OVERLOOKED FISHERIES OF *BADUWA'T*: AN ORAL HISTORY STUDY EXPLORING THE ENVIRONMENTAL AND CULTURAL HISTORIES OF EULACHON AND PACIFIC LAMPREY IN THE MAD RIVER BASIN, A WIYOT WATERSHED

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ABSTRACT

OVERLOOKED FISHERIES OF *BADUWA'T*: AN ORAL HISTORY STUDY EXPLORING THE ENVIRONMENTAL AND CULTURAL HISTORIES OF EULACHON AND PACIFIC LAMPREY IN THE MAD RIVER BASIN, A WIYOT WATERSHED

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Eulachon and Pacific lamprey fisheries of the Mad River are significant for Indigenous peoples of the region, but they remain data-poor and underfunded even though eulachon is listed as threatened under the federal Endangered Species Act and Pacific lamprey is recognized as a species of concern by U.S. Fish and Wildlife Service. The lower Mad River and Humboldt Bay region lie in the traditional territory of the Wiyot and are home to Indigenous people who have maintained subsistence eulachon and Pacific lamprey fisheries. This research primarily draws from 13 oral history interviews with local Indigenous people, 18 key informant interviews with experts in relevant fields, and archival research, to understand the historic and current state of eulachon and Pacific lamprey fisheries and the reciprocal socio-ecological relationships between fish, people, and the watershed. Oral histories demonstrate a strong cultural connection to the larger smelt family, including eulachon. Eulachon runs on the Mad and Eel Rivers were observed in the past, but not since the 1960s. Respondents recounted robust Pacific lamprey populations historically, numbers that gradually dwindled. Interviews uncovered important cultural connections to eulachon, Pacific lamprey, and other smelt species

through stories of fishing, gathering, eating, and sharing. With their Native foods and resources largely controlled by U.S. governmental agencies, local tribes are persistent in their efforts to protect eulachon and Pacific lamprey. This research reveals how cultural connections to these species remain important, and the need for resource managers to expand research and restoration to include this overlooked river and these fish species.

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ACRONYMS

BIA- Bureau of Indian Affairs

BLR- Blue Lake Rancheria

BRT- Biological Review Team

CDFG- California Department of Fish & Game

CDFW- California Department of Fish & Wildlife

ESA- Endangered Species Act

HBMWD- Humboldt Bay Municipal Water District

IK- Indigenous Knowledge

LEK- Local Ecological Knowledge

MRWA- Mad River Watershed Assessment

NMFS- National Marine Fisheries Service

NRCS- National Resource Conservation Service

ODFW- Oregon Department of Fish & Wildlife

SCS- Soil Conservation Service

Southern DPS- Southern Distinct Population Segment

TEK- Traditional Ecological Knowledge

USDA- United States Department of Agriculture

USFWS- United States Fish & Wildlife Service

WDFW- Washington Department of Fish & Wildlife

Wiyot Tribe NRD- Wiyot Tribe Natural Resources Department

1 INTRODUCTION

1.1 Field Notes, Monday, August 4th, 2014

Seven of us met at the Hatchery Road Bridge in Blue Lake, just after nine in the morning. My borrowed wetsuit, with assistance from the sun, kept me warm enough for our day of swimming with the fish, eager for a sighting of "half-pounder" steelhead trout. Dave Feral, Volunteer Director for Mad River Alliance and one of the organizers of the Summer Steelhead Dives, split us into two groups: one group would survey from the Hatchery Road Bridge up to a point slightly north of the hatchery. The other group – which consisted of me, Dave Feral, and two other volunteers – would start near Hall Creek. We were suited up and in the water by 10am.

Dennis Halligan, Fisheries Biologist with Stillwater Sciences, had taken a few of us out for a test run the day before under the Hatchery Road Bridge so we could become familiar with the fish counting process and learn how to properly identify the species. After seeing a small school of yearlings (steelhead estimated to be about two years old) and a 'half-pounder,' I was excited to count some fish. Two of us would hug the bank on the north side of the river meticulously combing the riparian zones where the fish seek refuge from the sun and attempt to hide from predators in the thickets of the vegetation. The other two would cover the south side of the channel, where large rocks and shallow holes allowed for a thriving blue-green algae environment where small fish might have

been able to disguise themselves. Diligently scouting out every little hole, shaded covering, fallen tree branch, and rocky crevasse, I learned to read the bed of the river.

Following the river's path revealed a story of time, place, people, and histories all overlapping in a physical manner. The river's bed was worn and littered with the evidence of upriver logging, showing weakened riparian zones and the imbedded logging industry's train tracks swallowed up by the eroded banks. The impacts of a dam removal and years of increased sediment loads to the lower reaches of the stream were made visible by a flattened and widened channel whose deep holes and pockets were buried under thick layers of silt and gravel. Plentiful carpets of blue-green algae and their bobbing algae-bloom counterparts were reminders of a warming trend that signal trouble for fish species reliant on the cold streams of Northern California.

By afternoon, the four of us had hardly spotted any fish at all. The most noteworthy sightings that day were the junctures where man meets river. Whether it was the concrete fish ladder at Hall Creek or the countless tires, pieces of cars and garbage constantly moving with the water, human activity in and around the watershed is ever-present and mixed in with the river's topography. Following the path that countless fish species have followed since this stream first emerged from the mountains, I realized that the fish that journey from the ocean back to their freshwater spawning grounds are players in a complex interactive story, not just passive victims in a human-impacted environment. Throughout the day, I wondered if I had unknowingly swum over any eulachon eggs, or if there had even been any on the river in the last quarter century. I kept my eye out for migrating Pacific lamprey or the carcasses of spawned fish, knowing that

the chances of an encounter were unlikely due to their nocturnal nature and dwindling numbers on the river.

1.2 Introduction of the Study

Sandwiched between the mighty Klamath River to the north and the Eel River to the south, the Mad River watershed[1] has been overlooked as a significant river ecosystem in Northern California. This river system provides valuable spawning habitat for anadromous fish, including steelhead trout and several salmonid species. Western management focus and commercial interest in salmon and steelhead fisheries have prompted considerable research and funding on the river, while other anadromous fishes that have held cultural significance for Indigenous people with longstanding subsistence fisheries have remained understudied and underfunded. As Indigenous people continue to rebuild cultural and place-based relationships to their Mad River environment despite a history of oppression, the lesser-known, non-salmon, non-trout fisheries of eulachon and Pacific lamprey are in decline.

Several anadromous fish that have been listed as threatened under the federal Endangered Species Act (ESA) have spawning grounds in the Mad River watershed (CDFW 2015; Stillwater Sciences 2010a; Trinity Associates and the HBMWD 2004). Anadromous fish spawn in freshwater habitats but spend most of their lives in the ocean

[1] The words ‘watershed’ and ‘basin’ are used interchangeably throughout the text, referring to the Mad River drainage system. The Mad River watershed is also referred to as a ‘landscape’ and ‘riverscape’ for the purpose of this research.

(CDFW 2015). They serve important ecosystem functions and are recognized as key indicators of stream health because they require specific conditions for migrating from marine environments to spawn in their chosen freshwater habitats (CDFW 2015; USFWS 2012; Moyle 2002). The Mad is known as a 'steelhead river' and the California Department of Fish and Wildlife (CDFW) runs a steelhead hatchery program near the City of Blue Lake, maintaining the river's most popular fish stocks (CDFG and NMFS 2001, 25; Trinity Associates and HBMWD 2004; Winzler and Kelly Consulting Engineering 2006). After a long history of intensive unregulated logging in the watershed, the Environmental Protection Agency (EPA) added the Mad River to California's Clean Water Act in 1992 under section 303(d) for being sediment impaired as the result of high levels of erosion (Trinity Associates and the HBMWD 2004; Tolhurst 1995). In 2007, the river was additionally identified as being temperature and turbidity-impaired (Stillwater Sciences 2010a, 1). In May 2010, the southern Distinct Population Segment (DPS) of Pacific eulachon was listed as threatened under the federal Endangered Species Act (ESA) (ODFW & WDFW 2013, 3; Gustafson et al. 2012). In October 2011, the Biological Review Team (BRT) designated critical habitat for eulachon (NMFS 2013, 3), listing the Mad River as the southernmost spawning habitat included in this designation for the species. U.S. Fish and Wildlife Service (USFWS) denied a petition to list Pacific lamprey as threatened under the federal ESA in 2004 (USFWS, Interior 2004), soon after recognizing the fish as a "species of concern" (USFWS 2012).

Draining an estimated 497 square miles of the Coastal Range Geomorphic Province in Northern California, the Mad River's headwaters are situated in Trinity County at nearly 6,000 feet, where the river begins its nearly 100-mile journey. The main channel moves in a northwestern direction all the way to its mouth in McKinleyville, California where it empties into the Pacific Ocean, north of Humboldt Bay. The watershed is narrow, averaging six miles wide, and flows through a combination of public and private forests, agricultural and grazing lands, several towns and communities, ultimately draining into an ecologically rich estuary environment that shares tidewaters with the ocean (Stillwater Sciences. 2010a; Graham Matthews & Associates 2007; Tolhurst 1995). About two-thirds of Humboldt County residents, or an estimated 88,000 people rely on the water provided by the Humboldt Bay Municipal Water District (HBMWD), a local government special district that operates a dam and small hydroelectric plant in the upper watershed and Ranney wells in the lower watershed to deliver water to seven municipal wholesale customers around Humboldt Bay (Hall 2014, 4; Trinity Associates and HBMWD 2004; Winzler and Kelly Consulting Engineering 2006, 2-3).

The Humboldt Bay region, which includes the water bodies and landscapes of Humboldt Bay and surrounding tributaries, as well as the lower Eel River and lower Mad River watersheds, is recognized by the Wiyot and neighboring tribes as the traditional, ancestral territory of the Wiyot (Wiyot Tribe 2010; Loud 1918). Categorized by their

distinct Algic language, *Soulatluk*[2], and settlement pattern, it is estimated that the Wiyot had a precontact population of 1,500 to 2,000 and had inhabited their homelands for at least 1,000 years pre-genocide (Eidsness et al. 1993, 17-18; Raphael and Freeman 2007; The Wiyot Tribe 2011; Wiyot Tribe n.d.; Reichard 1925). According to the Wiyot Tribe's website, "this population declined to approximately 200 after 1860, the[n] 100 by 1910, the result of disease, resource depletion, slavery, displacement, and genocide" (Wiyot Tribe n.d.). Historically, the Wiyot were comprised of three subgroups who primarily lived near the Mad River, or *Baduwa't*, Humboldt Bay, or *Wigi*, and the Eel River, or *Wiyat* (Loud, 1918; The Wiyot Tribe 2011). Today, three federally recognized tribal communities with memberships reflecting Wiyot, neighboring tribal, and other Indigenous affiliations hold lands that have been purchased by the tribes, and lands held in trust by the federal government, within the boundaries of Wiyot ancestral territory. These include, Bear River Band of Rohnerville Rancheria, Blue Lake Rancheria, and the Wiyot Tribe (County of Humboldt 2014; Raphael and House; Wiyot Tribe 2010; The Wiyot Tribe 2011). Tribes and local Indigenous people maintain subsistence fisheries, including in the Mad River watershed (Wiyot Tribe NRD and Stillwater Sciences 2016; Stillwater Sciences 2010b; USFWS 2012).

It is well established in the literature and in tribal communities that both eulachon and Pacific lamprey species have consistently held subsistence and cultural value for coastal Indigenous people of the Pacific Northwest, and specifically along what is now

[2] Wiyot language words are italicized throughout the text.

the Northern California coastline (USFWS 2012; Larson and Belchik 1998; Tushingham et al. 2016; AFSC 2006; Wiyot Tribe NRD and Stillwater Sciences 2016). Scholars and resource managers consistently highlight the lack of long-term data available for eulachon and Pacific lamprey, even though eulachon is a federal ESA listed species and Pacific lamprey is recognized by USFWS as a "species of concern." Currently, it is unknown if eulachon have any presence on the river or if they have spawned on the river at all since the 1980s (CDFG 2008). Like eulachon, current and historic quantitative data is not available for Pacific lamprey on the Mad. Biologists and agencies who have been charged with managing eulachon and Pacific lamprey on the Mad River know little about their current and historic population trends and lifecycles; likely too little to protect them. With the research that has been conducted, less attention has been paid to gathering qualitative data, especially in the form of oral history interviews with local tribal members, local fishers, and other knowledgeable parties.

This study uses Traditional Ecological Knowledge (TEK) and Local Ecological Knowledge (LEK) to help fill the gap of the data-poor fisheries of eulachon and Pacific lamprey on the Mad River. Oral history interviews with Indigenous people and interviews with other knowledgeable sources are necessary for understanding how the cultural and environmental landscape of the watershed has changed. TEK and LEK can demonstrate the significance these fish hold for local Indigenous people, and the reciprocal socio-ecological relationship between people, the watershed, and the fish species of concern. Additionally, these knowledges can help pinpoint the leading causes of declining eulachon and Pacific lamprey populations today.

1.3 Research Questions

Drawing from the disciplines of TEK, LEK, Environmental History, and Resilience Theory this research study was guided by the following questions:

What do Traditional Ecological Knowledge and Local Ecological Knowledge, drawn from oral history interviews with Indigenous people and key informant interviews with experts in their fields, demonstrate about historic and current eulachon and Pacific lamprey fisheries in the lower Mad River watershed?

1. What do Indigenous and key source perspectives reveal about changes to the cultural and environmental landscape of the Mad River?
2. What significance do Pacific lamprey and eulachon hold for local Indigenous people?
3. How have changes in land and resource management practices in and around the lower Mad River watershed shaped and been shaped by cultural values and how they relate to the species of study?
4. What are oral history participant and key informant perceptions regarding leading causes of declining eulachon and Pacific lamprey populations on the Mad River?

2 LITERATURE REVIEW

2.1 Traditional Ecological Knowledge

Scholars describe Traditional Ecological Knowledge (TEK) as a cumulative knowledge system passed down through generations, based on a history of learning through an on-going holistic relationship, linking humans to the environment in which they live through spiritual and practical applications (Anderson 2005; Berkes, Colding, and Folke 2000; McGregor 2005; Ross et al. 2011). U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) (2010) explains that Indigenous Knowledge (IK) and "wisdom result from generations of people living intrinsically with the environment" (7). Definitions from the literature describe TEK as a largely place-based and orally transmitted dynamic body of knowledge unique to a tribe or Indigenous Peoples within the landscape or landscapes in which they have built on-going relationships (Anderson 2005; Berkes, Colding, and Folke 2000; Ross et al. 2011; USDA NRCS 2010).

TEK remains a controversial field of study as it has received much criticism from Indigenous and non-Indigenous scholars alike. One of the main critiques examines how TEK research is often written by and for non-Indigenous academics, with research investigators often exhibiting little understanding and familiarity about the culture and system of knowledge they are describing (McGregor 2005; Ross et al. 2011). Scholars with this viewpoint demonstrate concern with simplifying Indigenous knowledge systems

through limited translation, as well as through the attempt of a non-knowledge-holder to force a dynamic worldview and practice into a western model of categorization (Berkes, Colding, and Folke 2000; McGregor 2005; Ross et al. 2011). In addition, scholars warn that the perpetuation of myths, such as that of the 'ecologically noble savage', are easily reinforced, continuously reducing the role Indigenous Peoples have had as active participants in their environments (Berkes, Colding, and Folke 2000; Davis and Ruddle 2010; Ross et al. 2011).

As the integration of TEK and Western Science resource management techniques becomes increasingly popular among government agencies and environmental managers, this method has been widely championed and criticized (Davis and Ruddle 2010; Huntington 2000; McGregor 2010; Petersen 2006; Ross et al 2011). Some scholars warn that this new attempt to 'bridge the gap' between TEK and Western science is actually a new era of furthering the agenda of development on the part of the dominant culture through continuous means of extraction and exploitation (Agrawal 1995; Davis and Ruddle 2010; Petersen 2006; Ross et al. 2011). Some scholars and Indigenous communities in favor of merging TEK with Western Science resource management techniques advocate for "TEK and what it can offer in terms of increased involvement and control over important environmental and natural resources decision-making" (McGregor 2010, 104). A number of studies have been conducted demonstrating the value of incorporating TEK into research projects and management strategies (Petersen 2006; Ruiz-Mallen 2013; Thornton and Scheer 2012; USDA NRCS 2010), including Huntington's (2010) examination of three successful case studies in Alaska and Davis

and Ruddle (2010) description of the New Zealand Maori and the recognition of their traditional fishing rights. While TEK is proving to be highly useful as a means for wildlife research and sustainable management strategies, it is the ethics of responsibility on the part of the researcher that is of utmost importance (Agrawal 1995; Davis and Ruddle 2010; Huntington 2000; Ruiz-Mallén and Corbera 2013). Drawing on the literature that exists within this field of study, my research will be guided by an understanding of ethics and responsibility as a non-Native academic conducting research with Native Americans, with focus on their traditional and contemporary Indigenous knowledges.

2.2 Local Ecological Knowledge

This research project also included the collection of knowledge and information from non-Indigenous people who were closely connected to the Mad River landscape. This type of information is often referred to as Local Ecological Knowledge (LEK). LEK typically refers to a cumulative experience-based body of knowledge shared among a community or group of resource-users who are often dependent on local resources in some manner for subsistence-based survival (Brook and McLachlan 2008; Bundy and Davis 2013; Failing and Harstone 2007; Raymond et al. 2010; Steele and Shackleton 2010). Raymond et al. (2010) distinguish ‘local’ from ‘traditional’ knowledge through the description that “the former has been derived from more recent human-environment interactions (e.g. a few generations) rather than being embedded in deeper cultural

practices" (1768). Western anthropological and social studies disciplines attempt to teach the idea that 'culture is not created in a vacuum.' Meaning, that cultures mutually influence and impact one another over time, as is the case with Indigenous and non-Indigenous communities and people of the lower Mad River watershed. Thus, LEK broadens the scope of the sample to include multiple types of fishers' knowledge.

Within this body of literature, TEK is frequently housed under the same broad definition as LEK (along with other localized and or experience-based knowledge systems) which can often be an oversimplification on the part of the researcher when integrating multiple knowledge types for environmental management research (Brook and McLachlan 2005; Brook and McLachlan 2008; Hagan et al. 2007; Hill et al. 2010; Raymond et al. 2010). For this reason, I find it imperative to distinguish between TEK and LEK, examining how each system of knowledge overlaps regarding local fishers' knowledge, while simultaneously remaining distinct.

The integration of LEK in fisheries research and management has received a lot of attention in recent years as national and international protocols increasingly require the integration of local and Indigenous knowledge systems into management procedures (Brook and McLachlan 2008; Failing and Harstone 2007; Haggan, Neis, and Baird 2007; Hill et al. 2010; Wilson, Raakjaer, and Degnbol 2006). Haggan, Neis, and Baird (2007) refer to the continuously evolving ways of life, involving adaptive and practical applications to changes in fishers and fisheries, as "fishers' knowledge;" including Indigenous, artisanal and industrial fishers under this category (35). Many scholars advocate for the benefits of integrating fishers' knowledge with formal, western scientific

knowledge systems, claiming that fishers' knowledge can be useful for data-poor and small-scale fisheries research, long-term and holistic ecosystems perspectives, as well as for providing relevant information regarding social and economic implications (Bundy and Davis 2013; Haggan, Neis, and Baird 2007; Hill et al. 2010; Wilson, Raakjaer, and Degnbol 2006). Ted Ames (2007), fisher and marine biologist, successfully demonstrated the applicability of using fishers' knowledges by mapping cod and haddock spawning grounds in the Gulf of Maine for the purpose of restocking and improving the sustainability of fisheries management (Ames 2007; Haggan, Neis, and Baird 2007). A widely cited critique is that LEK studies often lack a rigorous methodological framework for recording and analyzing knowledge, as well as a detailed description of how local "experts" are selected (Davis and Wagner 2003; Hill et al. 2010; Raymond et al. 2010). In addition, scholars and resource users alike describe the difficulty in measuring and testing LEK by empirical scientific standards and how such processes can be disempowering and easily reinforce existing power dynamics (Brook and McLachlan 2005; Bundy and Davis 2013; Failing and Harstone 2007; Hill et al. 2010). Designing a rigorous and robust methodological framework will guide the research process through the provision of ethical standards and detailed parameters.

LEK and TEK both speak to the human experience in the face of change. In addition to TEK, LEK has enormous potential for filling the gap in the data poor fisheries of eulachon and Pacific lamprey on the Mad River.

2.3 Environmental History

This project draws from environmental history as a discipline to piece together an in-depth understanding of how humans and the ecosystem of the lower Mad River basin have interacted and affected one another over time. An environmental history is necessary for linking social, ecological, and political factors in a way that will reveal uniquely useful information regarding eulachon and Pacific lamprey fisheries on the Mad River (Garwood 2017; McEvoy 1988; Payne 2013; Worster 1988). Environmental history is an interdisciplinary approach to interpreting human/non-human relationships and how they are shaped by one another through non-linear, dynamic and adaptive processes in which culture and the environment interact through mutual determination (Cronon 1983; Worster 1993). Environmental historians examine the concept of nature as it is viewed and interpreted by the culture or individual in question (Cronon 1983; Fiege 2012; Hull, Robertson, and Kendra 2001; Worster 1993). Within the context of this research study, the discipline of environmental history lays the foundation for examining the broader social, cultural, and environmental relationships and how they have shaped and been shaped by one another over time in the lower Mad River basin, ultimately leading to fisheries declines and lasting impacts to Wiyot and other local Indigenous populations as well the fragmenting of place-based knowledge systems.

An environmental history of the lower Mad River watershed reveals natural and anthropogenic changes in the landscape over time, how these changes have impacted the hydrological cycle of the river, and how specific species (including humans) have been

affected. Nature and the environment are not treated as separate static entities; humans exist within the changing ecosystem dynamics. Worster describes that "the great challenge in the new history does not lie in merely identifying such levels of inquiry, but in deciding how and where to make connections among them" (1993, 49). Therefore, environmental history serves as an invaluable approach for identifying and uncovering deeply imbedded and inextricably intertwined relationships and interactions and how these stories are told and demonstrated through the history and river landscape of the Mad River.

2.4 Resilience Theory

Resilience Theory broadens the scope of this framework to include a lens which is ecologically based. Resilience is a concept grounded in the ecological literature which focuses on non-linear, social-ecological systems dynamics (Berkes, Colding, and Folke 2003; Wilkinson 2012). Resilience is a concept used to identify processes by which social-ecological systems adapt to disturbances and how they sustain themselves in the face of change (Folke, 2003; Chapin 2009; Walker and Salt 2006). Resilience Theory is based on the central themes of environmental thresholds and adaptive cycles (Raffaelli and Frid 2010: 11), which serve as guiding principles for resilience-based ecosystem management thinking. Resilience Theory fits with the theoretical framework for this thesis because "it underscores the importance of considering linked social-ecological systems, rather than ecosystems or social systems in isolation" (Folke, Berkes, and

Colding 2003). The concept of resilience is a beneficial addition to the disciplines of sustainability science and environmental resource management because it provides useful means for examining how social-ecological systems learn, self-organize, and adapt to disturbance (Folke 2006; Chapin et al. 2009; Raffaelli and Frid 2010: 11).

Resilience Theory principles contribute to understanding fluctuations in eulachon and Pacific lamprey populations over the last 150 years, as well as the current state of these fisheries. It is also useful for identifying and interpreting changes in the Mad River watershed ecosystem and how humans, eulachon, and Pacific lamprey have adapted to changes over time. Combined with Indigenous epistemologies, this field of discipline allows for an emphasis on local Indigenous people as active agents in their own cultures and environments who continue to share their own stories.

Some Indigenous scholars discuss the problems with prevailing narratives and documentation continuously solidified by Western scholars, including focus on the destruction and loss of Indigenous cultures, languages, and knowledge systems, rather than focusing on the positive aspects of Indigenous Peoples and people by "celebrating survival" (Tuhiwai Smith 1999, 145; Risling Baldy 2018; Grande 2004; Fixico 1998). In her book *We Are Dancing For You: Native Feminisms and the Revitalization of Women's Coming-of-Age Ceremonies* (2018), Cutcha Risling Baldy, a member of the Hoopa Valley Tribe and Department Chair of Native American Studies at Humboldt State University (HSU), describes this prevailing approach as the "the narrative of loss" (5). Risling Baldy states:

> We are always losing something: our languages, our futures, our traditions, and our cultures. In this story, if we haven't lost these things, we are on our way to losing them, one step away from an extinction that seems inevitable and also, improbably, accidental. This is to solidify the settler colonial desire for an eventual inheriting of this land, a rightful, uninhabited, ahistorical passing of ownership from the poor, dying Indigenous to the stronger, healthier, more vibrant settler colonial society (2018, 5).

It is necessary for this research to understand how the devastation of genocide and forced displacement have been for the Wiyot and local Indigenous people, their lands, waters, and Native foods. Methodologies rooted in resilience thinking provide a lens making it equally as important to examine the surviving, thriving, and revitalizing aspects of the relationships local tribes and Indigenous people continue to deepen and expand upon as active and resilient agents in their landscape(s).

2.5 The State of Biological Research on Eulachon and Pacific Lamprey

This section primarily focuses on the most relevant and current biological research available in the literature that specifically speak to my research questions. There is also some focus on historical ecology.

2.5.1 Eulachon

Pacific eulachon (*Thaleichthys pacificus*) are a small anadromous smelt endemic to the northeastern Pacific Ocean. A member of the Osmeridae family of small forage fish, the species' habitat ranges from Northern California to the southeastern Bering Sea in Bristol Bay, Alaska (Jennings 1996, AFSC 2006, NMFS 2011). Eulachon run in large schools, and after being born in freshwater streams or estuaries, they spend 95 to 98

percent of their lives in the ocean (Clarke et al. 2007; Gustafson et al. 2012; Hay el al. 1997). The fish mature to three or four years in marine habitat, reaching approximately 15 to 20 cm (6 to 8 in), before migrating to spawning grounds "typically in the lower reaches of larger rivers fed by snowmelt," and further into freshwater inlets than other smelt species within their range (AFSC 2006; Larson and Belchik 1998). With a typical spawning season between December and May, associated with the highest of the spring tides, the Mad River was one of only a few Northern California streams that experienced annual and intermittent runs that varied by size prior to the 1990s (Odemar 1964, 305-306; CDFG 2008).

In 2008, California Department of Fish & Game (CDFG) staff conducted archival research, several interviews with tribal members and fishers, and interviews with biologists in order to determine current and historic population trends for eulachon in North Coast rivers, in response to a request by National Oceanic and Atmospheric Administration (NOAA) Fisheries. Steve Cannata, who was an Associate Fisheries Biologist with CDFW at the time, shared the results of his findings with Peter B. Adams, Ph.D, of National Marine Fisheries Service (NMFS) in Santa Cruz, California (CDFG 2008). The letter states, "prior to the 1990s, eulachon made large, annual spawning runs in the Klamath River, Redwood Creek, and Mad River. These runs likely varied in size between years" (CDFG 2008). A particularly large spawning run was noted in North Coast rivers in 1963, with a recorded 56,000 pounds in commercial catch split between the Mad, the Klamath, and Redwood Creek (CDFG 2008; Odemar 1964). As useful as this study is for my investigation, it is still limited in depth and scale. Information was not

made available regarding the significance eulachon have held for the Wiyot and other Indigenous residents of the Mad River watershed. Additionally, while the Mad was included in this study, few details are presented about long-term, place-based qualitative knowledge regarding historic trends, changes, and potential impacts to eulachon fisheries on the Mad River and other Wiyot watersheds of the region.

After eulachon was listed under the federal ESA in May 2010, the BRT identified major threats to the southern DPS of the species which, include, "climate change impacts on ocean and freshwater habitat, by-catch in offshore shrimp trawl fisheries, changes in downstream flow timing and intensity owing to dams and water diversions, and predation" (Gustafson et al. 2012, 121). Based on these identified threats, the Mad River was included as the southernmost spawning environment listed in the critical habitat designation for the listed species in 2011 (NMFS 2013). There is no available evidence in the literature to show concerted efforts on the part of management agencies to address the BRT's identified major threats to the listed species specifically for eulachon on the Mad River.

Published in *California Archeology* in May 2016, Tushingham et al. present major findings from Manila midden site (CA-HUM-321), providing historical ecological evidence that demonstrates the significance smelt species have held for the Wiyot People for at least a thousand years. Owned by the Blue Lake Rancheria and located on Humboldt Bay, "CA-HUM-321 has the earliest documented (1,309 cal BP) [calibrated years before present] evidence of mass harvested foods, smelt fishing, and intensive shellfish procurement on the North Coast of California," predating many local,

significant sites in the region by several hundred years (Tushingham et al. 2016, 29). The researchers used fine-mesh sampling techniques in the Archeology Laboratory at the University of California, Davis, to analyze the bulk soil sample recovered during field research. This method is necessary for preventing bias in the analysis of fish bone and other small materials that may have been missed by previous studies (Tushingham et al. 2016, 10). The researchers found that fish bones comprised 97.8% of all faunal remains at the site, and that the majority of the fish vertebrae that were found (81.0 percent) were identified as Osmeridae (smelt) (2016, 19).

Tushingham et al. concluded that "the number and ubiquity of smelt bone in the assemblage supports the argument that a mass capture smelt fishery (similar to that observed ethno-historically) was in place by the early part of the Late Period (2016, 27). Based on their results, the authors suggest that some ethnographers overemphasized the reliance on marine fishes and foods in the early part of the Late period, pre-contact Wiyot, while underestimating the importance of estuarine resources (Tushingham et al. 2016, 26). Though certain constraints do not allow for specific smelt species identification in excavation sites like these at this time, the findings of this research overwhelmingly show the significance smelt species, including eulachon, have had for the Indigenous people of this region for at least 1,300 years. Locally, this research provides the earliest evidence to date of the mass harvest of fish (especially smelt) and intensive shellfish procurement on the North Coast (Tushingham et al. 2016, 29).

The names 'eulachon' and 'candlefish' are used interchangeably throughout the text following the names' usage from interviews. Other versions of the name eulachon

used widely throughout the Pacific Northwest are ‘oolichan’, ‘ooligan’, and ‘hooligan’ (Hay et at. 1997; AFSC 2006).

2.5.2 Pacific Lamprey

Pacific Lamprey *(Entonospenus tridentatus,* formerly *Lampereta tridentate),* locally referred to as “eels,” are jawless, parasitic, anadromous fish species distributed in streams, rivers and coastal waters all along the Pacific West Coast; from Baja California to the Bering Sea in Alaska (Howard and Close 2003; Stillwater Sciences 2010b). A member of the Petromyzontidae family, Pacific lamprey belong to a group of fishes that have remained relatively unevolved over the last 400-450 million years. Historically, the species’ freshwater range spanned from Japan, around the Pacific Rim, and all the way down to Baja California, Mexico (USFWS, 2012; USFWS 2016).

Pacific lamprey spend an estimated one to three years in the ocean preying, like parasites, on larger fish and mammals. They grow to their full size, approximately 80cm (or 31 inches), before returning to freshwater streams to spawn and die (USFWS 2012; Stillwater Sciences 2010b, 4). The fish typically begin their migration into freshwater streams between February and June. River systems, streams and tributaries in and around Humboldt Bay, including the Mad River, have been major spawning grounds for Pacific lamprey. Northern California river systems, including the Klamath, are home to some of the most diverse lamprey populations in the world (USFWS 2012; Stillwater Sciences 2010b; Wiyot Tribe NRD and Stillwater Sciences 2016).

In 2003, eleven environmental groups filed a petition with USFWS to get Pacific lamprey listed under the federal ESA along with three other lamprey species. Nawa

(2003) reported that "industrial and agricultural pollution, urbanization, dewatering of streams, blockages of migration routes, and alien predators appear to be the principal causes of declines" in West Coast spawning systems (9). In response to the petition, USFWS responded with this 90-day finding:

> We find that the petition and additional information in our files does not present substantial scientific or commercial information indicating that listing these species may be warranted. We will not be initiating a further status review in response to this petition. We ask the public to submit to us any new information that becomes available concerning the status of or threats to the species. This information will help us monitor and encourage the conservation of these species (USFWS, Interior 2004).

The fish has since been recognized by USFWS as a "species of concern," and there is some amount of research and management strategizing that is being conducted by tribes, agencies, and stakeholder groups. The Mad is consistently uncited as an area of focus in the literature (USFWS 2012; Stillwater Sciences 2010b; Wiyot Tribe NRD and Stillwater Sciences 2016).

The Mad River Pacific lamprey fishery is experiencing a similar issue to eulachon, as their Eel and Klamath River fisheries continue to receive the most attention (Larson and Belchik 1998; Wiyot Tribe NRD and Stillwater Sciences 2016). In 2010, fisheries biologists with Stillwater Sciences began conducting an in-depth study of Pacific lamprey in the Eel River basin with the Wiyot Tribe in order "to provide the Wiyot Tribe and other stakeholders in the basin with an enhanced understanding of Pacific lamprey life history, distribution, changes in abundance, and causes of their decline" (Stillwater Sciences 2010b, 1). The Wiyot Tribe Natural Resources Department (NRD) and Stillwater Sciences released an adaptive management plan framework (2016)

for Pacific lamprey which included the Mad River within the geographical reach of the plan. As stated in the document:

> This version of the plan focuses heavily on the Eel River and secondarily on Humboldt Bay Tributaries where more information is available. To our knowledge, at this time very little data on the species exists for the Mad River and there has been no effort to compile and synthesize existing information on population status, distribution, or basic biology and life history there. The Mad River is within Wiyot Ancestral Territory and of interest to the Tribe, and is therefore considered in this plan. Ultimately, however, we foresee that research, monitoring, and management of lamprey in the Mad River by the Wiyot Tribe will be coordinated closely with other entities, including Blue Lake Rancheria (Wiyot Tribe NRD and Stillwater Sciences 2016, 3).

This statement highlights the Mad River as one of the main river systems located within Wiyot ancestral territory that has very little available research data for the Tribe to work with when they are actively seeking it out.

USFWS' Executive Summary in Pacific Lamprey (*Entosphenus tridentatus*) Assessment and Template for Conservation Measures in California (2012) details, "the Pacific lamprey population in California had been extirpated from at least 55% of their historical habitat north of Point Conception by 1985" (1). It is now well understood within the field of fisheries biology and conservation that this species has held long-term cultural significance for Indigenous Peoples along the West Coast including the Wiyot and other Indigenous residents of the Mad River basin (Larson and Belchik 1998, USFWS 2012, McCovey and Benson 2006, Petersen 2006; Wiyot Tribe NRD and Stillwater Sciences 2016). With the lack of focused qualitative research and synthesized information regarding decades of decline of the species, specifically on the Mad River,

the findings of this study could be useful for management partners like the Wiyot Tribe and stakeholders.

The names ‘Pacific lamprey’ and ‘eel’ are used interchangeably throughout the text following the names’ usage from the interviews. When discussing other lamprey species, I consistently refer to them specifically by name, distinguishing them from the species of interest.

2.5.3 The Mad River Watershed

The Mad River, along with other coastal watersheds of Northern California, has been identified as having high yields of sediment discharge compared to global averages (Tolhurst 1995; Stillwater Sciences 2010a; Warrick et al. 2013). For this reason, quantitative studies have been conducted in order to identify contributing factors. In depth, comprehensive research studies on the Mad River including Stillwater Science’s Mad River Watershed Assessment (MRWA) (2010) and Humboldt Bay Municipal Water District’s Habitat Conservation Plan (HCP) (2004), are valuable for their detailed discussion of environmental impacts to the structure of the river, its ecosystems, and species. Eulachon and Pacific lamprey receive little mention in both these documents and are not included in HBMWD’s Conservation Plan (Stillwater Sciences 2010a; Trinity Associates and HBMWD 2004).

3 METHODS

This research draws from four primary research methods: (1) Oral history interviews with tribal members; (2) Semi-structured interviews with key informants; (3) archival research and document review; and (4) Participant observation. The combination of these methods allowed for thorough investigation, uncovering pertinent information regarding the history of eulachon and Pacific lamprey within the area of study.

3.1 Subject Matter

Eulachon was identified as a priority by Blue Lake Rancheria Tribal Members and staff, who contacted HSU to have data gathered on the species. This project is an attempt to respond to that request. Pacific lamprey was later added because the two species are often discussed together and they both hold significance for local tribes.

Most of the preliminary investigation was focused specifically on the Mad River watershed. In response to Blue Lake Rancheria's inquiry and the Mad River's listing as the southernmost extent of the designated critical habitat range by the EPA and NOAA for the southern DPS of Pacific eulachon (Jennings 1996, NMFS 2016, NMFS 2011), the watershed was selected to be the area of investigation. An attempt to interview as many tribal members as possible having long-term familiarity with the species and the Mad River expanded my sample to include individual Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria, and Wiyot Tribe tribal members as well as Wiyot, Yurok, and

Tolowa descendants. In turn, I was able to interview tribal and Indigenous research participants who have lived, fished, and eeled throughout the ancestral territory of the Wiyot and beyond. While some of the findings expand beyond the area of investigation, the primary focus of this research remains centered on the lower Mad River watershed.

The name ‘Wiyot’ is used throughout this document to refer to the Indigenous People who originally inhabited the main study area. Recognizing the diversity of Indigenous affiliations represented by the three tribes as well as the oral history sample, I incorporate several inclusive words that describe them collectively such as ‘local Indigenous Peoples’ and ‘Native Peoples of the Mad River watershed and Wiyot ancestral territory’. ‘Native’, ‘Indigenous’, and ‘Peoples’ are capitalized because they are proper nouns used to refer collectively to distinct groups of individuals – specifically, the original occupants of the area of focus (IJIH 2018). The word ‘people’ will be used to refer to more than one person without distinguishing a distinct group. When possible, I try to capture the self-described identity of individuals, using the language presented by the individual person or individual tribal community in order to refer to them (UN General Assembly 2007).

3.2 Sampling Methods

Directly calling or emailing potential interviewees followed by snowball sampling were the primary methods utilized to obtain both oral history and key informant interviews. Snowball sampling, the method of working through networks of contacts

shared by research participants, was widely used to connect with oral history participants. Experts in their fields, or key informant interview participants, were contacted via phone or email. Upon completion of each interview, I asked the respondents if they knew of anyone in their network who might also be willing to be interviewed. Snowball sampling became the main method used to obtain interviews with both sample groups.

Prior to any contact with interview participants, I obtained full approval from the Institutional Review Board (IRB) at Humboldt State University (HSU). The IRB process serves to ensure that all research that involves humans or data on humans "will not only comply with Federal regulations; it will also protect the rights and well-being of [a researcher's] subjects" (HSU, n.d.). Interview participants were asked to review and sign an IRB approved informed consent form detailing the research and what was being asked of them (See Appendix A).

Prior to conducting oral history interviews with members of the Blue Lake Rancheria, the Wiyot Tribe, and the Bear River Band of Rohnerville Rancheria, I received council approval from each respective Tribe (See Appendix B). An agreement was made with the tribal councils to provide each tribe with a copy of the audio recordings and transcriptions from each of the respective tribal members I interviewed who did not choose to remain anonymous, as well as to submit a copy of my thesis upon completion. Staff and council members from the tribes connected me with tribal members they knew would be willing to speak with me and who had long-term knowledge about the species and area of study, as well as traditional and contemporary fishing practices and ways of life.

I have been fortunate to receive support for my research from the tribes. Ted Hernandez, Chairman and Tribal Historic Preservation Officer (THPO) for the Wiyot Tribe has provided oversight on the final draft, for cultural appropriateness and accuracy. The linguist for the Wiyot Tribe, Lynnika Butler, has also been generous with her time and expertise, having reviewed and provided her edits to the draft. Blue Lake Rancheria Environmental Director, Michelle Fuller, is sitting on my thesis committee, and the Tribal Historic Preservation Officer (THPO) for the tribe, Janet Eidsness, also provided her feedback.

3.3 Interview Sample

During the sampling process, I conducted interviews with a total of 31 interview participants. This sample can be divided between (1) oral history interviews with thirteen tribal members and Indigenous knowledge-holders of the lower Mad River watershed and Humboldt Bay region, and (2) semi-structured interviews with eighteen key informants.

Two oral history interview participants, Anonymous #1 and Anonymous #2, and one key informant interview participant, Anonymous #3, chose to opt out of being audio recorded. Anonymous #1, did grant permission to be directly quoted without the use of their name. Anonymous #2, allowed for the interview to be audio recorded, also granting permission to be directly quoted without the use of their name. Based on the low percentage of participants who chose to allow for the use of direct quotes without the use of their names, I am keeping this research participant anonymous (listed as Anonymous

#2) so that I can quote this person without inadvertently exposing their identity. Anonymous #3 opted out of being recorded or directly quoted.

3.3.1 Oral History Interviews

Directed by the TEK and LEK methodological framework, I set out to sample as many Wiyot descendants as possible who might have knowledge regarding current and historical fisheries trends for eulachon and Pacific lamprey on the Mad River or within their traditional ancestral territory. Oral history interviews with tribal members followed a loosely-structured, open-ended format allowing memories and stories to flow naturally (See Appendix C). The interviews took an average of one hour. On a handful of occasions, I had the opportunity to interview more than one participant at once; a method I tried to utilize as I moved forward with the process because I found it helped interviewees spark memories and conversations amongst one another. Interviews occurred in tribal offices, community buildings, or homes of the individuals being interviewed.

The 13 oral history research collaborators in this study are considered local experts, including for their place-based knowledge. Scholar Cutcha Risling Baldy, a member of the Hoopa Valley Tribe, describes how disciplines, such as anthropology, developed with the process of settler colonialism, building a prevailing narrative that Western scholars were responsible for documenting and disseminating Native culture before it disappeared (2018, 5). Baldy (2018) states:

> Though anthropologists usually relied on Native consultants as informants for their work, it was anthropologists and archeologists who became the ‘experts’ and ‘authorities’ on Indigenous peoples. Subsequently, these scholars were depended

> on as expert witnesses, and their ideas, theories, and findings were given more weight and consideration then that of Indigenous peoples (5).

Rather than extracting their knowledges for my own, personal research gain, I recognize each individual interview participant for their unique expertise and perspective.

I observe the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) which outlines Indigenous Peoples' right to self-determination (2007). Article 33 states, "Indigenous peoples have the right to determine their own identity or membership in accordance with their customs and traditions" (2007, 24). Throughout this document, oral history participants who selected and signed the "I give permission to be directly quoted with use of my name" option on the IRB approved informed consent form, will be fully acknowledged for their valuable contribution with the use of their name and self-determined tribal membership or Indigenous affiliation. For the participants who selected and signed the "I give permission to be directly quoted without the use of my name" option will also be recognized for their expertise and significant contribution to this research with the inclusion of their self-defined tribal membership or Indigenous lineage, but without the use of their name.

3.3.1.1 Oral History Participant Demographics

Table 1 captures the self-described tribal memberships of oral history participants. The two respondents included in the "unknown" category self-defined their tribal lineages and affiliations as being Wiyot and Yurok but did not delineate specific tribal memberships like the other oral history research participants did.

Table 1.Oral History Interview Sample Tribal Membership

Tribal Membership	# of Interviewees	% of Oral History Sample	% of Total Interview Sample
Bear River Band of Rohnerville Rancheria	3	23%	10%
Blue Lake Rancheria	3	23%	10%
Wiyot Tribe	4	30%	13%
Yurok and Tolowa	1	8%	3%
Unknown	2	15%	6%

At the time of the interviews, all oral history interview participants lived within the traditional territory of the Wiyot, and most lived on one of the rancherias or the Table Bluff Reservation. Almost all oral history respondents were over the age of 60 (Table 2).

Table 2. Age Range of Oral History Interview Participants by Decade

Age Range by Decade	# of Interviewees	% of Oral History Sample	% of Total Sample
30-40 years old	1	8%	3%
41-50 years old	1	8%	3%
51-60 years old	0	0%	0%
61-70 years old	3	23%	10%
71-80 years old	5	38%	16%
81-90 years old	3	23%	10%

3.3.2 Key Informant Interviews

Eighteen key informants were interviewed, forming a sample that represents diverse fields of study and expertise. Key informants were primarily selected and solicited based on their professional research, job duties, or affiliations as they pertained to the research topic at the time of or before the time of sampling.

Key informant interviews were conducted using semi-structured and open-ended interview questions (see Appendix D). Interviews lasted an hour on average. Fifteen interviews were conducted with a total of eighteen key informant participants. The place of work served as the setting for most of these interviews, while some were conducted in the home of the key informant. Several interviews occurred in a public space, including the HSU library, a coffee shop, and a sports facility. Two were recorded over the phone.

It is challenging to quantify this sample categorically, as many of the participants have multiple titles and expertise. Out of respect for all individual research participants included in my sample I will attempt to continue employing the language provided by the participants themselves as a manner of respecting everyone's right to self-define their titles and affiliations. Table 3 lists the key informants, their field of research or expertise, and their place of employment. Table 4 captures the field of study or expertise demographics of the key informant sample.

Table 3. Key Informant Interview Sample Field of Study or Expertise Demographics

Field of Study or Expertise	# of Interviewees	% of Key Informant Sample	% of Total Sample
Environmental Planning and Consulting or Tribal Environmental Programs	7	39%	23%
Fisheries Biology	6	33%	19%
Archeology and Cultural Resources	2	11%	6%
Sport and Commercial Fisheries	1	6%	3%
Local History and Ethnography	1	6%	3%
Wiyot Language	1	6%	3%

3.3.2.1 Key Informant Place-Based Knowledge

At the time of the interviews, all but two participants lived and worked within the Wiyot ancestral territory. While only three key informants said they had lived on the Mad River or within the watershed at one time, the majority had lived and worked in the Humboldt Bay region for at least five or more years (Table 4)[3]. More than half of the sample specifically mentioned that they were graduates from HSU undergraduate and/or graduate programs.

[3] Table 4 does not include the two key informant interview participants who live and work outside of the Humboldt Bay region.

Table 4. Amount of Time Key Informants Have Lived and Worked within Traditional Wiyot Ancestral Territory

Duration Living and Working in the Humboldt Bay Region by Decade	# of Key Informants	% of Key Informant Sample	% of Total Interview Sample
5-10 years	4	22%	13%
11-20 years	2	11%	6%
21-30 years	3	17%	10%
31-40 years	5	28%	16%
41-50 years	2	11%	6%

3.4 Visual Methods

Maps and photographs were used as tools during interviews. Maps of the study area allowed for geographical orientation, providing a visual platform upon which memories could be sparked and confusion about place names and locations could be diminished. Some oral history participants drew pictures to help demonstrate some of the things they were describing, especially tools used to fish and eel.

A variety of images of eulachon and Pacific lamprey were shown to each research participant as a necessary methodological approach to ensure species-specific accuracy since both species belong to families (smelt, or Osmeridae, and lamprey, or Petromyzontidae) which include several similar-looking species of fish which share overlapping distribution ranges. Along with the photographs of eulachon, I showed participants pictures of the species which included taxonomic and biological information about the specific fish, including photos that showed the average length of an adult and distinguishable differences between them and other similar smelt species (Figure 1 and Figure 2).

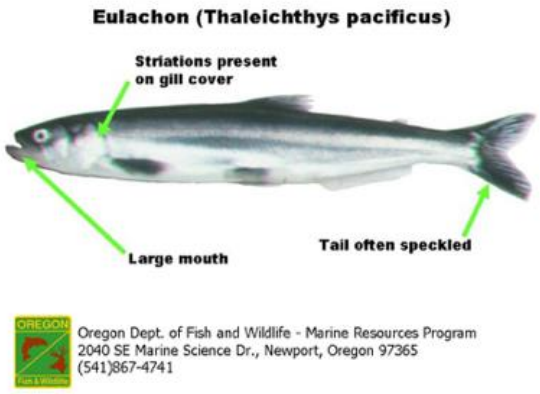

Figure 1. Picture of eulachon (*Thaleichthys pacificus*) showing distinguishable physical characteristics. (Source: Oregon Department of Fish and Wildlife, 2014).

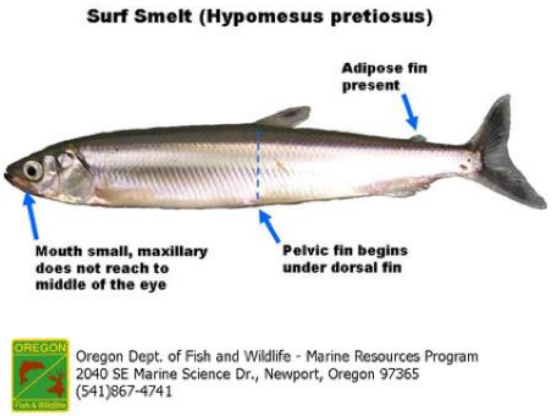

Figure 2. Picture of surf smelt (*Hypomesus pretiosus*) showing distinguishable physical characteristics. (Source: Oregon Department of Fish and Wildlife, 2014).

I showed images and discussed characteristics of longfin smelt (*Spirinchus thaleichthys*) because they are the only other anadromous smelt species that have been known to spawn on the Mad River, Humboldt Bay, and surrounding tributaries (CDFW 2015; Garwood 2017). Figure 4, a picture of a eulachon being measured at 20 cm long

shows how much bigger they mature to than longfin smelt, pictured in Figure 3 at 13 cm long.

Figure 3. Measurement photo of a longfin smelt (*Spirinchus thaleichthys*). (Source: USFWS 2017).

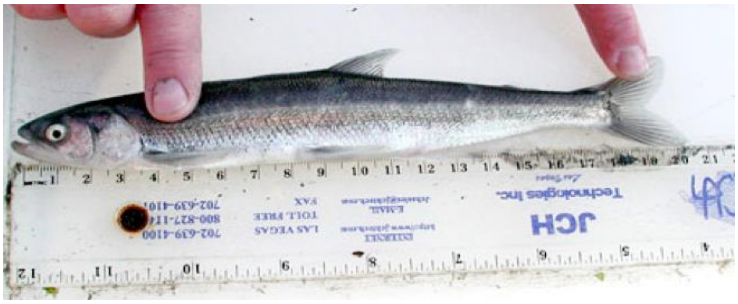

Figure 4. Measurement photo of an adult eulachon (*Thaleichthys pacificus*). (Source: Alaska Department of Fish and Game, n.d.).

Interviewees were asked to specify location, time of year, day or night fishing, and methods used to further determine key distinguishing factors between the species.

Adult Pacific lamprey are easily distinguished from the seven other species of the Petromyzontidae family with which they are known to co-occur in their California range (USFWS 2012, 7). The species is unique as the only known anadromous lamprey of the seven other species in their California range. The others are freshwater lake and river species. With the largest distribution on the West Coast, Pacific lamprey are the largest of the lamprey species, distinguished by three larger teeth along with some smaller teeth

present on their oral disc (USFWS 2016; USFWS 2012; Stillwater Sciences 2010b) (Figure 5 and Figure 6).

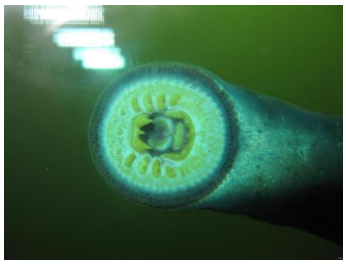

Figure 5. Photo of Pacific lamprey (*Entosphenus tridentatus*) oral disc showing three large, distinguishable teeth. (Source: Lyman Thorsteinson, United States Geological Survey, 2011).

Figure 6. Photo of a Pacific lamprey (*Entosphenus tridentatus*). (Source: USFWS 2017).

3.5 Archival Research

Archival research can reveal as much about what has been recorded as it can about what has been omitted. I combed newspapers, ethnographies, city, county, and federal agency records, pinpointing some of the major natural and anthropogenic factors that have impacted the Mad River, the fisheries, and the original inhabitants of the

watershed. I familiarized myself with archival maps and photographs, noting major changes to the landscape and the watershed.

3.6 Document Review

An important addition to my research was the act of familiarizing myself with important policy and agency documents pertaining to eulachon and Pacific lamprey, the three tribes, and the Mad River. Legal, governmental agency, and tribal documents provided a wealth of data, including historical and up-to-date information regarding laws and regulations, federal recognition status of the tribes, the status of the species, and the listing of the Mad River.

3.7 Participant Observation

The method of participant observation took several different forms throughout the research process. I participated in the 2014 Summer Steelhead Dive, joining local groups and individuals who work in collaboration to monitor steelhead and salmon populations on the Mad River. I took an in-the-field environmental education class called Paddle with a Purpose led by Dave Feral and Mad River Alliance, making site visits to several locations in the lower basin where we learned about the watershed, its species, and its ecosystems. I made numerous site visits to many of the publicly accessible locations in and around the lower Mad River, kayaking parts of the river and walking easily accessible streams. I attended tribal community events, including the Indian Island Vigil, a Wiyot Tribe elders luncheon, an Indian Island Planning Committee meeting, and Tribal Council meetings. I also had the opportunity to see a Brush Dance demonstration at HSU.

One of the key informant interviews involved joining Jacob Pounds, Environmental Resources Technician for the Blue Lake Rancheria, during one of his biweekly water quality monitoring rounds on the Mad River. During one of the key informant interviews, Thomas Dunklin, Geovideologist, provided me with the opportunity to try smoked eel from the Klamath River and eulachon oil he had been gifted from a tribal member from Washington State. (See Figure 7). Though I did not have the opportunity to go out fishing or eeling, I did get to see a few eel hooks of different kinds, a surf fish net, and an eel basket.

Figure 7. A Picture of fileted, smoked, and then pan-fried Pacific lamprey with its oral disc and teeth showing. (Photo by Kara Simpson, 2014).

3.8 Modes of Analysis

All thirteen oral history interviews were almost entirely transcribed except for the interview with Anonymous #1 which was unrecorded. Key informant interviews were partially transcribed. Each interview had a transcription file, a key themes and concepts

file, and a salient quotes file. This method of ‘bundling’ allowed me to organize my data into categories leading to a process of ‘saturation’. Certain ‘bundles’ would begin to overflow with data as I continued to enter it throughout the transcription process. Continuing with this procedure, I began adding related source information to the bundled categories pulled from archives, documents, and participant observation.

3.9 Researcher Background and Personal Biases

My position and privilege as a white, western academic, non-Native researcher has not been taken lightly during this research process. My interest in Indigenous water and sovereignty rights grew from work with Indigenous people and communities in Bolivia, South Africa, and the U.S., mestizo communities outside Guadalajara, Mexico, and Afro-Indigenous communities in Surinam. I was born and raised in a middle-class suburb of Washington, D.C. in an internationally diverse area. It was not until I lived in La Paz, Bolivia with my family, between the ages of 11 and 15, that I became aware of current-day imperial and colonizing impacts to Indigenous Peoples and their lands.

Working with Indigenous people, including through a position I held for three years with Seventh Generation Fund for Indigenous Peoples in Arcata, CA, has required an ongoing examination of my own Indigeneity as well as my white, settler privilege. Most of my genetic roots are English, Irish, and Scottish. My family is fortunate to have some genealogical records for our Native American ancestral affiliations. On my father’s paternal side, we are descendants of Kiowa and Wichita Peoples. On his maternal side, I

am four and five generations removed from my Choctaw and Comanche ancestors, who were recorded in late- 1800 and early- 1900 census records and tribal roll numbers as living in Chickasaw territory and on a Comanche reservation in what is now the state of Oklahoma. My father's bloodline is still predominantly white European, and the integrated lineage has allowed for at least three to six generations of white-passing family members.

While I have been actively engaging decolonizing methods throughout this process of research, I know I have unintended blind spots, prejudices, and assumptions based on my white, western-influenced privilege and perspective. I ask all my readers to review this research with the understanding that this document reflects only my own perspectives. This study is not intended to represent the Wiyot People, the three tribal communities who agreed to participate, or the tribal and Indigenous individuals who took the time to share their stories with me. I am not and do not claim to be an expert on Indigenous Peoples of any affiliation. Rather than speaking for the participants in the interviews, I have tried to report their own stories fairly and accurately.

4 SETTINGS

The Mad River watershed is situated between two ridges in a Northern California province known for its consistently active geomorphic characteristics and properties (USGS 1973). (See Figure 8). Its landscape and ecosystem(s) have consistently been shaped and forced to adapt since the river's inception. With its unstable geographic and geomorphic characteristics, its seismic activity, and its steep decline 6,000 feet to the ocean through "narrow, V-shaped canyons" (USGS 1973, 1), the Mad River watershed "is just one of several in coastal Northern California with suspended sediment discharges of 5 to 50 times those of comparable size in the United States" (Tolhurst 1995, 6) and compared to global averages (Warrick et al. 2013). The morphology of the basin and the species that depend on stable, balanced systems and characteristics are already vulnerable to natural geological and weather transformations (Brown 1973; Stillwater Sciences 2010a). White settlement in the region, which began in the mid-1800s, resulted in wide-scale anthropogenic changes to the watershed, its original Indigenous inhabitants, and its fisheries. Economically fueled overharvesting of both fish and old growth forests has had a devastating impact on the river's sediment load and its native species.

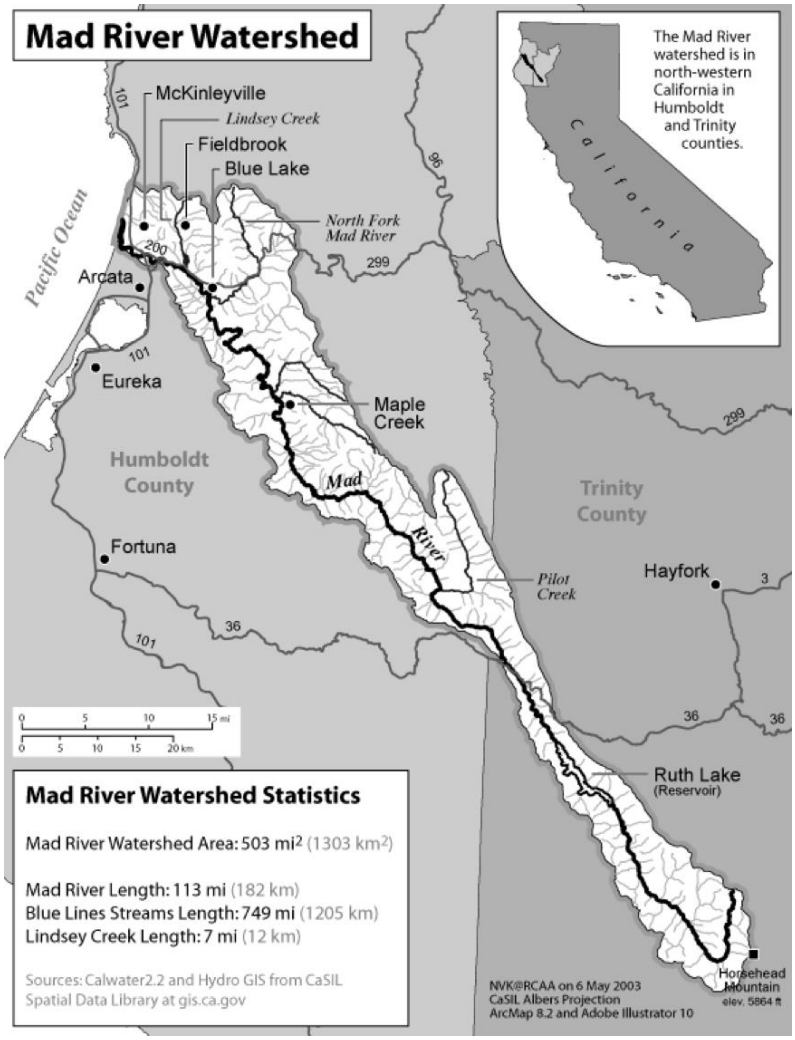

Figure 8. Map of the Mad River Watershed in Northern California. (Source: Redwood Coast Action Agency, 2003).

4.1 Pre-Genocide Overview

Early ethnographers estimated that the Wiyot have been here for thousands of years, at least, based on their distinct language. They were well established across many village sites throughout the region (Benson, Fredrickson, and McGrew 1977, II-1 - II-3; Loud 1918). While the watershed has not been impacted by major changes in climate

over the last 3,000 years, which has remained temperate, it has been "significantly influenced by a host of natural and anthropogenic events" (Stillwater Sciences 2010a, 7; Tolhurst 1995). During this time, "land use practices have evolved from the Native American use of fire as a tool to promote the development of cultural materials and food resources to industrial forestry as a means of maintaining economic opportunity" (Raphael and House 2007).

4.1.1 The Wiyot People

Llewellyn L. Loud is the most notable ethnographer to have conducted early field research with the Wiyot. His research provides a reliable sense of Wiyot ancestral territory (Figure 9). Loud elaborated:

> As already shown, the lowlands about Humboldt Bay have two very effective barriers separating them from the rest of California, namely, physiography and vegetation. The resulting isolation favored the development of a specialized form of language known as Wiyot. There was only one dialect for the region bounded on the north by the valley of Little River, and on the south by Bear River mountains. To the east the same dialect was spoken along Mad River for two or three miles above Blue Lake, and up Eel river for a mile or two above the mouth of the Van Duzen (1918, 249).

The language was spoken in an estimated 500-1000 square mile radius around the bay (Loud 1918; Reichard 1925; Wiyot Tribe 2011). Loud estimated that there were 1,000 Native Wiyot speakers in 1850 (1918, 392). When Gladys Reichard, Anthropologist and Linguist, conducted her fieldwork in 1922, she claimed that "there were only 11 [people] of full Wiyot blood under the age of twenty" (1925, 5). Based on a "crude census," Reichard showed that there were a hundred or less Wiyot people,

including of "mixed blood," living in the area at the time, and that the language was quickly being lost (5).

Figure 9. Map showing Wiyot traditional, ancestral territory. (Source: HSU, Native American Studies Program, n.d.).

Subsistence-based livelihoods dependent on some of the most abundant fisheries in the world allowed Indigenous Peoples to survive in the Humboldt region since time

immemorial[4]. The McKee expedition of 1851 described that "the population of the Humboldt area where the Wiyot were dependent 'wholly on fish, crabs, etc.' was rapidly diminishing due to diseases introduced by the Americans, internal dissention and because of their displacement sometimes due to want of food" (Benson, Fredrickson, and McGrew 1977, II-9).

4.1.1.1 A Fishing People

The Wiyot were known for fishing, trapping, and residing near the still waters of Humboldt Bay and near the mouths and streams of rivers (Eidsness et al. 1993). While salmon was a main staple, the Wiyot lived on a variety of fish including sturgeon, perch, and lampreys (Benson, Fredrickson, and McGrew 1977; Simons 1993). Early explorers and ethnographers noted that the Wiyot "had a fondness for fat," saving the oil from sea mammals such as seals and sea lions and eating it like butter (Benson, Fredrickson, and McGrew 1977, II-6),

The Wiyot actively engaged with their environment using specific land management techniques that would ensure ample harvest of goods (Anderson 2005, 4; Benson, Fredrickson, and McGrew 1977, II-7). Frequent burning of forests and grasslands was a technique used by many Native Peoples in the region, including the Wiyot (Anderson 2005; McEvoy 1986; Stillwater Sciences 2010a). Early population estimates convey that "the rich resources of the area allowed the support of a population

[4] 'Time immemorial' is defined as an epistemology of time and space often used by Indigenous people and Peoples in order to situate their place-based culture or tribe within a landscape or landscapes as it has existed for generations or thousands of years before memory (Weir 2013).

which was higher than the average for California" (Benson, Fredrickson, and McGrew 1977, II-9). Communities were connected by an intricate network of maintained trail systems (Loud 1918, 258; Stillwater Sciences 2010a, 8).

4.2 White Settler Economically Driven Interests in the Humboldt Bay Region

It is important to understand the physical characteristics of the landscape which mostly kept the Spanish and Euro-Americans at a distance until the time of contact in 1849. Loud described the natural, physical characteristics of the Wiyot's territory that helped keep the Wiyot People and their language distinct and somewhat isolated from other tribes. He explained, the "encircling mountain ridge would act, to a considerable extent, as a barrier in keeping separate peoples apart" (Loud 1918, 227). The thick vegetation comprised of enormous coastal redwoods provided further isolation for the Native inhabitants of the area as the density of these forests and the size of the trees made it nearly impossible to travel through (Raphael and House 2007, 70; Wallace W. Elliott & Co. 1881). Amidst "gold rush fever" and a demanding lumber market, Euro-American explorers were sent out to "discover" potential ship harbors and channels that could connect California's newly flourishing business enterprises in the interior to easily accessible product transportation centers. Starting in the 1850s, white settlers began moving into the Humboldt Bay region in waves (Van Kirk 1993). The Mad River was almost immediately levied and channelized to suit the agricultural and grazing needs of the growing white settler communities in and near the lower watershed floodplains

(Stillwater Sciences 2010a; Raphael and House 2007; Tolhurst 1995; Van Kirk 1993). The insatiable thirst of the rapidly expanding Humboldt Bay region lumber, agriculture, and grazing industries required a controlled and working Mad River (Caltrans 1993, 9; Haynes 1986, 4; Haynes 1994, 9; Schrimps 1986a, 14).

Until adequate railroad systems and steam engine technology sped up the logging race, starting in the 1870s and 1880s, impassible terrain, and the sheer size of the timber products made transportation by water and animal power the only means available to carry logs from timber sites to the mills around the bay (Raphael and House 2007, 148; Schrimps 1986 (b), 14; W.W. Elliot & Co. 1881, 159). Using the river to float logs was a method used intermittently between1854 and 1877 (Haynes 1986; Roberts 1946). This practice, and the digging of a canal along the Mad River Slough, added to high rates of erosion, sedimentation, and destabilization of the banks of the river, severely compromising its natural flooding regime (Caltrans 1993, 9-11) (Figure 10).

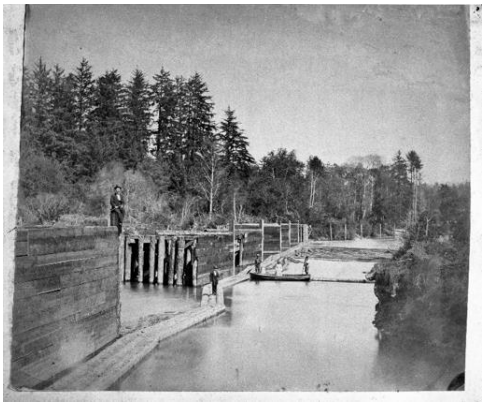

Figure 10. A picture of men posing next to a boom that was constructed to stop fast moving logs as part of the Mad River canal project. (Courtesy of HSU Special Collections, Photo Collection. Palmquist Collection. Estimated date of 1874).

Before the 1950s, standard practices to control and enforce erosion prevention and treatment on national forest land did not exist. U.S. Department of Agriculture (USDA) and Soil Conservation Service (SCS) describe "how areas logged prior to 1955 often show excessive and improperly located skid trails, landings, and spur roads and inadequate postharvest control treatment" (1970, 30) (Figure 11). Until the middle part of the 20th Century, an era that ushered in the ESA of 1973 and the National Forest Management Act of 1976, large unregulated portions of the lower Mad River watershed and its ecosystems were blasted with old growth clearcutting methods that destroyed stream structure and altered the morphology of the river (Figure 12). Clearcutting in the lower portions of the watershed, including "use of fire to clear slash and debris" (Stillwater Sciences 2010a, 11), allowed for the conversion of former forest land, wetland, and wild game grazing land into Euro-American settlement, cattle grazing, and agricultural lands (Tolurst 1995; USDA and SCS 1970). These quick and drastic changes intensified flooding events and contributed to eras of flooding (Stillwater Sciences 2010a; Raphael and House 2007; Tolhurst 1995; USGS 1973).

Figure 11. Example picture of a team of oxen pulling logs along a skid road in Elk River near Eureka. (Courtesy of HSU Special Collections, Photo Collection. Palmquist Collection, n.d.).

Figure 12. A picture of a logging scene on a steep hillside near Maple Creek (16 miles southeast of Blue Lake on the Boulder Creek tributary). (Courtesy of HSU Special Collections, Photo Collection. Shuster Collection, 1947).

4.3 Dams and Water Diversions

Constructed in 1938, Sweasey Dam, the river's first water impoundment structure, was built near Blue Lake (22 miles from the mouth of the river) to supply the City of Eureka with water. Built in a narrow portion of the middle watershed that experiences high levels of sediment influx, the dam was filled in with sediment by 1955 and demolished by dynamite in 1970 (Tolhurst 1995; Trinity Associates and HBMWD 2004; Stillwater Sciences 2010a). Until 2015, the demolition of Sweasey Dam was the largest dam removal in California's history (Rogers 2013). HBMWD owns and operates Matthews Dam, constructed in 1961, which impounds Ruth Reservoir in the upper watershed, and currently supplies seven municipalities, including the Cities of Eureka and Arcata, and other private wholesale customers with treated drinking water and industrial raw water (Trinity Associates and HBMWD 2004).

4.4 Species of Interest

Eulachon and Pacific lamprey provide important ecosystem functions in their spawning river systems, and they have held significance for Indigenous Peoples of the Pacific Northwest for thousands of years (Howard and Close 2003; Tushingham 2016; AFSC 2006).

4.4.1 Eulachon (*rru'mula'wi*, Candlefish, *Thaleichthys pacificus*)

The largest of the smelt, "eulachon were called 'candlefish' by early Euro-American explorers due to their high oil content (20% by weight), which allowed them to be burned like candles when dried" (CDFG 2010). Because of their high oil content, this species played a major role as a subsistence-based food source for Indigenous Peoples of the Pacific Northwest who lived on or near spawning river systems. Eulachon never gained significant commercial value south of the Columbia River Basin and have received considerably less research focus compared to other anadromous fish species (AFSC 2006; NMFS 2013), such as the salmonids. Because "run timing and duration may vary interannually and multiple runs occur in some rivers," it is not entirely known how frequently and in what quantities the species has run in river systems south of the Columbia (NMFS 2013) (Figure 13).

Figure 13. Picture of eulachon migrating upriver. (Source: NOAA West Coast Regional Office, 2017).

Archeological, ethnographic, and oral history research demonstrate that Indigenous Peoples of the Pacific Northwest have harvested eulachon for hundreds of

years, at the very least. First noted on February 24, 1806, at Fort Clatsop, Oregon, the excerpt from the *Journals of Captain Meriwether Lewis and William Clark* details:

> This evening we were visited by Comowool the Clatsop Chief and 12 men women and children of his nation . . . The Chief and his party had brought for sail a Sea Otter skin, some hats, stergeon and a species of small fish which now begin to run, and are taken in great quantities in the Columbia R. about 40 miles above us by means of skimming or scooping nets . . . I find them best when cooked in Indian stile, which is by roasting a number of them together on a wooden spit without any previous preparation whatever. They are so fat they require no additional sauce, and I think them superior to any fish I ever taste, even more delicate and luscious than the white fish of the lakes which have heretofore formed my standaart of excellence among the fishes (Lewis 2005) (Figure 14).

Figure 14. February 24, 1806, journal entry by Meriwether Lewis recording eulachon. (Courtesy of American Philosophical Society Library, n.d.)

Yurok Tribal elders recall "annual runs so great that one had no problem catching as much as [they] wanted" on the Klamath River (Larson and Belchik 1998, 5-6). Eulachon were an important winter and spring staple and trade commodity for many

tribes in the Pacific Northwest, as the fish would run during winter and spring months when other food and fish sources could grow scarce (NMFS 2006, iii-1). The species' historic distribution range includes freshwater streams as far South as Baja California (AFSC 2006).

Eulachon often stay close enough to the ocean within freshwater inlets to spawn in tide-influenced freshwater habitats, but have been recorded as far upstream as approximately 50 miles on the Susitina River in Alaska and 100 miles on the Columbia River in Oregon and Washington (NMFS 2011; AFSC 2006). They are sensitive to water temperatures and high velocity flows, and "spawning substrates can range from silt, sand, or gravel to cobble and detritus, but sand appears to be most common" (AFSC 2006, 17). Adult eulachon were known to spawn "in many other rivers and streams but often erratically, appearing some years but not in others and only rarely in some river systems" (NMFS 2013, 2). Eulachon usually return to their natal streams to spawn, sometimes spawning more than once before completing their lifecycle (NMFS 2011; AFSC 2006).

4.4.1.1 Spawning in the Humboldt Bay Region

HSU's Fisheries Biology Department's Fish Collection Database has 12 records for *Thaleichthys pacificus* samples found in and around the Humboldt Bay (HSU, n.d.). (See Appendix E). Only one sample is recorded in this library from the Mad River with a collection date of April 12, 1967. The dates of these recorded samples range from 1962 to 1986. It has been reported that "spawning of eulachon in streams tributary to Humboldt Bay may be natural or the result of straying from large populations in the Mad River during the early to mid-1970s" (Jennings 1996, 148). Some sources state that the Mad

River historically experienced annual and abundant eulachon runs (Simons 1993, 38; North Coast Region CDFG 2002).

4.4.2 Pacific Lamprey (*Gou'daw*, Eel, *Entosphenus tridentatus*)

Pacific lamprey was used as an important staple food in the winter as well as being used for medicinal oil by Native Peoples of the Pacific Northwest (Howard and Close 2003). As late as the 1970s, Pacific lamprey populations were reported as still being somewhat abundant (Nawa 2003, 16). Currently, "anecdotal and empirical information suggest that Pacific lamprey populations have declined or been [locally] extirpated in parts of California, Oregon, Washington, and Idaho" (USFWS 2012: 8). Pacific lamprey "are still regarded as an important food source and indicator of ecosystem health by many tribal members and biologists" (Stillwater Sciences 2010b, 1; Wiyot Tribe NRD and Stillwater Sciences 2016).

During migration and spawning, Pacific lamprey play an important part in the food web of freshwater streams. As weak swimmers with high caloric content, the fish are known to serve as easy prey for both aquatic and terrestrial predators, including larger fish, mammals such as sea lions and seals, and birds of prey (Wiyot Tribe NRD and Stillwater Sciences 2016; Wicks-Arshack et al. 2018). The species has also been considered a prey buffer for co-migrating fish such as salmon, serving as an easier catch and having higher caloric intake pound-for-pound than the quicker salmon species (Wicks-Arshack et al. 2018). The Wiyot and neighboring tribes are considered partners in the issue of declining Pacific lamprey populations in the region (Wiyot Tribe NRD and Stillwater Sciences 2016; Larson and Belchik 1998).

Many coastal tribes often dried or roasted Pacific Lamprey, and because of its high oil and caloric content, the dried product was used as an important winter food staple. Additionally, “the medicinal oil collected from drying lamprey was applied to skin or ailing parts of the body during a purifying sweat bath” (Howard and Close 2003, 2). The oil was also used as a hair conditioner and as a cure for earaches (2). The Wiyot would cook the species using the “same general methods [that] were followed in curing sturgeon, steelhead, [and] perch,” splitting them into three layers for drying over a small fire (Benson, Fredrickson, and McGrew 1977, II-5). Elaborate fishing weirs were used for gathering steelhead and lampreys, which were strong and large in size. Fishermen also removed the species using a dip net (II-6). The Wiyot and other local Indigenous people still have subsistence fisheries (USFWS 2012; Wiyot Tribe NRD and Stillwater Sciences 2016; Larson and Belchik 1998).

4.5 Wiyot and Neighboring Tribe Territories and Settlement Patterns

Earliest ethnographic records indicate that the lower Mad River watershed was settled by Wiyot communities and family groups from the mouth of the river to an area several miles north of what is now called Blue Lake when white settlers began moving in (Loud 1918). Though the Chilula’s territory was primarily to the northeast along Redwood Creek, they also held territory in the lower portion of the Mad River watershed near Korbel (Loud 1918). Loud writes about the culturally significant Arrow Tree, which was identified by his informants as a kind of territorial barrier between the Wiyot and

neighboring tribes and a sacred tree where male passersby would lodge arrows in the bark and women would pray and leave offerings for good luck (Loud 1918, 252). The Nongatl Peoples, though their settlements were known to be more concentrated to the southeastern part of the Wiyot territory, their own lands would have blended into the middle to upper portions of the Mad River watershed (Loud, 1918; Elsasser 1978). The Lassik held the headwaters territory of the watershed (Golla 2011; Elsasser 1978).

4.5.1 The "Indian Wars" and Forced Relocation

Starting in 1850, when the earliest white settler populations who entered the region set their sights on the lands closest to the Humboldt Bay, *Wigi*, the Wiyot soon realized they would have to flee, fight, or submit (Raphael and House 2007; Stanton 1991; Van Kirk 1993). Loud elaborates, "not only was there the occasional killing of small numbers of Indians, but between 1850 and 1873 a considerable number of slaughters, either by state troops or by unauthorized 'volunteer companies,' occurred on such a scale as to be dignified by the term of 'Indian wars'" (1918, 309).

The inception of California's Indian reservation system was born in 1853, when Congress approved the development of five military reservations in California leading to the creation of the Klamath Reservation (Raphael and House 2007; BIA n.d.). Along with the development of Fort Humboldt in 1853, which still overlooks the bay in south Eureka, the U.S. government took it upon itself to "protect" its citizens from local Indian populations by sending thousands of ground infantry and military officers to California. Displaced and unable to engage with their Native lands and resources in the subsistence ways they were accustomed to and angered by the deplorable treatment of their people

(and Native women, especially), Indigenous people would lash out on occasion or steal for survival. Such acts were met with brutal force, ultimately leading to one of the most violent and devastating massacres to the Wiyot People in 1860 (Coy 1929; Loud 1918; Raphael and House 2007).

Until 1864, the U.S. Army used their military forts and outposts to hold Native people prisoner. State sanctioned military initiatives and independent white vigilante parties used fire for forced removal, among other violent and deadly tactics. Locally, Native survivors were rounded up and taken prisoner at Fort Humboldt where 257 people were confined in a "corral" by June 1862 (Raphael and House 2007, 180; Heizer 1974). Prisoners were taken to Smith River Reservation, near Crescent City and later to Hoopa Valley Reservation. Legislation passed by the state and federal governments allowed whites to exploit Native survivors of genocide through systems of indentured servitude (Heizer 1974; Heizer and Almquist 1971).

4.5.2 The Annual World Renewal Ceremony Massacre

Between February 25 and February 26, 1860, the Wiyot suffered three massacres that occurred at three separate locations. The most infamous massacre occurred in the early morning hours of February 25th when a group of four or five white vigilantes murdered an estimated 80 to 250 mostly women, children, and elders who were sleeping at the village and ceremonial place of *Tuluwat* (on "Indian Island", or Gunther Island) (Green 2002; Wiyot Tribe n.d., Eidsness 2006; Loud 1918). Occurring during the Wiyot's annual World Renewal Ceremony, the men had travelled to the mainland to get supplies while the remaining folks were left to rest. Having rowed to the island by boat,

the vigilantes killed everyone they could find. Only four or five Wiyots survived this atrocity. Two other massacres were carried out on the Wiyot almost simultaneously: one at the South Spit of Humboldt Bay and the other in the lower Eel Valley. The Wiyot, who were already experiencing a devastating population loss at the time, were almost completely extirpated (Green 2002; Loud 1918; Raphael and House 2007; Wiyot Tribe n.d.).

4.6 California's Rancheria System

Many kidnapped and displaced Wiyot people managed to escape and make it back home from their Smith River, Hoopa Valley, Round Valley and Klamath River Reservation confinements. Some of the survivors of this period of genocide managed to stay settled within the Mad River watershed and the wider Humboldt Bay region (Bledsoe 1956; Raphael and House 2007). Intermarriage between Natives and non-Natives occurred in large numbers as well as intermarriage between Natives of varying lineages. The intensive periods of state sponsored and vigilante genocide and displacement programs and initiatives around the country resulted in a couple of hundred years of widespread geographic movement and settlement patterns for surviving Native American people and families including in the Humboldt Region and Mad River Watershed (Raphael and House 2007; Loud 1918; Wallace W. Elliott & Co. 1881; Wiyot Tribe n.d.).

In 1905, U.S. Congress was pressured to set aside parcels of unused land as a refuge for dispossessed Native Americans in California (BIA n.d.). The original rancheria boundaries were not upheld and are different than the rancherias and reservations in existence today (BIA n.d.; National Indian Law Library 1972; U.S. Congress 1958). Many of the tribes who lost their lands and tribal status under the California Rancheria Act of 1958 spent more than 30 years fighting a legal battle with the US government, some describing the policy and its ramifications as continued genocide (National Indian Law Library 1972). The Wiyot filed a lawsuit in 1975 "against the Federal Government for unlawful termination, and in 1981, in Table Bluff Band of Indians v. Lujan (United States), it was determined the Tribe's termination was unlawful and trust status was reinstated" (County of Humboldt 2014, 2-11). Blue Lake Rancheria and Rohnerville Rancherias were included as part of 17 terminated California rancherias in the monumental, class action lawsuit Tillie Hardwick et al. vs The United States et al. of 1983. The U.S. government determined that the status of the groups, tribes, or bands included in the case would be restored to the status they had prior to termination (National Indian Law Library 2012).

The fight to reinstate tribal status was still an uphill battle because the federal government refused to reclaim lands held by private citizens. Many of the rancherias listed in the case, including Blue Lake and Rohnerville Rancherias, had tribal lands that had been largely sold off in parcels to private citizens after the instatement of the California Rancheria Act. The rancherias have been working to piece together tribal lands ever since, both through lands held in trust by the federal government and through private

purchases (Blue Lake Rancheria 2015, 1; NIGC 2002; National Indian Law Library 2012). In 1991, the Wiyot Tribe was involved with another lawsuit because of water quality and poor sanitation issues on the "Old Reservation". The U.S. government purchased the 88-acre plot in the Eel River estuary that is held in trust as the current reservation (County of Humboldt 2014, 2-11; Wiyot Tribe n.d.).

4.7 The Three Federally Recognized Tribes

Today, there are three distinct, federally recognized tribes located within Wiyot ancestral territories (Stanton 1991). Situated between two locations close to the Eel River and adjacent to the towns of Fortuna and Loleta, California, Bear River Band of Rohnerville Rancheria has a current enrollment of 400 members and has 191 acres in tribal lands. The tribe is recognized federally for having members from Bear River and Mattole tribes, as well as having "direct ancestral links to each of the local tribes, and principally to the Wiyot, Bear River, Mattole, Lassik, Nongatl, Sinkyone and Whilkut" (Bear River Band of Rohnerville Rancheria 2010). Located slightly northwest of the City of Blue Lake, California, the Blue Lake Rancheria holds approximately 95 acres along the Mad River. With cultural heritage connected to Wiyot, Tolowa, Hupa, Yurok, Redwood Creek and Cherokee, there were 53 members as of 2015 (Blue Lake Rancheria 2015; Blue Lake Rancheria Tribal Government Office n.d.). Located about 16 miles southwest of Eureka on Table Bluff (*Giloulh*) above Humboldt Bay and the Pacific Ocean, the current Table Bluff Reservation is situated near the mouth of the Eel River.

The Wiyot Tribe also owns the majority of Indian Island (*Tuluwat*) in Humboldt Bay, much deeded to them by the City of Eureka. The old village of *Tuluwat* is the ceremonial center of the Wiyot world (Murkherjee 2019). The tribe currently has approximately 600 members (Wiyot Tribe n.d.; Wiyot Tribe 2010).

5 RESULTS

Oral history accounts of eulachon, or ‘candlefish’, and Pacific lamprey, or ‘eel’, serve as the backbone for this chapter. To fill the listed research gaps, an examination of candlefish knowledge requires a broadening of the geographical landscape to include memories of the species in multiple local watersheds. In contrast, dynamic relationships with eel will primarily be explored under the place-based focus of the Mad River. The reason for this difference in approach is due to the considerable data that exist for Pacific lamprey within the Wiyot ancestral territory region when compared to paucity of data on eulachon.

5.1 Oral History Riverscape Demographics

In order to share traditional and contemporary place-based knowledge regarding eel, candlefish, and the Mad River watershed as it was demonstrated through oral history interviews, I must first show how oral history participants are connected to North Coast river systems. Unbounded by one single geographic location or river system, oral history participants revealed fluid relationships with multiple North Coast rivers. The main riverscapes represented by the oral history sample include the Mad River, the Eel River, Redwood Creek, and the Klamath River. Additionally, stories of fishing and eeling grew to include the waters of local North Coast beaches, Humboldt Bay, and the lagoons near Redwood Creek (Figure 15) (See Appendix F).

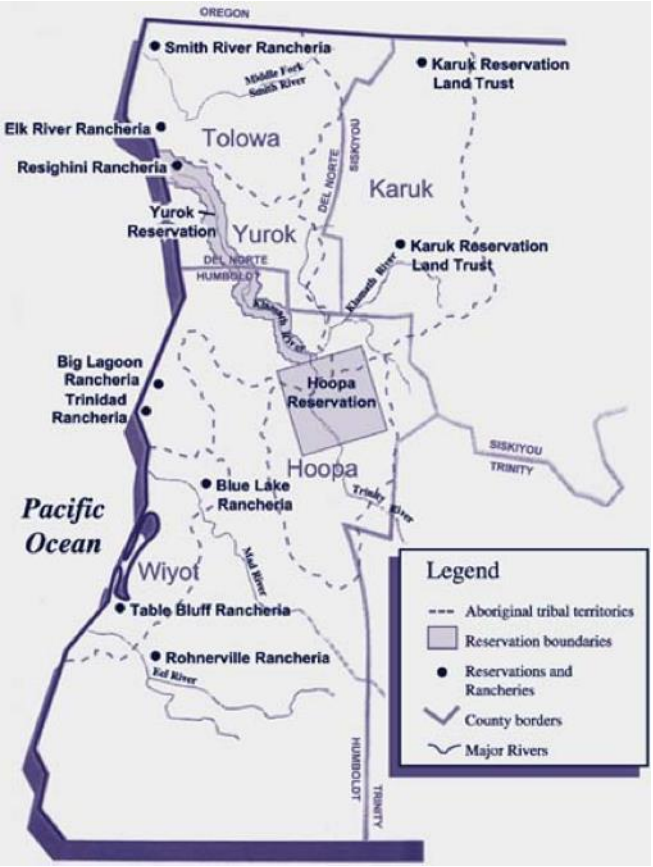

Figure 15. Tribal trust map land of the North Coast showing the Eel, Mad, and Klamath Rivers and the location of the Rancherias. (Source: William Bright, 1957, BIA edition 2000).

5.1.1 Primary Riverscapes

Participants relayed an intimate relationship with the river with which they spent the most time growing up – generally the watershed they lived in or lived closest to. I will refer to this category as primary riverscapes. For the purpose of this research, a primary riverscape refers to the watershed where an oral history participant described the most place-based knowledge, having been raised in that location or having greater familiarity with and ties to that particular river than to others rivers due to family or community connections and firsthand experience (Table 5).

Table 5. Oral History Participant's Primary Riverscapes

Primary Riverscape	# of Oral History Participants	% of Oral History Sample	% of Total Sample
Mad River	6	46%	19%
Eel River	6	46%	19%
Klamath River & Redwood Creek	1	8%	3%

While the oral history interviews demonstrate a distinct primary riverscape connection, the data reveal changes in living locations over time. A few people stated that they "grew up all over," reflecting a broad place-based knowledge of fishing, hunting, and eeling throughout the North Coast region including within the Mad River landscape. Several tribal members were forcibly sent to Indian boarding schools by the U.S. Government. Barry Brenard, Bear River Band of Rohnerville Rancheria Tribe Member, described how his family lived out of the area because his grandmother was sent to an Indian boarding school two generations ago. He elaborated, "a lot of our elders and people got relocated to [schools] like Sherman, Chemawa, and Stewart. They were all boarding schools during the boarding school era, and they got relocated over in those areas. And so they started families over in those areas" (interview, 2014).

5.1.2 Secondary Riverscapes

For the purpose of this research, secondary riverscapes are defined as watersheds with which an oral history participant detailed place-based familiarity, having fished, eeled, participated in fish camps, or spent time with family and community members who

lived in that landscape over extended periods of time or on several occasions at least (Table 6).

Table 6. Oral History Participants' Secondary Riverscapes

Secondary Riverscape	# of Oral History Participants	% of Oral History Sample	% of Total Sample
Mad River	5	38%	16%
Eel River	2	15%	6%
Redwood Creek	7	53%	23%
Klamath River	5	38%	16%

5.1.3 Subsistence or Sport Rivers and Waterscapes

All respondents recounted traveling outside of their primary riverscapes with family and community members to either fish, or eel or to participate in fish camps. Subsistence or sport rivers and waterscapes are defined as waterbody landscapes named by an oral history participant where they have participated in fishing, eeling, hunting, or gathering either for sport or subsistence-based purposes (Table 7).

Table 7. Rivers and Waterscapes Where Oral History Participants Have Engaged in Harvesting Methods for Sport or Subsistence-Based Purposes

Subsistence or Sport River Waterscape	# of Oral History Participants	% of Oral History Sample	% of Total Sample
Mad River & Tributaries; Ruth Lake	12	92%	39%
Eel River & Tributaries; Lake Pillsbury	8	62%	26%
Freshwater Creek	2	15%	6%
Humboldt Bay	2	15%	6%
Beaches located within or near Traditional Wiyot Territory	6	46%	19%
Ocean off the North Coast	5	38%	16%
Redwood Creek	7	53%	16%
Big & Stone Lagoons and Surrounding Beaches	4	30%	13%
Klamath River and its Tributaries	5	38%	16%
Waterscapes Beyond Humboldt County Lines by 200+ Miles	5	38%	38%

5.1.4 Subsistence Living in a Broad Geographical Landscape

Whether they stated a “need” or a “want” to live off the land, all respondents shared knowledge and accounts of some degree of subsistence living they had participated in. Jim Evenson, Table Bluff Wiyot, shared his experience growing up, “I think it was probably in the tail end of when people depended on fish and game for food. They don’t no more, but we did a lot of duck hunting, deer hunting, fishing. All the different kind of fishes, fish there was down there” (interview, 2014). Marcie Frye, born on the old Rohnerville Rancheria in 1938, talked about “living by the old ways” and how she and her family relied on their “Indian foods,” even when the government and church

groups were supplying tribe members with “white people’s food” through programs. When I asked her why, she described, “well, because that was our food. And back then we didn’t have nothing. And so that’s what we lived on – all our different fishes from the rivers and the ocean. And deer hunting. Bear hunting. And the whole bit, you know” (Bear River, interview, 2014).

5.2 Key Informant Mad River Riverscape Demographics

Almost all key informant respondents demonstrated a knowledgeable, firsthand relationship with the Mad River basin, many with multiple professional and personal connections to the river and its ecosystems (Table 8).

Table 8. Key Informants' Professional and Personal Knowledge of the Mad River Watershed[5]

On or Off the River Engagement	Category of Research, Work, or Familiarity	Specific Type of Research or Work (If Applicable)	# of Key Informants	% of Key Informant Sample
On-the-River Interactions with the Ecosystems & Landscape	Hands-On Research or Projects	biological sampling, "fish dives" to monitor populations, water quality sampling and monitoring, electrofishing, habitat restoration projects, environmental education, environmental planning or management, mapping, and cleanup efforts	11	61%
	Lived in the Watershed		3	17%
	Fished in the Watershed	sport fishing, and commercial fishing	4	22%
	Recreated in the Watershed	swimming, kayaking/boating, and hiking	7	39%
Off-the-River Engagement with Mad River Watershed-Related Research	Document, Archival, or Policy Related Research	fisheries, historical, archeological, cultural and ethnographic, land and resource management practices, and policy	14	78%
	Environmental Advocacy Work	fisheries and environmental related work	7	39%

[5] Only one Key Informant has not studied or interacted with the Mad River watershed specifically

5.3 Fish Camps and Fishing Networks

Drawing from the oral history interviews, ‘fish camps’ can be defined as a camping or gathering event centered around harvesting migrating fish when families and groups of Indigenous community members, primarily, join together on a beach or along the banks of a river to share in the responsibilities and enjoyment of fishing and/or eeling, cleaning and preparing the fish, cooking and sharing, and “packing fish out.” Family and community relationships tied through Indigenous affiliations proved to be a driving factor that spurred trade and sharing of harvested fish and other resources through networks spanning the broader Wiyot landscape and beyond. These wider regional and geographical relationships proved to be a major connecting factor that prompted folks to travel to other landscapes and river systems to fish, eel, and harvest other food sources. Weaving together a perspective representing past generations and his own, George E. Buckley, Wiyot Indian, explained, “Wiyot go all the way to Covelo. And it’s basically like, if you show up there and tell them you’re Wiyot, more than likely somehow you’re related to them. I mean, a distant cousin, yeah, but it was just – that’s how I look at it.” He continued, “like, a lot of them, in the summertime they’d go down and pick fruit. You know, that’s how they stayed alive. But yeah, we fished Mad River, Eel River, all over” (interview, 2014). Most respondents discussed travelling to other locations to fish and/or eel or to join a fish camp with other family and community members because they would hear through their network about runs that were happening in various locations.

Fish camps were remembered fondly by the oral history interviewees. Most specifically used the phrase ‘fish camps’ to refer to this communal method of harvesting candlefish and eel. Marcie Frye, Bear River, explained how she and her family would travel together to set up camp wherever the big runs were happening. She recounted, “We had fun fishing with grandma when she was alive. She’d go down and cook sand bread and have a big pot of beans and everything to go with it. And mom would help her. And then we’d all sing and pray and eat. Then we’d go home. But sometimes we’d camp two or three days, just fishing and doing our thing” (interview, 2014). Frye elaborated that “everyone” who was able to would join the gathering; referring to how the fish camps would often grow to much larger numbers, including community members from her tribe as well as other tribes.

Even the two interview respondents who fall into a younger demographic than the rest of the sample also grew up participating in fish camps, and one of them still does. Recalling the eel fish camps near the mouth on the Eel River, Vincent DiMarzo, a Wiyot Tribe Member who was serving as the Natural Resource Technician for the tribe at the time of the interview, detailed, “that is where I spent most of my time as a kid fishing. With my grandma and grandpa. With my mom and my family. We used to go down there and have big gatherings. Lot of Indians would go down there. We’d all pile in the back of a truck with three or four trucks. And everybody would go down there. Have big bar-b-ques. Everybody catching eels. Everybody cooking and having a good time” (interview, 2014).

5.3.1 Subsistence and Sharing

Some tribal members related memories of gathering berries, among other wild harvested "Indian foods," during the fish camps to share with the group. Most of the oral history interviewees discussed the process of "packing fish out" of the camps to share with tribal elders, community members who could not make it down for the fish run, and/or traveling to other locations to share with family members and community members. A few mentioned travelling as far as Hoopa and Orleans to share fish with relatives and friends. Barry Brenard, a Bear River Band of Rohnerville Rancheria Tribe Member who grew up in Nevada, explained how he and his family would take their catch to someone who would smoke it for them and then they would take it home to Nevada to share with folks there. Sharing fish and other harvests proved to be an integral part of the cultural tradition and subsistence-based value system.

5.3.2 Fish Camps and Relationships to Several Species of Smelt

Memories of "fish camps" were far more frequent than specific accounts of fishing methods or species-specific memories, especially regarding the different smelt species (Figure 16). Shared memories rarely remained focused on the singular eulachon species, often expanding the conversation to include other smelt and fish species all together, most notably "surf fish" (*Hypomesus pretiosus*). Responses to candlefish-specific questions often expanded beyond the confines of a singular river-system or location. Mad River Beach, near the mouth of the Mad River was mentioned by the majority of the participants, as a spot they frequented at some point in their lives to participate in fish camps, especially for surf smelt harvests (See Appendix G).

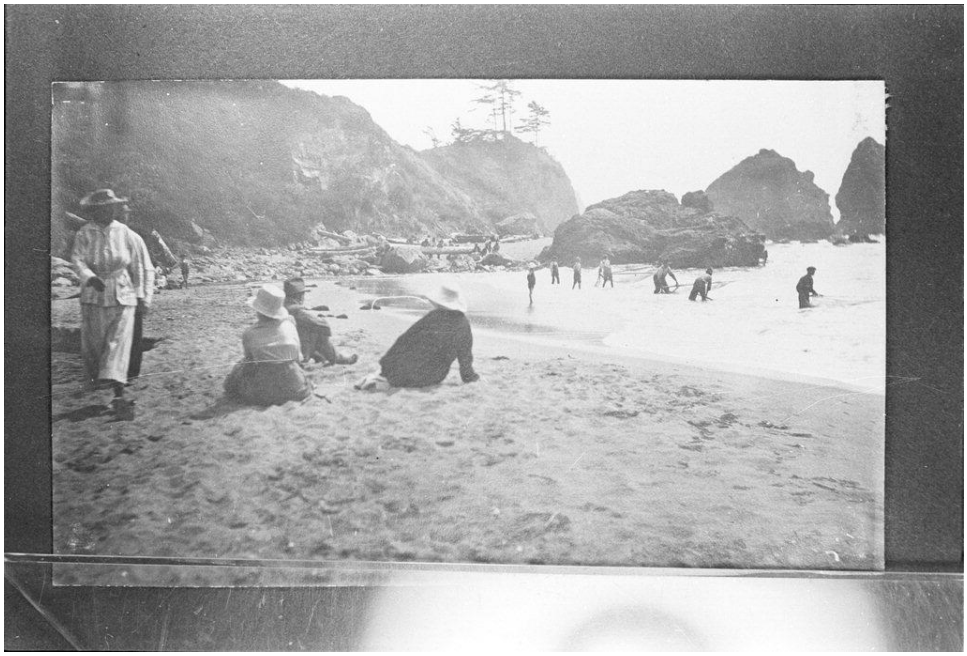

Figure 16. People surf fishing at Luffenholtz Beach. (Courtesy of HSU Special Collections, Photo Collection Source. Boyle Collection, 1915).

Some respondents revealed a commercial aspect to fish camp culture. Only one interviewee shared knowledge of eulachon being sold in the region, stating that his grandparents had caught and sold candlefish from Redwood Creek (Frank M. Lara, Tolowa/Yurok “dual-citizen”, interview 2014). Several research participants recalled personally catching or their family members landing and selling several species of smelt including surf smelt, night smelt, and whitebait. Harriet Oscar’s, Bear River Band of Rohnerville Rancheria Tribe Member, brothers sold surf fish and her mom made a living making and selling surf fish nets (Figure 17).

Figure 17. A photo of "Mad River Annie", shows a Wiyot woman making surf fish baskets on Mad River Beach. (Courtesy of HSU Special Collections, Photo Collection. Ericson Collection, 1905).

5.4 Oral History Accounts of Candlefish on the Mad River and North Coast Streams

This section explores living, Indigenous memory of eulachon, also called candlefish, in the Mad River basin and other significant streams identified by oral history participants. More than half of the oral history interviewees described firsthand memories of witnessing candlefish runs on the Mad River, the Eel River, Redwood Creek, or the Klamath River at some point during their lives. Five shared firsthand memories of candlefish runs on the river systems that lie within Wiyot ancestral territory. A couple of respondents were not entirely sure if they had specifically witnessed eulachon runs on local river systems or not, as they did not seem confident distinguishing the species from other species of smelt they described as sharing similar characteristics, such as surf fish.

Four oral history interviewees personally witnessed one or more candlefish runs on the Mad River. Of these participants, only one had personally fished for eulachon there.

Two respondents remember witnessing one or more eulachon runs on the Eel River, one of whom remembers fishing for them and witnessing them on multiple occasions on the Eel and Mad Rivers, among others. Four participants shared firsthand memories of witnessing candlefish on Redwood Creek and three shared firsthand memories of witnessing and catching the fish on the Klamath River (Table 9).

Table 9. Oral History Participants' First and Secondhand Knowledge of Eulachon on North Coast River Systems

First or Secondhand Knowledge	River System	Source of Knowledge	# of Oral History Participants	% of Oral History Sample
Firsthand Knowledge	Mad River	Witnessed	4	30%
		Caught	1	8%
		Consumed	4	30%
	Eel River	Witnessed	2	15%
		Caught	1	8%
		Consumed	2	15%
	Redwood Creek	Witnessed	4	30%
		Caught	2	15%
		Consumed	4	30%
	Klamath River	Witnessed	3	23%
		Caught	2	15%
		Consumed	2	15%
Secondhand Knowledge	Mad River	Family/Community	2	15%
	Eel River	Family/Community	5	38%
	Redwood Creek	Family/Community	1	8%
	Klamath River	Family/Community	6	46%

Most informants described having eaten candlefish at some point, but less than half had fished for eulachon themselves. Two participants who had eaten the fish but had not fished for them had not because, as they both described it, women in their culture did not traditionally fish; the men did the fishing (Harriet Oscar, Bear River Band of Rohnerville Rancheria Tribe Member, interview, 2014 and Marcie Frye, Bear River, interview, 2014). Half of the eight participants who consumed candlefish expressed a distaste for the fish. They were primarily characterized as being "too greasy".

More than two thirds of the respondents had heard about candlefish runs on one or more of the rivers listed as primary and secondary riverscapes. Secondhand memories include knowing one or more family members or community members who had seen or fished for candlefish in the specified location.

5.4.1 Firsthand Accounts: Estimated Timeline of Eulachon Runs

Oral history interview participants' firsthand memories of candlefish primarily occurred on North Coast rivers during their youth. Of the four respondents who estimated years of eulachon sightings, the 1960s were specifically identified as the decade in which the witnessed runs took place as well as when the last sightings occurred on the Mad and Eel Rivers and Redwood Creek. Based on descriptions of not being involved with candlefish fish camps since they were in their youth, I can deduce that another two oral history participants last witnessed candlefish runs sometime between the mid-1950s and the mid-1970s. Though none of the oral history participants specified seeing candlefish runs on the Klamath River after the 1970s, the Klamath was consistently pointed to as a river that still may have runs by two-thirds of the respondents.

5.4.2 Indications of Large Candlefish Runs on Local River Systems

Based on the descriptions provided by the oral history interview participants, it is evident that eulachon runs that occurred in large numbers of any kind were unmistakable on local rivers. Anonymous #1, Wiyot Tribe, Table Bluff Reservation, who was in their sixties at the time of the interview, paints a picture of how "one month out of the year the sides of the river would just turn silver and you knew they were there" (interview, 2014). The Tribal member explained how they would come up the rivers "after the surf fish would run and always before the rains would start" (interview, 2014). Anonymous #1 also recalled the runs occurring annually on the Eel and Mad Rivers during a time in their youth, but I have not been able to substantiate this claim with any other source.

Art Ramsey, Blue Lake Rancheria Tribe Member, remembers the runs on the Mad River being "so plentiful, I would just scoop them up with my hands to kick them up to the shore. They were thick" (interview, 2014). Anonymous #1, Wiyot Tribe, Table Bluff, remembers the runs being so plentiful on the Eel River and Redwood Creek that he also could scoop them right out of the river with his hands. Twin brothers, Bill and Ben Mager, Yurok and Wiyot, recounted how they knew the candlefish were running up the Mad when loons (aquatic, fish-eating waterfowl) were feeding in large numbers on both sides of the river near the Hammond Bridge. Art Ramsey, also remembers seeing large numbers of candlefish and feeding birds down by the old Hammond Bridge, recounting, "anytime you see the birds down there – you look for the birds down there across from the bridge – and I always knew that's what it was" (Blue Lake Rancheria Tribe Member, interview, 2014).

5.4.3 First and Secondhand Knowledge: Frequency of Candlefish Runs

Four participants shared either first and/or secondhand knowledge exemplifying how candlefish runs did occur somewhat regularly in the past on the river systems that lie within the Wiyot ancestral landscape. Two shared experiences of witnessing multiple candlefish runs on the Mad River, both specifying that they had personally witnessed three or more eulachon runs. One participant stated that he had fished for them on the Mad River, while the other explained that he had seen them on the Mad but had only fished for them on other river systems, including the Eel River, Redwood Creek, and the Klamath River. Oral history interviews show that no runs were witnessed by any participant included in the sample beyond the late 1960s and early 1970s.

Bill and Ben Mager, Yurok and Wiyot, only specified one run that they had witnessed on the Mad River, which Bill estimated to be around 1962 or 1963. The candlefish run was described as being thick and covering both sides of the river. They claimed they had never fished for them on the Mad River themselves, as neither cared for the taste, and that they did not hear much about other people fishing for them on the river. Bill Mager mentioned fishing for them on the Klamath at some point, and both explained that there were more candlefish on the Klamath River than on the Mad River. Firsthand fishing knowledge was expressed by both participants in reference to the species, including methods and tools used to catch them on the banks of the river (interview, 2014).

5.4.5 A Fish of the North

Nearly half of the oral history sample recounted the species running on river systems to the north more regularly and in larger numbers, three of whom, expressed that candlefish may have been more significant or plentiful fish to the rivers and tribes of the north (referring to the neighboring Yuroks and north from there). Harriet Oscar, Bear River Band of Rohnerville Rancheria Tribe Member who grew up near the mouth of the Mad River, expressed her knowledge of candlefish based on her experience of eating a bite of one on a single occasion. She detailed, “they’re too rich. I don’t know, I just didn’t like them. It’s oily-like.” In comparison to other types of smelt, primarily surf fish, on which she grew up and had a tremendous amount of knowledge, Oscar claimed, “it seemed like they were the same, but they were just real oily. I didn’t care for them. I only tried a taste of them once and I didn’t care for it so I never did try it again. Besides, we don’t get candlefish around here anyway. It’s from up that way,” she stated as she pointed north (interview, 2014). While Harriet Oscar’s long-term, place-based knowledge is extremely valuable, her firsthand knowledge regarding local runs may be limited by the fact that her brothers and the men in her family did the fishing.

5.5 Key Informant Sample: Candlefish in the Mad River Basin and Other Significant Streams

This section explores the relationship key informants have with eulachon as well as key findings this sample provides regarding this species. While none of the key

informant participants have firsthand experience witnessing, fishing for, or sampling for candlefish on the Mad River specifically, key informant interviews did reveal dynamic connections to this species.

Almost all key informants expressed some amount of familiarity with eulachon, having either directly researched the fish or having some knowledge of the species related to their work or personal experience. Three of the respondents have heavily studied the species for their work with agencies, universities, and/or tribes. Nearly a third have conducted some qualitative research on the species as related to their work or projects, focusing on archival, cultural, and policy research primarily. Two interview participants have firsthand accounts with eulachon fisheries in the field, neither of whom specified whether they fished for them themselves, or not. One interview participant, Thomas Dunklin, a Geovideologist who has worked in fisheries restoration and fish passage initiatives on the Mad River and other local rivers, described photographing eulachon being smoked in smokehouses by Yurok friends in the lower Klamath watershed (interview, 2014). TallChief Comet, former Program Director for the Blue Lake Rancheria Tribe's Environmental Programs Department, attributed his familiarity with the species with his time working and fishing in Alaska during the 1990s.

5.5.1 Mad River: Critical Habitat Designation

Nine of the fourteen key informant participants who described some amount of familiarity with eulachon knowledgeably described the fish as having made regular runs as far south as the North Coast river systems, including on the Mad River. Aldaron Laird, HBMWD Board Member, explained that the fish used to run up the North Fork of the

Mad to spawn. He mentioned that the district should update their 2004 Habitat Conservation Plan For Its Mad River Operations since the species has been listed since this report was released in 2004 (interview, 2014). Robert Anderson, Fish Biologist with NOAA in Portland, Oregon, was serving as the Eulachon Recovery Coordinator for the West Coast at the time of the interview and had been since 2012. Anderson acknowledged past spawning consistency and described reasons the Mad River was listed as critical habitat for the southern DPS for the species. He explained key indicators:

> eulachon had consistently spawned in the Mad River – at least in the 60s and 70s – and, that being the southern extent of the range of the species, there was enough degradation whether it be Matthew's Dam, other water diversions, things that would affect flow and temperature. Some pollution runoff. Probably sediment deposition continuing from logging in the upper part of the watershed. We would want to ensure that that habitat was given special management consideration in order to keep it in tact for recovery purposes such that as the species rebuilds that it can re-express itself within the Mad River such that the range of the species is restored to the extent practicable (interview, 2014).

Though there was enough evidence to include the Mad River as critical habitat for the southern DPS of eulachon, three key informants, including Robert Anderson, knowledgeable with the literature pointed out major research gaps that exist not only on the Mad River but for the entire southern DPS of the species. The main reason identified was a lack of long-term data regarding life cycle history and population trends because so little species-specific biological sampling and genetic testing has been done.

5.5.2 Work and Research: Cultural and Tribal Significance of Eulachon

The significance eulachon hold for tribes and Indigenous people of the Pacific Northwest was described as it pertains to the work and research with which key informants have been involved. Half of the key informant interview respondents

described hearing firsthand accounts of eulachon from local and non-local tribal members and Indigenous people who they either have directly worked with, interviewed, or spoken with. Five key informant participants included in this category were referring specifically to local Indigenous individuals who were referencing changes in eulachon populations in the rivers located within Wiyot ancestral territories and up to the Klamath River.

More than a quarter of the participants had conducted research or worked on projects that specifically relied on or considered the cultural significance this species holds for many Indigenous people of the Pacific Northwest. Included is Robert Anderson, who discussed solicitation efforts to incorporate tribal input during the critical habitat designation process:

> I know that with the listing that we did do, we did outreach. Particularly in California, we worked mostly, I believe, with the Yurok Indian Tribe. Probably the Klamath being the most significant river there in California. And some work with the Karuk. We did at least solicit information and let them know about the designation process. And even if they have information – even if it's not quantitative, [if it's] qualitative – to help inform decision making (Fish Biologist and Eulachon Recovery Coordinator with NOAA, interview, 2014).

5.5.3 Archeological Research

Shannon Tushingham, who described herself as an Anthropological Archeologist and a Washington State Adjunct Professor, has extensively studied smelt species from a historical ecology perspective. Her smelt-related research has primarily been carried out with the Tolowa, whose ancestral and current landscape situates them geographically as the Yurok's immediate neighbor to the north. Tushingham has also worked on an archeological site at Manila on the Samoa Peninsula (CA-HUM-321) in collaboration

with the Blue Lake Rancheria, which purchased the property for purposes of site preservation. Collaborative research, as she explained it, was the main factor that guided her to study the cultural and tribal significance smelt species have and still hold for northern California tribes and Indigenous people, including eulachon. She expressed, "somehow through all the adversity they've gone through, they've been able to hang onto this," referring to the large number of Native people who are still smelt fishing along the Northern California coast (interview, 2014). Her cultural and archeological research delved into how prolific smelt fishing has been and still is for Indigenous communities, and how smelt fisheries and their tribal significance have been overlooked as a research topic. Tushingham described being "a big advocate for improving archeological recognition of smelt fishing," she and co-researchers have discovered thousands of smelt bones through fine-grain screening and sampling techniques in their research on coastal midden sites (interview, 2014).

Though Shannon Tushingham's focus has been coastal surf smelt species, she did express hope for improved DNA analysis and taxonomic identification of species-specific bones in the future. Even if they did recover and accurately identify eulachon bones, she highlighted the reality that the fish have a history of being widely traded between tribes and regions and that it would be difficult to determine whether the fish had been harvested and consumed in the same location (Shannon Tushingham, Anthropological Archeologist and a Washington State Adjunct Professor, interview, 2014). Tushingham's knowledge of a candlefish trade adds to her confidence that the bones could exist in many locations whether they were harvested from that same location or not. She noted, "people

up at Smith River would get it from people down at Klamath, because there was a pretty good run of eulachon on the Klamath" (interview, 2014).

Janet P. Eidsness, Tribal Historic Preservation Officer for the Blue Lake Rancheria and Archeologist, has worked with Tushingham on the Humboldt Bay region archeological site. In reference to eulachon, Eidsness pointed out how discovery of fish bones on the coast would be easier and more likely because inland preservation of bone in this region in general and up the Mad River is very poor due to high soil acidity levels (interview, 2014). Both archeologists described the massive amounts of smelt bones that were found in the midden at the Manila site on the North Spit, between the Bay and the coast, and how it would be unlikely that eulachon bones would be found there as the fish were more likely consumed a little further inland. Elaborating on the difficulty of situating candlefish accurately into a landscape, Tushingham stated, "if you were upriver more, it would be more likely that it would be eulachon. But again, it is recorded that people came down to the mouth of the Klamath in canoes to capture surf smelt. And they would regularly go out to other places to get those resources and bring them back home. So that can be a little more difficult" (interview, 2014). Because so little long-term and historical research exist for eulachon fisheries on the Mad River and in the region, both key informants expressed a hope that improved archeological methods might be able to fill some of the existing research gaps at some point. However, as they pointed out, linking archeological evidence of fish consumption to specific runs on specific streams would still be difficult as eulachon was a highly traded commodity, at least between northern tribes.

5.5.4 Issues of Species Identification Accuracy

Potential issues concerning accuracy of species-specific identification of eulachon were highlighted by a third of the key informant sample. Several respondents addressed the importance of accurately identifying species through biological and genetic testing, while another discussed the issue of language specifically.

Lynnika Butler is a linguist who had been working for the Wiyot Tribe for six years at the time of our interview. She played several archival audio recordings which included multiple Native Wiyot speakers translating several words from English into the Wiyot language. Birdie James, a Wiyot speaker who was Yurok by birth, shared her knowledge with ethnographer and linguist, John Peabody Harrington, in the 1920s. James stated the word "*rru'mula'wi*" on the recording. Butler pointed to the ethnographic note Harrington made next to this entry which said, "a kind of small fish resembling [surf fish] that run in the Klamath & which are cal[le]d candlefish, but none in this region" (Harrington 1926, 1942). Based on her linguistic understanding she noted, "it looks like it's related to the word for 'soft', just looking at it. It may be related to being soft." In comparison to other words that cannot be broken down by meaning, she described, "surf fish itself is '*hout*'. '*Rru'mula'wi*'; 'Candlefish', that's a descriptive one, if I am right about that. The 'soft one' – '*Hout*' is not something you can break down. It's just a name" (interview, 2014). While one could infer that this archival description of candlefish most likely refers to eulachon specifically, we may never know for sure (See Appendix H).

Many of the key points that emerged from my interview with Butler centered around issues of language loss due to genocide, cultural discrimination, and forced relocation. Butler pointed out the myriad of ways in which language can be lost in a matter of one to two generations:

> …it can happen because people die off, or they are killed. Or famine or disease. Or war or genocide. If you reduce the population enough, there aren't going to be enough speakers left. So that certainly was part of the process with Wiyot. There was the one infamous massacre at Indian Island, but there were others. And the Wiyot population was – Gladys Reichard says in 1925 – there was only something like 125 full blood Wiyot left. And so when you get a population bottleneck like that, that's one way. It's also pressures. So even if you have a large population, you have a dominant culture coming in and there tends to be a lot of prejudice about language. And so it's one way to be able to identify – when you talk about white settlers coming in – language can be a way – and this is true all over the world. It can be beaten out of people literally or figuratively. The boarding schools where Native kids were taken and put in boarding schools and physically punished if they spoke their languages. I am not sure how much that affected Wiyot, but it's true for many tribes (interview, 2014).

As a population that was almost entirely lost in only a few generations due to state-sponsored genocide efforts, there are no living Native Wiyot speakers today, according to Butler. However, she and the tribe are actively working on language revitalization efforts.

Referencing his experience working as the Program Director for Blue Lake Rancheria's Environmental Programs Department, TallChief Comet recounted:

> I never recall anyone talking about eulachon. Candlefish, they talked about. But I never made a one hundred percent connection between what they called candlefish [to] actually be eulachon. I never had anyone show me what they thought was a candlefish and we were able to compare it to a eulachon and make sure they were or were not the same species. Because there's a couple of different types of smelt-type fish that a lot of people just treated as kind of the same. But in essence, they were actually different species (interview, 2014).

Local smelt fisheries that proved to be popular with the oral history sample, were commonly referred to as “day fish” (most likely surf smelt, or *Hypomesus pretiosus*) and “night fish” (most likely night smelt, or *Spirinchus starski*). Both species, often commonly generalized into one group, “surf fish,” hug the coastline and stay close to the surf. Robert Anderson, Fish Biologist and Eulachon Recovery Coordinator with NOAA, discussed co-occurrences of the two species in many river systems where longfin smelt (*Spirinchus thaleichthys)* could travel almost as far as eulachon. Describing identification challenges, he related:

> if you look at the two just by looking at them pretty quickly, they’d be hard to tell. You’ve gotta start doing things where you take like pectoral fins and depress them against the body [to see] how far back it goes. Then you’d have to get into characteristics. If you just have one in hand, and you’re just the average recreational fisherman, or something, you may not know the difference right off hand (interview, 2014).

As the largest of the true smelt species, eulachon were known to run in considerably larger numbers and further upstream to spawn on local rivers, as described by Anderson (interview, 2014).

5.6 Catching, Cooking, and Consuming Candlefish

This section primarily draws from oral history interviews to uncover traditional and contemporary ways of catching, cooking, and consuming candlefish. I also examine distinguishing characteristics of the species, compared to those of other smelt species, as described by oral history interview participants.

5.6.1 Distinguishing Characteristics of Candlefish

Familiarity with the species is exhibited by oral history interview participants' knowledge about methods for catching and preparing the fish to eat, as well as physical characteristics that distinguished them from other smelt species. Drawing from firsthand experience, four interviewees described how delicate the fish are and how careful one needs to be to cook them in comparison to the other smelt species with which they were familiar. Five respondents remembered that the fish were softer than the other types of smelt. Anonymous #1, Wiyot Tribe – Table Bluff, recalled, "they are real hard to cook. They are real fragile. If you aren't careful or you cook them too fast, they'll fall apart in your pan and you'll end up with a pan full of mush." When asked how candlefish were different than the other types of smelt species the oral history participant detailed, "they had all different flavors than the night fish and the day fish. They were real different. They [eulachon] had a dark mark going down the middle," referring to a distinguishing feature that appeared when the fish were cooked and pulled off the bone. The tribal member continued their comparison, estimating that the candlefish were a bit larger than the other species at about six to seven inches long (interview, 2014).

Six participants said candlefish were a bit bigger than the other species of smelt with which they were also familiar. Three specified that there was a distinct, dark line going down the middle of the fish when you would start taking the meat off the bone to eat it. Recalling candlefish along with another type of smelt, Frank M. Lara, Yurok Tribe Member and Tolowa/Yurok dual-citizen, distinguished:

> the Oolichan, the candlefish was just a real rough colored green, or a grass green color. This was more pretty. But then when you open them up after they're cooked – say you fry 'em – the candlefish will have a dark film on the inside. And you peel that; it comes right off. Well this other one doesn't. And the meat's more firmer on this other fish (interview, 2014).

Several respondents described the fish as being darker than the surf smelt and as having white bellies. Marcie Frye, Bear River, recalled how the candlefish would slightly "turn a different color once they were upriver. Kind of like the salmon" (interview, 2014). Frank M. Lara, Yurok Tribe Member and Tolowa/Yurok dual-citizen, was the only one to use other language to refer to candlefish. He first referred to the fish as 'oolichan,' later calling them "eulachon, Columbia River smelt" (interview, 2014).

The "greasy" or "oily" characteristic was the one oral history participants relayed the most. Of the eight oral history participants mentioned earlier in the chapter who described the fish in this manner, only one, Frank M. Lara, Yurok Tribe Member and Tolowa/Yurok dual-citizen, said that he liked them, but only when cooked a certain way: "I like them when they're half smoked and you put it in somebody's oven." Continuing, "and you could smell them a half a mile away!" (interview, 2014). Art Ramsey, Blue Lake Rancheria Tribe Member, recalled his mother broiling them to cook off extra oil in "double-broiler". Ramsey also recalled them having a distinctly strong smell (interview, 2014).

A couple of participants mentioned how the process of learning to eat candlefish was a bit different than some of the other smelt species. Some smelt species, like night smelt, could be eaten whole because they were smaller and less bony. Distinguishing between the different types of smelt species, George Buckley, Wiyot, estimated that the

day fish would grow to about six inches at the most while the night fish would only get to be about four inches long, comparing the night fish to sardines. Buckley described how the process of eating eulachon, ‘candlefish’, was different than the process of consuming smaller species of smelt. He elaborated:

> A lot of people don’t want to mess with them, all taking the backbone out of them, they can just munch them down. And once they’re cooked, the bone got real soft, so with [this] bigger fish, you kind of had to take the backbone out. Once you get to eating them, you learn real quick how to take that backbone out of there. And you kind of squeeze them a little bit, and that little dorsal fin on there, you just pull that off and use it kind of where your fingers will just pull it open. And it will just leave the backbone right there (interview, 2014).

While day fish were continuously described by participants as being bigger than the night fish, the two species were generally combined into one group, ‘surf fish’, when discussing fishing methods and fishing locations. A-net framed fishing nets were pointed to as the main method used to catch the surf fish in the break of the waves along the local ocean beaches. In contrast, the oral history interview participants described the process of dip-netting to catch eulachon along the banks of the rivers either as the fish entered the mouth or when they were working their way upriver.

5.6.2 Methods of Fishing for Candlefish

Dip-netting was identified by oral history participants as the main method for catching candlefish. Almost half of the respondents detailed this specific method, four of whom specified that they were drawing from firsthand memories of fishing for the species themselves. Bill Mager, Wiyot and Yurok, explained how “you use a dip-net” to catch candlefish in the river. Describing it as “a round net on a loop with a long pole.” He elaborated, “you sweep it down and turn it up, and walk it back to the bank if you got fish

in there, and then dump it out" (interview, 2014). Anonymous #1, Wiyot Tribe, Table Bluff Reservation, specified that the dip nets used to catch candlefish near the mouth of the rivers were "usually made out of willow with the net made out of twine," and were often flat at the bottom. Referring to the last time this tribal member remembers catching candlefish, which was in Redwood Creek sometime in the 1970s, the participant described, "we'd use scoop nets and catch five or six pounds, or more – before, it was ten or twenty at a time." Continuing, "there'd be a lot of people up there catching tons of them. There'd always be a lot of people up there" (interview, 2014). Anonymous #1 considered the candlefish to be more important to a lot of people than the surf fish (See Appendix I).

George Buckley, Wiyot Tribe, remembers going up to Redwood Creek to catch candlefish during the big runs that happened during his childhood. While he did not remember fishing for them himself, as he was "too small" during the time these big fish camps were happening, he did recall watching how women from multiple nearby tribes would prepare the candlefish for consumption by drying them on the sand. He detailed:

> That's how they cured them. Because they would be catching them, and how are you going to keep them from going bad? There was no refrigerators. There was no ice. So they would dry them. They would just lay them on the warm sand. Like, say you would catch them early in the morning, the sun come up and it'd heat up the sand. And they'd just lay them side-by-side. The women-folk would have to go over and turn them over, turn them back. And pretty quickly they'd dry (interview, 2014).

Drying smelt on the sand was a common, traditional method used to preserve candlefish and smelt of various kinds for tribes along the Northern California coastline. A few

participants recalled having to pull sand off the candlefish when eating them and not being able to get it all off (Figure 18).

Figure 18. Picture of Maggie Pilgrim drying surf smelt on Luffenholtz Beach. (Courtesy of HSU Special Collections, Photo Collection. Katie Boyle Collection, 1951).

During the oral history interview with Frank M. Lara, Yurok Tribe Member and Tolowa/Yurok dual-citizen, and Art Ramsey, Blue Lake Rancheria Tribe member, the two research participants distinguished between different types of smokehouses that would be used to preserve different kinds of fish and game. Frank explained how a long smokehouse would be used for surf fish, while a tall smokehouse would be needed for candlefish because, “the oil drips and it could burn down your house.” Lara recalled hearing about folks who did that very thing (interview, 2014).

The oral history sample revealed lasting, living memory of a species that was witnessed in large numbers on the Mad River and within the wider Wiyot landscape forty-five to sixty-five years ago but not since. Accounts of candlefish showed a greater

knowledge of and a stronger relationship with other true smelt species, especially those of surf smelt and night smelt.

5.7 Oral History Accounts of Eel on the Mad River

Oral history interviews revealed deeply imbedded place-based and cultural ties to eel that are almost beyond compare to the other species discussed. Indigenous research participants shared how they would wait all year for the eel runs. Eelers would travel frequently and widely within Wiyot ancestral landscapes and beyond in search of eel and good spots where they could catch them. The Mad River proved to be a popular river for this cultural practice, and a place where oral history participants noticed both small and drastic changes in eel populations during their lifetimes.

The data overwhelmingly demonstrate the significance this species holds and has held for Wiyot and Indigenous descendants of this region. In stark contrast with candlefish findings, the oral history respondents all had many firsthand memories and knowledge regarding Pacific lamprey spanning more than five decades. Eleven of the 13 oral history participants had eeled for Pacific lamprey. The other two were women who "lived by the old ways," as Marcie Frye explained it. Meaning, that women did not traditionally fish for eels (Bear River, interview, 2014). All respondents grew up eating eel. This fish is undeniably a culturally significant species whose fisheries in local river systems, and specifically on the Mad River, have experienced major declines over the last forty to fifty years, as expressed by the interview sample.

Nine participants eeled on the Mad River in the past. Five shared the Mad River as their primary riverscape, three shared the Eel River as their primary riverscape, and one identified the Klamath and Redwood Creek as his primary riversheds. Another interviewee, Harriet Oscar, shared several firsthand memories of eel on the Mad River, though she only tried eeling one time. Oscar said she ended up falling in the water because, as she explained it, “it’s not as easy as it looks!” (interview, 2014).

5.7.1 Eeling Methods

Eeling is the method for catching lamprey as they migrate into and up a river system to spawn. Oral history sample data show that this process relied on the use of an eel hook – a long handled device with a sharp hook at the end that is used to puncture and catch the fish. Other traditional and contemporary methods have been utilized for eeling, such as the use of baskets. The eleven eelers represented in this sample primarily or solely used an eel hook to catch the fish (Figure 19).

Figure 19. Twins, Bill and Ben Mager, Yurok and Wiyot, with an eel hook. (Photo by Kara Simpson, 2014).

5.7.1.1 Eel Hooks

Eel hooks proved to be a source of pride and identity, central drivers of an important way of life that linked their owners to countless generations. Three quarters of the eelers mentioned they still had an eel hook even if they had not used it in decades. Some showed me their eel hooks during the interview, each one exhibiting the wears of longevity and countless eel catches. Two of the participants, had their eel hooks displayed prominently in the living rooms of their homes where the interviews were conducted.

The eel hooks pictured in the two photos in Figure 20 show two different styles of eel hooks: the one on the left is a newer version with a shaped metal hook at the top. The hook on the right is made in the "old style" with a bone fastened to the top as the hook. The picture on the right shows a wooden handle hand-carved to look like the head and mouth of a Pacific lamprey with its teeth showing. The eel hooks pictured in Figure 21 are a close-up of the two hook styles: the "old" and the "new style". The picture on the right is just a close-up of the "old style" eel hook fashioned out of a piece of bone tied to the end of a stick.

Figure 20. Left: Two different kinds of eel hooks side-by-side. Right: A hand-carved wooden handle shaped to look like and eel. (Photos by Kara Simpson, 2014).

Figure 21. Left: Two side-by-side eel hooks close-up. Right: Close-up of an “old style” eel hook made of bone. (Photos by Kara Simpson, 2014).

The hooks were either made by the participant themselves, or a by a close male family member who has since passed on. A few respondents discussed making eel hooks out of repurposed materials including broom handles. Bone was identified as the material that people used to use for eel hooks before metal was incorporated into the modern design.

The style and the shape of the hook could be used to identify where an eeler was from. Almost half the sample respondents presented these distinguishing characteristics either verbally and/or on paper. George E. Buckley explained:

> Our style was like a big question mark. And the Yurok Indians, theirs is just more of a horseshoe type. It just comes up, real narrow-like, just like a regular fishhook. But ours – I don't know what the reason for it was – but if you was catching a lot you could catch the eel and slide it around that hook and push it up to the handle, and that question mark part would stop the eel from sliding off (Wiyot Indian, interview, 2014) (Figure 22).

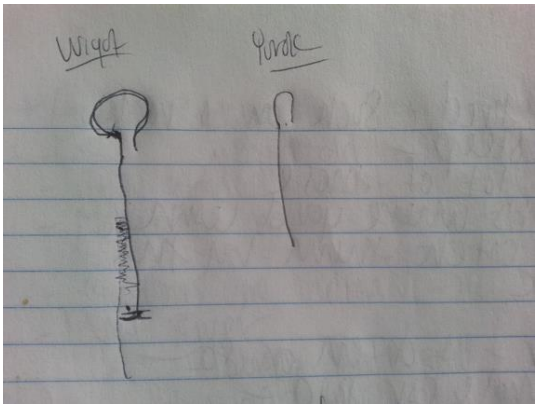

Figure 22. Drawing of eel hooks showing the difference between Wiyot and Yurok eel hooks. (Drawing by George Buckley, Wiyot. Photo by Kara Simpson, 2014).

Frank M. Lara, Yurok Tribe Member and Tolowa/Yurok dual citizen, shared, "these guys down here use what they call a round hook," detailing how the sharp bend at what would

be the “base of the questions mark” acted as a stopper so they could hook an eel and push it down in time to catch another so they wouldn’t have to keep going back-and-forth to the shore (interview, 2014). Jason Ramos, Blue Lake Rancheria, drew three different styles of eel hooks. He referred to the round hook that was “shaped like a question mark” as the “Portegue’, Mad River Indian hook he and his tribe used. He elaborated that the style was a blend of the Mad River Indian style of eel hook mixed with a style used by Portuguese people on the river at one time. The wide, but slightly flat-on-top shaped hook he drew in the middle was used by the Eel River Wiyot, as he described it, and the much smaller hook with a thinner opening was they style used by the Yuroks (interview, 2014) (Figure 23).

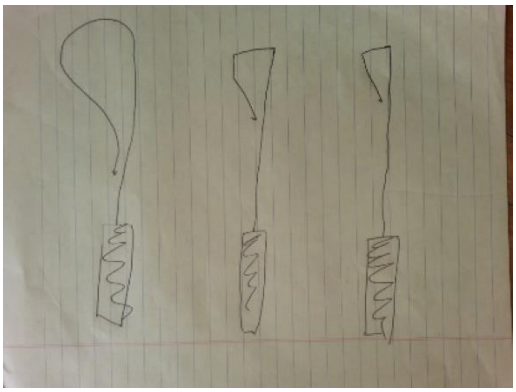

Figure 23. Drawing of three styles of eel hooks: “Portegue’, Mad River Indian hook on the left, Eel River Wiyot in the middle, and Yurok on the right. (Drawing by Jason Ramos. Photo by Kara Simpson, 2014

5.7.1.2 Eel Baskets

While eel hooks were the preferred tool for catching eels amongst the participants, oral histories uncovered traditional knowledge of other methods used to

catch eels. A popular method employed the use of an eel basket. All oral history interviewees were familiar with eel baskets, and three-quarters of the sample remembered a time on the Mad River near Blue Lake when eel baskets would be left in the river by Indigenous people who lived nearby. Four of the participants shared firsthand memories of witnessing this practice on the Mad River; the others shared secondhand knowledge. Anonymous #2, Blue Lake Rancheria Tribe Member, explained how neighboring tribes and Peoples were known for using eel baskets, but that the Blue Lake Rancheria was not one of them. They did remember one tribe member who would use one, because "one of the tribes had given her an eel basket." Adding, "we grew up using eel hooks here, not baskets" (interview, 2014).

Several respondents detailed how the baskets worked. They were handmade, and they had a float to keep it upright and an anchor to keep it from being swept away. Sometimes they would be tied to a tree or a rock on the bank to keep them in place. The basket was woven so that it looked like it was folding in on itself; the narrow opening to the center acting like an anchor to get the eels into the basket without being able to get out. Eel baskets were characterized as an easy way to catch eels, since a person could leave them in the river and come back for them later without having to get wet. The practice was explained as something that was used either by tribal elders or people from other tribes. This was not a popular method of eeling with the oral history participants interviewed for this study (Figure 24).

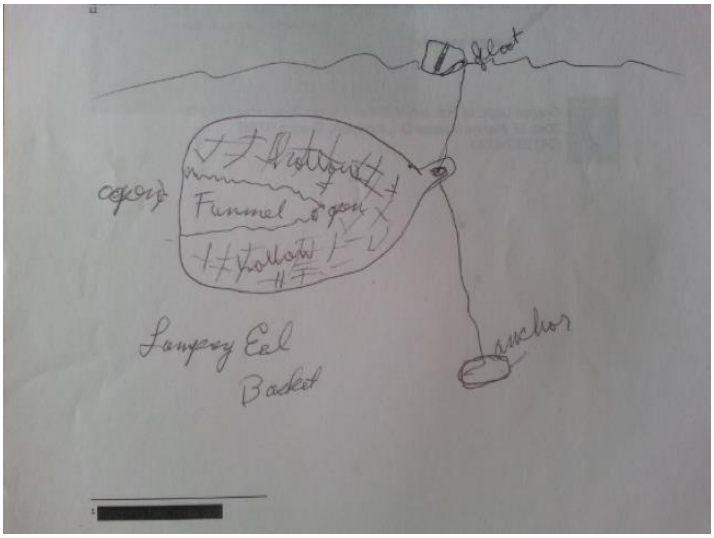

Figure 24. Drawing of an eel basket and its components. (Drawing by Frank M. Lara. Photo by Kara Simpson, 2014).

5.7.1.3 Eeling off the Dams

Another popular way to catch eels was a method that highlights anthropogenic changes to Wiyot watersheds. This was the method of pulling or hooking eels off the fish ladders on the sides of the dams or off the dams themselves. Three-quarters of the sample, shared firsthand memories of pulling eels off the sides of the dams and "filling gunny sacks full of them." This was one method eelers used when they wanted or needed to harvest many eels in one night. Anonymous #2, Blue Lake Rancheria tribe member, elaborated on how "there would be thousands of them just stuck there to the side of the [Sweasey] Dam" (interview, 2014). Both Sweasey Dam and Benbow Dam (located on the Eel River about 60 miles south of Loleta, California) were popular spots for this method of eeling.

Like other types of fishing, catching eels in the rivers was not a guarantee. Oral history participants explained how driving to the dams almost guaranteed a good harvest when they knew eel were there, so they could bring "gunny sacks full of them" home to share with their families and communities. Jim Evenson, Table Bluff Wiyot, distinguished between eeling on a riffle and eeling off the side of a dam, claiming how Benbow Dam was "a special case because they got ladders up there. Eels stick onto the ladders and you just hook them off the concrete. Of course, if you chase them on the riffles, you can't catch that many in a night because there's a lot of work involved. Sometimes you gotta do a lot of running" (interview, 2014). Anonymous #1, Wiyot Tribe – Table Bluff, mentioned that the Sweasey Dam was hard to get to on the Mad River (interview, 2014). Interview accounts reveal that Benbow Dam on the Eel River was a more popular harvesting spot for this particular method for the tribal members who lived near the Eel River, especially, but also because it was more easily accessed on foot.

5.7.2 Evolution of Eeling Methods

Incorporating dams as a contemporary addition to an age-old practice demonstrated the ongoing innovative process of this important way of life. Most oral history participants discussed changes to eeling techniques over time. Jim Evenson, Table Bluff Wiyot who was born in 1932, detailed changes to the practice of eeling he witnessed within his lifetime:

> I think when I first started, we was using cut up tires for torches. Cut up like a 4x6 piece out of a tire and put it in some campfire and catch it a' flame. And then to chase eels with that was kind of – if the fire comes down and starts dripping down on your hand – it's kind of nasty. But then we went to lanterns – corridor lanterns.

> And then we went to gas lanterns. So everything kind of evolved over time (interview, 2014).

Several respondents explained how the hooks changed over time, going from hand carved wooden handles with a piece of bone tied to the end with some sort of rope or twine, to a wooden broom handle with a metal rod from a car, or some other repurposed metal rod. The torches that were once pieces of old tires and would drip burning rubber on eelers' arms if they were not cautious, became Coleman Lanterns with a Folger's Coffee Can wrapped around it so that the eeler could point the light out in front of them so they would not be blinded by the light in the darkness.

5.7.3 The Art and Practice of Hooking Eels

Eeling was done either at the mouth of the river or on a riffle further upriver, but the hook was used in a similar manner in both cases. Because the species is nocturnal, eeling was done at night both at the mouth of the river and upstream. Jim Evenson detailed eeling on a riffle:

> You have a light and a hook, and you have to find a riffle that's not too wide and not too deep because you have to run in the water. And then you just stand there with a lantern, or whatever you're using, and when you get used to spotting the eels – when you see the eels, if he's coming close to you – you reach down and snag him if he goes by you so you can chase him. Because they don't swim that fast up the river and up the riffles, and you hook them out (Table Bluff Wiyot, interview, 2014).

Eeler research participants verbally and/or physically demonstrated how they would snag an eel by plunging the hook into the water in a downward motion, quickly pulling it back toward them. In a series of quick movements, they would draw the hook with the eel on it

up and over their head using centrifugal force to draw the eel further down onto the opening on the hook.

Half the sample remembered fearing the creatures when they were young because they "looked like snakes" and because of how the eel's mouths were filled with sharp sets of teeth. They recalled how it could be scary to be in the water in the dark as kids who were not used to the practice. Barry Brenard, Bear River Band of the Rohnerville Rancheria Tribe Member who grew up in Nevada, recounted his experience eeling when he would come back in the summer to visit:

> Back then, we used to use old tires as part of our torch. You'd have to hold a torch and a hook to go out to the river and wait for the eel to come up. You could see it swim towards your legs and then you'd scoop it up and swing it around while you walked back towards the shore and drop it off with the women to have them clean it and fillet it. And then they do the cooking and everything. But, yeah, it was scary at first because you really don't know about the eel, and if they'll attach onto your leg (interview, 2014).

Eelers became accustomed to the process, each generation adding their own contemporary contribution to the method. Oral history participants explained how learning to eel was informal and a learn-as-you-go process, where younger boys would travel with older relatives and community members to areas where the eel where running. The eels that were caught proved to be an important food source for all oral history participants at some point during their lives, and one that was shared widely within their respective tribal communities and beyond.

5.7.4 Eeling on the Mad River

Specific conditions and factors would draw folks from other river systems to the Mad River. Three respondents recalled eel runs occurring on the Mad River often a

month before they began spawning on the Eel River. The Mad River was described by several interview participants as being smaller than the Eel River and with smaller riffles, which made for good eeling conditions. These factors would spur carloads of people to make their way up to the Mad River in search of the best eeling spots.

George E. Buckley, Wiyot Indian, explained how he and other community and family members would drive up to the Mad River during the day to scout out good eeling spots from the road that paralleled the river. They would go back that night to eel, since that is when the eel migrated upriver, returning to the spots they had located during the day. Describing some of the factors that brought him to the Mad River to eel, he explained, "there's no tidewater over there. So once you're ankle-deep in a riffle, it's not going to get any deeper until you run out of the riffle. And that was the fun part of eeling on the [Mad] river. If you missed them, you had a chance to chase them down" (interview2014).

5.7.5 Firsthand Accounts: Estimated Timeline of Eel Runs in the Mad River Basin

Twelve of the 13 oral history participants specified that they had consumed eel that was caught on the Mad River at some point in their lives. Three of these participants pointed to the 1980s as the last time they remembered consuming eel that came directly from the Mad River, two of whom had caught them themselves. The remaining nine participants last eeled and/or consumed eel from the Mad River at some point during the 1960s and 1970s. Firsthand accounts of eel on the Mad River span the decades of the 1940s to the 1990s, with the 1950s through the 1970s being the main years discussed.

Oral history interview participants' ages ranged from thirty-two years old to eighty-seven years old at the time of the interviews; representing memories and knowledge spanning a little more than five decades of change in river dynamics and relationships. All respondents noted a decline in eel populations on local river systems over time. Even the folks who did not eel themselves, and the oral history interview participants who had not eeled in decades, described a major decline in eel populations.

Oral history interviewees explained how the decline of the fisheries in local river systems happened gradually to the point of there being few if any. On the Mad River, most respondents shared firsthand knowledge of declines in Pacific lamprey populations they witnessed overtime. Some participants included in this category pointed to fewer eels being shared with folks in other locations that were harvested from the Mad River as compared to what was shared in the past. Because transporting fish to share with elders, community members, and family members is an important cultural practice, as evidenced by this sample, a lack of sharing of eel from the Mad River over time can also be considered an indicator of a decline in the eel fishery.

5.7.6 Accounts of Eel Declines on the Mad River

Two-thirds of the respondents shared memories of catching an abundance of eel on the Mad River between the 1940s and 1970s. Four participants estimated catches upwards of forty in a night, depending on how many people were eeling as part of a fish camp, and especially if they or their parents were gathering them off the side of Sweasey Dam. Bill and Ben Mager, Yurok and Wiyot, remember sometimes getting one hundred in a night, and averaging forty to fifty. Ben had not eeled since the early 1960s, while Bill

said it had been fifteen to twenty years since he had tried to catch any on the river (interview, 2014). One Blue Lake Rancheria Tribe Member, Anonymous #1, who remembers their mother filling entire sacks full of eel pulled from the dam, recalled their children hardly getting any when they would eel on the river in the 1970s and 1980s (interview, 2014).

Some accounts paint a slightly different picture of catch numbers. George E. Buckley, Wiyot Indian, explained how a night's catch depended on how many people were eeling in a group. He estimated that they would catch "a dozen, or so, on a good day" (interview, 2014). Regardless of how many eels people were catching in a night on the Mad River, most of the participants recalled the decline happening gradually. A third of the respondents pointed to the 1980s as being the time when they observed major eel declines on all local rivers with which they were familiar.

Of the six oral history participants who grew up in the Mad River basin, four remember a time during the summers when the riverbed would be lined with the carcasses of eel that had spawned. Based on the demographics of the respondents included in this category, these accounts reflect a time period spanning the 1950s through the 1980s. Two of the oral history participants said the riverbed would just be "littered" with carcasses, pointing to the large number of eels that would spawn on the river at a time. One participant, Anonymous #1, Blue Lake Rancheria Tribe Member, recalled the smell being so strong from the vast number of decomposing carcasses in the river that you could smell them from a good distance away. They recounted not wanting to swim in the river during this time of the summer (interview, 2014). The 1970s was identified as

the decade when a couple of Blue Lake Rancheria Tribal Members last remembered eel runs that left such large amounts of rotting carcasses on the bed of the river.

5.7.7 Cooking and Eating Eels

Nine of the thirteen oral history informants recalled eating eels when they were fresh out of the water and cooked over an open fire on the beach, many preferring them this way. Anonymous #2, Blue Laker Rancheria Tribe Member, described the flavor of eel as being "really rich tasting. Not like the eel you get on your sushi." Following with how their mother would "fry fresh ones, and the rest she would smoke and dry. Which was just absolutely delicious, too" (interview, 2014). The love for eels as a delicious food was backed by a knowledge that they were also an important food source. Art Ramsey, Blue Lake Rancheria Tribe Member, recalled, "they were so rich and good for you. And I think it would probably be like the Native Alaskans putting seal oil on everything, because it's good for you and it makes things taste better. I used to say I could eat five yards of eel; they were that good!" (interview, 2014).

Firsthand memories of preparing the eel, which involved slitting them up the middle and up to the gills to splay it open and pull out the cord, were relayed by respondents reflecting most of the sample. People would often nail them to a board and use pliers to pull the cord out. All oral history participants shared memories of being at fish camps where eel were fileted and cooked over an open fire and shared with the group. Most interviewees discussed other methods for cooking eel that they either preferred or enjoyed as much. These methods included, smoked eel, eel that is baked in

an oven and then fried in a pan, and two participants shared that they preferred eel when it was smoked or baked and then cooled.

5.7.8 Commercial Significance

Three of the research participants used to sell eel for financial profit at some point in their youth. Bill and Ben shared memories of catching eel all night on the Mad River, forty or fifty on average, and then selling them for a quarter a piece to other local Indians (interview, 2014). Jim Evenson, Table Bluff Wiyot, remembered many people buying eels rather than eeling for them themselves. Evenson recalled selling eel for a dollar a piece to folks on the Klamath. Sometimes selling hundreds at a time, he stated "we sold them like hot cakes" (interview, 2014).

5.7.9 Present Day Eeling

Only one interview participant was aware of people still eeling on the Mad River. Jason Ramos, Blue Lake Rancheria Tribe Member, said that some folks still eel on occasion, but not like they used to (interview, 2014). A third of the respondents, pointed to a decline in eeling on all the local rivers. Two interviewees shared that they were still eeling when there was an opportunity. Barry Brenard, Bear River Band of Rohnerville Rancheria Tribe Member, discussed cultural revitalization efforts he and his tribe have been implementing, including teaching the youth how to fish and eel (interview, 2014). Vincent DiMarzo, Wiyot – from the Reservation, talked about eeling with his kids and other tribal youth.

5.7.10 Subsistence-Based Significance

Almost everyone expressed a love for eating the fish. All participants related a love and appreciation for the species and the time they spent eeling and participating in fish camps. Most respondents said that they still had the chance to eat eel on occasion. Several respondents specifically stated they would eat eel more often if they could, and only one participant, Ben Mager, Yurok and Wiyot, shared that he never liked to eat them but that he did love to catch them (interview, 2014).

5.7.10.1 Sharing Eel Harvests

All oral history participants discussed the practice of sharing eel harvests with elders and other community members who were not able to join fish camps on the river. George E. Buckley, Wiyot, expressed, "it was fun. And basically, we eeled for subsistence. But it was just true it was a lot of fun, because we was kids. The elders would wait for us to come home…. 'oh, you catch any?'. And if we did, we'd eat it. Literally all of it. If we didn't, we'd go back and try again" (interview, 2014). Travelling to other rancherias/reservations or other tribal communities to share eel harvests or to secondary or tertiary riverscapes to eel and then bring the harvest home to share with their family and community was an important cultural way of life, as reflected by most of the sample. Two thirds of the respondents recalled having younger family members, community members, or people from other tribes and river systems bring eel to share with them. At the time of the interviews, five interviewees shared that eels had been shared with them in this manner as recently as the last few years.

5.7.11 Eel and Eeling, an Important Part of Life

Eeling was not just a part of a subsistence-based lifestyle, it was a way of life that people enjoyed and celebrated. Anonymous #1, Wiyot Tribe – Table Bluff Reservation, remembered how "everybody would go. Not just the guys. There were a lot of girls too. It was a fun thing to do. We'd all be down there on the beach, catching eels and cooking them right there" (interview, 2014). When asked if they eeled for subsistence-based purposes, Anonymous #1 replied that they did not do it because they "had to, but because I got to" (interview, 2014). Vincent DiMarzo elaborated on the role the species has played in his life:

> Eel is a pretty important fish to me. I remember when I was in the third grade and they let us do a book report on anything we wanted to do it on and I did mine on eels. I remember at that time there wasn't a whole lot of knowledge about them yet. Or it was hard to find if there was, for me at that age. And so I was like, 'oh I want to learn more about this because it's such an interesting creature.' It's not like a lot of the other fish around. So I would say it's always important. The name of our river is the Eel River, so that goes to show how important they are. They named the river after the fish. I can't remember a time when they weren't a part of my life (interview, 2014).

While eel were pointed to as an important food source for tribal members and Indigenous descendants of the region by all respondents, it was made apparent that the Indigenous respondents had a relationship with the species that went far deeper than pure sustenance.

5.8 Key Informant Sample: Pacific Lamprey on the Mad River

All but four of the 18 key informants were familiar with Pacific lamprey through their work, research, or personal experience. More than a quarter of the key informant

sample has seen, sampled for, or come into contact with eel on the Mad River through their work on the river. Nearly half of the interviewees were additionally familiar with the species through their employment position with local tribes, or collaborative work they have been a part of with local tribes and North Coast Indigenous people. Most key informants agreed that Pacific lamprey have held significance and value for Indigenous Peoples of the Humboldt Bay region and that tribes are recognized partners in the issue of declining populations.

5.8.1 Wiyot Language and Tribal Significance

During our interview, Lynnika Butler, Linguist with the Wiyot Tribe, played several archival pieces of audio recorded in the 1950s of Native Wiyot speakers saying "*gou'daw*", the Wiyot word for eel. Butler explained that the Wiyot language consultants heard speaking on the recordings, Della Prince and Nettie Rossig, were recorded by linguists in 1954 and 1956 saying common Wiyot words and phrases. Butler explained how the Wiyot language shows not only how important fish and fishing have been traditionally for the Wiyot, but also the significance of eel and eeling. She elaborated, "There's a verb that means to fish by 'scaring [eel] into a basket'," which is "*dadutulhadouwilh*," as heard on the 1956 recording of Della Prince. She continued, "so many different words for so many different kinds of fishing – eel fishing. A verb doesn't just come to be overnight. Those are long established things. And that shows that these activities have been going on for a really long time" (interview, 2014) (See Appendix H).

5.8.2 Incidental Findings on the Mad River

Green Diamond Timber Company, one of the major landholders in the lower Mad River watershed, is one of the few entities that has been conducting long-term species monitoring as part of their due diligence requirements under federal and state ESA policies and procedures. Ryan Borque, who was the Aquatic Monitoring Supervisor at the company at the time of the interview, described field surveys he and aquatic monitoring crews would conduct which involved sampling for salmon and other ESA listed aquatic species in tributaries to the river that fall on Green Diamond lands. Specifically referring to the Canõn Creek surveys, Borque explained that the company had unreliable data for some juvenile and adult lamprey findings for most years since 1995 at that site (interview, 2014). While the company's surveys and summer steelhead dive counts show lamprey and, specifically, Pacific lamprey presence in the watershed, this cannot be used as evidence to determine health and population status of the fishery, especially because the Canõn Creek findings were inconsistent and incidental (Appendix J).

5.8.3 Pacific Lamprey Conservation Initiatives

Damon Goodman, Biologist with the USFWS who was the Pacific Lamprey Conservation Initiative (PLCI) lead for Region 8 at the time of the interview, discussed outreach and collaborative education efforts he and the PLCI had been doing to improve upon general awareness and accurate species identification, and collective work with partnering tribes and stakeholders to improve Pacific lamprey populations throughout the California distribution range. On the Mad River, Goodman described finding adult Pacific lamprey as far up the river as just below Matthews Dam in recent years. Not only

does the dam act as a physical barrier for migrating species that, unimpeded, could potentially make it up to the tributaries of the river's headwaters, it also disrupts the natural sediment transfer and regime of the bed of the river which potentially disrupts the preferred spawning conditions for the species (interview, 2014).

More than half of the sample's respondents discussed local and regional tribes as major management partners in the issue of declining eel populations, many identifying work and research several tribes are doing to monitor the species, identify factors leading to their declining numbers, and to improve habitat conditions.

5.9 How Cultural and Environmental Changes in the Mad River Watershed Have Impacted Wiyot and Local Indigenous Peoples

All oral history interviewees and most key informant respondents identified major cultural changes and impacts to local Indigenous Peoples that have occurred within the landscape of the Mad River. Key findings from this emerging data include the following: (1) The persisting effects genocide against the Wiyot Peoples and other Indigenous Peoples of the wider region has had on their cultures and ways of life; (2) The lasting impacts removal and displacement of Wiyot and other Indigenous Peoples of the region through state sponsored systems, such as those of the reservations, rancherias and Indian boarding schools have had on cultural memory and place-based knowledge; and (3) A cultivation of distrust of U.S. state and federal natural resource and regulatory agencies

and policies, as a result of feeling discriminated against or suffering loss of rights to access or the ability to harvest a particular resource.

5.9.1 The Persisting Effects of Genocide on Indigenous Peoples and Ways of Life

While indigenous relationships persist within the watershed and their ancestral territory, systematic murder and massacre, continuous forced removal, and famine and disease have led to fragmented traditional knowledge of the Mad River watershed. Relationships with Native food sources, river systems, and ways of life was simultaneously continuous and impacted by concerted colonization efforts to control Indigenous Peoples and their food sources.

More than half of each of the samples recognized the impact tribal and cultural genocide carried out within and around the Mad River watershed had on long term cultural memory and knowledge of the region. Nearly half of the oral history interviewees shared knowledge and sentiments regarding white settler attempts to control Wiyot and local Indigenous food sources and the impacts that had on their people. Marcie Frye, Bear River Band of Rohnerville Rancheria Tribe Member, shared how her mom and grandparents tried to continue subsistence living practices while she was growing up even though there were government food programs happening on her rancheria. As she described it, “that’s one way of genociding us; by taking all of our Indian foods away from us where we end up eating the white man’s food” (interview, 2014). Berry Brenard, Bear River Band of Rohnerville Rancheria Tribe Member, elaborated, “a long time ago, in the boarding school era, a lot of the Native Americans were used to getting hand downs from the government and that’s the way the government wanted it; to be the

caregiver to the Native Americans. To supply all their food, you know? The commodities and everything along those lines so they wouldn't be interested in going out fishing and eeling. And so they became dependent on that" (interview, 2014).

Most tribal and Indigenous respondents discussed the current state of fishing and eeling as something members of the three local tribes and local Indigenous people are still doing, but in dwindling numbers. The main reasons for this decline were attributed to genocidal and colonizing impacts to local Indigenous populations and environmental impacts to fisheries on local rivers and coastal beaches. Seven oral history participants included in this category, tribal elders, shared a sentiment that the younger generations were not practicing subsistence living practices due to cultural changes including easier access to food, modern entertainment devices and technologies, a lack of desire, and generation gaps. Two participants, Vincent DiMarzo, Wiyot – from the Reservation, and Berry Brenard, Bear River Band of Rohnerville Rancheria Tribe Member, discussed cultural revitalization initiatives they and their tribes have been implementing to share eeling and fishing experiences and knowledge with tribal youth.

5.9.2 The Lasting Impacts of Forced Removal and Displacement

Seven oral history participants and eight key informants, pointed to the forced removal and displacement of Indigenous Peoples of the region, including the Wiyot, as a major impact to the Peoples and cultures who were displaced and their connection through ancestral ties to the lower Mad River Watershed. While discussing ancestral family members who lived on the Mad River, George E. Buckley, Wiyot Indian, discussed how the Wiyot who lived there were rounded up and sent to Hoopa like the

other Native people, explaining that the reservation was not just for Hoopa Valley Tribe Members. Buckley elaborated, “like that deal they had there at Fort Humboldt. They called it the ‘corral.’” He continued, “that’s where they put you. Put you in there until they shipped you up to Hoopa.” Referring to people who were able to escape and get back home, Buckley shared, “they just took the young people and put them in schools. Make them quit speaking their own language” (interview, 2014). Tribal members whose primary riverscape is that of the Eel River mentioned family they had on the Mad River as a past connection within their lives. Some tribal members attributed distancing family, fishing, and eeling relationships on the Mad River to “generation gaps”.

5.9.3 Cultivated Distrust of U.S. State and Federal Natural Resource and Regulatory Agencies and Policies

More than a quarter of all respondents recognized the impacts changes in regulatory standards and laws have had on Wiyot and Indigenous descendant fishers, eelers, and hunters in the lower Mad River watershed. A few oral history interviewees recall a time when they and their families could fish and eel without having to get a license or worry about fines. Art Ramsey, Blue Lake Rancheria, remembered a time when “the laws were a lot less strict. I think the game wardens knew you were doing this for subsistence and that’s what you were living on. So, they didn’t hassle the way they would throw a person in jail now if you kill an elk, you know” (interview, 2014). Respondents expressed how they, their family and community members have had to adapt their cultural fishing and eeling practices as the result of regulatory changes without receiving special considerations or rights. For example, several eelers mentioned

how they could not have a barb on their eel hooks because it was an illegal way to catch salmon. A few participants stated that changes to the cost and the process of permitting had affected their ability or desire to fish.

From a tribal government standpoint, Michelle Fuller, who is the Environmental Director for the Blue Lake Rancheria, discussed the difficulty of trying to get funding to back environmental projects and research when a specific species or river is not listed as or recognized as a priority, such as species listed under the ESA. Even when it is, the tribe still must follow the same process as any other entity. Additionally, sovereignty rights stop at the boundaries of their rancheria or reservation lands.

5.10 Natural and Anthropogenic Changes to the Mad River Watershed

Emerging data from both interview samples identify major changes in the Mad River landscape, environment, and culture. Of the eleven oral history participants who have had an ongoing relationship with the Mad River watershed over the course of decades or an entire lifetime, all individuals detailed environmental impacts and changes they have witnessed or have known about and how eel and candlefish fisheries could have been affected. Fourteen key informants acknowledged land management practices and their impacts to the river and its fisheries overtime. This category reflects knowledge and perceptions regarding anthropogenic influences in the Mad River watershed and how they have affected eel and candlefish fisheries.

5.10.1 Direct Environmental Impacts to the River and Biological Systems

Findings include: (1) A history of unregulated logging practices, including unregulated clearcutting, road construction, pesticide and herbicide spraying, destruction of the riparian vegetation, demolition of smaller streams and tributaries due to the use of large equipment, and an increased influx of runoff and silt loads; (2) The removal of Sweasey Dam, and the lasting impacts the added silt load had on the stream, including the flattening of the riverbed and the widening of the channel; (3) The lasting effects of major flooding events; (4) Impacts from levies, channelized streams, dams, and other attempts to control water flows; (5) Impacts of grazing and agricultural lands; (6) Effects of gravel mining; and (7) Impacts of the modern "green rush," of cannabis cultivation, including high levels of nutrient dumping, water theft, and tributary destruction.

5.10.1.1 The Impacts of Logging

Three quarters of the research participants identified a long history of logging in the Mad River watershed as one of the major contributors that impacted the river and its fisheries. Included in this category are six oral history participants who understand logging industry practices firsthand, as they all worked locally as career loggers. Three oral history participants specifically implicated Simpson Lumber Company in the devastation they witnessed during their lifetimes. Many respondents, representing both samples, specified that forestry impacts have significantly improved overtime even though long-lasting impacts of past practices have left their mark.

Nearly half of the total sample pointed to a history of unregulated clearcutting. One oral history and four key informant interview participants discussed the effects of

unregulated logging roads. A few key informants touched upon the use of pesticides and herbicides in forestry practices, while half the key informant sample detailed the devastation logging practices wreaked on the riparian vegetation of the river, from practices such as using the river to float logs to mill sites to clearcutting all the way down to the stream. Two thirds of both samples noted the increased influx of runoff and silt loads as a direct result of logging. Jim Evenson, Table Bluff Wiyot, painted a picture of a slow progression over time. Elaborating, "all the logging that went around in the mountains up there. All that silt and stuff comes down and just gradually built the riverbeds up to where there's no big flow in them anymore" (interview, 2014). He was referring to the morphological flattening of the riverbed which caused local rivers to be shallower and less dynamic systems, providing fewer holes and topographical fluctuations, or riffles, where fish and eel could hide and spawn.

5.10.1.2 The Removal of Sweasey Dam

Eight oral history participants and eleven key informants named the removal of Sweasey Dam in 1970 as the second most devastating impact to the river. The oral history respondents recounted firsthand memory of changes they witnessed to the structure of the river and declines to fisheries after the dam was blown out. Art Ramsey, Blue Lake Rancheria Tribe Member, recounted a story of the first time he went up to Sweasey Dam and how he was "going to run across the dam and jump into the lake, and the gravel and the mud was all the way to the top of that dam. There was no lake behind it." He continued, "water people had their big pipes there, and the water would go in, go down the river in the pipes, and go to Eureka and Arcata. But when they blew the dam all

that mud and sediment came down the river and filled all the big holes and covered the bed of the river. I think it really impacted the eels. And I think it had to do a big number on the fish" (interview, 2014). Oral history participants primarily used the phrase "silted up" or "silted up all the big holes, making it less deep." Key informants primarily discussed the result of the dam removal as "dumping a large sediment load" causing "substrate issues." Or as Dennis Halligan, Fisheries Biologist with Stillwater Sciences at the time of the interview, specified, "It released [about] three million yards of gravel all at once" (interview, 2014).

For the oral history participants who grew up on the stretch of river near Blue Lake, the immediate and lasting impacts of the dam removal were particularly memorable. Bill Mager, Yurok and Wiyot, elaborated, "well there used to be a lot of water here. From here to the house over there was 50-foot-deep holes and stuff. But then they blew that dam and it just filled every hole in. There was nothing there. Probably that much water was a hole," he said while holding his hand about three and a half feet off the ground, "and the rest was just silt. From way up the river it all come down when they blew it out of there" (interview, 2014). The big fishing holes that were once located on the river, not far from where the oral history participants' houses were, no longer existed.

5.10.1.3 Flooding Events

Half of the key informants and some oral history participants pointed to massive flooding events on the river as major contributors to changes in the watershed and its biological systems. The largest floods in living memory and recorded history include the 1955 and the 1964 floods, which were primarily the flooding events specified by

respondents. Anonymous #2, Blue Lake Rancheria Tribe Member, recalled, "the river was different in those days. The river changes. And above the [Hatchery Road] Bridge, before the flood of 1964, it was…we called them 'the cliffs'. It was more of a ravine. And one side, where the hatchery was, was 'the cliffs', and then a small beach. So the river was a different shape. And it was deeper, and it had a more defined channel there" (interview, 2014). Like the removal of the dam, major flooding events dumped massive sediment loads into the river. Dennis Halligan, Fisheries Biologist with Stillwater Sciences, detailed:

> Typically, big floods bring in huge loads of sediment. And so you can end up burying these off-channel habitats. You fill in the river and make it more of a plain bed. Instead of having something that is meandering with nice pool riffle sequences bouncing off of these highly vegetated banks, you get these big floods – '64 floods – come in and scour the living daylights from bank to bank. Takes away a lot of the riparian vegetation. What it does is it resets the successional stages in the river. You're going to set back to an early successional stage where now you have your willows will start coming in and start the whole thing all over. And you'll have a real braided channel because you've filled everything up with gravel. And so it takes time for the river to get back and adjust to a single threaded channel and for that riparian vegetation to continue to build again (interview, 2014).

Roughly 26% of the respondents attributed some of the devastation that occurred due to these massive flooding events to human-caused influences. They identified the following contributing factors: (1) The effects of deforestation allowed for higher amounts of run off and sediment loads to dump into the river because the natural "sponge-system" of absorbing runoff in the watershed was impeded; and (2) The effects of the dam removal would have been more catastrophic, because of the impacts to the river from logging and flooding.

5.10.1.4 Levies, Channelized Streams, and Dams

A few key informants discussed the impacts levies have had on the river system and several others highlighted the issues caused by channelized streams. Half of the interviewees, representing both samples, pointed out changes to the natural flows of the river due to the historic Sweasey Dam and the current Matthews Dam. Five of the key informants who mentioned the current Matthews Dam as a structural impact to the river also described the current benefits the dam provides for the river and the community. According to Aldaron Laird, HBMWD Board Member, Matthews Dam and Ruth Reservoir have allowed the district to augment flows to an 85 mile stretch of river down to the mouth during the summer and the fall, keeping the mouth open and allowing the river to serve as a refuge for spawning fish (interview, 2014). In contrast to the Sweasey Dam, Laird explained, Matthews Dam "is so far up in the watershed, the most geologically unstable part of the watershed is below the dam, we don't really have an effect on sediment supply" (interview, 2014). While benefits were described by several participants, the Matthews Dam was explained as a structural and biological barrier across the board by the participants included in this category, especially for migrating Pacific lamprey.

5.10.1.5 Impacts of Grazing and Agricultural Lands

Some research participants presented grazing lands and agricultural lands as an impact to the watershed environment. With a point that blends cultural and environmental impacts, George E. Buckley, Wiyot Indian, described the process in which white settlers clearcut the big trees and then turned the cleared areas into pasture and agricultural lands.

Regarding the impact to Wiyot People, he described, “once they realized they were way out numbered, they realized they had to start work for a dollar a day. My dad used to work for a dollar a day” (interview, 2014).

5.10.1.6 Gravel Mining

Two oral history and seven key informant interview respondents listed gravel mining as an impact to the natural process and structure of the river. Dennis Halligan, Fisheries Biologist, and Dave Feral, Volunteer Director for the Mad River Alliance, discussed the complexities of optimally trying to manage a river system that “has already been tweaked”. In reference to the gravel extraction issue, Feral stated despite “one of the conjectures going on [which] is that gravel extraction is bad,” he pointed out the role, “gravel extraction plays in maintaining that stream channel pretty much where it is”(interview, 2014). Meaning, with the high sediment loads that were dumped into the system during the middle part of the last century, gravel extraction can be viewed as helping with the removal of some of the leftover high sediment loads. However, as the participants described, gravel extraction is inherently impactful to rivers (Dave Feral and Dennis Halligan, interview, 2014).

5.10.1.7 The Current Impacts of the “Green Rush”

Some key informants identified illegal cannabis farms and their associated illegal water diversions, high level of nutrient use and dumping, and damming and destruction of tributaries as being a current contributing factor to environmental impacts in the Mad River watershed. Referring to his experience studying the river during the summer of 2015, Aldaron Laird, Environmental Planner and HBMWD Board Member, detailed:

> All that extra water we're releasing down the river, they're essentially reversing all the benefit from it. Because we're getting all this nutrient loading from them dumping their soils and their fertilizer into the creeks. They're damming up the tributaries and the mainstem is getting lower. We're having algae blooms. We never had blue green algae blooms on the Mad River before, and now we have those. And so they are destroying the water quality in the summer and the fall. And so all that extra water we are releasing is for naught. It's just a waste (interview, 2014).

Two participants included in this sample had witnessed water trucks illegally filling up with pumps on the river.

5.10.1.8 Other Noted Changes to the Mad River Watershed and Landscape

Many respondents also discussed: (1) Changes in the weather; with specific memories indicating that there is less rain and fog in the present; (2) There being less water in the river in general, especially during the winter and spring; (3) The perception that the river used to be considerably muddier than it is now; and (4) Changes in biodiversity – there used to be a wider variety of and larger populations of fish and wildlife.

5.11 Impacts to Anadromous Fish Species and Their Spawning Habitat

Three quarters of oral history informants described declines in Mad River anadromous fish populations based on firsthand knowledge and memory. Four key informants shared firsthand knowledge of fisheries declines as they have witnessed them overtime on the river, and more than half of the key informant sample shared secondhand knowledge pointing to declining fisheries populations on the river.

Interview participants represented in this category connected anthropogenic environmental influences on the Mad River to declining anadromous fisheries in the following ways: (1) Destruction of fish habitat including impacts to preferred spawning conditions which require specific types of sand or silt; (2) Inadequate fish ladders and other fish barriers that impact the migration of anadromous species; (3) A flatter riverbed with shallower holes, less shaded areas for respite, and less pockets where fish can hide; (4) Warming water temperatures; (5) A growing population of people dependent on the river for water; (6) One or multiple generations of year classes being wiped out; and (7) Overfishing.

5.12 Overlooked Species and River

Eulachon, Pacific lamprey, and the Mad River were identified by many participants from both the oral history and key informant samples as species and a river that have been overlooked by non-Native people and governmental agencies. In response to a question asking whether management agencies overlook the river, Michelle Fuller, Environmental Director at the Blue Lake Rancheria, expressed, “for all the nonprofit, environmentally focused groups that we have in Humboldt, it is amazing that the source of our drinking water sparked no interest until just recently. So there’s more than just the agency – the Mad River is hiding in plain sight” (interview, 2014). Most participants pointed to one or both species as being overshadowed by more commercially significant species, like salmon and steelhead. Dave Feral, Volunteer Director for the Mad River

Alliance, expressed, “people are really focused on the salmonids and have been. And there’s a whole system for that” (interview, 2014). Damon Goodman, Biologist with USFWS, detailed important management issues concerning Pacific lamprey:

> A lot of our fisheries management is focused commercially or sport – species that are important commercially or to sport fishermen. So our sampling protocols and approaches are really, specifically designed to target those species. Pacific lamprey are anadromous and sympatric to our anadromous chinook and those primary commercial species in the area. However, they have a much different life history strategy. So sampling protocols that are appropriate for – let’s say an anadromous salmonid, or even, say, a freshwater resident salmonid – are not appropriate for lamprey. So the inference you can make from that information is much different. And also, if a team is set out target sampling a specific species, the level of information collected about other species varies widely. So if that’s not part of the goals of the sampling program it may or may not be recorded, or given a different level of priority and data collections. The other aspect of this is, identification of lamprey species can be challenging and have been confused in the past. So even in the records that we do have, it’s not always clear that the appropriate species were recorded (interview, 2014).

Goodman’s statement not only highlights the lack of data available for Pacific lamprey, it also shows why this remains a data-poor fishery, making it a difficult one to properly manage.

Many research informants discussed the lack of, or the difficulty in, acquiring funding to conduct long-term species, water quality, and environmental monitoring, specifically on the Mad River. Michelle Fuller listed some of the challenges tribal governments and departments face when seeking funding to support research or initiatives for non-commercially significant species:

> How important salmon have been under the ESA process and funding and how overlooked more subsistence and tribally important species have been – like eulachon and lamprey – and shining a light on that. An obvious answer is that salmon is so commercially important, but is that really how the ESA is supposed

> to operate? Looking at tiering and how challenging it can be for tribes to assert their rights under the state and federal bureaucratic systems that exist to control those rights (Environmental Director at the Blue Lake Rancheria, interview, 2014).

Even with eulachon's ESA listing and the Mad River's California Clean Water Act status, most interview participants agree that the river and its non-commercially significant fisheries have not been receiving the attention they deserve.

6 DISCUSSION

In this chapter, I summarize the main findings from my research study, reexamining my methodological approach and synthesizing my results with existing literature. Drawing from the disciplines TEK, LEK, environmental history, and Resilience Theory, my analysis situates my results within these fields of study. Recommendations are offered based on my findings.

6.1 Overlooked River and Species

Overall, the literature and the total interview sample indicates that the Mad River, Pacific lamprey, and eulachon share a common thread: they are continuously overshadowed and overlooked by agencies, researchers, and funding sources. With the mighty Klamath to its north and sprawling Eel River system to its south, the little 100-mile, narrow watershed of the Mad River and its fisheries are treated as minor and unworthy in comparison. Even with the eulachon's EPA listing status, the Mad River and its non-salmon, non-steelhead fisheries lack long-term data collection (Stillwater Sciences 2010a; Trinity Associates and HBMWD 2004). My findings reflect that there needs to be more focus on the overlooked river and species.

6.1.1 Eulachon

More than half the oral history sample respondents remembered witnessing at least one eulachon run on North Coast river systems, while only a few remember

witnessing several runs. Four oral history participants remembered witnessing one or more eulachon migrations upriver on the Mad sometime in the early 1960s. Only two of these participants remember seeing multiple runs on the river and neither remembered seeing eulachon at all on the river after the late 1960s. Only one interviewee recalled fishing for them at the time when they witnessed these runs. These findings fit with CDFG records and available information in the literature showing that the spring of 1963 proved to have a heavy enough run of eulachon on the Klamath, Redwood Creek, and the Mad, to result in the development of the only commercial fishery recorded south of the Columbia River with 56,000 pounds of fish sold (Odemar 1964; CDFG 2008). Oral history respondent's memories of witnessing large runs near the Hammond Bridge corroborate U.S. Army Engineer District's (1973) description that "the spawning run [was] in the area below Essex and upstream of the bridge on U.S. Highway 101" (58).

Most candlefish camps and memories occurred on Redwood Creek during the 1950s and 1960s. These findings fit with a 1963 Humboldt Times newspaper article detailing large eulachon runs on Redwood Creek and the Native and non-Native people fishing for them (Humboldt Times 1963), and agency reports describing large runs in the early- and mid- 1960s (Odemar 1964; North Coast Region CDFG 2002; CDFG 2008). Many oral history interview respondents predominantly associated the fish with northern tribes and river systems, through most acknowledged through firsthand and secondhand knowledge that eulachon have been known to spawn on the Mad and Eel Rivers. Environmental fluctuations, such as changes in oceanic conditions that happen during such conditions as volcanic activity, add to irregularities and variability in spawning river

distribution (Hay et al. 1997). The influx of eulachon spawning on the North Coast river systems south of the Klamath during the 1960s reflects a presence that is considered to be both frequent and infrequent, with this particular time period being linked to active El Niño event years (NMFS 2016; Humboldt Times 1963; AFSC 2006; Gustafson et al. 2012). Other subsistence smelt species, including those of surf smelt and night smelt, proved to hold more significance for most of the oral history respondents.

Several oral history and key informant research participants pointed out several factors that could allow for an unknown presence of the species, past and present, on the river. Many oral history respondents shared knowledge that the river used to be a lot muddier and that there was more water during the winter and spring seasons. With fluctuations in run years and numbers, the fact that eulachon are nocturnal, and the off-season fishing time of year when they would migrate up the Mad River, the presence of the fish may have been missed in past years. For this reason, I recommend that agencies provide funding for sampling projects that can be diligently carried out over several years in the areas in the conditions under which the fish were known to spawn. I also recommend using environmental DNA collection methods, or eDNA metabarcoding approach, which is a noninvasive technique for determining the presence of extra-organism DNA, such as that of fish, up to a few days or a few weeks through water samples (Pont et al. 2018).

6.1.2 Pacific Lamprey

The enthusiasm with which oral history respondents discussed eeling and systems of values connected to harvesting and sharing reinforced the fact that this species has

consistently held significance for local Indigenous people. The Mad River proved to be a popular eeling spot for most of the oral history interviewees, as Pacific lamprey would often migrate sooner than they would on the Eel River, and the riffles were shallower, making it easier to chase the fish. Number of fish harvested per night varied. Some oral history respondents remembered catching an average of 12-15 in a night while others remember catching upwards of 40-50 when eeling on the riffles. Four participants stated that you could catch as many as you wanted on the Mad River, especially if you went up to Sweasey Dam to hook them off the fish ladder. The time period reflected by the oral history sample spans the 1940s through the 1980s. With steady population declines reported as starting in the 1970s and 1980s on all local river systems, including the Mad, these memories of abundance when tribal members would "fill gunny sacks full of them," are situated primarily in the 1950s through the 1970s. Respondents recalled the runs happening every year on the river, taking place in the spring and summer, and consistently occurring in large numbers until they began their incremental decline. These findings build on historical population estimates and changes mentioned in the literature which prove to be inconsistent and unreliable since the fish has remained relatively unmonitored by commercial and agency interests (USFWS 2012; Larson and Belchik 1998; U.S. Army Engineer District 1973, 58). This study adds to the research because little exists specifically examining Indigenous perspectives regarding Pacific lamprey on the Mad River watershed (Wiyot Tribe NRD and Stillwater Sciences 2016). I recommend that more funding and research go into supporting Native-led, and collaborative research and restoration projects for Pacific lamprey on the Mad River.

6.2 The Tribes as Partners

My findings corroborate and build on claims made in the literature that the three local tribes maintain subsistence fisheries and are actively engaged in many environmental and culturally significant species-related issues in the watersheds that flow within the boundaries of their traditional ancestral territories, including those of candlefish and eel, and the wider landscape of the Mad River basin (CDFG 2008; Larson and Belchik 1998; USFWS 2012; Wiyot Tribe NRD and Stillwater Sciences 2016). The three tribes had active Pacific lamprey subsistence fisheries within all the watersheds that lie within their ancestral territories and beyond well into the 1980s (USFWS 2012; Stillwater Sciences 2010b; Wiyot Tribe NRD and Stillwater Sciences 2016). With a subsistence fishery that still exists on the Eel River, the Wiyot Tribe and Bear River Band of Rohnerville Rancheria are engaging their youth in fishing and eeling as part of cultural revitalization programs (Bear River Band of Rohnerville Rancheria 2010; Wiyot Tribe 2010). As a partner in the issue of Pacific lamprey population declines, and the Mad River being situated within Wiyot ancestral territory, the Wiyot Tribe and its Natural Resources Department included the watershed within the geographical scope of its Pacific Lamprey Adaptive Management Plan Framework (Wiyot Tribe NRD and Stillwater Sciences 2016; Wiyot Tribe. 2010; Wiyot Tribe, n.d.).

Even as established management partners with active subsistence fisheries, my findings reflect a sentiment that tribal fishing rights are not observed for local tribal members. Also, a history of cultural tension and oppression against local Indigenous people has led to feelings of distrust and resentment towards resource management

agencies and regulations. I recommend more funding and community and agency support for the natural and environmental resource departments of the three local tribes so they may expand the scope of their research and projects. I also recommend that local, state, and federal agencies work more closely with local tribes and tribal members to develop a more genuine co-management strategy and to determine and appropriately respect tribal fishing and eeling rights.

My results demonstrate how fish camp networks and ways of life have kept local Indigenous, traditional and contemporary fishing knowledge alive across generations, communities, and river systems. Through the genocide, forced removal and displacement, discrimination, and continuous state sanctioned cultural genocide efforts like the California Rancheria Act of 1958, which was another attempt to "civilize the Indian" through forced assimilation (BIA n.d.; National Indian Law Library 1972; National Indian Law Library 2012; U.S. Congress 1958), fish camp culture helped keep local Indigenous people connected to their Native environments, foods, and ways of life. This simultaneously mobile and place-based way of subsistence living and gathering has kept alive dynamic and geographically robust information regarding eulachon and Pacific lamprey, past and present. This finding contradicts a point made by TEK and LEK scholars, such as Raymond et al. (2010), who treat these knowledge systems as mutually exclusive; the former, connected to long-standing, cultural practices, and the latter, connected to more recent interactions with an environment. My oral history sample reflects a place-based, cultural knowledge system that can be interpreted through both theoretical perspectives simultaneously. Thus, the concurrently contemporary and

traditional knowledge shared by the Indigenous respondents is more appropriately referred to as Traditional, Local Ecological Knowledge.

6.3 Cultural and Environmental Impacts to the Mad River Watershed

Most of the interview participants' perspectives reflect a devastating history that has played out in the watershed overtime, as well as the resilience demonstrated by the persistence of Indigenous people, species, and cultures. Logging, flooding, and the removal of Sweasey Dam in the early 1970s proved to be the leading causes of morphological and ecological destruction impacting species' spawning habitat as identified by the total interview sample. These historically, environmentally, and culturally significant events and eras are widely covered in the literature and recognized as leading contributors to fisheries declines, as well as the elevated temperature, turbidity, and sedimentation which led to the river's EPA listings (Trinity Associates and HBMWD 2004; Stillwater Sciences 2010a; Tolhurst 1995). I have yet to find a comprehensive and synthesized document detailing local, Indigenous perceptions and experiences of these events and their impacts to the environment and non-salmon, non-trout fisheries. This study builds on the existing environmental history research, contributing a blend of contemporary and traditional Indigenous perspectives and knowledge regarding eulachon and Pacific lamprey on the Mad River and other North Coast rivers. These perspectives provide valuable insight regarding environmental changes and impacts to the Mad River watershed through living Indigenous memories, situated in long-term, place-based

knowledge systems; distinct in their contribution to TEK and environmental history literature.

The oral history sample reflects populations of surviving Indigenous people and communities that have reinforced and grown place-based connections to the watershed, its species, and its ecosystems. Many research participants discussed the impacts environmental destruction, fisheries declines, and 167 years of white settlement have had on local Indigenous people, including the Wiyot. Both samples pointed to the ongoing effects state sanctioned genocide and forced removal initiatives have had on these communities. While fragmented cultural knowledge and generation gaps related to long-term traditional, place-based cultural memory were pointed to by oral history interviewees within the Mad River landscape, the results show that Indigenous Peoples of the region have a living connection to the basin and its fisheries.

Though ecologically based, Resilience Theory provides a lens for examining linkages between social and ecological systems. Resilience-based ecosystem management thinking requires a broad perspective, with the central themes of environmental thresholds and adaptive cycles (Raffaelli and Frid 2010), for pinpointing processes by which these systems adapt to disturbances and how they sustain themselves in the face of change (Berkes, Colding, and Folke 2003; Chapin 2009; Walker and Salt 2006). Oral history and key informant interviews revealed major impacts to the cultural and environmental landscape of the Mad River watershed. Research participants demonstrated that two culturally significant fish species have experienced substantial population declines on the river.

The literature shows that the landscapes and ecosystems of the Mad River have always been vulnerable to high sediment loads, flooding events, and the effects of being situated in a seismically active province (Tolhurst 1995; USGS 1973; Warrick et al. 2013). Resilience theory offers a framework for determining how eulachon and Pacific lamprey have adapted to environmental disturbances, past and present. TEK and LEK provided through this framework show how local Indigenous people and tribes have adapted and continued eulachon and Pacific lamprey subsistence fisheries on the Mad River and in the Humboldt Bay region. Based on these ongoing socio-ecological relationships that have demonstrated resiliency in the way they have adapted to cultural and environmental disturbances, I recommend that resource management agencies expand their collaborative research capacities to include local and Indigenous people as co-managers and co-researchers. I also recommend that resource management agencies and researchers begin implementing more resilience-based ecosystem management approaches, extending funding and research to include species and systems that have been overlooked. Further, like the City of Eureka returned ownership of *Tuluwat* (Indian Island) lands, partially in 2014 and fully in 2019 (Mukherjee 2019; Wiyot Tribe n.d.), I recommend that U.S. governmental entities expand efforts and funding to return lands to local tribes and Indigenous People. This could be especially significant for lands that abut important river or water systems, or that contain good fishing grounds.

7 CONCLUSIONS

The key players in this story share common threads of being overlooked and disregarded for the importance they have held within the delicate structure of their rivershed environments. The landscape, ecosystem, and Indigenous Peoples of the Mad River watershed have been impacted and transformed by 167 years of white settlement in the region. Contemporary survivors of genocide, the Peoples of the three tribes are still living with the echoes of the atrocities their ancestors suffered and the impacts white settler greed and industry have had on their homelands and rivers. The tribes continue to rebuild and revitalize their cultural traditions; many tribal members and Indigenous people of the region have never stopped fishing, eeling, and subsistence living on Native food sources. Though they still co-exist in a world where their Native foods and resources are largely controlled and overseen by U.S. federal and state governmental agencies, the tribes are persistent in their efforts to exercise their sovereignty rights and to do what they can to protect the species and habitats that have been important to them and their ancestors, including those of eel, candlefish, and the Mad River.

Through this research, I have highlighted the necessity of implementing more substantial co-management practices which incorporate long-term, place-based Indigenous and local knowledge for fisheries restoration efforts. This need is especially important in streams where culturally significant anadromous fish species that have held little-to-no commercial value, such as eulachon and Pacific lamprey, have been known to spawn. My examination uncovered the broader relationship between Indigenous Peoples

and fish as they have shaped one another within the lower Mad River watershed landscape, revealing complexities as dynamic as the river systems on which they have relied. This relationship is held together by two seemingly dichotomous characteristics which in fact work in tandem: change and persistence. The people, species, and landscapes of the Wiyot watersheds, and more specifically of the Mad River basin, have experienced dramatic fluctuations of change, continuously shaped and shaping, like the ebb and flow of the rivers – sometimes good, sometimes bad, and sometimes tragic. Along with change, persistence lies at the heart of this relationship – demonstrated by a living, thriving connection to culture, systems of values, and the waters and the species that support these relationships.

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Appendix A: IRB Approved Research Participation Consent Form

Research Participation Consent Form
Eulachon and Pacific Lamprey Oral History Project in the Mad River Watershed

You are being asked to participate in a research project examining the present and historical distribution and abundance of eulachon and pacific lamprey in the Mad River Watershed and surrounding river systems. In addition, the research will be focused on the cultural significance of the two fish species to members of the Wiyot Tribe and other longtime local fishers. Please take the time to carefully read through the following information, asking questions and addressing any concerns you might have **before** you agree to participate.

What the study is about: The focus of this study is on eulachon and pacific lamprey fisheries in the Mad River Watershed and any significance they have held for the Wiyot Tribe, the wider community, and for the ecosystem as a whole. Through oral history interviews and semi-structured interviews, research participants will help the researcher identify past population trends of these two species and how and why people fished for them.

What we will ask you to do: For this study, I will ask you open ended questions about your experiences through a semi-structured interview, and we will not be using a scripted set of questions. The interview will take roughly 1 hour. With your permission, I would like to audio record the interview and take notes.

Risks and benefits: We do not anticipate any risks to you participating in this study other than those encountered in day-to-day life. We cannot guarantee confidentiality. There are no direct benefits to you for your participation.

Compensation: You will receive no compensation for participating in this project.

Research records will be kept in a locked file cabinet or password protected server; only the researcher will have access to the records. Data, including direct quotes from interviews, will be used and published in a master's thesis. Your name will not be associated with your answer unless you give explicit permission to do so. Those participants who chose to not be directly quoted will remain anonymous. To give or deny this permission, please check one of the three boxes provided below:

□ I give permission to be directly quoted with use of my name

□ I give permission to be directly quoted without use of my name
□ I do not give permission to be directly quoted.

Taking part in this interview is voluntary: You may skip any questions that you do not want to answer. If you decide to take part, you are free to withdraw at any time.

If you have questions, please contact: Kara Simpson at 707-498-5678 kls1051@humboldt.edu**, or** Faculty Advisor Dr. Laurie Richmond, at 707 -826-3202 Laurie.richmond@humboldt.edu.

If you have any concerns regarding this project, or any dissatisfaction with any part of this study: you may contact the IRB Chair, Dr. Ethan Gahtan, at eg51@humboldt.edu or (707) 826-4545.

If you have questions regarding your rights as a participant: you may report them to the IRB Institutional Official at Humboldt State University, Dr. Rhea Williamson, at Rhea.Williamson@humboldt.edu or (707) 826-5169.

You will be given a copy of this form to keep for your records.

Statement of Consent: I understand that the Investigator will answer any questions I may have concerning the investigation or the procedures at any time. I also understand that my participation in any study is entirely voluntary and that I may decline to enter this study or may withdraw from it at any time without jeopardy. I understand that the investigator may terminate my participation in the study at any time.

I have read the above information, and have received answers to any questions I asked. I consent to take part in the study.

Your Signature
_____ Date _____

Your Name (printed)
_____

In addition to agreeing to participate, I also consent to having the interview tape-recorded.

Your Signature
_____ Date _____
This consent form will be kept by the researcher for the duration of the IRB approval

Appendix B: Tribal Council Approval Resolution Letters

Kara Simpson
1588 J Street
Arcata, CA 95521
(707) 498-5678
Graduate Student
Environment & Community Program
Humboldt State University

Tribal Council
Bear River Band of Rohnerville Rancheria
27 Bear River Drive
Loleta, CA 95551

October 11, 2014

Dear Honorable Chairman William Sand and tribal council,

It is with utmost respect that I ask for your permission to conduct interviews with Bear River Band of Rohnerville Rancheria tribe members. Please review the attached research proposal which details the research I am conducting in partial fulfilment of a master's degree through Humboldt State University's Environment & Community Program.

Humbly, I ask for Council approval so I may move forward with this oral history project examining eulachon, "candlefish", and Pacific lamprey "eel", on the Mad River. Bear River Band of Rohnerville Rancheria tribe members will not be included in this project without full approval from tribal council. I have been in contact with Member-at-Large, Edwin Smith, and this letter is being written based on his recommendation. Blue Lake Rancheria and Wiyot Tribe Councils have already fully approved this research. I am working closely with council and staff members from both tribes in order to ensure ethical responsibility and formal oversight. This research will not financially benefit me or any research participants at any time. Participation in this project is completely voluntary. I will connect with tribe members to interview only under the advisement of tribal staff and other tribe members. Each research participant will sign a consent form and will have the option of opting out of the research project at any time during the interview process.

Thank you for your time and consideration. I look forward to hearing from you soon. Please contact me at any time if you have further questions or concerns.

Respectfully,

Kara Simpson

Figure 25. Bear River Band of Rohnerville Rancheria Tribal Council Approval Letter, stamped and signed October 20, 2014

Resolution of
The Blue Lake Rancheria California
13-31

SUBJECT: Authorization given to Michelle Fuller and Kara Simpson to pursue an oral history research project on the Mad River and culturally important fish species.

WHEREAS: The Blue Lake Rancheria is a federally recognized Indian tribe as listed in the Federal Register, Vol. 72, No. 55, p. 13648 (Thursday, March 22, 2007), as "Blue Lake Rancheria, California."

WHEREAS: The Blue Lake Rancheria Constitution has been approved by the Assistant Secretary of the Indian Affairs on March 22, 1989, and revised and approved by the Assistant Secretary of Indian Affairs on February 11, 1994, establishing the duly elected Business Council as the governing body of the Tribe; and

WHEREAS: The Blue Lake Rancheria's Business Council has the authority to administer programs designed to meet the needs of American Indians residing on the Blue Lake Rancheria; and

WHEREAS: The Blue Lake Rancheria's Environmental Department serves its mission "to preserve and protect the natural and cultural resources of both the Blue Lake Rancheria and the Tribe's ancestral area;" and

WHEREAS: The Environmental Programs Department has applied for a NOAA Species Recovery Grant to Tribes to study eulachon in the Mad River including an oral history component.

NOW, THEREFORE, BE IT RESOLVED the Business Council gives authorization to the Environmental Programs Director (Michelle Fuller) and Kara Simpson (an HSU graduate student) to pursue an oral history research project on the Mad River and culturally important fish species.

CERTIFICATION

As the Chairperson of the Blue Lake Rancheria Business Council for the Blue Lake Rancheria of California, I hereby certify that the Blue Lake Rancheria Business

Figure 26. Blue Lake Rancheria Tribal Council Resolution Letter (image one of two)

Council adopted this resolution at a duly called meeting with a quorum present by a vote of 5 for, 0 against, 0 abstaining, and 2 absent on this 1st. day of February, 2013.

Claudia Brundin, Chairperson — Date of Approval

ATTEST:

Bonnie Mobbs, Tribal Executive Secretary — 11-1-13 Date of Approval

Figure 27. Blue Lake Rancheria Tribal Council Resolution Letter (image two of two), signed February 1, 2013

Wiyot Tribe

Resolution of the
WIYOT TRIBAL COUNCIL

RESOLUTION NO: #14-27

DATE APPROVED: September 22, 2014

SUBJECT: Authorization for Kara Simpson, Humboldt State University graduate student, to pursue an oral history research project on the Mad River and culturally important fish species.

WHEREAS: the Wiyot Tribe (the "Tribe") is a federally recognized Indian Tribe eligible for all rights and privileges afforded to recognized Tribes; and

WHEREAS: the Wiyot Tribal Council is the governing body of the Wiyot Tribe under the authority of the Constitution of the Tribe; and

WHEREAS: The Tribe authorizes Kara Simpson to purse an oral history research project on the Mad River and culturally important fish species.

NOW, THEREFORE, BE IT RESOLVED THAT the Tribal Council hereby approves Kara Simpson to purse an oral history research project on the Mad River and culturally important fish species.

BE IT FURTHER RESOLVED THAT this shall remain in effect until rescinded by action of the Tribal Council.

1000 Wiyot Drive • Loleta, California 95551 • (707) 733-5055 • (800) 388-7633 • FAX (707) 733-5601

Figure 28. Wiyot Tribe Council Resolution Letter (Resolution # 14-27), approved September 22, 2014

Appendix C: Loosely-Structured, Open-Ended Oral History Interview Sample Questions

- Where are you from? Your parents? Grandparents?
- Where did you grow up?
- Where do you live now?
- How long did/have you lived/fished in the Mad River Watershed?
- Can you tell me a little bit about your family/community? Where are you from? What are your roots?
- Has fishing been part of your life? If so, how?
- What does fishing mean to you?
- Have you fished on the Mad River? If so, what types of fish have you fished for, and why? What do these particular species mean to you, your family, your community?
- Can you share what you know about eulachon?
- Have you ever been aware of eulachon runs or fisheries in the Mad River Watershed? If so, what were they like? Were they abundant? Did they run seasonally? Where were they in the watershed? When would they come?
- Did you or anyone you know ever fish for eulachon in the Mad River Watershed? If so, during what time period? Where would you/they fish? How would you/they fish for them? What would you/they do with them? Why would you/they fish for them?

- As far as you are aware, have eulachon ever held any specific significance for the Wiyot Tribe or members of the tribe? If so, how and why? If not, why not?
- Can you share what you know about pacific lamprey?
- Have you ever been aware of pacific lamprey runs or fisheries in the Mad River Watershed? If so, what were they like? Were they abundant? Did they run seasonally? Where were they in the watershed? When would they come?
- Did you or anyone you know ever fish for pacific lamprey in the Mad River Watershed? If so, during what time period? Where would you/they fish? How would you/they fish for them? What would you/they do with them? Why would you/they fish for them?
- As far as you are aware, have pacific lamprey ever held any specific significance for the Wiyot Tribe or for members of the tribe? If so, how? If not, why not?
- Do you think eulachon and/or pacific lamprey have ever carried any significance in the Mad River Watershed? To the ecosystem? If so, how? Why?
- What does fishing in the Mad River Watershed mean for you, your family, your community, the tribe?
- Have you seen changes to the Mad River and to the surrounding land and environment in your lifetime? If so, how?
- Have you seen changes to the fisheries of the Mad River Watershed in your lifetime? If so, how?
- Is there anything else you would like to share before we finish?

Thank you for your time and your important contribution!

Appendix D: Semi-Structured, Open-Ended Key Informant Sample Interview Questions

- Can you please share your name, your job title, and the organization/agency you work for/with?
- How long have you worked with this organization/agency?
- Have you done any specific work, research, or studies on the Mad River Watershed?
- Have you done any specific work, research, or studies on eulachon and/or pacific lamprey?
- Can you please share what you know about eulachon? (Biologically, taxonomically, migration patterns, habitat, and spawning characteristics)
- What do you know about the Endangered Species Act (ESA) listing of Eulachon?
- What do you know about eulachon fisheries in the Mad River Watershed presently and historically? Were they known to run and/or spawn in the Mad River Watershed or in surrounding areas?
- What did historical abundance and distribution of eulachon look like in the Mad River Watershed?
- Presently, what does abundance and distribution of eulachon look like in the Mad River Watershed?
- Has there been a change to the eulachon fisheries of the Mad River Watershed over time? If so, since when? Why? Has there been a similar trend for nearby river systems and watersheds? How?

- If there has been a decline in eulachon in the Mad River Watershed, do you know what some of the contributing factors are?
- Can you please share what you know about pacific lamprey? (Biologically, taxonomically, migration patterns, habitat, and spawning characteristics)
- Do you know why pacific lamprey have not been listed under the ESA? Do you know about the petition to list them under the ESA?
- What do you know about pacific lamprey fisheries in the Mad River Watershed presently and historically? Were they known to run and/or spawn in the Mad River Watershed or in surrounding areas?
- What did historical abundance and distribution of pacific lamprey look like in the Mad River Watershed?
- Presently, what does abundance and distribution of pacific lamprey look like in the Mad River Watershed?
- Has there been a change to the pacific lamprey fisheries of the Mad River Watershed over time? If so, since when? Why? Has there been a similar trend for nearby river systems and watersheds? How?
- If there has been a decline in pacific lamprey in the Mad River Watershed, do you know what some of the contributing factors to this decline are?
- Do you know if eulachon have traditionally held any significance for any of the local tribes? How about the Wiyot Tribe in particular? If so, how?

- Do you know if pacific lamprey have traditionally held any significance for any of the local tribes? How about the Wiyot Tribe in particular? If so, how?
- Do you know if either eulachon or pacific lamprey have ever carried any commercial value in the region or anywhere else in the country?
- What land management techniques and practices have been used in the Mad River Watershed? Pre Euro-American settlement? Post Euro-American settlement? How have these land management techniques and practices changed the ecosystem of the watershed? Gold mining? Cattle Ranching? Logging? Fire?
- How have fisheries of the Mad River Watershed been managed? Pre Euro-American settlement? Post Euro-American settlement?
- Can you describe some the defining characteristics of the watershed? The geography? The topography? The ecology? The hydrology?
- Can you describe some of the major human-influenced hydrological changes to the Mad River?
- How is the Mad River currently being used? How much water is diverted for domestic use? Industrial use? Hydroelectricity?
- Can you tell me about the history of the dams on the Mad River? Sweasey Dam, Butler Valley Dam, Mathew's Dam? Any issues in the community regarding dam construction and dam removal?
- Why was the Mad River listed under the American Clean Rivers Act? What does this listing mean?

- What is the history of Wiyot settlement in the watershed? Villages? Migratory patterns? Trade routes?
- How and where are the majority of Wiyot tribe members living today? Population? Rancherias?
- What is the status of the tribe today? Are they federally recognized? Do they have a political position in the local community?
- Is the tribe currently involved with fisheries management in the region? In the Mad River Watershed specifically? If so, how? With which species?
- Are there any initiatives within the Wiyot Tribe, the wider community, statewide, or federally, to restore fisheries habitats in the Mad River Watershed? If so, what is being done and who is involved? Which specific species are being considered?
- What research studies have been conducted on eulachon and pacific lamprey in the Mad River Watershed? How about in the region? On the Pacific Coast? If any, what are some major gaps that exist in the research?
- Are there initiatives to restore eulachon and/or pacific lamprey fisheries on other ecosystems? If so, who is leading the initiative? Why? What is being done?
- Is there anything else you would like to share before we finish the interview? Is there anything you would like to clarify or anything you feel we missed?

Thank you so much for your time and for your important contribution!

Appendix E: HSU Fish Collection Database Eulachon Entries

Table 10. HSU Fish Collection Database Entries for Pacific Eulachon (*Thaleichthys pacificus*) Identified Samples Found Within Wiyot Ancestral Territory

Collection #	Collection Date	Collection Locality	Drainage Lake or Ocean	Geographical Reference Point
HSU 4967	11/3/1975	Off Samoa	Pacific Ocean	Near Eureka
HSU 781	1/5/1973	Perpendicular to CS Pulp Mill	Null	Near Eureka
HSU 717	4/12/1967	0.3 mi. below 299 Bridge, 2mi. N Arcata, Mad river	Null	Near Arcata
HSU 2244	4/19/1986	Outside Humboldt Bay	Pacific Ocean	Near Eureka
HSUL 0723	4/30/1978		North American Eel River Mouth	Near Loleta
HSUL 0720	4/30/1978		North American Eel River Mouth	Near Loleta
HSUL 0686	4/20/1978		North American Eel River Mouth	Near Loleta
HSUL 0685	3/1978		North American Eel River Mouth	Near Loleta
HSUL 0683	1/21/1978	Bouy 12	North American South Humboldt Bay	Near Eureka
HSUL 0682	1/21/1978	Bouy 12	North American South Humboldt Bay	Near Eureka
OT 6817E	4/30/1968	Near Humboldt Bay: From WSW of G.P Stack to NNW of C.S. Stack	Pacific Ocean	Near Eureka

Collection #	Collection Date	Collection Locality	Drainage Lake or Ocean	Geographical Reference Point
OT 6603G	3/12/1966	Near Humboldt Bay: From halfway between G.P. and Samoa Stack to ¼ mile SW of Samoa Stack	Pacific Ocean	Near Eureka

Appendix F: 1960s Fishing Map of Humboldt County, California Showing Popular Fishing Spots

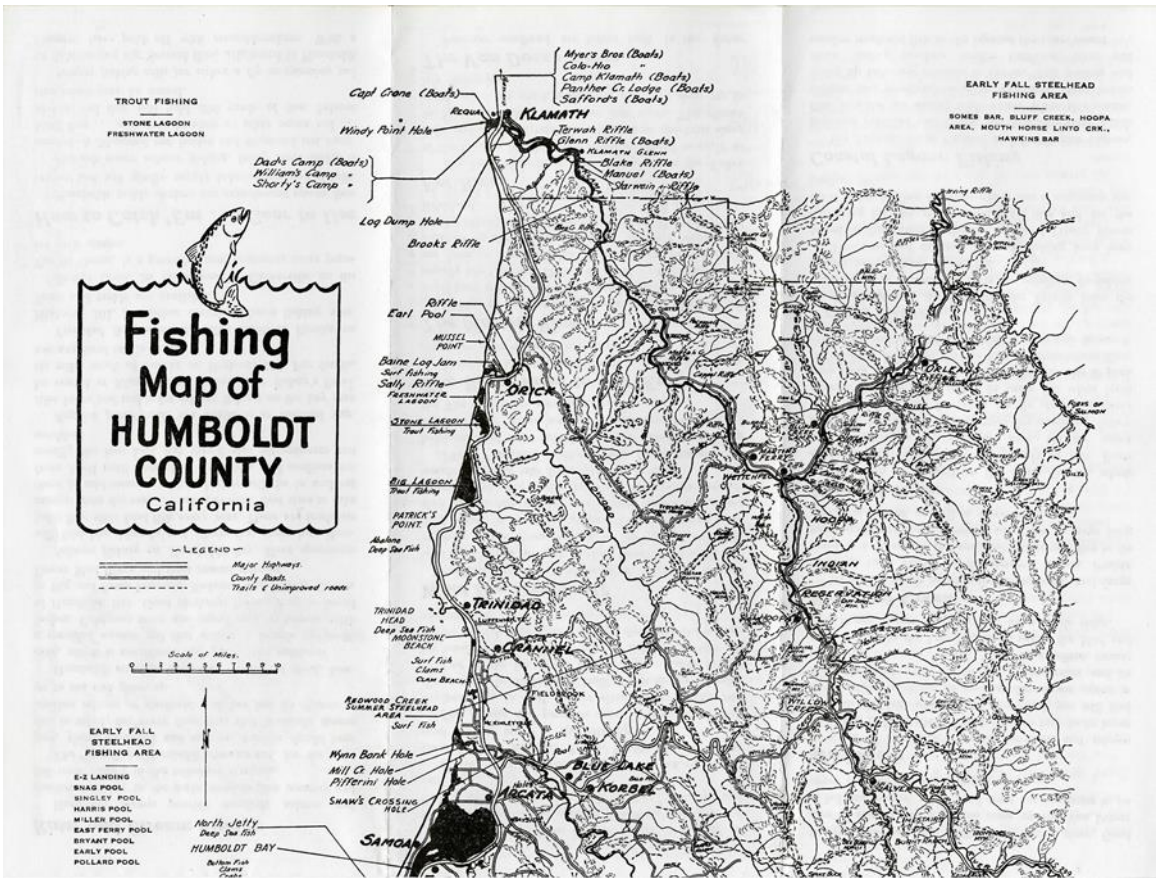


Figure 29. Northern Portion of a 1960s fishing map of Humboldt County, California, showing popular North Coast region fishing spots. (Humboldt County Board of Trade, *Humboldt Beacon*, courtesy of HSU Special Collections, HCC Pamphlet Collection).

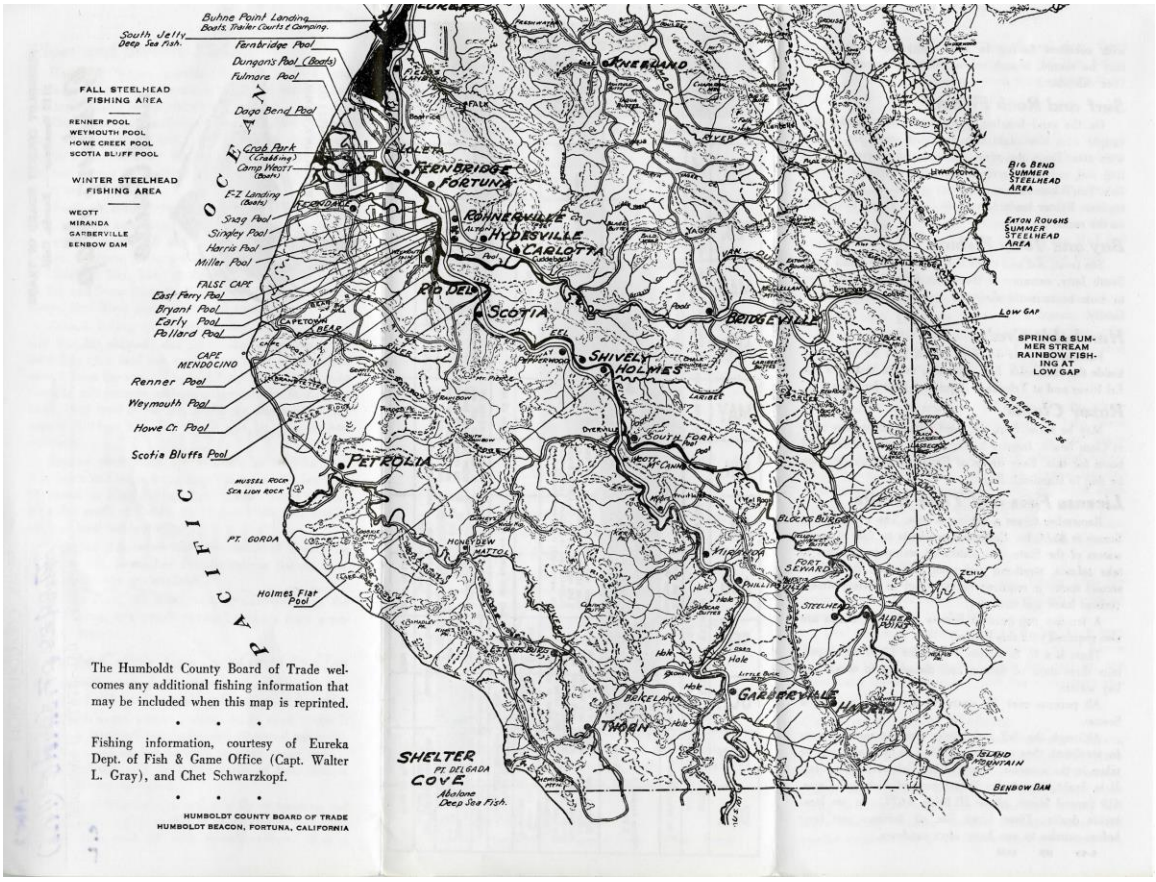


Figure 30. Southern Portion of a 1960s fishing map of Humboldt County, California, showing popular North Coast region fishing spots. (Humboldt County Board of Trade, *Humboldt Beacon*, courtesy of HSU Special Collections, HCC Pamphlet Collection).

Appendix G: 1960s CDFG Pamphlet Mentioning Surf Netting with A-Frame Nets on Local Beaches, Also Referencing Candlefish Fishing at the Mouth of the Klamath

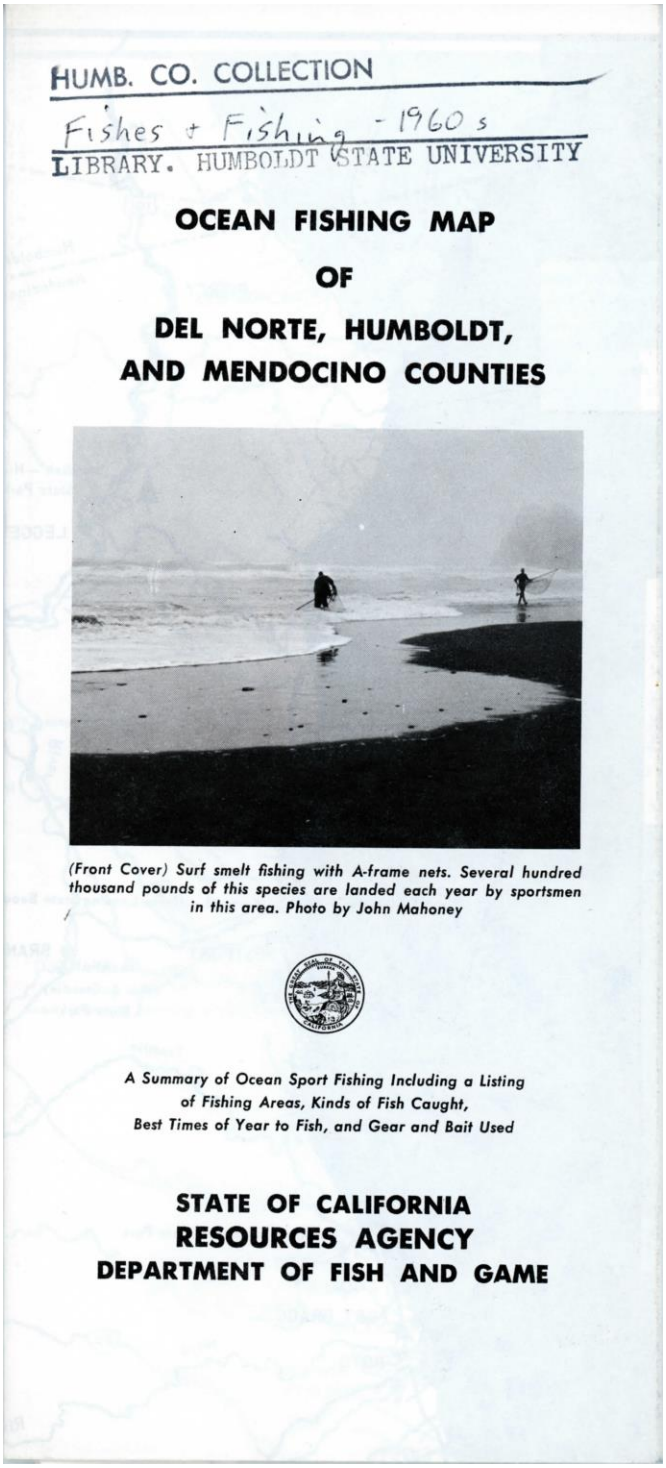


Figure 31: 1960s Ocean fishing map and summary pamphlet for Del Norte, Humboldt, and Mendocino Counties; front cover picture showing surf smelt fishing with A-frame nets. (CDFG, courtesy of HSU Special Collections, HCC Pamphlet Collection).

Drive Public access area, Russian Gulch State Park, and Van Damme State Park near Fort Bragg; and Point Arena Lighthouse Station, Arena Cove and Anchor Bay near Point Arena.

Surf Netting

Surf netting with A-frame nets is conducted for both day-spawning surf smelt and night-spawning night smelt (Table 3). Surf smelt average about 10 per pound, and night smelt are about half as large averaging about 20 per pound. Both are excellent eating and annually provide several hundred thousand pounds of food to sport netters. Surf smelt and night smelt spawn in schools in the breaker area where sand particles are stirred in the water. The adhesive eggs are released by the female into the churning water, are fertilized there, and become attached to individual grains of sand.

Surf smelt may spawn at anytime during the day, but most catches are made during midday and in the afternoon. Occasionally, a few surf smelt are taken at night along with night smelt and occasionally a few night smelt are taken during the day, but these occurrences are rare. Night smelt probably spawn at various times during the night, but most catches are made from 9 P.M. to midnight. There is no strong spawning behavior during particular stages of the tide cycles.

The A-frame net (front cover) is of the same type which was used for centuries by the native Indians for whom the surf smelt was one of the principal stable food items. The major surf netting localities are: Crescent City beach, Fort Dick beach, Wilson Creek beach, the mouth of the Klamath River, Gold Bluffs beach, Luffenholtz beach, Mad River beach, Centerville beach, Jackass Creek, Juan Creek, Howard Creek, the mouth of Ten Mile River, MacKerricher Beach State Park, and the mouth of Alder Creek.

Candlefish fishing with an A-frame net at the mouth of the Klamath River. This is the only river in California that has an annual run of candlefish. Photo by Doug Wilson

[9]

Figure 32. 1960s Ocean fishing map and summary pamphlet for Del Norte, Humboldt, and Mendocino Counties; description of surf netting with an A-frame net and picture showing candlefish fishing with A-frame net at the mouth of the Klamath. (CDFG, courtesy of HSU Special Collections, HCC Pamphlet Collection).

Appendix H: Wiyot Language Table Shared by Lynnika Butler, Linguist with the Wiyot Tribe

Table 10. Wiyot Language Table, Shared October 17, 2019

English	Wiyot	Speaker/researcher
Eel (Pacific lamprey)	*gou'daw*	multiple speakers 1. Curtin, Jeremiah. 1889. Vocabulary. Manuscripts 1455/Patawat & 1457/Kowihl (Wishoskan), National Anthropological Archives, Smithsonian Institution, p. 122 (Wiyot speaker(s) unknown). 2. Edward Curtis (1924). *The North American Indian*, vol. 13, p. 264 (Wiyot speaker: Jerry James) 3. Kroeber, Alfred L. 1911. The Languages of the Coast of California North of San Francisco. University of California Publications in American Archaeology and Ethnology 9(3), p. 408 (Wiyot speaker(s) unknown) 4. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-001 part 2, frame 0345 (Wiyot speakers: Amos Riley, Birdie James). 5. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, p. 31, The Bancroft

English	Wiyot	Speaker/researcher
		Library, University of California, Berkeley. (Wiyot speaker: Jerry James) 6. Teeter, Karl V. (researcher); Prince, Della (consultant). 1954. California Language Archive. 7. Fletcher, Stuart (researcher); Teeter, Karl V. (researcher); Rossig, Nettie (consultant). 1956. California Language Archive.
surffish	*hout*	multiple speakers 1. Kroeber, Alfred L. 1911. The Languages of the Coast of California North of San Francisco. University of California Publications in American Archaeology and Ethnology 9(3), p. 408 (Wiyot speaker(s) unknown) 2. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, pp. 31, 128, 170, The Bancroft Library, University of California, Berkeley. (Wiyot speakers: Amos Riley, Warren Brainard, Jane Duncan Searson) 3. Edward Curtis (1924). *The North American Indian*, vol. 13, p. 265 (Wiyot speaker: Jerry James) 4. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-

English	Wiyot	Speaker/researcher
		001 part 2, frame 0359 (Wiyot speaker: Amos Riley). 5. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-001 part 2, frame 0360 (Wiyot speaker: Birdie James). 6. Denman, Weaver (consultant); Bright, William (researcher). 1951. California Language Archive. 7. Teeter, Karl V. (researcher); Prince, Della (consultant). 1954. California Language Archive. 8. Fletcher, Stuart (researcher); Teeter, Karl V. (researcher); Rossig, Nettie (consultant). 1956. California Language Archive. 9. Teeter, Karl V. (researcher); Fletcher, Stuart (researcher); Prince, Della (consultant). 1956. California Language Archive.
candlefish (?)	*rru'mula'wi*	Birdie James / John P. Harrington "a kind of small fish resembling surffish that run in the Klamath & which are cald candlefish, but none in this region" 1. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-

English	Wiyot	Speaker/researcher
		001 part 2, frame 0361 (Wiyot speaker: Birdie James)
bay smelt	*wi'ywili'l*	Birdie James / John P. Harrington 1. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-001 part 2, frame 0362 (Wiyot speaker: Birdie James)
Mad River	*Baduwa't*	multiple speakers 1. Fletcher, Stuart (researcher); Teeter, Karl V. (researcher); Rossig, Nettie (consultant). 1956. California Language Archive. 2. Teeter, Karl V. (researcher); Fletcher, Stuart (researcher); Prince, Della (consultant). 1956. California Language Archive. 3. Curtin, Jeremiah. 1889. Vocabulary. Manuscripts 1455/Patawat & 1457/Kowihl (Wishoskan), National Anthropological Archives, Smithsonian Institution, front page (Wiyot speaker(s) unknown). 4. Edward Curtis (1924). *The North American Indian*, vol. 13, pp. 67, 86 (Wiyot speaker: Jerry James) 5. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian

English	Wiyot	Speaker/researcher
		National Anthropological Archives. Harrington 690510-001 part 2, frames 0520, 0523, 0536-0537 (Wiyot speaker: Birdie James) 6. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, pp. 134, 410, The Bancroft Library, University of California, Berkeley. (Wiyot speakers: Warren Brainard, Jerry James)
a Mad River Wiyot person, lit. 'belongs to Mad River'	*Baduwa't darrudalilh*	Amos Riley & Birdie James / John P. Harrington 1. Edward Curtis (1924). *The North American Indian*, vol. 13, pp. 226, 228 (Wiyot speaker: Jerry James) 2. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-001 part 2, frames 0398, 0550 (Wiyot speakers: Amos Riley, Birdie James) 3. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, p. 311, The Bancroft Library, University of California, Berkeley. (Wiyot speaker: Jerry James)
a Yurok man	*Hikdak or 'Ikdak*	Della Prince / Karl Teeter (Hikdak); Amos Riley / John P. Harrington ('Ikdak)

English	Wiyot	Speaker/researcher
		1. Curtin, Jeremiah. 1889. Vocabulary. Manuscripts 1455/Patawat & 1457/Kowihl (Wishoskan), National Anthropological Archives, Smithsonian Institution, p. 184 (Wiyot speaker(s) unknown). 2. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-001 part 2, frames 0382-0383, 0515 (Wiyot speakers: Amos Riley, Birdie James) 3. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, pp. 28+1, 205, 235, 684, The Bancroft Library, University of California, Berkeley. (Wiyot speakers: Winnie Buckley, Elsie Barto) 4. Fletcher, Stuart (researcher); Teeter, Karl V. (researcher); Prince, Della (consultant). 1956. California Language Archive.
a Yurok woman	*Na'qashk or Naqash*	Della Prince / Karl Teeter (Naqash); Elsie Barto / Gladys Reichard 1. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-001 part 2, frames 0382, 0384

English	Wiyot	Speaker/researcher
		(Wiyot speakers: Amos Riley, Birdie James) 2. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, p. 205, 353, The Bancroft Library, University of California, Berkeley. (Wiyot speaker: Elsie Barto) 3. Fletcher, Stuart (researcher); Teeter, Karl V. (researcher); Prince, Della (consultant). 1956. California Language Archive
a northerner (Yurok), lit. 'belongs to the north	*rrak vou'r dadadalilh*	Amos Riley & Birdie James / John P. Harrington; Della Prince / Karl Teeter 1. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-001 part 2, frames 0021, 0329, 0397 (Wiyot speakers: Amos Riley, Birdie James) 2. Teeter, Karl V. (researcher). [2003 May]. California Language Archive: Wiyot fileslips of K.V. Teeter: Box 2.
fishing with a line	*vusgouy'*	Elise Barto / Gladys Reichard 1. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, pp. 487, 546+1 The Bancroft Library, University of California, Berkeley. (Wiyot speaker: Elsie Barto)

English	Wiyot	Speaker/researcher
he's fishing with a dipnet	*tegi'vilh*	Della Prince / Karl Teeter 1. Fletcher, Stuart (researcher); Teeter, Karl V. (researcher); Prince, Della (consultant). 1956. California Language Archive.
he's fishing by "scaring" the fish into a basket	*dadutulhadouwilh*	Della Prince / Karl Teeter 1. Fletcher, Stuart (researcher); Teeter, Karl V. (researcher); Prince, Della (consultant). 1956. California Language Archive
I'm fishing with a gillnet	*vousu'*	Elsie Barto / Gladys Reichard 1. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, p. 509, The Bancroft Library, University of California, Berkeley. (Wiyot speaker: Elsie Barto)
He's spearing salmon (from land)	*dutwaghilh*	Elsie Barto / Gladys Reichard 1. Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, p. 363+1, The Bancroft Library, University of California, Berkeley. (Wiyot speaker: Elsie Barto)
a stick used to slit eels	*rroughulhitgurrurouwulh*	Elsie Barto / Gladys Reichard **1.** Reichard, Gladys A. 1922. Gladys Reichard field notebooks on Wiyot Indians, BANC MSS 2004/111 c, p. 674, The Bancroft Library, University of California, Berkeley. (Wiyot speaker: Elsie Barto)
string eels on a stick	*la'yawouy*	Elsie Barto / Gladys Reichard 1. Reichard, Gladys A. 1922. Gladys Reichard field notebooks

English	Wiyot	Speaker/researcher
		on Wiyot Indians, BANC MSS 2004/111 c, p. 177, The Bancroft Library, University of California, Berkeley. (Wiyot speaker: Elsie Barto or Jane Duncan Searson, not clear)
Eel basket	*yaw*	multiple speakers 1. Teeter, Karl V. (researcher); Fletcher, Stuart (researcher); Prince, Della (consultant). 1956. California Language Archive. 2. Harrington, John Peabody. 1926, 1942. John Peabody Harrington Papers: Wiyot/Yurok/Mattole. Microfilm, Smithsonian National Anthropological Archives. Harrington 690510-001 part 2, frame 0379 (Wiyot speaker: Birdie James)

Appendix I: 1963 *Humboldt Times* Article Showing People Using Dip Nets and A-Frame Nets to Land Candlefish at the Mouth of Redwood Creek

Candlefish Running

The candlefish are running. By the thousands they are swarming up the muddy waters of the Klamath River at Klamath and Redwood Creek near Orick. Everyone is turning out, the small fry included, to dip out limits of the silvery little smelt that a upstream to spawn. Here a group of candlefish net from the bank of Redwood Creek with long, two-handl

Figure 33. 1963 *Humboldt Times* article showing people dip-netting for candlefish on Redwood Creek. (Source: Humboldt Times, 1963. Courtesy of Times Standard).


Humboldt Times
April 14, 1963

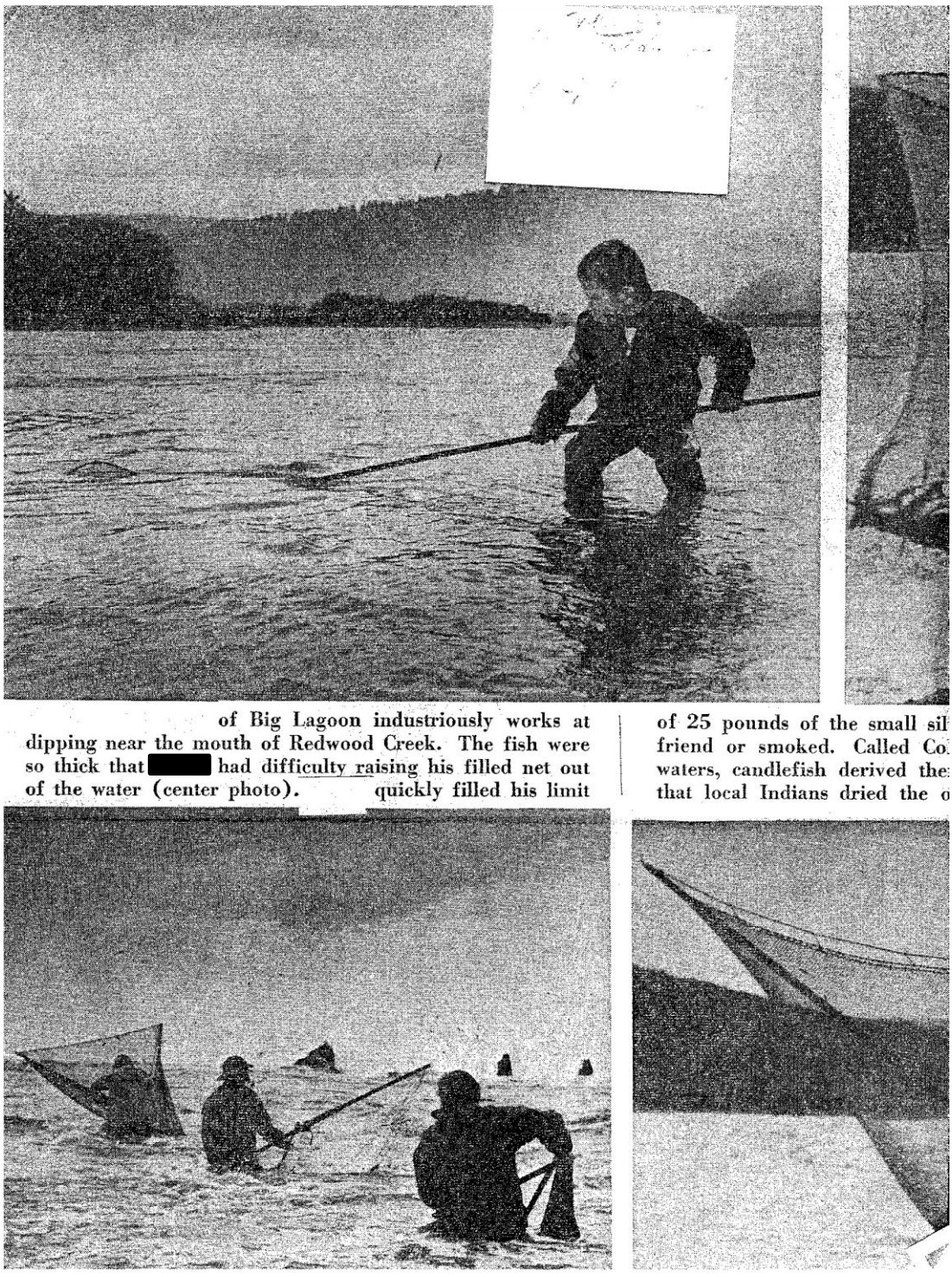
in Redwood Creek!

re headed

Fresh caught candlefish lie flopping in a dip net. An extremely large run up Redwood Creek is in

first time candlefish have run up Redwood Creek in large numbers. Normally the fish are found only

Figure 34. 1963 *Humboldt Times* article showing "fresh caught candlefish" in a net on Redwood Creek. (Source: Humboldt Times, 1963. Courtesy of Times Standard).



of Big Lagoon industriously works at dipping near the mouth of Redwood Creek. The fish were so thick that [redacted] had difficulty raising his filled net out of the water (center photo). quickly filled his limit

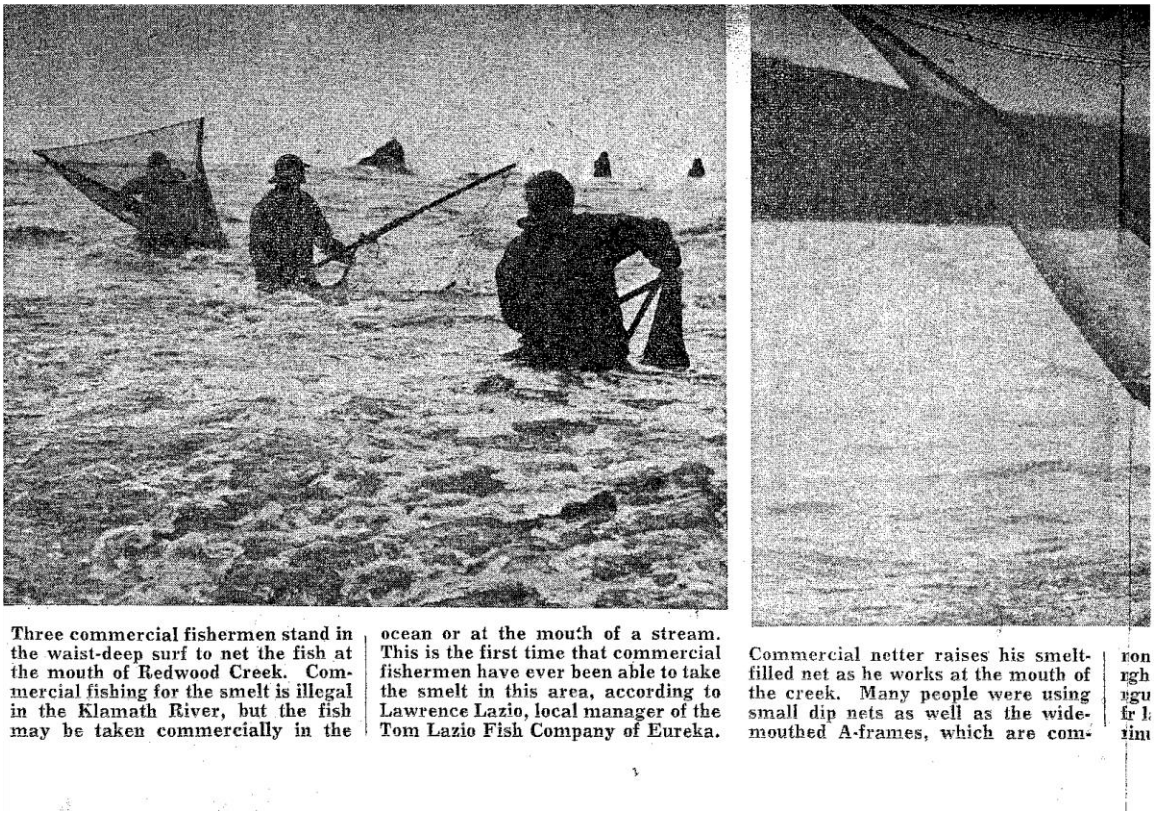
of 25 pounds of the small sil friend or smoked. Called Co waters, candlefish derived the that local Indians dried the o

Figure 35. 1963 *Humboldt Times* article showing a young fisher dip-netting for candlefish on Redwood Creek (pictured above), and three fishers using A-frame nets to catch candlefish in the surf (pictured below). (Source: Humboldt Times, 1963. Courtesy of Times Standard).

silvery smelt that are delicious
Columbia River smelt in most
heir local name from the fact
oily fish and used them for

candles to light their dwellings. A note of caution to the prospective candlefish dipper: a fishing license is required of anyone over the age of 16.

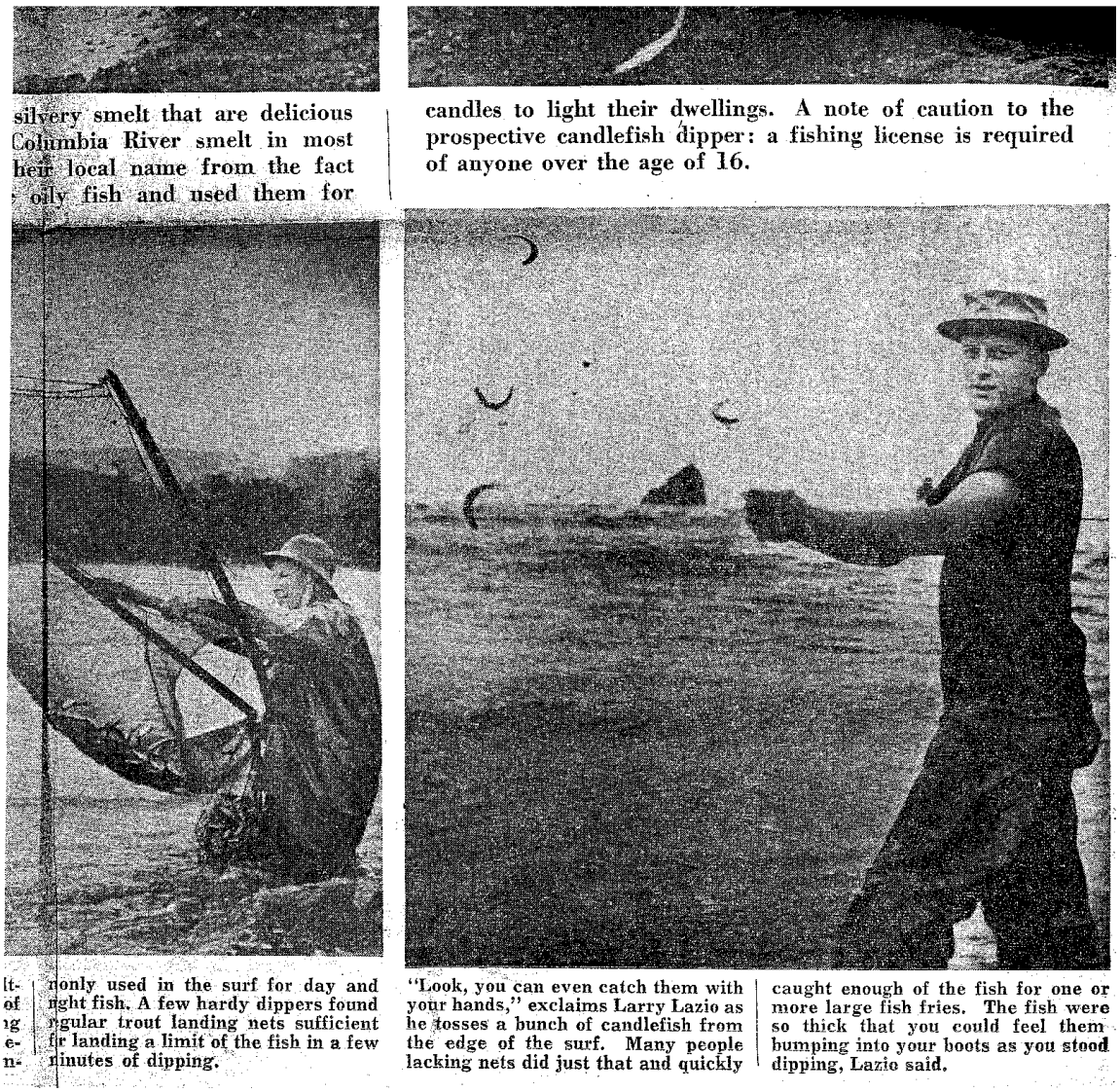
Figure 36. 1963 *Humboldt Times* article showing a young fisher dip-netting for candlefish on the banks of Redwood Creek and bringing them to shore (pictured above), and an adult fisher throwing candlefish to shore (pictured below). (Source: Humboldt Times, 1963. Courtesy of Times Standard).



Three commercial fishermen stand in the waist-deep surf to net the fish at the mouth of Redwood Creek. Commercial fishing for the smelt is illegal in the Klamath River, but the fish may be taken commercially in the ocean or at the mouth of a stream. This is the first time that commercial fishermen have ever been able to take the smelt in this area, according to Lawrence Lazio, local manager of the Tom Lazio Fish Company of Eureka.

Commercial netter raises his smelt-filled net as he works at the mouth of the creek. Many people were using small dip nets as well as the wide-mouthed A-frames, which are com-

Figure 37. 1963 *Humboldt Times* showing "three commercial fishermen stand[ing] in the waist-deep surf to net the fish at the mouth of Redwood Creek." (Source: Humboldt Times, 1963. Courtesy of Times Standard).



silvery smelt that are delicious Columbia River smelt in most heir local name from the fact oily fish and used them for

candles to light their dwellings. A note of caution to the prospective candlefish dipper: a fishing license is required of anyone over the age of 16.

lt- of ıg e- n-

nonly used in the surf for day and nght fish. A few hardy dippers found rgular trout landing nets sufficient fr landing a limit of the fish in a few inutes of dipping.

"Look, you can even catch them with your hands," exclaims Larry Lazio as he tosses a bunch of candlefish from the edge of the surf. Many people lacking nets did just that and quickly caught enough of the fish for one or more large fish fries. The fish were so thick that you could feel them bumping into your boots as you stood dipping, Lazio said.

Figure 38. 1963 *Humboldt Times* showing fisher using an A-frame net to catch candlefish in the surf (left), and a man using his hands to scoop up candlefish and throw them to shore (right). (Source: Humboldt Times, 1963. Courtesy of Times Standard).

Appendix J: Green Diamond Resource Company Email Correspondence and Cañon Creek Surveys and Summer Steelhead Dive Incidental Findings Table

Table 11.Summary of Lamprey Detections During Summer Juvenile Salmonid Population Monitoring in Cañon Creek, Provided by Green Diamond Resource Company

	Pacific Lamprey			Unknown Lamprey Species	
Year	Adult	Ammocete	Juvenile	Ammocete	Unknown Age Class
1995	0	0	0	5	1
1996	0	0	0	3	0
1997	1	0	0	3	0
1999	0	0	0	8	0
2000	0	0	0	9	0
2001	0	0	0	25	0
2002	0	0	0	13	0
2003	0	0	0	3	0
2004	0	0	0	11	0
2005	0	0	0	2	0
2006	0	0	1	0	0
2007	0	0	0	7	2
2008	0	0	0	77	0
2010	0	0	0	5	0
2011	0	0	0	5	0
2012	0	0	0	0	3
2013	0	0	0	2	0
2014	0	1	0	0	0
2016	0	0	1	0	0
2017	0	2	0	0	0
2018	0	10	0	0	0
2019	0	1	0	0	0
Totals	1	14	2	178	6