Salmon At the Center: What Bay Delta Communities Want for the Future of California Salmon

By

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THESIS

Submitted in partial satisfaction of the requirements for the degree of

MASTER OF ARTS

in

Geography

in the

OFFICE OF GRADUATE STUDIES

of the

UNIVERSITY OF CALIFORNIA

DAVIS

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2024

ACKNOWLEDGEMENTS

I would like to first acknowledge and thank my thesis committee Dr. Beth Rose Middleton Manning, Dr. Clare Cannon, and Dr. Natalia Deeb-Sossa for their support, time, and commitment to using academic research to making meaningful change. Beth Rose, thank you for your encouragement, many meetings over coffee and tea, advice on career paths, support during my thesis writing, and most of all your kindness and friendship. You were the reason I chose UC Davis, and I am thankful to have had the opportunity to work with and learn from you. Clare, I thank you for your time and the inspiring work you do. Your thoughtful input and insight on my thesis has been invaluable. Natalia, taking your class reminded me of why I went to grad school initially and what it looks like to take our academic skills and access to make meaningful change in our communities and world. Your guidance and insights during the thesis process made a world of difference and has made me a better researcher, and person, gracias por todo. I would also like to extend a special thanks to Mark Cooper, thank you for taking time to meet with me and guide me, I appreciate you. Additionally, Carrie Armstrong Rupert, thank you for your commitment, kindness, and wealth of knowledge – I could not have done this without you.

I would like to thank the community of environmentalists, NGO leaders, scientists, outdoor enthusiasts, and Tribes who tirelessly work to improve conditions for salmon, communities, and Californians alike. Thank you for your tirelessness and commitment, this work is because of, and for you.

Special thanks to my family and friends. Especially to my mom, sister, and mother-in-law who always supported me, loved me, and pushed me while pursuing my higher education.

Most importantly, I would like to thank my wife, Julia Rose. Without you this simply would not be possible – you helped show me what I am capable of and supported me in my times of struggle. From the bottom of my heart, thank you.

ABSTRACT

This thesis is focused on the experience of fishing communities, Tribes, and frontline communities impacted by declining chinook salmon populations in the Bay-Delta Watershed of California, especially considering the 2023 and 2024 salmon season closure. This work analyzes the impacts of state and federal water projects on salmon, salmon conservation policies, community engagement efforts, and how feedback from fishing, environmental, and tribal entities are incorporated into policy and conservation. I use critical discourse analysis to examine news articles and public comments, as well as interviews with area experts on salmon decline, public policy, and advocacy. These results show that fishing communities, including tribal, subsistence, recreational, and subsistence, and salmon-reliant Tribes are greatly impacted by the decline of salmon in California. Additionally, this thesis concludes with some actionable steps that policy makers and agencies tasked with salmon conservation and water resource management can take to improve conditions for all salmon-reliant communities.

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I: Introduction:

Much of what California is known for, metropolitan cities and a thriving economy, is only possible because of the state's complex water infrastructure (Hanak, 2011). These advancements are not without their issues, and they are as unique as the state itself. Perhaps the greatest of these issues is that California is outgrowing its water infrastructure and its ability to balance the needs of the economy, environment, and society (Hanak, 2011). These competing interests are especially prominent in the Sacramento-San Joaquin Delta, the hub of California's water supply and a region of dense biodiversity that is currently in a state of ecological collapse (Hanak, 2011 p. 7). The Delta is suffering from issues with pollution, chronic harmful algal blooms, and altered flows; currently there are eight fish species listed as threatened or endangered, including salmon, and an additional nine species of concern (Branan, 2024).

Chinook salmon were once plentiful in California's Central Valley, with 3-4 million fish returning from the Pacific Ocean to their natal streams annually (Hanak, 2011). Currently salmon runs are declining throughout the state; this is due to several factors but primarily because of dams, alteration of freshwater flows, and water diversions; These activities make salmon increasingly susceptible to significant climatic events such as drought (Moyle et al., 2009). California is on the forefront of critical endangerment of fauna due to water management; the action or inaction taken here may have serious policy implications for other regions experiencing similar circumstances (Leidy & Moyle, 1998). If effective political action is taken to save California salmon, this could set an important precedent for how other regions handle

related issues. In contrast, further inaction could promote similar passivity for agencies dealing with issues of resources management and threatened species.

Figure 1: Map of state and federal water projects in the state of California. (Scoville, 2019).

The federal and state policies have created and implemented policies to help mitigate the negative impacts salmon face with ranging success. Additionally, there are policies that do not specifically aim to protect salmon but should benefit them. The Clean Water Act (CWA) (1972) requires the State Water Resources Control Board (SWRCB) to set water quality standards that support the multitude of beneficial uses throughout California (Hanak, 2011). Through the Clean Water Act, state and regional water boards have identified twenty-eight beneficial uses including municipal and

agricultural water use and the preservation and enhancement of fish, wildlife, and other aquatic resources (Clean Water Act, 1972). Effective CWA enforcement would have positive impacts on salmon and other aquatic species. Similarly, the Endangered Species Act (ESA) was enacted to generally protect species threatened, to various degrees, by extinction (United States, 1973). Several Chinook salmon runs are listed as endangered and, because threatened in California and because the mandate of the ESA is to ensure both the survival and reproduction of species identified regardless of the finances or impacts to human uses, this could mean that water should be appropriated to fish over human and economic uses such as agriculture (Hanak, 2011).

Balancing the needs to environmental, urban, and agricultural uses of water in California continues to be a point of contention for the multiple federal, state, and local jurisdictions and agencies involved. The 2006 Bay-Delta Water Quality Control Plan (Bay-Delta Plan) outlines the beneficial uses, water quality objectives, protective measures, and strategies to meet targets for the Bay-Delta. The Bay-Delta Plan outlines procedures to set inflow and non-flow measures to protect fish and wildlife (California Water Boards et al., 2006). In addition to setting flow requirements for rivers, other non-flow interventions like habitat restoration and invasive species control should be taken to help meet the biological goals set forth in the Plan. Phase one of the Bay-Delta plan calls for 40% unimpaired flows for the San Joaquin River and its major tributaries (the Tuolumne River, Stanislaus River, and Merced River), during critical months for young fish, February to June. However, this has not yet been implemented (California Water Boards et al., 2006).

Figure 2: Map showing the San Joaquin River and its major tributaries; NOAA

Currently, the full implementation of the full Bay Delta Plan remains delayed because the California State Water Board is entertaining the possibility of adopting Voluntary Agreements (VA's) in lieu of the Bay Delta Plan. The VA's are a set of terms created by private and public entities concerning beneficial uses of water, environmental objectives, management strategies, and water related priorities. Voluntary Agreements are not inherently detrimental to the health of river ecosystems or aquatic species, particularly if there are appropriate representatives of tribal and fishing interests at the bargaining table. The current VA's which outline how to manage Delta water resources, address declining fish species, and improve watershed health were proposed in partnership by state and federal agencies, water districts, utility commissions, irrigation

districts, and agricultural interests. The VA's are notably missing meaningful input from Tribes.

Amid these management debates and periods of inaction, the salmon fishing season was declared closed for the 2023 season for only the third time in state history. The Pacific Fishery Management Council (PFMC) is responsible for considering factors such as river conditions, salmon population health, and water availability to determine if commercial and recreational fishing is sustainable or needs to be closed in California. Dismal salmon returns and poor drought conditions from previous years were cited as contributing factors. In April 2024, the PFMC declared the season closed for a second consecutive year, again because of poor salmon escapement to inland waters.

There is much research and literature on the California salmon decline and the complexities of California water resources and management which will be discussed at length in the literature review section. However, there is significantly less academic research dedicated to understanding how these issues impact subsistence, commercial, recreational, and tribal fishing communities and environmental justice movements. This research is aimed at better understanding how fishing and tribal communities are impacted by salmon decline and season closures, beliefs around causes for decline, and desires for management changes.

Research Questions:

How are tribal, subsistence, commercial, and recreational fishing communities impacted by the decline of California salmon, particularly by the closing of salmon seasons?

- What are the concerns, impacts, and desired changes across fishing and tribal communities? How are these concerns and impacts portrayed in the media?
- Do current water and management policies/practices reflect the concerns and desired changes of frontline and tribal communities?

II: Literature Review

II.I: Historical Context

Salmon are a keystone species in California ecosystems, meaning they support other species and contribute to the overall health and functioning of critical ecosystems (NOAA). In addition to supporting ecosystems, salmon also are an integral piece to the cultural fabric of California, particularly to Tribes whose lands surround the Bay-Delta Watershed. Prior to Spanish colonization, the Central Valley of California, which encompasses the San Joaquin and Sacramento Rivers, supported one of the densest concentrations of Native Americans on the continent (Boilard, et al, 2015). The region was rich with resources such as fish, game, and edible and medicinal vegetation, which supported the Indigenous tribes, primarily Miwok and Wintun peoples (Lund & Hanak, 2007). It is estimated that pre-colonial salmon harvests in the Central Valley surpassed 8.5 million pounds a year (California Department of Fish and Game, 2001).

The land during the pre-colonial period functioned much differently than it does today. Prior to the industrial revolution, the land surrounding the Bay-Delta was primarily tidal wetlands and was largely underwater due to higher tides (Lund & Hanak, 2007). Between the late 1700's and 1980, 91% of wetlands were filled in California; in fact, California has filled more wetlands than any other state (Kurlansky, 2021). The wetlands of the Bay-Delta are critical in supporting salmon; the brackish waters allow young salmon to prepare for their time at sea (Kurlansky, 2021). The aquatic ecosystems of the pre-colonial Bay-Delta provided excellent habitat for salmon runs, which greatly benefited ecosystem health and the first peoples.

The Gold Rush, which took place between 1848-1852, rapidly increased the number of individuals entering the region during the period of westward expansion. The promise of gold, or some type of adjacent prosperity, led individuals to the interior rivers of California, including to the Delta region. With this new expansion of pioneer settlers came significant industrial scale changes to the landscape; Gold miners built out hundreds of miles of water diversions to support mining operations (California Department of Water Resources, n.d.). These mining practices led to negative fishery impacts including habitat destruction, water pollution, and direct contamination of fish (Reed, 2023).

During this period, immigrants to California began formalizing commercial salmon fishing operations (California Department of Fish and Game, 2001). Initial fishing operations began in the Northern sections of the San Francisco Bay (Suisun and San Pablo Bays) and at the confluences of the Sacramento River and San Joaquin River in the Delta (CDFG, 2001). In the latter half of the 1800's, canneries were built along the Sacramento and San Joaquin Rivers supporting takes that reached up to 12 million pounds of salmon (CDFG, 2001). The resulting rapid degeneration of river conditions and declining salmon fishery led to a precipitous decline in river-based fishing operations and canneries. This decline ultimately led to the proliferation of ocean trolling to support the fishery (CDFG, 2001). The impact of settler fishery management has and continues to have major impacts on California Tribes. The Winnemem Wintu people, for example, have stewarded a fishery in the McCloud River since time immemorial, but after 50 years settler management their traditional fishery was completely devastated (Reed, 2023 p. 88). Salmon decline in the upper Sacramento, Pitt, and McCloud Rivers

were initially due to settler commercial fishing operations, however the construction of Shasta Dam in 1943 completely blocked salmon from these traditional spawning grounds (Yoshiyama & Fisher, 2001).

In 1850, during the height of the gold rush, California became a state; which had a significant impact on the development of California's water rights. Riparian rights -- water rights given to landowners whose property encompasses or is adjacent to waterways -- were the first to be adopted by California, following similar practices in Eastern states (State Water Resources Control Board, 2018). However, the "first in time, first in right" principle used to govern gold rush era mining projects influenced the adoption of appropriative water rights, which allows water to be diverted for beneficial use elsewhere (California State Water Resources Control Board, 2018). The Water Commission Act was adopted in 1914 giving the State (now the State Water Board) the right to oversee and require permits for appropriative water use (Water Education Foundation, n.d.). Those with appropriative rights established pre-1914 were granted what is called "senior water right status." This senior status gives priority water access after riparian right holders but before appropriative users after 1914. Those given appropriate water rights post-1914 are also referred to as junior water rights holders (Water Education Foundation, n.d.). Although the vast majority of those seeking gold were unsuccessful, settlements grew around the region. Many who decided to stay began farming, thus further altering the landscape to clear parcels for agriculture and then irrigate crops (Lund & Hanak, 2007).

State and Federal water projects were instituted to fulfill these growing demands for urban and agricultural use in the Central and Southern parts of the state. According

to the California Department of Water Resources, the original idea for a statewide water project was first introduced in 1919. In 1946 the federally managed Central Valley Project (CVP) was completed, and the first water delivery took place in August 1940. In addition to the CVP, California has a state managed water project aptly named the State Water Project (SWP). Today, these projects export millions of acre feet (the number varies depending on the year) down south for urban, agricultural, and environmental uses (Obegi et al., 2008 15). These water projects created a false image of water availability in California leading farmers to take on unsustainable growing operations, rely on state and federal water projects to support them, and pump groundwater when there is not enough water flowing down the conveyance canals (Arax, 2019).

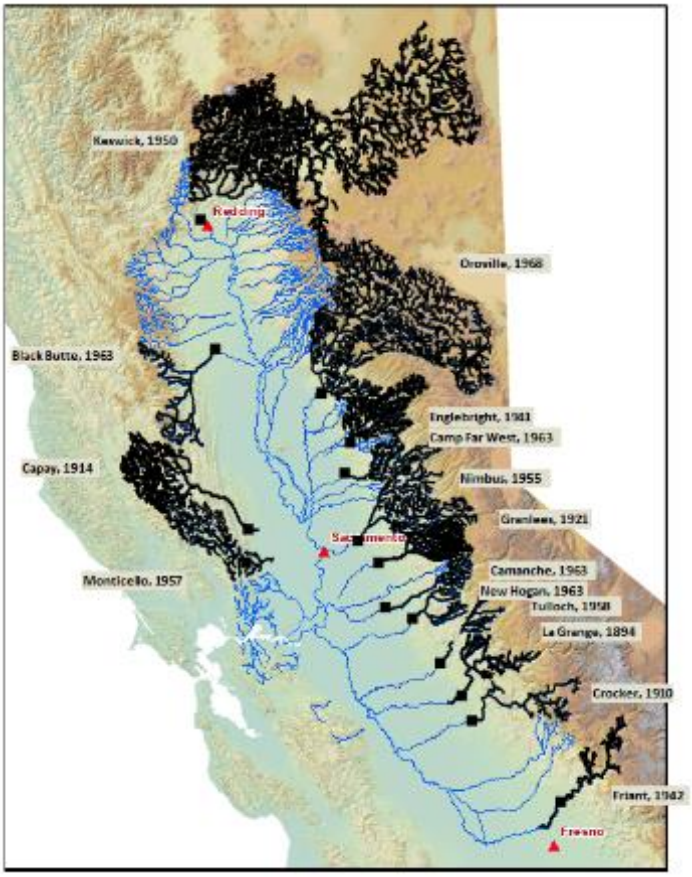

Figure 1: Map of the Central Valley's river and stream systems still accessible to salmon (blue) and historic but no longer accessible salmon habitat (black); NOAA

The impacts of the increased water diversions and landscape transformations in the Delta and Central Valley rivers are significant for tribal communities, Delta farmers, surrounding communities, and aquatic and terrestrial species. A report by the San Francisco Estuary Institute (SFEI) titled *A Delta Renewed,* articulates the continued loss of tidal wetlands in the Delta region post initial colonization. A significant driver of wetland degradation is the disconnection of the historic wetlands from critical floodwaters that fed them (SFEI, 2016, 14). While the totality of this degradation cannot be blamed entirely on the CVP and SWP, these projects certainly played a large role in the changing landscape.

II.II: Basics on Salmon Biology + Ecology

There are several species of salmon that have historically run throughout California; the focus of this paper will be on the Chinook Salmon species, also known as King Salmon. The appearance of Chinook Salmon can vary slightly; however, they are primarily silver fish with darker blue/green backs and dorsal fins. Chinook Salmon are anadromous fish, meaning they are born in freshwater, migrate to the ocean to feed on marine food sources, and travel back to their natal waters to spawn (Kurlansky, 2021). Healthy river systems are critical to sustaining the food webs needed to support salmon populations. The marine-derived nutrients that salmon bring back upstream provide many ecosystem benefits (Coté, 2022). Other species benefit from these nutrients, whether from direct consumption of Salmon or from the nitrogen released during their decomposition (Coté, 2022). Samples from trees in old growth forests have

traced nitrogen back to the ocean, salmon have been feeding the forests and the people since time immemorial (Kimmerer, 2013).

(Credit: Michael Humling, U.S. Fish & Wildlife Service)

Chinook salmon use an olfactory mechanism that bonds them to the spawning grounds in which they were born. Some call this phenomenon river imprinting and refer to these rivers or streams as “home waters” (Fultonk, 2012). Reproduction is the final stage in the life cycle of Salmon. For Salmon to successfully reproduce, they rely on specific river conditions. Large gravel and sediment in deeper sections of rivers are needed for females to prepare their spawning area, also known as redds (NOAA, 2022). Additionally, water temperatures need to be cool, specifically under 55 degrees Fahrenheit for eggs to be viable. The eggs rely on proper oxygen supply provided by steady water flow to survive. Even in perfectly healthy habitats, the survival rate of salmon eggs and fry is low. For young fry, rearing typically happens in freshwater floodplains and wetlands, as these ecosystems provide ample food supplies and protection during the maturation process (SFEI, 2016). Chinook salmon are incredibly resilient fish, however, due to anthropogenic changes in the Central Valley salmon face great challenges. Specifically, the loss and disconnection from important ecosystems in

the Delta create compounding hardship for these fish. Less habitat means declining support for salmon population growth.

In river systems, flow regimes are inextricably linked to the health of aquatic organisms and are a determining factor in critical biodiversity (Michel et al., 2021 2). The State Water Project and Central Valley Project are the largest water diverters and disruptors of natural flows in California. A significant consequence of these water projects is their role in warming water temperatures. The decreased amount of cold-water flows is creating warming temperatures in downstream ecosystems. Additionally, the water that is eventually released into the ecosystem has typically sat stagnant in a reservoir, growing warm and increasing water temperatures in the river once reintroduced (Obegi, et al, 15). Salmon can be adaptable to changing water temperatures to an extent but rely on cooler waters for optimal health. Increased water temperatures have ranging impacts on salmon based on stage of lifecycle (NOAA, 2009 77). For example, the Biological Opinions document released by The National Oceanic and Atmospheric Association (NOAA) states that salmon prefer upstream temperatures for adult migration ranging between 38-56 degrees Fahrenheit, Temperatures above 70 degrees Fahrenheit create stress for salmon and will block migration, often resulting in mass mortality events (NOAA, 2009 77). In 2021, NOAA estimated that 75% of winter-run salmon eggs in the Sacramento River due to high temperature.

II.III Salmon decline is colonialism

The impacts and proliferation of colonization can be seen and felt throughout California. Colonization refers to the dispossession of land from Indigenous peoples to which it belongs and maintaining this dispossession through constant

erasure and stripping of Indigenous self-determination (Coté, 2022). Declining river conditions and salmon runs are a symptom of colonial land stewardship; these issues are environmental injustices specifically impacting California Native Nations. Indigenous scholar Dina Gilio-Whitaker, notes that indigenous environmental justice (IEJ) differs from the mainstream environmental justice (EJ) movement, IEJ acknowledges that settler colonialism itself is a structure of environmental injustice (Gilio-Whitaker, 2019). Indigenous environmental justice recognizes the issues related to sacred sites within and extending the boundaries of reservation lands and uplifts the right of self-determination for both federally and non-federally recognized tribes (Gilio-Whitaker, 2019). Fishery decline poses major food sovereignty issues for California salmon-reliant tribes.

Worldwide, Indigenous people face the most serious food insecurity as a result of perpetual impacts of settler colonialism (Coté, 2022). Kari Marie Norgaard conducted research with the Karuk Tribe in Northern California to document the impacts of and connections between environmental degradation, inaccessible traditional foods, and diet- related disease (Norgaard, 2005). The resulting report, entitled, “The Effects of Altered Diet on the Health of Karuk People,” presents the relationship between dams built on the Klamath River and increased rates of diabetes and other disease within the Tribe (Norgaard, 2019). Severing access to traditional foods can impact more than physical health; many Indigenous peoples have sacred relationships with traditional foods and the environments they are sourced from (Norgaard, 2019). Ron Reed, an enrolled Hoopa Valley Tribal member and Karuk cultural practitioner, describes the sacred relationship between salmon and people. Reed explains that humans are tasked

with caring for salmon and in turn salmon feed the people. As such, management activities is at the core of tribal responsibility and culture (Norgaard, 2019).

III. METHODS

III.I: Background

Aims of research:

This research aims to understand the impacts, concerns, and desires for change of local environmental organizations, impacted Tribes, and commercial, recreational, and subsistence fishing communities in the Bay-Delta Watershed impacted by salmon decline and season closures. This research utilizes qualitative methods, including critical discourse analysis to analyze the publicly available data sources, and targeted interviews with representatives of key non-profit organizations working on the issues.

Research Lens:

This research utilizes a decolonial framework to situate the state of landscape and human and non-human beings following 150 years of colonial and Eurocentric land management and policies. Decolonial research allows researchers to draw connections between imperialist knowledge production and oppressive policies and negative impacts on formerly colonized peoples (Naidu et al., 2024). Research on fisheries and water management is rarely done through a decolonial lens. I argue that this research would benefit greatly by examining the issues of historical context of fishery and ecosystem decline by considering pre-colonial and post-contact timelines.

This research embraces the tenants of the decolonial framework including self-determination, social justice, and centering voices of those who have been colonized (Naidu et al., 2024). Using a decolonial framework, I aim to detach this research from colonial structures of knowledge, management, and conservation. It is critical to parse

out the ecological reality from the narrative of the dominant culture and center traditional ecological knowledge (Radcliffe, 2022).

III.II: Critical Discourse Analysis

Critical discourse analysis (CDA) is a method of examining sometimes murky relationships between language and the social and cultural relationships, processes, and power structures that influence it (Locke, 2004). CDA is commonly used in political research to understand systems of institutional inequality and exploitation (Locke, 2024). For this research, CDA is being used to evaluate public opinion on the impacts of salmon decline and season closures, water management decisions, and public engagement processes around fishery and water policies. There are two data sets that will be analyzed using CDA; news articles pertaining to salmon season closures, and public comments given at an environmental justice listening session workshop hosted by the California State Water Board in March 2023. I chose to analyze news articles because of the role media plays in public opinion and because of its potential to contain biases. Analyzing public comment is critical because of its ability to give voice to chronically disenfranchised communities, who may be underrepresented in the media. To organize and analyze these two data sets, I used discourse analysis software, Dedoose. Dedoose allows researchers to upload data, highlight quotes, and organize actors, themes, and sentiments using codes.

CDA will be used to analyze two sets of collected data. The first data set is a collection of articles written about salmon decline and season closures. The second set of data is made up of public comments made during a State Water Board listening session related to water resources management plans and salmon management.

III.II.I: Types of Data Analyzed

News Articles:

Twenty-five news articles about California's salmon season closures, written between March 2023 and May 2024, were collected from regional, state, and national media outlets to provide diverse ideological and geographic perspectives. To analyze the news articles, I created codes to categorize sub-groups of those quoted, types of impacts caused by salmon season closure, and claims of responsibility for salmon decline and season closures. To categorize those quoted I will be using the following sub-categories: government and/or agency, non-profit, tribal member, and commercial or recreational fishing. The impacts will be categorized by the fishing industry, economy, tribal culture and resources, and ecosystem health. Lastly, when articles ascribe blame for season closures these will be coded into the following categories: environmental factors/climate change, development & destruction of habitat, industrial farming, pollution, and state water management and policy. Understanding the beliefs around responsibility for salmon decline is critical to conceptualizing management strategies that address these concerns held by those most impacted.

Analyzing media coverage on the topic allows for greater insight on the issues and how they are being portrayed to the public. Through this analysis it is possible to identify trends in who is represented in media coverage, the types of impacts getting the most visibility, and how responsibility for the problems is being addressed and portrayed.

Public Comments

Public comments relating to the state of California salmon and water management are difficult to compile because salmon management is a joint power effort between many agencies. For this reason, I decided to analyze the comments made at the California State Water Board's March 2023 Environmental Justice Listening Session because of the State Water Board's role as lead agency on issues of water management and protecting beneficial uses. This listening session is described as an opportunity for various impacted stakeholders to give public comment on Bay-Delta watershed management and policy decisions, particularly pertaining to the Bay-Delta Plan and the consideration of Voluntary Agreements. A total of 63 comments were given during this listening session and all comments were collected from transcripts and analyzed. For the public comments, codes were created to organize how commenters identified themselves, as members of non-profit organizations, fishing communities, tribes, frontline communities, scientists, and unidentified.

To analyze the comments made during this meeting, I created codes to organize the concerns and issues brought up in each comment. The comments made during the Listening Session were complex and unique and therefore needed to be tagged with various codes.

The codes:

Salmon decline
Salmon season closure
Climate change
Diversions
Economic impacts
Environmental justice
Tribal cultural and resource impacts

Impacts to Central Valley agriculture
Voluntary Agreements are inadequate
Community health impacts
Against Bay Delta Plan
Commercial and Rec fishing

III.III: Interviews

In addition to discourse analysis, the research utilizes semi-structured interviews to gain additional insight gathered from the public comment analysis. A key group of 3 key informants were identified and participated in a 30-45 minute structured interview. Before interviews were conducted, I submitted an application with the UC Davis Internal Review Board to ensure that all participants' anonymity was properly protected and that the questions would not endanger the participants. The goal of selecting interview participants was to get geographically diverse representation. This was achieved by having one participant represent a tribal-environmental organization (Save California Salmon) that focuses their work in Northern California, a representative of a water advocacy and science organization based in San Francisco Bay (SF Baykeeper), and a participant from the Tuolumne River Trust that is geographically focused in the Central Valley.

Interviews were conducted on video calls using Google Meet and were not recorded to ensure participants' privacy. Extensive notes were taken during the interview process and were analyzed for core messages, common themes amongst the three interviews, and to provide any clarity on the analysis done on the news articles and public comments.

The interviewees were asked a combination of the following questions:

- What is your relationship with California salmon? What do they mean or represent to you?
- How do you feel about the future of salmon throughout the Bay-Delta watershed?
- How do you feel about the current policies and management strategies that are meant to address the declining population of salmon in the state?
- What do you think of the public participation process and implementation of public comments in decision making?
- Do you think the concerns and desires of the public are reflected in decisions made around salmon conservation?
- Are there any changes you would like to see in policy and management that relate to salmon? If so, what are they?

III.IV: Limitations

There are some limitations present in this study. It is important to acknowledge that, in any complex and intersectional issue, it is impossible to capture the voices, experiences, and true impacts to everyone impacted by the issue itself. There are many nuances to understanding the issue of salmon decline and water management in the state of California; the intention here is to analyze available information without asserting that any group mentioned in this work is monolithic. This research places an emphasis on the environmental justice efforts within the Delta and Central Valley to protect salmon, ecosystem health, water quality, and the human and non-human communities that call this region home.

Additionally, these methods, while effective in understanding the generalized impacts and concerns around salmon decline and water management for the specific communities of focus, could be bolstered by an extensive survey of more individuals within the impacted categories identified in this research.

IV. FINDINGS

IV.I: Findings of News Articles Analysis:

Significant themes and patterns emerged from the structured analysis of 25 news articles from regional, state, and national news outlets on California's 2023 and 2024 salmon season closures. To better understand who was being interviewed and represented in the media coverage of salmon season closures, individuals quoted were categorized into the following categories: members of fishing communities, government/agency representatives, tribal members or representatives, or representatives of a non-governmental organization. Individuals included in the fishing community category include fishers (commercial and recreational), fishing outfitters, and fishing gear retailers. The NGO category includes representatives of environmental non-profits and fishing associations. It is important to note that some these quotes could be assigned two codes depending on how the individual was regarded or self-identified in the article.

Figure 3 below shows the distribution of representation in the news articles out of 70 coded quotes. Government and agency representatives make up the largest percentage of quotes included in the article analysis at 42.9 percent followed by NGO representatives at 28.6 percent. The fishing community was just under the NGO category at 22.9 percent. The smallest category represented throughout these articles was tribal members and representatives.

Figure 3: Bar chart illustrating the categories of individuals quoted in news article analysis.

The second type of analysis done on the news articles was to highlight the opinions of causes for salmon decline and therefore, season closures. These opinions were captured from quotes and body text from the articles. The leading opinion on causation was water management. More specifically, water management decisions that harm salmon runs, alongside the lack of effective execution of protective policies, such as the Endangered Species Act and Clean Water Act. Environmental factors and climate change were the second most cited cause for salmon decline. This category includes a range of associated topics including drought, rising temperature, ocean acidification, and general comments regarding climate change. Human changes to the environment/development (11.8%) and prioritizing industrial farming (10.8%) were also cited as causes for salmon decline. Human changes to the environment/development include more specific mentions of building dams, impacts from mining operations, and urban development. Prioritizing industrial farming included concerns that fish are not

getting adequate freshwater flows due to the demands of San Joaquin Valley agriculture. Pollution as a cause for decline was mentioned twice.

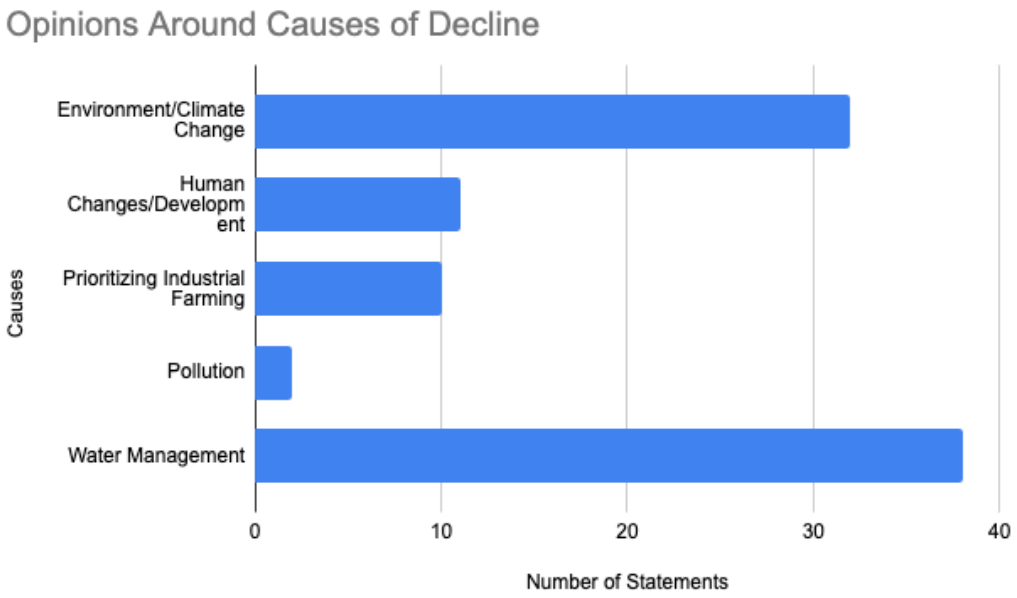

Figure 4: Bar chart shows the number of statements coded for accusations of cause for salmon decline.

The third category for media analysis is the attitudes on impacts of salmon season closures. This analysis shows how the media portrays who, or what, is most impacted by the closure of salmon seasons. There are two categories that stand out: impacts to the fishing community at 45.9% and the economy at 31.1%. In many instances, these impacts were coupled because a substantial portion of California commercial fishing industry is centered around Chinook salmon. However, there was more discussion of how the season closures impact the fishing community, including commercial fishing, fishing outfitters, recreational fishers, and their families. The third most common mention of impact was California tribes. Tribal impacts mentioned include loss of access to salmon for traditional cultural, dietary, and spiritual uses. The least common impacts mentioned were related to salmon-reliant communities (Tribes and

communities reliant on salmon fishing for subsistence and recreational related economies) and ecosystem health.

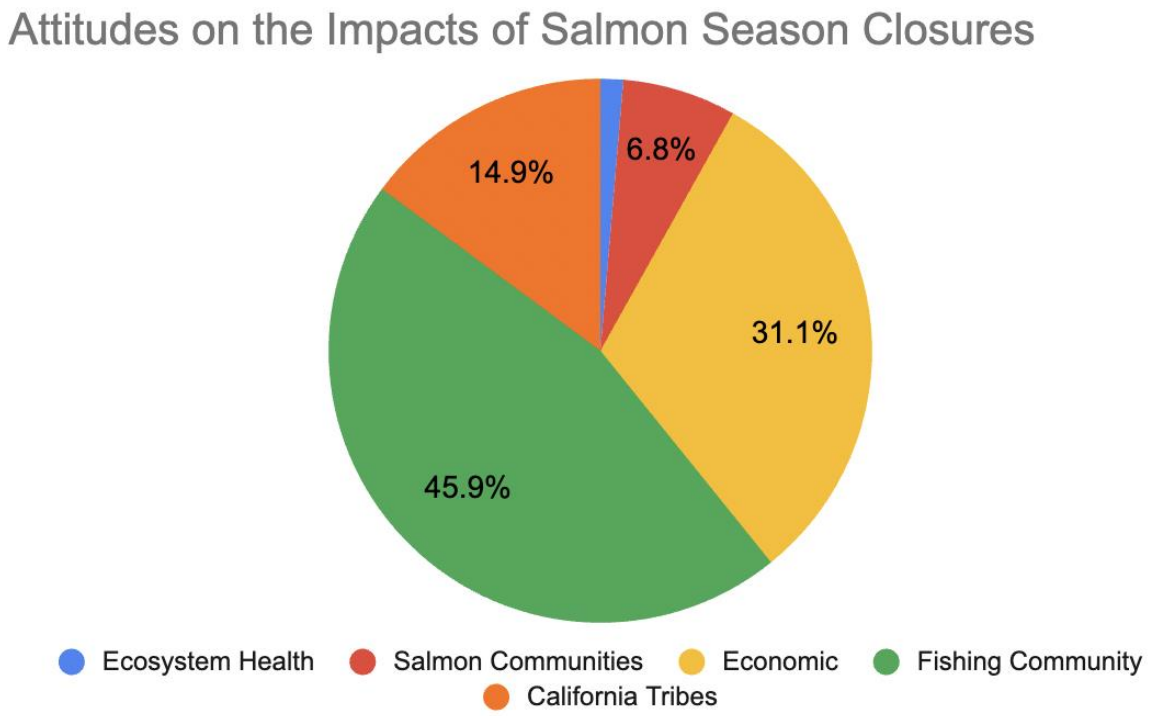

Figure 5: Attitudes on the associated impacts of salmon season closures.

IV.II Public Comment Analysis

Over 65 public comments were analyzed from transcripts of the California State Water Resources Control Board's (SWRCB) March 2023 Listening Session. This listening session was targeted at receiving comments related to the management of the Sacramento-San Joaquin Delta Watershed, particularly around the implementation of the 2006 Bay Delta Plan and the voluntary agreements that are currently under consideration. The majority of commenters were representatives of non-governmental organizations focused on the environment, environmental policy, tribal interests, and fishing. Other prominent categories of commenters represented at this meeting include

the fishing community (primarily recreational) and frontline community members. The frontline community category is designated for any commenter who self-identified as such or identified themselves as someone living in a community within the watershed and being impacted by issues of salmon decline and water management. Three other categories were captured as well: tribal members, scientists, and unidentified commenters. It is important to note that the scientist category was created to organize several commenters who solely identified as subject experts/scientists, and that many of the commenters who were placed in other categories would also fit this category.

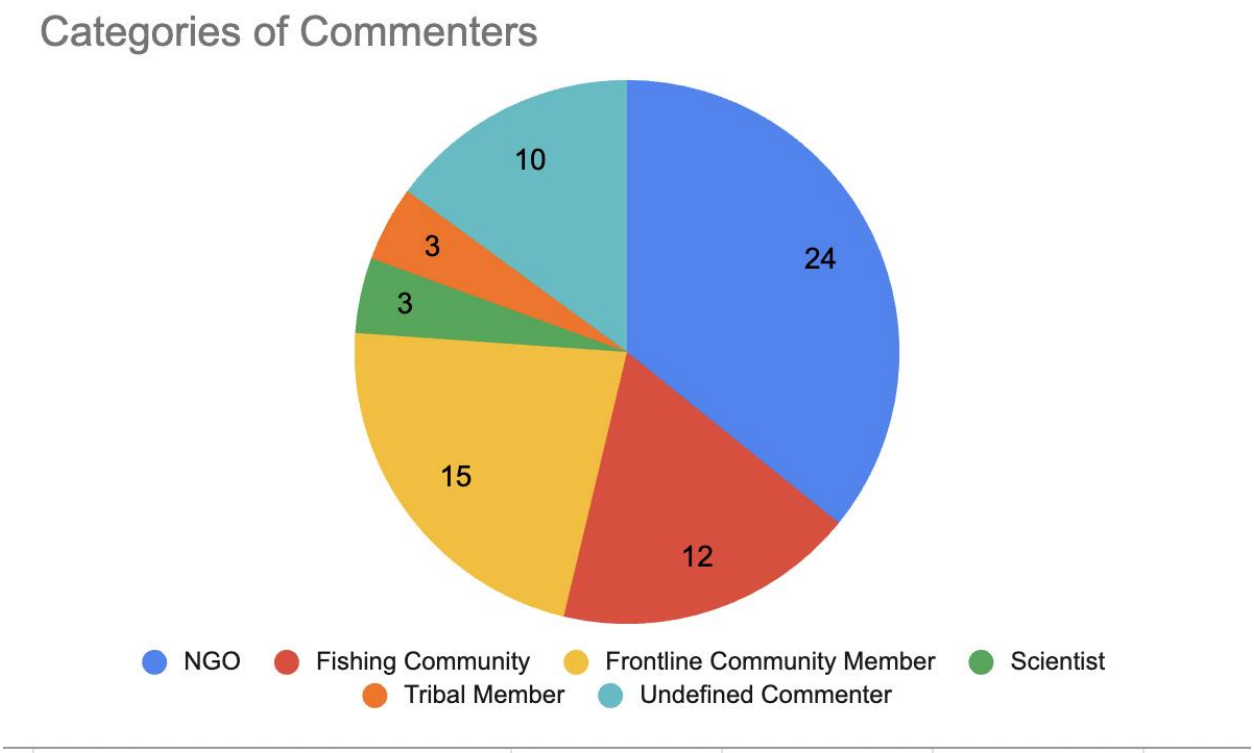

Figure 6: Categories of commenters from SWRCB March 2023 Listening Session meeting.

Findings from Comment Analysis:

Each comment was analyzed and coded using the codes mentioned previously. The primary message that reverberated throughout the meeting was for the Board to drop further consideration of the voluntary agreements (VA's) and move forward with

implementation of the Bay-Delta Plan. Commenters expressed concern that the VA's are not science-based, protective of species, or best for the public good. As mentioned previously, the proposed VA's were brought forth to the SWB by state agencies, the US Bureau of Reclamation, water districts, irrigation districts, and one farming entity. Further consideration of the VA's means more time in which there is a lapse of protective measures for California salmon. Concern about dwindling salmon numbers was the second most common theme amongst the comments; these comments mentioned the importance of salmon as a keystone species, their significance as a cultural resource, and their many ecosystem benefits.

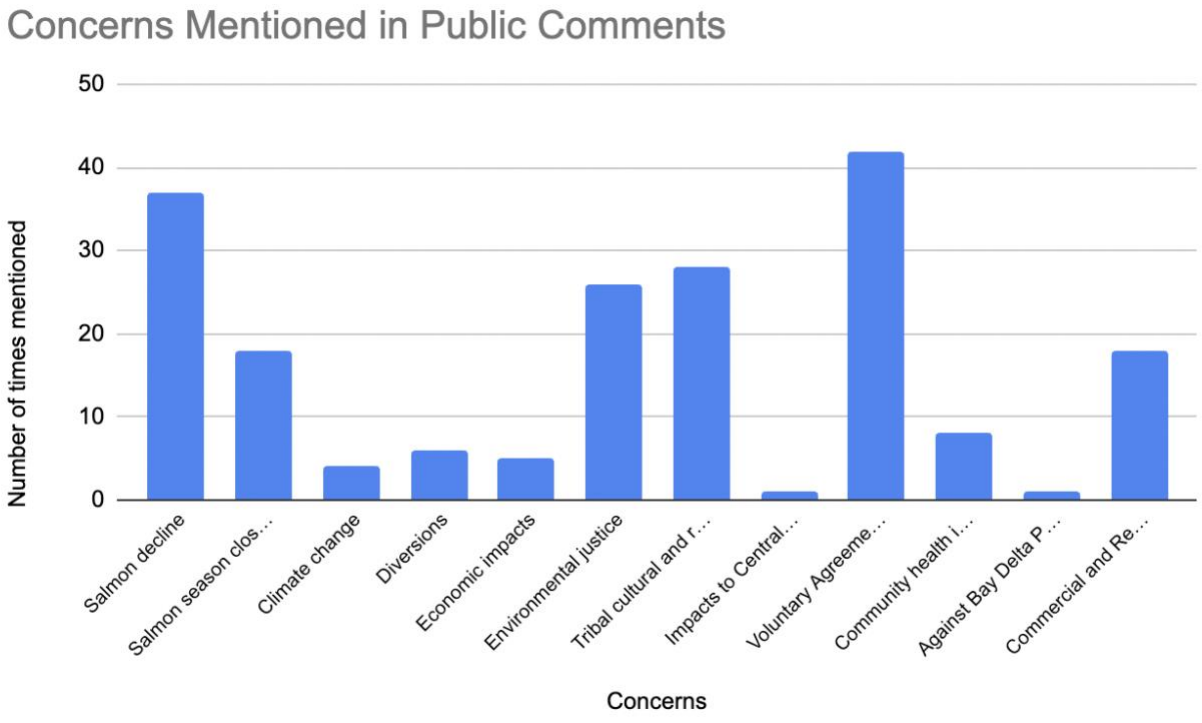

Figure 7: Graph depicting the categories of concerns mentioned in public comments and the number of times mentioned.

Negative impacts to California tribes and environmental justice concerns were mentioned frequently in the comments. The comments pertaining to the impacts of

salmon decline and water management decisions on tribes included statements about colonization, the systematic exclusion of tribes from decision making processes, and the mental, emotional, and physical toll of salmon season closures. Amongst these comments about tribal impacts were concerns around the SWRCB's lack of meaningful outreach and engagement with tribes. Some comments mentioned broadly that environmental justice should be a top priority for resource managers. These types of comments included calls for agencies to bring in Tribes and frontline communities impacted by water quality issues to the decision-making table from the beginning. Other comments made more specific claims that management of water and fishery resources were inequitable. Several NGO representatives cited the perpetuation of gold rush era water rights to be racist and in direct opposition to the claims of agencies wanting to repair relationships with California Tribes. During the Listening Session, comments were made about the emotional, financial, and health impacts of salmon season closures on the commercial, recreational, and subsistence fishing communities. Several comments specifically mentioned that climate change and unsustainable diversions both contribute to worsening conditions. Additionally, there were a few comments related to the severe economic impacts of salmon decline due to water management.

During the listening session there was only one comment made in opposition of the Bay-Delta Plan and in support of the Voluntary Agreements. This comment came from a frontline community, they said that prioritizing water for rivers would have negative impacts on San Joaquin Valley agricultural workers. This commenter did mention concern for water quality, particularly related to pollution and harmful algal blooms within the watershed.

IV.III Interview Findings

The first interview conducted was with a representative from the Tuolumne River Trust, a non-profit organization that is focused on educating on, advocating for, and restoring the Tuolumne River. The Tuolumne River runs from the Sierra Nevada mountains down to the Central Valley where it meets the San Joaquin River and supports seasonal salmon runs.

To share the findings of the interviews, I will be listing each question the participants were asked and the offer the highlights of the answers from each organizational representative; Tuolumne River Trust (TRT), SF Baykeeper, and Save California Salmon (SCS). Save California Salmon is an advocacy and policy focused nonprofit organization working to support fish dependent communities in Northern California. The organization helps Tribes and other fishing communities protect fisheries, water quality, and beneficial uses. Tuolumne River Trust (TRT) focuses its advocacy and political work on any federal, state, and regional processes that may impact the health and wellbeing of the Tuolumne River and the salmon that call it home. San Francisco Baykeeper is a science and advocacy organization working to protect the Bay-Delta estuary and its larger watershed. The organization uses science and litigation to enhance its mission of protection of the watershed and the many species inhabiting it, including salmon.

Question 1: What is your relationship with California salmon? What do they mean or represent to you?

The participant shared that salmon is a vital part of many Tribes' cultural practices, oral traditions, ceremonies, and is a traditional food source. Additionally, they

shared that as an Indigenous person they [themselves and tribal members] have historical trauma of dispossession of resources and restriction of spiritual connection. The participants shared that they feel using political and regulatory tools to protect tribal cultural resources is critical. Knowing salmon's deep importance to Native communities drives their desire to work to protect salmon and to help others understand their importance.

Question 2: How do you feel about the future of salmon throughout the Bay-Delta watershed?

Tuolumne River Trust: The participant shared that they were not very optimistic about the long-term future of salmon in California, mostly because humans fixate on growth and capitol. They mentioned that humans tend to exceed the carrying capacity of our environments and lack the political will to do what needs to be done to save salmon. Additionally, they mentioned that the California water rights system is archaic, and that our agencies are at the mercy of this antiquated system, and a political system that does not seek to improve them, but rather to carry them out to feed the economy.

SF Baykeeper:

The participant explained that they do not feel good about the future of salmon in the Bay-Delta Watershed because more and more water is being taken from salmon rivers. Low flows due to extensive diversions, make salmon's journey to the ocean much more difficult. Reservoirs and dams keep salmon from their higher elevation cold water habitats and spawning grounds. We [Californians] use too much reservoir water to provide fish with the cold water they need, juvenile fish are left with problematic river

conditions that don't allow many of them to grow up. According to this representative of an environmental non-profit, California is just diverting too much water and only planning on diverting more.

Save California Salmon: The participant described being worried about the future of salmon. They said with 2023 and 2024 salmon season closures, and what they believe is a third consecutive closure on the horizon, things could be better. The participant discussed the major impacts on Tribal, commercial, and recreational fisheries. Even so, they do share they have some hope. They believe that awareness of salmon decline among the public has increased. Also, that the efforts by the non-profit organizations, community groups, and Tribes is making a difference, and they believe more protective measures will be taken to save salmon because of this work.

Question 3: How do you feel about the current policies and management strategies that are meant to address the declining population of salmon in the state?

Tuolumne River Trust: The participant said they believed that the Bay-Delta Plan, which guarantees a specific amount of water to be left in rivers and sets biological goals, could be an effective management strategy for salmon and ecosystem health. They said that there is a need for adaptive management to best support salmon and river health. Additionally, the participant mentioned that the amended Bay-Delta Plan (2018) has yet to be implemented and that the consideration of voluntary agreements are a big threat to the future of salmon and healthy ecosystems- you just can't compromise on ecosystem and fishery health. Lastly, they said that the State Water Board (SWB) is

constrained in what they can do and is ultimately at the mercy of the Governor. These positions are appointed, and people rather fall in line than lose their jobs.

SF Baykeeper: The participant said that there are many policies meant to help salmon and that clearly state that salmon need to be protected over other uses, diversions for example. These policies are plentiful, we don't need more of them; our execution of these policies and management strategies are what is the problem. They said that management is ineffective, and that is because the goals of (1) saving salmon and (2) fulfilling water contracts and diversions are at odds with each other. Policies like the ESA, CWA, and Delta Protection Act (DPA) are not being upheld.

Save California Salmon: The participant said that generally they do not feel like not enough is being done. They described that although salmon are a keystone species, there is hesitation in taking extreme measures to protect them. They believe that time is a prohibitive factor in saving salmon. Meaningful action to restore salmon populations will take time, they are concerned that if that action is not taken now it may spell disaster for California salmon. The participants mentioned that agencies tend to be more willing to take action on specific pieces over others in addressing salmon decline. They think that this is not effective management, and that salmon conservation needs to be holistic. Any policies or strategies that fail to acknowledge and analyze all threats and stressors to salmon will be ineffective.

Question 4: What do you think of the public participation process and implementation of public comments in decision making?

Tuolumne River Trust: The participant said that they believe the State Water Board listens to the public's input and can be influenced, but that outreach is a requirement of an agency and sometimes just a checkbox item for them. They said that while science and facts are important, right now politics seem to be more important in these management decisions, which means that public engagement and participation is more important than ever. They said that they really believe change is happening, and that the SWB has acknowledged that they can do a better job with community outreach and public engagement, and that means something. But ultimately the input from the public has not yet been seen in policy or management changes.

SF Baykeeper: The participant said that public comments are important; they show that people care, but that these issues are so complicated and filled with so much detail that it is hard for the public to be able to understand it and make a strong comment in a three-minute time frame. They also shared that the window of time between documents becoming publicly available and when they have public comment opportunities is far too short; it does not give people enough time to review and make substantive comments. Agencies do not do enough public engagement or education to help the public understand these issues. Additionally, they said that they don’t see the feedback given at public comment or workshops reflected or having any bearing on water or fishery management. The participant said that they believe agencies pit fish advocates/environmentalists/fishing community and agriculture against each other to detract from finding real solutions to the problems. The California water rights system is racist and classist, making profit off of water, it's an antiquated system.

Save California Salmon: The participant said that depending on the agency, they believe public participation can be a useful tool. They also said that in some cases outreach is ineffective and sometimes methods of public participation can actually be barriers. They said that communities that are most impacted by policy, like Tribes and Environmental Justice communities, are not given adequate notice and therefore are not able to participate. They shared some specific examples of participation barriers including meetings that take place during work hours, not allowing online participation, and meetings that are geographically far from impacted communities, especially when there is not transportation or lodging stipends available. The participants also shared that even when there is adequate notice to comment on the policies or management strategies, these documents are often technical and not translated into easily understood information. This renders participation impossible without consultation of technical experts or lawyers.

Question 5: Do you think the concerns and desires of the public are reflected in decisions made around salmon conservation?

Save California Salmon: The participant said that they believe federal and state agencies are often selective in what they choose to acknowledge from the public related to salmon management. They shared the example that in this year's salmon management strategy agencies glossed over two projects proposed for the Bay-Delta that would have detrimental impacts to salmon, the Delta Conveyance Project and Sites Reservoir. They said that organizations and communities have expressed their concern around Bay-Delta Management extensively, and agencies still ignore these concerns while choosing to address others.

Question 6: Are there any changes you would like to see in policy and management that relates to salmon? If so, what are they?

Tuolumne River Trust: The participant said that they would like to see more value placed on salmon and less focus on low-cost crops for short term profits at the expense of salmon. There needs to be more attention placed on ecosystem services, and if that happened, salmon would be treated much better- California agricultural lands have long benefited from nutrients delivered by salmon.

The participant also mentioned that good policies already exist, such as the Endangered Species Act (ESA) and the Clean Water Act, but that there are constantly attempts made to weaken or bypass these policies. These policies need to be upheld and strengthened. The participant explained that they support the Bay-Delta Plan but note that the goal is not to restore traditional salmon run numbers, but to keep them from going extinct, which is not totally in line with the ESA but is better than nothing. They also talked about the need for there to be a greater cost for agricultural uses of water and reform for the agricultural industry at large. We need to move away from low value crops, exported crops are taking critical water resources away from California, and the profits are privatized and not given back to the people of California. Lastly the participant said that management decisions need to reflect the Public Trust Doctrine, which recognizes that water belongs to the people of California. (The Public Trust Doctrine protects particular natural and cultural resources for public use; In California these lands are held in trust by the state for Californians).

SF Baykeeper: The participant said that our current water rights system is racist and classist, and designed for an economy from the late 1800's. It was intended to encourage agricultural production to supply food for the growing population, which is an honorable job. However, these days, crops follow commodity markets and are grown for profit, not local people. They said that this is a major issue and needs reform. The participant stressed the need to reform water rights and land grab systems. They discussed the lasting impacts of the Homestead Act, the law that granted people large parcels of land if they farmed it during the time of westward expansion and manifest destiny. However, the aggregation of land and water rights turned into something it was not meant to, power. More access to water and land means more control and power; This is the crux of the issue. The participant reiterated that water rights and land grabs all have taken place on stolen land and with stolen resources. In addition to these points, the participant discussed how crop insurance encourages risky decisions, like planting tree crops in the San Joaquin Valley, at the expense of California's water. This insurance is federal and protects farmers' losses in time of drought or extreme heat; This incentivizes growers to go after unreliable crops that have a chance at a big pay out, and disincentives growers from more climate resilient annual crops. They said that this is also an issue because big corporations are buying up crop lands as investments and money-making opportunities and obtaining crop insurance to protect their investments. Often, these owners do not live on the land or even in the state, and they exploit water and resources to the maximum extent and can walk away.

Save California Salmon: The participant said they'd like to see a stronger commitment by the state to protect the remaining populations of salmon within the Bay Delta

watershed. They also mentioned that there should be leadership positions specifically dedicated to prioritizing environmental justice and tribal concerns. Having these positions would provide more confidence that the policy and management strategies incorporate the concerns of the environmental justice, tribal, and fishing communities in a more effective manner.

V. Discussion:

This section offers an interpretation of the findings from data analysis and discusses the true cost of salmon decline to tribal and fishing communities. Additionally, this section will organize statements related to who or what is responsible for the decline of salmon and season closures and the desired changes captured in the news articles, public comments, and interviews. The section will conclude with final thoughts on the significance of these findings, how this research could be expanded, and recommendations to agencies on improving public engagement and equity efforts.

V.I: The True Cost

V.I.I: Commercial Fisheries and Adjacent Industries

The analysis of news articles showed that there was a significant emphasis on the impacts to the fishing industry and the California economy. It is important to understand the main messages presented by the media around salmon season closures and their impacts, as media plays a significant role in informing public opinion. The full extent damage caused by the 2023 and 2024 season closures have not been fully realized. According to the National Oceanic and Atmospheric Administration (NOAA), the 2008 and 2009 salmon season closures were responsible for an economic loss anywhere from $500 million to $2 billion and job losses between 5,000-23,000 (NOAA, 2022). Second generation salmon fisherman Dan Snell told the San Francisco Chronicle that his income dropped by 90% because of the closures (Duggan, 2023)

The impacts of salmon decline and season closures to the fishing industry can be seen in the drastic change in the number of commercial fishing boats in California. In an Los Angeles Times article, Bay Area commercial fisher Sarah Bates said she believed

that many commercial and recreational boats will be lost because of these closures (James, 2024). Several of the commercial fishers quoted in the articles mentioned that salmon fishing is far more lucrative than fisheries for other species. Fisher people who shift to pursuing other species after a salmon closure may not break even after the expenses associated with boat maintenance and gas.

In addition to the impacts to the commercial fishing industry, many of the news articles discussed impacts to recreational fishers, tackle shop owners, restaurants, and hospitality businesses and workers throughout California. The owner of Fishetarian Fish Market in Bodega Bay told the San Francisco Chronicle that, for the first time in business history, the restaurant is selling farm-raised king salmon. While the business is still doing well, the absence of local salmon has had an impact on their revenue (Duggan, 2023). Recreational fishers and charter owners are at the mercy of customer interests, much of which is focused on salmon. Recreational fishing charter owner Jared Davis talked about the scramble to shift his business to target other species and the struggle to keep his operation going because of the overwhelming interest in salmon fishing (Bland, 2023). The impacts to commercial and recreational fishing businesses and their families cannot be understated. The hit goes beyond that to people’s wallet; many affected by season closures cited impacts to emotional and psychological wellbeing. Salmon fishing for many is more than a paycheck, it is a way of life and a passion.

V.II: Tribal Subsistence Fishery

In addition to the commercial and recreational fishery impacts is the major impact to California Tribal fisheries. Although not part of the Bay-Delta Watershed, the Yurok, Karuk, and Hupa tribes in the Klamath River basin are subsistence fishers and have been severely impacted the consecutive salmon season closures. Bill Tripp, the Karuk Tribe's Director of Natural Resources and Environmental Policy explained to CalMatters the significance of salmon to the Karuk. He said, "The health of our people depends on having salmon… Their survival in the basin is imperative. If they disappear, we could lose our ability to survive here," (Bland, 2023 par. 29). For many salmon-dependent tribes in California, individual and community health, both physical and spiritual, has been greatly impacted by salmon loss.

The health and wellbeing research conducted by Kari Marie Norgaard in partnership with the Karuk peoples can shed light on the effects of salmon decline and lost access to salmon fishing for California salmon-dependent Native communities. Norgaard's findings show negative health outcomes because of decreased or severed access to traditional foods, particularly salmon; this includes rising rates of obesity, high blood pressure, diabetes, heart disease, and kidney related issues (Norgaard, 2005). In self-reporting health survey 60% of Karuk families reported being touched by diabetes (Norgaard, 2019). While the link between salmon decline and rising diabetes rates cannot be definitively linked, the timing corresponds.

V.II: Who's to blame? Discussion of cause

The analysis of the articles showed that the primary beliefs around causation were related to water management decisions and environmental/climate factors. Closer analysis showed that most quotes from the fishing industry and NGO's discussed water management as the primary driver for salmon decline and season closures. One representative from the Golden State Salmon Association said, "This is a direct reflection on California's water policy," (Russell, 2023). A similar sentiment was shared by a representative from San Francisco Baykeeper, "Gov. Newsom has preferred to appease privileged water districts at the expense of our rivers and San Francisco Bay. If he stays on this course, salmon fisheries will remain closed and San Francisco Bay's six endangered fish species will continue to slide towards extinction" (Russell, 2023).

The interview participants shared similar sentiments when asked about current policy and management strategies. Policies to protect salmon are plentiful but are not being appropriately enforced to ensure the protection of the species. The participant from Save California Salmon talked about agencies and decision makers having a particular willingness to address certain issues related to salmon but not wanting to address other areas. In contrast, they argued that salmon conservation needs to be more holistic. These feelings are in direct opposition to many of the sentiments shared by various agency representatives and Governor Gavin Newsom, who cite environmental and climatic conditions as responsible for declining salmon populations.

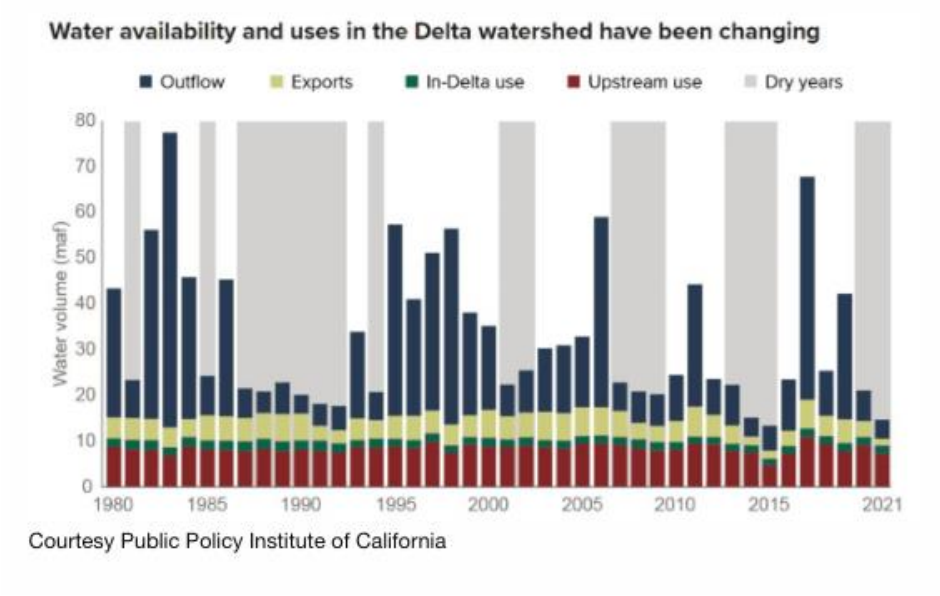

Figure 8: Graph shows water recourses and uses in the Delta watershed from 1980 to 2021. (Gartrell et al., 2022)

Agency representatives and elected officials, especially Governor Gavin Newsom, primarily cited the cause for season closure as environmental factors and climate change impacts such as drought conditions. In one article, Governor Newsom stated that anyone blaming salmon decline on water management was spreading false information (Russell, 2023). In the same article a representative from California Department of Fish and Wildlife asserted that management could not be to blame for the consecutive season closures because salmon are born in freshwater, and it takes three years for them to travel to the ocean and return to their natal waters (Russell, 2023). The representative asserted that the drought conditions from several years ago were to blame (Russel, 2023). A deeper historical analysis reveals that river systems have been negatively impacted by colonial changes to the landscape since the Gold Rush, and salmon have paid the price of dam operations, diversion pumps, and water contracts.

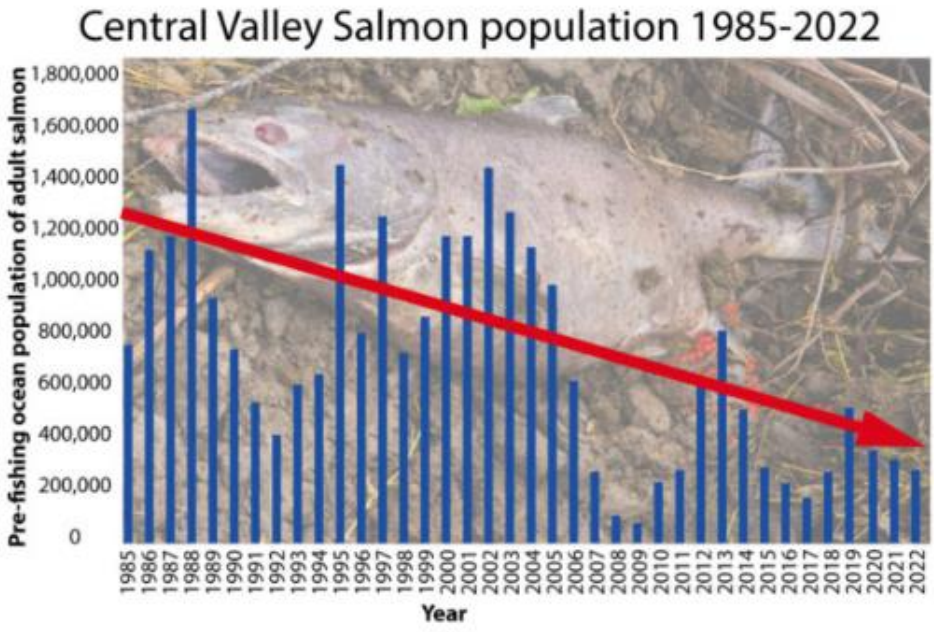

Figure 9: Graph showing Central Valley salmon populations every year from 1985-2022 (Golden State Salmon Association, 2022)

V.III: What the people want

This section will focus on the desired changes that frontline, fishing, and tribal communities and environmentalists have expressed in the news articles, during the public comment period, and through the interviews with organizations working closely on the issue and within salmon dependent communities.

Non-profit organizations, including groups representing environmental, tribal, and fishing interests, were outspoken in the media discussing what they believed to be the cause for repeated season closures and general decline--California water management. These comments focused on the negative effects of dam operations, increased water temperature due to diversions, and the problematic prioritization of agricultural water contractors.

Additionally, a common theme of the public comments during the listening session was the need for agencies to implement a more engaged consultation process with affected communities. Nearly all of the comments given during this meeting included concern for either environmental justice or tribal communities (or both) and the lack of consideration and inclusion of these perspectives in management decisions.

Environmental Groups

In analyzing the public comments, quotes from articles, and two interviews, general themes in desires of environmental organizations for California water and fishery management became clear. The public comments made by environmental non-profits called for the SWB to prioritize management of water and fish over the needs of agricultural water districts. Some of these groups made it clear that they do not oppose voluntary agreements as a concept, but that the particular creation of these VA's was not in good faith, as it excluded input from environmental, fishing, and tribal organizations. All of the environmental groups called for the SWB to implement the Bay Delta Plan, including the provisions that water (to some degree) must be allocated and left in rivers to protect the biological wellbeing of salmon and other species.

The interviewees touched on similar topics including agricultural reform, better enforcement of existing policies, and the need for more holistic approaches to conservation. Agriculture and environmental/fishing interests often get pitted against each other in discussions of California water. Both representatives from the NGO's mentioned how commodity crops were being placed on a pedestal over California's public resource, water. These crops are then sold overseas, and profits go into the

pockets of private agricultural interests while river ecosystems and Californians pay an unaccounted-for price.

The donut graphs in Figure 9 below shows how California water was used in 2006 (wet year) and 2014 (dry year) (Mount et al., 2023). Interestingly, in the dry year, agriculture received more water (32.9 maf) than in the wet year (29.9 maf). This is in direct opposition of environmental water usage between the wet and dry years showed below, environmental usage was allotted 62% in 2006 and just 35% in 2014, which equaled a difference in 42.2 mah.

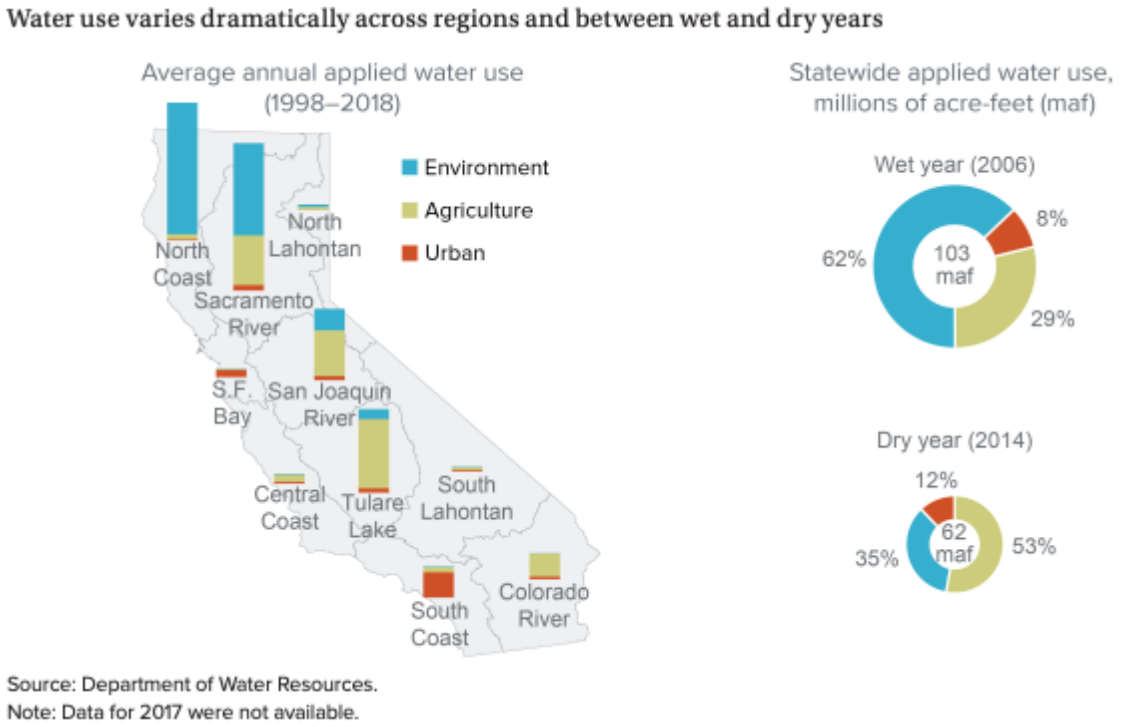

Figure 10: Graph on the left shows types of water usage in California depending on region and broken up into environmental, agricultural, and urban uses. The graph on the left shows water usage for a wet year (2006) and a dry year (2014) in California.

Fishing Community

Understandably, much of what the fishing community is focused on sharing with the media focuses on the devastating impacts of the closures on their livelihoods and

long-term futures of businesses. However, beyond wishes for better conditions for salmon, many fishers shared their hopes for better management of both California water and fisheries. According to commercial salmon troller Sarah Bates, “This is a very resilient species. So, I think with appropriate water management and appropriate fisheries management, that we will recover. I just hope that there are still boats and captains around when the species recovers,” (Duggan, 2023).

In the public comment period, the fishing community overwhelmingly asked that the SWB end its consideration of the VAs and move forward with implementing the Bay Delta Plan.

Frontline and Tribal Communities

It is important to note that tribal interests were not robustly represented in the media, or the public comments given in the listening session. In fact, during the listening session, two enrolled tribal members and representatives from several tribal and environmental justice organizations brought up that the SWB was not properly consulting and engaging with affected tribes. These commenters asked that the SWB make a more concerted effort to get tribes engaged in these processes. The representative from Save California Salmon said in their interview that they would like to see leadership positions created specifically to work with environmental justice communities and tribes. They believe that this would ensure more effective inclusion of tribal and environmental interests in all phases of water management.

VI. Conclusion

“When we first bubbled out of our sacred spring on Mt. Shasta at the time of creation, we were helpless and unable to speak. It was salmon, the Nur, who took pity on us humans and gave us their voice. In return, we promised to always speak for them.” Winnemem Wintu Spiritual and Cultural Belief

California salmon are critical to the health, wellbeing, and spirit of many California ecosystems and peoples. The future of California is inextricably linked to the survival and propagation of salmon. This research shows the depth of this reciprocal relationship, and the critical state in which salmon and reliant communities find themselves. However, it is important to note this the management of Bay-Delta water resources, ecosystem health, and salmon is extremely complicated. The full scope of the complex history, systems, and management decisions is not entirely represented in this work.

VI.I: Research Implications

This research, while important, just begins to scratch the surface in uncovering how further decline of salmon or extinction could impact Tribes and commercial, recreational, and subsistence fisheries throughout California. A comprehensive health survey given to impacted Tribes and members who subsistence fish could be used to better understand the health implications of season closures and reduced access to salmon as a food source. Additionally, it would be interesting to conduct a survey with commercial and recreational fishing outfitters who were unable to continue their

businesses due to salmon decline or season closures. This could shed light on the long-term impacts of fishery decline and how those impacted have or have not been able to adapt to their changing circumstances.

VI.II: Policy Implications

The findings of this research have shown that management and policy decisions related to salmon are of significant concern to all communities identified in this scope of work. The following are recommendations, based on the findings of this analysis, to agencies and decision makers working to promote equitable salmon management planning and policy:

1. Begin the process of reforming California's antiquated water rights system. This process should begin with the consultation of Tribes to understand, address, and rectify the harm that has been caused because of these exclusionary practices.
2. Redesign public outreach and engagement mandates using the plentiful feedback from environmental justice organizations, Tribes, fishing entities, and frontline community members. This should include more equitable and accessible meetings, materials, and contacts within the agency specifically focused on communities.
3. Mandate that any Voluntary Agreements include tribal, fishing, and frontline communities' interests. There should be no consideration for management proposals that do not include the partnership of and input from these communities at the outset.

With attention to California water history and context, particularly to the impact of California water management on the Native peoples and Native species of California, implementing these recommendations will respond to the concerns of Tribal and frontline communities. Implementing these recommendations show critical steps being taken toward reversing salmon decline and ensuring that this keystone species can continue to survive and thrive in the Delta.

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