“Everything Revolves Around the Herring”: The Heiltsuk-Herring Relationship Through Time

by

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Abstract

Pacific herring (*Clupea pallasii*), a cultural keystone species, are a critical part of the social-ecological systems of British Columbia's central coast. For millennia, Heiltsuk First Nation has depended on this forage fish for food, social, ceremonial, and economic purposes. My research, nested within the coast-wide "Herring School" initiative, documents the components of Heiltsuk First Nation's relationship with Pacific herring and how this relationship has changed over time. Results identify (1) how Heiltsuk social institutions, local and traditional ecological knowledge, and worldview (Gvi'ilas) have informed herring management strategies from pre-contact times until present, and (2) how changes in state-led herring management and other social and institutional developments in BC have affected the role and transmission of Heiltsuk local knowledge and management strategies over time.

Keywords: Heiltsuk First Nation; Aboriginal; Pacific herring; traditional ecological knowledge; management strategies; traditional governance

This thesis is dedicated to the memory of my mother,
Pauline Gauvreau.

Her incredible strength, perseverance, and endless love
will forever inspire me.

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List of Acronyms

CBC	Canadian Broadcasting Corporation
BC	British Columbia
BCCA	British Columbia Court of Appeal
DFO	Department of Fisheries and Oceans Canada
EBM	Ecosystem Based Management
FC	Federal Court
FSC	Food, Social, Ceremonial
GRS	Gladstone Reconciliation Society
HCEC	Heiltsuk Cultural Education Center
HEDC	Heiltsuk Economic Development Corporation
HIRMD	Heiltsuk Integrated Resource Management Department
HTC	Heiltsuk Tribal Council
TEK	Traditional Ecological Knowledge
LTEK	Local and Traditional Ecological Knowledge
SOK	Spawn on Kelp
SCC	Supreme Court of Canada

Chapter 1. Introduction

Indigenous people around the world are working to regain control of the fisheries resources in their traditional territories to retain and reinvigorate local food security, governance, social relations, and economies. Recent global declines of fish stocks, and forage fish in particular (Pinsky et al. 2011; Pikitch et al. 2012), have been a driving force for many of these initiatives. Forage fish are a mainstay of cultural groups around the world (Morita 1985; Barrett et al. 2004) and serve as the foundation of many coastal ecosystems (Schweigert et al. 2010; Pikitch et al. 2012). For millennia, Indigenous peoples developed unique, place-based knowledge of forage and other valued fish species and transmitted this knowledge inter-generationally through oral narratives, songs, systems of rules, and communication about landscape features (cf. Berkes et al. 2000; cf. Turner and Berkes 2006; cf. Barthel et al. 2013). This evolving body of knowledge, called Traditional Ecological Knowledge (TEK), informed fisheries management systems for thousands of years (Berkes et al. 2000; Moller et al. 2004; Menzies 2006). More recent ecological observations, made in the last 50-80 years by local indigenous and non-indigenous community members, (which I define as "local knowledge") have played an important role in the development of modern Indigenous marine conservation strategies (Berkes et. al. 2007; Murray et. al. 2011). Coupled local and traditional ecological knowledge (LTEK) represents a powerful combination of deep time and recent observations and strategies relevant to contemporary fisheries management (Murray et. al. 2011).

On the northwest coast of North America, Pacific herring (*Clupea pallasii*) are a forage fish and cultural keystone species that has played a foundational role in coastal social-ecological systems for millennia (Thorton et al. 2010; McKechnie et. al. 2014; Moss 2015). Over the last 140 years, the Canadian Department of Fisheries and Oceans (DFO), through powers vested in the federal government by the Canadian Constitution Act, 1867 ([UK], 30 & 31 Victoria, c. 3), has exercised regulatory authority over herring fisheries management. In the last fifty years, herring biomass on the Pacific coast has

significantly declined in many areas, disrupting ecological systems and impacting human communities closely connected to the fish (Cleary et al. 2009; DFO 2011; Moss 2015). Declines in herring biomass have been attributed to habitat degradation, pollution, predators, climate change, ineffective management strategies, and overharvesting (Parsons and Lear 1993; Harris 2000; Benson et al. 2011; Powell 2012; Keeling 2014). In British Columbia's unique situation, where many First Nations have not entered into treaties with colonial or Canadian governments, several First Nation groups have looked to the courts to assert their fisheries rights and revitalize LTEK and associated management strategies, through the recognition of their Aboriginal rights and title (R. *v. Sparrow* 1990, Supreme Court of Canada; *R. v. Van der Peet* 1996, Supreme Court of Canada; *R. v. Delgamuukw* 1997, Supreme Court of Canada).

The Supreme Court of Canada's decision in *R. v. Gladstone* (1996) recognized the rights of the Heiltsuk First Nation to harvest Pacific herring (wá'nái) within the boundaries of their traditional territory for food, social, ceremonial, and economic purposes. The traditional territory of the Heiltsuk First Nation is located on the central coast of British Columbia, around the village site of Bella Bella (Figure 1). For some members of the Heiltsuk First Nation, "everything revolves around the herring" (pers. com. Harvey Humchitt Sept. 2014); their right and ability to fish and steward herring is tightly linked to their worldview, history, social relations, economies, and physical well being (Lane 1990; HTC 2005).

Nineteen years after the landmark *R. v. Gladstone* (1996) decision, DFO and Heiltsuk leaders are still involved in a reconciliation process in which they are considering accommodation options with regards to Heiltsuk loss of access to this fishery. The Heiltsuk Tribal Council (HTC) and the Gladstone Reconciliation Society (GRS) are dissatisfied with the antiquated level of consultation and negotiations that have stalled reconciliation (HTC 2011). Despite having made a commitment in the early 1980s to develop a co-management arrangement, DFO continues to assert exclusive authority over the herring fisheries and reserves the right to make final decisions on issues of fisheries management (HTC 2011). Conflicting worldviews and a lack of perceived legitimacy on both sides have contributed to the history of distrust between DFO and Heiltsuk decision makers. Co-management arrangements entered into by DFO for other Canadian fisheries have often been based on asymmetrical power hierarchies

in which government manages and all other parties cooperate (cf. Pinkerton and John 2008). My research is therefore influenced by the larger desire of the HTC, Heiltsuk fisheries resource managers, and hereditary chiefs (Hemas) to devolve power and authority from DFO and to reclaim managerial rights over the herring fisheries in their traditional territories (HTC 2005).

The primary goal of this study is to examine the long-term history of the Heiltsuk-herring relationship and identify how the various components of the relationship have evolved and transformed over time. This aim is born from the recognition that locally specific rules of herring management cannot be decoupled from broader Heiltsuk views about the right way to interact with their environment, about their social system and oral narratives, and indeed about their worldview. I identify and disaggregate the nested components of the Heiltsuk-herring relationship, namely: local and traditional ecological knowledge, management strategies, social institutions, and worldview (cf. Berkes 2012).

My results highlight how traditional social institutions, LTEK, and aspects of Heiltsuk worldview informed herring management strategies in the past, and how changes introduced by state-led herring management in BC have affected the role and transmission of LTEK-based strategies today. These results may be used to improve ongoing Heiltsuk-DFO negotiations and identify potential solutions to advance reconciliation. An understanding of Heiltsuk-herring LTEK and its role in local fishery management is fundamental to the design of a management system that is more inclusive of Heiltsuk traditional values and worldview. In addition, this study has global relevance as it offers an example of the steps required for locally legitimate collaborative research. True collaborative research is fundamental to the design of more symmetrical power hierarchies that are necessary for the development of sustainable fisheries management worldwide.

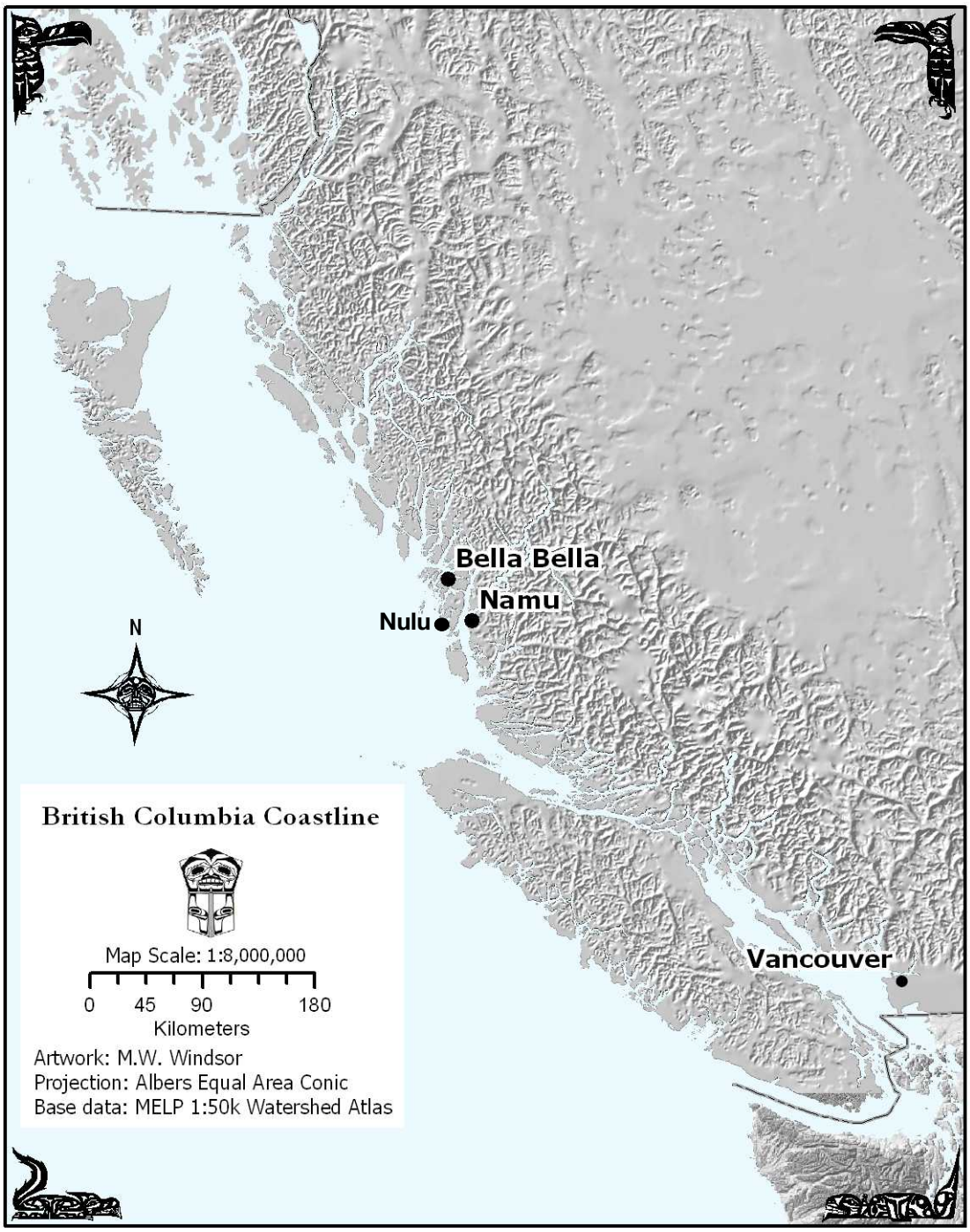

Figure 1 Location of Bella Bella, and the ancient village sites, Nulu and Namu, on the central coast of British Columbia, Canada

Chapter 2. Methods

This project is nested within the coast-wide Herring School research initiative (www.pacificherring.org) and founded on the tenets of community based participatory research (Castleden et al. 2012). I collaborated with the HTC and the Heiltsuk Integrated Resource Management Department (HIRMD) to design the research. The main outputs they requested were: (1) a technical report summarizing the information shared during interviews of Heiltsuk community members, (2) verbatim transcripts from key knowledge holders about local management strategies and the importance of herring, and (3) a timeline documenting the history of the Heiltsuk-herring relationship. I used three qualitative research methods: (1) a review of scientific and historical literature, archival documents, and oral narratives, (2) semi-structured interviews, and (3) data analysis with conceptual guidance from Berkes (2012) *knowledge-practice-belief* framework.

2.1. Literature Review

The first stage of the research involved a comprehensive review of key archaeological, ethnographic, archival, and historical literature. I selected articles and documents to review through online library key-word searches, as well as following leads and suggestions from my supervisors and mentors. The Heiltsuk Cultural Education Centre (HCEC) and HIRMD also provided me with key internal documents, grey literature, and other materials that discussed the cultural importance and uses of herring, Heiltsuk management initiatives for herring, and information about the broader Heiltsuk social system. For a list of all documents provided by HCEC, HTC, and HIRMD, see Appendix A.

The first goal of the literature review was to identify the cultural, socio-economic, ecological, and ceremonial roles that Pacific herring has played and continues to play for some members of the Heiltsuk community. The second goal of the literature review was to identify how Heiltsuk social institutions, local and traditional ecological knowledge, and

aspects of worldview (Gvi'ilas) have informed Heiltsuk herring management strategies from pre-contact times until present. These goals were achieved through qualitative content analysis whereby key statements and information about these topics were compiled and thematically organized into the sub-sections of the Results chapter. I reviewed transcripts of testimony and submissions filed by the parties in *R. v. Gladstone* (1996), and transcripts of testimony from the hearings of the Joint Review Panel for the 2012 Enbridge Northern Gateway Project, to identify additional evidence about the Heiltsuk relationship with herring, including their longstanding tradition of harvesting herring-spawn on the central coast (Hearing Order OH-4-2011, 2012).

2.2. Interviews

Members of HIRMD assisted with the identification of individuals within the Heiltsuk community who could provide expert information about Heiltsuk herring management strategies, LTEK, and the broader Heiltsuk social system and worldview. During the period from spring 2011 until fall 2014, I conducted 25 semi-structured interviews with 22 Heiltsuk First Nation herring resource users, including elders and hereditary chiefs (for a list of interview participants see Appendix B). All interviews were conducted in accordance with the ethics protocol approved by Simon Fraser University and HIRMD. The participants included leaders, decision makers, and key knowledge holders across three generations of herring resource users, ranging in age from 27 to 86 years old. Although the views of these individuals do not necessarily represent the full range of views, opinions, and knowledge of the broader Heiltsuk community, this sample of community members was selected because of their particular knowledge, expertise, and experience with the traditional and industrial herring fisheries and their knowledge of the broader Heiltsuk social system and worldview.

Fourteen of the interviews were electronically recorded and transcribed. The remaining conversations were conducted as unofficial discussions; responses were recorded only as hand-written notes at the request of the participants. These participants verbally granted their consent to use the notes as a guide for insights into community perspectives and experiences with the herring fisheries.

The interview questions were open-ended, and followed a general guide (Appendix C) to cover the topics identified in consultation with HIRMD and HTC. The topics were selected to capture the time and spatial scale of each person's observations as well community-based management strategies and local opinions. General topics included: timing of harvest; stock monitoring procedures and techniques; technologies used for harvesting and processing; the rules and ancestral laws surrounding the traditional fishery; the impacts of the state-sanctioned fishery on the traditional fishery; and conservation initiatives. Interviews typically lasted 1-2 hours and the majority of the interviews were conducted in person in Bella Bella, BC, (Figure 1) either at the offices of HIRMD or the Heiltsuk Economic Development Corporation (HEDC), in the participant's homes, or in the float-house located at Martins Dock. Two interviews were conducted in person in Vancouver. I also incorporated data from interviews conducted by others during 2004 – 2014, which I refer to and cite specifically in the results.

My interview strategy is informed by the recognition that specific rules of herring management are tied to broader Heiltsuk views about the environment, their social system and oral narratives, and their worldview. Thus, I sought to understand the Heiltsuk concept of Gvi'ilas, and the mechanisms that underpin the broader Heiltsuk social system and give meaning to the more specific rules as well as the more specific aspects of management and ecological knowledge about herring. I learned about these broader concepts through my interviews, but also through informal conversations with community members, participation in potlatches, and discussions of oral narratives about herring with elders and other knowledge keepers.

2.3. Data Analysis

Inspired by Berke's (2012) knowledge-practice-belief framework, I compiled the data derived from the literature review and interviews into three domains of the Heiltsuk-herring relationship: (1) local and traditional ecological knowledge; (2) management strategies, including the practices, tools, and techniques employed to manage herring; and (3) social institutions and worldview. Data from the first two domains were further divided into recent (within the last 80 years) and deep time (beyond 80 years) observations and actions.

Heiltsuk local and traditional ecological knowledge (LTEK) about herring, including herring ecology, trophic level interactions, and behaviour, are in the first domain at the core of the larger system. Data about this domain were derived from interviews, ethnographic works, and oral narratives. Heiltsuk herring management strategies (the second domain) are informed by and make use of this LTEK. Data from archaeological evidence, ethnographic works, interviews, and technical documents informed this domain. Heiltsuk social institutions and worldview (the third domain) permeate my understanding and presentation of the other two domains in the Heiltsuk-herring relationship. Like Berkes (2012), I conceptualize worldview as encompassing the other domains, and involving the perceptions, identities, and *ethos* of Heiltsuk herring stewards and fishermen. My understanding of Heiltsuk worldview comes from an analysis of Heiltsuk oral traditions, technical documents, ethnographic works, and importantly, interview data and conversations. Heiltsuk social institutions are nested within, and iteratively connected to worldview. Data on social institutions were gleaned from interviews and from documents produced by HIRMD and HTC. Data concerning the domains of social institutions and worldview as well as the major events that have shaped the nature of the Heiltsuk-herring relationship over time are represented in a timeline that I have divided into three categorical columns: Heiltsuk Institutions and Knowledge, Colonial Institutions and Impacts, and Resistance and Protest.

Chapter 3. Results

Heiltsuk people have shared a relationship with Pacific herring since time immemorial (HTC 2005; Housty et al. 2014) (Figure 2). Over millennia, Heiltsuk fishermen and stewards developed extensive knowledge about this fish, and their knowledge evolved in shifting social-ecological contexts. Heiltsuk LTEK (Tables 1 and 2) is the core component of the Heiltsuk-herring relationship. This LTEK serves as the foundation of Heiltsuk management strategies (Tables 3 and 4). Results highlight how herring has played an important food, social, and ceremonial (FSC) role as well as being a major staple of Heiltsuk economies for millennia. After describing LTEK and management strategies, I discuss major social events, including the emergence of colonial institutions and their impacts. I then discuss Heiltsuk resistance and protest.

3.1. Local and Traditional Ecological Knowledge of Pacific Herring

Heiltsuk LTEK of herring spans from deep time until the present (Figure 2 and Table 1). As in other cultural systems, this knowledge represents cumulative bodies of observations transmitted across generations via a myriad of cultural processes (cf. Gadgil et al. 1993; Turner et al. 2000; Moller et al. 2004; Drew 2005; Lepofsky 2009). Oral narratives are one of many cultural processes for transmitting ecological information (Turner et al. 2000; Jones and Russel 2012). In the case of Heiltsuk and herring, this includes knowledge about seasonality, spawning locations, harvesting technologies, and other aspects of herring ecology. The Heiltsuk have two narratives in which herring are prominently featured (Table 1, Topics 1 and 2). “Raven Obtains Herring,” from Namu village, and “The Golden-Eye Duck,” from Nulu village, document the antiquity of the Heiltsuk-herring relationship and offer some of the first examples of herring management recorded in Heiltsuk traditions. These narratives are complemented by the archaeology of the village sites from which they originate; Namu (Figure 2) has been a consistently important location for harvesting large quantities of herring since at least 7000 years

ago, while Nulu's record of the same extends to at least 2400 years ago (Cannon et al. 2011; McKechnie et al. 2014).

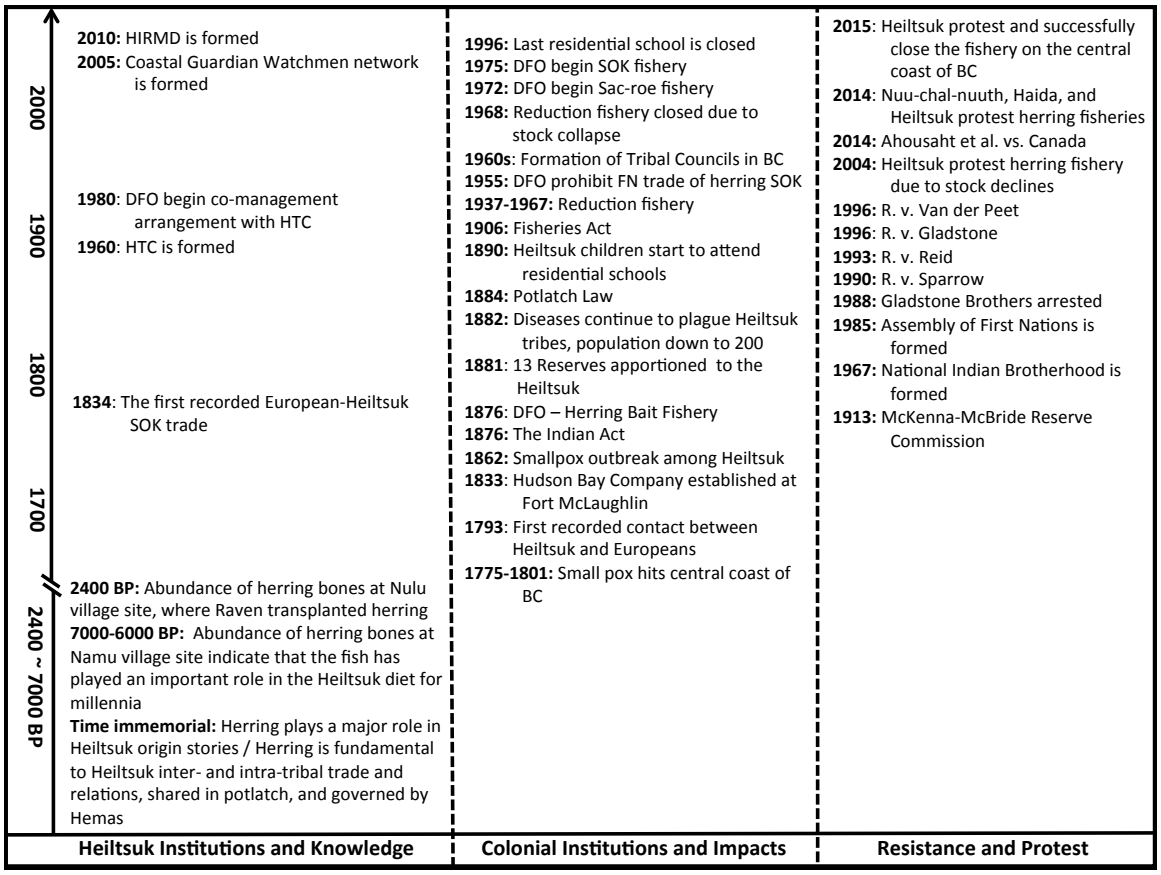

Figure 2 Events that have shaped the Heiltsuk-herring relationship through time

Table 1 Deep-time Traditional Ecological Knowledge of Pacific Herring

Topic #	Observations	Sources
1	Raven (chief/himaskas'u) transplanted herring to the village site of Nulu from Gildith.	Raven Obtains Herring (Bella Bella Tales – Franz Boas)
2	Black ducks dive underwater to harvest and consume kelp fronds that are laden with herring roe, and this is how some of the Heiltsuk ancestors learned how to harvest herring roe on kelp and hemlock boughs.	"Golden-eye duck" (Owned by Beatrice Brown) shared by EW September 2014
3	The full moon (nusi) in February represents the beginning of the herring season and the Heiltsuk new year. When the crescent moon starts to tip over, herring begin to spawn and it is the time to set trees/kelp.	Brown and Brown 2009; Interview data: E.W. September 2014; P.W. September 2014
4	For people living around Rivers Inlet, alder trees turning from brown to green marked the time to head to the more coastal fish camps to prepare for the herring spawn.	Interview data: E.W. September 2014
5	Birdlife, whale, and other animal activity indicate where herring are massing and spawning.	Interview data: E.W. September 2014; W.H. May 2013; J.B. March 2011; G.W. May 2013
6	Seagulls will mass and dive around herring balls and herring spawning sites.	Interview data: E.W. September 2014; W.H. May 2013; J.B. March 2011; G.W. May 2013
7	Spawning herring are sensitive to noise and disturbances. Disruptions can cause herring to disperse and stop spawning.	Interview data: G.H. May 2012; R.B. May 2013; F.R. May 2013; A.P. March 2011; G.W. May 2013
8	Herring will repeatedly spawn on branches and kelp that are suspended in the water column; if too may layers of roe are deposited it will cause egg die off and rot.	Interview data: W.H. June 2014; S.C. October 2012

Heiltsuk stewards monitored celestial, environmental, and ecological indicators to know when the herring season was approaching (Table 1, Topics 3 and 4). There was an intimate knowledge of their social-ecological system and herring were seen as a keystone to the renewal of the cycle of the Heiltsuk people every spring (Brown and Brown 2009). Herring attracted groundfish, birds, and other animals closer to shore, facilitating hunting and fishing of other species after the spawn (Table 1, Topics 5 and 6). The arrival of herring therefore marked the beginning of the Heiltsuk New Year. Herring were the first fresh fish to arrive in February after the stormy winter and fall months when people historically relied on their dry-stored goods. Close attention was paid to the behavioural characteristics of herring while they spawned and it was understood that

certain behaviours affected the quality of the roe harvested, as well as the overall wellbeing of the fish (Table 1, Topics 7 and 8). Herring were known to be particularly sensitive to disturbances and perceived threats while spawning and would respond quickly to predators and loud noises by fleeing the spawning site, balling together, or going deeper in the water column.

In recent times, Heiltsuk fishermen have noticed changes in herring seasonality, biology, abundance, distribution, and behaviour (Table 2). Pacific herring now begin spawning in localized areas within Heiltsuk territory in March and occasionally continue spawning until late April. People remember, however, that spawning events used to occur around the time of the crescent moon in mid-February, and some Heiltsuk recall that there was still snow on the ground when herring would spawn (Table 2, Topic 1). These latter observations, however, may be related to declining snow pack associated with climate change rather than, or in addition to, changes in spawn timing. People also noted that the size of the mature herring has decreased over time, from an average of about 10-11 inches (25-27cm), to 5-6 inches (12-15cm) (Table 2, Topic 1). Some Heiltsuk believe that smaller juvenile herring now dominate herring populations as a result of the targeted removal of large, gravid females by the industrial sac-roe fishery of the last few decades (pers. comm. Gary Wilson, May 2013; Gerrard 2014).

Table 2 Recent Observations about Pacific Herring

Topic #	Observations	Sources
1	Herring spawn later then they did historically, occasionally not until the end of March. There used to be snow on the ground when herring spawned; the air and oceanic temperatures are now much warmer.	Gerrard 2014; Interview data: E.N. March 2011; C.R. April 2011; P.W. September 2014; ER. And T.R. November 2013
2	Herring size has decreased over time. Many people have noticed a decline since the 1980s.	ITIS 2015; Interview Data: W.H. May 2011; K.G. March 2011; G.W. May 2013; M.R. March 2011
3	The duration of spawning events has decreased since the early 1940s. Herring used to spawn for 7-8 days consecutively. They now spawn for about 2-3 days.	Interview Data: H.H. May 2013; W.H. May 2013; Gerrard 2014; Interview Data: H.H. May 2013; W.H. May 2013
4	The predictability and quantity of herring spawning locations have declined over time.	Gerrard 2014; Interview Data: H.H. May 2013; W.H. May 2013
5	Herring now spawn deeper in the water column.	Interview Data: F.R. May 2013; G.W. 2013

The duration of spawning events has noticeably shortened (Table 2, Topic 3) and the predictability, distribution, and abundance of sites where herring mass and spawn have also shifted over time (Table 2, Topic 4) (Gerrard 2014). Herring occasionally have "puff-spawns" where they spawn for a day or so and then relocate to another bay. In the past, the Heiltsuk observed heavy spawns for seven to eight days straight in the same bay. It is now necessary for fishermen to follow herring between sites and re-set their kelp and trees to get a worthwhile harvest. Herring have also been observed spawning deeper in the water column (Table 2, Topic 5). This increased depth makes it more challenging to harvest the eggs, which can in turn result in egg-loss due to increased mortality caused by colder temperatures and predation (Keeling 2013). These recent observations are among the drivers of Heiltsuk demands for more localized management strategies for herring on the central coast of BC.

3.2. The Heiltsuk Management System for Pacific Herring

Heiltsuk ancestors sustained a long-term relationship with herring by tending to, looking out for, and selectively harvesting the fish (Table 3). The strategies for herring management were an embodiment of ancient Heiltsuk laws and fluid "ways of doing and being" known as Gvi'ilas (Table 3, Topics 1 and 2). "Gvi'ilas" (pronounced "gwee-ee-las"), is a complex set of orally transmitted customary laws, values, beliefs, teachings, principles, and practices; its source is ancestral, mythical, and inherited (Harkin 1996; HTC 2005). The laws and nature of Gvi'ilas are discussed and lived both formally and informally. Formal discussions of Gvi'ilas occurred during the potlatch, a millennia old practice and occasion during which laws were reviewed, revised, and then agreed upon by the hereditary chiefs (Cole and Chaikin 1990; Harkin 1996; HTC 2005). Traditional names, rank or hereditary privileges (e.g., access rights and ownership of specific herring harvesting sites) were also claimed through dances, speeches, and the distribution of property to those involved in the potlatch (Cole and Chaikin 1990; Harkin 1996; HTC 2005). The potlatch was and remains a complex institution that is fundamental to the Heiltsuk social system. Outside of the potlatch, informal discussions of Gvi'ilas occurred and still occur among family and friends (pers. comm. William Housty, September 2014).

The onus to harvest herring in alignment with Gvi'ilas was the responsibility of all Heiltsuk individuals, not just the Hemas (hereditary chiefs). In the past, resource ownership was regulated through the laws of Lhaxvai, (pronounced "lah-hay") (Table 3,Topics 3 and 4). Lhaxvai, coupled with Gvi'ilas, refers to the inherent authority held by the Hemas within their traditional territory (HTC 2005). Their "inherent authority" is derived from their millennia-old land-tenure system comprised of access, title, and stewardship rights and responsibilities associated with family-owned harvesting locations (Table 3, Topic 4). Each family was given responsibility over specific lands and waters, and by following the laws of Gvi'ilas and Laxhvai, implemented measures designed to ensure sustainable harvest of herring within those areas (HTC 2005). Sustainability was key to ensuring a continued relationship with the species (Table 3, Topic 5).

Where the cultural and physical landscape permitted, Heiltsuk fishermen and their families built herring traps to facilitate selective harvest of adult herring and to "pen" herring while they spawned (Table 3, Topic 6). One type of trap was constructed of narrowly spaced lattice fencing anchored to rows of boulders that had been arranged in the intertidal zones (White 2006). This is similar to the herring traps of the Northern Coast Salish (Caldwell and Lepofsky 2013). Herring would swarm the intertidal zone on high tide, and would become trapped in the curvature of the rock walls and the lattice of the fence when the tide receded. When herring were present in significant numbers, they could be scooped from the water using open-lattice baskets, scoop-nets, buckets, or herring rakes (Lane 1990; White 2006; also Caldwell and Lepofsky 2013). "Open-pens" built from logs and lines strung across bays were also used to "loosely" pen the fish (pers. com. Evelyn Windsor, September 2014). Strategies to ensure sustainable harvest included the selective removal of roe and herring from the fish traps, and ensuring that some branches were left behind so that the eggs could hatch (Table 3, Topics 7, 8, and 9).

Table 3 Deep-time Management Strategies for Pacific Herring

#	Strategies	Sources
1	The Heiltsuk manage herring stocks in their traditional territory in accordance with the laws of Gvi'ilas.	HTC 2005; Interview Data: W.H. June 2014; H.H. May 2013; P.W. September 2014; F.R. May 2013
2	Heiltsuk hereditary chiefs (Hemas) and their right-hand men/ women (Auuks) oversee the management of herring in their respective tribal areas, however, all Heiltsuk people are responsible for harvesting herring in accordance with the laws of Gvi'ilas.	HTC 2005; Interview Data: W.H. June 2013; H.H. May 2013; G.W. May 2013
3	Families inherit and hold access rights to specific herring harvesting sites and processing camps located within the tribal areas of their traditional territory.	Interview Data: R.B. May 2013; H.H. May 2013; G.W. May 2013; E.W. September 2014; W.H. June 2014
4	If people want to harvest herring and herring roe at another family's site, they must ask the highest ranking person within the family for permission; this is typically a Heiltsuk hereditary chief (Hemas).	Interview Data: R.B. May 2013; H.H. May 2013; G.W. May 2013; E.W. September 2014; W.H. June 2014
5	The right to harvest herring and its roe comes with the responsibility to maintain herring abundance, in its natural or ecological entirety.	Housty et al. 2014; Interview Data: P.W. September 2014
6	Tidal weirs or fish traps allow for selective harvest of herring and to control spawning in bays for easy harvest. Herring can be harvested from the traps using open-lattice baskets, scoop-nets, or herring rakes.	Barnett 1939; Drucker 1963; Lane 1974; White 2009; Interview data: E.W. September 2014; D.V. 2004; C.H. September 2004
7	Leave some behind; the primary focus should be on what is left behind, not what is taken. Leave some branches with roe in the water so that herring can hatch.	Housty et al. 2014; Interview Data: S.C. October 2012; G.W. May 2013; P.W. September 2014; W.H. June 2014
8	The best hemlock branches to set for harvesting herring roe have needles that fan out flat on two sides. Set branches earlier than kelp fronds, but harvest the roe-covered kelp first. Once the branches/kelp are set, leave them for at least two 2 days so as not to disturb the herring.	Interview Data: E.W. September 2014; S.C. October 2011
9	To avoid egg loss, harvest branches and kelp once they have 5-6 layers of roe deposited on them.	Interview data: W.H. June 2014; S.C. October 2012
10	Out of respect and understanding for herring behavior during spawning events, no noise can be made on the spawning grounds. Anchor away from the spawning grounds, and do not use motors as you approach - row in or coast in.	Brown and Brown 2009; Interview data: G.H. May 2012; R.B. May 2013; F.R. May 2013; A.P. March 2011; G.W. May 2013
11	People should not hunt or kill other animals on or around the spawning grounds during the spawn.	Interview Data: G.W. May 2013
12	People should not harvest clams when herring are spawning.	Interview Data: E.R. and T.R. November 2013
13	The trade of herring, and herring-roe, is a Heiltsuk tradition that is integral for the maintenance of inter- and intra- tribal relations. Herring plays a fundamental role in the Heiltsuk economy.	Harris 2000; Lane 1990; Tolmie 1963; Interview data: R.B. May 2013; F.R. May 2013; H.H. May 2013; E.W. September 2014

The Heiltsuk had several strategies that were explicitly intended to encourage long-term sustainable harvests. For instance, the strategies of "leaving some behind" and remaining "quiet" while on the spawning grounds (Table 1, Topic 7, and Table 3, Topic 10) were considered to be fundamental to the health of the herring populations. Some Heiltsuk fishermen have observed that spawning herring are sensitive to the presence of blood in the water; the fish will stop spawning if an animal is killed at the site. For this reason, hunting of ducks, seals, or other animals feeding on herring spawn was not permitted at the spawning locations (Table 3, Topic 11). Harvesting clams both during and after herring had spawned was also discouraged, as the clams were considered contaminated from the spawn (Table 3, Topic 12).

The ancient tradition of trading whole herring and herring roe was integral to the maintenance of inter- and intra- group relations (Table 3, Topic 13). The earliest recorded European observation of Heiltsuk fishermen trading herring was in 1793 when Alexander Mackenzie noted Heiltsuk people trading "cedar-bark, [herring] fish-spawn, copper, iron, and beads" with the Nuxalk of Bella Coola (Lane 1990). The fish was, and remains, a valuable product for trade and sale (Harris 2000). The traditional Heiltsuk management system for Pacific herring created a strong foundation for the Heiltsuk economy and general wellbeing of the people (Lane 1990; Harris 2000).

In recent times, members of the HTC and HIRMD established new management strategies in response to the observed decline of herring abundance, distribution, and viable spawning habitats (Table 2). These strategies reflect the coupling of recent local observations of herring ecology with the deep-time knowledge from Heiltsuk ancestors (Table 4). Many of the strategies (Table 3 and Table 4) align with principles of ecosystem-based management (EBM) for fisheries proposed by DFO, because they require the consideration of impacts to target species, non-target species and their surrounding ecosystems, as well as the role of climate change, predation, competition, and other risks (DFO 2009b). For HTC, contemporary aboriginal stewardship embodies an integrated, ecosystem-based approach to fisheries resources management, where the manner, amount, and allocation of harvest are regulated within the local community, in a geographically specific manner, and with reliance on the traditional ecological knowledge passed down from generation to generation (Lane 1990; HTC 2005). The strategies for herring management listed in Table 4 align with the four guiding principles

outlined in the Marine Use Plan for the central coast, BC (CCFN 2015). Specifically, (1) ensure conservation of natural and cultural resources, (2) ensure central coast First Nations' priority access to resources for cultural and sustenance use, (3) enable appropriate central coast First Nations' commercial use of resources, and (4) enable appropriate non-First Nations' commercial and recreational use of resources (CCFN 2015). Once the herring stocks have been allowed to rebuild, Heiltsuk and non-Heiltsuk commercial fisheries may be possible in some areas of Heiltsuk traditional territory (The Tyee, 3 April 2014). As stated by HTC executive director Marilyn Slett, "Heiltsuk Nation is in no way opposed to commercial fishing, but it can't support a fishery that isn't viable" (The Tyee, 3 April 2014).

Table 4 Recent Management Strategies for Pacific Herring

#	Strategies	Sources
1	There should be no "kill-fisheries" in Heiltsuk traditional territory until the stocks have been allowed to rebuild; only FSC and spawn on kelp harvest in designated areas.	Housty et al. 2014; Interview Data: H.H. May 2013; Brown and Brown 2009
2	Out of an understanding of recent declines in herring abundance and distribution, certain ocean areas should be off-limits to some, or all, herring harvesting activities.	Housty et al. 2014; Interview Data: G.W. May 2013; P.W. September 2014
3	Closed ponds result in higher mortality rates; only open-pond spawn on kelp systems should be used in Heiltsuk territory.	Interview Data: G.W. May 2013
4	Conservation of herring is a high priority for the Heiltsuk. Herring must be sustained to maintain and safeguard Heiltsuk well-being and direct connection to their territory and resources.	HTC 2005; Interview Data: P.W. September 2014; W.H. June 2014

3.3. Colonial Institutions and Impacts: Disruptions to the Heiltsuk-Herring Relationship

There were major structural changes to many First Nation societies following European contact in the 18th century (Parsons and Lear 1993; McCormick 1996). By the late 1700s, Heiltsuk communities were significantly affected by these social and environmental transformations (Figure 2) (Harkin 1996). Between 1775 and 1889, roughly 80% of the Heiltsuk population died as a result of pandemic diseases, notably

smallpox, influenza, measles, and tuberculosis (Tolmie 1963; cf. Boyd 1999). The majority of the survivors amalgamated at the village of Bella Bella (Waglisla), on Campbell Island, BC in the late 1800s (Lane 1990; Tolmie 1963). A wealth of traditional knowledge about herring and other aspects of the social-ecological system was lost and the land-tenure system was shaken by the dramatic declines in the Heiltsuk population (Harkin 1996; Turner et. al. 2008).

The implementation of the *Indian Act* in 1876, and the *Potlatch Law* in 1884 by the Canadian federal government caused additional dissonance within the social systems of coastal First Nations (Haig-Brown 1988; Cole and Chaikin 1990; Simpson 2004). These acts and associated laws challenged Heiltsuk paradigms of authority, land-tenure, and most importantly, Gvi'ilas. By 1890, many Heiltsuk children were forced to leave Bella Bella to attend residential schools across the Pacific coast (Harkin 1993). The transmission of LTEK acquired over millennia (e.g., knowledge of herring seasonality, spawning locations, harvesting technologies, and ecological indicators) was hindered by these social developments (cf. Simpson 2004).

In 1876, the federal government authorized the first commercial harvest of herring as a bait fishery (Powell 2012). In 1906, DFO established the *Fisheries Act*, which created more regulations for the fisheries and changed the structure of the licensing system, including the intentional exclusion of many First Nations fishermen (Parsons and Lear 1993; Harris 2000). By the early 20th century, the herring industry witnessed the emergence and subsequent collapse of the reduction fishery (Parsons and Lear 1993; DFO 2011). During the years of the reduction fishery (1937-1967), herring were caught in large quantities and indiscriminately processed into fishmeal and oil (Parsons and Lear 1993; DFO 2011). DFO closed the reduction fishery from 1968 until the early 1970s to allow herring stocks to rebuild (DFO 2011).

Following the partial recovery of the stocks, DFO initiated the sac roe fisheries in 1972 and the spawn on kelp fisheries (SOK) in 1975 (DFO 2011). The sac roe fisheries target unfertilized "pre-spawn" egg sacs that are removed from the female herring and shipped overseas; the carcasses are processed into fishmeal (DFO 2013). In contrast, SOK fisheries target the fertilized eggs that have been deposited on kelp suspended in the water column, and the females are not harvested (DFO 2013). Both the sac roe and SOK fisheries remain in operation today (DFO 2013). By the early 1980s, the SOK

fisheries became increasingly economically viable (Harris 2000). Heiltsuk fishermen wanted to participate in the fisheries, but the HTC did not have enough licenses allocated to it from DFO to support all of them; many fishermen became "deckhands" for other larger companies (e.g., BC Packers) as a result (pers. comm. Steve Carpenter, September 2011). HTC requested more SOK licenses during the 1980s to help the fishermen of their community escape poverty, but they were denied by DFO (Harkin 1997; Harris 2000). By the late 1990s, as a result of the *R. v. Gladstone* (1996) decision, DFO began allocating additional SOK licenses to the HTC, and HTC was responsible for allocating these licenses to Heiltsuk herring fishermen. Unfortunately, resource allocation remained increasingly difficult with several resource users, and less fish to go around (Harris 2000).

3.4. Resistance and Protest

By the late 19th century, several First Nation fishermen in British Columbia were circumventing the law in an effort to overcome the poverty they had faced over the last century (Harkin 1997; Harris and Millerd 2010). In 1988, Heiltsuk brothers William and Donald Gladstone were arrested for selling herring SOK in Richmond, BC without a proper federal fisheries license (a J-license). The Gladstone brothers disputed the charges and the case ended up in the Supreme Court of Canada, where the court ruled that the licensing system was an infringement of the Heiltsuk constitutionally protected Aboriginal rights to harvest and trade SOK (*R. v. Gladstone* 1996). A few years before this decision, the Supreme Court had ruled in *R. v. Sparrow* (1990) that Aboriginal rights, including fishing rights, were protected under the Canadian constitution and could not be infringed upon without justification, which includes a duty to consult and accommodate the affected Aboriginal group.

First Nation advocacy of rights and title gained increasing momentum in the courts during the 20th century and this substantially affected the Heiltsuk-herring relationship. In *R. v. Van der Peet* (1996), the Supreme Court of Canada recognized that commercial fisheries could be an integral part of "a distinctive pre-European-contact Aboriginal culture." This case established the "Van der Peet Test" for determining if an Aboriginal right exists. The Gladstone brothers continued to press their own case forward through appeals to the Supreme Court of BC and the BC Court of Appeal during

this time. Ultimately, through the application of the Van der Peet Test in *R v. Gladstone* (1996), the Supreme Court of Canada recognized the Heiltsuk right to participate in the SOK fishery within the boundaries of their territory for economic purposes.

The *R. v. Gladstone* (1996) decision was seen by HTC as a monumental victory that would set a precedent for improved relationships with DFO. Unfortunately, the state-sanctioned fisheries system had difficulty adjusting to the new legal framework established by the Gladstone case and other court rulings, and while DFO and First Nation community leaders continued to meet and negotiate together, the institutionalized inertia continued.

By the early 21st century, the Heiltsuk and other coastal communities witnessed continued declines in herring biomass and repeated regional fisheries closures (DFO 2013; HTC 2014). DFO opened a commercial sac roe fishery on the central coast in 2004 despite Heiltsuk opposition. Several members of the Heiltsuk community occupied the waters of their traditional territory in protest, out of concern for the dwindling stocks. Their efforts to protest the sac roe fishery did not go unnoticed, yet they were unable to stop the commercial fishermen from obtaining most of their quota. Similar events were unfolding between the Nuu-chah-nulth and DFO on the west coast of Vancouver Island during this time. Coupling protest and court action, nine member-nations of the Nuu-chah-nulth tribal council were successful in having the BC Court of Appeal rule that the federal government must work with the Nuu-chah-nulth (and other nations) to design fisheries that meet the needs of their community, using their preferred means to fish, and in their preferred fishing areas (*Ahousaht et al. v. Canada,* 2011). A few years later, in a subsequent decision in *Ahousaht et al. v. Canada* (2014, Federal Court) DFO was prohibited from opening a commercial roe herring fishery on the West Coast of Vancouver Island during the 2014 herring season.

The *Ahousaht et al. v. Canada* (2011) and *Ahousaht et al. v. Canada* (2014) decisions should have had far-reaching implications for fisheries management, especially for members of the Gladstone Reconciliation Society (GRS), HTC, and HIRMD that were still actively seeking reconciliation based on the *R. v. Gladstone* (1996) decision. But DFO officials announced in the spring of 2015 that the agency was once again planning on opening the commercial herring fisheries on the central coast despite Heiltsuk opposition. Members of the Heiltsuk community occupied the federal agency's

office on Denny Island, BC, for several days, and were eventually victorious in having the fishery closed (CBC, The Early Edition, 2 April, 2015). These protests required considerable financial, emotional, and physical energy from all involved. Members of the GRS, HTC and HIRMD remain in ongoing conversations with DFO and industry regarding the fate of the commercial herring fisheries in their traditional territory.

Chapter 4. Discussion and Conclusions

Over at least the last 7000 years, Heiltsuk fishermen and stewards have developed specialized technologies, harvesting and management strategies, social organizations, and local economies related to Pacific herring. All of this was perpetuated through time via memory carriers such as oral narratives, landscape features, and systems of rules (cf. Barthel et al. 2003). Prior to the establishment of DFO, herring resource use and allocation within Heiltsuk territory operated solely through tribal governance systems (Lane 1990). The Canadian federal government disregarded the millennia-old indigenous herring-harvesting traditions and governance systems when it superimposed its management regime on these pre-existing systems. In the last 200 years (approximately) of DFO control, the centralized state-sanctioned management system has infringed on Heiltsuk Aboriginal rights, affecting their food security, governance systems, and the transmission and use of LTEK (Harris and Millerd 2010). Although Heiltsuk LTEK evolved in response to global changes and pressures (HTC 2005), localized strategies narrowly endured industrialization (Harris 2000). Declines in herring abundance due to pollution (cf. Incardona et al. 2015), climate change (cf. Baudron et al. 2014), and over-fishing (cf. Parsons and Lear 1993; Watson and Pauly 2001; Pikitch et al. 2012) further exacerbated the situation. Disease and declining human population levels (Figure 2), the *Indian Act*, the *Potlatch Law*, and the residential school system created additional disorder in the Heiltsuk relationship with herring over time (cf. Simpson 2004; Turner et al. 2008).

Despite colonial attempts to sever the cultural systems that encompass and define traditional herring management, some aspects of LTEK remain at the core of the Heiltsuk-herring relationship (cf. Boyd 1999; See also, HTC 2005; Brown and Brown 2009; Housty et al. 2014). Deep-time knowledge and recent observations continue to provide valuable local insights about herring abundance, distribution, and other behaviours. Management strategies born from this knowledge prescribe regionally specific actions that could potentially remedy some of the current issues affecting the

herring fisheries. Conceptualizing the Heiltsuk relationship to herring in terms of LTEK, management strategies, and social institutions and worldview enables us, as outsiders, to gain a better understanding of the dimensions of this relationship, including the broader Heiltsuk worldview, and how this relationship and worldview relate to the vision of herring resource management now promoted by HTC and HIRMD. This vision, founded on LTEK, involves the application of tangible rules and sustainable fishing strategies. HTCs vision closely aligns with DFO goals outlined in the Sustainable Fisheries Framework (DFO 2009a), the Aboriginal Fishing Strategy (DFO 2003), and the Integrated Oceans Management initiative (DFO 2011). Specifically, this involves the consideration of the fish as well as the ecosystems of which they are a part, including the effects of weather and climate change, predation, and competition with other species (DFO 2009b).

Conflicts have persisted in herring fisheries management in Heiltsuk territory, and members of the HTC, GRS, and DFO have been unable to reach agreement about reconciliation and appropriate management of the fishery (HTC 2011). The herring management goals of the HTC, GRS, HIRMD, and DFO are unachievable if pursued in isolation (Harris 2000). The HTC argues that a true joint-management arrangement - one in which Heiltsuk Aboriginal rights are honoured and respected, where decision-making power is shared equally, and where management is transparent and effective – could remedy some of the current management issues in their territory (HTC 2005). It is possible that some DFO management techniques could be coupled with Heiltsuk community based approaches to harvesting and monitoring herring, and designed as an adaptive management or “learning by doing” approach that could serve to build partnerships and community consensus. This could also allow Heiltsuk herring fishermen the opportunity to critically evaluate scientific predictions and stewardship strategies on their own terms while all parties work towards sustainable management (cf. Walters and Holling 1990; Lertzman 2009; Gunton et al. 2010).

Some members of the HTC and GRS, and the general Heiltsuk community, distrust DFO, claiming that they are “captured by industry”, “ineffective” managers, and primarily responsible for the declines in herring populations (HTC 2011). DFO management strategies for herring were developed and implemented without the input and consent of the Heiltsuk community; it is not surprising that these strategies are

perceived by community members to lack legitimacy (cf. Pinkerton and John 2008). Legitimacy must not only be founded on legality (e.g., designed according to prevailing law) but also be justified according to moral values and principles held by Heiltsuk community members (cf. Jentoft 2000).

In my own research, working in close partnership with local decision makers helped to ensure that the data gathered would be relevant, applicable, and valuable to the Heiltsuk community. The data presented in Tables 1 - 4 represent locally legitimate strategies for managing Pacific herring. This study therefore serves as an example of how DFO could potentially improve its relationship with First Nation communities by engaging in more collaborative data collection during consultation processes, and also by collaborating during the design of integrated herring harvesting plans. It is clear that in order for a herring management system to be legitimate and in line with Heiltsuk rights, conservation must be prioritized and decision-making power must be equitably shared. My research also has implications that are relevant at the global level, as it provides an example of steps that may be taken to help overcome institutionalized inertia and attain more equitable power relationships for sustainable fisheries management.

Local Heiltsuk authorities have indicated that they are willing and able to participate in marine planning processes, and they are working towards capacity building in order to implement the vision of their own Marine Use Plan (2015). The HTC vision for herring management is not a substantial departure from that of DFO, but it is more locally legitimate and founded on LTEK and principles of ecosystem-based management. Community workshops and information sessions are being planned by members of HIRMD to help individuals feel more closely linked to their landscapes and associated resources, thereby reinforcing a sense of belonging and responsibility. These key prerequisites should increase the potential for success of a decentralized management arrangement for herring on the central coast (cf. Gunton et al. 2010). Members of the HTC, GRS, HIRMD, and the broader Heiltsuk community have shown that they will not passively await the demise of the herring in their traditional territory. Heiltsuk authorities say they are committed to working with scientists, researchers, and government officials in an attempt to overcome the issues affecting their fisheries today (HTC 2014). As expressed by Heiltsuk Hemas Harvey Humchitt, “everything revolves

around the herring" and there are many directions to go from here (pers. comm. September 2014).

References

Barthel, S., with C.L. Crumley, and U. Svedin. (2013). Biocultural Refugia: Combating the Erosion of Diversity in Landscapes of Food Production. Ecology and Society 18(4):1-71.

Barrett, J.H., with A.M. Locker and C.M. Roberts. (2004). The origins of intensive marine fishing in medieval Europe: The English evidence. The Royal Society of London (271): 2417-2421.

Baudron. A., with C. Needle, A. Rijnsdorp, C. Marshall (2014). Warming Temperatures and smaller body sizes: synchronous changes in growth of North Sea fishes. Global Change Biology 20(4): 1023-1031.

Berkes, F., with J. Colding and C. Folke. (2000). Rediscovery of Traditional Ecological Knowledge as Adaptive Management. Ecological Applications 10:1251-1262.

Berkes, F., with M.K. Berkes, and H. Fast. (2007). Collaborative Integrated Management in Canada's North: The Role of Local and Traditional Knowledge and Community-Based Monitoring. Coastal Management 35(1): 143-162.

Berkes, F. (2012). Sacred Ecology. 3rd Ed. Traditional Ecological Knowledge and Resource Management. Philadelphia, PA: Taylor and Francis.

Bernard, H.R. (2006). Research methods in anthropology: Qualitative and quantitative approaches (4th ed.). Langham, MD: Altamira Press.

Bond. N., with M. Cronin, H. Freeland, and N. Mantua. (2015). Causes and Impacts of the 2014 Warm Anomaly in the NE Pacific. Geophysical Research Letters, AGU Journal, Vol. 42, Issue 9, pp.3414-3420.

Boyd, D. (2003). Unnatural Law: Rethinking Canadian Environmental Law and Policy. Vancouver: UBC Press.

Boyd, R. (1999). The Coming of the Spirit of Pestilence: Introduced Infectious Diseases and Population Decline among Northwest Coast Indians 1774-1874. Vancouver and Toronto: University of Washington Press.

Brown, F. and Y.K. Brown. (2009). Staying the Course, Staying Alive: Coastal First Nations Fundamental Truths: Biodiversity, Stewardship, and Sustainability. Victoria, BC: Biodiversity BC.

Caldwell, M. and D. Lepofsky. (2013). Indigenous Marine Resource Management on the Northwest Coast of North America. Ecological Processes 2:1-12.

Cannon, A. with D. Yang, and C. Speller. (2011). Chapter 5: Site-Specific Salmon Fisheries on the Central Coast of British Columbia. In: The Archaeology of North Pacific Fisheries, edited by: M. Moss and A. Cannon. University of Chicago Press.

Castleden, H., with V.S. Morgan and C. Lamb. (2012). "I spent the first year drinking tea": Exploring Canadian University researchers perspectives on community-based participatory research involving Indigenous peoples. The Canadian Geographer, 00:1-20.

Cleary, J.S., with J.F. Schweigert, and V. Haist (2009). Stock Assessment and Management Advice for the British Columbia Herring Fishery: 2009 Assessment and 2010 Forecasts. Canadian Science Advisory Secretariat Research Document.

Cole, D. and I. Chaikan. (1990). An Iron Hand Upon the People: The Law against the Potlatch on the Northwest Coast. Seattle: University of Washington Press.

Davis, A. and S. Jentoft. (2001). The Challenge and Promise of Indigenous Peoples' Fishing Rights – From Dependency to Agency. Marine Policy 25(3): 223-237.

Davis, A. and J.R. Wagner. (2003). Who Knows? On the Importance of Identifying "Experts" When Researching Local Ecological Knowledge. Human Ecology 31(3): 463-489.

Dei, G., with B. Hall, and D.G. Rosenberg. (2000). Indigenous Knowledge's in Global Contexts" Multiple Readings of Our World. Toronto: University of Toronto Press.

Ebbin, S. (2011). The Problem with Problem Definition: Mapping the Discursive Terrain of Conservation in Two Pacific Salmon Management Regimes. Science and Natural Resources 24:148-164.

Fedje, D. with Q. Mackie, N. Smith, and D. McLaren. (2005). Function, Visibility, and Interpretation of Archaeological Assemblages at the Pleistocene/Holocene Transition in Haida Gwaii. In: From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia. Edited by: T. Goebel and I. Buvit. USA: Center for the Study of the First Americans.

Folke, C., with S. Carpenter, B. Walker, M. Scheffer, T. Elmqvist, L. Gunderson, and C.S. Holling. (2004). Regime Shifts, Resilience, and Biodiversity in Ecosystem Management. Annual Review of Ecology, Evolution, and Systematics 35:557-581.

Gadgil, M., with F. Berkes and C. Folke. (1993). "Indigenous Knowledge for Biodiversity Conservation". Ambio, 22 (2/3): 151-156.

Garibaldi, A. and N. Turner. (2004). Cultural Keystone Species: Implications for Ecological Conservation and Restoration. Ecology and Society 9(3): 1-18.

Gerrard, A.L. (2014). Understanding the Past to Inform Future Conservation Policy: Mapping Traditional Ecological Knowledge of Pacific Herring Spawn Areas Through Time. Masters Thesis, Simon Fraser University, Department of Resource and Environmental Management.

Gratani, M., with J.R.A. Butler, F. Royee, P. Valentine, D. Burrows, W.I. Canendo, and A.S. Anderson. (2011). Is Validation of Indigenous Ecological Knowledge a Disrespectful Process? A Case Study of Traditional Fishing Poisons and Invasive Fish Management from the Wet Tropics, Australia. Ecology and Society 16(3): 25.

Gunton, T., with M. Rutherford and M. Dickinson. (2010). Stakeholder Analysis in Marine Planning. Environments 37(3): 95-110.

Haig-Brown, C. (1988). Resistance and Renewal: Surviving the Indian Residential School. Vancouver: Tillicum.

Harkin, M. (1996). Carnival and Authority: Heiltsuk Cultural Models of Power. Wiley, American Anthropological Association, Ethos 24(2): 281-313.

Harkin, M. (1997). The Heiltsuks: Dialogue of Cultures and History on the Northwest Coast. Lincoln Press.

Harris, D. (2000). Territoriality, Aboriginal Rights and the Heiltsuk Spawn on Kelp Fishery. University of British Columbia Law Review 34: 195-238.

Harris, D., and P. Millerd (2010). Food Fish, Commercial Fish, and Fish to Support a Moderate Livelihood: Characterizing Aboriginal and Treaty Rights to Canadian Fisheries.

Heaslip, R. (2008). Monitoring Salmon Aquaculture Waste: The contribution of First Nations' Rights, Knowledge, and Practices in British Columbia, Canada. Marine Policy 32: 988–996.

Housty, W.G., with A. Noson, G.W. Scoville, J. Boulanger, R.M. Jeo, C.T. Darimont, and C.E. Filardi (2014). Grizzly Bear Monitoring by the Heiltsuk People As A Crucible for First Nation Conservation Practice. Ecology and Society 19(2): 70.

Huntington, H.P. (2000). Using Traditional Ecological Knowledge in Science: Methods and Applications. Ecological Applications 10(5): 1270-1274.

Incardona, J.P., with M.G. Carls, L. Holland, T.L. Linbo, D.H. Baldwin, M.S. Myers, K.A. Peck, M. Tagal, S.D. Rice, and N.L. Scholz. (2015). Very Low Embryonic Crude Oil Exposures Cause Lasting Cardiac Defects in Salmon and Herring. Scientific Reports 5:13499.

Jentoft, S. (2000). Legitimacy and disappointment in fisheries management. Marine Policy, 24: 141-148.

Johannes, R.E. with H.T. Lewis (1993). The importance of researchers' expertise in environmental subjects. p. 104–108. In: N.G. Williams and G. Baines. Traditional ecological knowledge: Wisdom for sustain- able development. Canberra, Centre for Resource and Environmental Studies, Australian National University.

Jones, S. and L. Russell (2012). Archaeology, Memory, and Oral Tradition: An Introduction. International Journal of Historical Archaeology 16:267-283.

Kalland, A. (1994). Indigenous local knowledge: prospects and limitations. In B.V. Hansen (ed.) Arctic environment: Report on the Seminar on Integration of Indigenous Peoples Knowledge, 20-23 September 1994, Keykjavik. Ministry for the Environment (Iceland), Ministry of the Environment (Denmark), and the Home Rule of Greenland (Denmark Office), Reykjavik and Copenhagen.

Keeling, B. (2013). Quantifying the Magnitude and Mechanisms Driving Pacific Herring (Clupea pallasii) Egg Loss on the Central Coast of British Columbia, Canada. Masters Thesis, Simon Fraser University, Department of Resource and Environmental Management.

Lane, B. (1990). Harvest of Herring Spawn and Commerce in Herring Spawn by the Heiltsuk (Bella Bella) Indians of Central British Columbia from Aboriginal Times to the Present.

Lepofsky, D. (2009). The Past, Present, and Future of Traditional Resource and Environmental Management. Journal of Ethnobiology 29(2): 161-166.

Lertzman, K. (2009). The Paradigm of Management, Management Systems, and Resource Stewardship. Journal of Ethnobiology, 29(2): 339-358.

Maffi, L. (2005). Linguistic, Cultural, and Biological Diversity. Annual Review of Anthropology 34:599-617.

Marshall, C., & Rossman, G.B. (2006). Designing Qualitative Research (4th ed.). Thousand Oaks, CA: Sage Publications.

McCormick, R. (1996). The Facilitation of Healing for the First Nations People of British Columbia. Canadian Journal of Native Education 21(2): 249-322.

McKechnie, I., with D. Lepofsky, M. Moss, V.L. Butler, T.J. Orchard, G. Coupland, F. Foster, M. Caldwell, and K. Lertzman. (2014). Archaeological Data Provide Alternative Hypotheses on Pacific Herring (Clupea pallasii) distribution, abundance, and variability. PNAS 111(9): E807-E816.

Menzies, C. (2006). Ecological Knowledge, Subsistence, and Livelihood Practices: The Case of the Pine Mushroom Harvest in Northwestern British Columbia. In: Traditional Ecological Knowledge and Natural Resource Management, Ed. Charles Menzies, University of Nebraska Press.

Moller, H., with F. Berkes, P.O. Lyver, and M. Kislalioglu (2004). Combining science and traditional ecological knowledge: monitoring populations for co-management. Ecology and Society, 9(3): 2.

Morita, S. (1985). History of the Herring Fishery and Review of Artificial Propagation Techniques for Herring in Japan. Canadian Journal of Fisheries and Aquatic Sciences, 42(S1): s222-s229.

Moss, M.L. (2015). The Nutritional Value of Pacific herring: An ancient cultural keystone species on the Northwest Coast of North America. Journal of Archaeological Science: Reports (2015), http://dx.doi.org/10.1016/j.jasrep.2015.08.041

Murray, C., with K. Wieckowski, and D. Hurlburt. (2011). Incorporation of Traditional and Local Ecological Knowledge and Values in Fisheries Management. Vancouver, BC, CAN: Pacific Fisheries Resources Conservation Council, 2011. ProQuest ebrary. Web. 5 October 2015.

Parsons, L.S. and W.H. Lear. (1993). Perspectives on Canadian Marine Fisheries Management. Canadian Bulletin of Fisheries and Aquatic Sciences 226. Ottawa, ON: National Research Council of Canada and Department of Fisheries and Oceans.

Pikitch, E.K., with K.J. Rountos, T.E. Essington, C. Santora, D. Pauly, R. Watson, U.R. Sumalia, P.D. Boersma, I.L. Boyd, D.O. Conover, P. Cury, S.S. Heppell, E.D. Houde, M. Mangel, E. Plaganyi, K. Sainsbury, R.S. Steneck, T.M. Geers, N. Gownaris, and S.B. Munch. (2012). The Global Contribution of Forage Fish to Marine Fisheries and Ecosystems. Fish and Fisheries 15(1): 43-64.

Pinkerton, E., and L. John. (2008). Creating Local Management Legitimacy. Science Direct. Marine Policy 32:680-691.

Pinsky, M.L., with O.P. Jensen, D. Ricard, and S.R. Palumbi. (2011). Unexpected Patterns of Fisheries Collapse in the World's Oceans. Proceedings of the National Academy of Science, USA 108(20): 8317-8322.

Powell, M. (2012). Divided Waters: Heiltsuk Spatial Management of Herring Fisheries and The Politics of Native Sovereignty. Western Historical Quarterly 43:489-510.

Schweigert, J. F., Boldt, J. L., Flostrand, L., and Cleary, J. S. (2010). A review of factors limiting recovery of Pacific herring stocks in Canada. ICES Journal of Marine Science, 67: 1903–1913.

Simpson, L. (2004). Anticolonial Strategies for the Recovery and Maintenance of Indigenous Knowledge. American Indian Quarterly, Vol. 28, No.3/4, Special Issue: The Recovery of Indigenous Knowledge. Summer-Autumn, 2004, pp. 373-384.

Thorton, T.F., with. M. Moss, V. Butler, J. Hebert, and F. Funk (2010). Herring Synthesis: Documenting and Modeling Herring Spawning Areas within Socio-Ecological Systems over Time in the SE Gulf of Alaska. North Pacific Research Board, Project #728, Portland State University, Portland, OR).

Tolmie, W.F. (1963). The Journals of William Fraser Tolmie: Physician and Fur Trader. Mitchell Press.

Turner, N., with M. Boelscher-Ignace, and R. Ignace. (2000). "Traditional Ecological Knowledge and Wisdom of Aboriginal Peoples in British Columbia". Ecological Applications, Ecological Society of America 10(5): 1275-1287.

Turner, N., with F. Berkes. (2006). Coming to Understanding: Developing Conservation through Incremental Learning in the Pacific Northwest. Human Ecology 34:495-513.

Turner, N., with R. Gregory, C. Brooks, L. Failing, and T. Satterfield. (2008) From Invisibility to Transparency: Identifying the Implications. Ecology and Society 13(2): 7.

UBC First Nations Studies Program (2009). Aboriginal Fisheries in British Columbia. Retrieved from: http://indigenousfoundations.arts.ubc.ca/?id=1072

Walters, C.J. and C.S. Holling. (1990). Large-Scale Management Experiments and Learning by Doing. Ecology 71(6):2060-2068.

Watson, R. and D. Pauly. (2001). Systematic Distortions in World Fisheries Catch Trends. Nature 414: 534-536.

White, E.A.F. (2006). Heiltsuk Stone Fish Traps: Products of my Ancestors Labour. Masters Thesis, Simon Fraser University. Burnaby, BC.

Statutes and Regulations

Constitution Act, 1867 (UK), 30 & 31 Victoria, c 3

Constitution Act, 1982, being Schedule B to the Canada Act 1982 (UK), 1982, c11

Indian Act, R.S.C. 1985, c. I-5P

Fisheries Act, R.S.C. 1985, c. F-14

Cases Cited

R. v. Sparrow, [1990] 1 S.C.R 1075

R. v. Gladstone, [1996] 2 S.C.R. 723

R. v. Van der Peet [1996] 2 S.C.R. 507

R. v. Delgamuukw [1997] 3 S.C.R. 1010

Ahousaht Indian Band and Nation v. Canada (Attorney General), [2011] B.C.C.A. 237

Ahousaht Indian Band and Nation v. Canada (Attorney General), [2014] F.C. 197

Other

Assembly of First Nations. (2011). Co-management Discussion Paper. Retrieved from: http://www.afn.ca/index.php/en/policy-areas/fisheries-and-aquatic-resources-management1/key-issues-activities/co-management

Canadian Broadcasting Corporation. (CBC). (2 April 2015). Heiltsuk Protest Shuts Out Commercial Herring Fishermen: Four Day Protest Leads to Closure of Commercial Fishery on B.C. Central Coast. The Early Edition, CBC News. Accessed Online October 1st 2015: http://www.cbc.ca/news/canada/british-columbia/heiltsuk-protest-shuts-out-commercial-herring-fishermen-1.3019583

Fisheries and Oceans Canada. (2003). Strengthening Our Relationship – The Aboriginal Fisheries Strategy and Beyond. Retrieved from: http://www.dfo-mpo.gc.ca/fm-gp/aboriginal-autochtones/afs/afsoct03-eng.htm

Fisheries and Oceans Canada. (2007). One Fishery for All of Us. Retrieved from: http://www.dfo-mpo.gc.ca/media/back-fiche/2007/hq-ac38a-eng.htm

Fisheries and Oceans Canada. (2009a). Sustainable Fisheries Framework. Retrieved from: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/overview-cadre-eng.htm

Fisheries and Oceans Canada. (2009b). Principles of Ecosystem-based Fisheries Management. Retrieved from: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/ecosys-back-fiche-eng.htm

Fisheries and Oceans Canada. (2011). 2011/2012 Pacific Region Integrated Fisheries Management Plan: Pacific Herring. Retrieved from: www.dfo-mpo.gc.ca/Library/344588.pdf

Fisheries and Oceans Canada. (2013). 2013/2014 Pacific Region Integrated Fisheries Management Plan: Pacific Herring. Retrieved from: www.dfo-mpo.gc.ca/Library/344588.pdf

Fisheries and Oceans Canada. (n.d.). 2011-2012 Report on Plans and Priorities. Retrieved from: http://www.tbs-sct.gc.ca/rpp/2011-2012/inst/dfo/dfo01-eng.asp#s1

The Tyee. (3 April 2014). Heiltsuk Vow to Disrupt Central Coast Fisheries Reopening: Looming conflict between First Nation and feds traps herring fishermen in between. The Tyee News. Accessed Online April 4th 2014: http://thetyee.ca/News/2014/04/03/Heiltsuk-Disrupt-Fisheries/

UBC First Nations Studies Program. (2009). Aboriginal Fisheries in British Columbia. Retrieved from: http://indigenousfoundations.arts.ubc.ca/?id=107

Appendix A.

Heiltsuk Internal Documents and Grey Literature about Pacific Herring, and the broader Heiltsuk Social System, provided by the Heiltsuk Cultural Education Center, the Heiltsuk Tribal Council, and the Heiltsuk Integrated Resource Management Department

Heiltsuk Cultural Education Center (1984). English 030 Assignment "Ah-unt" by Kathy White. Bella Bella, BC.

Heiltsuk Cultural Education Center (1985). Heiltsuk Herring Roe Harvest: A Living History. Report by Anja P. Brown and Clarence Martin. Bella Bella, BC.

Heiltsuk Cultural Education Center (1989). "Keeping track of the year in Heiltsuk", Information Bulletin, Vol.1, No.1. Bella Bella, BC.

Heiltsuk Cultural Education Center (1991). Copy of Bella Bella Notes, By Franz Boas, RE: Social Rank. From Boas Collection of American Indian Linguistics, American Philosophical Society Library Film 372, Reel 1.

Heiltsuk Cultural Education Center (1997). Main Tribal Groups of the Heiltsuk. Bella Bella, BC.

Heiltsuk Cultural Education Center (2004). Chronological Timeline: Heiltsuk History at Bella Bella and Waglisla (New Bella Bella). Prepared by Jacquelyn Humchitt, "Waglisla History Project" Researcher & Community Liaison Summer Student Employment Opportunities Project 2004. Bella Bella, BC.

Heiltsuk Tribal Council (2005). For Our Children's Tomorrows: Heiltsuk Land Use Plan. Bella Bella, BC.

Heiltsuk Tribal Council (2007). Heiltsuk Spawn-on-kelp Management Plan. Bella Bella, BC.

Heiltsuk Tribal Council (2011). In The Matter of The Commission of Inquiry Into The Decline of Sockeye Salmon in The Fraser River: Closing Submissions of Heiltsuk Tribal Council. Retrieved from: http://www.cohencommission.ca/en/FinalSubmissions.php

Heiltsuk Tribal Council (2012). Heiltsuk Fisheries Management Framework Presentation. Institute on Governance. Bella Bella, BC.

Heiltsuk Tribal Council (2014). Heiltsuk Draft Marine Use Plan. Executive Summary. Bella Bella, BC.

Heiltsuk Tribal Council (2014). Heiltsuk Community Needs Study: Heiltsuk Marine Use Planning. Bella Bella, BC.

Heiltsuk Tribal Council (2014). Gathering of the Minds: A Herring Symposium. Bella Bella, BC.

Appendix B.

List of Formal Interviewees and Casual Informants

Formal Interviewees

Brown, Kelly
Brown, Rod
Gladstone, Keith
Gladstone, William
Housty, Gary
Housty, William
Humchitt, Harvey
Reid, Fred
Reid, Mike
Waterfall, Pauline
Wilson, Gary
Windsor, Evelyn

Casual Informants

Brown, Frank
Brown, Kathy
Campbell, Walter
Carpenter, Steve
Innis, Mel
Lawson, Desiree
Sandy, Jordan
Vickers, Josh
Vickers(Walkus), Andrea
White, Elroy

Appendix C.

Interview Guide: Semi-directed Interview Questions

Introductory Questions

1. Can you tell me your full name?
2. What year were you born?
3. Where did you grow up? Where do you usually live? Do you live somewhere else at different times of the year?
4. Did you ever harvest herring spawn on [substrate (e.g. on flat-kelp, hemlock, stringy-kelp)] to feed your family? Who taught you how to harvest herring spawn this way?
5. Does your family harvest from the same area each year? If not, how do you decide where to go?
6. Do you participate in the FSC herring spawn on [substrate] food fishery today?
7. Over what years did you harvest herring spawn (on substrate) and make observations about the herring spawning ground/ egg thickness/ stock behaviour?
8. How often do you harvest herring spawn on (substrate) during the spawning season?
9. Do you participate in the FSC herring spawn on [substrate] food fishery today?
10. Did/do you participate in the SOK fishery? What management areas did/do you fish?
11. Did/do you participate in the sac-roe fishery? What management areas did/do you fish?
12. Did/do you participate in the reduction fishery? What management areas did/do you fish?
13. What company(ies) do/have you work(ed) for?

Community-based Management Questions

1. Within the Heiltsuk community, who makes the rules for harvesting herring/spawn?
2. Do the ancestral laws of Gvi'ilas inform the rules? If so, how?
3. How did the implementation of the state sanctioned fishery affect how the community made decisions about **who** could harvest herring/spawn? (i.e. Decisions about distribution of FSC, or fishing licenses) How did this change over time? (a) During the reduction fishery (1937-1967), (b) During the sac roe fishery (1972), (c) Commercial SOK fishery (1975)
4. If someone has access rights/ license to harvest herring/spawn, can they transfer their license/rights?
5. How did the implementation of the state sanctioned fishery affect how the community made decisions about **where** people could harvest herring/spawn? How did this change over time?

6. How did the implementation of the state sanctioned fishery affect how the community made decisions about **when** people could harvest herring/spawn? How did this change over time?
7. How did the implementation of the state sanctioned fishery affect how the community made decisions about **how much** herring/spawn people could harvest? How did this change over time?
8. How did the implementation of the state sanctioned fishery affect how the community **traded** herring/spawn with other First Nations, and international buyers? How did this change over time?
9. Who is responsible for enforcing the rules of the fishery among community members? How is this done?
10. What are the sanctions for breaking the rules? (Today vs. in the past)
11. Who is responsible for monitoring the condition of the herring stocks?
12. What are the signs that you would use to tell if herring stocks in an area were healthy or if they were in trouble?
13. What do we need to monitor to ensure that herring spawn on (substrate) is being harvested in a sustainable way?
14. Do you know of any herring stock enhancement practices that were used traditionally? (i.e. transplanting boughs)
15. What do you think are the concerns (risks) and benefits of re-opening a commercial SRF/SOK fishery? How do you think we can minimize the concerns (risks) that come with a commercial fishery?
16. What do you think are the concerns (risks) and benefits of maintaining a food (FSC) fishery? How do you think we can minimize the concerns (risks) that come with a food (FSC) fishery?
17. How do you think the Pacific herring fishery should be managed? What do you think are the key characteristics of a well-managed Heiltsuk SOK fishery?
18. If the current closure for the commercial (SRF/SOK) Pacific herring fishery in the central coast management area is opened, what do you think are the most important factors to consider before that can happen?
19. Are there particular areas that you feel should be considered as Pacific herring spawning ground stewardship and food fishing areas?
20. Are there areas that you feel should be protected from any harvest? Why?
21. How do you envision people and Pacific herring co-existing today and into the future?
22. How well do you think the current herring-management system functions? What, if any, problems do you think are the most important?
23. Is there anything else you would like to tell us?