



Hawai'i Bottomfish Heritage Project: Traditions and Fishery Development

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EXECUTIVE SUMMARY

This report synthesizes the qualitative analysis of oral histories collected for the Hawai‘i Bottomfish Heritage Project. The Hawai‘i Bottomfish Heritage Project is a collaborative effort between the Hawai‘i bottomfish community, the Western Pacific Regional Fisheries Management Council, the Pacific Islands Fisheries Group (PIFG), and Pacific Islands Fisheries Science Center (PIFSC). The purpose of this study was to document local fisheries knowledge and cultural heritage for the bottomfish community, resource users, and fisheries managers. Findings contribute to the broader understanding of changing conditions over time and can be used to inform the sustainable management of the fishery.

In early 2017, PIFG conducted 46 individual and group oral history interviews with 57 bottomfish fishermen using a semi-structured interview format. Use of an interview guide allowed for collection of qualitative data that could be compared across multiple interviewees while allowing participants to speak to their personal experiences. Video ethnography was used to visually capture interviews, and select “*Fisher Highlight*” videos will be made publicly available and uploaded to the NOAA Voices from the Fisheries Database.¹ Interviews were transcribed verbatim to allow for qualitative analysis and ensure participant’s stories were fully captured. Copies of interviews and transcripts were also provided to project participants.

Thematic coding of interview transcripts was conducted using NVivo 12 Mac. Final analysis resulted in 13 major themes with 38 supporting subthemes to illustrate the full breadth of findings within the analysis. A complete list of thematic findings and coding rationale has been provided in a coding rubric at the end of this report. Academic literature and previous socio-economic assessments of the bottomfish fishery have been reviewed and used to frame and triangulate findings where applicable throughout the report. Findings aim to summarize the knowledge, culture, and traditions of local fishing communities on the islands of Maui, Hawai‘i, Kaua‘i, and O‘ahu from the participants’ perspectives. In an effort to effectively describe the collective experiences of the bottomfishing community, results have been organized under three larger categories: *Cultural Identity*, *Evolution of Bottomfishing*, and *Community Resilience*.

The first section of the results, *Cultural Identity*, highlights factors leading to cultural identity including motivations for bottomfishing, the practice of giving away fish, and concerns about the public perception of fishermen. Giving away fish was referenced by most participants as a predominant fishing motivation, often superseding the practice of selling fish, which demonstrates the dominant role of fish in maintaining the cultural identity of the bottomfish community. Other fishing motivations (e.g., income, food, fishing for fun, relaxing hobby) varied depending on the participant’s self-reported status as a full-time, part-time, or recreational fisherman and the personal timeframe for which a motivation is referenced (e.g., early career, post-retirement).

The second section of the results, *Evolution of Bottomfishing*, sought to describe broader community changes (e.g., advancements in technology, changes in fleet dynamics, regulatory changes due to depleting fish stocks) and how the bottomfish community has adapted to such

¹ This collection is available at <https://voices.nmfs.noaa.gov/collection/hawaii-bottomfish-heritage-project>.

changes while maintaining its cultural identity. “Changes in technology” was a prominent theme found within the data, described most frequently as the advent of navigation technologies (i.e., Loran-C and GPS). Participants had varying perspectives, both positive and negative, of what this means for bottomfishing and the future of the fishery. Many believed that advancements in technology may be to blame for a shift in knowledge sharing practices due to reduced dependence on community members for information exchange when new people enter the fishery.

The third section of the results, *Community Resilience*, highlights the resilience of the bottomfish community to external changes and stressors. Community resilience is strengthened by social networks and the passing of local fishery knowledge, which have been referenced as ‘community connections’ within the results. Community connections are defined as the ways individuals connect with other fishermen and the wider community. Community ties among project participants appear to be island-specific, with few instances of sharing knowledge between Hawaiian Islands. Participants alluded to a delicate balance between sharing and protecting local fishery knowledge within their own communities, primarily due to the increased use of navigation and plotting technologies (mentioned above) and the ease by which fishing location information can be gleaned while on the water through technology such as GPS.

Participants frequently spoke of external pressures such as weather, markets, and regulatory changes as drivers in dictating when, where, and how often to go fishing. When discussing regulatory changes, participants were most vocal regarding fishery closures (i.e., Bottomfish Restricted Fishing Areas (BRFAs) and closure of the Northwestern Hawaiian Islands (NWHI)) and how closures have impacted the fishery due to increased fishing pressure on fewer fishing areas. These observations support previous work that has shown negative socio-economic impacts associated with the loss of fishing grounds can result in loss of confidence with fishery managers and lower levels of regulatory compliance or cooperative behavior.

This summary of findings illustrates the dynamic nature of the fishery and variations in how social phenomena are experienced. Findings presented in this report attempt to recognize variations in experience between individuals and island communities to avoid overgeneralization of the larger Hawaiian bottomfish community.

Oral histories serve as a resource for the Hawai‘i bottomfish community as a form of cultural preservation and knowledge transfer for future generations. When properly analyzed, they can also serve to document the collective experiences of an entire community for consideration in future fishery management plans, as required under the Magnuson-Stevens Fishery Conservation and Management Act. The Hawai‘i Bottomfish Heritage Project could serve as a model for future research if there is interest from managers or the fishing community to better understand historical perspectives and thoughts on the future for regional fisheries.

INTRODUCTION

The Hawai‘i bottomfish fishery is a unique small-scale fishery with rich traditions and strong social, cultural, and economic importance to the people of Hawai‘i (Hospital and Beavers 2012; Severance 2010). Marine resource use, knowledge, and management in Hawai‘i date back to pre-contact Hawaiian societies, which was documented by Native Hawaiian scholars in the late 1800s and later by nonindigenous scholars spanning from 1908 to 2006 (Friedlander et al. 2013). More recent efforts to describe the history of the bottomfish fishery (Moffitt et al. 2008; Morioka and Yamada 2014; Williams 2014) have provided comprehensive reviews of regulatory changes and impacts, fishing effort, and biophysical characteristics. Although these studies include a historical perspective reflecting human dimensions of the fishery and evolution of fishing practices, a more thorough documentation of how modern-day traditions and cultural practices are influenced by changing social, economic, and environmental conditions is needed.

In 2016, the Pacific Islands Fisheries Group (PIFG), Pacific Islands Fisheries Science Center (PIFSC), Western Pacific Regional Fishery Management Council, and members of the Hawai‘i bottomfish community launched a cooperative research proposal in an effort to address this knowledge gap. The Hawai‘i Bottomfish Heritage Project was born out of this collaborative effort to document the modern-day traditions, culture, and evolution of the Hawai‘i bottomfish fishery using local fishermen as a source of first-hand knowledge.

Key objectives of the Hawai‘i Bottomfish Heritage Project:

- Develop a bottomfish fishing “family tree” to visualize knowledge transfer over time;
- Document local knowledge and changes in fishing techniques, including rotation of fishing spots and introduction of new technologies;
- Understand adaptations to weather, climate, and regulatory regimes;
- Detail individual-level gear innovation; and
- Record aspects of culture, practices, and traditions specific to modern-day bottomfish fishing, including social and cultural sharing of catch.

Using the above research objectives as a guide, the purpose of the Hawai‘i Bottomfish Heritage Project was to document this knowledge by collecting oral histories from expert fishermen to improve understanding of changes in the fishery over time. These could allow for consideration of traditional values and local knowledge in fishery management programs, improve our interpretation of historical commercial catch data, and support sustainable management for the future. Additionally, and perhaps most importantly, documenting oral histories supports the preservation of traditional and local knowledge that is often lost as elders in the fishery or community pass away. Preserving historical knowledge can reinforce the cultural connection to the bottomfish fishery and marine environment, which can serve to sustain cultural pride and marine resource stewardship by future generations (Friedlander et al. 2013).

Native Hawaiian fishing practices and traditions have been well documented (Jokiel et al. 2011) and there is evidence of these techniques in the modern-day bottomfish fishery (Spalding 2006). The term ‘traditional’ used in the context of this report is meant to describe the evolution of fishing techniques and gear as illustrated by interviewees over the span of their lifetimes. To describe the passing of knowledge and techniques among fishing community members, the term

“local fisheries knowledge” is used to describe historical knowledge tied to the Hawaiian Islands, acquired over a single lifetime and/or passed down through generations.²

The results of this study aim to document and describe the evolution of the modern-day bottomfish fishery using a comprehensive qualitative data analysis of the transcribed oral history interviews collected for this project.

² https://www.st.nmfs.noaa.gov/lfkproject/02_c.definitions.htm

METHODS

In 2017, the Pacific Islands Fisheries Group (PIFG) conducted a total of 46 semi-structured individual and group oral history interviews with 57 Hawai‘i bottomfish fishermen on the islands of Maui, Hawai‘i, Kaua‘i, and O‘ahu ([Table 1](#)). Interviews conducted on Hawai‘i Island have been further categorized by community (i.e., Hilo and Kona).

Table 1. Communities and number of participants interviewed.

Kaua‘i	n = 7
O‘ahu	n = 20
Maui	n = 14
Kona (Hawai‘i)	n = 9
Hilo (Hawai‘i)	n = 7
Total Participants	n = 57

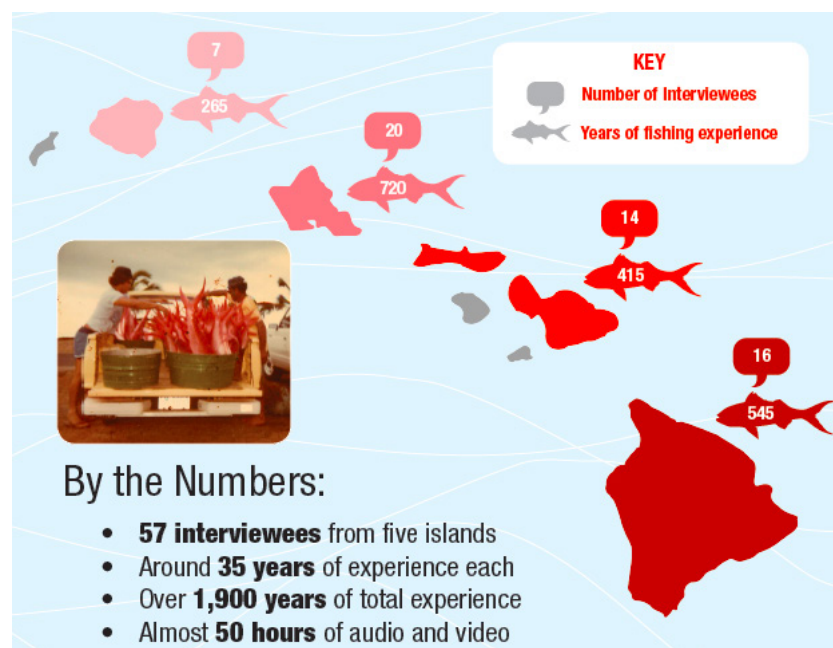


Figure 1. Project infographic describing interviewee statistics.

Participant Recruitment and Data Collection

Participants were recruited by the Pacific Islands Fisheries Group. In an effort to document local fisheries knowledge before it is lost, purposive sampling of older fishermen was used to target an older demographic; however, younger fishermen were not excluded which resulted in a subset of interviews with individuals under the age of 50 ([Table 2](#)). Convenience sampling of O‘ahu

fishermen occurred due to limitations of project resources, location of principal investigators, and higher population of bottomfish fishermen on O‘ahu, resulting in 20 of 57 participants representing communities around O‘ahu. In addition to individual interviews, two group interviews were conducted in Maui to document the history of the Maui Cooperative Fishing Association. Of the 46 interviews, 45 were transcribed verbatim resulting in 2,246 pages of qualitative data. The omitted interview was not transcribed due to communication issues as first language assistance was not available at the time of the interview.

Table 2. Participant demographics

Age category	Number of Participants	Percent of Participants
<50 years	10	17%
50–70 years	26	46%
>70 years	21	37%
Total	57	100%

Oral history methodology was used to conduct interviews that allowed participants to talk freely through their history and lived experiences. Oral histories preserve traditional knowledge and document changes over time. Further, this type of social science methodology can support fisheries social impact assessments to help guide management and policy decisions (Calhoun et al. 2016; Colburn and Clay 2012).

“Separately, each history provides an in-depth view into the professional and personal lives of individual participants. Together, they have the power to illuminate common themes, issues and concerns across diverse fishing communities over time. The Voices from the Fisheries Database is a powerful resource available to the public to inform, educate, and provide primary information for researchers interested in our local, human experience with the surrounding marine environment.”³

To better understand and document changes in the bottomfish fishery over time, a semi-structured interview template (Appendix A) was used to guide interviews. Interview themes were developed collaboratively by PIFSC principal investigators, project partners, and bottomfish fishermen. Initial interview themes included: (a) deriving a Hawai‘i bottomfish family tree, (b) changes in gear, technology, fishing methods and their relationship to catch rates, (c) timing of potential shifts in fishery knowledge with the loss of fishery elders/highliners, (d) perceived changes in weather, targeting, size-selectivity, species composition, and perceptions of abundance.

In an effort to create a Hawai‘i bottomfish family tree, additional forms were completed by participants to provide names of individuals that taught them to fish, who they fished with, and who they have or are currently teaching to fish. A social network analysis was completed using these participant forms, interview transcripts, and initial coding of themes related to community

³ NOAA Oral history database. Retrieved March 9, 2020, from <https://catalog.data.gov/dataset/oral-history-database>.

connections and passing of knowledge. Sociograms were created to visualize the transfer of knowledge between interview participants and island communities (Appendix B).

Data Analysis

NVivo 12 Mac (QSR International) was used to organize, manage, and analyze the interview data. A deductive approach to coding was initially used to group relevant text suggested by the interview questions and research objectives (Appendix C). Using Glaser and Strauss' (Glaser and Strauss 1967) method of grounded-theory coding, an inductive approach was also used to generate repeating ideas and themes directly from the data. A second round of groupings was completed to refine the preliminary codes according to grounded theory discovery (Miles et al. 2014) and produce the narrative described within the results below. Project metadata is available through the NMFS InPort enterprise management system (PIFSC 2019).

LITERATURE REVIEW

A Brief History of the Hawaiian Bottomfish Fishery

The Hawai‘i bottomfish fishery is a hook-and-line fishery with rich traditions and strong social, cultural, and economic importance to the people of Hawai‘i (Friedlander et al. 2013; Glazier et al. 2013; Hospital and Beavers 2014; Severance 2010). The Hawai‘i Bottomfish Management Unit Species complex consists of 14 species. Seven species (the Deep 7) are the most economically and culturally important; therefore, the fishery is managed by this Deep 7 complex (see Appendix D). Fishery techniques can be traced to Native Hawaiian populations demonstrating harvesting patterns of the same deep-water species (Spalding 2006). However, changing economies, regulatory patterns, social structures, and environmental conditions have resulted in a constantly evolving industry. Today’s bottomfish fishery represents a mix of commercial, recreational, and subsistence fishermen often claiming more than one motivation for fishing (Hospital and Beavers 2011).

In the 1940s and 50s, the bottomfish fishery was characterized by full-time fishermen, with vessel sizes ranging from small day-trip canoes to larger sampans⁴ that allowed fishermen to fish multi-day trips in harsher seas (Moffitt et al. 2008). With the advent of newer materials and technologies in the 1960s and 70s, boats transitioned from the more traditional large wooden sampan boats to more efficient fiberglass boats that could be easily trailered. Bottomfishing became less of a full-time career and the fleet saw an increase in part-time fishermen (Moffitt et al. 2008; Morioka and Yamada 2014). Evolution of boats and the resulting ability to fish unfavorable weather conditions also led to an increase in the amount of time that could be spent bottomfishing—deep ocean fishing became less dictated by the weather and more so by the markets.

Morioka and Yamada (2014) reference the 1970s as the beginning of the fishery evolution due to the introduction of GPS and hydraulic pullers. Though fishing techniques had remained relatively the same over the past 70 years, efficiencies in fishing practices were gained with advances in technology. Navigation technologies and depth finders allowed fishermen to find and return to productive fishing grounds much faster than traditional techniques such as ‘landmarking’ (described in the Evolution of Bottomfishing section of the Results), although landmarking is still used as well. In addition to finding fishing grounds more efficiently, power-assisted line hauling, such as hydraulic pullers or electric reels, have increased the number of drops an individual can complete in a given fishing session (Moffitt et al. 2008). These advances in technology are not unique to the Hawaiian bottomfish fishery; however, they may play a significant role in altering fishing practices and interdependent community connections that are unique to the fishery.

The Hawai‘i bottomfish fishery has undergone various shifts in management due to overfishing, stock depletion, and establishment of the Papahānaumokuākea Marine National Monument (PMNM) in 2007 (Kikiloi et al. 2017). The bottomfish fishery, once an open access fishery, is now subject to bottomfish restricted fishing areas (BRFAs) and an annual catch limit (ACL). However, there are concerns from the fishing community that changes in the fishery are not

⁴ A wooden-hulled fishing craft design introduced by Japanese fishermen in the early 1900s (Pooley 2006).

accurately reflected in current stock assessment models (Morioka and Yamada 2014), resulting in low levels of satisfaction with state and federal management (Hospital and Beavers 2011).

Human Dimensions of the Hawaiian Bottomfish Fishery

Socio-economic and cultural studies have been conducted on the bottomfish fishery dating back to the early 1970s (Hau 1984; Titcomb 1972) with earlier studies documenting Native Hawaiian fishing practices and social norms back to the late 1800s (Friedlander et al. 2013). A more recent literature review was conducted at the request of the Western Pacific Fishery Management Council in 2014 (Williams 2014) to document a ten-year span (2004–2014) of research on the bottomfish fishery. This particular review found twenty-four publications specific to the bottomfish species, habitat, and fishery in Hawai‘i with only four publications representing the human dimensions of the bottomfish fishery. The review conducted by Williams supports the need for continued human dimensions research to document and support the socio-economic and cultural significance of the bottomfish fishery.

U.S. fishery regulations require the inclusion of socioeconomic data for consideration within fisheries management plans through the Magnuson-Stevens Fishery Conservation Management Act National Standard 8 (16 U.S.C. § 1851 (a)(8)). The majority of socioeconomic studies conducted on the Hawai‘i bottomfish fishery have been completed by the Pacific Islands Fisheries Science Center (Hospital and Beavers 2011, 2012; Hospital and Beavers 2014; Pan and Griesemer 2006). These studies focused on the realized and potential impacts of regulatory changes on local communities to support the “sustained participation of such communities” (16 U.S.C. §1851(2)(8)) and highlight the varied motivations (beyond income) for participating in the fishery. A special issue of *Pacific Science* (vol. 67, no. 3) on the Human Dimensions of Small-Scale and Traditional Fisheries in the Asia-Pacific Region (Kittinger 2013) further explores the cultural aspects of social organization (e.g., sharing of seafood, fisher classification, and cultural perpetuation via social networks) within the bottomfish fishery to help inform fishery managers of community-based resource allocation practices (Allen 2013; Friedlander et al. 2013; Glazier et al. 2013; Vaughan and Vitousek 2013). Combined, these studies emphasized the cultural uniqueness and significance behind fisher participation.

The above cited literature highlights numerous studies aimed at understanding the Hawaiian bottomfish fishery—socially, economically, and culturally. Many, if not all, of the authors reference the cultural significance of the fishery to Hawaiian communities, and benefits of considering cultural customs and local knowledge in fishery management efforts. The findings presented in this report are meant to reflect the knowledge, culture, and traditions of local fishing communities on the islands of Maui, Hawai‘i, Kaua‘i, and O‘ahu from the participants’ personal, lived experiences. Additional references have been included within the results section to frame thematic findings and allow participant’s lived experiences to groundtruth findings within the literature.

RESULTS

The following results reflect the complexities and dynamic nature of the Hawaiian bottomfish fishery. For example, project participants mentioned various classifications to describe fishing practices that ranged from full-time commercial, part-time commercial, recreational, subsistence, to sharing of catch. Classification of bottomfish boats ranged in size from 14 feet to 50 feet and have evolved over time from traditional wooden sampans to modern fiberglass boats. Some participants claimed to only fish bottomfish while others participate in multiple fisheries. Reasons for participating in the bottomfish fishery ranged from lifestyle or cultural reasons to strictly financial reasons. Fishing techniques varied by individual and community, often driven by weather conditions and currents (e.g., conditions conducive to certain species, determining whether to use techniques such as drifting vs. anchoring) or as a result of maintaining traditional practices. Changes in technology was a prominent theme found within the data, causing a shift in the way fishing is performed. Participants had differing views of what this meant for bottomfishing and the future of the fishery. This subset of responses exemplifies the diverse and dynamic nature of the fishery and variations in how social phenomena are experienced.

In an effort to effectively describe the collective experiences of the bottomfish community, the results have been organized under three larger categories: *Cultural Identity*, *Evolution of Bottomfishing*, and *Community Resilience*. Verbatim quotes from interview transcripts have been used to accurately represent the voices of the bottomfish community and account for variations in experience. To protect interviewee identity, quotes have been attributed by island and a unique source ID.

Thematic coding of interview transcripts resulted in 13 major themes and 38 supporting subthemes meant to illustrate the full breadth of findings within the analysis. The coding rubric includes a description of each theme and can be found in Appendix E.

Cultural Identity

No, by far, bottom fishing is what defines who I am, and I'm just trying to carry it on for my grandfather and my dad. And you know, that's definitely -- that's what I want to do and that's what I love to do. And it's my livelihood. So I guess I don't really have a choice. – Maui, MA127

Reason for Bottomfishing

Themes reflecting reasons for bottomfishing and self-identification represent the overlapping motivations for fishing often indicative of small-scale and subsistence fisheries (Allen 2013). Most participants had multiple reasons for bottomfishing and often highlighted fishing as “a way of life.” There does not appear to be a consistent pattern in the use of terms (i.e., full time, part time, subsistence, recreational), though part-time and full-time designations were most common. Some referenced part-time and recreational fishers as “weekend warriors.” Other fishing motivations were referenced as “fishing for fun,” “giving away fish to eat,” “supporting family,” and “paying expenses.” Each of these motivations represents a varying level of fishing activity and may be associated with full-time, part-time, subsistence, and/or recreational fishing.

My number one objective was to get fish to give away. And my number two objective -- well, I guess, number one is to eat. Number two, the extra, give away. And I rarely sold my bottomfish because I wasn't going out and catching big numbers. But if I did end up with large numbers, then I would sell it, and that was primarily to just make up some expenses. – Hilo, HI105

I enjoy the ocean. I grew up fishing, you know, starting from small kid time with a bamboo pole. Then you progress into diving. I was mostly a diver until I got the boat. Then I enjoyed the boat. I enjoyed the company of the boat club people. And, you know, I enjoyed the sharing. – O'ahu, OA141

Well, when we first started out it was subsistence, yeah. As far as financial and food for the home, and sharing. So we give away more fish than we're selling. So at that time, I don't know if -- well, it was like our culture, tradition, that we give away. – Maui, MA122

And then I'm not trying as hard as I used to because I don't have the incentive where I'm going to make, you know, X amount of money off Y amount of pounds. I know if I'm going to go, it's going to be great. I'm going to have a nice time, and stuff. But I don't look at it as like that drive to earn, which previously was there when I was a little younger, you know. – Kaua'i, KA111

Some fished predominantly for financial reasons, as a career choice.

Onaga paid for our house, paid for our car, sent me to college all at the same time. - O'ahu, OA143

I had a wife and kids, so that was my income, commercial fishing. So we'd keep the fish that weren't high value or one that had a shark bite, or something, or a little baby mahi mahi that we wouldn't get paid much for, that's what we'd bring home. – Kona, KO116

I've been bottom fishing for about 30 years full time, and a lot of guys do it as a supplement to their income. I did it as my main income. So it's hard to make a living full-time bottom fishing. The only way I could do it was to take it to the next level and go to the northwest. – Maui, MA125

Due to the larger subset of older participants interviewed for this study, there were numerous instances of participants only fishing recreationally for fun, for food, or to relax.

I'm 76 years old. So, you know, I'm stretching my luck, but I want to stay healthy. So that's why I want to go, keep on going, do as much as I can, you know, as long as I can. – Hilo, HI103

We're not hustling like before, yeah. We just catch our kau kau⁵ fish and we're happy, and after that, lucky, lucky. The main thing is something to eat when you go home.
– Kona, KO115

Sharing of catch was another primary motivation for fishing, often combined among other reasons like individual subsistence, recreational fishing with friends, and even in cases where fishing was economically driven. Giving away fish is a predominant fishing motivation unique to the region, often superseding the practice of selling fish within this particular group of fishery participants.

Giving Away Fish

The practice of giving away fish was documented across all communities. Sharing fish was often referenced as instilling a sense of cultural pride in doing the right thing and providing for the community or elders. Primary reasons for giving away fish varied; some mentioned promoting fish to those who are not familiar with it, trading fish for maintenance or another service, providing for the family, a friend's celebration, or giving to those that cannot catch fish themselves.

I kind of learned a little bit of that from my dad in the local culture here of just -- you know, you always give your neighbors. That's just a really important thing, your neighbors and your friends. And I've always done it. So instead of buying everybody Christmas presents, I'll go catch fish and, you know, it's easy. It's easy for me and makes me feel good and everybody's pumped. – Hilo, HI104

Well, we've always been giving away. You know, you see how happy people are because quite often they can't afford it. And generally, especially they don't buy the red ones. So I feel like if I can give away onaga and ehu and people learn about onaga and ehu, they might buy one sometime. – O'ahu, OA143

Because part of that was I know a lot of fishermen don't talk about it, but for me, I feel really proud to be a fisherman like this, that I can catch this fish, I can provide fish for people to eat, people who can't go fishing, who can't catch fish. – O'ahu, OA140

The extent of giving away fish in the bottomfish fishery has been documented by Hospital et al. (2011), which found that “97% of 343 surveyed small-boat fishermen participated in fish sharing networks”. This finding extends to commercial fishery highliners where nearly 15% of catch is retained for participation in traditional fish-sharing networks and customary exchange (Hospital and Beavers 2012).

And in those days, we never sold a fish. We fished all day and we come back in. It was like a party every time. They had the rice. They had the guys making the vegetables, everything ready, the fire going. The fish would go right on the fire, and everybody sit down and drink and eat. – Maui, MA120

⁵ Hawaiian word meaning “to eat” or “food.”

... when I started in the '80s, generally, I'd say about 75 percent went to the market, keep some to give my family and friends, that's mainly 25 percent... Whatever mom wanted to eat, that's what didn't go on the market. And we do like at least one trip just before New Year's, and whatever we catch, the whole load, we just give it away. So I think the most we gave away, one year was almost like 1,000 pounds we gave away. – Hilo, HI107

Public Perception of Fishermen

Though not a high-frequency theme within the data, reflections on how the public perceive fishermen was mentioned enough times it was worth noting. The consensus among participants was that the public viewed fishermen negatively, as unforgiving bandits of the sea. This notion is contradictory to the feeling of pride when providing food for the community. Some mentioned a need for increased understanding about the practice of bottomfishing to confront misconceptions about the role of “fishermen.”

Well, just people -- maybe some people, they don't like the fishermen, the way we do things, or whatever. But they need to be more educated..., to really know what's going on out there. We're not on big ships and processing – a boat that we can process, and stuff. We're on little boats and we're fishing by ourselves. We're fishing with just a line and a hook. –Kaua'i, KA110

But we fish because we love it, and that's our passion, and we're not out there just trying to kill things. But I think the perception is it seems like they're even teaching in schools that how the oceans are overfished, and these guys are catching too many fish. But I think it's all – there's like a freight train of people that want to help the world and are just jumping on the bandwagon. But they really should be informed about the things that we do. – O'ahu, OA135

Every single bit of it, even stuff that comes from outside is because of commercial fishing, and that's what the general public has to understand. They've got to get to know that. And it's not some big cooperation. It's guys like you. It's not some huge company, like Dole, or whatever, yeah. It's individual fishermen working really hard at a job that most people don't want to do. – Maui, MA124

Evolution of Bottomfishing

Evolution of modern-day bottomfishing is represented at the individual level and broader community level. At the individual level, many interviewees mentioned the progression of their fishing career and knowledge from family fishing, diving, buying their first small boat, eventually leading to a larger boat or sampan, which sometimes catalyzed the transition of recreational fishing practices to part-time or full-time commercial.

My first one [boat] was a 24 Radon. Then I got a 31 Radon, and I started going offshore anywhere from 280 mile, 140 mile out. But the boat kept -- you know, my boats kept getting too small for me. I kept plugging them and just coming in with loads. And then I

*got a 42, and that was really difficult to fill. But we'd catch 12,000 pounds in five hours.*⁶
– Kona, KO116

Well, it's changed dramatically. Back in the day, we only fished for the day. It was more of a weekend thing, because my father worked and my grandfather was retired. Go out in the morning, come back four or five in the afternoon... And as I started going on my own as a teenager and in my early 20s, I started to fish at night... And I was targeting only 'ōpaka. So that's how that started. And then I got a bigger boat and I started targeting onaga. Then it turned into where we are today, we're out there for two days and one night, and it's mainly because we want our fish to be really nice and fresh when we come in for the restaurant. – Maui, MA127

Any fisherman, you got to evolve, right. You've got to figure it out and then figure it out some more and figure it out some more. It's never ending. Till today, I'm still figuring it out, yeah. – Hilo, HI106

At the community level, much of the evolutionary patterns occurred as a result of technological advancements often resulting in new gear and fishing techniques and changes in fisheries management. Findings are consistent with other historical narratives such as those provided by Moffitt et al. (2008) and Morioka and Yamada (2014).

Changes in Technology and Fishing Techniques

Prior to the advent of GPS in the early 1970s, fishermen depended on the practice of “landmark fishing,” a method of triangulating your position from shore using landmarks such as mountains, buildings, or other non-moving markers. Landmarking was used to mark fishing grounds once a productive spot was found. This method of trial and error took patience and perseverance to discover new spots. Landmarks were considered prized fishing knowledge and only passed on to family members or individuals having earned the required trust to keep spots secret and well-protected (see Shared Ocean Spaces section).

And back then, too, we didn't have GPS. So we needed to use landmarks, real landmarks. The landmarks would change if somebody built a house or tore down a house or tore down a tree. You know, so it changed with the technology. – Hilo, HI105

And triangulating, and I could still never master. He would go to a place in the middle of nowhere and you only got two sights that I could really align with. But he would figure it out, and tell me, you're still the wrong place, come over here. And you'd steam back, and sure enough, he'd say, drop here. And you drop, and you find it – and it's a pinnacle in the middle of nowhere. – O'ahu, OA139

Navigation technologies like GPS and the Loran-C⁷ allowed fishermen to find and return to productive fishing grounds much faster than traditional techniques resulting in more fishing time

⁶ The increased catch of 12,000 pounds in five hours occurred when the interviewee had switched to targeting tuna.

⁷ Loran-C was a long-range navigation and positioning system developed in World War II and pre-dated GPS technology. <https://www.nauticalcharts.noaa.gov/updates/navigating-waters-before-gps-why-some-mariners-still-refer-to-lozan-c/> Accessed August 30, 2019.

and less reliance on the coveted knowledge of productive fishing grounds previously held by veteran fishermen.

Well, I remember in the '80s, they came out with the Loran-C, and then a couple years later they came out with all these plotters, color recorders and GPS. So you know, it made fishing much easier because now you know the exact spot where you caught, you know the depth. And these recorders today is unreal. You can see the fish. You know, like the old days, it was all by Hawaiian eye, you know, all by landmark. – Maui, MA126

Then GPS came along, we didn't have to search anywhere. We'd just go (indicating) right there. So it saved us a whole bunch of time, which translates to more fishing time. So we thought, gee, we've got three, four times more fishing time, we're going to catch three, four times more fish. But we found out that wasn't necessarily true because the fish don't bite the same all day long. – O'ahu, OA101

Tremendous. Absolute night and day. I could be fishing in the right area, but because I didn't have the right technology, I wasn't finding the right bottom. And these bottom areas could be just the size of the house. So if you're not looking at the bottom correctly, you're fishing in the muddy area right on the side and you're not going to catch anything. – Hilo, HI105

While navigation technologies altered the traditional practices of finding (and sharing) fishing grounds, it was the emergence of electric reels that led to the transition from more traditional handlining techniques. Previously, fishermen sent fishing line anywhere from 250 to 1000 feet deep keeping their hand on the line to feel the bite and currents, then haul up the line by hand with as many as 20 hooks. Power assisted line hauling reduced the manpower needed to haul in fish and increased the efficiency of handlining. However, as efficiencies are gained, traditional aspects of handlining may be lost.

We were hooking uku, and then late at night we were holding the line. We were falling asleep because late. I remember he get a bite, this is ulua. The thing just ran through his hand. You know, the handline, that's all we used. We never had machine at those time, handline. I look at the line running through his hand, I thought, I thought there was smoke in his hand. I mean, like burning. There is a mist coming up, and he holds the line (indicating). That's fun. – Maui, MA123

You can get more fish now, I think, yeah. Because it's pretty much hands free, yeah. Once you turn the reel on, you can kind of leave it and do other stuff. Your efficiency improves, right. You can cut bait, put away the other fish. – O'ahu, OA139

The electric pinch-pullers, that was great when they came out with that. I think if they get rid of electric pinchers, and people have to go back and either pull by hand or go with the hydraulic, half of the fleet wouldn't fish. They would go right back to shoreline. Because a lot of guys that go in deep water was all handline, you know, shallow water. But when the electric pinchers came out, then everybody started going to deeper water. – Maui, MA119

So it's not the same. And even though they've got some hydraulics, a lot of them have got electric reels, nobody is handlining anymore, but still you find an awful lot of guys going more shallow. So they'll fish for the paka first. They don't fish for the onaga, the deeper stuff quite so often, and I think it's because of the time they've got on the spot and then the retrieval method that they've got. Electric reels are -- they work. They work, but not as good for deep fishing with a heavy weight with bigger fish. So the nature of the fishing has changed, and that's got import for the future of the fishery that we don't even know. - O'ahu, OA131

Although the majority of interviewees spoke positively about changes in technology, some were more hesitant of increased fishing efficiency benefiting the fishery. These concerns were sometimes a result of a belief that current generations have it too easy without the need to put in the same effort to find productive fishing spots. Others mentioned that misuse of technology could lead to a depletion of fishing grounds in a short amount of time.

Equipment made a big difference in the fishery because now people who don't know how to fish can come by you and because you on the ocean, no can tell them to go away. They'll come by you and press save. And they might not fish that day, but next time you go there, going to get 40 boats that came with their friends over there. So it's changed, not like before. - O'ahu, OA136

No, the technology today, like the fish don't have any chance. You know, before time, like I said, it's like all landmarks. Now with the depth recorder, you can pinpoint. And the type of technology today is like looking at that so-called recorder can tell you what kind of fish it is on the bottom. So that is, you know, technology is awesome. But a part is like I said now, it all depends on the technology of who is using them, because commercial can wipe out our grounds within so many months. - Hilo, HI102

Changes in Boats and Fleet Characteristics

Changes documented by participants were not limited to fishery techniques and technology, but included the bottomfishing fleet as a whole. Characteristics of the fleet changed with the emergence of smaller, fiberglass boats, a stark shift from the traditional large, wooden sampans of the early- to mid-1900s. The newer vessels coupled with technology are able to reach fishing grounds faster and take advantage of weather windows but cannot endure larger storms. Participants' perspective of changes in the Hawaiian bottomfishing fleet support changes highlighted by Moffitt et al. (2008), related to shorter and more efficient trips.

Because the fleet now has changed. They have fast smaller boats and faster boats. There are very few larger boats, but they all go -- they leave at dawn, and they be home by 1:00, 2:00 o'clock in the morning. I say, why you guys no stay out at night and then catch the 3:00, 4:00 o'clock bite again and then in the early morning come home. But they said the traffic down the harbor is part of the problem. - Maui, MA122

So the fishing has changed a lot. It's fast, hit 'em now, move, move, move, move, fish, drift, fish, fish, catch some here, move, fish, and that's how they're doing it. And some of them stay overnight. But the majority, maybe if they stay one night, come home next morning. They're not fishing like we do anymore. In a way I cannot blame them because

their boats are different. They're fiberglass. They're light. You know, our sampans are heavy. – Maui, MA120

Well, like for us, it's totally weather-dependent because we're a small-boat fishery now. In the past, the bigger boats, they had range. They could go outside the local weather. Or they could weather the storms. But today's fishery is more an overnight type of thing, one-day fishery with a lot smaller, faster boats. So we're more weather-dependent. – O'ahu, OA101

Plus, generally, they would anchor. When you have a bigger boat like that and you anchor, you can pretty much stay in all kinds of conditions. In a small boat, you cannot take a chance, yeah. – O'ahu, OA139

Regulatory Changes

The Hawaiian bottomfish fishery has undergone various regulatory changes since the early 1980s, which have been highlighted by Morioka and Yamada (2014) using a comprehensive regulatory timeline spanning from 1982 to 2014. Participants were most vocal regarding fishery closures, or Bottomfish Restricted Fishing Areas (BRFAs), and subsequent impacts to the fishery due to increased fishing pressure on fewer fishing zones.

Because people are the way people are, in an area that would space out maybe 10 guys every month for the whole year, now you've got 100 guys for two weeks, and then it goes back. So this closed area/open area, you're taking the same number of fishermen, we're not going to stop fishing, you exclude us from a certain area, we add more pressure to another area. – O'ahu, OA101

The establishment of the restricted fishing areas has changed that, and I understand the fact that they need to rest areas, but to have it closed for years on end with no opening in sight is, in my opinion, counter-productive, because then you have people poaching and they're taking the chance that they're not going to get caught. – Hilo, HI105

Yeah, there's a lot less full-time commercial guys now, especially for the bottomfish fishery because of the regulations that we had. When they put in those closed areas, that killed off pretty much the rest of our sampan fishermen and our old-time guys. – O'ahu, OA140

Another critical management change affecting the bottomfish fishery participants in this study was the closure of the Northwestern Hawaiian Islands (NWHI) fishery in 2010. Although some bottomfish fishermen refocused their fishing efforts to the main Hawaiian Islands (MHI) zone, the closure resulted in a decrease of full-time fishermen within the bottomfish fleet (Friedlander et al. 2014; Pooley 2006; WPRFMC 2016).

So it was pretty hard for me, an older person, the end of my career, to be forced out of that work. The government offered us a formula of how to buy us out, which was based on previous gross and previous trips, which we didn't make any money on anyway. So, obviously, they didn't pay us enough money for giving up that right to be able to fish there. So I feel pretty hurt about that. – Kaua'i, KA111

I would love to be one of the guys to go back up there (NWHI). I would think they should give us guys like first chance, you know, being that I used to fish up there, this is what my dad taught me. I didn't go to college. This is all I did, was commercial fish, build boats, fix all our own boats. – Kaua'i, KA110

Few participants had positive things to say about the NWHI closure. They hope to see a rebound of bottomfish in the coming years.

I think since they closed the Northwestern Hawaiian Islands, my personal opinion, I think we're going to have more fish in about another -- maybe like 10 or 15 years. – O'ahu, OA144

Given the participants' excitement to share stories of fishing the NWHI, it is not surprising that many are still bitter over what has now been almost a decade of restricted fishing. Many participants spoke of the massive size of fish, unique wildlife, and large numbers of fish making the long-haul worth it. One fisherman called it "the wild, wild west."

No Change

Although the majority of participants described some aspect of evolution in fishing practices, changes in fleet characteristics, or impacts of changing regulations, there are a few instances in which the fishery was described as remaining the same. This is likely a result of older fishermen maintaining their tried and true traditional gear and techniques and passing this knowledge to younger generations that choose to continue fishing using these methods.

The style of fishing and the gear hasn't really changed, just maybe some swivel improvements and, you know. But it's generally the same kaka line⁸ we've been using for the last 30 years. The same gear I used in the north, I use here, and it works, you know. So it's basically the same rig. I use four hooks. You've got lead, four hooks and a chum bag, that's basically -- some guys use more hooks or less, but that fishery hasn't changed much in all these years. – Maui, MA124

If I could show you a picture of my gear that I used in the '90s compared to the gear that I use now, you would say there's no difference. – O'ahu, OA145

I'm pretty sure the rigs are exact -- almost exactly to what the old-time fishermen taught us, it's just the difference is our hustling efforts is a lot more than sitting on one spot and paluing [chumming method], that's the biggest difference. – Maui, MA128

Whether change is perceived or not, the adaptive capacity of small-scale fisheries in the face of these evolving practices and external pressures is critical to community well-being. The following section speaks to the cultural and community connections held by bottomfish fishermen, which can contribute to community resilience.

⁸ Fishing with gear consisting of a mainline less than one nautical mile in length to which are attached multiple branch lines with baited hooks. Mainline is set vertically, and fixed on or near the bottom, or in shallow water.

Community Resilience

It is clear from the interviews and supporting literature that the cultural and community connections between individuals are integral to the social fabric of the bottomfish fishery and contribute to cultural continuity.

The major theme of community connections can broadly be defined as the ways in which individuals connect with other fishermen, the wider community, and engage in cooperative settings (e.g., fishing co-ops or clubs, cooperative research, or providing fish to the community). Community connections within the bottomfish fishery are further defined by the transfer of generational knowledge between individuals and family members. From this subset of interviews, community ties appear to be island-specific, with few instances of sharing knowledge or connecting with fishermen on other Hawaiian Islands. The lack of inter-island connections was also noted in the family-tree forms and social network analysis sociograms, where only one or two individuals were referenced as bridging a connection between island communities (Appendix B).

Additional themes around adapting to environmental and market changes, shared ocean spaces, and self-regulation practices are highlighted to reflect individual and community resilience to external pressures.

Community Connections: Social Networks and Generational Knowledge

Passing of knowledge and *community connections* are two major themes that have significant overlap and help to inform the social network analysis, or Hawai'i Bottomfish Family Tree (Appendix B). Sub-themes specific to "taught to fish" and "teaching to fish" are synonymous with the family tree worksheets completed by the interview participants. Additional data were coded to reflect bottomfishing skills or traditional knowledge handed down by their fishing predecessors.

The following quotes highlight the importance of social networks in maintaining the unique social fabric deemed important by fishery participants.

It was a community. When we dry dock, everybody would help each other. Everybody would help bring up the boats, you know. And you'd always make a party. After you bring up the boat, everybody gets fed. You drink beer, you have pupus [appetizers], and everything. Everybody would be for the boat. It's lost today. You don't see that. You don't see that anymore. – Maui, MA120

Because this is -- it's not a real big fishery in Hawai'i, but it's very important. It's a small group of fishermen and it would be a shame to lose all of this knowledge or the stories, and everything, about how this has affected our communities, and everything, because it does. – O'ahu, OA140

They don't share too openly at the beginning, but once you get to know people, they open up. It's a special -- the fishing community is a special community to me, you know. And the people who don't fish probably will never understand the interaction of the fishing community among ourselves. – O'ahu, OA137

Knowledge transfer occurs between family members or between community members and friends. When participants mentioned learning from their parents or grandparents, it was coded under “generational fishing.” Many participants mentioned the importance of sharing knowledge due to the constant trial and error and steeper learning curve involved with obtaining necessary bottomfishing skills.

And my nephews and nieces all go with us now, you know, the younger generation. We're trying to get them interested in what's going on. So my niece took diving lessons, and she's getting into it, which you know, my younger brother, he dives. We kind of like -- because the uncles are kind of like to keep her in the loop, you know, as a fishing family.
– O‘ahu, OA130

And when you get together with all your friends, your bottom fishing friends, or whatever, and you talk story and that's where it really comes out. It's like, oh, yeah, one time I was doing this, or whatever, and then I caught that. And so, oh, every time after that I started doing that or I did notice it for other kinds of fishing, or something, you know. – O‘ahu, OA140

A few participants deemed the fishery to be left in careless hands (lack of confidence in next generation fishermen) and chose to keep their knowledge to themselves. Building trust and respect within a community is referenced as a criterion for whether fishermen will share their knowledge.

No. Kona fishermen, they always keep to themselves. They don't ask you, where is a good spot. Maybe they know that nobody is going to tell you where a good spot is. So we don't talk about, where is good fishing. – Kona, KO114

And you won't be giving away any secrets? Oh, no, no, no. Part of my responsibility is to take it to the grave with me when I'm done. – O‘ahu, OA134

If you're a new guy, you didn't get much information. But as you become friendlier and friendlier, they'll show you things. Like they'll show you how you tie the flies, the different things that enhance the bite, like luminosity, stuff like that. And after a while they'll talk to you about bottom fishing, what to look for, where to go, how to read your lines.
– O‘ahu, OA141

Individuals from the Maui Cooperative Fishing Association (coop) were interviewed in a subset of oral histories collected, which provided another look into community connections within the bottomfish fishery. In this case, a fishing cooperative led to community resilience when individuals banded together to leverage their position when challenged with prevailing market prices.

It wasn't a coop, it was just all the fishermen at that time selling fish to different markets, and we were getting pretty screwed because the markets would apparently dictate price to us and we really had no place to go, and that's when we decided to form a coop and stick together so we had some power and we had some say in the fish-selling business.
– Maui, MA124

The coop has changed from what it started to be when it first started and what the coop is today. So being the coop now is coming to more of a club environment, hopefully, we can get more younger guys in. And I'm pretty sure if we can get the guys, the club will stay along. – Maui, MA128

The coop has been good to me. So I kind of think I need to hang on, thanks to [name redacted] for pulling me into something that's a good thing. We're trying to get the younger generation to realize that the fishing industry is going to die if they don't cooperate and know what the heck is happening outside of their little boxes. – Maui, MA125

The data clearly show that community connections and passing of knowledge have been important traditions in the bottomfish fishery, though some participants hint that this social fabric is a thing of the past. Others mention the desire to pass knowledge down to the next generation so it may experience and help sustain the fishery. Transfer of local knowledge can serve to strengthen community connections, increasing resilience of communities adapting to social, economic, and cultural change. However, local fisheries knowledge is not restricted to community connections; it can also contribute to resilience against external stressors including interactions with the local environment and market pressures.

External Pressures: Environmental

The Hawaiian bottomfish community has long been accustomed to dealing with fluctuating, and often unforgiving, environmental conditions. Morioka and Yamada (2014) reference claims of bottomfish fishermen asserting that wind and weather are the true managers of the fishery.

Over here, we're regulated by the ocean. – Kaua'i, KA110

Bottomfish fishermen have acquired a set of skills and techniques specific to addressing environmental stressors such as currents, wind, fluctuating fish stocks, and temperature. These factors have been referenced by study participants as playing a crucial role in driving the various fishing techniques employed (i.e., anchoring versus drift fishing), ability to find productive fishing grounds, choosing where to fish, and deciding when weather conditions pose too high a risk.

You know, there's current. There's the boat handling and how you set up. Because the bottom fishing is so deep -- if the current is doing six knots,⁹ and you go right on the spot and you drop the line, you'll be off the spot by the time the line reaches the bottom. So you have to know how to go up current and upwind and hold the boat straight. – Hilo, HI104

Right outside here, was a tremendous fishing ground for 'ōpakapaka and gindai and hapu'upu'u. But it's very close, and during rough weather it's easy to fish. So people

⁹ A six-knot current would be rare, 2.5–3.5 knots is more typical. The six-knot example was likely used for effect to illustrate the importance of understanding the interaction between currents and location.

tend to cluster up to the place. Say, from 2008 to 2010, that place was hit so hard it's depleted now. – Hilo, 2015

If no more wind and no more current, then it's a lot easier to just drift over the spot because you move real slow. But if there's a little wind or the current pretty strong, then I would tend to anchor sooner and just fish that way. – Maui, 2009

So if I know I'm going to fish by myself, bottomfish, if I plan to anchor on that trip, like I do look for a lot nicer weather. Anchoring is really dangerous. – O'ahu, OA135

A few participants took the opportunity to share environmental changes they have witnessed through their own fishing experiences.

You know, before time, to me, the seasons were like -- you could see the seasons, you know. Wintertime would get rough. Summertime would get nice. But the last few years I fished up there, it doesn't matter. Like it comes rough all year-round. And before, when it gets rough, you would anchor up for a day, two days at the most, and it would pass through, right. But lately, I don't know if because of pollution, or what, but everything is jammed up, you know. Like we'd sit on anchor for five days because it's blowing like 60 knots, like that, you know, 30-foot seas. We cannot fish. – Kaua'i, KA109

I kind of kept track on the water temperatures and the currents. For the longest time that I know, the currents used to run parallel with the islands, and it doesn't anymore. It goes straight inshore and straight offshore. It never happened before. Then the water temperature, you kind of notice that the warmer water is sometimes lasting a lot longer than it should to the winter months, which I would think would keep the fish on the deeper side in the colder water. – O'ahu, OA130

Many fishermen referenced the ability to read currents and handle a boat in harsh weather as necessary skills for successful bottomfishing. There were variations in the level of risk that individuals were willing to take when confronted with high winds and strong currents, often dictated by vessel capacity.

If 15, 20 [knots], I still go because I have to make a living. I'll go. I'm very uncomfortable, but it's risky because sometimes if the wave breaks in the boat, you don't know what is going to happen. So everything depends on the weather for fishermen. – O'ahu, OA136

To know bottomfish, learn the current, how fast, you know, and know weather. If you get a small boat, you cannot fish bottomfish because it gets rough. – Kona, KO117

Other fishermen chose to fish in harsher weather conditions because market prices would increase due to limited access to the fishery. While some individuals made the choice to fish harsh ocean conditions, others went due to economic necessity, for example, when they had contracts to supply fish regardless of conditions.

Because we knew that when the wind came to blow for a week or two, prices were going to go up because guys weren't going to go out. So we jump on the old [boat name]

redacted], you know. And we'd actually go trolling on the [boat name redacted], too, because it was a sampan. It was built for 25-knot winds, 10, 15-foot seas, that's what it was built for. – O'ahu, OA131

But yet, it's a big commitment for us to know that when the demand side comes, and it is blowing 30 knots, we have to go fishing. We don't really have a choice. – Maui, MA127

External Pressures: Market Influences

Market considerations were often interlinked with other themes, for example, fishing in bad weather to meet market demands (referenced above), lack of market diversity driving fishing pressure on specific stocks, and market influences on targeting specific species and sizes.

Generally, the higher the demand the higher the price at the auction. If there's a big convention or there's like a holiday, New Year's, red fish, onaga, culturally that's a fish that everybody wants to eat during the New Year's. So I try to target that fish and be in at least three days before New Year's and you get a higher price. – Maui, MA125

We're not selling our fish as a filet to, say, like a fish market, or anything like that. We're selling it to the tourist as a plate, and it's definitely a different outlook on the fish sales, for sure. Because at that point, we're targeting different sizes because of the filet fish and how it presents itself on a plate. – Maui, MA127

Multiple participants referenced weather and prices as the primary drivers of fishing. Individuals that fished commercially appeared to be more likely impacted by market demands and fluctuating prices while recreational or subsistence fishing trips were often driven by weather. This is supported by a study previously conducted by Hospital and Beavers (2011) that shows agreement among fishery highliners in fishing in “less safe sea conditions,” whereas noncommercial fishermen did not find themselves fishing in less safe conditions overall.

Weather first and foremost. Other things that dictate [fishing trips] is prices. If you know the fish are biting, then you might push it a little bit and say, you know what, I might be able to manage it with the weather and the currents. – O'ahu, OA135

You know, once in a while, a couple of markets do call me that I sell to and I'll go and catch for them, like Christmas or New Year, even if it's rough. Like this past Christmas had gales and, you know, 30-knot winds, and all that. But, you know, we went out. – Maui, MA126

The market demand for red fish, onaga, has a major influence on determining when to fish, especially around the holidays as mentioned in the quote above. Onaga is a cultural icon in Hawai'i, rooted in Japanese culture of decorating whole onaga on a centerpiece for celebrations such as weddings and holidays. Red fish is meant to symbolize longevity, abundance, and good health.

I usually start about middle of November because the demand during -- for the tradition of having a red fish on the table in December and January, for the New Year and Christmas. – Hilo, HI107

Because the bigger the fish, the better marriage you're going to have, that's the way we look at it. So we try to target, like I said, mostly red fish. And if it is going to a wedding, we target bigger fish, yeah, rather than smaller fish. – O'ahu, OA136

Catching for holidays, you know. You give red fish to people on the holidays, wow. Once I caught a whole load of 'ōpaka right before Christmas, and I pass out some to my customers who used to buy akule all the time. So this is something they don't see very often. So, you know, it was a real treat for them. – O'ahu, OA141

Although the demand for onaga is highest in December, one participant mentioned that the winter is not the best season for harvesting it.

As far as the bottom fishing goes -- New Year's really isn't the season for it. It's just the time when the money is the highest. So that's when most guys go and do it. – Hilo, HI104

In addition to the external processes at play, the Hawaiian bottomfish fishermen are subject to sharing fishing grounds and marine fauna with an increasing number of ocean actors. Ocean spaces are shared among fellow bottomfish fishermen, other types of fishing activities, tourism (e.g., cruise ships, dive boats, whale watching excursions), marine protected areas, military presence, oceanic shipping practices, etc. Sharing of ocean spaces is further complicated by the traditional practices of hiding and protecting fishing grounds.

Shared Ocean Spaces

The major theme of *shared ocean spaces* is primarily composed of two sub-themes: shared fishing grounds or “spots” and interactions with other boats. Interactions with non-bottomfish fishing vessels out at sea are mentioned less frequently but speak to the complexity of sharing ocean spaces and additional safety considerations needed for fishing at night.

The fishing grounds sub-theme stems from concerns around protecting spots from other bottomfish fishermen, a form of competitive advantage and secrecy indicative of fleet dynamics. Productive fishing grounds were considered coveted fishing knowledge and only passed on to family members or individuals having earned sufficient trust to keep spots secret and well-managed. This has become more complicated over time with the advent of GPS (see section on [Changes in Technology and Fishing Techniques](#)) and has resulted in a lack of trust between some older and newer entry fishermen. Use of GPS and recorders is noted as having eliminated the hard work of finding productive fishing grounds and the trial and error that comes with it.

And the modern technology nowadays is ruining everything. So they go over there and when they see you fishing, they go right past you and they push their little button. And the next time you go there, they're there. – O'ahu, OA130

And you're fishing one spot, and if you see one boat coming, you would drift away, and they don't know where you're fishing. But when the GPS came out, sometimes a trolling boat comes by, and he marks it. So next time you go, there's somebody there already. – Kona, KO114

Some participants mentioned the technique of “faking” anchoring in one place while waiting for a boat to pass so as not to give away the location of productive fishing grounds. Privileged knowledge of fishing spots was referenced as being passed down through families and fishing mentors only when trust has been earned.

I used to go up Hamakua [northeast coast of Hawai‘i island] a lot, me and my dad, and then -- I don't know how many guys tried following us. Even had guys from Maui would come over from Maui side and try to find our areas. We just throw the anchor and let it drag, and wherever it stuck, we just fished right there. Whether they bite or not, we'd just stay there until they left, then we'd start fishing. – Hilo, HI107

So bottom fishing, a little bit different story. Everybody is trying to hide. Everybody doesn't want to be seen. They want to turn out their lights. But that's been traditional in Hawai‘i, that attitude that if you go -- the old days, you would go near a bottomfish spot, the guy would pull his anchor and some people have gone as far as cutting their anchor ropes so you're not finding out where they are. – Kaua‘i, KA111

Some of these are spots that I've learned from 30, 40 years, I mean. I want to preserve them for like my grandchildren. I mean, if you know and you find out, that's great. But certain areas, I wouldn't want to tell anybody. I mean, I don't want to sound selfish, but. – Maui, MA126

Reluctance to share fishing grounds can further be linked to the practice of rotating spots to keep fishing grounds from becoming overfished.

Self-regulation

Interviewees discussed what precautions, if any, they take to ensure the sustainability of the bottomfish stocks. Although some individuals mentioned targeting larger size fish and avoiding juvenile hot spots, “rotating spots” was mentioned most frequently. Rotating or resting fishing grounds is a common technique used by many of the bottomfish fishermen interviewed to ensure the fish are not depleted or do not learn to avoid the area.

One time a year I go there, and that's it, and I don't go there no more. So when I go there I always get fish. I was taught that way, you know, no keep on fishing the same place over and over. – Maui, MA119

If we happen to land on a spot that is producing small paka, we move. We're not going to sit there and catch little ones. – O‘ahu, OA135

What I try to teach the young people about bottom fishing is they need to learn how to find their own fishing spots, how to run a recorder, how to follow a ledge, how to find fish on their own. And to be successful around here, anyway, you have to have at least 10 or 15 good spots that you can take a little bit from each area so you don't overfish one area, you know. – Maui, MA125

One of the things that he taught me was if it's biting, it's biting all over. So that means that they're in a biting mood, it's the current, it's the moon phase, whatever it is. Catch

two or three off of this hole and move. Because he knew if he caught 10 off of that hole, they weren't going to be there the next time, you know. So it's almost like we've got to kind of regulate ourselves, in a way. – Hilo, HI104

Future of Bottomfishing

The final set of interview themes sought to gather reflections on the future of bottomfishing (Appendix A). Discussions aimed at gathering insight on current fishing practices to ensure fishing into the future are reflected in the above theme, “self-regulation.” Participants also discussed the degree to which they shared local fishing knowledge with new entrants and the role secrecy plays in protecting the fishery, which have been addressed in the above sections supporting “generational knowledge” and “shared ocean spaces.”

This final theme of “future of bottomfishing” highlights both the negative and positive responses individuals had when reflecting specifically on the future of the fishery. The subset of individuals having a negative perception of the future referenced challenges associated with cost to new entrants, lack of interest and patience from the younger generations, lack of conservation ethics, and the preference of sending their own kids to college to avoid the tough and unpredictable life of bottomfishing.

You know, it's so hard right now with so many regulations being put on fishermen. I feel so sorry for young guys trying to get started in the field. It's so expensive. – Maui, MA120

They'd just rather play games with electronics now, they had no interest in the outdoor things like how we were before. So they really didn't take to it. So it's going to fizzle out after me. – Hilo, HI106

You don't want to show these people too much because the fishermen nowadays have no conservation ethic. We worried about the next year coming, so we tried to limit the amount of damage you do to the grounds. People nowadays don't have that ethic. – Hilo, HI107

I'd like them [kids] to probably go and probably get a real job, yeah, go to school, get a degree. Fishing is a very, very tough life. – Kaua'i, K110

On the other hand, positive perceptions referenced the resilience and abundance of bottomfish within the Hawaiian Islands, provided you can find them. One participant mentioned the innovation of new gear leading to exciting, new fishing techniques. Other positive perceptions reflected the passing of knowledge that could reach future generations.

And our catch averages are getting higher and higher as the years go on. And coming from a full-time commercial guy, that's a pretty impressive thing to say because we're fishing these spots year-round. And to see our numbers go up tells me that the fishery is thriving. – Maui, MA127

I see a lot of new fishermen, they're trying with all this new type of gear. And it's amazing that I didn't experiment much, and I notice there's a lot of experimenting. They're

changing type of line, color of line, type of hooks, even designing jigs, you know. I'm glad that they're learning. They're trying something different. – Maui, MA123

If the students that I teach are successful and they can teach their kids. Their future is good. – O'ahu, OA136

DISCUSSION

The purpose of this study was to document the traditions, culture, and evolution of the Hawai‘i bottomfish fishery using local fishermen as a source of first-hand knowledge in an effort to improve understanding of changes in the fishery over time. Results of this study illustrate the unique characteristics and interdependent community connections that have contributed to the bottomfish communities’ identity and resilience to change. Though the bottomfish community holds deep cultural ties to their ancestral heritage and traditional fishing practices, it is not immune to larger societal changes. Understanding the factors that contribute to social cohesion, transfer of knowledge, and community well-being is essential to track impacts of changing environmental, economic, and social conditions (Bennett 2019; Berkes and Turner 2006). To contribute to this understanding, the results were outlined using three larger thematic categories: *Cultural Identity*, *Evolution of Bottomfishing*, and *Community Resilience*.

The first section of the results, *Cultural Identity*, highlighted factors leading to cultural identity including motivations for bottomfishing, the practice of giving away fish, and concerns about the public perception of fishermen. Considering the multiple reasons for fishing mentioned by a single individual within a small subset of fishery interviews, it is no wonder fisher classification systems remain a challenge for fishery managers (Hospital and Beavers 2012; Kittinger 2013). Motivations for bottomfishing do not fit neatly into broad definitions of non-commercial and commercial fisheries. However, cultural benefits of acknowledging fishing identity are important in policy decision making, as demonstrated by the increasing number of studies that seek to understand the depth of these motivations and applicability to future policy frameworks (Allen 2013; Kleiber and Leong 2018; Vaughan and Vitousek 2013; Young et al. 2016).

Giving away fish is a predominant fishing motivation unique to the region, often superseding the practice of selling fish within this particular group of fishery participants, which demonstrates the critical role of fish in maintaining the social fabric of the bottomfish community. The cultural significance and benefits of noncommercial distribution or “sharing of catch” has been documented by other scholars as resulting in cultural perpetuation, self-reliance, social status, social networks, and even reciprocal exchange (Glazier et al. 2013; Severance 2010; Severance et al. 2013; Vaughan and Vitousek 2013).

The second section of the results, *Evolution of Bottomfishing*, sought to describe broader community changes (e.g., advancements in technology and vessels, regulatory changes due to depleting fish stocks) and how the bottomfish community has adapted to such changes. Changes in technology was a prominent theme found within the data, causing a shift in the way fishing is performed, impacting fishing effort and efficiency, and resulting in a reduced level of secrecy within the fleet due to increased ease of finding and plotting productive fishing grounds. Participants had differing views of what this meant for bottomfishing and the future of the fishers. Advancements in technology are not unique to the Hawaiian bottomfish fishery but may play the most significant role in altering fishing practices and interdependent community connections that are unique to the fishery. Modification of fishing technologies has been a pivotal factor in defining the evolution of the modern-day fishery, with both positive and negative perceptions held by the community.

The third section of the results, *Community Resilience*, highlights the adaptive capacity of the bottomfish community. Community resilience is strengthened by social networks and the passing (and uptake) of local fishery knowledge, which can lead to more responsible fishing practices and the ability to cope with external stressors. There is no shortage of studies identifying the importance of social networks and transmission of local fishery knowledge to sustaining cultural traditions and perpetuating the respect and sustainable use of natural resources (Bennett 2019; Berkström et al. 2019; Bodin and Crona 2009; Friedlander et al. 2013; Glazier et al. 2013; Turner et al. 2014). However, participants in the bottomfish heritage study referenced a delicate balance between sharing and protecting local fishery knowledge. Advancements in navigation and GPS technologies may play a role in this shift in sharing of knowledge due to increased lack of trust and reduced dependence on community members for information exchange by younger people entering the fishery.

It is clear from the data that the bottomfish community is increasingly influenced by, and vulnerable to, conflicting external pressures (i.e., weather, markets, and regulatory changes). Communities often lack control and power over these external processes; however, their ability to adapt their fishing practices and market decisions demonstrates capacity to cope with change (Clay and Olson, 2008). Adaptive capacity can be further strengthened by community connections in the form of informal social networks and formal fishing cooperatives, as demonstrated by the Maui Cooperative Fishing Association's ability to confront unfair market practices through their united front.

Rotating or resting fishing grounds was mentioned by most interviewees as a method to ensure sustainability of fish stocks, which can be referenced back to traditional management practices (Friedlander et al. 2013; Friedlander et al. 2000). Rotational fisheries management has been documented as a viable approach for sessile marine species (Plagányi et al. 2015); however, rotations occur on a long-term basis and no evidence is available to support functionality for finfish fisheries (Cohen and Foale 2013). Additional research is needed to assess the effectiveness of self-regulated rotational fishing practices present within the bottomfish fishery.

When discussing regulatory changes, participants were most vocal regarding fishery closures (i.e., BRFA and closure of the NWHI) and how they have negatively impacted the fishery due to increased fishing pressure on fewer fishing areas. The loss of traditional fishing grounds and displacement of local fishermen is a common public concern when implementing fishery closures or marine protected areas. Loss of fishing grounds has socio-economic impacts that can be detrimental to a small-scale fishery and results in loss of confidence with state and federal fishery managers (Friedlander et al. 2014; Hospital et al. 2014; Bennett et al. 2019).

Given the scope and breadth of findings identified within the interview transcripts, a broad overview of the results was provided and can act as a platform to identify areas for future exploration and inform other PIFSC projects (e.g., studies related to fisher motivations). Academic literature and previous assessments of the bottomfish fishery have been used to frame and triangulate findings where applicable throughout the report. Additional analysis of the interview content could further groundtruth information collected in socioeconomic surveys (e.g., supporting classification of fishers, supporting estimates of non-commercial catch that is eaten or given away, and better understanding practices of self-regulation) and serve as a resource for considering historical context of any future fishery issues.

CONCLUSION

Oral history supports the preservation of traditional knowledge. Combined with other social science methodologies, oral histories can also identify cultural values of local fishing communities and draw out traditional and local ecological knowledge of past and current fisheries for consideration in management programs (Calhoun et al. 2016; Colburn and Clay 2012). In-depth qualitative findings such as those found within this report and the NVivo project database can be used to support social impact analyses as required under the Magnuson-Stevens Fishery Conservation and Management Act (Clay and Olson 2008). Furthermore, this subset of oral histories is a resource for the Hawai‘i bottomfish community as a form of cultural preservation and knowledge transfer for future fishing generations. Public access to select “*Fisher Highlight*” videos made available through the Voices from the Fisheries database¹⁰ can contribute to the public’s knowledge of the bottomfish fishery and cultural significance of fishing practices.

The collaborative nature of the Hawai‘i Bottomfish Heritage Project led to a high level of fisher engagement in the co-design and implementation phases of the study. This project demonstrates the value of bringing fishermen’s voices into human dimensions research for consideration in fishery assessments and future management plans. Respect for local and cultural practices in these assessments can strengthen confidence in state management of fisheries (Friedlander et al. 2013). Building relationships between managing agencies and fishing communities can serve to increase the current low level of satisfaction documented among bottomfish fishermen when asked about their perceptions of management processes (Hospital and Beavers 2014). It is these types of collaborative studies, when considered by managers, which can also lead to policies that adequately address both environmental and social challenges in the face of changing climate. A timely example of this regulatory process is the upcoming reauthorization of the Magnuson-Stevens Act. A roundtable tour is planned to “hear from people whose livelihoods depend on healthy oceans.”¹¹

Considering the importance and interest of this project to the local fishing community, this study could be expanded to conduct additional oral histories with fishermen, fishing families, and other bottomfish community stakeholders that may contribute to the broader understanding of local fishery knowledge and community traditions. It is critical to recognize variations in experiences between individuals and island communities to avoid overgeneralization of the larger Hawaiian bottomfish community. Regardless of the analytical findings, the value of oral history and video ethnography research within a targeted community can ensure the preservation of local fishery knowledge and increase cultural heritage pride for generations to come.

¹⁰ This collection is available at <https://voices.nmfs.noaa.gov/collection/hawaii-bottomfish-heritage-project>.

¹¹ <https://www.seafoodsource.com/news/supply-trade/roundtable-tour-leading-up-to-magnuson-stevens-re-authorization-planned>. Accessed July 15th, 2019.

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Appendix A: Interview Template for Deductive Coding



Guiding Questions

BACKGROUND/PERSONAL STORY

1. Please tell me about yourself as a bottomfish fisherman.
2. What are the things you need to know to be good at bottomfishing?
3. Why do you go bottomfishing? What do you like most about it?
4. What is your best memory of bottomfish fishing?
5. Have your reasons for bottomfishing changed over the years? If so, how?
6. What kind of bottomfish do you target? Why? Are there seasonal changes in what you target?
7. What determines whether you keep or sell your catch? Whether catch is reported as commercial?

CHANGES OVER TIME

8. Please tell me about any years that were different from others in terms of catch, e.g., years with few fish, a lot of fish, size differences, more of different species.
 - a. Which years/decades?
 - b. Why do you think this is?
 - c. How did you respond?
9. How did any new gear, techniques, or innovations really change bottomfishing?
 - a. When did these changes happen?
 - b. What was the magnitude of the change?
10. How did you learn about them?

How has a typical bottomfishing “trip” changed since you have been fishing? When did these changes happen?
11. Have you changed how you report your catch/trips over time? If so, why?

FUTURE OF BOTTOMFISHING

12. When you are fishing, what things do you do to make sure there will be bottomfish in the future?

Have any of these practices changed over time, and if so, why?
13. Have you introduced any other people to bottomfishing or shared knowledge with them? If so, who? What role does secrecy play in bottomfishing?
14. When you leave the fishery how will you pass on your knowledge? To whom? Why?
15. What is your advice to future bottomfish fishermen?

CLOSE-OUT

16. Do you have any additional pictures or objects you would like to share?
17. Who else should we make sure that we talk to about bottomfishing?
18. Do you have any questions for us

Appendix B: Social Network Analysis Sociograms

Forms were completed by each interviewee to provide names of individuals that taught them to fish, who they fished with, and who they have or are currently teaching to fish to create a “Bottomfish Family Tree”. Sociograms were created to visualize the transfer of knowledge between interview participants and island communities.

Interview participants are referenced by NVivo case icons and the unique source ID (e.g., MA120). The blue circles represent individuals mentioned by participants in the family tree forms and/or within interview transcripts as participating in a transfer of knowledge. A blue person icon represents individuals not mentioned by name (e.g., father, grandfather, crew, future generation). Direction of the arrow between individuals denotes direction of knowledge transfer.

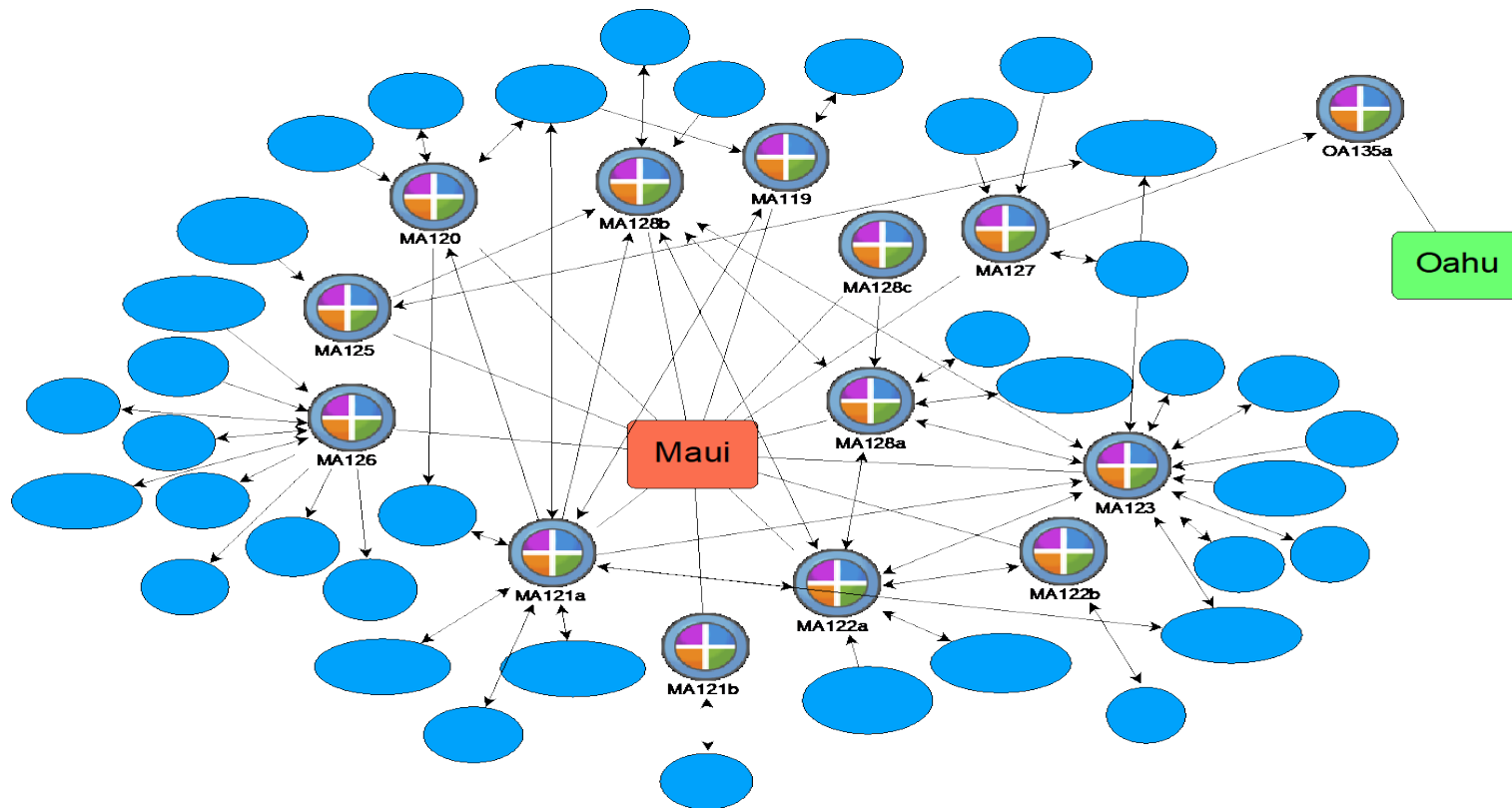


Figure 2. Maui sociogram

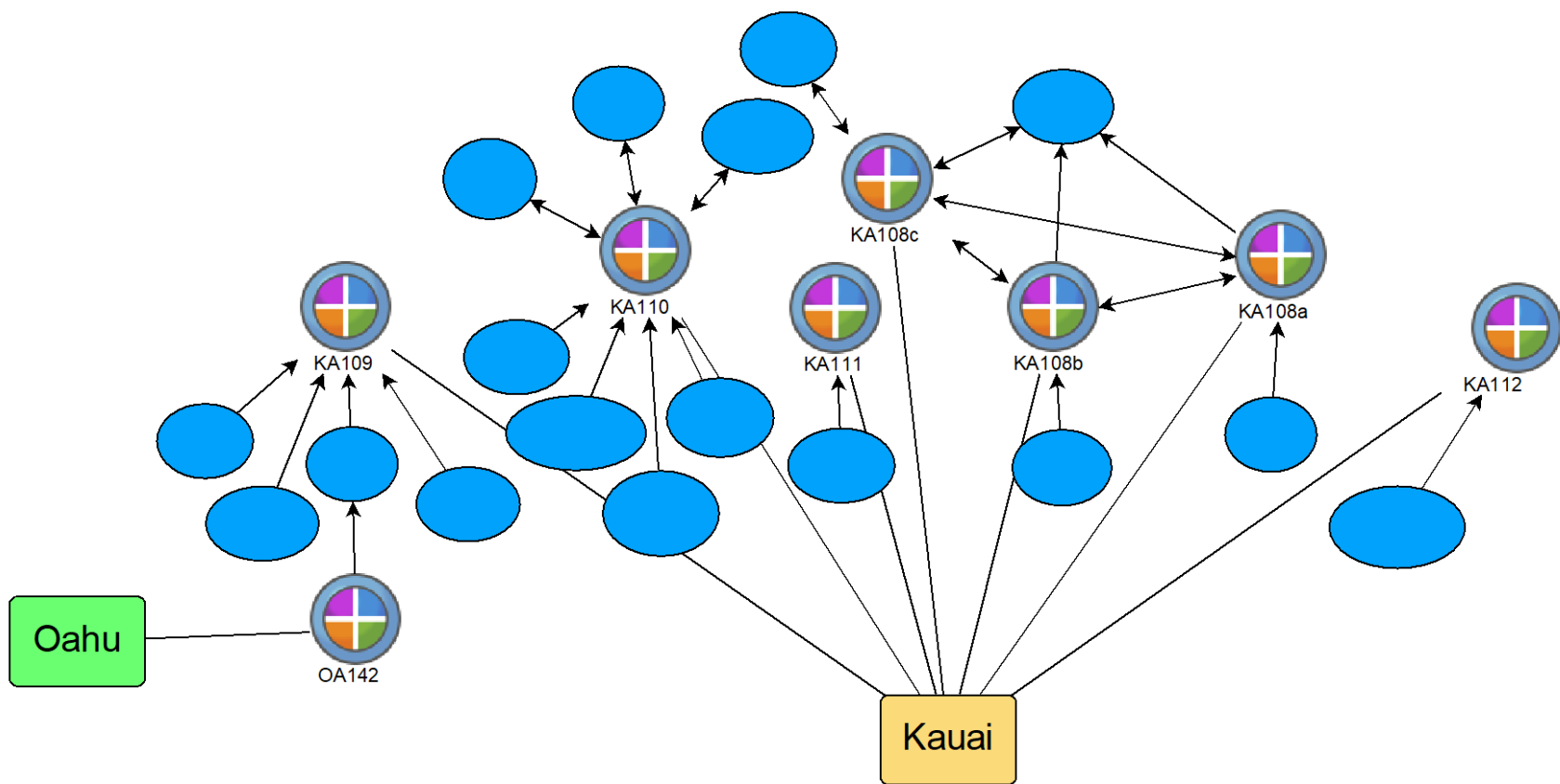


Figure 3. Kaua'i sociogram

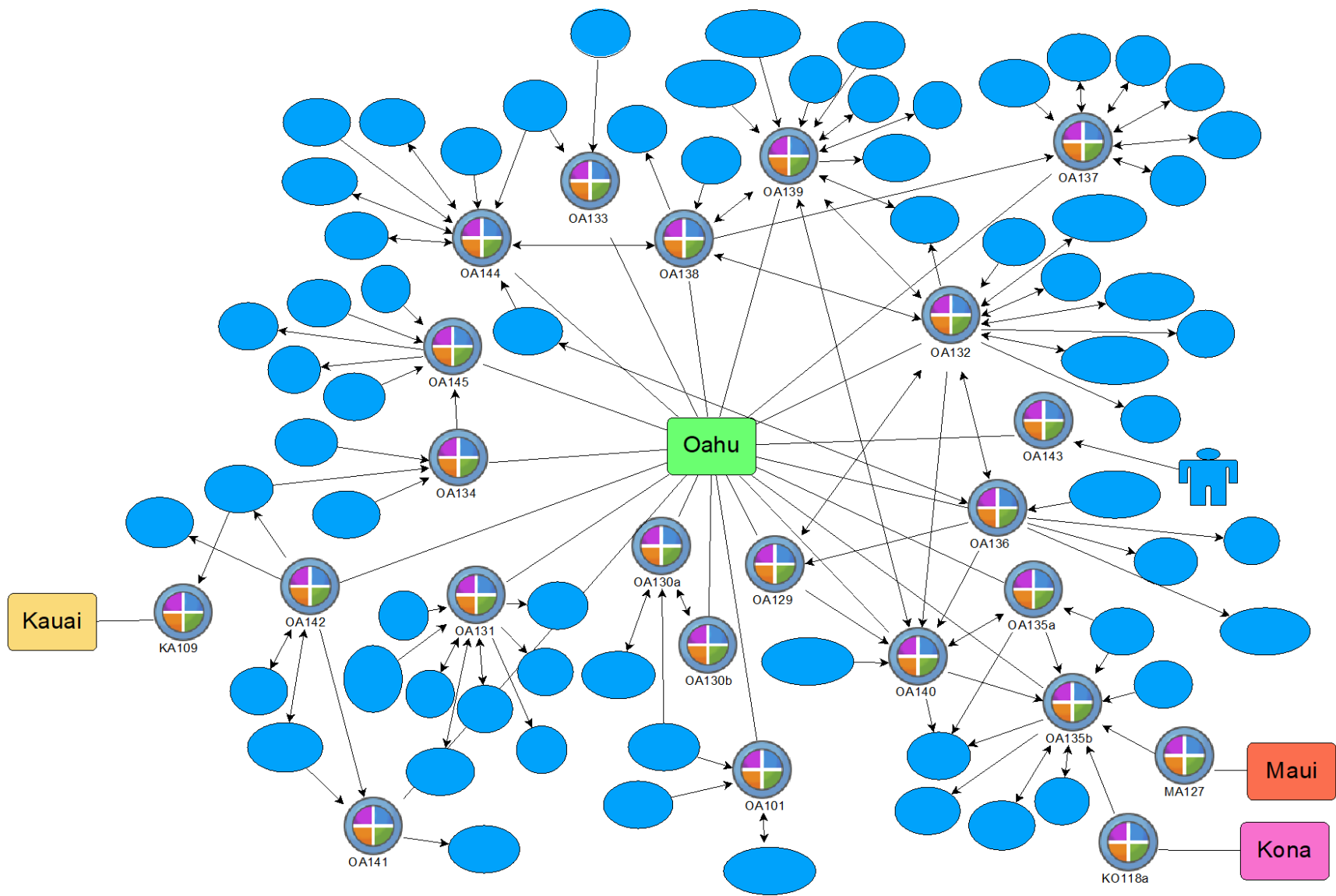


Figure 4. O'ahu sociogram

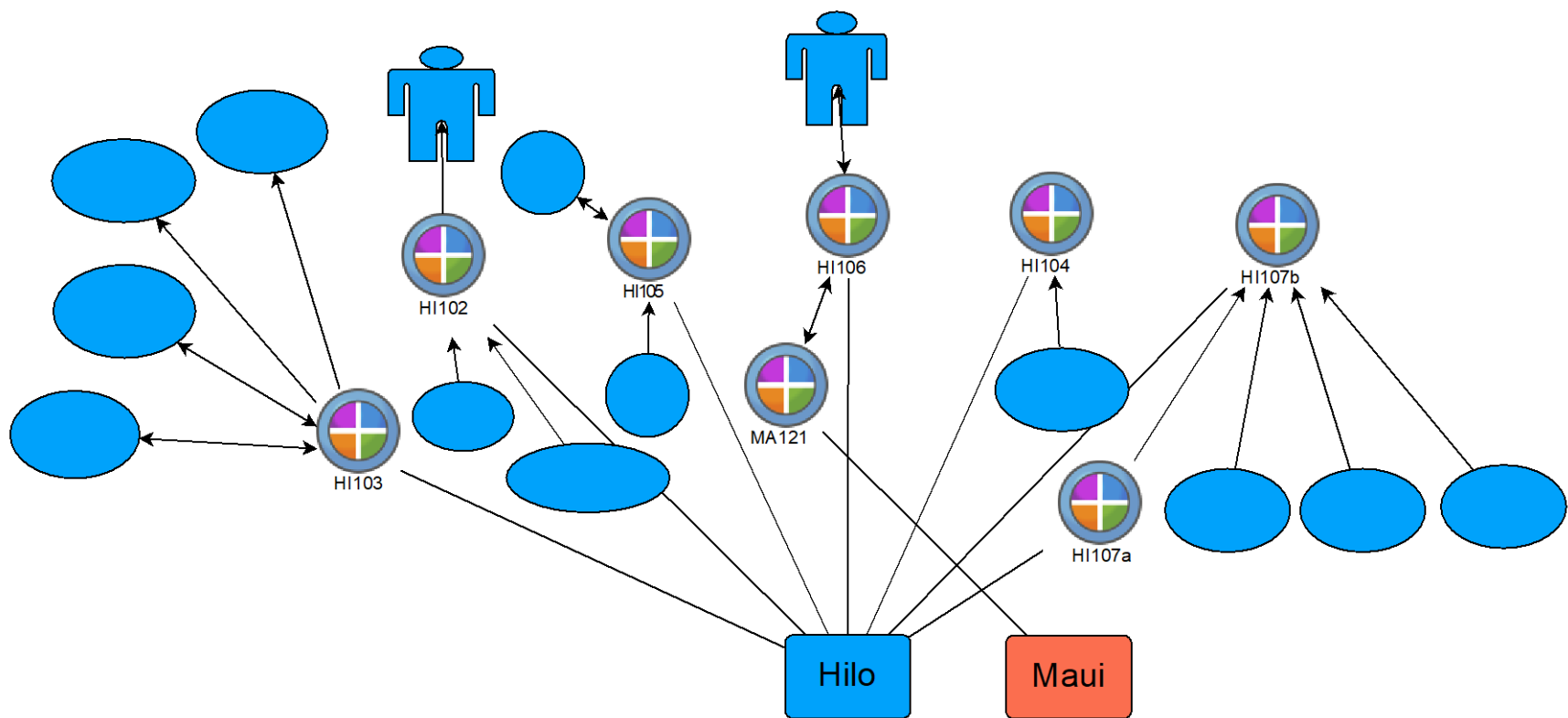


Figure 5. Hilo sociogram

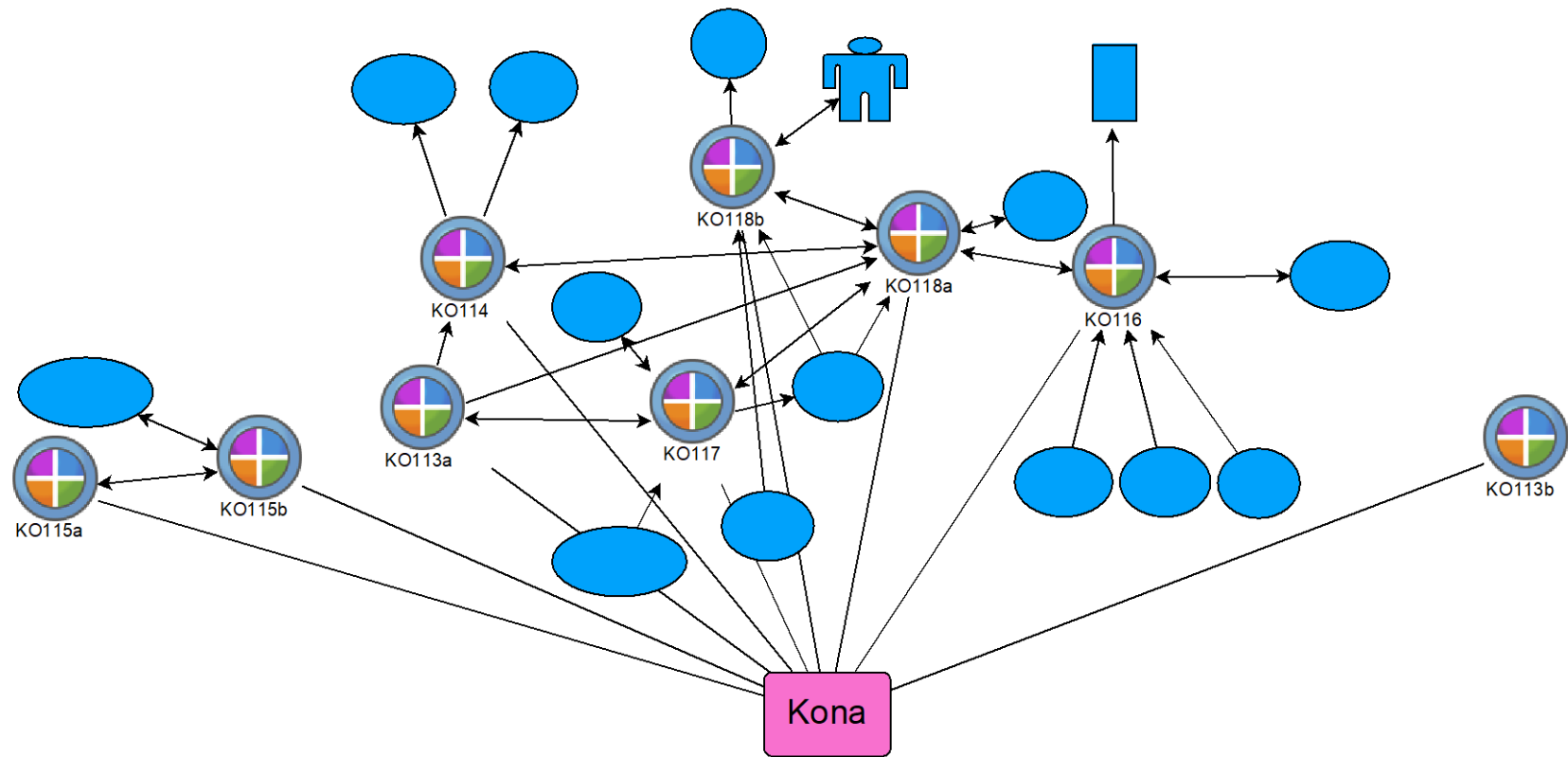


Figure 6. Kona sociogram

Appendix C: Initial Coding Guide

The initial coding process was informed by a conceptual model that identified broad thematic concepts to examine in analysis (Figure 7). Through the coding process, additional details and sub-themes were expanded upon, as reflected in the final codebook (Appendix E).

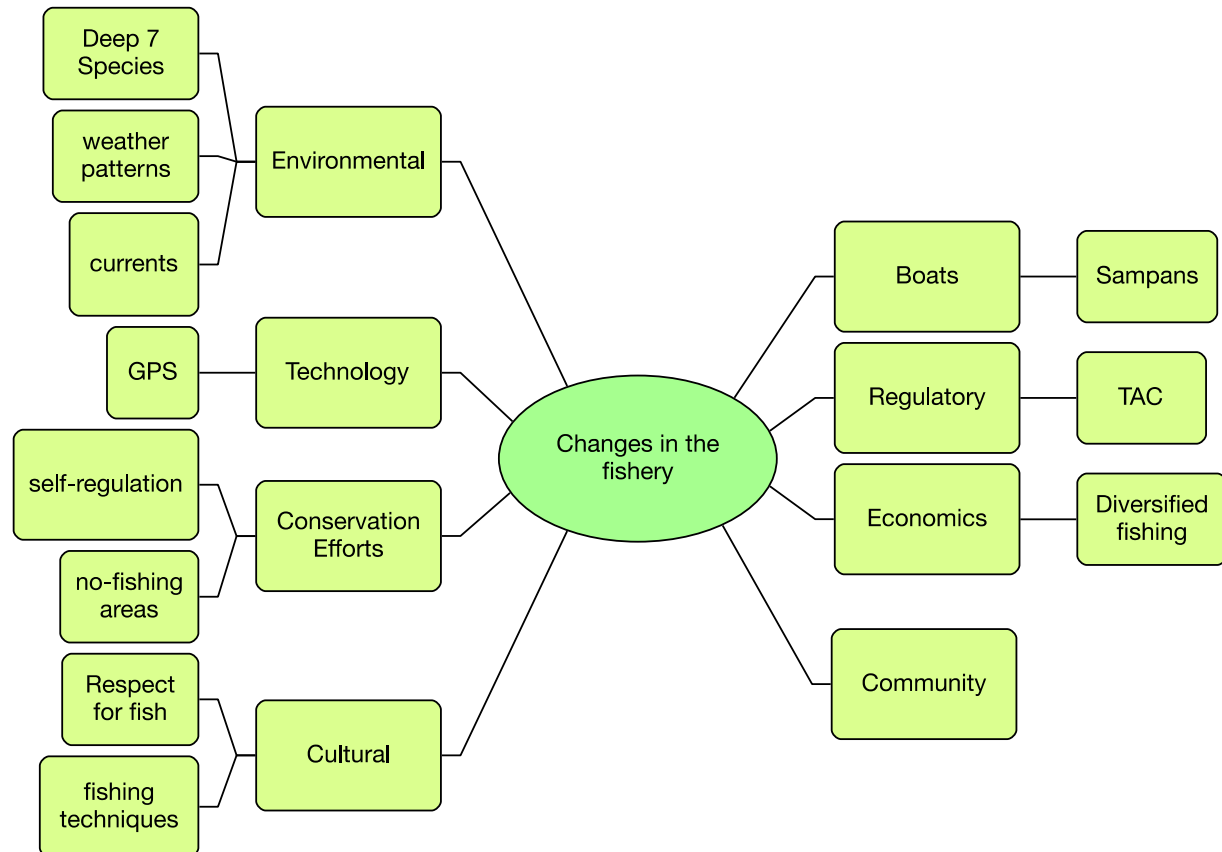
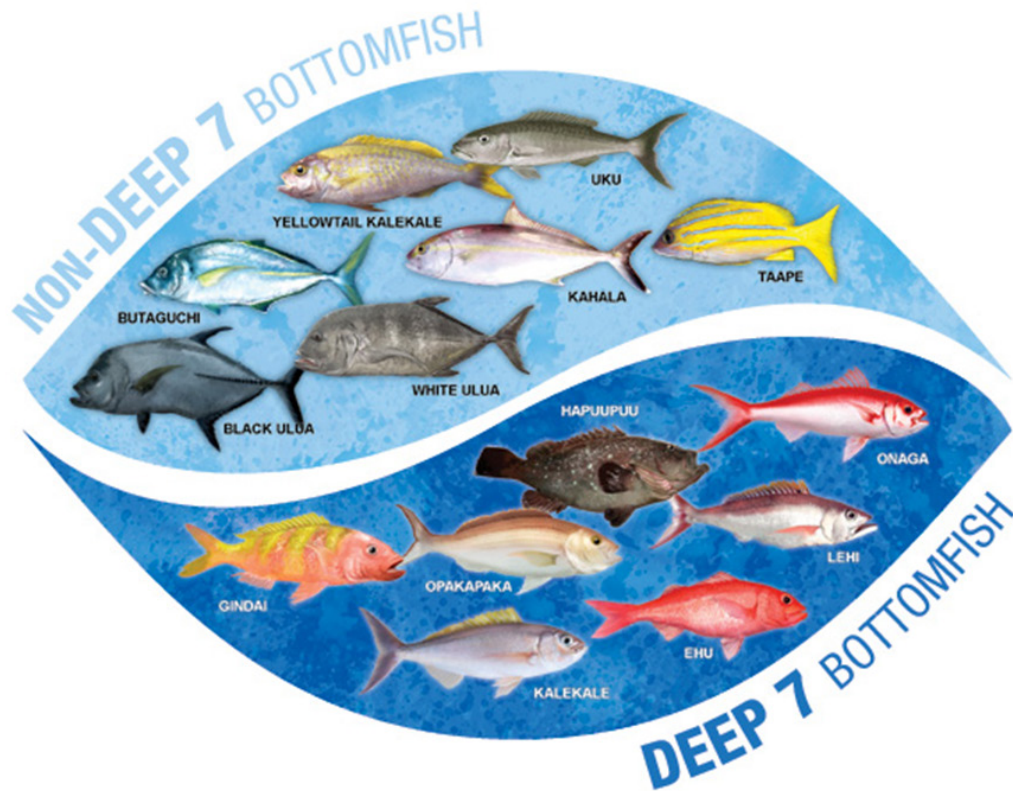


Figure 7. Conceptual model of concepts used initially to guide coding

Appendix D: Species in the Hawaiian bottomfish management unit species complex.



Common name	Local name	Scientific name
Pink snapper	‘Ōpakapaka*	<i>Pristipomoides filamentosus</i>
Long-tail red snapper	Onaga*	<i>Etelis coruscans</i>
Ruby snapper	Ehu*	<i>Etelis carbunculus</i>
Hawaiian grouper	Hapu‘upu‘u*	<i>Hyporthodus quernus</i>
Oblique-banded snapper	Gindai*	<i>Pristipomoides zonatus</i>
Von Siebold’s snapper	Kalekale*	<i>Pristipomoides sieboldii</i>
Silver mouth snapper	Lehi*	<i>Aphareus rutilans</i>
Grey snapper	Uku	<i>Aprion virescens</i>
Bluestripe snapper	Ta‘ape	<i>Lutjanus kasmira</i>
Yellowtail snapper	Yellowtail kalekale	<i>Pristipomoides auricilla</i>
Amberjack	Kahala	<i>Seriola dumerili</i>
Thick-lipped trevally	Butaguchi	<i>Pseudocaranx dentex</i>
Giant trevally	White ulua	<i>Caranx ignobilis</i>
Black trevally	Black ulua	<i>Caranx lugubris</i>

* Deep 7 Bottomfish species

Appendix E: Hawai‘i Bottomfish Heritage Project Coding Rubric

Major Theme	Subtheme	Description
Bottomfishing skills	<i>NA</i>	<ul style="list-style-type: none"> Skills necessary to be a good bottomfish fisherman (e.g., patience, adapting to external pressures)
Community connections	<i>Big Names in Bottomfishing</i>	<ul style="list-style-type: none"> Historical and current individuals highlighted by participants as instrumental to the fishery
	<i>Cooperatives, Clubs</i>	<ul style="list-style-type: none"> Fishing cooperatives (e.g., Maui Cooperative Fishing Association and Waialua Boat Club) and cooperative research with PIFG
	<i>Giving Away Fish</i>	<ul style="list-style-type: none"> Family, community ties, social networks, and cultural reasons (e.g., holidays, celebrations, signal of health)
Conservation efforts	<i>Cultural</i>	<ul style="list-style-type: none"> Conservation efforts as a result of cultural heritage, knowledge, and respect for nature
	<i>Self-regulation</i>	<ul style="list-style-type: none"> Rotating fishing spots (<i>see ‘Fishing Grounds’ subtheme</i>), only catching what you need, selective fishing practices (by size); ‘Pono’ fishing
Environmental considerations	<i>Currents</i>	<ul style="list-style-type: none"> Need to understand currents to be a skilled bottomfish fisherman (see ‘bottomfishing skills’) Currents as a driver of fishing technique (anchoring vs. drifting) and success of trip Currents drive movement of fish
	<i>Cyclical Fisheries</i>	<ul style="list-style-type: none"> Due to seasonality, migration, or other environmental factors Changes in fish populations (e.g., variation by season, weather, overfishing, increase in predation) More time spent searching for fish Shift in target species and size of fish

	<i>Environmental Changes</i>	<ul style="list-style-type: none"> • Currents, ocean temperatures, weather, climate, etc.
	<i>Fishing Pressure</i>	<ul style="list-style-type: none"> • Opposite of rotating areas—fishing pressure on specific areas (may be due to GPS use); more boats fishing the same areas
	<i>Water Temp</i>	<ul style="list-style-type: none"> • Influence of water temperature on location and availability of fish
	<i>Weather</i>	<ul style="list-style-type: none"> • Driver of fishing technique and when to fish • ‘Weather-dependent fishery’
Evolution of bottomfishing	<i>Changes in Technology</i>	<ul style="list-style-type: none"> • GPS, Loren C, recorders, depth finders, electric reels (some overlap with ‘gear’) • Positive vs. negative perceptions • Cultural implications
	<i>Fleet Characteristics</i>	<ul style="list-style-type: none"> • Size and types of boats • Changes in size of fleet
	<i>Future of Bottomfishing</i>	<ul style="list-style-type: none"> • Positive and negative perceptions • Next generation practices
	<i>Historical Catch</i>	<ul style="list-style-type: none"> • Changes in targeted catch and availability of stocks
	<i>No Change</i>	<ul style="list-style-type: none"> • Fishery has stayed the same
Fishery Management	<i>Fishing Zones</i>	<ul style="list-style-type: none"> • Historical fishing areas, current fishing areas, and thoughts for future management areas
	<i>Regulations</i>	<ul style="list-style-type: none"> • Fishing closures: BRFAs, NWHI
Fishing characteristics	<i>Boat Considerations</i>	<ul style="list-style-type: none"> • Stories about boats—traditional to modern • Evolution of boats • Individuals evolving fishing effort with boat advancements

	<i>Cost of Fishing</i>	<ul style="list-style-type: none"> ● How much went into a trip, then and now
	<i>Diversified Fishing</i>	<ul style="list-style-type: none"> ● Participating in various fisheries due to economic reasons or progression of fishing career
	<i>Fishing Techniques</i>	<ul style="list-style-type: none"> ● Gear types and modifications ● When to fish, best practices (e.g., rotating spots, finding spots) ● Techniques then and now, what's changed—see 'evolution of bottomfishing' ● Traditional methods (e.g., landmark fishing, handlining, lunar cycles)
	<i>Fishing Trip Duration</i>	<ul style="list-style-type: none"> ● Differences between main island fishing and northwest island fishing (e.g., multiple days vs. single-day trips)
	<i>Fishing Trip Load</i>	<ul style="list-style-type: none"> ● Typical or good load (indicator of fishing effort)
Market considerations	<i>NA</i>	<ul style="list-style-type: none"> ● Flooding the market, supply and demand, market diversity, quality of fish, etc. ● Dictating fishing trips (e.g., fishing in bad weather to meet seasonal market demands)
Passing of Knowledge	<i>Generational Fishing</i>	<ul style="list-style-type: none"> ● Family ties (also see 'Reason for Bottomfishing' theme)
	<i>Taught to Fish</i>	<ul style="list-style-type: none"> ● Who taught the individual to fish (e.g., mentor who helped them get started)
	<i>Teaching to Fish</i>	<ul style="list-style-type: none"> ● Who the individual taught, or is currently teaching to fish (mentoring role)
	<i>Traditional Knowledge</i>	<ul style="list-style-type: none"> ● Passing down traditional bottomfishing skills, expertise (e.g., techniques, fishing spots)

	<i>Trust</i>	<ul style="list-style-type: none"> • When participants choose to share (or choose not to) knowledge, teaching to fish, secrets of fishing, fishing spots • Referencing trust to government relationships/confidence in fishery management
Public Perception of Fishermen	<i>NA</i>	<ul style="list-style-type: none"> • How the public views fishermen • Changes in perception over time • Need for continued education/outreach
Reason for bottomfishing (Identity)	<i>Financial</i>	<ul style="list-style-type: none"> • Career choice, family support, boat maintenance, etc.
	<i>Lifestyle</i>	<ul style="list-style-type: none"> • Referring to bottomfishing as a lifestyle (e.g., cultural and/or community ties to fishing) • Subsistence fishing
	<i>No Longer Fishing</i>	<ul style="list-style-type: none"> • Reasons for quitting fishing (e.g., age-related, other job opportunities, industry changes)
	<i>Recreational</i>	<ul style="list-style-type: none"> • Fishing for fun, hobbies, relaxing, social reasons
	<i>Started Fishing</i>	<ul style="list-style-type: none"> • Variation of experiences led to entrance into fishery
Red fish	<i>NA</i>	<ul style="list-style-type: none"> • Cultural traditions around red fish/paka (e.g. celebrations, symbol of good health, sharing with community)
Shared ocean spaces	<i>Differences by Island</i>	<ul style="list-style-type: none"> • Weather differences (e.g., ability to fish, fishing technique) • Availability of fish • Fishing zones • Number of bottomfish fishermen
	<i>Fishing Grounds – Spots</i>	<ul style="list-style-type: none"> • Protecting fishing spots from other fishermen (secrecy) and sharing spots with trusted community members • Technology, specifically GPS, affecting scouting or hunting techniques

		<ul style="list-style-type: none"> • Techniques to hide fishing spots (e.g., use of drifting and pretend fishing) to avoid ‘stealing’ grounds • Theme connects to ‘passing of knowledge,’ ‘lack of confidence in next gen,’ and ‘bottomfishing skills’
	<i>Interactions with Fishing Boats (non-bottomfish)</i>	<ul style="list-style-type: none"> • Some issues/contention around industrial fishing affecting catch and safety
	<i>Interactions with non-fishing Boats</i>	<ul style="list-style-type: none"> • Non-fishing boats include submarines (military presence), coast guard, tugs, barges, and cruise ships (tourism)