] and the most important commercially… it is destined to become the object of a very important industry at no distant day" (Bean, 1889:27).

Expansion west of the Rocky Mountains had only begun in significant numbers by the Gold Rush era (ca. 1848). The Gold Rush created an influx of settlers into San Francisco (then called Yerba Buena), increasing the city's population from 800 in 1848 to over 20,000 in 1849 (Conrad *et al.*, 2021). Many people migrated to the West Coast in search of a better, more affluent life. A mass migration of impoverished people quite literally hoping to "strike it rich", living in an era prior to in-home refrigeration, necessitated the accessibility of shelf-stable, affordable foods – like salt cod (Conrad *et al.,* 2021). By the 1890s, salt cod companies had been established in San Francisco and Seattle, and through the early 1910s the fishery was perceived to be booming. Local

demand for salt cod was high and large fish could be caught with relative ease. By the 1930s, however, the fishery's productivity had declined. Scholars note that "for not fully understood reasons, landings… began declining in the 1930s," (Laurel et *al*., 2023:961) and by the 1940s, Pacific salt cod had all but vanished. While this is recognized as a gap in our knowledge, little academic work has been conducted to understand it.

Following the decline of the salt cod fishery, there was little interest in fishing Pacific cod in any capacity beyond its use as bait. There was no Pacific cod production in 1951 or 1952, attributed to "poor market conditions", and demand for salt cod was waning in tandem with the rise of frozen fish and in-home refrigeration infrastructure (Mackovjak, 2019:208). After the Atlantic cod fishery collapsed, however, Pacific cod production increased dramatically, and today Alaska produces more than 95 percent of the US cod harvest, valued at $103 million from 2007 to 2017 (Mackovjak, 2019:228; Barbeaux *et al.*, 2020). Today, climate change continues to threaten the sustainability and productivity of the fishery. In the mid-2010s, 'The Blob' reduced cod biomass to the lowest abundances ever recorded, after which cod distribution shifted northwards (Earl, 2019; Bigman *et al.*, 2023). What we have come to know as Pacific cod habitat is changing: amid warming water and the loss of sea ice, cod are migrating northwards into cooler waters where their spawning habitat is limited by cold, rather than warm, temperatures (Stabeno & Bell, 2019; Stevenson & Lauth, 2019; Bigman *et al*., 2023). Notably, the Unangax̂ name for Pacific cod, "*atxidax*," translates to "the fish that stops" (Betts *et al*., 2011). Examination of archaeological deposits in the Aleutian Islands has found that Pacific cod abundance decreases as the climate warms and increases as the climate cools (Maschner *et al.*, 2008; Helser *et al*., 2018; Corbett & Hanson, 2023). Thus, there is the potential that part of the Pacific cod fishery's lack of success in the early 20th century may have been climate related. This research aims to help fill this gap by

examining drivers of decline in the 1930s, which has thus far been overlooked in the literature on Pacific cod.

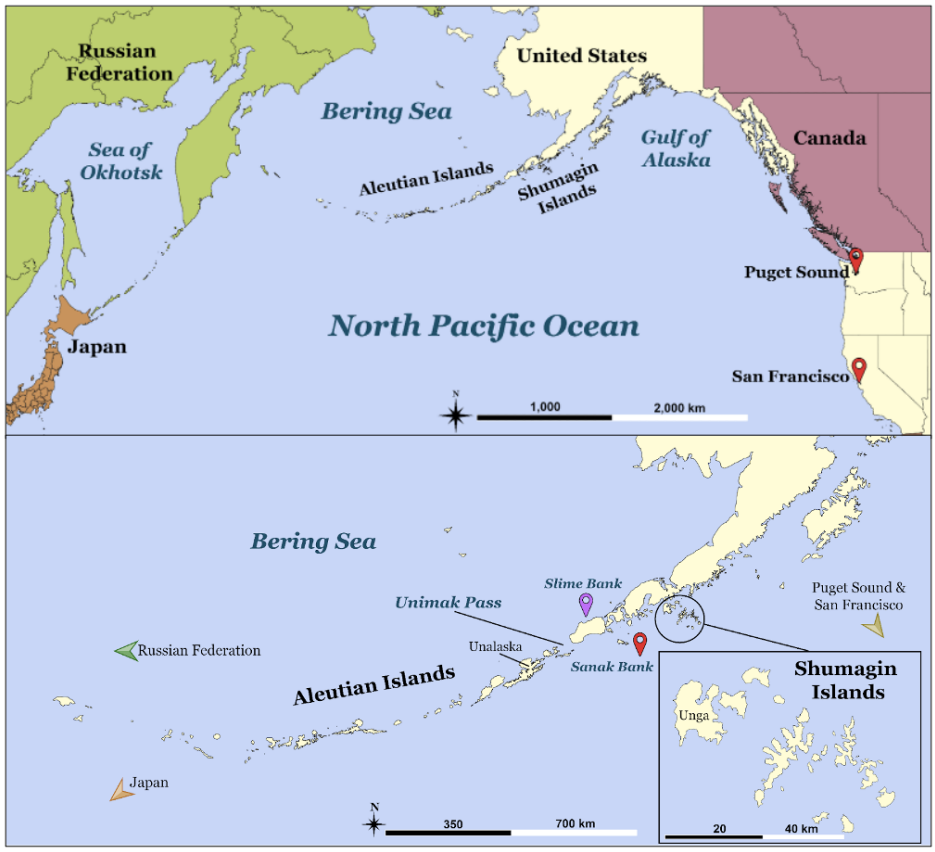


Figure 1. Map of North Pacific cod fishing grounds, including the Aleutian and Shumagin Islands in Alaska, USA. The Aleutians form the broader archipelago of islands that form the barrier between the Pacific Ocean and the Bering Sea. Unimak Pass is where vessels entered Bering Sea for fishing. Slime Bank (54°57'N, 164°15'W) and Sanak Bank (54°20'N, 161°53'W) were the preferred fishing grounds for the schooner fleet (see fig. 4 for closer detail), where the largest and best quality cod were found (Cobb, 1916). Projection: WGS 84/PDC Mercator. Political boundaries are sourced from Runfola *et al*. (2020).

1.5 Research Structure and Questions

Ample research has explored Pacific cod biology, historical distribution and relative abundance (Alderdice & Forrester, 1971; Maschner *et al*., 2008; Seung *et al*., 2021; West *et al.*, 2022), but there exists a gap in the literature: while research has focused on Pacific cod today and in deep time, the era of the salt cod fishery (ca. 1865-1950) is relatively unexamined. In particular, the drivers of decline in the salt cod era have yet to be formally assessed. From these gaps, a research question was formed: "What factors led to the decline of the Pacific cod fishery in the 1930s?" To address this question, I conducted archival research using approaches from both environmental history and historical ecology. Data was sourced from the *Pacific Fisherman* journal publications from 1915 to 1940. This 25-year period allowed for the inclusion of data from the fishery's "boom" (1915 to 1920) as well as data during the decline (1925 to 1940). The *Pacific Fisherman* synthesised key information about fisheries on the West Coast and disseminated it to stakeholders – notably, fisheries managers and fishermen, and is considered a key source of contemporary knowledge on 20th-century West Coast fisheries (University of Washington [UW], n.d.). The conclusion (Chapter 3) summarises the results of my research and discusses the practical applications and academic importance of my thesis.

In summary, this thesis fills the gap in literary understanding of the Pacific cod fishery of the 1930s by presenting the social drivers which contributed to decreased landings. My work also produces evidence of localised depletions in the form of qualitative descriptions of reduced relative abundance and a trend of declining fish body size during the salt cod era. Examining how the sociotemporal setting of the early 20th century affected fishery operations has the potential to spark discussion on the presence or absence of social dimensions which contribute to fishery productivity. This work also adds to the growing body of literature countering the idea that

industrialisation precedes fishery collapse and ecosystem restructuring. My research has the potential to contribute towards better informed Pacific cod fishery management by producing knowledge on historical precedents in this fishery's declines.

Chapter 2:
Sociopolitical drivers of decline and impacts of fishing pressure in the Pacific cod fishery of the 1930s

"Fish! Fish in the water, on the deck, on the table, and in your stomachs… [T]here is nothing deader than a dead fish and to see a checker full of 'em with their bug eyes kind of kills one's enthusiasm for seafood. I wouldn't eat a cod if I were starving to death now, thousands of 'em on deck… boy, what tasty dishes they'll make for someone this winter."

– Donald McInturf, radio operator of the *Wawona*, 1936[3].

2.1 Introduction

Following the Atlantic fishery's collapse in the 1990s and the subsequent growth in demand for Pacific cod, the modern Pacific cod fishery has gained considerable scholarly attention. Archaeological and palaeoecological research has also extended our understanding of Pacific cod relative abundance, distribution and historical fishing practices up to 4,500 years ago (Maschner *et al.*, 2008; Betts *et al.*, 2011). Biological research following 'The Blob' has increased our knowledge of how Pacific cod populations respond to extreme heat events (Barbeaux *et al.*, 2020; Seung *et al.*, 2021). But between modern day and the deep past, a significant gap exists in the literature in the late 19th to early 20th centuries, during the era of the Pacific salt cod fishery (ca. 1865 to 1950). The fishery experienced decreased landings in the 1930s, but the drivers behind this decline have not been thoroughly examined. In this research, I sought to fill this knowledge gap by examining drivers of decline in the salt cod fishery of the 1930s. To do this, I conducted archival research using historical fishery journal articles published from 1915 to 1940 which aid in contextualising decreased landings in the 1930s. The journal I used, the *Pacific Fisherman*, is regarded as one of the foremost sources of information on historical West Coast fisheries, holding details about the Pacific cod fishery which are unavailable elsewhere (UW, n.d.). The *Pacific*

[3] McInturf, D. (1936:16). Document provided by Northwest Seaport Maritime Heritage Center.

Fisherman has been used in several publications in the past to uncover information about historical fisheries (Mighetto, 2005; Mackovjak, 2019). By focusing on this underexplored period, this work not only fills the research gap but also provides valuable insights into the broader processes that can lead to fishery collapses. This research demonstrates the complexities behind the fishery's history and enhances our understanding of the factors that shaped the fishery's trajectory over time.

2.2 Methods

2.2.1 Methodological Context

This research is rooted in marine historical ecology (MHE) and environmental history methodologies. As described in the introduction, these two fields serve different purposes: MHE targets the way marine ecosystems have changed, and marine environmental history explores the relationship between humans and marine settings, and the subsequent ways that human interaction with marine ecosystems can lead to change. Examining how social drivers contribute to ecological change may provide additional indicators of ecosystem shifts, in addition to ecological or archaeological research (Hicks *et al.,* 2016). The cross-disciplinarity of MHE ensures that this work captures the critical ecological, social and historical contexts to understand the fishery's decline. The critical examination style of marine environmental history (wherein ecological and social aspects of fisheries are inextricable) provides an important foundation for understanding the context of this fishery. I used the *Pacific Fisherman* magazine, a West Coast fishing industry journal published from 1903 to 1966 which collected and shared information about the various fisheries on the West Coast, including resource management, catch totals, and innovations in gear technology, and was written by and for members of fishing industries. My use of this source aligns well with the transdisciplinary nature of MHE research, particularly in the quantitative and

qualitative analyses of this source. However, it is noted in the literature that this approach also holds conflicting priorities. Baxter and Eyles express this conflict as existing between "the creativity of the qualitative research process – which implies contingent methods to capture the richness of context-dependent sites and situations – and evaluation – which implies standardised procedures and modes of reporting" (1997:505). Bailey *et al*. (1999) also comment that the conflict between creative innovation and scientific requirements of standardisation and replicability in research stems from "an artificial post-Enlightenment separation of rhetorical (creative) and scientific (rational) thinking," when in actuality both are inextricable and contribute important value and context. They also argue that restricting qualitative research to a scientific method can strip it of its context and circumstance, and therefore its meaning (1999). This sentiment is echoed by marine historian W. Jeffrey Bolster, who says that "compelling stories communicate their own truths… Such stories need not be linear, or based on quantifiable evidence. They need not be inspired by a rigid work plan, or based on testable hypotheses. In fact, as every historian knows, great histories often emerge from rather open-ended inquiries or serendipitous discoveries" (2006:571). As such, situating this work in marine environmental history and MHE allows for the story of the Pacific cod fishery's decline to communicate its own legacy, while also ensuring that the methods are replicable within an academic framework.

An important consideration in my research was conducting qualitative research using case-specific data, which required flexibility and adaptation, in addition to quantitative research which required scientific transferability. The nature of historical primary documents requires the researcher to be led by the data – as Bolster said, the story being able to communicate its own truth – so that the methods and findings are as context-laden and historically-correct as possible. In other words, the sociotemporal context of 1930s West Coast America is as vital to the story as the

collected data itself, which is inevitably influenced by its context. The use of narrative historical texts and anecdotes alongside scientific processes – a blend of qualitative and quantitative methods – has created valuable contributions to the literature (see Rosenberg *et al*., 2005). In my research, the combined use of qualitative and quantitative data and analysis serves to create a well-rounded examination of the Pacific cod fishery in its 20th-century salt cod era.

2.2.2 Research Methods

Two distinct forms of the *Pacific Fisherman* were published: the yearbook, a summary of the previous year's operations published in late January (often as 'number 2' in the 13-part annual series); and the monthly editions, which summarised the previous month's operations (numbers 1 and 3 through 13). Some of the journals were publicly available online in a digitised format through HathiTrust (HathiTrust, n.d.-a-b[4]). Many were only available in physical print on the shelves at the UW Suzzallo and Allen Libraries. Using these journals, I identified passages that included information on Pacific cod.

First, two databases were created to organise and catalogue data following Broman and Woo's principles (2018). The metadata spreadsheet (see Table 1) categorised the year, volume and edition of each journal (i.e., April 1915 is vol. 13, no. 5), online availability, the HathiTrust and journal starting page numbers, availability at the University of Washington, review status, and notes. The yearly editions and the monthly editions were organised into separate pages within the metadata sheet.

[4] The HathiTrust pages are undated. It appears that several more editions have been digitised after my use of the digital collections over the summer of 2023. As such, there may be some discrepancies between my metadata sheet and the volumes available digitally. Source a holds the 1915-1920 and 1922-1926 yearbooks, and source b holds the July-December 1919 and 1920-1928 monthly editions.

Table 1. Layout of metadata spreadsheet, yearbook editions (sheet 1), years 1915 to 1921. Monthly editions (sheet 2) were organised the same. 'SC' denotes Special Collections, where the 1915 to 1921 journals were housed.

Year	*Vol.*	*Exists online?*	*Link*	*HathiTrust Page #*	*Journal Page #*	*Exists at UW?*	*Read?*	*Notes*
1915	13	Y	Link	#161	19	Y	●	SC
1916	14	Y	Link	#301	19	Y	●	SC
1917	15	Y	Link	#445	19	Y	●	SC
1918	16	Y	Link	#41	7	Y	●	SC
1919	17	Y	Link	#87	55	Y	●	SC
1920	18	Y	Link	#179	65	Y	●	SC
1921	19	N	N/A	N/A	N/A	Y	●	SC

The raw data spreadsheet (Tables 3a, 3b) included information on the article (year, volume, date, number, page number, the quote itself), a summary of the quote with key information, and coded information from the quotes about catch, perceived changes to cod in the water, social indicators of decline, ecological indicators of decline, notes, and a driver if applicable (Ecological, Social, and Overfishing). For example, a passage on low demand for cod specifically used the words 'low demand' to facilitate using the spreadsheet search option later to analyse the number of social drivers mentioned in relation to one another. Indicator words (or search terms) were used in column J of the research data spreadsheet when encoding quotes, which facilitated quantitative analysis of the qualitative data (see Table 4 below for examples). These search terms (which were one to three words long) were chosen to derive analysable meaning from a long quote. For example, "competition" as a search term inferred that the quote cited some form of product competition as a driver of the fishery's decline. The encoding of historical anecdotes has been shown to be a reliable method of acquiring quantitative data (see Al-Abdulrazzak *et al.*, 2012).

In total, 338 editions of the *Pacific Fisherman* were examined: 26 yearbook editions and 312 monthly editions (1915-1940, both inclusive). 42 percent (n=11) of the yearbook editions and

21 percent (n=66) of the monthly editions were available online on HathiTrust, totalling 23 percent (n=77) of the 338 total editions. The data for the analysis on declines were also sourced from these spreadsheets, in addition to Ed Shields' "*The Salt of the Sea*" (2001).

Table 2. Availability of yearbook and monthly editions of the *Pacific Fisherman*, online via HathiTrust or in the Special Collections (SC). 'YB' stands for yearbook, and 'MO' stands for monthly. Any editions not available in the SC or online were on the UW Suzzallo and Allen shelves.

	YB: online	***MO: online***	***Total: online***	***YB: SC***	***MO: SC***	***Total: SC***
Number	11	66	77	5	96	101
Total	26	312	338	26	312	338
Percent	42.3%	21.1%	22.8%	19.2%	30.8%	29.9%

Table 3a. Layout of raw data spreadsheet, columns A-G, with example data. These quotes were chosen to demonstrate the variety of data in the Pacific Fisherman. Any key information in the quote was bolded to facilitate visual understanding by the author.

	A	B	C	D	E	F	G
	Year	Vol.	Date	No.	Page #	Quote	Summary
1	1915	13	Jan.	1	27	The local codfish market has been in a **very quiet condition** during the past month. No new fish has arrived from the north. The independent station fish which came down the latter part of the year is now being worked up by Tacoma and Seattle wholesale houses, and **the addition of this supply to an already overloaded market has not tended to keep prices up.**	Quiet cod market in January 1915 due to oversupply (low price for cod)
2	1919	17	Yearbook	2	92	Bering Sea codfish, caught by American as well as Canadian fishermen from British Columbia, now also has the competition of the same fish caught and cured by the Japanese, who are not only seeking our Eastern markets, but are actively engaged in learning every detail of the business and seeking our South American markets, and incidentally **seem to have turned a very clever trick on the American people by speculating and to an extent now controlling so foreign a thing to Japan as the coffee of Brazil, intended to supply the United States.**	Perception that Japanese companies were seeking the same cod markets as Pacific American companies; example of prejudice against Japanese fishery ("...[the Japanese] have turned a very clever trick on the American people…")
3	1928	26	July	8	50-51	These figures give striking evidence of the success of the outboard motors with which the "Charles R. Wilson's" dories were equipped for the first time; the average catch, in practically the same time and under similar conditions, being 1,900 fish per dory ahead of the "Wawona", **making a total excess of 10,000 fish from only 17 dories against 26**. Mr. Shields states that the excess alone, not counting the total catch, has already paid for the outboard motors, with the season barely started.	The use of outboard motors on dories significantly increased individual catch per dory and total catch per schooner
4	1935	33	Nov.	12	52	Capt. Olsen [a trader in Alaska since 1881] reported that there had been very little codfishing from the shore stations in the Shumagin and Sanak Islands during the past season, due principally to the fact that **the dory fishermen there no longer find codfish abundant on the banks within reach of their small craft.**	Shore station fishing light in 1935 due to depletion of nearshore banks on Shumagin and Sanak Islands

Table 3b. Layout of raw data spreadsheet, columns H-N, continuing the quotes from Table 3a. Cells that were answered with 'yes' were highlighted to expedite data analysis. The blue column on the left was added for this thesis and denotes a quote number to identify the quote in conjuction with Table 3a.

.	H	I	J	K	L	M	N
	Does quote describe American cod catch? e.g., increase or decrease or absolute catch?	Does quote describe changes to cod in the water? e.g., size, perceived abundance, change in CPUE	Does quote describe potential social drivers of change? e.g, markets, industry challenges	Does quote describe potential natural drivers of change? e.g, weather, novel species	Does quote provide other context to the fishery, not captured by previous questions?	Driver of Decline (Ecological, Social, Overfishing)	Notes
1	No	No	**Yes, low price**	No	No	N/A	N/A
2	No	No	**Yes, Japanese competition**	No	No	**S**	N/A
3	**Yes (relative)**	**Yes, increased efficiency**	No	No	**Yes, demonstrated efficiency of outboard motors on dories**	N/A	Technological advancement
4	**Yes, decrease (relative)**	**Yes, perceived decline in abundance**	No	No	**Yes, localised depletion (maybe due to overfishing)**	**O**	N/A

2.3 Results: Sociopolitical

In total, 1,504 separate quotes were collected, the vast majority of which related to social drivers of change in the fishery. The most significant drivers were the inability of Pacific salt cod to compete within global markets and the lack of sustainable export markets, the high cost of operations with low profit due to low demand for salt cod, and financial or regulatory constraints on the industrialisation of the fishery. These drivers are expanded upon within the following pages. Market competition was the most highly mentioned driver (83 times), which was more than double the number of mentions of the next key driver (cost of operations, 35 times). See Table 4 for the number of mentions of each of the five key social drivers of decline.

2.3.1 Market Competition

Market competition was the most significant factor in the demise of the fishery. As noted above, the success of the early establishment of the Pacific salt cod industry can be attributed to the growing demand for food with the influx of European settlers to the West Coast in the mid 19th-century. The acquisition of Alaska by the United States in 1867 facilitated the expansion of cod fishing operations, and this rapid expansion in the fishery is mirrored by human population dynamics on the West Coast at the time. The sudden influx of settlers created a severe food and housing shortage (Conrad *et al.*, 2021). Widespread in-home use of refrigeration did not expand until the mid-20th century, so the Pacific salt cod industry filled this chasm, allowing producers to earn favourable prices while rapidly expanding their operations (Cobb, 1916). Salt cod was a valuable food source, and the markets in San Francisco and Seattle were much closer to the Pacific banks than those of the Atlantic, which made the production of cod on the West Coast a natural option.

Table 4. Social drivers of decline and their number of mentions. The number of mentions is measured by the number of times the identified search terms were used to describe quotes.

Driver of Decline	*Description*	*Search terms*	*No. Mentions*	*Example quote*
Market competition (domestic and export)	Increased competition within domestic and global markets for salt cod, competition of salt cod products against other food items, desire for duties to give P. cod a better competitive edge	"competition"; "duties"; "tariffs"	**83**	"[Decreased production in 1921] is accounted for partly by the discouragement of American producers arising from the importation of Japanese codfish during the last few years, and partly to the abundance of low prices in Nova Scotia codfish imported at Atlantic ports, which make it impossible to move the output in Eastern markets at prices that will enable producers on this Coast to meet the demands of their fishermen." (PF, October 1921:32).
Cost of operations	Increased production costs (inc. fishermen's wages, methods, etc.) without remunerative profit due to the low market price for P. cod	"increased production costs"; "wages"; "low price"	**35**	"The lay of the fishermen this year is 75 per cent more than it was ten years ago, and if the price of the fish is not made sufficient to reimburse owners for the increased cost of operation there is likely to be a heavy loss facing the operators, who don't seem to realize the increased cost as compared with former years". (PF, April 1915:32).
Inability to develop export markets	Inability for P. cod producers to secure reliable, sustainable export markets due to competition	"market options"; "export"	**32**	"The general domestic business of the Pacific Coast companies… is limited to the territory west of the Rocky Mountains, comparatively little of the Alaska product finding its way to Eastern markets; while the foreign market is now being supplied mainly with Norwegian and Japanese codfish." (PF, November 1920:46)
Low demand for P. cod	Decreased consumer demand for P. salt cod	"low demand"	**26**	"In these days [1927] salted fish do not move as freely as in the last century, most people preferring their fish in cans." (PF, April 1927:24).
Industry Innovations	Shifting gear technology; regulations which inhibit industrialisation	"technological advancement"; "regulations"	**17**	"The Alaska fishery regulations have always forbidden the use of trawl gear in Alaska [except for the shrimp and flounder fisheries]. This has restrained American from using trawls in Bering Sea, but now the Japanese operators are apparently making profitable use of this gear prohibited to Americans in waters close along the Alaska coast." (PF, 1937 Yearbook:225)

By the First World War (WWI), however, the West Coast market had become oversaturated. A large number of companies created a "congested field", where too many companies were trying to sell more salt cod than consumers could absorb (Pacific Fisherman [PF], May 1915:32)[5]. This necessitated producers to explore the possibility of outside markets – those which were predominantly monopolised by Atlantic cod producers in New England, the Canadian Maritimes, Iceland and Norway. C.P. Hale, the owner of the Union Fish Company ('Company' written hereafter as 'Co.'), reported in 1924 that the domestic market for Pacific salt cod was "limited to the territory west of the Rocky Mountains, comparatively little of the Alaska product finding its way to the Eastern markets" (PF, November 1924:46). John Cobb, a fisheries researcher, illustrated the impact of the Atlantic fishery's dominance (1916:23):

> The history of the Pacific codfishery *[sic]* is a record of the strenuous struggle of a few individuals and companies against its giant brother on the Atlantic coast, which, backed by great wealth, the prestige and advantage gained by years of unopposed command of the American markets, an almost unlimited supply of raw product and during the last two season the ability to import from the Eastern provinces of Canada large supplies free of duty, has had an immense advantage over its younger and weaker brother.

Within this context, attempts to establish domestic markets east of the Rocky Mountains were generally unsuccessful. Atlantic cod producers were not welcoming of Pacific cod producers attempting to enter already-established markets, contributing to social prejudice against Pacific cod. In 1921, the *Pacific Fisherman* stated that East Coast interests, particularly Newfoundland

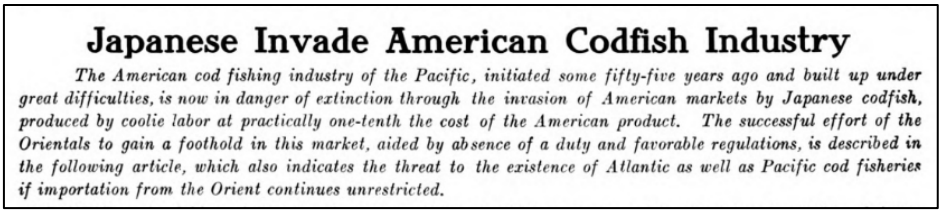
[5] Many of the articles within the journal editions did not specify an author. To ensure consistency across in-text citations and references, in-text citations cite the year and month (or yearbook) the volume was published in (month is used over edition number for legibility) and the page number. Titles are given (if applicable) within the end references.

cod packers and New York importers, were attempting to infer that "Pacific Coast products are of inferior quality, and that the American fisheries cannot produce enough to supply the market" (PF, September 1921:14). Additionally, Atlantic dealers were sometimes told that Pacific cod was not true cod, and that it would spoil quicker than the Atlantic product (Cobb, 1916:72). While Pacific cod has a higher moisture content than Atlantic cod, evidence proving that Pacific cod would spoil quicker than Atlantic cod is lacking. This speaks both to the stigma Pacific cod producers faced and the consensus that the Atlantic banks were the sole source of quality cod abundant enough to supply the vast American markets. A venture in 1921 saw Pacific producers attempt to establish a market in Louisville, Kentucky, US. This venture failed, however, because saltwater species were odorous, especially in hot weather, and lake and river fish were customary in Louisville diets. Both fresh and frozen cod in Louisville were stigmatised as "unpopular" (PF, October 1921:14).

With export markets to Europe controlled by Atlantic producers and the limited West Coast market facing oversupply, Pacific cod producers sought markets in the American Midwest, Mexico, the Caribbean, South and Central America, Australia, and the Pacific Islands (Cobb, 1916:73). As part of the 'Eat More Fish' campaign in WWI, Pacific salt cod producers were able to secure temporary markets in central Canada. Between March to November 1918, 1,000,000 pounds (lbs.) of Pacific cod had been marketed in the Western Canadian provinces, and "several carloads" of salt cod had been shipped to Toronto and Montreal (PF, 1919 Yearbook:116). Similarly, some minor demand had been created in the American Midwest, but efforts to solidify long-term, sustainable markets outside of the West Coast were unsuccessful. As such, Pacific producers were extremely protective of their economic territory.

The introduction of Japanese codfish into the Pacific Coast market in the late 1910s was perceived to pose a critical threat to the industry's existence. WWI had greatly increased demand

for cod, but since large-scale Atlantic fishing had been interrupted due to the war, Pacific producers found a ready market that greatly needed supplying. Due to this, both West Coast American and Japanese producers began to increase operations. In February 1918, the United States Department of Commerce announced a directive that was intended to "promote the vigorous prosecution of [WWI] and to make the utmost use jointly of all the resources of the nations now cooperating" (Mackovjak, 2019:173). This directive temporarily suspended the law prohibiting foreign fishing vessels from landing in American ports directly from fishing banks, specifically for "Canadian fishing vessels and those of other nations now acting with the United States" (Mackovjak, 2019:173). As Japan was allied with the US, Japanese codfish could be imported into the US and sold in the limited West Coast markets, free of tariffs.



Japanese Invade American Codfish Industry

The American cod fishing industry of the Pacific, initiated some fifty-five years ago and built up under great difficulties, is now in danger of extinction through the invasion of American markets by Japanese codfish, produced by coolie labor at practically one-tenth the cost of the American product. The successful effort of the Orientals to gain a foothold in this market, aided by absence of a duty and favorable regulations, is described in the following article, which also indicates the threat to the existence of Atlantic as well as Pacific cod fisheries if importation from the Orient continues unrestricted.

Figure 2. Anecdote from an article titled "Japanese Invade American Codfish Industry", written in the December 1919 edition of the *Pacific Fisherman*. This image is one of several examples illustrating the ways in which Japanese producers and fishermen were written about in the *Pacific Fisherman*. The use of racialized language is prevalent throughout much of the dialogue about Japanese competition within the salt cod industry, but also speaks to the broader pervasiveness of anti-Japanese sentiments in the Western world in the 20th century. (PF, December 1919:23).

American companies were outraged, particularly because Japanese cod could be produced much cheaper than American cod. The *Pacific Fisherman* editors and codfish companies alike protested the directive, requesting tariffs be placed on Japanese cod to increase the competitive ability of American-caught Pacific cod. "If we cannot have a protective tariff," said C. P. Hale of the Union Fish Co. (San Francisco), "it will be necessary for us to close down entirely in view of the expected Japanese competition during the coming season and the poor market prospects" (PF,

April 1921:23). As Hale predicted, the influx of Japanese cod in the Pacific coast market caused American producers to decrease operations materially: from 1918 to 1919, production decreased by 23 percent – 3,000,000 less lbs. of cod were produced and 13 fewer vessels operated, from 32 to 19. Concurrently, over 4,000,000 lbs. of Japanese codfish were imported to the Pacific Coast in 1919 (PF, March 1921:48). On July 15, 1921, the Department of Commerce withdrew its initial directive, after which importing Japanese cod into Pacific American markets became impractical (Mackovjak, 2019:175). After this, the Japanese companies withdrew from both the Puget Sound and San Francisco industries, though not permanently. The Japanese companies were not felt to be a threat again until the mid-1930s when American fishermen began noticing the presence of Japanese trawlers fishing for cod in the Bering Sea.

In summary, salt cod markets, both domestically and internationally, were extremely competitive. Atlantic producers had essentially monopolised continental North America, in addition to markets in Europe and the Caribbean. While Pacific producers were able to find a market west of the Rocky Mountains, the introduction of Japanese-caught cod (produced at half the cost of American Pacific cod) resulted in a material decrease in American operations in the Pacific. This driver of decline is undoubtedly related to the inability of Pacific producers to create sustainable export markets, but export markets are discussed more thoroughly later in this thesis.

2.3.2 Cost of Operations

The high cost of operations in conjunction with low remunerative profit was the second-most cited social contributor to the decline of the fishery. These costs mostly had to do with high wages, the operation of shore stations, and the low market price for salt cod. Of these, the most significant cost was attributed to wages. This analysis focuses on the wages paid to cod fishermen

– the dress gang (the crew who cleaned the fish), salters (the crew who salted the fish), and the vessel's leadership and kitchen crew were paid separately along different pay scales. At first glance, one would consider the wages owed to fishermen to not be a significant inhibitor to the fishery's profits (see Table 9 in the appendix for specific wages from 1915 to 1940). Instead, when considering the number of labourers required to produce salt cod (a process nearly done entirely by hand), it is likely that labour costs in conjunction with low demand and the consequent low market price for cod were significant. Wages were highly variable based on a fisherman's total catch and the size of the fish caught, and the overall pay scale fluctuated often from year to year. In 1921, American salt cod was produced at eight cents per lb., whereas Japanese cod could be produced at four cents per lb., attributed to higher wages paid to fishermen (PF, March 1921:46; April 1921:23). The cost associated with wages was also exacerbated in some years by the scarcity of experienced cod fishermen. As salt cod companies responded to annual variations in increased demand for salt cod by increasing their fleet sizes, skilled fishermen to work these vessels became scarcer (PF, February 1920:60). In 1906, the crew of a typical codfish schooner were characterised as "having a few good fishermen, but mostly comprising riff-raff picked up along the water fronts of the Pacific coast cities" (Cobb, 1906, as cited in Mackovjak, 2019:101).In 1920, the scarcity of fishermen in San Francisco resulted in companies hiring and transporting East Coast fishermen to work in the West Coast fishery (PF, 1921 Yearbook:97). Salt cod production in this era was an inherently costly process: every step of production, from fishing to cleaning, salting to packaging, was done by hand. Fishing required physically strong, skilled fishermen who had learned cod schooling behaviours and other "tricks of the trade" (PF, May 1932:57). The depth, technique and quick pace of cod fishing was an acquired skill, as highlighted here:

> A trick of codfishing which highliners must know is the way to nurse the fish up as far toward the surface as possible. Fishing starts in from 18 [33 metres] to 30 fathoms [55 metres] of water, with the hooks 2 to 3 fathoms [<5.5 metres] clear of the bottom. As the codfish school about the dory, the experienced fisherman gradually shortens his lines, leading the fish up toward the surface as far as possible, so the haul to the dory will be shortened. How to do this without losing the spot of fish is one of the tricks of the trade. As codfishing is done at present from outboard motor dories, the fisherman stands in the bow, working two lines. One is hauled, the fish removed, the bait replaced, and the line leaved [*sic*] out again. The next is pulled immediately if the fish are plentiful. (PF, May 1932:57).

Before the installation of gasoline-powered outboard motors on dories, the fishermen would row or sail to the school of fish (fishing within a five-mile radius of the schooner), then return to the schooner to offload their catch, and subsequently return to the school (Mackovjak, 2019). This was done two to three times per day (Mackovjak, 2019), which limited the time and energy fishermen were able to spend fishing. Once motorised dories became common practice, fishermen were able to spend more time and energy fishing, which increased both individual and total catch. In 1928, the 17 dories aboard the *Charles R. Wilson* were equipped with motors for the first time. Compared to the 26 rowed dories on the *Wawona* (a vessel of similar size and fishing in the same area), the *Charles R. Wilson* fishermen caught approximately 1,900 more fish per dory, equating to 10,000 more fish from nine fewer dories (PF, July 1928:50-51). This difference illustrates the material value of industrialising the fishery – fewer dories, equipped with motors, was revolutionary in increasing catch output. This also would have decreased the total number of fishermen needed, in part easing the scarcity of cod fishermen on the West Coast. By 1929, all cod schooners, apart

from the *Fanny Dutard*, were equipped with motorised dories (PF, 1930 Yearbook:207). Motorised dories were expressed to be a significant aid to the fishery's operations (PF, March 1932:42).

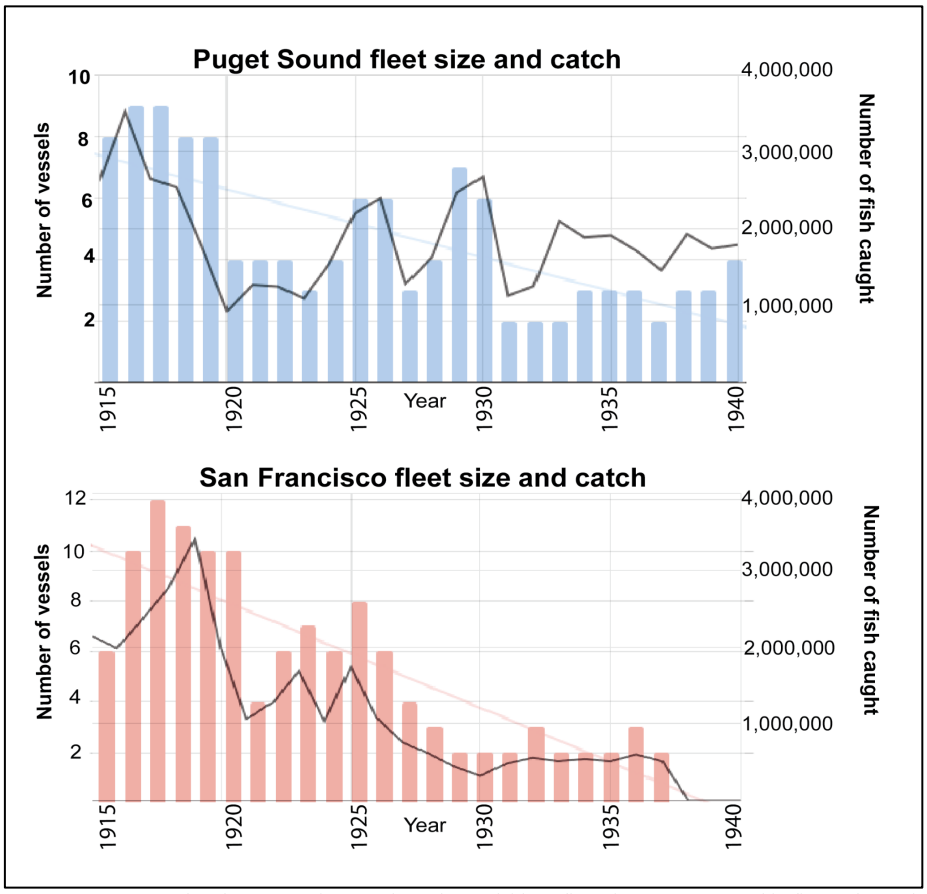


Figure 3. Puget Sound and San Francisco catch totals overlaid on fleet size, 1915-1940. This figure shows the relationship between fleet size and total catch, demonstrating how fishing effort was a significant factor in total landings.

Despite the mechanisation of the dories, there was still limited demand for salt cod; operating the schooner fleet to its full potential could have led to an overproduction of cod which would have further decreased its market price. A compilation of catch data, recorded by the *Pacific Fisherman* using totals reported by the cod companies, shows how total catch and total fleet size were closely related (see Figure 3). As fleet size increased or decreased (in response to the leftover unsold stock of salted cod from the previous year or labour conflicts between companies and fishermen), total catch also increased or decreased. This is particularly evident in Puget Sound's operations between 1920 to 1930: four vessels in 1920 to 1922 were able to make a moderate catch of roughly 1,100,000 fish, but seven vessels in 1929 were able to catch over 2,500,000 fish. This shows that catch was not severely restricted by the availability of fish (although this certainly may have been a factor), but rather by fleet operations. It was reported that the 1928 season showed an "actual shortage of fish in Bering Sea", but while this may have impacted fishery operations in 1929, it is unclear to what extent because Puget Sound operators were still able to catch over 2,500,000 fish (PF, 1928 Yearbook:192).

Another example of cost outweighing profit existed in the operation of shore stations. Shore stations were small camps or towns located mostly in the Shumagin Islands from which fishermen travelled daily by dory to the inshore banks, approximately five miles from shore (Mackovjak, 2019). The most significant stations were on Unga and Popof Islands (see Figure 4). Pirate Cove on Popof Island was also the oldest, established in 1876 by Thomas McCollam of San Francisco (Mackovjak, 2019). McCollam's company (the McCollam Fishing & Trading Co.) was later purchased and renamed the Union Fish Co. (Cobb, 1916; Mackovjak, 2019). The schooner fishery operated in the summer, restricted by extreme weather and sea ice from late fall through early spring, following the migrations of cod populations onto the offshore banks in summer to

feed. Shore stations, however, operated year-round, as cod were abundant on the nearshore banks all year (Mackovjak, 2019). Most shore stations were independently owned, with fishermen furnishing their own gear and organising the southward transportation of their catch (although shore stations owned by San Francisco or Puget Sound companies sometimes loaded the shore station catch onto the schooners). For years, shore stations operated year-round, but by the early 1920s, they had become financially ineffective. By 1900, Pacific cod were showing signs of depletion, and fishermen were required to travel much further from shore to maintain their catches. The fish they were catching also averaged smaller than in years pre-1900 (Mackovjak, 2019).

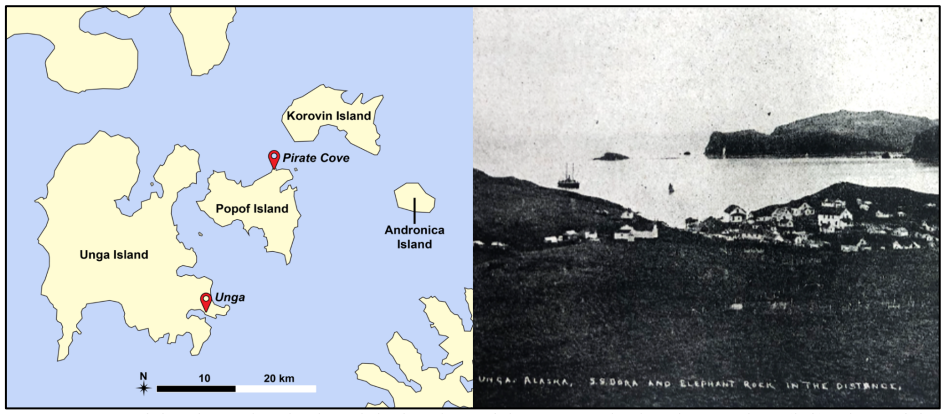


Figure 4. Map of the Shumagin Islands and the locations of the most productive shore stations (left). Photo of the town of Unga, a cod fishing settlement in Southeast Unga Island (right). Photograph of Unga from the March 1918 edition of the *Pacific Fisherman*.

In 1920, the Alaska Codfish Co. and the Union Fish Co. (both based in San Francisco) closed their shore stations in early summer and held the closure throughout the winter into 1921. The reason for the closure was cited to be due to high wages, low demand, and Japanese competition (PF November 1920:53; 1921 Yearbook:97). Meanwhile, due to similar reasons – but particularly inspired by the addition of Japanese cod in the West Coast market – the offshore schooner fishery was also not operating at its full potential. The Puget Sound and San Francisco-

based companies' schooners and shore stations sometimes worked in tandem when it was unprofitable to operate both. In 1921, the Alaska Codfish Co. sent its vessels *Alasco III* and *Maweema* to retrieve Unga station's catch, caught by fishermen living in Unga (PF, May 1921:38). In 1922 the Alaska Codfish Co. also sent its schooners *Glendale* and *City of Papeete* to act as floating stations, where fishermen living at the stations brought their catch to salt and eventually transport to San Francisco (PF, April 1922:49). In short, shore stations often struggled to break even, leaving the bulk of the profit to the catch from the schooner fishery. For this reason, this research thesis focuses on the offshore, schooner fleet.

Even though the costs of operations were high, there were several ways in which salt cod companies could reduce costs. First, cod companies often purchased schooners that were being retired from different industries. In the 1910s, sailing schooners formerly used in the lumber trade were replaced with steamships (Raymond, 1999). "Any old vessel would do," said C. P. Overton of the Union Fish Co. in 1906 (Mackovjak, 2019:36). But lumber vessels were built with large holds to store and transport lumber, which were well-suited for the salt cod industry. Where lumber used to be held, dry salt was stored for the journey to the Bering Sea; as the salt was used, its space was taken by salted cod as the catch came in from dories. When the schooner was full or the season came to an end, the vessels would return to San Francisco or Puget Sound. The *Wawona*, built in 1897 for the lumber trade, was purchased by the Robinson Fisheries Co. in 1913 and was refitted for use in the cod industry. The *C. A. Thayer* was another vessel which had previously been engaged in lumber and was purchased and refitted for use in the cod industry. In this way, the industrialisation of other industries benefited the Pacific salt cod industry, as an abundance of retired vessels facilitated increased fishing ability. In several seasons, it was more profitable for companies to charter their vessels into what was known as the "offshore trade" than to produce

cod, leasing their vessels to other industries to transport goods across the Pacific Ocean (PF, July 1927:38). Despite its profitability, leasing vessels in the offshore trade was risky. Companies had to secure insurance for the vessel which presented a cost not all companies were willing to take, and, even with insurance, there was no certainty that a vessel would return. In 1918, the *Bertha Dolbeer* (of the Pacific States Trading Co.) was used in the offshore trade, but failed to return from her trip to Australia, likely having been sunk by the German raider *SMS Wolf* (PF, April 1918:36). If companies were not interested in leasing their vessels into the offshore trade, they were also able to lease them for charter into various West Coast industries, including the salmon and tuna fisheries. In 1937, the Union Fish Co.'s *Golden State* was even chartered to a film company (PF, May 1937:69). Despite this, the costs of wages owed to the numerous labourers employed in the fishery, in tandem with low demand and market price for salt cod (creating low overall profit), created an adverse financial situation. This likely inhibited the fishery's mechanisation in the 1930s and therefore its continued success after 1940. This long-standing economic condition led to a declining trend in fleet size from 1915 to 1940, and thus declining catch (see Figure 5).

Overall, the market price for Pacific salt cod was very low, and the costs of operations were very high. In the fishery's earlier years (before 1915), salt cod production was a prosperous venture, both from the shore stations and from the schooners. But as demand for salt cod decreased and wages naturally increased over time, it became an unprofitable operation, in some years leading Pacific cod producers to cancel shore station fishing altogether and lease their vessels into more profitable trades.

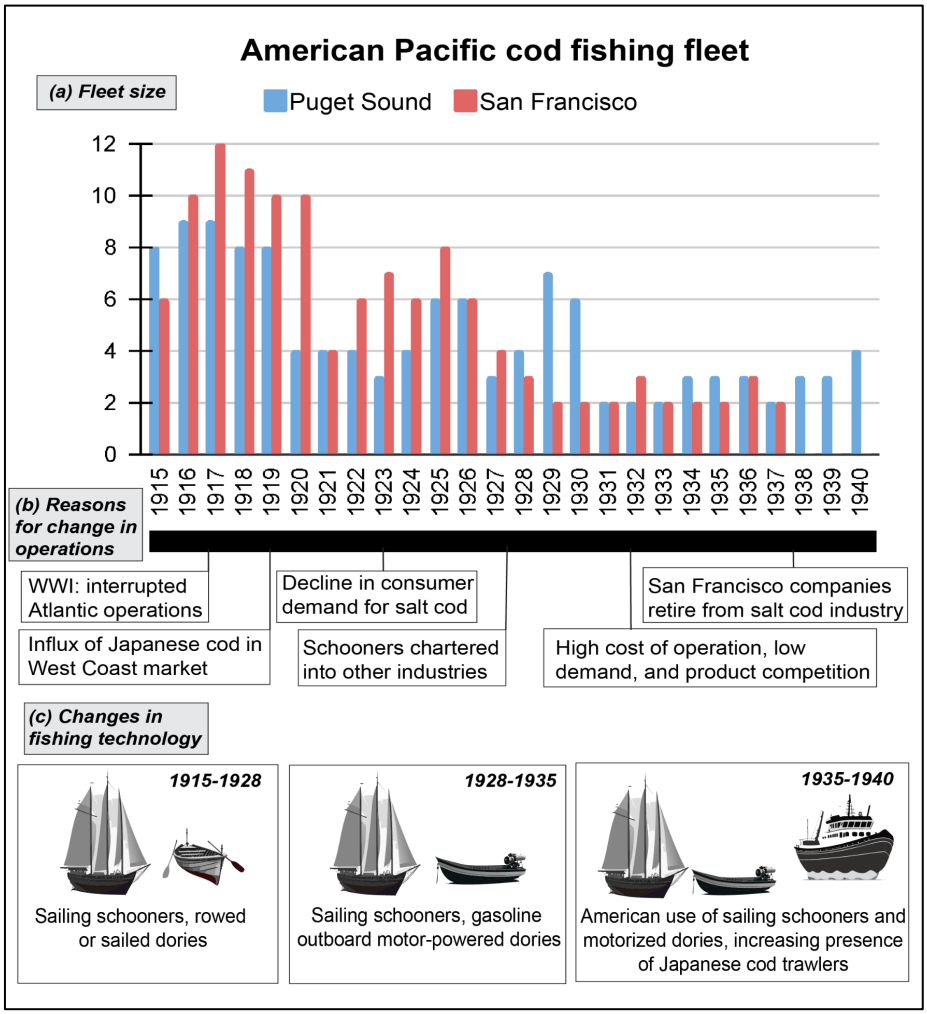


Figure 5. American Pacific fleet size, reasons for increased or decreased operations, and gear technology from 1915-1940. (a) Between 1915 to 1940, Puget Sound catch peaked in 1916 (1,759,723 fish from 9 vessels), and San Francisco catch peaked in 1919 (3,392,500 fish from 10 vessels). See Appendix, Table 11 for detailed catch and Table 12 for detailed fleet size per year. **(b)** Events that explain decreased catch over time, including product competition within the salt cod market, increasing costs of operations, and shifting consumer demands. By 1938, the San Francisco cod companies had ceased operations altogether and sold their vessels to other industries. **(c)** By the mid-1920s the fishery was industrialising, from rowed or sailed dories to gasoline-power, and the growing Japanese use of trawling in the Bering Sea for cod fishing. Regulations in Alaska prohibited the use of trawl gear for cod until 1942. The preferred American banks were within Alaskan waters (3 miles from shore), while the Japanese trawlers operated outside of the 3-mile line.

2.3.3 Inability to Develop Export Markets

The inability to develop markets outside of the domestic West Coast market presented a very serious restriction on the growth of the fishery. As discussed earlier, global markets were dominated by Atlantic cod producers based predominantly in coastal New England (USA), Nova Scotia and Newfoundland (Canada), Iceland and Norway. As such, it is more accurate to discuss instances when the Pacific fishery *was* able to secure short-term export markets, rather than times when it was not. During WWI, Atlantic operations were heavily constricted, which led to increased demand for Pacific salt cod. At the beginning of the war, however, because global commerce had been interrupted, former credit arrangements had begun to fail which made fulfilling orders and securing payment for shipments of Pacific salt cod challenging (PF, 1915 Yearbook:102). As the production of Atlantic salt cod was severely impeded, Pacific salt cod producers soon found an overwhelming foreign export market. The market for Pacific salt cod had been strengthened further because Atlantic fishing vessels were being sunk by submarines, which reduced Atlantic cod operations materially (PF, September 1918:45). With a wealth of options, some producers were hesitant to accept offers due to concerns over securing payment (PF, May 1915:25). Even with initial hesitance, salt cod companies began increasing operations in response to increased global demand. Demand was high throughout WWI, but once the armistice had been signed, export trade declined once again (PF, 1919 Yearbook:92).

Outside of WWI, it was equally difficult to secure reliable export markets in foreign countries with high consumption of salt cod due to foreign sociopolitical and ecological affairs. For example, in 1918, strikes in Brazil and Cuba affected Pacific salt cod exports (PF, 1919 Yearbook:92), while in 1915 the Mexican Revolution also limited exports (PF, January 1915:27). In Argentina, the 1916 election disrupted usual commerce operations (PF, December 1916:36).

The following quote, from page 50 of the September 1930 edition, illustrates the domino-like effect of foreign economies on salt cod markets:

> A review of the Caribbean and Mediterranean codfish markets… says that the Nova Scotia codfish production has been no more than normal, but that the doubling of the Cuban duty on codfish will force Nova Scotia to depend on the Porto Rico [sic] market. The Newfoundland output appears to have set a new record, but its principal markets are in bad shape economically, with Spain suffering from an adverse exchange and Brazil in a crisis due to the staggering drop in the price of coffee.

While the Atlantic fishery could better withstand economic changes in foreign markets, the Pacific fishery was reliant on the economic success of its export markets. If demand in an export market was high one year, but sociopolitical events reduced demand for salt cod in the next, the fishery might face overproduction, which would decrease the market price of salt cod even more. The Atlantic fishery, while no doubt affected by global sociopolitical shifts as well, was better established and was likely less vulnerable to – or perhaps better equipped for – the loss of global export markets. Broadly, export markets for Pacific cod were only in response to global events, like WWI. As such, because the Atlantic fishery had existed for centuries before the advent of the Pacific fishery, they had established venues of commerce long before the production of salt cod in the Pacific was a thought. Pacific salt cod producers, in short, were attempting to hold onto a product from a bygone era when societal demands were changing.

2.3.4 Low Demand for Salt Cod

Domestic demand for salt cod fluctuated heavily, both seasonally and across years. Until 1922, demand for salt cod increased when Lent was observed, then was followed by decreased

demand in the summer (PF, August 1923:46-48). This seasonal fluctuation had become characteristic of the early salt cod industry. Interestingly, after 1922, Lent is no longer mentioned in the *Pacific Fisherman* articles about cod, inferring possibly that salt cod consumption no longer spiked during Lent as it had in previous years. By 1927, Cobb had noted that "salted fish [did] not move as freely as in the last century, most people preferring their fish in cans" (PF, April 1927:23-24). Before the 1930s salt cod was packed in barrels, to be packaged for the consumer by the grocery store clerk. This method produced a wealth of problems: the fish could deteriorate, become malodorous, dry out, turn yellow, or the salt could crystallise (PF, November 1936:25). The cooking of salt cod was another issue: it required the fish to be washed and soaked to rehydrate it and remove excess salt, which was a time-consuming process. Perhaps due to these reasons, people began to prefer their fish in cans. The packing of salt cod in cans eliminated these issues, the fish reaching the consumer in its original condition with minimum soaking required (PF, November 1936:25). In short, improving the packaging of salt cod improved its quality, and made it more attractive to consumers. The consumers in question were specifically "housewives", and it was understood that the more housewives knew how to cook salt cod, the more they would purchase it.

In 1932, the Pacific Coast Codfish Co. began experimenting with tinned salt cod to be sold in Asia. This was seen as an important development because tinned salt cod would prevent mould and infestation from occurring, especially in tropical climates, which presented an opportunity for expanding foreign export markets (PF, March 1932:53). Similarly, in the early 1930s, the development of more attractive packaging increased sales of salt cod. The Union Fish Co. made "Ice-Kist", one-pound packages of salt cod wrapped in wax paper and packed in cartons (PF, December 1931:71). "Rofico", by the Robinson Fisheries Co., was one-pound bricks of "specially

selected salt codfish", wrapped in parchment paper with the brand's name, a photo of its schooner Azalea, and several recipes for using cod (PF: 1932 Yearbook:227). This new packaging was especially successful because the cod would retain its quality and be attractive to consumers (PF, March 1933:45). This innovation also enhanced salt cod's societal perception, "lift[ing] salt codfish from the status of a tolerated but unloved step-child to full equality with any product in the family of groceries" (PF, November 1936:25). Despite this, producing salt cod was still a laborious manual process; while canned fish was more attractive to consumers and may have increased revenue, it did not decrease the cost of production.

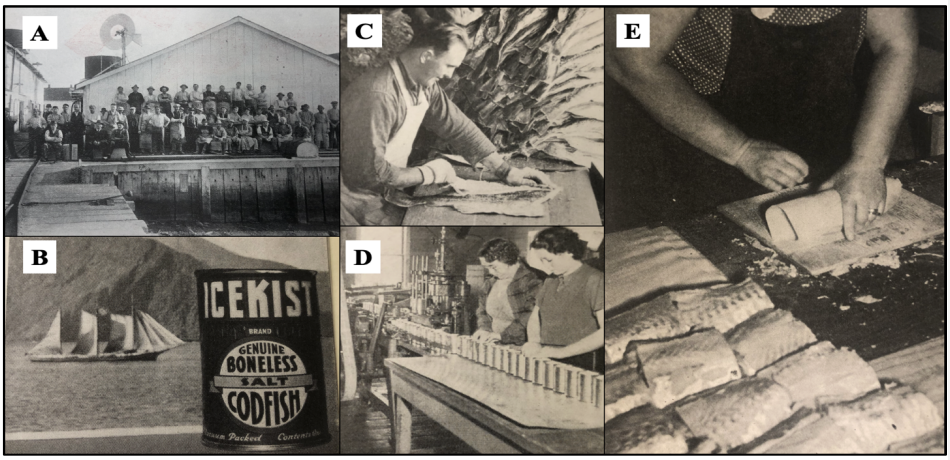


Figure 6. Photographs from the *Pacific Fisherman*. (A) The Alaska Codfish Co.'s plant in Redwood City, CA (March, 1916:36); (B) an "Ice-Kist" advertisement, with the Union Fish Co.'s schooner Louise on the left and the product on the right (April, 1937:73); (c) a man skinning cod at the Robinson Fisheries Co.'s plant in Anacortes, WA (1937 Yearbook:225); (D) women at the Continental Can Co. vacuum-canning salt cod in Rofico and Velvet cans for the Robinson Fisheries Co. (1937 Yearbook:227); (E) a woman wrapping salt cod in parchment paper to insert into cans at the Robinson Fisheries Co. plant in Anacortes, WA (1939 Yearbook:197). Photos of original photographs taken by K. Moore.

The low demand for Pacific salt cod exacerbated other drivers of decline: market demands were predominantly for the widely distributed and well-established Atlantic cod, high operations costs were worsened by low profit due to low demand, and industrial innovations were limited in

part by financial barriers. Unfortunately for those invested in the early 20th-century Pacific cod fishery, it was evident that the salt cod era was ending: people preferred their fish in other forms (fresh, frozen or canned), and the infrastructure required to transition towards frozen cod did not exist in Alaska (PF, October 1940:46). Similarly, other technological advances that may have aided in the fishery's transition away from salt cod production were either financially restricted or prohibited due to governmental regulations.

2.3.5 Technological Advancement

As was discussed formerly, the fishery was only able to mechanise operations to a certain extent. The use of "fireless and electric light on the schooners" and the availability of wireless radio encouraged communication between the vessels fishing in the Bering Sea and the company headquarters in San Francisco and Puget Sound (PF, 1932 Yearbook:133). The mechanisation of the dories assisted in increasing catch by reducing the amount of energy and time fishermen expended travelling to and from the main schooner. While motor-powered dories aided significantly in increasing catch, and the use of wireless radio on the vessels improved communication, these were about the only mechanical advancements made in the American fishery prior to the growth of trawling in the 1950s. Despite the mechanisation of dories, the schooners themselves were not replaced with industrialised vessels. The *Wawona* had a donkey engine on board which facilitated loading and unloading supplies (Raymond, 1999), but while other fisheries were beginning to mechanise, the cod fishery continued to use their sailing schooners. What had once facilitated the expansion of the fishery was now perhaps a barrier to its industrialisation: cod companies had created their entire fleets from sailing schooners, and the low market price for cod did not generate the capital required to overhaul the fleet if the fishery was going to modernise. By the mid-1930s, the reappearance of Japanese vessels in the Bering Sea

(presumably outside of the three-mile boundary which demarcated Alaskan waters), this time in the form of trawlers, stirred discussion about the inability to mechanise the fishery. In Alaskan waters, the preferred fishing grounds of the American fleets, trawling was prohibited except for shrimp and flounder from 1930 until 1942 (Mackovjak, 2019). In other words, even if the cod companies could afford to transition to trawl equipment, it would not have been legal to trawl for cod until after 1942. Similarly, the method of processing and packing salt cod was difficult to mechanise. Once the fish had been caught, they were cleaned on board the vessel by the dress gang, then piled in the vessel's hold in salt by the salters. Alternatively, some companies had curing plants in Puget Sound and San Francisco where the fish were washed, dressed and processed. In this case, a crew to work at the curing plant – men to remove the fins, skin and large bones, and women to remove the remaining bones and package the cod – were also required. As late as 1938, the production of cod was still almost entirely done by hand, the only mechanised aspect being the labelling of cans (PF, 1939 Yearbook:242).

By 1940, however, much of the American cod catch was being transitioned from salt curing to fresh and frozen products, and 50 percent of US domestic salting of cod fish happened in Alaska (PF, October 1940:46). Noticing the decreasing demand for salt cod, and likely in response to it, salt cod companies began transitioning to packaging their product in cans, which were more attractive to consumers. Del-Pac Pure Food Products, a company based in Seattle, began selling freshened and cooked cod in glass jars in 1935, which had a higher shelf price and may have been considered a "fancy grocery item" (PF, 1936 Yearbook:225). It was also noted that fresh cod was popular in Atlantic markets, that it would likely also perform well in West Coast markets, and that the halibut fishery, with access to "first-class refrigeration facilities", was also operating in known codfish banks (PF, August 1927:23). This seemed to allude to interest in producing fresh cod on

the West Coast, although this option was not realised before 1940. Both consumer preferences and fishing technology changed from 1915 to 1940, and these shifts were not easy to adapt to for the Pacific salt cod industry (see Figure 7).

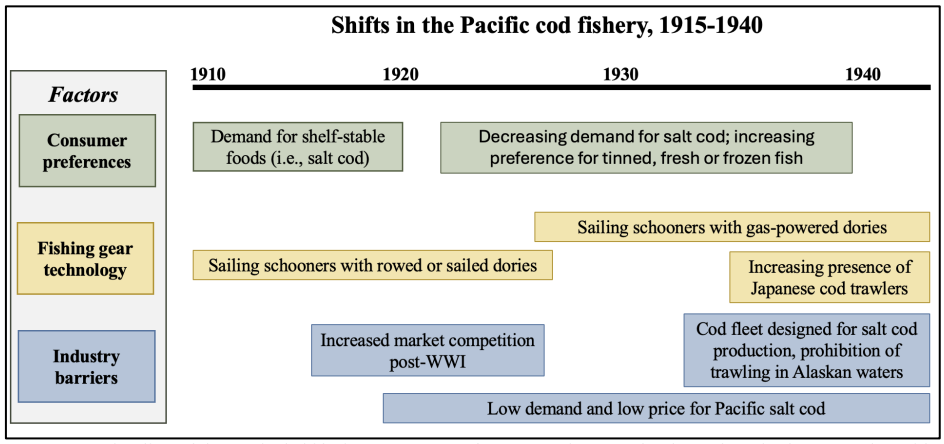


Figure 7. A timeline of the gradual shifts in consumer preferences and gear technology aboard schooners, alongside barriers faced by cod companies to adapt to change. Most notably, the persistent low market price for Pacific salt cod left companies with little capital, and as such little ability to adapt to changes in domain consumer and vessel technology trends.

While interconnected, these drivers are distinct in their nuanced details. For example, the Pacific producers' market being limited to the west of the Rocky Mountains is both due to global and domestic product competition and the inconsistency of export market options for Pacific cod. Similarly, the profitability of Pacific salt cod was inhibited by the high cost of wages (which also speaks to conflicts between companies and fishermen over labour costs), competition with Japanese producers within the West Coast market, and the overall cost of producing salt cod. The drivers are both global and local in scale, as well as economic and social, which demonstrates the difficult socioeconomic conditions the fishery existed within. Considering the myriad social factors which did not align with the fishery's success (and often inhibited it), it is perhaps

unsurprising that producers began to decrease effort in the 1930s which therefore resulted in decreased catch.

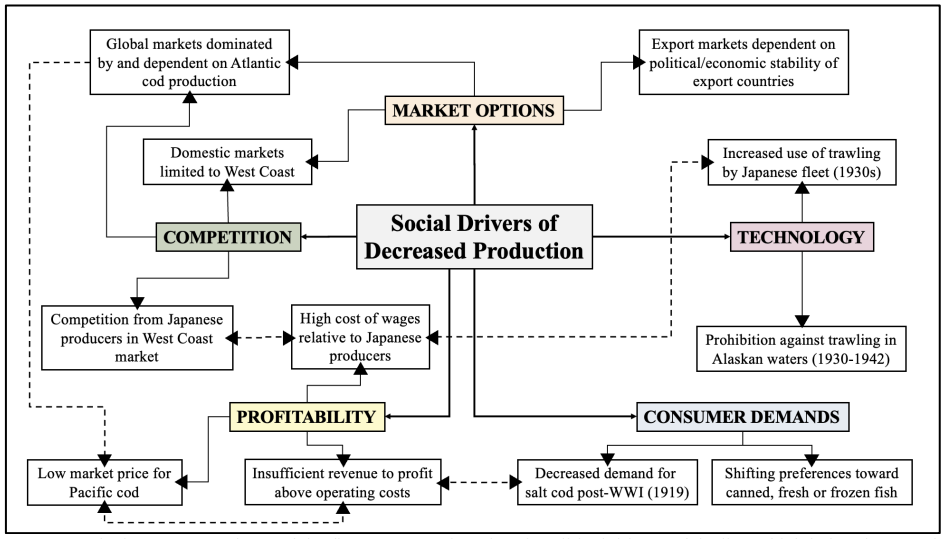


Figure 8. The interconnectedness of the five most mentioned sociopolitical drivers of decline which led to decreased productivity in the Pacific cod fishery of the 1930s. Dotted lines show interconnections between sub-aspects of the main drivers (i.e., insufficient revenue was in part due to decreased demand for salt cod after WWI).

To conclude this section on the sociopolitical drivers of decline in the Pacific cod fishery, it is apparent that there were a multitude of factors that were distinct yet mutually-exacerbating. Between 1915 and 1940, the American Pacific cod catch peaked in 1919 with 4,278,500 fish caught, after which operations began to decrease. The most significant factors were intense competition within salt cod markets (both domestically and globally), the demand for salt cod was declining following WWI, revenue was too low to offset the high cost of operations, and the industry was unable to transition towards supplying products which consumers desired because of financial and regulatory constraints. Low revenue (due to low demand and the accompanying low market prices) barred the ability to mechanise the salt cod process, in turn reinforcing the need for many workers needed to process the fish and reducing net profit. In short, the salt cod fishery's

decline is a complex story of interconnected social drivers, conditions which inhibited the growth and continued success of the salt cod fishery. This is an example of a fishery which, despite its short-term success, largely failed due to these social conditions.

2.4 Results: Localised Depletions

In addition to the evidence that sociopolitical drivers had greatly contributed to the fishery's decline in the 1930s, there was evidence that Pacific cod populations in the Bering Sea were declining, both in terms of relative abundance and in individual body size. This evidence was procured from the *Pacific Fisherman* data I had collected from the sociopolitical drivers of decline analysis and Ed Shields' "*The Salt of the Sea*" (2001). E. Shields is the son of J. E. Shields, a cod schooner captain in the salt cod era, and his book "*Salt of the Sea*" narrates his father's experiences cod fishing in the Bering Sea. The *Pacific Fisherman* sources were qualitative, descriptive reports from the captains of the cod schooners fishing on the offshore banks to the companies in San Francisco and Puget Sound. While there was qualitative evidence of localised depletions occurring in the Bering Sea, there were also indicators against broader ecosystem depletion. The first signs of depletion were noticed by 1900 when fishermen were "forced to travel much greater distances to maintain their catches, although the fish they caught averaged smaller than formerly" (Mackovjak, 2019:95). This phenomenon continued into the 1910s (PF, 1919 Yearbook:62), after which shore station fishing had decreased significantly by the 1920s. This was specifically the case in the Shumagins Islands (where many of the shore stations were located) and on Sanak Island (Shields, 2001:137). Sanak Bank and Slime Bank were notably productive banks for the offshore schooner fishery but showed signs of depletion by the 1940s (Shields, 2001:136). Similarly, local Aleut people reported that Pacific cod disappeared from Sanak Island in large numbers between

1942 to 1975 (Maschner *et al.*, 2008). This may have been due to intensive fishing on the inshore banks near Sanak Island, but also could have been due to shifting climatic conditions. Pacific cod in the Eastern Bering Sea and the Aleutian Islands have been shown to undertake partial or full seasonal migrations, inferring that migration patterns may have also affected fishing ability (Shimada & Kimura, 1994; Bryan *et al.*, 2021). At the same time as localised depletions were being noted, fishermen were reporting that cod were still abundant in the broader Bering Sea (see Appendix, Table 8). Due to the localised nature of the witnessed depletions around well-known cod fishing banks but not in the broader region, declining catch may have been driven, in part, by depleting cod populations due to localised harvesting pressure over decades, or cod distribution was shifting due to harvesting pressure (Table 5, Appendix Table 7).

Mantua *et al.* (1997) investigated interdecadal shifts in the Pacific Decadal Oscillation (PDO) in the North Pacific basin in connection to salmon productivity. They noted that in Alaska, a positive PDO is associated with above-average temperatures, while a negative PDO corresponds to below-average temperatures. As the polarity of the PDO shifts, it influences the temperature of the ocean's surface which can either reinforce the existing PDO state or indicate forthcoming shifts in the PDO itself (Mantua *et al*., 1997; Mantua & Hare, 2002). Mantua and Hare (2002) found that these shifts have profound impacts on marine ecosystems and fishery yields. To illustrate how climatic changes are documented, Mantua *et al.* (1997) used quotes from the *Pacific Fisherman* regarding shifts in marine species. They highlighted reversals in the prevailing polarity of the PDO occurring around 1925, 1947, and 1977 (Mantua *et al*., 1997:1069).

In the 1920s, the PDO shifted from negative to positive, coinciding with a warming climate and a negative correlation with Pacific cod abundance (Helser *et al*., 2018; Corbett & Hanson, 2023). This period of declining cod catch (1925-1945) occurred during a period of warming in the

GoA and the Bering Sea, where sea surface temperatures (SST) increased by up to 2.0°C in summer and fall compared to 1895-1915 (McClenachan *et al*., 2024). Warming was particularly pronounced in SSTs during key seasons relative to Pacific cod life history, highlighting how temperature fluctuations relate to PDO phases. While there was a correlation between Gulf of Alaska SSTs and the PDO, this relationship was relatively weak (McClenachan *et al*., 2024). Notably, during the 1925-1945 period, both the SSTs and the PDO indicated warm conditions; however, this correspondence was not present in the 1895-1915 period, when the PDO suggested warm conditions while Alaska Peninsula SSTs were at their coldest. Along the southern shelf of the Alaska Peninsula, SST peaked at 12°C, exceeding thresholds known to affect Pacific cod metabolic rates (Hanna *et al.,* 2008). Furthermore, my research revealed that fishermen reported declining cod abundance in the decade preceding 1925 around heavily fished areas like the Shumagin and Sanak Islands, even as cod remained abundant in the broader Bering Sea. Aleut people also noted the disappearance of Pacific cod from Sanak Island between 1942 and 1975, aligning with the PDO shifts highlighted by Mantua *et al.* (1997). In summary, the years from 1925 to 1945 were marked by rising SSTs associated with a positive PDO, coinciding with declining Pacific cod catch and localized depletions.

Table 5. Examples of qualitative evidence of localised depletions. This table does not include all evidence of depletion. See Table 7 in the appendix for a complete list of evidence of depletion. 'PF' denotes *Pacific Fisherman*.

Year	***Quote***	***Source***
1919	**Eventually the inshore banks began to show signs of depletion** and in order to keep up the catch it was found necessary to go farther and farther away from the shore stations.	PF, 1919 Yearbook, p. 62
1915-1925	**[The shore stations in the Shumagin Islands and Sanak Island] were very profitable for many years, but then the supply of fish diminished drastically.** The decline did not occur all in one year, but over many seasons between 1915 and 1925. Similar conditions occurred on Slime	Shields, p. 137

	Bank, although not as drastic.	
1928	Curtailed operations by both the Puget Sound and San Francisco fleets, coupled with **an actual shortage of fish in Bering Sea**, resulted in a marked decrease in the Pacific codfish production in 1927	PF, 1928 Yearbook, p. 192
1935	Capt. Olsen [a trader in Alaska since 1881] reported that there had been very little codfishing from the shore stations in the Shumagin and Sanak Islands during the past season, due principally to the fact that **the dory fishermen there no longer find codfish abundant on the banks within reach of their small craft.**	PF, November 1935, p. 52
1937	The last year we sent vessels to the Bering Sea [1937], **there were few if any cod south of [Amak] Island**. For reasons unknown to us, **the abundance of fish in different locations would change.**	Shields, p. 136-137
1940s	All the way from Dublin Bay to about 35 miles southwest of Amak Island was at some time productive for catching cod. **Slime Bank produced good yields before the 1940s.**	Shields, p. 136

In addition to localised depletions, cod fishermen noticed an unexplained declining trend of individual fish body size, particularly in the late 1920s. Between 1925 and 1929, the average weight of a schooner cargo was 5 lbs. per fish. In 1930 this had changed to 3.5 lbs. per fish, which was considered light at the time because a good cargo was then judged to be roughly 4 lbs. per fish. By 1931, the average fish weighed <3.25 lbs. (PF, 1932 Yearbook:277-278). This trend of declining fish body size is consistent with the findings of other studies conducted on harvesting pressures and marine species declines (Baum *et al.*, 2003; Rosenberg *et al*., 2005; McClenachan, 2009). Similarly, the distribution and size of large vertebrates that have been subjected to intense harvesting pressures is often unknown due to the loss of knowledge of past, unaltered marine ecosystems (Jackson *et al.*, 2001). As such, it is very possible that localised harvesting pressure on Pacific cod over 75 years, from 1865 to 1940, contributed to the trend of declining cod body size, especially if fishermen were paid in some years based on the size and weight of fish (see Table 9 in the appendix for wages earned based on fish size). Declines in fish body size within the

geographic scope of the fishery's operations are consistent with West *et al.*'s findings of truncated length distributions in the most heavily exploited areas (2022). Larger cod are also known to spend a greater amount of time annually in deeper waters than smaller cod, which stay on the nearshore banks over the winter (West *et al.*, 2022). This suggests that the offshore schooner fishery would have been able to catch larger fish than the shore station fishery. By 1933, most companies had a minimum length requirement for fish. While some vessels would have had a higher total catch, this would have also resulted in a lower average weight per fish. Table 6 below demonstrates the relationship between a minimum length requirement for fish, total catch, and total tonnage. In this way, catch totals (which reported the total number of fish or the collective tonnage) may not accurately illustrate size diversity in fish caught and therefore capture the totality of ecological impact. In 1933 all fish caught were at least 23 inches, the minimum length requirement across all cod companies (as set by the Pacific Coast Codfish Co.).

Table 6. Schooner catch, tonnage and average pounds per fish for the 1933 season. The Pacific Coast Codfish Co. (PCCC) had a minimum fish length requirement of 23 inches, the Robinson Fisheries Co. (RFC), 25 inches, and the Union Fish Co. (UFC), 28 inches. This table demonstrates the relationship between the number of dories, the minimum length requirement, and the total catch.

Vessel (Company)	*Dories*	*Catch*	*Tonnage*	*Avg. lbs./fish*	*Min. length (in)*
Sophie Christenson (PCCC)	22	453,356	672	2.96	23
Wawona (RFC)	18	327,865	528	3.22	25
Azalea (RFC)	16	264,000	428	3.24	25
Louise (UFC)	17	237,000	394	3.32	28
William H. Smith (UFC)	20	277,000	463	3.33	28

Size-selective fishing is known to impact the future generations of a species (Hanson & Chouinard, 1992; Svedäng & Hornborg, 2014; Evangelista *et al.*, 2021). In the context of Pacific cod, larger females produce more and higher quality eggs (Mackovjak, 2019). As such, fishermen being incentivised (and sometimes required) to catch large fish may have contributed to the trend

of declining body sizes of Pacific cod in the 1930s and may have had implications on Pacific cod population sizes today.

In summary, this research produced evidence of the impact of a pre-industrial, commercial fishery on Pacific cod abundance, distribution and individual fish size. Regionally focused fishing pressure, concentrated on several banks which were heavily fished from the 1880s through the mid-1930s, may have contributed towards localised depletions of Pacific cod. Size-selective fishing, where larger fish were preferred, may have also contributed to the trend of declining fish body size. This may be particularly evident in the fishing of the inshore banks from shore stations, which showed signs of depletion by the 1910s. These findings contribute towards a better understanding of the historical impact of fishing Pacific cod populations, with potential ramifications for relative abundance and cod body sizes today. This work also adds to the growing scholarship on the impacts of fisheries which had yet to industrialise but were still considered commercial, a lesser-explored subsection of the larger body of fisheries research.

2.5 Discussion

The following section discusses the human dimensions not explored previously in this thesis: specifically, the prevalence of racism in early 20th-century West Coast America and the lack of inclusion of marginalised communities (particularly, women and Indigenous people) within the fishery. Further points for discussion about this research, including my study's practical and academic applications, the limitations of my research, and future research directions are included in the conclusion.

A critical area of discussion within this work is the ubiquity of racism against Japanese people within the texts. Miller Freeman, a powerful Seattle-based businessman and the publisher

of the *Pacific Fisherman*, was known for racism. This is evident within the context of the Pacific cod fishery, but also in the history of Seattle. Sumie Seguro Akizuki was a Japanese American woman born in Bellevue, Washington in 1929 whose family spent three years in a Second World War (WWII) internment camp. In a 2008 interview, she recalled that "every person that you would talk to of the Nikkei community would know that Miller Freeman was anti-Japanese" (Ikeda, 2020). While it is likely that the addition of Japanese cod to the extremely limited West Coast market elicited concern in American Pacific cod producers, it is also possible that xenophobia affected cod companies' responses to imported Japanese cod, and certainly influenced Miller Freeman's choices of wording, editing and topic. Freeman's use of incendiary and derogatory language – like the terms "invasion from the Orient" (PF, December 1919:36) and "yellow peril" (PF, March 1920:58), along with the inference that the Japanese were "[turning] a very clever trick on the American people" (PF, 1919 Yearbook:92) – may have reflected and encouraged anti-Japanese sentiments at the time. Within this context, it is uncertain to what extent Japanese cod truly affected American operations. It is possible that the severity of the situation – Japanese cod being sold within the same market – may have been dramatised, especially considering that producers on the Atlantic Coast, who dominated the global salt cod market and whose race is not mentioned, were not spoken of with the same disdain. When Japanese trawling began gaining visibility in the Bering Sea in the 1930s, American producers expressed annoyance that governmental regulations forbade trawling in Alaskan waters. However, prior to this, experimental trawls for cod had failed, and trawling was largely considered to be infeasible for cod fishing. Once Japanese trawling for cod had begun, it appears that American companies also wanted the ability to trawl, if not simply the right to. Similarly, gender is rarely discussed in the *Pacific Fisherman,* perhaps reflective of its time. In this thesis, I use the terms "fisherman" or "fishermen" rather than

"fisher", which is becoming more common in scholarly works on fisheries (Branch & Kleiber, 2017; Rubio-Cisneros *et al.*, 2023). The term "fisher" – in addition to other terms, like "fisherwomen" and "fisherfolk" (Branch & Kleiber, 2017) – is developing out of the discourse that women and gender-diverse people also work in fisheries and hold vital roles within these systems, while women's contributions to fisheries are sometimes viewed as subsidiary to men's labour (Williams, 2008; Kleiber *et al.*, 2015; Branch & Kleiber, 2017; Harper *et al.*, 2017). However, between 1915 and 1940 all the people fishing on schooners and managing the cod companies were men, most of whom (if not all) were of European descent. It is important to note, however, that some of the fishermen at American shore stations were Indigenous. An opportunity exists for researching the demographics of shore stations to advance understanding of the salt cod era. Within the *Pacific Fisherman* articles on the cod industry, Indigenous people were only mentioned twice: once in 1923 when it was noted that Indigenous boys cut out the tongues of codfish when paid to by fishermen of European descent (PF, May, 1923:15), and once in 1919 when cod fishing vessels were delayed in returning from their trans-Pacific charter voyages due to the "influenza epidemic" (likely, the Spanish Flu) (PF, February, 1919:45). Women's roles within the *Pacific Fisherman* cod articles were limited to their roles processing the fish or as 'housewives' who purchased the product.

Chapter 3: Conclusion

"Oh, God, if you have one fair wind, a spare nor'easter left over, please send it down in Bering Sea and let us take the lutefisken [salt cod] down to the starving squareheads in Ballard. And so, goodnight."
– Donald McInturf, radio operator of the *Wawona*, 1936[6].

Prior to this thesis, the dynamics of the early 20th-century Pacific cod fishery had yet to be formally assessed, and the reason for declining catch in the 1930s was unknown (as stated in Laurel *et al*., 2023). My research examines the drivers of decline in the Pacific salt cod fishery between 1915 to 1940, with a particular focus on the sociopolitical drivers of decline and the impacts of fishing on Pacific cod populations. Using archival methods using historical journal articles, I analysed contemporary observations of the Pacific cod fishery between 1915 and 1940, examined sociopolitical factors that contributed to the fishery's decline in the 1930s and explored how fishing pressure leading up to the fishery's failure affected Pacific cod populations. The most significant social drivers were competition within the market for salt cod domestically and globally, the high cost of operations (specifically in the form of wages due to the necessity of a large workforce), declining consumer demand for salt cod, and the inability to industrialise the fishery to meet shifting consumer preferences. In addition, I demonstrated how Pacific cod populations in the 1930s had been subjected to decades of size-selective fishing pressures, which in turn may have contributed to localised depletions and a declining trend of fish body size. In short, the salt cod era was ending, and salt cod companies could not adjust to this change financially. Simply put, this fishery existed at the wrong time and the wrong place: it began near the end of global demand for salt cod, and while climatic conditions supported the fishery's

[6] McInturf (1936:40). Document provided by Northwest Seaport Maritime Heritage Center.

expansion in the early 20th century, a change to these conditions between 1925 to 1945 impeded the fishery's continued success (perhaps connected to the ETCW). This research contributes to the growing body of knowledge on the historical Pacific cod fishery and has generated further understanding of the historical fishery. As I have extended the historical knowledge of the impacts of fishing pressure this may have applicability to modern-day fishery operations, particularly in identifying how harvesting pressure may have caused localised depletions and led to reduced individual fish body size over time.

3.1. Academic contributions

This research addresses a critical gap in the literature by investigating the decline of the Pacific cod fishery in the 1930s, a period that had previously been underexamined. Prior to this thesis, the specific dynamics behind the fishery's decline by the 1940s had not been thoroughly examined, making this study a novel contribution to the field. By shedding light on the sociopolitical factors that led to the fishery's decline, my work enhances both scholarly and public understanding of the fishery's historical productivity and its decline. A key finding of this research is that total catch numbers may not fully reflect the true impact on Pacific cod populations. Fishermen were incentivized (and in some years required) to catch larger fish, and because larger female cod produce more and higher-quality eggs, analysing landings alone may not accurately represent the fishery's impact on biomass. This insight adds an important dimension to the ongoing discourse about the complexity of the effects of fishing on marine population health but requires further analysis to fully understand. Additionally, my thesis highlights the multifaceted nature of fisheries, emphasising how human dynamics play a significant role in shaping fishery outcomes, alongside climate change and fishing pressure. This work has the potential to be used as a case study for the examination of the impacts that other pre-industrial, yet commercial fisheries have

had on fish populations. In summary, by providing a deeper understanding of the historical salt cod fishery and its impacts on Pacific cod populations, my research contributes to the global academic literature on marine historical ecology and the environmental history of fisheries, thus adding to the literature discussing the importance of integrating historical insights into contemporary perspectives on fisheries management and sustainability.

3.2. Practical applications

My thesis presents a case study of how archival research into the documented historical record can contribute to better understanding modern-day marine populations and the fisheries they support. As has been highlighted by many academic texts (see Pauly, 1995, Jackson, 2001, Al-Abdulrazzak *et al.*, 2012, and Thurstan *et al*., 2015), historical research can have significant contributions to fishery management and ecosystem recovery plans. While this work focuses on the Pacific salt cod fishery, the methods are applicable to other fisheries for which archival written data are available. Using non-traditional data sources (in this case, magazine articles written with the intent of sharing information for fishermen and fishery managers) can contribute knowledge where other forms of historical inquiry fall short. Therefore, the methodology of this thesis proves how archival research and mixed-method approaches can provide valuable insights. As stated previously, formal catch records for the Pacific cod fishery only date back to 1977, but because the *Pacific Fisherman* kept fairly detailed records of landings, I have been able to trace Pacific cod landings back to 1915 (albeit, informally, as this was not the key focus of my research). In addition, I have been able to demonstrate how fishing in a pre-industrialised fishery still contributed to changes in Pacific cod distribution and size, contributing to the broader literature on the ecological impacts of fisheries, particularly pre-industrial ones.

3.3. Limitations

There are two key limitations within my research: the dependence on one source for primary data and the lack of examination of climatic conditions which may have also contributed towards the fishery's decline. As is often the case with archival research, this study was limited by the quality and availability of its sources. The *Pacific Fisherman* journal, the keystone resource for this research, was primarily designed to disseminate important, fishery-specific knowledge to stakeholders. Consequently, the journal was crafted within the framework of what was deemed "important" by its editors and contributors, focusing on information they considered valuable enough to share. This focus meant that the narratives and records within the journal predominantly feature men of European descent as the central figures in the fishery sector, while the roles and contributions of women and Indigenous peoples, such as the Unangax̂ or Aleut, are only peripherally mentioned. It is also important to acknowledge that there are likely other historical records related to the Pacific salt cod fishery beyond the *Pacific Fisherman* journal and other documents used within this thesis (such as Cobb, 1916 and 1927, Shields, 2001 and Mackovjak, 2019). However, the scope of this research was constrained by the practical limits of what could be achieved within the timeframe and resources available for a Master's thesis. This limitation implies that while the *Pacific Fisherman* journal provided a substantial amount of important information, I did not produce an exhaustive list of all historical and contemporary documents that include information about the Pacific cod fishery in its salt cod era. Further research, particularly examining what documents exist, would be useful in expanding knowledge of the historical fishery.

3.4. Directions for future research

Further research into the decline of the Pacific cod fishery in the 1930s is undoubtedly needed, particularly to understand the climatic conditions that influenced the fishery during this period, like McClenachan *et al.* (2024). Investigating the role that fishing pressure played in declining cod body sizes would also be a valuable contribution to both the historical understanding of Pacific cod populations, body size and distribution. The insights gained from such research might hold significant relevance for contemporary Pacific cod fishery management, as understanding historical patterns and precedents can inform current practices and strategies and enhance the sustainability of the modern fishery.

The period studied in this thesis (1915 to 1940) also presents several underexplored dimensions that would benefit from further research. For instance, there are unresolved questions about nuanced sociopolitical factors contributing to the fishery's decline, like the decreased prevalence of Lent observance in the 1920s. This issue may intersect with broader themes in early 20th-century American history, including shifts in consumer preferences, urbanisation, the rise of household refrigeration technology, and changes in religious practices during the interwar period. Understanding these factors could shed light on how they influenced the demand for salt cod, particularly during seasons traditionally associated with increased consumption of fish. Additionally, the question of why San Francisco and Seattle were the primary centres for salt cod production, while other regions (excluding Alaska) did not establish similar operations, remains unknown. In the early days of the fishery (1880s), San Francisco was uniquely equipped with suitable curing facilities (Cobb, 1916). Moreover, Cobb notes that the only exception to the San Francisco/Puget Sound landing ports was in 1877 when Captain Joshua Slocum chose to land a cargo of 23,000 cod in Portland instead of his prior destination in the Philippines (1916). Further

exploration of this topic could reveal more about the economic and logistic factors influencing the geographical distribution of salt cod production. Another critical area for further investigation is the impact of fishing activities on cod populations. While this temporally focused research contributes to the existing literature on cod fishing in pre-industrial times, it is essential to consider the historical context of subsistence fishing by Unangax̂ or Aleut peoples before the commercial fishery's establishment, adding to the research conducted by Tews (2005), Maschner *et al*. (2008), and West *et al.* (2022). Cod abundance and distribution during the salt cod era were likely influenced by subsistence fishing practices. Although my work has produced evidence of localised depletion and a decreasing trend of cod body size during the salt cod fishery, the quantitative landings suggest that Pacific cod populations did not experience the same severe decline as observed in the Atlantic fishery during the 1990s.

Given these considerations, additional research is essential to develop a more nuanced and comprehensive understanding of how the salt cod fishery impacted Pacific cod populations, particularly in the years before 1915 and following 1940. Investigating this period in greater detail may provide insights into the long-term effects of commercial fishing on Pacific cod, revealing patterns and trends that could help to inform current and future management practices. Further studies should focus on several key areas to create a more comprehensive understanding. First, examining archival data and historical records from pre-1915 could help identify changes in fishing practices, technological advancements, and shifts in market demand that may have influenced Pacific cod populations within my study's period. Another important aspect of future research should include a comparative analysis with other underexamined, mid-20th-century fisheries, both within and outside of the Pacific Ocean. By examining the experiences of similar fisheries, commonalities and differences be found that illustrate broader patterns within pre-

industrialised yet commercial fisheries (similar to Grasso, 2008). This comparative approach will help determine whether sociopolitical trends in the Pacific salt cod fishery are unique or part of a larger pattern. Moreover, research conducted with local communities, including Aleut/Unangax̂ peoples and fishery stakeholders, can provide valuable perspectives on the Pacific salt cod fishery that were missed within this research. Their lived and traditional ecological knowledge can contribute to more effective and culturally sensitive management practices.

Ultimately, expanding research into these areas will not only enhance our historical understanding of the Pacific cod fishery but also contribute to a better understanding of the salt cod fishery's effects on modern-day Pacific cod population, which may lead to the development of better-informed management strategies. By learning from the past and incorporating a range of perspectives and data sources, current challenges can be better addressed for the sustainability of future Pacific cod populations.

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Appendix

Notes from author:

- For more information about the content of this thesis, or for access to original spreadsheets or documents, please email author, Karoline Moore, at karolinemoore@uvic.ca.
- For tables in the appendix, data sourced from the *Pacific Fisherman* is written as PF, followed by the year (volume, or vol.), the edition ('ed.'; yearbook editions are ed. 2, and monthly editions are 1 through 13 respectively), and the page number.

Table 7. Qualitative evidence of localised depletions.

Year	*Quote*	*Source*
1900	Codfish in the early years… were abundant in the immediate vicinity of the stations, but **by about 1900, there were signs of depletion**… **the fish they caught [by traveling further from shore] averaged smaller than formerly.**	Mackovjak, 2019, p. 95
1915	The codfish industry has lagged behind in the utilisation of the gas engine. This is due mainly to the fact that the larger vessels usually anchor on the banks and send out their dories, **moving the vessel only when the fish show signs of exhaustion in the spot being fished.**	PF, vol. 13, ed. 2, p. 21
1919	**Eventually the inshore banks began to show signs of depletion** and in order to keep up the catch it was found necessary to go farther and farther away from the shore stations.	PF, vol. 17, ed. 2, p. 62
1919	...[T]he launch could go to **parts of the banks which had not been fished before, and where fish was still abundant**... For many years the codfish industry lagged behind in the utilization of the internal combustion engine... due to certain conditions peculiar to this fishery. On the inshore banks **fishing was restricted to sheltered areas within about five miles of the stations, as fish were abundant here**...	PF, vol. 17, ed. 2, p. 62
1919	On the outside banks the schooner would anchor in a favorable spot and remain there (her men fishing from dories) **until the fish showed signs of falling off** - which might not be for weeks - when it would move on to another presumably favorable spot and repeat the operation. Under these conditions sail power was ample for the work.	PF, vol. 17, ed. 2, p. 62

1915-1925	The same thing happened [changing abundances] to the cod around the shore stations in the Shumagin Islands and on the island of Sanak. **These were very profitable for many years, but then the supply of fish diminished drastically.** The decline did not occur all in one year, but over many seasons between 1915 and 1925. Similar conditions occured on Slime Bank, although not as drastic.	Shields, p. 137
1928	Curtailed operations by both the Puget Sound and San Francisco fleets, coupled with **an actual shortage of fish in Bering Sea**, resulted in a marked decrease in the Pacific codfish production in 1927	PF, vol. 26, ed. 2, p. 192
1930s	"[In the 1930s] it was normal to move the vessel a few miles every two or three days… A short move of two to five miles indicated the fish were still there and the move was just to get fresh bottom. **A long move indicated the fish had departed.**"	Shields, p. 120-121
1930s	A schooner seldom remained in the same location for more than three days. **It appeared that the offal thrown overboard during several days of fishing caused the fish to move elsewhere.**	Shields, p. 119
1935	**The "Azalea" found fish a little more scattered than in 1933**, and several of her best fishermen were on the sick list during a part of the trip, so her fare wasn't just what Capt. Grotle would have liked. The fish ran larger than last year, however. From the end of June until she made port Sept. 20, the "Azalea" had only three days on which it did not rain.	PF, vol. 32, ed. 11, p. 60
1935	Capt. Olsen [a trader in Alaska since 1881] reported that there had been very little codfishing from the shore stations in the Shumagin and Sanak Islands during the past season, due principally to the fact that **the dory fishermen there no longer find codfish abundant on the banks within reach of their small craft.**	PF, vol. 33, ed. 12, p. 52
1936	J. E. Shields, president of the company, who directed operations personally, reports that the short catch was due merely to failure to get on the fish. Although the "Sophie" fished 22 dories throughout the season and worked hard, **good fortune in finding spots of codfish was lacking** and the a whole [sic] was most disappointing.	PF, vol. 34, ed. 11, p. 66
1936	**The fish seemed to be badly scattered and the boats had extreme difficulty in getting onto profitable spots**. Some of the fishermen are of the belief that Japanese trawlers have scattered the schools, making it difficult to make profitable catches from dories. Whether that is true can hardly be determined for several years.	PF, vol. 35, ed. 2, p. 225
1937	The last year we sent vessels to the Bering Sea [1937], **there were few if any cod south of [Amak] Island**. For reasons unknown to us, **the abundance of fish in different locations would change.**	Shields, p. 136-137
1940s	All the way from Dublin Bay to about 35 miles southwest of Amak Island was at some time productive for catching cod. **Slime Bank produced good yields before the 1940s.**	Shields, p. 136

Table 8. Qualitative evidence of abundance in the broader Bering Sea.

Year	*Quote*	*Source*
1917	The reports coming from the north are that fishing is not as good as usual on account of stormy weather and the scarcity of good fishermen. With a plentiful supply of the latter weather conditions would not have much effect, as **there is no scarcity of fish.**	PF vol. 15, ed. 13, p. 31
1917	**We have 45,000 square miles of known codfish banks in the Pacific, from which the quantity so far utilized is insignificant**. Prof. Cobb closed his remarks by saying that, as the supply of one fish drops off, another comes into prominence, and on that account, at least, he felt justified in being an optimist as to the future of the Pacific fish business.	PF, vol. 15, ed. 13, p. 31
1919	**The codfish are so plentiful on the halibut banks that they are a menace to the halibut fishermen**. **They are caught in great quantities,** but thrown away on account of not being able to take care of them on the banks... A movement might be in order to send some of the sub-chasers to the district, to protect the fishermen from the "menace" of the codfish.	PF, vol. 17, ed. 5, p. 77-78
1919	The fish... are caught in the Okhotsk Sea, **where codfish are quite abundant,** but they seem to be of a different shape from those taken in Bering Sea, being smaller on the average, and having a thinner flesh than the Alaska codfish, which makes them somewhat less desirable from the American viewpoint.	PF, vol. 17, ed. 13, p. 48
1922	"[T]he schooners John A. and Maid of Orleans, of the Pacific Coast Codfish company, and the Fanny Dutard, of J. A. Matheson, sailed for Bering Sea in late April and early May. Fishing was exceptionally good, and the vessels got much better fare than usual, **the fish being large in size as well as numerous**."	PF, vol. 20, ed. 2, p. 93
1924	J. A. Matheson received a message from the Fanny Dutard dated June 9, when she had 50,000 fish, and there were said to be plenty of fish on the banks, though some bad weather had been encountered.	PF, vol. 22, ed. 9, p. 40
1925	During June several other [schooners] were spoken [to], reporting **plenty of fish but a great deal of bad weather,** which also encountered a considerable part of the season at the Shumagin Island stations.	PF, vol. 23, ed. 2, p. 148
1925	With the San Francisco codfish fleet on its way home in August from its summer's operations in Bering Sea, what seems to be one of the most successful seasons in years is drawing to a close. Reports indicate that **an unlimited supply of fish has made possible a much heavier catch than was anticipated earlier in the year.**	PF, vol. 23, ed. 9, p. 98
1925	**The poor season was not due to shortage of fish** but owing to the fact that eleven members of the crew deserted early in the season, taking seven of the dories with them.	PF, vol. 23, ed. 10, p. 46
1926	Capt. Coolin [aboard the Fanny Dutard in Bering Sea] reported f**ish were plentiful and of good size.**	PF, vol. 24, ed. 8, p. 34

1927	While the Pacific codfish catch in 1926 was considerably smaller than the previous year, the decrease was due to curtailed operations by the San Francisco fleet, and **not to any scarcity of fish**; the average production per vessel being somewhat better than in 1925.	PF, vol. 25, ed. 2, p. 204
1927	Fresh codfish is highly prized in the leading Atlantic markets, and if it could be brought to Pacific ports in good condition it should become an important item. Some of our halibut fishermen, with first-class refrigeration facilities, are now making voyages to **grounds where codfish are abundant.**	PF, vol. 25, ed. 9, p. 23
1930	While the east side of the Bering Sea has been regarded as an American fishing area for decades, the Japanese are presumed to be within their rights as long as they remain three miles offshore. The present enterprise can only be regarded as experimental... **Codfish can probably be taken in considerable numbers**. Previous trawling ventures on the Bering Sea have not proved successful because of the character of the bottom.	PF, vol. 28, ed. 8, p. 12
1932	[The Sophie Christenson] landed 273,000 codfish and might have landed more but for leaks which developed. From the middle of August to the 28th, when she left Bering Sea, prevailing weather was fine and **there were lots of fish**, but the fishermen did not want to go after them, fearing loss of their catch because of the vessel's leaking condition.	PF, vol. 30, ed. 11, p. 75
1933	[Capt. Grotle] declared that **fish were plentiful** and the weather generally good throughout the season.	PF, vol. 31, ed. 11, p. 49
1935	The four-master "Sophie Christenson", fishing 22 dories, took 416,290 fish... **due to the remarkable abundance of fish** and good weather experienced in June... **In June the fishing was so good at times that the boat's usual minimum of 23 inches had to be raised to 25** to permit the dress gang to clean up the fish. One day the fishermen voluntarily remained aboard the boat despite the fact that **it was fine weather, with lots of fish**, so the dress gang could get some rest.	PF, vol. 33, ed. 11, p. 48
1937	Capt. Tom Haugen [aboard the Wawona] reported the best of weather while the vessel was in Bering Sea, the fish being plentiful and the men able to get at them.	PF, vol. 35, ed. 12, p. 81
1938	With weather exceptionally good throughout the season, and **fish generally abundant**, all American codfishing operations in the Bering Sea in 1937 did very well in spite of the increased interference of the Japanese motherships, trawlers and crab boats.	PF, vol. 36, ed. 2, p. 197
N/A	Most often the cod were at a particular location because some form occuring below the surface... Sometimes there were good catches at Black Hill and at other times very little. The Bering Sea is a large sea and it is easy to miss a former good location... We operated on a hit or miss basis.	Shields, 2001, p. 121

Table 9. Wages paid to cod fishermen working on schooners for Puget Sound and San Francisco cod companies, 1915 to 1940. The vessel's dress gang, captain and cook were paid separately.

Puget Sound wages	*Year*	*San Francisco wages*
$40 per thousand	1915	$34 per thousand
N/A	1916	N/A
N/A	1917	N/A
2 c. per lb.	1918	$80 per thousand
N/A	1919	N/A
2 c. per lb.	1920	$90/thousand
1 ½ c. per lb.	1921	N/A
1 ¼ c. per lb.	1922	N/A
1 ¼ c. per lb. for <8000 fish, 1 ½ c. per lb. for >8000 fish	1923	1 ¼ c. per lb. for <8000 fish, 1 ½ c. per lb. for >8000 fish
1 ½ c. per lb. for <7000 fish, 1 ⅝ c. per lb. for 7000-9000 fish, 1 ¾ c. per lb. for >9000 fish	1924	1 ¼ c. per lb. for <8000 fish, 1 ½ c. per lb. for >8000 fish
1 ½ c. per lb for <7000 fish, 1 ⅝ c. per lb. for 7000-9000 fish, 1 ¾ c. per lb. for >9000 fish	1925	N/A
1 ½ c. per lb for <7000 fish, 1 ⅝ c. per lb. for 7000-9000 fish, 1 ¾ c. per lb. for >9000 fish	1926	N/A
1 ½ c. per lb. flat rate, 1 ⅝ c. per lb. if fish >4lbs., 1 ¾ c. per lb. for >9000 fish	1927	N/A
N/A	1928	N/A
N/A	1929	N/A
1 ½ c. per lb.	1930	1 ½ c. per lb.
1 ⅜ c. per lb.	1931	1 ⅜ c. per lb.

1 c. per lb.	1932	1 c. per lb.
1 c. per lb.	1933	1c. per lb.
1 ⅜ c. per lb.	1934	1 ⅜ c. per lb.
1 ⅝ c. per lb.	1935	1 ⅝ c. per lb.
N/A	1936	N/A
1 ⅞ c. per lb.	1937	1 ⅞ c. per lb.
1 ⅞ c. per lb.	1938	N/A
1 ⅞ c. per lb.	1939	N/A
N/A	1940	N/A

Table 10. Evidence of declining fish body size.

Year	*Quote*	*Decrease or increase*	*Source (PF)*
1920	On the Pacific Coast are to be found several species of the family Gadidae... The Pacific cod is very abundant in Bering Sea... They vary greatly in weight, ranging from one-half pound to 75 pounds or more.	N/A	1920, no. 2, p. 116.
1921	Fishing was exceptionally good [in Bering Sea], and the vessels got much better fare than usual, **the fish being large in size as well as numerous.**	Increase	1922, no. 2, p. 193
1922	The fish are not so large as last year, when they weighed out exceptionally well…	Decrease	1922, no. 10, p. 32.
1922	The total catch of the Bering Sea fleet from Puget Sound was 314,000 fish more than in 1921, but **the fish were somewhat smaller on the average.**	Decrease	1923, no. 2, p. 99.
1923	The Pacific Coast Codfish company reports the fish unusually small, the catch of the Chas. R. Wilson, despite the unusually large number of fish, weighing out only about 361 tons and that of the John A. 318 tons… These vessels fished from the Slime Bank to Bristol Bay, where fine weather prevailed.	Decrease	1923, no. 11, p. 25.
1923	…[L]ast year the average weight per fish fas [sic] 4 1/2 lbs., while this year the John A. averaged 3 7/8 lbs., the Chas. R. Wilson 3 1/2 lbs., the Wawona 4.7 lbs., and the Fanny Dutard 3.3 lbs.	Decrease	1923, no. 12, p. 38.
1923	[T]he arrivals were far smaller than for any year from 1914 to 1920, inclusive... [T]he fish taken by a number of vessels averaged fully a pound less in weight than the year before.	Decrease	1924, no. 2, p. 108.
1923	Most of the fish taken on the Slime Bank, however, were **unusually small in size.**	Decrease	1924, no. 2, p. 110
1924	The fish are said to be of good size and quality, running well over 4 lbs. each.	Increase	1924, no. 10, p. 44
1924	…[T]he codfish taken in Bering Sea by the Puget Sound fleet were of large size, but on weighing out the results have proven very disappointing… the average weight per fish being only about 3.86 lbs. The average for other vessels of the Puget Sound fleet is believed to be no better, if as good.	Decrease	1924, no. 11, p. 46
1925	One reason for the lighter return is the fact that **the fish have averaged smaller in size than usual.**	Decrease	1925, no. 11, p. 46.
1926	While no definite information concerning the tonnage of the catch is available, it is understood that the majority of **the fish ran to rather small sizes this year.**	Decrease	1926, no. 10, p. 28.

1931	Fish of the Bering sea schooner catch weighed out rather light this season [in 1931], the average for the fleet being **under 3.25lbs. per fish**. Codfish company executives comment on the fact that **there appears to be a gradual decline in the average weight of the Bering Sea codfish** when noted over a period of years. **In 1930 the average weight was around 3.5 lbs.**, and that was considered light, a good cargo being judged to average about 4 lbs.; while in past years a few cargoes have weighed out to an average of above 5 lbs. No explanation has been offered for this decline in the average weight of fish.	Decrease	1932, no. 2, p. 277-278.
1932	…[I]t appears the fish averaged perhaps a quarter-pound more than the year before, the 1932 average being calculated as around 3.5 lbs., or slightly more. This was somewhat reassuring after a downward tendency of average weights for several years.	Increase	1933, no. 2, p. 181.
1934	…[I]t is believed that the fish this season are somewhat larger than those of 1933, a condition which was reported by the captains from time to time during the season.	Increase	1934, no. 10, p. 44.
1934	The "Azalea" found fish a little more scattered than in 1933… The fish ran larger than last year, however.	Increase	1934, no. 11, p. 60
1934	This apparent paradox, wherein fewer fish gave a greater tonnage is traceable to the average weight of the fish, **which was 3.35 lbs. in 1934, as against 3.18 lbs. the year before**. This difference of .17 lb. in the average weight of the fish appears small individually, but amounts to a large tonnage on 1,520,255 fish.	Decrease	1935, no. 2, p. 199.
1939	The number of fish, however, showed a material decline, which traced to the fact that **the individual fish were much larger**. Tonnage for 1939 was 1,537, against 1,560 the previous year… This gives an average cured weight per fish of 3.55 lbs., as against 3.18 lbs. for the previous season. As a matter of fact, the 1939 average weight was the greatest recorded during any year since accurate figures on this factor have been available.	Increase	1940, no. 2, p. 301
1939	…[T]here is good reason to doubt if larger and finer fish have ever been taken since the schooners started working among the smaller but more numerous fish of the Bering Sea.	Increase	1940, no. 2, p. 301
1939	The power schooner "Dorothea" of the Kanaga Ranching Co. made one fishing trip during the season, taking a fare of **45,000 lbs. [22.5 tons] exceptionally fine, large fish**.	Increase	1940, no. 2, p. 302

Table 11. Puget Sound, San Francisco, and total catch per year, 1915 to 1940. Cells shaded in green are peak catch per region between 1915-1940. This data was compiled from the catch reports throughout the *Pacific Fisherman* articles. This is only reported catch from the schooners (shore station catch not included in these totals).

Year	*Puget Sound*	*San Francisco*	*Combined*
1915	1,307,571	2,149,000	3,456,571
1916	1,759,723	1,984,000	3,743,723
1917	1,323,633	2,372,000	3,695,633
1918	1,269,116	2,771,268	4,040,384
1919	886,000	3,392,500	4,278,500
1920	465,000	1,980,000	2,445,000
1921	631,000	1,062,000	1,693,000
1922	620,000	1,277,000	1,897,000
1923	544,000	1,686,377	2,230,377
1924	769,000	1,035,647	1,804,647
1925	1,099,471	1,734,000	2,833,471
1926	1,195,847	1,074,614	2,270,461
1927	639,000	761,000	1,400,000
1928	810,000	609,342	1,419,342
1929	1,232,000	440,000	1,672,000
1930	1,335,000	324,000	1,659,000
1931	562,000	483,000	1,045,000
1932	621,026	556,423	1,177,449
1933	1,045,221	514,000	1,559,221
1934	941,056	541,485	1,482,541
1935	954,004	512,039	1,466,043
1936	859,000	599,342	1,458,342
1937	729,827	508,974	1,238,801
1938	962,365	0	962,365
1939	870,000	0	870,000
1940	895,000	0	895,000

Table 12. Total number of offshore vessels fishing for Pacific cod in the Bering Sea, Shumagin and Aleutian Islands. Cells shaded in green are represent the years with the highest number of vessels sent cod fishing. Additional pertains to non-industry vessels who were either catching cod for one season or were contracted to transport cod to San Francisco or Puget Sound.

Year	*Puget*	*S.F.*	*Japan*	*Additional*	*Total*
1913	5	5	0	0	10
1914	8	6	0	0	14
1915	8	6	0	3	17
1916	9	10	0	0	19
1917	9	12	0	0	21
1918	8	11	4	0	23
1919	8	10	3	1	22
1920	4	10	0	1	15
1921	4	4	0	0	8
1922	4	6	0	0	10
1923	3	7	0	0	10
1924	4	6	0	0	10
1925	6	8	0	0	14
1926	6	6	0	0	12
1927	3	4	0	0	7
1928	4	3	0	0	7
1929	7	2	0	0	9
1930	6	2	0	0	8
1931	2	2	0	0	4
1932	2	3	0	2	7
1933	2	2	0	0	4
1934	3	2	0	1	6
1935	3	2	0	0	5

1936	3	3	0	0	6
1937	2	2	0	0	4
1938	3	0	0	0	3
1939	3	0	0	0	3
1940	4	0	0	0	4