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Social Conflict on the Seas: Links Between Overfishing-Induced Marine Fish Stock Declines and Forced Labor Slavery

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Using fuzzy cognitive mapping - a participatory, semi-quantitative systems modeling technique that uses participants' knowledge to define complex system dynamics including fuzzy causality (causality represented as a matter of degree on a spectrum rather than certainty) - this study tested the hypothesis by interviewing stakeholders from global slavery hotspots. Data was obtained through semi-structured, qualitative interviews (n = 44) that included a cognitive mapping activity. An iterative, systematic, and inductive thematic content analysis condensed each map into major variables. Using structural models derived from graph theory, each cognitive map was converted into an adjacency matrix. From the matrix, influence metrics were calculated to elicit further information about each graph's structure and group like maps. ANOVAs and independent sample t-tests to test for map structure differences across demographic variables were statistically insignificant. As such, using vector-matrix operations, all 44 maps were aggregated into one cumulative, consensus map. This consensus map was then used to refine the posited theory and execute case scenario analyses to assess the value of forced labor slavery changes in proposed case scenario simulations.

Broadly, participants identified forced labor slavery as a distal outcome of marine fish stock declines, describing a process wherein declines intensify effort - increasing production costs. These increasing costs then incentivize the use of forced labor in response to narrowing profit margins, ultimately normalizing the use of forced labor as an economically rational decision. Case scenario analyses suggested if overfishing is not addressed, and marine stocks continue to decline, forced labor slavery in the fishing sector will continue to increase. Additionally, increases in forced labor slavery may increase stock declines. Proposed policy interventions to mitigate overfishing could reduce labor abuses in the sector. Therefore, the framework produced by the consensus map should guide more wide-scale, empirical testing of the relationship between fish stock declines and forced labor slavery and identify points-of-intervention for policy and fisheries management practices to mitigate social-ecological injustices in the fishing sector.

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Jessica L. Sparks, MS, MSW, LICSW

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In closing, I would like to dedicate this dissertation to the strongest, most courageous woman I have ever known—my grandmother. The woman whose good kind of stubbornness I like to think I inherited. And despite all the violence in the world, and its enduring impacts, I know she would want me to still believe that love and compassion will one day win.

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Chapter One: Introduction

Problem Statement

Globally, vulnerable populations facing extreme poverty disproportionately depend on marine fish for food, nutrition, livelihood, and export earnings (Food and Agriculture Organization of the United Nations [FAO], 2014, 2016a). Approximately 3.1 billion people worldwide, or more than 40% of the world's population, rely on seafood as their primary protein source, with oceanic fish accounting for more than 20% of protein consumption. However, in most small island developing states (SIDS) and coastal low-income food-deficit countries (LIFDCs) (e.g., Bangladesh, Ghana, and Sierra Leone), marine fish species constitute more than 50% of dietary protein intake. In these poorer countries, more than 120 million impoverished persons also depend on marine capture fisheries for all or most of their income (FAO, 2014, 2016a). Approximately 90% of all small-scale[1], marine capture fishers and more than two-thirds of all marine fishers worldwide live in developing countries' coastal areas where few alternative livelihood activities exist (Organisation for Economic Co-operation and Development [OECD], 2015; World Bank, 2013). Additionally, developing countries export more than 50% of all global fish products, stimulating development through job and income generation (Bellmann, Tipping, & Sumaila, 2016; FAO, 2016a; Smith et al., 2010). The human

[1] See Appendix A for a list of terms commonly used to describe fisheries and vessels.

population is projected to reach 9.7 billion people by 2050, with the majority of this increase in developing countries with pre-existing high food insecurity rates, rendering fisheries essential for poverty alleviation and the achievement of the Sustainable Development Goals (SDGs)in the developing world (United Nations [UN], 2017).

Despite developing countries' dependence on fish, anthropogenic pressures primarily perpetrated by industrialized nations (countries with developed economies and the social capacity to adapt to environmental hazards) have endangered approximately 77% of marine fish stocks, with at least 30% of stocks classified beyond or near beyond ecological recovery (FAO, 2016a). These human-induced pressures include overfishing and wasteful bycatch[2] and discard from extractive industries;[3] pollution from coastal development; and ocean acidification and warming caused by greenhouse gas emissions (Halpern et al., 2008; World Wildlife Fund [WWF], 2015; Zeller, Cashion, Palomares, & Pauly, 2017). The resulting ecological impacts on fish stocks from these pressures include food web disruptions, anatomical and physiological changes, catastrophic population and abundance declines, and shifts in spatial and depth distribution (Jackson et al., 2001; Maureaud et al., 2017; Pauly & Cheung, 2017; Rijnsdorp, Peck, Engelhard, Möllmann, & Pinnegar, 2009).

[2] Bycatch is all unintended, non-targeted specimens harvested in a catch. This includes specimens that are the wrong species, sex, or age (i.e., a juvenile or undersized specimen).

[3] Marine extractive industries include various fishing methods, deep sea trawling wherein weighted nets are dragged along the sea bed, deep sea and seabed mining, and deep-water gas and oil drilling.

Slavery as a proposed social outcome of fish stock changes. While these ecological impairments are well understood and extensively documented, research on the social impact of fish stocks' changes (specifically fewer and smaller fish with altered spatial distributions that result in reduced catches) has been limited to primarily proximal outcomes such as malnutrition (Golden et al., 2016). Changes the influence of fish stocks on more distal outcomes, such as social conflicts like forced labor slavery, is less understood and often unanalyzed.

Defining modern forced labor slavery.

For this study, forced labor slavery was defined as "the involuntary entry and holding of people at a workplace through force, fraud, or coercion for purposes of forced labor so that the slaveholder can extract profit" (Free the Slaves, 2017, para. 1), and was consistent with the author's previous scholarly work on the subject matter (Decker Sparks & Hasche, 2018). The reasons for using this definition, espoused in Decker Sparks & Hasche (2018), and repeated here, include focusing the identification of labor abuses on the victims' experiences versus legal frameworks which overemphasize the need for specific forms of movement across borders (Bales, 2017). Human trafficking, the more rhetorically popular term in scholarship, media, and the public, instead centers legal frameworks and is influenced by conflicting and inconsistent definitions that vary between governments and institutions (Bales, 2017). As a result, the term human trafficking is applied more narrowly, and likely under identifies the scope and scale of labor abuses on fishing vessels.

The definition used in this study points to the nuanced differences between historical slavery and modern slavery, wherein slavery is still defined by the relationship

between victim and abuser (akin to an owner in historical slavery). However, over time, slavery has evolved from an owner-property relationship to a relationship where the victim receives little or no payment for their labor while the perpetrator's profits increase (Bales, 2006). Other shifts include the transposition of unfreedoms, or when the victims' freedom is restrained, from point of entry into the exploitative relationship (historical slavery) to the point of exit from the relationship (modern slavery) (Barrientos, Kothari, and Phillips, 2013; Phillips and Mieres, 2015; Stringer, Whittaker, & Simmons, 2016) and control of the victim at point of entry into the relationship being exerted by a person (historical slavery) to socio-economic conditions (modern) (O'Neill, 2011). Indeed, while some victimized fishers are still purchased by boat captains (Chantavanich, Laodumrongchai, and Stringer, 2016), many exhibit a degree of agency at point of entry caused by desperation to meet basic needs and exploited by brokers and/or recruiters' deception (O'Neill, 2011). These subtle differences are important distinctions to encompass in a definition, as they challenge misconceptions about what constitutes slavery that lead to misunderstandings about the nature and extent of modern slavery.

Beyond the legal concept of human trafficking, some governments, international frameworks and protocols, and non-governmental organizations also make a distinction between non-sexually exploitive coercive labor practices such as forced labor, debt bondage, and bonded labor. Because these definitions can differ between inter and intra-country based on laws, political structures, and cultural influences, the International Labour Organization (ILO) defines any activity or process involving involuntary consent into an exploitative labor relationship and using the threat of or actual force, coercion, or punishment to remain in the exploitative relationship as forced labor exploitation, one of

the four types of modern slavery[4] (Walk Free Foundation & International Labour Organization [ILO], 2017). Therefore, this definition is considered holistic enough to encompass all manifestations of forced labor slavery globally. The ILO's authority is derived from the perception that it is a global governing body impervious to country or regional biases, and thus more objective in defining and identifying slavery. Indeed, within the human rights community, governments are often accused of minimizing slavery whereas NGOs are accused of inflating the problem (e.g., Kessler, 2015).

Slavery in the fishing industry.

The shift from historical to modern slavery as noted by Bales (2006), also challenges the legitimacy of slavery in the fishing industry as a problem. Because slavery is illegal in every country and most forced labor slavery victims are no longer sold in public venues, slavery is perceived as a historical relic, and therefore not a current or important problem. Also, unlike historical slavery, modern slavery is more fluid, where victims spend on average 20.5 months enslaved, instead of lifetimes, (ILO & Walk Free Foundation, 2017), further contributing to false beliefs and perceptions that slavery has been eradicated and is no longer a problem.

Enslaved persons' hidden nature, and the physical inaccessibility of fishing fleets sailing hundreds of miles from shore for years at a time have created a dearth of empirical research on the problem, making it difficult to quantify the problem and further contributing to hiding the problem from the public. Investigations suggest the fishing industry is one of the biggest users of forced labor slavery, with a conservative estimate

[4] Beyond forced labor exploitation, the other three types of modern slavery are forced sexual exploitation, state-imposed exploitation, and forced marriage.

of two million people enslaved in the fishing/agriculture sector (Walk Free Foundation & ILO, 2017), including on boats originating from the United States, Thailand, New Zealand, United Kingdom, Nicaragua, and Peru amongst others (Bales, 2016; Bureau of International Labor Affairs, 2016; Environmental Justice Foundation [EJF], 2014, 2015a; FishWise, 2014; ILO, 2013a; Mendoza, McDowell, Mason, & Htusan, 2016; United Nations Office on Drugs and Crime [UNODC], 2011; Verité, 2016; Yea, 2014). Additionally, of all the sector estimates for forced labor slavery, fishing is the most challenging in that victims in the middle of the ocean remain inaccessible and unaccounted for despite technological advances such as drones which have aided the counting of victims in other sectors. In 2017, out of concern that the problem is growing, INTERPOL even issued a notice alerting law enforcement about the presence of labor exploitation, human trafficking and slavery in the fishing industry (INTERPOL, 2017).

From the little existing research, it is believed that most slavery victims in the fisheries sector are illiterate, impoverished, male domestic and transnational migrants (Bales, 2016; EJF, 2014; ILO, 2013a; International Organization for Migration [IOM], 2008). Unable to read contracts, they are frequently tricked into debt bondage schemes by middlemen and employers who offer employment agreements that include debt repayment, advanced wages, equipment loans, and/or travel advances and documents for "higher paying" work in foreign countries in exchange for labor until the "debt" to the employer is satisfied. These schemes persist as employers continuously add new debts (e.g., for food and shelter) making repayment impossible, enslaving the laborer, and increasing the employer's profits (Aghazarm & Laczko, 2008; Bales, 2006, 2007, 2012, 2016; ILO, 2005; Chantavanich, Laodumrongchai, & Stringer, 2016; End Slavery Now,

2017; Ferolin & Dunaway, 2013; IOM, 2008; MacFarlane, 2015; Stringer et al., 2016; Wheaton et al., 2010; Yea, 2014). However, though debt bondage is the most common mechanism for victims to enter slavery, it is not the only one. A smaller number of victims have reported being kidnapped. Moreover, though slaves may board a vessel in their country of origin, they can be released from bondage and/or slavery without resources in countries anywhere in the world, making them vulnerable to enslavement on a ship in their new country and perpetuating a vicious cycle (Mendoza et al., 2016).

Extensive changes in fish stock abundance, distribution, and individual specimen size (herein referred to as fish stock declines) force fishing vessels to fish longer, farther from shore, and in deeper waters to maintain yields (Brashares et al., 2014; UNODC, 2011). This fishing intensification increases production costs and inflates cheap labor needs in response to narrowing profit margins (Bell, Watson, & Ye, 2016; Gascuel et al., 2016; Hutchings & Myers, 1995; Watson et al., 2013). Therefore, ecological drivers of forced labor slavery must be considered in conjunction with other known indicators, such as poverty (Bales, 2006, 2007), to efficaciously mitigate labor abuses on fishing vessels. Thus, this dissertation frames anthropogenic-induced fish stock declines and forced labor slavery as a coupled social-ecological problem within the context of Social-Ecological Systems theory (SES). SES postulates that social and ecological multilevel systems are nested, interactive, and interdependent, exhibiting complex feedback loops that result in disturbances in one system impacting all systems (McGinnis & Ostrom, 2014; Ostrom, 2007, 2009, 2010). As a result, SES provides the theoretical rationale for linking two previously considered disparate systems.

Study Purpose and Specific Aims

Data characterizing fish stock declines and forced labor slavery's relationship does not yet exist and trans-disciplinary research is necessary to create efficacious, linked social-ecological interventions that balance ecological and human security. Fisheries management approaches have historically been reactive and siloed within biology, ignoring and potentially perpetuating human rights violations. To shift fisheries management towards preventive strategies inclusive of socially just outcomes, social work must aid in the production of trans-disciplinary knowledge exploring the linkages between fish stocks and labor conditions.

Guided by an overarching research question, "What is the relationship between fish stock changes and forced labor slavery," this exploratory study's goal is to build a theoretical framework modeling marine fish stock declines and forced labor slavery as a social-ecological system using fuzzy logic cognitive mapping (FCM) to assess relationships and their strength between key constructs and variables. FCM is a participatory, semi-quantitative systems modeling technique that uses participants' knowledge and experiences to define complex system dynamics, including fuzzy causality (causality represented as a matter of degree on a spectrum rather than certainty), and infer proposed interventions' impacts on the system by executing case scenario analyses (Kosko, 1986; Özesmi & Özesmi, 2004). While several NGOs, including Environmental Justie Foundation (EJF) and FishWise have posited a relationship between fish stock declines and forced labor slavery, data quantifying the strength of the relationship and the processes that create the relationship are still lacking.

Based on the fishing farther, longer, and deeper premise supported by empirical fisheries data (see Bell et al., 2017; Costello et al., 2012; Pauly & Zeller, 2016; Watson et al., 2013; White et al., 2008) and human rights theory (see Brown, 2000; Crane, 2013; Domar, 1970), this author previously posited a framework (Figure 1) hypothesizing a negative association between fish stocks and forced labor slavery (Decker Sparks & Hasche, 2018). An adaptation of Brashares and colleagues' (2014) Wildlife Decline and Social Conflict framework, the framework theorized the mechanisms, processes, outcomes, and contextual constructs linking the two problems (Decker Sparks & Hasche, 2018). Revisions to the new framework from Brashares et al.'s (2014) original included improved integration of human rights theory with fisheries empirical data and a greater emphasis on power differentials in that incite exploitative labor relationships.

Figure 1. Revised Wildlife Decline and Social Conflict Framework

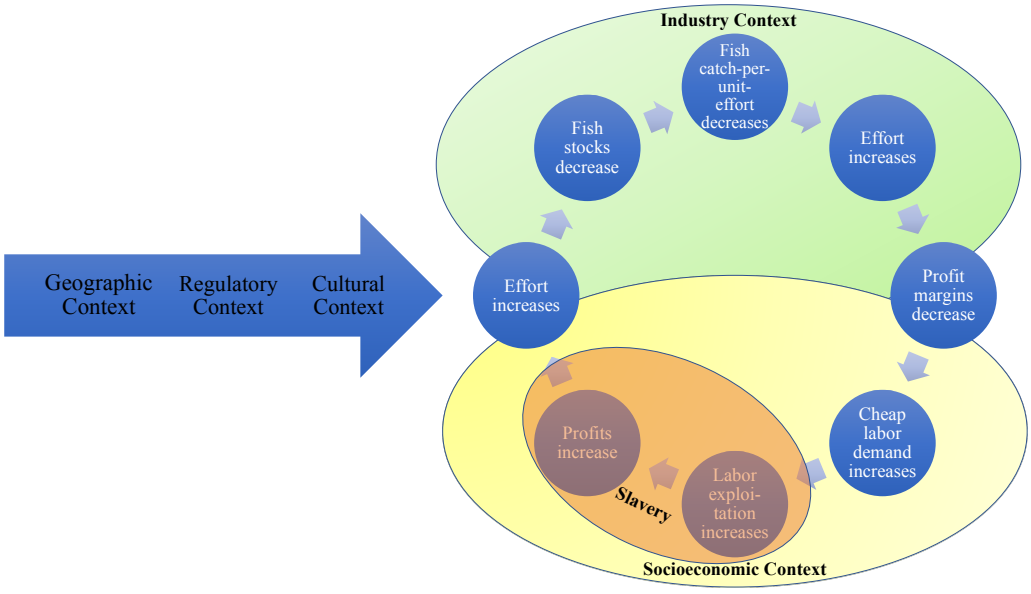

Figure 1. Theoretical framework hypothesizing the pathways linking fish stock declines and increases in forced labor slavery and the contextual constructs influencing the proposed pathways (Decker Sparks & Hasche, 2017).

Using the revised framework, and still hypothesizing a negative association, this study's specific aims are to: (1) test the framework's validity, and use participants' knowledge to refine the framework's social-ecological system's components, organization, and interrelationships; (2) quantitatively characterize the relationship between fish stock declines and slavery using adjacency matrices; (3) identify constructs and variables that potentially mediate and/or moderate the relationship between fish stocks and forced labor slavery; and (4) explore how the system might react under a range of possible changes in stock abundance and fishing intensification due to proposed interventions.

Dissertation Organization

This introductory chapter identifies and provides a context for the substantive topic under study, as well as an overview of the study's purpose and aims. Chapter two provides a brief review of empirical and theoretical literature, from diverse disciplines, supporting the linking of these two historically disparate problems. A concise assessment of international policy gaps is also included. In chapters three and four, the study's methods and results are presented in detail. The dissertation concludes with a discussion of key findings from the results and implications for future research as well as the identification of opportunities for transdisciplinary collaboration.

Chapter Two: Literature Review

Misconceptions and disagreement in public and academic arenas about what constitutes post-20th century slavery, coupled with the hidden nature of forced labor slavery victims and the physical inaccessibility of fishing fleets sailing hundreds of miles from shore have created a dearth of traditional research in the area. Recently, investigative journalism from the Associated Press augmented existing traditional research by providing first-hand testimony of the fishing industry's numerous and extensive labor abuses, including slavery (Mendoza et al., 2016). The reporting's scope was limited, though, focusing almost exclusively on the supply chain. As a result, still very little empirical research explores the drivers of slavery on fishing vessels and theoretical research on forced labor often fails to consider the complex linkages between social and ecological systems when conceptualizing slavery drivers. If the motivation for enslaving persons is profit maximization (Bales, 2006), then the mechanisms that inhibit profits must be assessed for their contributions to slavery. As such, Decker Sparks and Hasche (2018) posited Figure 1, delineating the potential economic mechanisms facilitating a relationship between fish stocks and labor conditions, and further explicating the empirical and theoretical support for each pathway represented in the figure.

Anthropogenic Pressures on Fish Stocks

This study's underlying premise is that human behavior is inducing changes in fish stock abundance, distribution, and individual specimen size, resulting in increasing pressures to human economic systems in the fishing sector. These anthropogenic threats include overfishing, coastal pollution, and ocean warming and acidification resulting from climate change. Though studies and conversations about these problems are typically siloed in the natural sciences, these pressures on marine ecosystems have dire social impacts on predominantly vulnerable populations, though they are disproportionately caused by industrialized societies, making this a social justice issue pertinent to fields like social work and social welfare research.

Overfishing. Since 1970, unsustainable global fishing has resulted in a 50% decrease in populations of fish species consumed by humans for food products (FAO, 2014). Additionally, the percent of assessed marine commercial fish stocks classified as overexploited (near beyond ecological recovery) or depleted (beyond ecological recovery) increased from 10% to 31.4%, with the plausibility of recovery in some stocks (e.g., cod) questionable (FAO, 2016a). These classifications are based on the ecological theory of maximum sustainable yield (MSY), or the maximum number of fish that can be harvested from a stock in a period without impacting the stock's ability to reproduce and maintain or replenish the stock's population size over time (Fox, 1970; Schaefer, 1954). When fish extractions exceed MSY, the stock declines. The global fishing fleet, dominated by EU and US subsidized trawlers, harvests two to three times more fish than the ocean's MSY (Sumaila et al., 2015; WWF, 2015).

Increased demand. Increased demand for fish drives overfishing. Since 1960, the annual per capita fish consumption in industrialized countries has continued to grow annually, reaching 26.8 kilograms in 2013 (FAO, 2016a). Demand in the United States, European Union countries, and China has surpassed the production capabilities of their coastal waters, resulting in these countries fishing more and more in the territorial waters of developing countries who lack the infrastructure to fully exploit (i.e., extract the maximum amount of fish without jeopardizing a stock's sustainability) their fisheries (Pauly & Zeller, 2016). This continued demand growth in developed countries is predicated on a growing obsession with exotic fish products such as sushi, trade globalization, human population increases, and increasing scientific evidence of fish's health benefits (FAO, 2014, 2016a WWF, 2015). During the same 53-year period, the annual per capita consumption in developing countries rose to 18.8 kilograms from 5.2 kilograms, and in LIFDCs from 3.5 to 7.6 kilograms, while per capita consumption declined in some African countries (FAO, 2016a). While consumption in developing countries is also increasing, overall per capita consumption is still substantially inferior to developed countries. Though this consumption data is not differentiated by marine versus freshwater species, more than half of all fish consumed by humans for food is harvested from marine waters (FAO, 2014).

Historical overfishing. Marine overfishing is also not a recent phenomenon. It has long been rooted in the freedom of the seas principle, a belief that (privileged) humans are entitled to harvest as much as they want from the shared ocean; therefore, marine fishing practices should not be subjected to regulation. While it is difficult to

reconstruct exhaustive historical accounts of fish harvests and extractions (in part, because fish decompose quickly and human consumption includes bones), paleontologists, archaeologists, and biologists have documented centuries of large marine vertebrate (e.g., whales) and small invertebrate (e.g., invertebrates with shells such as conchs) culls (Clapham & Baker, 2002; Jackson et al., 2001). For example, in the 16th and 17th centuries the Basque extirpated entire whale populations in the Bay of Biscay, then began whaling farther into the sea. This behavior further decimated other North Atlantic whale populations that five hundred years later have yet to recover (McLeod et al., 2008), and likely impacted indigenous populations access to a subsistent natural resource. Scholars hypothesize that historical overfishing likely coincided with mass whale and invertebrate slaughters, and suggest three distinct periods of human impact on marine ecosystems: aboriginal, colonial, and global (Jackson et al., 2001).

During the aboriginal period, while indigenous populations impacted marine ecosystems, most research suggests they fished sustainably and only for subsistence purposes until contact with White settlers (Bennett, 2007; Jackson et al., 2011; Nuttall et al., 2005). The colonial period, coinciding with colonization of indigenous populations, was characterized by mercantile powers' systematic exploitation of marine species for financial and political gain (Jackson et al., 2001). And the current global period, starting approximately after World War II, is similar to the colonial period in that fishing and marine resource extraction is a strategy for usurping political power and economically oppressing marginalized populations. However, it is also now characterized by new

intensive extractive technologies that have increased the breadth and depth of unsustainable fishing (Jackson et al., 2001).

In addition to the freedom of the seas principle, a belief that the ocean's bounty was limitless permeated all three periods (including the global period until the late 1990s/mid 2000s). In 1883, at the London International Fisheries Exhibition, professor and biologist T. H. Huxley infamously stated, "all the great sea fisheries are inexhaustible; that is to say, that nothing we do seriously affects the number of the fish. And any attempt to regulate these fisheries seems to be useless" (as cited in North Atlantic Coast Fisheries Arbitration, 1909). By the 1940s, research suggested that unregulated fishing's deleterious impacts included collapsing fish stocks just five decades after initial fishing; disruptions to food chains and natural predation that enabled non-native fish and algae to flourish; and chemical imbalances that caused massive coral reef die-offs (Finley & Oreskes, 2013; Graham, 1943; Russell, 1942; Thompson, 1936). However, despite the growing evidence, overfishing was still widely considered unimaginable. Globally, fishing marine areas was still framed exclusively as a political and territorial issue. Further, the political resistance to regulation highlighted by Huxley was pervasive, ignoring overfishing's environmental and social implications.

Current overfishing challenges. Today, consensus about overfishing's occurrence exists, despite divergent paradigms and approaches between fisheries managers and conservationists (Davies & Baum, 2012; Worm et al., 2009). Curbing overfishing; however, faces numerous challenges. Foremost, catch quotas are an imperfect, data-limited science, and most quotas are still based on the FAO fisheries

statistics database—the only longitudinal, global repository of reported catch and landing data (FAO, 2016b). While representing the best available, non-reconstructed or hypothetically modeled data, the FAO's catch data is flawed. It is not adjusted for illegal, unreported, and unregulated fishing (IUU), bycatch (i.e., the incidental harvesting of non-targeted marine organisms during extraction activities), or discard (i.e., targeted species thrown overboard, often deceased, to harvest more profitable fish); excludes catches from small-scale and artisanal fisheries; and mostly relies on self-reported data from countries (Kelleher, 2005; Pauly & Zeller, 2016; Zeller, Cashion, Palomares, & Pauly, 2017). It is believed that numerous countries under report their catch data to cover up rampant IUU. Additionally, some countries also over report their catch data to exaggerate their coastal fisheries' productivity and minimize overfishing-induced declines (Pauly & Zeller, 2016). As a result, historical catch reconstructions have disagreed with FAO's measures by as much as 50% (Pauly & Zeller, 2016). These potentially erroneous catch data points, are then part of the statistical calculations used to estimate abundance trends, which provide the foundation for establishing quotas; therefore, potentially contributing to "legal" overfishing.

Further, more reliable data on fish stocks, particularly deep sea fish, obtained via scientific observations is difficult to obtain due to a lack of technological capacity. It is also time intensive and cost prohibitive (Devine, Baker, & Haedrich, 2006). As a result, less than 1% of all fish stocks have been assessed by scientists (Costello et al., 2012), and 80% of global fish catch is harvested from unassessed stocks (Richard et al., 2011).

Consequently, many fisheries scientists interpret the available data as best case scenario and recognize in their interpretations that the situations may be more dire than presented. Within the scientific community, there is also a communal understanding of which ports and countries have reliable data (e.g., Norway) and which do not (e.g., Somalia) and thus require extrapolations of potential worst case scenarios that include adjusted models to account for potentially erroneous catch data. While the FAO data was used in this study, newer, more complex abundance models that have yet to be validated were also considered (Pauly & Zeller, 2016). And qualitative, ecological knowledge from stakeholders based on first-hand testimony from fishers about length of time to fish and catch sizes amongst other attributes of their fishing experiences was also integrated to assess for the extent of overfishing.

Overfishing decreases abundance, causing fishers to fish longer, deeper, and father to maintain yields (UNODC, 2011), and it also impacts the evolution of phenotypic traits. For example, increasing fishing pressures in overfished stocks have decreased fecundity, reduced stock age, and delayed sexual maturation (Pandolfi, 2009). The decreased reproduction delays the stock's ability to replenish itself when being fished, further threatening the stock's population and abundance. Additionally, overfishing has decreased the overall size and quality of the fish, also causing fishers to fish deeper, farther, and longer to harvest larger fish that are more profitable in economic markets since quotas often limit the number of fish that can be harvested in a given haul (Zeller et al., 2017).

Ocean warming and acidification and coastal pollution. Modern overfishing is also compounded by other anthropogenic pressures that are impacting phenotypic traits, abundance, and fish stock distributions. Increased greenhouse gas emissions, which warm the ocean, increase acidification, and decrease oxygen levels, are reducing fish reproduction and growth rates and body weights (Cheung et al., 2012)—again resulting in less economically valuable fish that could cause fishers to increase fishing intensification to maximize profits. Warming temperatures have also caused notable distribution shifts in latitude and depth (Perry, Low, Ellis, & Reynolds, 2005), forcing fishers to fish further, deeper, and longer than previously. Some studies also suggest fish may not be able to evolve sufficiently to decreased oxygen levels, potentially causing mass die-offs that could affect population abundance (Cheung et al., 2012).

Marine pollution also compounds overfishing's effects on population abundance. Eutrophication (i.e., nitrogen enrichment) caused by chemical runoffs and fossil fuel burning associated with coastal development is increasing the number of dead zones in marine ecosystems (Diaz & Rosenberg, 2008). These zones lack enough oxygen to support fish species. If concentration thresholds are surpassed too quickly, it can again cause massive die-offs (lowering abundance), but even slower rates of eutrophication lead to notable distribution shifts that can intensify fishing efforts (Diaz & Rosenberg, 2008).

Theoretical Support for Linking Social-Ecological Systems

As previously described on page 7, social-ecological systems (SES) theory assumes human and non-human systems are nested and interconnected; therefore,

disturbances in one system have impacts across all systems (McGinnis & Ostrom, 2014; Ostrom 2007, 2009). It integrates social and behavioral theories with ecological resilience theory and the ecosystem services framework in analyzing natural resource users' decision-making processes (Berkes & Folke, 1998; Chan, Satterfield, & Goldstein, 2012; Cote & Nightingale, 2012; Rands et al., 2010). Ecological resilience theory posits that an ecosystem possesses an innate ability to self-organize to adapt to disturbances (Walker & Salt, 2006), and the ecosystem services framework accounts for the "benefits people obtain from ecosystems" (e.g., food, disease control, and nutrient cycling) (Millennium Ecosystem Assessment, 2005, p. 49). Beyond providing a theoretical foundation for linking traditionally disparate social and ecological problems, the theory's goal is to prevent segregated knowledge accumulation in traditional disciplinary silos by integrating diverse knowledge sources, institutional structures and subsystems, and social behavior patterns at all levels (Ostrom 2009; Rands et al., 2010). By modeling how the social and ecological systems interface, practitioners determine how, when, and where to intervene in each system to ensure the equitable and just sustainment of both ecological resources and the human resources users.

Critiques of SES theory. SES functions like a grand theory and is often criticized as too holistic, with abstract conceptualizations lacking the specificity needed to better understand highly contextualized problems (Binder et al., 2013; Hinkel, 2011; Mills, 1959). While this non-specificity ensures the theory's utility for a multitude of linked social-ecological problems, the abstract nature becomes problematic when researchers apply the framework to hypothesize coupled social-ecological problems whose linkages

have not yet been validated or to data limited systems. When critics suggest the framework's ambiguity hinders its purported ability to detect and predict feedbacks and identify causation (Hinkel, 2011; Ostrom & Cox, 2010), they are likely making inaccurate generalizations from the SES framework's applications to these hypothetically associated problems and systems. Without entering empirically supported models into the framework, SES is likely to "mask" deleterious uni- and bidirectional feedbacks and maladaptive responses (e.g., increased slavery) to resource unit disturbances (e.g., drastic declines in fish stocks) in favor of resilience thinking which assumes that systems (and users in the system) can inherently adapt to a shock (Hughes, Bellwood, Folke, Steneck, & Wilson, 2005, p. 383). The propensity to mask negative interaction outcomes results from the framework's underlying assumptions about innate self-organization and consequent oversimplification and over consideration of emergent positive behaviors, while neglecting emergent negative behaviors. SES may also oversimplify social-ecological problems by only accounting for uncertainty in ecological systems and not in human behavior, which perpetuates the framework's positive emergence bias and limits its predictive accuracy in relation to resource users' behaviors (Fulton, Smith, Smith, & Van Putten, 2011).

Since slavery and fisheries are both data limited systems (Bentley, 2015; Guth, Anderson, Kinnard, & Tran, 2014), and research investigating a negative association between fish stocks and slavery is limited, an analysis of the problem using social-ecological systems theory is not yet appropriate. Instead a more specific model that seeks empirical evidence to support the proposed relationship between fish stocks declines and

slavery increases, and develops a comprehensive understanding of slavery as a maladaptation to fish stock fluctuations, is needed. One such model is Brashares et al.'s (2014) Wildlife Decline and Social Conflict framework.

Brashares' Wildlife Decline and Social Conflict framework. While Decker Sparks and Hasche (2018) reviewed Brashares' Wildlife Decline and Social Conflict Framework at length, the framework's hypothesized pathways and empirical work from supporting scholars were included here to further inform the reader of their relevance for the dissertation. Brashares et al. (2014) postulated how and why fish stock declines could be a driver of increases in child slavery through an amalgamation of previously siloed empirical and theoretical disciplinary research (Figure 2). Building on the United Nations Office on Drugs and Crime's (UNODC) (2011) investigation that first speculated about the potential relationship between overfishing and human trafficking based on the presence of transnational criminal syndicates in illegal fishing rings, Brashares et al. (2014) proposed that fish stock declines increase fishing effort which subsequently increases costs. Specifically declines force vessels to fish longer, farther from shore, and in deeper waters to maintain yields. The framework deduces that cheap or free labor is thus an economically justified approach to offset increasing costs and continue harvesting fish at a rate that would otherwise be cost-prohibitive (Brashares et al., 2014).

Despite providing a useful starting point for exploring the relationship between fish stock declines and forced labor slavery, Brashares et al.'s (2014) framework has several limitations. Foremost, without explanation, it focuses on child slavery as the outcome of fish stock declines. However, because these scholars failed to consider

differing cultural norms around child work, the outcome of interest they describe is more akin to modern forced labor slavery of adults. Additionally, their construct language does not consider the power differentials that incite these exploitative relationships, nor do they define their non-technical constructs (e.g., child slavery). They also fail to provide support for their pathways or consider several important variables from the human rights literature which have been identified as increasing fishers' vulnerability to enslavement (e.g., transnational migration), since not all fishers are enslaved. As a result, Decker Sparks and Hasche (2018) revised the framework (see Figure 1) to address these concerns.

Figure 2. Brashares et al.'s (2014) Wildlife Decline and Social Conflict Framework

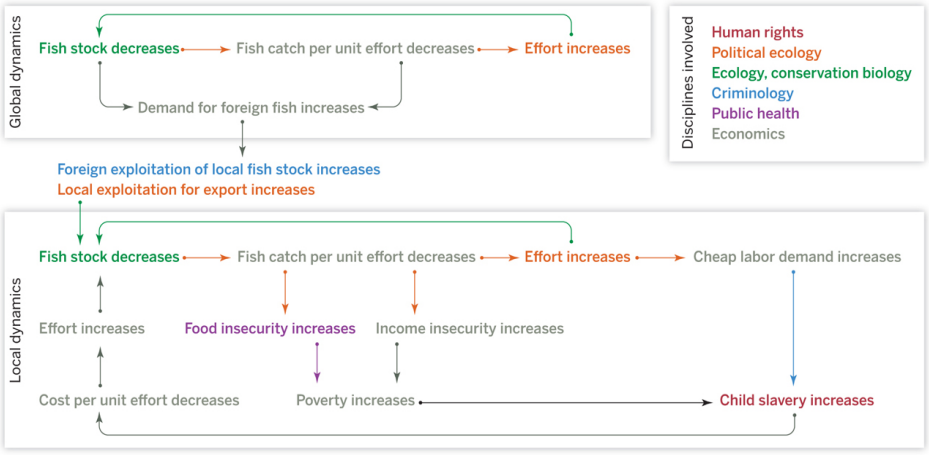

Figure 2. Brashares et al. (2014, p. 377) offer a hypothesized feedback loop linking fishery declines with exploitative labor practices such as child slavery. It is hypothesized here that as demand for cheap labor increase, more children will be enslaved.

Revised Wildlife Decline and Social Conflict Framework

Decker Sparks and Hasche (2018) explicated in detail and analyzed the quality of empirical and theoretical support for Figure 1's pathways. The primary tenets are described below.

Contextual constructs. As noted in Decker Sparks and Hasche (2018, p. 7), "While forced labor slavery is a global phenomenon, not all fishers are enslaved and context influences" the level of exploitation in a fisher and employer's relationship. Derived from Bales' (2006) and Crane's (2013) theories on modern slavery, geographic, regulatory, cultural, and socioeconomic contexts "create an environment that not only accommodates, but enables slavery" (Decker Sparks & Hasche, 2018 p. 9). Their interaction with one another then essentially creates a slave labor supply, while the industry contexts "create[s] the demand for slave labor" congruent with supply and demand economics (Decker Sparks & Hasche, 2018, p. 9). In the revised framework (Figure 1), though some indicators for each contextual construct were included (e.g., rates of documented, undocumented, and irregular migration as a proxy for geographic context or low education and literacy for the socioeconomic context), these constructs were intentionally broad to allow for operationalizations that could be tailored to the unique context of individual countries and regions.

Regulatory context. While there are numerous contextual constructs, the regulatory context may be the most important as the exploitation of a compilation of regularity gaps exacerbates the vulnerability of both the oceans and migrant fishers. Regulating the ocean (of which 64% is an open-access, common pool resource), and

transnational migration and fishing require multilateral, international legal agreements through the United Nations (UN). However, an analysis of power disparities within UN structures, using the six main organs leaders' country of origin and country representation as proxies for power, demonstrated that large-economies or developed countries consistently vote in their own economic self-interests, usurp power and leadership positions, and subvert the interests of small-economy, low-income, developing countries (Decker Sparks & Sliva, 2018). As a result, most transnational issues are governed by: a) bi- or unilateral instruments, b) non-legally binding instruments (i.e., soft laws), or c) legally-binding instruments that are essentially a decentralized patchwork of unenforceable obligations covering specific sub-issues (in the interest of developed countries) of larger issues (in the interest of developing countries) (Decker Sparks & Sliva, 2018). Further, countries are only obligated to binding and non-binding regulations laid out in an instrument if they signed it, ratified it (often done through their own domestic legislative bodies), and then ascent to the treaty—becoming a party to it once it goes into force. Most UN multilateral treaties have a threshold for how many parties must ascent before the instrument becomes a binding or soft law, and this threshold varies for each instrument (UN, n.d.)

As a result, the following regulatory gaps persist (Figure 3). Foremost, the ocean is governed by an international legally-binding document—the United Nations Convention on the Law of the Sea (UNCLOS). Signed in 1982, UNCLOS has become obsolete (Decker Sparks & Sliva, 2018). While UNCLOS ascribed authority over territorial waters (marine waters within 200 miles of its shoreline), fishing on the high

seas (international waters beyond 200 miles from a coastal state's shoreline), was essentially left unregulated to preserve the 'freedom of fishing' principle—the false belief that marine fish stocks are so abundant they could never be exhausted (UN, 1982, Part VII, Sect. 1, Art. 87, para. 1). Since then, more than a decade of negotiations for regulating fishing on the high seas have continuously been thwarted and stagnated by the lucrative commercial fishing interests of the United States, the European Union, and Russia (Decker Sparks & Sliva, 2018). On the other hand, low-income and developing countries lack the capacity to fish on the high seas, yet disproportionately incur the ramifications of the high seas stock declines (Teh et al., 2016; White & Costello, 2014).

Figure 3. Multilateral Regulatory Gaps

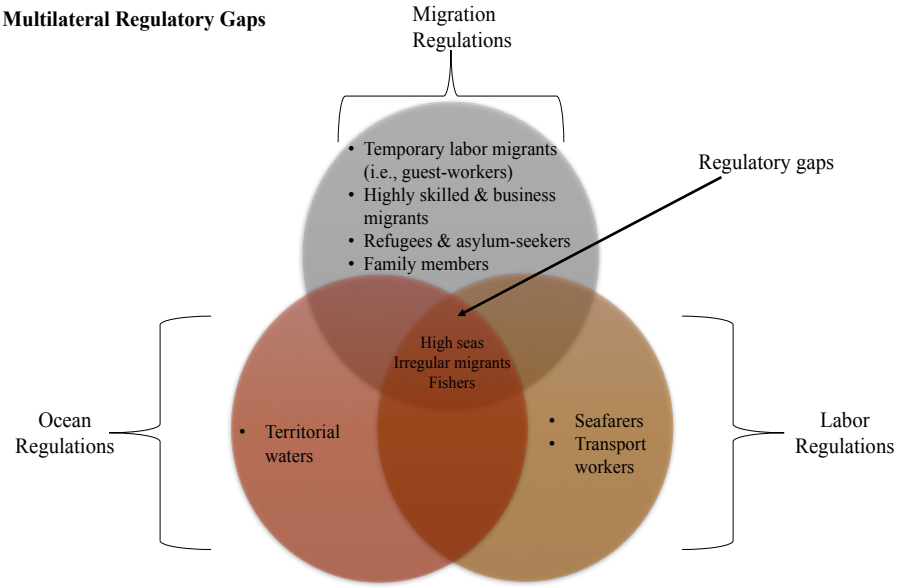

Figure 3. Venn diagram demonstrating that irregular (i.e., undocumented) fishers working on high seas vessels lack protections and rights under international, legally-binding instrumentation.

No legally binding, international instrument for transnational migration exists, resulting in the invisibility of irregular migrants left without protections or recourse—further exacerbating their vulnerability. While documented migrant workers are afforded some protections under the UN's (1990) Convention of the Rights of All Migrant

Workers and Members of Their Families, these are migrants who typically constitute guest workers and thus receive temporary authorization for migration and work in the destination country. These workers are also considered less vulnerable and typically have more economic security than irregular migrants attempting to cross borders out of economic desperation. Additionally, most of the countries that ratified the 1990 convention were origin countries and not host countries (ILO, 2003). Thus, the lack of an international, legally-binding instrument for migration results in lower-income, developing countries hosting a disproportionate number of irregular migrants while wealthier countries like the United States and European Union member states select migrants of their choosing and increase their border security to block the immigration of migrants perceived as less desirable (IOM, 2017).

Similarly, while seafarers and transport workers (crew on non-fishing vessels) on the high seas are protected under the ILO's various international labor standards protocols, all consolidated under the ILO's 2006 Maritime Labour Convention, fishers are specifically excluded and therefore have no labor protections when working in international waters (ILO, 2013b). As a result, in 2007 the ILO Work in Fishing Convention was signed; however, it just received enough in-country ratifications to enter into force on November 16th, 2017 (ten years after its signing). Further, it has only been ratified by 10 countries (Angola, Argentina, Bosnia and Herzegovina, Congo, Estonia, France, Lithuania, Morocco, Norway, South Africa), meaning only these 10 countries are bound by its regulations (ILO, 2017). UNCLOS' article 99, which is one sentence in length, does prohibit the transport of slaves for trade on vessels traversing the high seas

(UN, 1982). However, its language was never altered from the first UNCLOS in 1956, it does not define what constitutes a slave, and its typical interpretation is more congruent with historical slavery than modern forced labor slavery (e.g., UN, 2005).

Moreover, fishers lack rights and protections in most territorial waters as well. The practice of 'flags of convenience' allows vessel owners to flag or register their ship in any country they choose, and not necessarily where their boat is from or where their boat is fishing (Dieter, 2014). It is estimated that 73% of the world's fishing fleet flies a flag or multiple flags of convenience (Braestrup, Neuman, & Gold, 2016). Per UNCLOS, the flag state then has "exclusive jurisdiction" over the vessel, no matter where the vessel is fishing (UN, 1982). Consequently, many owners flag their vessels to countries whose regulations, monitoring, and enforcement are perceived as subpar or lax, or will change their flag while at sea to evade regulation wherever they are fishing.

Flag state jurisdiction intersects with fishers' labor rights because if a fisher is on a vessel flagged to Indonesia, but fishing in South Africa's territorial waters near Capetown, they are not protected by South Africa's labor laws. They would instead be subject to Indonesia's laws, but Indonesia lacks the capacity to monitor or enforce labor regulations on a vessel in South Africa. South Africa could and should report the vessel to Indonesian authorities, but only the flag state is responsible for penalty imposition (Dieter, 2014). Currently, New Zealand is the only country in the world that requires vessels fishing in their territorial waters to reflag or register with them so that fishers are protected by New Zealand's labor laws while fishing in New Zealand waters (New Zealand Parliament, 2016). Flag state jurisdiction also obscures which country has the

right or authority to prosecute identified slaveholders when human rights violations, which are criminalized under a legally-binding international treaty, are discovered—resulting in most vessel owners caught using forced labor incurring little more than a monetary fine.

Empirically supported pathways. As noted in expanded detail in Decker Sparks and Hasche (2018), empirical analyses of longitudinal, global fish stock data support Figure 1's pathways from fish stock declines to decreased profits (Figure 4). When fish stocks decline, as previously noted, so too do catches (Pauly & Zeller, 2016). However, instead of reducing effort to minimize losses, fishing effort is increased to maintain yields to meet subsistence needs and consumer demand (Bell et al., 2016; Watson et al., 2013). This increased effort increases fishing costs, decreasing already narrow profit margins (White et al., 2008) and increasing reliance on foreign subsidies to prop up the sector (Gjerde et al., 2013).

Theoretically supported pathways. Empirical studies of fisheries behavior have repeatedly found that fishing is a profit-driven industry continuously seeking to maximize economic gains by reducing input costs (Sethi et al., 2010). Therefore, based on the 1970 Domar Serfdom Model, the combination of profit motivation, lack of ownership over non-labor production means, and high labor intensity within the industry results in the reduction of labor costs being one of the only options for reducing cost inputs. Therefore, as highlighted in Figure 4, decreasing profits increase the demand for cheap labor (Andrees & Belser, 2009; Domar, 1970).

Figure 4. Empirically Supported Pathways in the Revised Wildlife Decline and Social Conflict Framework

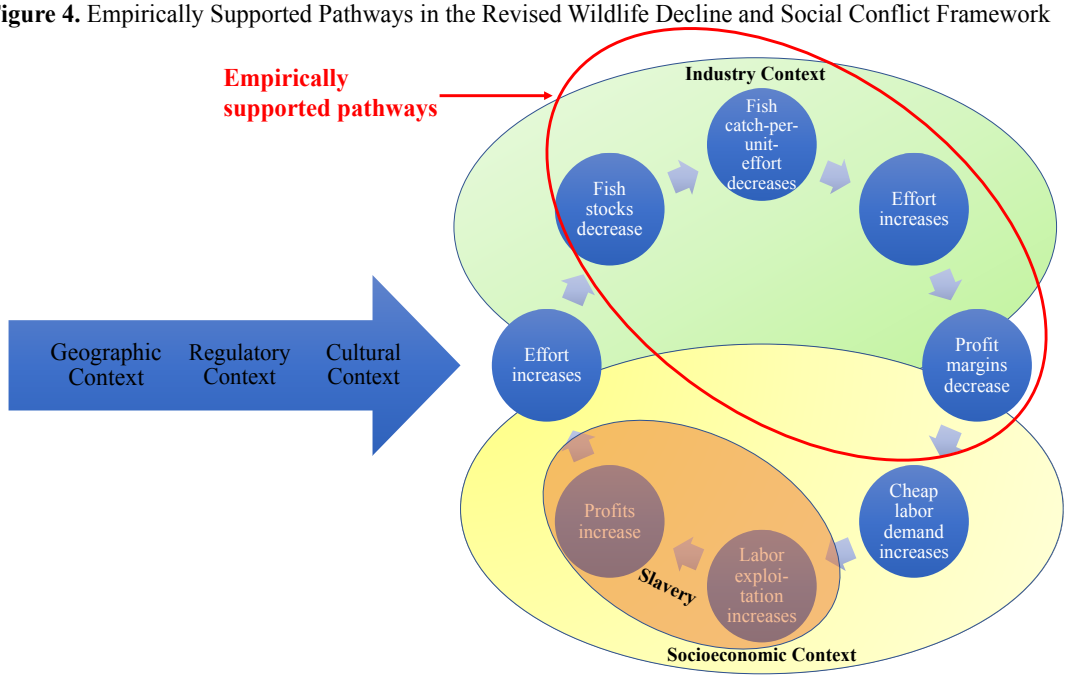

Figure 4. Highlighted are pathways in the framework supported by longitudinal and global empirical fisheries data.

Moreover, Crane's (2013) Theory of Modern Slavery supports increases in forced labor exploitation (i.e., slavery) as a product of increased demand for cheap labor within capitalist societies, where labor management is an entrenched value. Because of these entrenched values and the lack of other production inputs to reduce costs, forced labor becomes legitimized as an economically rational decision—making the use of forced labor not only plausible, but a likely response to the decreased profit margins incurred from increased effort amidst stock declines (Figure 5). And, since the cost of acquiring a slave has decreased substantially to an average of $90 USD per person and as little as $7 USD for refugees (K. Bales, personal communication, October 6, 2017), modern slavery is surprisingly inexpensive to enter. Then coercion and deception maintain the slaveholder/slave relationship between captain and crew at no financial cost, thus

increasing the slaveholder's profits. Per Bales (2006), it is when labor exploitation leads to increased profits, that slavery exists.

According to Bales' (2016) Ecocide theory, once profits have increased, there is no incentive for slaveholders to cease using forced labor. Instead, they will continue to try to maximize their profits by using as much forced labor as they can acquire to harvest as much fish as possible, thus increasing fishing effort and further overfishing stocks (Figure 5). Indeed, it is believed the use of slave labor on fishing vessels contributes to IUU fishing, a major driver of overfishing and fish stock declines (EJF, 2015b; Global Ocean Commission, 2013). Per the theory, as long as a steady *supply* of slave labor exists (which is created by the contextual constructs previously noted), and the *demand* for fish is not reduced, the use of forced labor will persist in the fishing sector (Bales, 2016).

Figure 5. Theoretically Supported Pathways in the Revised Wildlife Decline and Social Conflict Framework

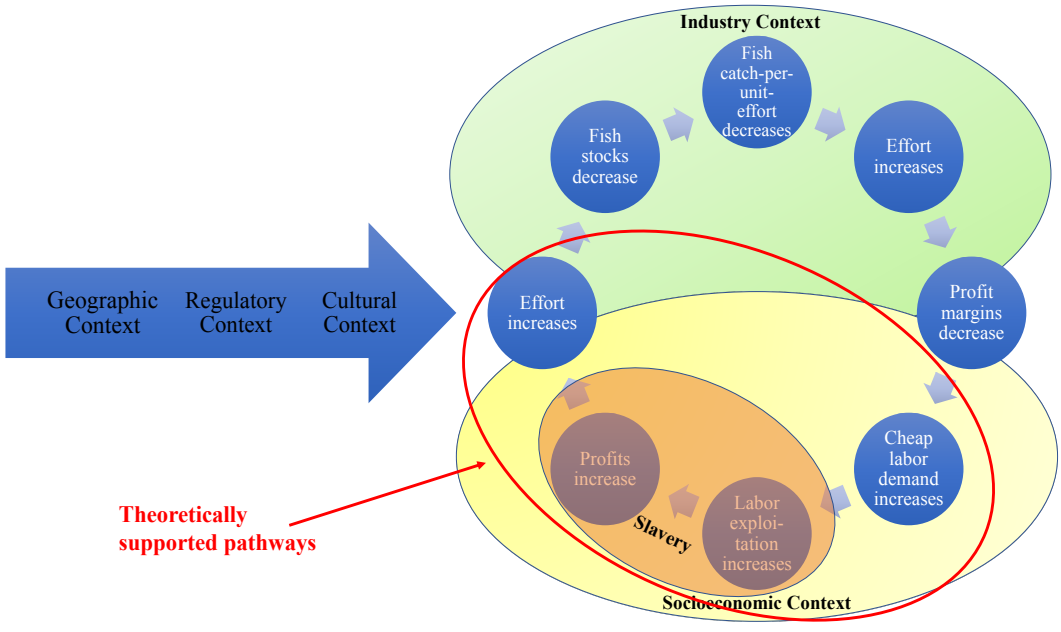

Figure 5. Highlighted are pathways in the framework supported by human rights theory. While a data limited field, most of these theories were constructed from in-depth case studies with victims, survivors, and offenders.

While data characterizing fish stock declines and slavery's relationship does not yet exist, Decker Sparks and Hasche's (2018) revised Wildlife Decline and Social Conflict framework can be used to direct empirical testing. Research advancing the framework is necessary to create efficacious ecological and social interventions and shift the social-ecological systems field from reactive, crisis management strategies to preventive ecological and anti-slavery strategies—particularly if fish stock declines are demonstrated to predict a substantial enough amount of slavery prevalence to be considered a root cause or driver.

Thus, this dissertation's boundary breaking and reformulating hypothesis challenged the boundaries of singular disciplines by linking two critical, yet historically, disparate issues. It is imperative for both natural and social scientists to consider these linkages as social-ecological conflicts inhibit equitable development and threaten vulnerable populations' security. Besides the continued framing of marine fish stock declines as primarily an environmental and political issue, the historical disciplinary boundaries that considered the social and natural sciences discordant also perpetuated the lack of consideration of fish stock declines' social impacts, including slavery.

By conducting this study, the author integrated social work knowledge, methods, and values to ensure that social outcomes and mitigating marginalization, oppression, and injustices are at the forefront of environmental interventions. Social work scholars have produced limited research about the connections between social injustices and unsustainable natural resources use, in spite of declarations by the International Federation of Social Workers, the International Association of Schools of Social Work,

and the International Council on Social Welfare (2012) that environmental sustainability and human trafficking and slavery are prioritized objectives for the discipline. In addition, social work scholars are being called to develop evidence to address these social-environmental inequities by the American Academy of Social Work & Social Welfare's 12 Grand Challenges for Social Work, one of which calls for a global agenda to "create social responses to a changing environment" (Kemp & Palinkas, 2015, p. 1). This paucity of knowledge threatens global equity. Instead, linking fish stock declines and slavery (previously disparate areas) can potentially generate greater consideration of relational power differentials between countries underlying overfishing practices and the lack of marine fishing regulations.

Chapter Three: Methodology

Methodological Orientation and Theory

This dissertation aimed to answer the research question, what is the relationship between fish stock changes and forced labor slavery, through a fuzzy logic cognitive mapping (FCM) methodological approach. The following aims were addressed in a step-wise process: (1) test the framework's validity, and use participants' knowledge to refine the framework's social-ecological system components, organization, and interrelationships; (2) quantitatively characterize the relationship between fish stock declines and slavery using adjacency matrices; (3) identify constructs and variables that potentially mediate and/or moderate the relationship between fish stocks and forced labor slavery; and (4) explore how the system might react under a range of possible changes in stock abundance and fishing intensification due to proposed interventions.

Though underused in social work research, historically, a variety of disciplines have used FCM as a theoretical and research approach, including engineering and the computer, social, behavioral, and political sciences (Papageorgiou & Salmeron, 2012). However, in the past decade, its popularity as a research tool to model complex and interrelated social-ecological systems has increased (see Devisscher, Boyd, & Malhi, 2016; Gray, Chan, Clark, & Jordan, 2012; Hobbs et al., 2002; Berkes & Berkes, 2009; Kok, 2009). Within social-ecological systems research, experts have primarily used FCM to understand local communities' decision-making processes including stakeholder

perceptions of social-ecological issues (Gray et al., 2014); compliance with natural resource management policies (Nyaki, Gray, Lepczyk, Skibins, & Rentsch, 2014); adoption of conservation interventions (Halbrendt et al., 2014); and adaptation strategies to perceived environmental risks (Henly-Shepard, Gray, & Cox, 2015).

FCM was selected for its known capacity to produce fuzzy causal theories in data and knowledge-limited areas where robust quantitative data would be expensive or near impossible to collect, but historically unrecognized stakeholder knowledge is extensive and available (Glykas, 2010; Kosko, 1986; Reckien, 2014). Within the field of modern slavery, a historical lack of transparency and cooperation between NGOs and academia has resulted in substantial, previously unconsidered and untapped stakeholder knowledge (Bales, 2017).

Prior research suggests FCM is particularly useful in building and refining theory, distinguishing drivers, and identifying linkages between social and ecological phenomena previously considered disparate (Fiss, 2011; Halbrendt et al., 2014). As such, FCM has often been described as the default methodology for hypotheses that are ideal for structural equation modeling (SEM), but lack empirical data for confirmatory model testing (Özesmi & Özesmi, 2004). Similar to SEM, FCM's foci is the entire model rather than isolating individual pathways (Gefen, Straub, & Boudreau, 2000), and its strengths include its ability to accommodate uncertainty created by insufficient data, abstract variables, feedback loops, and varied knowledge sources (Özesmi & Özesmi, 2004).

Approaching theory building comparably to grounded theory methodologies, FCM emphasizes the participant's construction of knowledge (Özesmi & Özesmi, 2004).

Unlike grounded theory, it is hypothesis driven, uses participant knowledge to confirm expert developed premises, and uses a more positivist approach to data analysis by quantifying qualitative data to make inferences (Bendassolli, 2013; Charmaz, 1990, 2014; Kennedy & Lingard, 2006). On the other hand, the validated fuzzy causal algebraic algorithms that underpin FCM's data quantification are considered a less positivist approach to causality more accepted by the social sciences (Glykas, 2010; Kosko, 1986). As a result, FCM balances the philosophical tensions about rigor and limitations that often exist between the social and natural sciences and hinder social-ecological systems research by integrating research methodologies from both the natural and social sciences. Thus, FCM was selected over purely qualitative methods.

FCM uses directed graph theory to integrate fuzzy logic, cognitive mapping, and neural networks (i.e., interconnected, nonlinear, dynamic processes). In FCM's first phase participants construct models from cognitive maps based on their knowledge, experiences, and observations. Guided by a research question, the researcher bounds the system and facilitates a dialogue where participants define the system's most relevant variables and the dynamic (i.e., stock and flow) cause-linkage-effect relationships between variables (Gray et al., 2014). Data to construct the model is typically obtained through (1) questionnaires and surveys; (2) content analyses of written texts including literature; (3) empirical data demonstrating causal relationships; (4) qualitative interviews; or (5) a combination of the aforementioned strategies (Özesmi & Özesmi, 2004). Participants analyze within-map data using directed content analysis, which permits conclusions about the degree, strength, and direction of relationships between

variables (Gray et al., 2014). These within-map analyses are characterized as directed since the researcher's hypothesis guided interview question development, which influences participants' variable identification (Hsieh & Shannon, 2005).

In the second phase, maps are quantified by the researcher using fuzzy graph structure theory, which employs adjacency matrices and specifically edge and partial edge connection calculations to produce a quantifiable, fuzzy causality (Glykas, 2010; Kosko, 1986). Once all maps are individually quantified, they are aggregated using a mean approach that averages values for common components and corresponding causal descriptions and dynamics (based on directed graph theory) to produce a singular social cognitive, consensus map that reflects the collective sample, explained in more detail on pages 62-63 (Glykas, 2010; Henly-Shepard et al., 2015; Kosko, 1986; Papageorgiou & Salmeron, 2012). Lastly, in the third phase, the converged consensus map is then used to establish the system's equilibrium and test "what if" case scenarios to identify the most efficacious interventions (Gray et al., 2014; Kosko, 1986; Nyaki et al., 2014).

Study Population

The study population was staff of anti-slavery non-government organizations (NGOs) working in the fishing sector, and staff from environmental justice and migration/immigration NGOs focusing on labor abuses in the fishing industry. Agency staff were selected over fishers as the study population, though many agency staff were former fishers, to minimize risk to participants and the researcher and maximize feasibility of engaging key stakeholders. Additionally, most fishers experiencing forced labor slavery are hidden and inaccessible to research staff as they are detained on fishing

vessels and not permitted to come ashore at landing sites (EJF 2014, 2015a; Fishwise 2014; ILO, 2013a; Mendoza et al., 2016). Therefore, it is highly unlikely that these individuals could be recruited to a sample without the researcher boarding fishing vessels. And when contacted by researchers who have boarded vessels, fishers are still hesitant and unlikely to disclose abuse out of fear of losing what they perceived as one of their only employment opportunities (Stringer & Simmons, n.d.). Further, due to these accessibility limitations, a precedent exists in modern slavery research for using stakeholder knowledge to generate estimations of the extent of the problem as well as an understanding of the problem's scope and nature (Bales, 2017).

Study Setting

Due to the limited number of NGOs working in this area globally, it was necessary to sample from NGOs worldwide, rather than a specific region or country, to achieve theoretical saturation for the methodology. Therefore, participants work in countries ranging from southeast Asia to western Africa, North America and the Pacific Islands/Oceania (see Table 1 on page 43 for inclusion of focus region in participant demographics). Noticeably absent in the sample, despite targeted recruiting efforts, were participants who worked exclusively in South America and participants from larger, international NGOs. Despite the more global approach to the study's setting, countries that had NGOs with active anti-forced labor slavery programs in the fisheries sector were comparable in terms of the contextual constructs posited in Figure 1 that resulted in the country either being an origin or destination country for victims. That is, each of these countries exhibited high densities of migrant laborers in the fishing sector; limited and/or

corrupt regulatory environments; racial/ethnic/tribal stratification; and socioeconomic inequalities (e.g., income, access to credit, and education) creating high risk for the use of forced labor slavery in the fishing and agricultural sectors (Walk Free Foundation, 2016). Participants from New Zealand and Sweden were also purposefully recruited for negative case analyses to further explore the role of contextual factors. New Zealand Parliament's (2016) new fishing regulations, put into effect on May 1, 2016, under the 2014 Fisheries (Foreign Charter Vessels and Other Matters) Amendment Act are characterized as the most stringent globally and Sweden's fishers have one of the highest ranking socio-economic profile globally (T. Harré, personal communication, July 5, 2017).

Positionality Statement

As a doctoral candidate, of United States nationality, conducting global qualitative research, the impacts of positionality on data collection and data analysis were considered throughout the research process. Foremost, my own positivist orientation led to methodological selections and research design, most notably selecting a FCM approach over grounded theory and selecting fish stocks and labor conditions as the boundary variables in the mapping activity (discussed further in "Interview and mapping procedures"). Additionally, my hypothesis (which demonstrated my positivist core beliefs that: a) fish stocks are indeed declining, and b) fish stocks and forced labor slavery are related) was based on a critical review of empirical and theoretical literature from the fisheries sciences and human rights sector. Whereas the study's participants had first-hand knowledge about the experiences of fishers with both fish stock declines and labor conditions. Related, as I previously practiced in a different sector of social work,

my years of experience working in the field of socially responsible fisheries was substantially lower than most participants. As a result, the use of a participatory, qualitative method was intended to center the participants' knowledge.

While the knowledge imbalance favored participants, as the researcher, and being an American citizen, I still possessed power in the short-term interactions and relationships with participants. Notably, socially responsible fisheries research almost always originates in the fisheries sector; is often hyper-focused on southeast Asian countries or low-income, developing African countries; and the prevailing narrative frequently blames these low-income and developing countries while ignoring the existence of the problem or the role of western countries in perpetuating the problem. Additionally, this study was conducted between October 2017 and January 2018, in a political era of creeping economic nationalism and isolationism within developed countries globally. Consequently, and justifiably, substantial distrust existed between many participants and myself that led to participants requesting to not be audio recorded. To mitigate this distrust, I identified myself as a social work researcher who studies social-ecological systems, emphasizing the social aspects. I also purposefully recruited participants from the United States and throughout this dissertation attempted to elucidate the disproportionate role of western, industrialized countries' power and privilege in inducing fish stock declines.

Participant Selection

Sampling. The study used a non-probability, purposeful sampling frame. Inclusion criteria were as follows. Participants must have had direct contact or

interactions with fishers, be aged 18 years or older, English speaking, and affiliated with a NGO registered with the home country's government. For example, if the organization was based in the United States, the organization must be registered as a 501(c)(3) with the United States government. This specific criterion was intended to reduce risks to participants. If the NGO was registered with the government, the government was already aware of the work the organization and its staff were engaged in, versus "underground" organizations that were assisting victims without the government's knowledge— most likely because the government did not support their work and would/could punish the organization and/or individual. In regard to the English speaking criteria, per Thomas Harré, director of Slave Free Seas legal advocacy, because of the United Kingdom's historic leadership in the human rights sector dating back to the abolitionist movement, and the global nature of slavery, most inter-organization communication is already conducted in English (personal communication, July 5, 2017). Therefore, most agency staff members are fluent in English regardless of location.

The sample was a non-probability, purposive sample as participants were interested persons with the time and availability to participate in an interview when recruited. Due to the limited number of organizations available for participation, the author tried to maintain a balanced sample across continents, services provided (i.e., legal services, advocacy, etc.), type of fishery (i.e., large scale, small scale, and artisanal), and organization's focus (i.e., an anti-slavery organization versus an environmental organization). While Southeast Asia was well-represented in the study, the researcher also wanted to ensure that the study did not focus exclusively on this region as to date,

most literature and research has, ignoring the issue in other parts of the world. Due to the global setting, the study sample was also diverse in terms of age, gender, race and ethnicity, and organizational focus (Table 1).

Recruitment. The researcher used multiple approaches to recruitment. First, the investigator posted a digital recruitment flyer to the Freedom Collaborative—an online, members-only platform intended to securely and confidentially connect anti-slavery NGOs and other stakeholders across 55 countries to facilitate information sharing, collaboration, and research. Part of the platform is a message board available to all 500+ member organizations and 2,000+ stakeholders where the researcher posted the flyer. Each member organization and stakeholder also has access to personal messaging through the platform, and the investigator sent the recruitment flyer via the personal messaging option to organizations and stakeholders previously engaged in fisheries threads on the platform (threads were archived and were available to the researcher for searching).

In the second approach, the investigator sent recruitment emails to environmental NGOs that have previously published reports on labor abuses in the fishing sector (e.g., Greenpeace and Environmental Justice Foundation) and immigration/migration and anti-slavery NGOs working in the fishing sector and who were not part of the Freedom Collaborative. The researcher generated this list of organizations from a comprehensive literature review performed, mining of NGO social media platforms, and communications with experts in the field from around the globe to prevent geographic biases.

Lastly, the investigator used snowball sampling wherein enrolled participants referred other potential participants to the study. Study recruitment was also aided when one participant served on a panel sponsored by the Freedom Collaborative and endorsed the study and called attention to the recruitment messaging posted on the Freedom Collaborative's online platform. This panel was disseminated as a webinar, and thus reached diverse audiences globally.

All potential participants who contacted the investigator indicating interest in participating were screened to ensure they met the study's eligibility criteria. These screening questions occurred before the consent process so that the individual's response to the name of their NGO was not linked to their interview responses, protecting privacy. The screening questions were as follows, and were conducted over email:

1) "Do you have direct contact with fishers in the context of your normal job responsibilities?"
2) "Please identify the NGO that you are affiliated with."
3) "Are you able to participate in an interview conducted in English?"
4) "Are you at least 18 years of age?"

All recruitment materials are included in Appendix B.

Sample size. The study's total sample was 44 participants. Using the methods described in "Recruitment", 27 out of 51 (52.9%) prospective participants who were individually approached by the researcher were recruited and enrolled in the study. The remaining 24 (47.1%) did not reply to the researcher's initial recruitment contact. An additional 13 participants were recruited through the general flyer posting, and four

participants were recruited and enrolled through snowball sampling for the final sample size of 44 participants. Sample demographics are presented in Table 1.

Table 1

Sample Demographics (n = 44)

Variable	**Variable category**	***n***	**Percent of sample**
Age			
	20-29 years	*n* = 4	9.1%
	30-39 years	*n* = 9	20.5%
	40-49 years	*n* = 13	29.5%
	50-59 years	*n* = 15	34.1%
	60-69 years	*n* = 3	6.8%
Race/Ethnicity			
	Asian	*n* = 12	27.3%
	Black	*n* = 2	4.5%
	Latinx	*n* = 2	4.5%
	Pacific Islander	*n* = 1	2.3%
	White	*n* = 26	59.1%
	Other	*n* = 1	2.3%
Gender			
	Female	*n* = 14	31.8%
	Male	*n* = 30	68.2%
Education			
	Primary	*n* = 2	4.5%
	High school	*n* = 8	18.2%
	College	*n* = 10	22.7%
	Graduate schooling	*n* = 24	54.6%
Organizational Focus			
	Environment	*n* = 18	40.9%
	Labor & human rights	*n* = 12	27.3%
	Maritime crime & regulations	*n* = 6	13.6%
	Migration & immigration	*n* = 8	18.2%
Regional Focus			
	North America	*n* = 3	6.8%
	Europe	*n* = 5	11.4%
	Southeast Asia	*n* = 15	34.1%
	Africa	*n* = 3	6.8%
	Pacific, Oceania, & Australasia	*n* = 3	6.8%
	Global	*n* = 15	34.1%
Years of Experience			
	Less than 10	*n* = 10	22.7%
	10-19	*n* = 12	27.3%

	20-29	$n = 14$	31.8%
	30-39	$n = 8$	18.2%
Employment as a Fisher			
	No	$n = 33$	75.0%
	Former	$n = 4$	4 (9.1%)
	Current	$n = 7$	7 (15.9%)

To protect against bias and subjectivity in determining theoretical data saturation, the study used an average accumulation curve with the Monte Carlo technique to calculate sample size (Colwell, Mao, & Chang, 2004; Özesmi & Özesmi, 2004). In this approach, mathematical modeling considering known map concepts and the presence of an unknown quantity of undisclosed concepts generates an accumulation curve that extrapolates the number of new themes that could potentially be yielded if more maps were added to the sample (Tran, Procher, Tran, & Ravaud, 2017). A researcher-specified number of iterations randomizes the sample order, producing multiple curves that are then aggregated into the final accumulation curve (Colwell & Coddington, 1994), with each data point on the final curve representing the mean value of these randomizations (Kristensen & Balslev, 2003). The slope of the accumulation curve—at the point of tangency—with a cut-off established a priori, then becomes the criterion for concluding recruitment (Tran et al., 2017).

In this study, the accumulation curve was based on the cumulative number of unique map variables obtained per participant as a function of the number of participants' maps in the sample (Colwell et al., 2004; Özesmi & Özesmi, 2004). The slope value was set at ≤ 0.05, or one new concept for every 20 maps, for stopping recruitment. Since the methodology originated in ecology to estimate species richness and abundance, and has only recently started being applied to qualitative research, the literature does not provide

a rationale for selecting a number of iterations. As such, this study used 20 iterations since a relatively small sample size was projected at the onset of the study based on previous research using FCM.

The *EstimateS* v. 9.1.0 software was used to sequentially calculate an accumulation curve based on 20 randomizations, and its slope after every five maps in the study up until 35 participants (Tran et al., 2017). The slope of the expected cognitive map concept accumulation curve after the inclusion of 35 participants was 0.021 (Figure 6). The slope at the point of tangency at 32 participants was also calculated, since on a graph this appeared to be where the slope was the steepest (and thus error would be at its highest), and was 0.034. The asymptote was estimated to be at 36 participants. Based on this approach, the sample size of 44 participants and maps thus achieved theoretical saturation.

Figure 6. Accumulation Curve for Sample Size Estimation

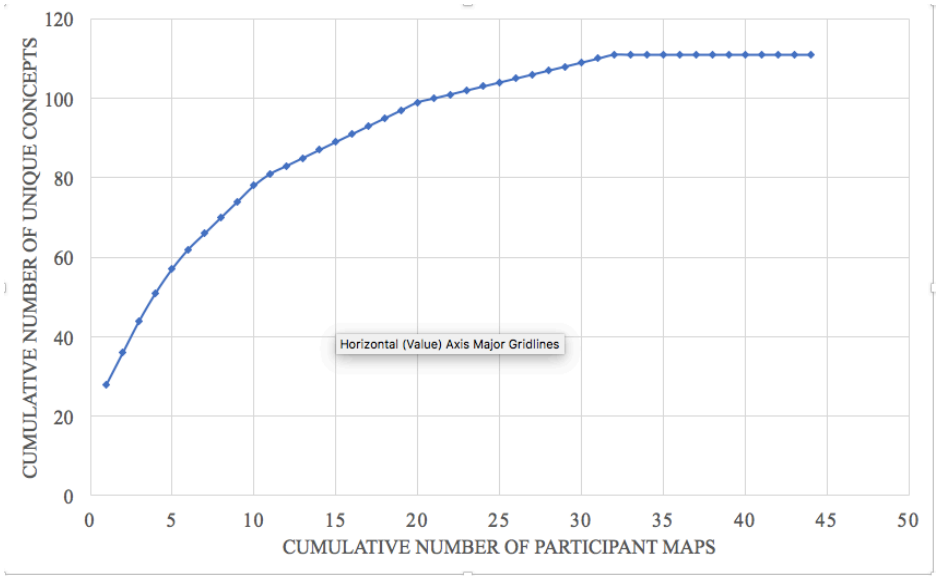

Figure 6. Final accumulation curve comparing the diversity of concepts based on the number of maps sampled. The curve was used to extrapolate the number of concepts that would likely be produced if the entire population was sampled.

Each participant and their fuzzy cognitive map counted as one data point, no matter how many fishers' experiences they included or aggregated in the map's creation. If multiple participants were interviewed from the same organization, then each interview counted as a separate data point. Multiple participants from the same organization were only included if the participants differed in their country or fishing community of focus.

Expert Mapping

Prior to data collection with participants, the researcher created an expert derived FCM (Figure 7). The expert mapping activity is intended to provide the foundation for theory building and aides in hypothesis generation, selecting study site(s) and population, and developing the interview schedule (Gray et al., 2014). The first step of the expert mapping was identifying the system's key variables through a directed content analysis, of existing literature (Gray et al., 2014). The content analysis is described as directed since initial coding was guided by Brashares et al.'s (2014) theory and a global review of key literature on fisheries, overfishing, forced labor, and modern slavery (Hsieh & Shannon, 2005).

Figure 7. Expert Map

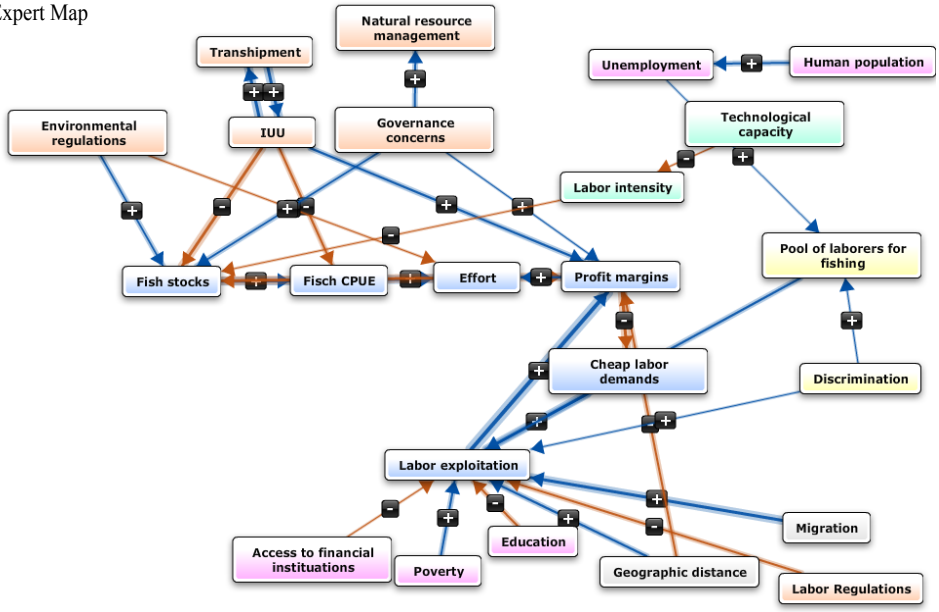

Figure 7. Researcher's model of the relationship between fish stock declines and forced labor slavery constructed in the Mental Modeler software. Blue lines indicate a positive relationship wherein an increase in the transmitter variable causes an increase in the receiver variable. Orange lines indicate a negative relationship wherein an increase in the transmitter variable causes a decrease in the receiver variable.

After identification of variables for each pertinent construct noted in Figure 1, a directed content analysis of peer-reviewed empirical literature and trend analyses of open source data was used to generate inferences about direction and strength of cause-linkage-effect relationships between variables (Gray et al., 2014). Empirical data regarding the contextual constructs were obtained from the 2016 and 2017 Global Slavery Indices (ILO & Walk Free Foundation, 2017; Walk Free Foundation, 2016). Fisheries data was obtained from FAO FishStatJ and the Sea Around Us Project, both open source fisheries repositories (FAO, 2017a; Sea Around Us, 2017). The expert derived map was then transcribed into the Mental Modeler software.

In the FCM methodology, the generation of an expert derived map functioned similarly to bracketing techniques, encouraging the researcher to acknowledge and separate attachment to the expert map during date analysis. Often employed in other qualitative research methodologies, bracketing reduced the influence of the researcher's

biases resulting from preconceptions and extreme familiarity with the research topic (Creswell, 2013; Tufford & Newman, 2012).

Data Collection

Interview and mapping procedures. The author of this dissertation, herein referred to as the researcher, completed all interviews and data collection. Once participants enrolled in the study, they completed either face-to-face or web-based semi-structured interviews that included self-construction of a cognitive map intended to measure how fish stock declines would influence human decision-making about whether or not to use forced labor slavery. All maps were drawn in front of each participant by the researcher in the Mental Modeler software (see Figure 8 for an example map), and as described by the participant, to ensure consistency across differing interview modalities. Twenty-six web-based interviews were conducted using the Zoom platform, while the remaining 18 (40.9%) interviews, including the first four participant interviews completed, were conducted in-person. Interviews were selected over focus groups due to the topic's sensitivity and power dynamics that could have suppressed marginalized identities in focus groups (Stringer & Simmons, n.d.). Further, research suggests theoretical saturation is more likely to be reached in FCM when using interviews instead of focus groups (Özesmi & Özesmi, 2004).

Figure 8. Example Participant Map

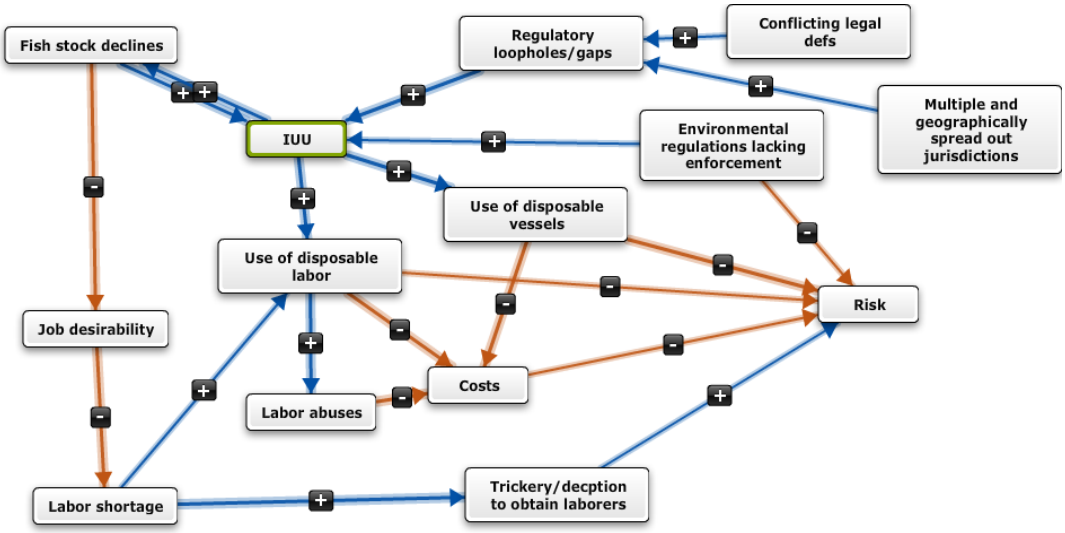

Figure 8. Example of a participant map constructed in the Mental Modeler software. Blue lines indicate a positive relationship wherein an increase in the transmitter variable causes an increase in the receiver variable. Orange lines indicate a negative relationship wherein an increase in the transmitter variable causes a decrease in the receiver variable.

An interview schedule including fuzzy cognitive mapping facilitation is included in Appendix B. After the researcher formulated the initial interview schedule, the questions and mapping activity were piloted with four persons, whose data were not included in the study. After the pilot, the researcher obtained feedback on the questions and facilitation of the mapping activity and edited the interview schedule as necessary, resulting in the final, appended interview schedule. Interview duration ranged from 43 minutes and 15 seconds to 112 minutes and 59 seconds, with a mean interview time of 85 minutes and 55 seconds.

For some participants, the interview started with closed-ended demographic questions followed by open-ended questions about their fisheries employment experiences. Other participants completed the closed-ended demographic questions in advance of the interview via the web-based survey software Qualtrics, and thus their interviews started with the questions about fisheries employment experiences (question 9

in the appended interview schedule). After the demographic and employment questions, the researcher explained how to draw a cognitive map using an unrelated and neutral example that was culturally relevant, and differed based on the participant's home country (Taber, 1991). For instance, one unrelated example concerned drought and increased energy prices impacts on the dynamics of a farm. Once the participant indicated understanding of the mapping process, the researcher proceeded with the mapping exercise included open-ended questions about ecological knowledge, labor conditions, and then linkages between fish stocks and labor conditions as disclosed by fishers and that they themselves may have observed. Probing questions were added to the interview as needed. The only two variables participants were provided at the beginning of variable brainstorming were "fish stocks" and "labor conditions". In the FCM literature, some studies have provided participants with a list of variables to choose from (Gray et al., 2014), while others have only provided two to three key variables (typically one variable to identify the problem and one to identify the outcome of interest) to help bound the system and maintain the mapping activity's relevance to the research question (Nyaki et al, 2014). The latter approach was selected to reduce the researcher's bias and influence and to maximize the participant's knowledge construction (Kosko, 1986). Participants also had the ability to eliminate either or both of these variables during the iterative mapping process, and indeed, participants who felt that fish stock declines were not influential in the decision to use forced labor slavery eliminated the construct in their maps.

While the participant was speaking, the researcher recorded key variables and constructs in the Mental Modeler software. As indicated in the interview schedule, at various time points and after set questions, the researcher paused questioning and together with the participant reviewed the list of key variables. Once the participant approved the list of key variables, the researcher then asked the participant how the variables should be arranged. The researcher also facilitated questions to aid the participant in identifying relationships between variables (known as nodes in directed graph theory) and assessments of the relationships' direction and strength (see interview schedule in Appendix A for further detail). Because the relationship's direction was based on a directed edge-connection, participants were asked to delineate between the source (i.e., cause) variable and the target (i.e., outcome) variable when identifying and describing a relationship between two variables. Promoting relationships, defined as increases in the source variable causing increases in the target variable, were signed with a +. Inhibiting relationships, defined as the increases in the source variable causing decreases in the target variable, were signed with a -. Demarked by a 0, no edge relationships implied the relationship was bidirectional, and the two variables neutralized each other (Axelrod, 1976). Signs were denoted in the software by the researcher. If participants did not know if a relationship existed, no relationship was entered. For participants who added relationships that they were unsure or less sure about, the Mental Modeler software allowed the researcher to indicate degree of certainty for each entered relationship. While this value did not impact the adjacency matrix, it was noted in the map via color-coding, and thus could be assessed qualitatively during map aggregation.

Regarding relationship strength, participants were first asked to weight the relationship qualitatively (low, medium, high), and then to translate their qualitative weightings into quantitative weightings using the scale delineated in Table 2. These weightings were also denoted in the digitized cognitive map by the researcher. Participants were able to add and delete variables at any time, and the process was iterative, reducing the maps into the participant's most salient variables (Henly-Shepard et al., 2015; Özesmi & Özesmi, 2004). This process was repeated until the participant had no new content to add and indicated their cognitive map accurately described their knowledge, experience, and observations.

Digitization, recording, transcription. Once the participant indicated they had completed their cognitive map, it was saved and stored electronically. Interviews, including formal interview questions and dialogue while constructing the cognitive map were audio recorded. Interviews conducted face-to-face were recorded using a digital audio recorder. Interviews conducted via the Zoom platform were recorded using Zoom's audio recording feature and transcribed by the researcher. Recording was optional for all participants, and 21 (47.7%) participants declined to have their interview recorded.

All data collection methods and procedures were approved by the University of Denver's Institutional Review Board.

Table 2

Scales for Converting Qualitative Weightings into Quantitative Weightings for FCMs

Qualitative Weighting	**Quantitative Weighting Range**
No relationship	0
Low/weak relationship	0.1 to 0.3 or -0.1 to -0.3
Medium/moderate relationship	0.4 to 0.7 or -0.4 to -0.7
High/strong relationship	0.8 to 1.0 or -0.8 to -1.0

Data Analysis

Coded cognitive maps for simplification. To achieve *aim one*, an iterative, systematic, and inductive thematic content analysis (i.e., coding) of each participant's interview transcript and/or notes and map were used to condense each map's variables into the major variables most pertinent to the two phenomena under investigation—fish stocks and forced labor (Figure 9) (Buede & Ferrell, 1993; Harary, Norman, & Cartwright, 1965; Özesmi & Özesmi, 2004). Since the FCM literature does not specify the coding techniques that should be used in data analysis, the researcher used techniques consistent with grounded theory. As such, the researcher employed in-vivo, process, and initial coding for first-cycle coding techniques and focused, axial, and theoretical coding for second-cycle coding (Saldaña, 2013). This process included using interview quotes to attribute meaning and definitions to map variables, and combining similar variables into over-arching themes as is typical in qualitative data analysis (Saldaña, 2013). Condensing the maps into major themes, constructs, and/or variables is considered a "best practice"

and intended to make comparisons across maps and map aggregation more interpretable (Özesmi & Özesmi, 2004). The data-driven, inductive approach was selected to limit the researcher's influence and to center the participant's knowledge construction (Fereday & Muir-Cochrane, 2006). Coding of transcripts and maps was completed in Dedoose, as well as memoing wherein rigorous notes were maintained on the researcher's cognitive interpretation of each map for greater transparency and to create an audit trail (Özesmi & Özesmi, 2004; Thomas, 2017). Memoing that occurred during data collection was also transcribed into Dedoose.

Figure 9. Example Participant Map Coded

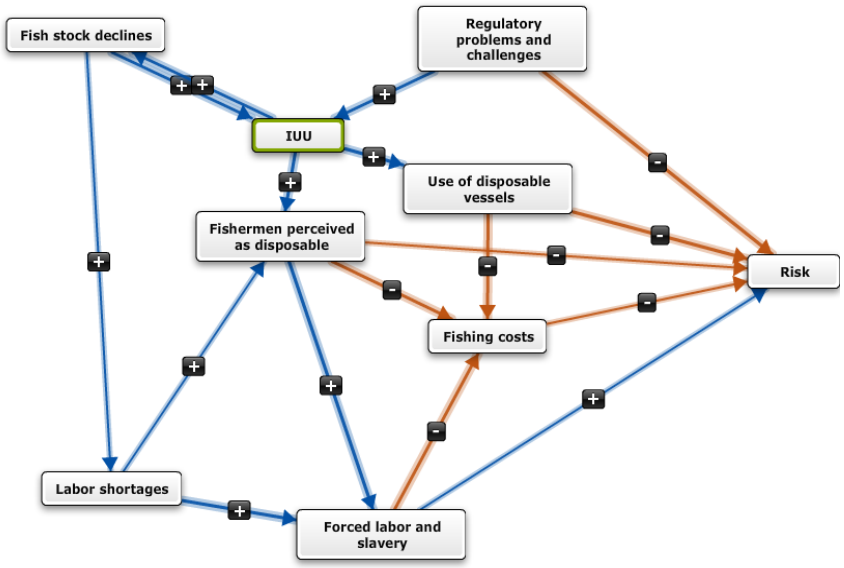

Figure 9. Example participant map represented in Fig. 8 after being coded by the researcher.

Inter-rater reliability. After the researcher initially coded all interview transcripts, notes, and maps, a codebook was generated. The codebook was then supplied to an outside research assistant, trained in FCM, who independently coded all transcripts, notes, and maps. Inter-rater reliability was then measured as a percentage of agreement between the researcher and research assistant in the application of codes and

condensation of maps. With percentages ranging from 83% to 96% agreement, the inter-rater reliability for all variables was deemed acceptable. Areas of substantial disagreement between the researcher and research assistant (e.g., when the research assistant felt that a necessary code was not included in the codebook) were negotiated until a consensus was achieved (Patton, 1999).

Converted cognitive maps into adjacency matrices. Using structural models derived from graph theory, each cognitive map was converted by the Mental Modeler software into an adjacency matrix (see Table 3)—the standard mathematical representation of a graph or the quantification of a cognitive map—to accomplish *aim two* (Harary et al., 1965; Kosko, 1986; Özesmi & Özesmi, 2004). In graph theory, each variable in the cognitive map operates as a vertex (also known as a node). Edges are the lines between each variable indicating a relationship. The software transformed the map into a square adjacency matrix based on counts of the number of edges between adjacent vertices—variables that shared at least one common edge. In this study, edges were both directed and weighted in that participants were asked to identify the source and target variables (orienting the relationship direction) and then assigned a qualitative and quantitative weight to describe the relationship strength (Harary et al., 1965; Kosko, 1986). Directing and weighting the edges allowed for more complex structural analyses of the matrices.

Analyzed individual maps with graph theory indices and metrics. Graph theory variable influence indices and structural map metrics were calculated from the adjacency matrix (see Table 4 for a complete list). All metrics and indices were

calculated in the Mental Modeler software. Standard measures included a count of the number of variables and connections (i.e., edges). Edge indegree and outdegree were calculated to classify variables as transmitter (forcing or independent variables), receiver (end or dependent variables), or ordinary (defined as mean variables that possess both force and receive) variables (Eden, Ackerman, & Cropper, 1992). Degree centrality, connectedness, and density were computed from variable indices and map metrics to elicit further information about each graph's structure, fulfilling *aim two* (Özesmi & Özesmi, 2004).

Table 3

Example Adjacency Matrix Corresponding with Figure 9

	Fish stock declines	Labor short	IUU	Risk	Use of disposable vessels	Fishers perceived disposable	Fish-ing costs	Force labor slave
Fish stock declines		0.25	0.69					
Labor shortages	0.69					0.28		0.72
IUU					0.72	0.56		
Risk								
Use of disposable vessels				-0.53			-0.5	
Fishers perceived disposable				-0.22			-0.5	0.83
Fishing costs				-0.31				
Reg. problems and challenges				-0.67				
Forced labor slavery				0.17			-0.61	

Note. This adjacency matrix corresponds with the participant map depicted in Figure 9.

Compared individual maps. All interviews and map facilitations were conducted by the same researcher to allow for individual map comparisons using qualitative and quantitative comparison strategies further described below (Özesmi & Özesmi, 2004). These comparisons were intended to 1) test reliability across different interview modalities and 2) elucidate important, likely contextual, variables confounding the relationship between fish stocks and slavery, achieving *aim three*.

Initially maps were divided into two groups, with all maps in one group noting some type of relationship between fish stock declines and labor conditions, and all maps in the second group not identifying a relationship between fish stock declines and labor conditions. Maps in the second group were analyzed separately, akin to a negative case analysis, as another strategy to identify potential mediators, moderators, and buffering effects (Patton, 1999).

Table 4

Standard FCM Variable Indices and Structural Metrics

Metric	Definition	Purpose	Formula	Source
N (Vertices) *N*	Number of variables and/or constructs in the model	Describes how many vertices are included in the model	Count of the total number	(Gray, Zane, & Gray, 2014; Özesmi & Özesmi, 2004)
N (Edges) *E*	Number of relationships or connections between variables in the model	Describes how many edges are included in the model	Count of the total number	(Gray, Zane, & Gray, 2014; Özesmi & Özesmi, 2004)
Indegree *id*	Cumulative strength of edges (i.e., connections) entering vertices (i.e., variables)	Used to identify receiver variables, which have a positive indegree and no outdegree	Colum summation of absolute value of quantitative weightings, where N is the total number of variables and a_{ki} is is the absolute value of the cumulative strength of	(Bougon, Weick, & Binkhorst, 1977; Gray et al., 2014; Nyaki et al., 2014; Özesmi

			connections entering a variable $id(v_i) = \sum_{k=1}^{N} \bar{a}_{ki}$	& Özesmi, 2004)
Outdegree *od*	Cumulative strength of edges (i.e., connections) exiting vertices (i.e., variables)	Used to identify transmitter variables, which have a positive outdegree and no indegree	Row summation of absolute value of quantitative weightings, where *N* is the total number of variables and a_{ki} is is the absolute value of the cumulative strength of connections exiting a variable $od(v_i) = \sum_{k=1}^{N} \bar{a}_{ki}$	Bougon et al., 1977; Gray et al., 2014; Nyaki et al., 2014; Özesmi & Özesmi, 2004)
N (Receiver Variables) *R*	Variables that have a positive indegree and zero outdegree, thus they have only "receiving functions" in the model	"Indicates number of variables that are influenced by other variables but do not influence other variables"	Count of the total number	(Bougon et al., 1977; Eden, Ackerman, & Cropper, 1992; Gray, Zane, & Gray, 2014, p. 36)
N (Transmitter Variables) *T*	Variables that have positive outdegree and zero indegree, they have only "forcing fuctions" in the model	"Indicates the number of variables that influence other system variables, but are not influenced by other variables"	Count of the total number	(Bougon et al., Eden et al., 1992; 1977; Gray, Zane, & Gray, 2014, p. 36)
N (Ordinary Variables) *O*	Variables that have both indegree and outdegree; typically characterized as leaning toward either transmitter or receiver	"Indicates the number of variables that influence but are also influenced by other variables"	Count of the total number, to characterize as leaning toward transmitter or receiver calculate the ratio of indegree to outdegree	(Bougon et al., 1977; Eden et al., 1992; Gray, Zane, & Gray, 2014, p. 36)
Degree Centrality C_D *(V)*	Absolute value of a variable's total influence within the model	Indicates how connected a variable is to other variables, and therefore, how	Summation of the absolute value of indegree and the absolute value of outdegree:	(Eden et al., 1992; Harary et al., 1965; Özesmi &

		much a variable contributes to the structure of a FCM based on the number and strength of connections; typically variables are ranked by centrality	$C_D(V) = \Sigma(id(V) + od(V))$	Özesmi, 2004)
Connectedness (C/N ratio, link-node ratio) *C/N*	Measures a FCM's connectivity to determine the strength of the causal arguments	"The lower the C/N score, the higher the degree of connectedness in a system"	Number of edges divided by number of vertices: E/N	(Gray, Zane, & Gray, 2014; Özesmi & Özesmi, 2004)
Complexity *C*	Ratio of receiver variables to transmitter variables	"Degree to which outcomes of transmitter/driving forces are considered. Higher complexity indicates more complex systems thinking" where more outcomes and implications are considered. Low complexity is described as "flatness" in that too few causal arguments are considered because of top-down thinking.	$C = \frac{R}{T}$	(Devisscher et al., 2016; Eden et al., 1992; Gray, Zane, & Gray, 2014, p. 36; Özesmi & Özesmi, 2004)
Density (clustering coefficient) *D*	Connectivity index demonstrating the "number of connections compared to the number of all possible connections"	The higher the density, the more potential intervention points	Number of edges divided by the maximum number of possible edges between *N* variables $D = \frac{E}{N(N-1)}$	(Devisscher, et al., 2016; Gray, Zane, & Gray, 2014, p. 36; Hage & Harary, 1983)

Comparative content analysis of variables. Using a directed, comparative content analysis, the researcher constructed a present/absent variable index categorizing all variables and their definitions across all 44 maps as common, partially common, or

uncommon concepts (Clarke & Mackaness, 2001). Proportional to sample size, common concepts indicated the variable was used in at least 22 maps and uncommon concepts were unique variables that were only identified by one participant. Partially common concepts were variables that were included in a minimum of two and maximum of 21 maps (Clarke & Mackaness, 2001). Variable definitions were derived from the original interview coding as described previously. This index was used to identify similarities and differences in variable inclusion and exclusion between participants.

Variable rankings. Variables were then ranked into three separate lists including most mentioned variables, variable types, and most central variables (Özesmi & Özesmi, 2004). Most mentioned variables were a list of the top 10 variables in frequency across all 44 maps. Variable types included sub-lists of the top 10 transmitter, receiver, and ordinary variables across all maps. All previously listed variables were then ranked by their centrality (see Table 4 for definition and formula), an index of the variable's importance to the entire system. These lists were then used to identify similarities and differences in variable importance and role amongst the 44 participants.

Structural indices comparisons. The graph theory indices including C/N ratio, complexity, and density were also compared across all participants. These measures were used to identify similarities and differences in map structure, particularly how connected or sparse (i.e., how complex) each map was and how strongly individual variables influenced the entire system (Yoon & Jetter, 2016).

Pairwise comparisons. Once qualitative coding techniques provided preliminary reasoning for grouping like maps, quantitative pairwise analyses corroborated similarity

between group members' variables. Since each participant's map already had a corresponding adjacency matrix, the Phi similarity coefficient and the Yule Q coefficient were calculated for count variables (Özesmi & Özesmi, 2004). A matrix of counts created from the individual adjacency matrices was used to calculate both coefficients. For the Phi similarity coefficient, values ranged from -1 to 1, with 1/-1 indicating most similar. The Yule Q coefficient was "the proportionate reduction in errors in predicting whether or not one group has the variable" and therefore was used to confirm the Phi values (Özesmi & Özesmi, 2004, p. 52).

Identifying commonalities. Based on the comparative content analysis, variable ranking, and pairwise structural indices comparisons, the researcher identified similar participants. Once similar participants were identified, the researcher returned to the coded interviews to ascertain commonalities, particularly demographic, amongst the similar participants. Similar participants were then grouped by commonalities, for example, former fishers versus non-former fishers.

Group comparisons. For each group, the mean value for participants' metrics and indices reported in Table 3 were calculated. Each outcome variable's skewness was between negative two and positive two, and kurtosis between 0 and positive three, meeting the normality assumptions for univariate tests (George & Mallery, 2010). To assesses similarities and differences between group means, ANOVA and independent samples t-tests for variables with two groups were performed (Özesmi & Özesmi, 2004; Palmquist, Carley, & Dale, 1997). A series of univariate ANOVAs were selected over the multivariate analysis of variance (MANOVA) since FCM violates multiple

assumptions—particularly small cell numbers and high multicollinearity since some dependent variables are calculated, in part, from other dependent variables. As such, Bonferroni corrections of $p \leq .008$ for the ANOVAs and $p \leq .01$ for the independent samples t-tests were applied to reduce Type I error inflation. However, both the adjusted and non-adjusted significant findings are presented in the Results chapter since these FCM quantitative analyses ideally prove the null hypothesis of similarity to aid in map aggregation. Thus the absence of the Bonferroni correction is the more conservative approach.

For comparisons amongst demographic variables race, education, and former employment as a fisher were recoded due to small sample sizes for some groups. Race was recategorized as White, Asian, and other—which included the original other category in addition to Black, LatinX, and Pacific Islander. For education, primary school and high school were combined into a category of high school or less. Lastly, the variable employment as a fisher was transformed into a dichotomous, nominal variable wherein the categories of current and former fisher were combined into a "yes" category. SPSS v. 23.0 software was used to perform the ANOVAs and independent samples t-tests.

Created cumulative consensus map. Individual maps were then aggregated into one cumulative, consensus, social cognitive map using both qualitative and quantitative procedures. To begin, the researcher selected which variables to include in the aggregated FCM based on a content analysis of the variable rankings lists, graph theory indices comparison table, and results elucidated from the group comparisons about the role of potential mediators, moderators, and contextual factors. Using vector-matrix operations

and the creation of augmented matrices that listed every variable used in the individual matrices, common matrix components were added or averaged to infer the sign and strength of each connection in the aggregated map (Halbrendt et al., 2014; Henly-Shepard, 2015; Kosko, 1992; Özesmi & Özesmi, 2004). All vector-matrix operations were completed in the Mental Modeler software. In this approach, consensus amongst participants strengthened the fuzzy causal relationship in the aggregated map, whereas, dissent was still recognized (and added to the map's complexity) but weakened the fuzzy causal relationships (Kosko, 1992).

Returning to *aim one*, once finalized, the cumulative consensus map was used to refine the amended Brashares et al. (2014) Wildlife Decline and Social Conflict framework posited by Decker Sparks & Hasche (2018).

Established system's steady state. Prior to performing the case scenario analyses needed to fulfill *aim four*, the researcher established the consensus map's steady state—what happens to the outcome of interest (forced labor slavery) if there are no interventions and fish stock levels stagnate, meaning stock declines will level off, but stocks will not rebound and increase either. Using a neural network computational method (Kosko, 1992) where initial state variable vectors were multiplied by the adjacency matrix, iterations were run by the Mental Modeler software until the "system converged to a fixed point" (Özesmi & Özesmi, 2004, p. 55). That fixed point was then the steady state or baseline for comparisons to assess the value of variable changes in case scenarios described below (Devisscher, 2016).

Executed case-scenario simulations. Running case scenario analyses allowed the researcher to generate "what if" inferences based on the current relationships between system components and assumptions of plausible scenarios, and achieve the study's *fourth aim* (Devisscher et al., 2016). Four scenarios were tested. Two scenarios explored both problem intensification and amelioration while the third and fourth scenarios tested interventions. All four scenarios were developed once the consensus map was finalized and analyzed and were based on transmitter variables and target variables with the high degrees of centrality (Devisscher et al., 2016).

For scenario runs, the same mathematical calculations (vector-matrix multiplication) used in the baseline determination were replicated, but this time included manipulation of targeted variables and/or the weights of causal connections in the consensus map (Devisscher et al., 2016). Because the FCMs and consensus map were semi-quantitative, scenario outcomes were not "compared with absolute indicators but rather interpreted as a summary of relationships between variables and changes [in those variables] compared to the baseline" (Devisscher et al., 2016, p. 7).

Chapter Four: Results

This chapter presents the quantitative and qualitative analyses of participants' individual maps and interviews, with the similarities in problem construction across diverse participants demonstrating the universality and systemic nature of the problem globally. Following individual map analyses is the map aggregation results and a detailed explication of each variable and relationship in the consensus map, as supported by the qualitative analysis of participants' maps and interviews.

The pervading sentiment expressed by study participants was that the relationship between overfishing-induced fish stock declines and forced labor slavery was "like a tangled web" in that fish stock declines led to other reverberating changes throughout the linked social and ecological systems which ultimately contributed to changes in forced labor slavery. Participants also clearly articulated that incidents of fish stock declines relating to forced labor slavery were not isolated cases, but rather representative of a systemic, widespread problem that is likely "severely underestimated and still increasing." Out of the 44 participants, 41 (93.2%) stated that since 2010 they had seen substantial increases in the number of forced labor slavery victims from fishing vessels. Acknowledging that a portion of this increase could be shifts in the content and delivery of questions professionals ask to accurately determine if someone has been victimized or not, all 41 participants stated the majority of the increase should be attributed to a

growing problem that "started slowly, and is now snowballing." Participants also discredited claims that more victims are coming forward to report abuses and/or seek services, saying that most victims lack the education and comprehension of the English language to consume media content that would help them identify themselves as a victim.

In total, 32 out of 44 (72.7%) participants linked fish stock declines and forced labor slavery in their cognitive maps. Per data obtained from participants, forced labor slavery related to fish stock declines was occurring on both short and long-haul vessels that fished primarily for low and mid-value fish (e.g., white, albacore tuna), on trawlers and long-line vessels, and in territorial and international waters (i.e., the high seas). Figure 10 represents all countries mentioned by participants where victims and vessels originated from, as well as the flag state of vessels caught using forced labor slavery, and territorial waters where vessels were known or suspected of using forced labor slavery. The most cited countries of origin for victims were Cambodia, Indonesia, India, Myanmar, and the Philippines. Specific to the vessels, participants were less familiar with flag states, since many of the implicated vessels flew multiple flags or changed their flags. However, the most frequently noted countries of origin for vessels were Thailand, Spain, China, and Taiwan (whose fishing fleet participants considered distinct from China's). The territorial waters of concern referenced by the most participants were Senegal, Indonesia, and South Africa—though participants noted that the forced labor occurring in these waters was typically on foreign, not domestic, vessels. The Indian and southern Pacific oceans were the most frequently indicated locations for vessels using forced labor slavery on the high seas.

Bivariate and multivariate analyses were used to determine if demographic variables (see Table 1 for variables) along with interview modality were associated with and/or significant predictors of whether a participant linked fish stock decline and forced labor slavery in their cognitive map. First, bivariate Chi-square tests of independence were performed. As detailed in Table 5, organizational focus was the only demographic variable significantly related to linking fish stock declines and forced labor slavery. All other demographic variables, and interview modality, were independent from linking fish stocks and slavery, though it should be noted that most analyses had at least 1 cell with a count less than five, and Age and Region had more than 20% of its cells with counts less than five.

Table 5

Chi-Square Tests of Independence between Demographic Variables and Forced Labor Slavery

Variable	**Result**
Interview Modality	$\mathcal{X}^2(1) = .004, p = .95$
Education	$\mathcal{X}^2(2) = .14, p = .93$
Age	$\mathcal{X}^2(4) = 7.98, p = .09$
Race/Ethnicity	$\mathcal{X}^2(2) = .56, p = .75$
Gender	$\mathcal{X}^2(1) = 1.75, p = .19$
Organizational Focus	$\mathcal{X}^2(3) = 8.08, p = .04$*
Region	$\mathcal{X}^2(5) = 5.01, p = .42$
Years of Experience	$\mathcal{X}^2(3) = 2.67, p = .45$
Fisherman	$\mathcal{X}^2(1) = .61, p = .43$

*$p < .05$

[a]At least one cell, but less than 20% of cells with counts less than five

[b]More than 20% of cells with counts less than five

A binary logistic regression model was then used to determine if demographic variables (see Table 1 for variables) along with interview modality were significant predictors of whether a participant linked fish stock declines and forced labor slavery in

their cognitive map. The Hosmer-Lemeshow test was non-significant, $X^2(8) = 4.37$, $p = .82$, thus it was assumed the model had adequate fit to the data, though low power may also explain the high p-value. While the overall model was significant, $X^2(23) = 51.56$, $p = .001$, there was insufficient evidence to conclude that any specific demographic predictor or interview modality was significant in explaining whether a participant linked fish stock declines and forced labor slavery. Of the 12 participants who did not connect the two issues in their cognitive map, seven (58.3%) reported during their interviews that they had not previously considered the connection, and therefore had not expanded either their ecological view to include social systems or vice versa.

The two participants purposefully sampled for negative case analyses failed to yield insight about confounders distinct from other participants. In particular, the participant from Sweden expressed concerns about the presence of slavery in the sector, despite popular opinion that Sweden is slave free. The participant reported multiple risk factors along Sweden's maritime border with Russia such as unsustainable stock management driven by Russia's economic interests instead of science, and illegal fishing by Russian and Ukrainian vessels. In addition, the participant disclosed recent reports of labor abuses of migrant crew members on transport and ice breaking vessels.

Map Composition

At the conclusion of data collection, 111 unique variables were identified by the 44 participants. After two coding cycles, the 111 variables were reduced to 53 variables, categorized by number of appearances in the Present/Absent Variable Index (Table 6). Excluding the two bounding variables (fish stock declines and forced labor slavery) and

the uncommon variables (i.e., the variables only listed by one participant), Figure 11 ranks each variable by how many maps it appeared in during the study. After each map

Figure 10. Hotspots for Forced Labor Slavery in the Fishing Industry

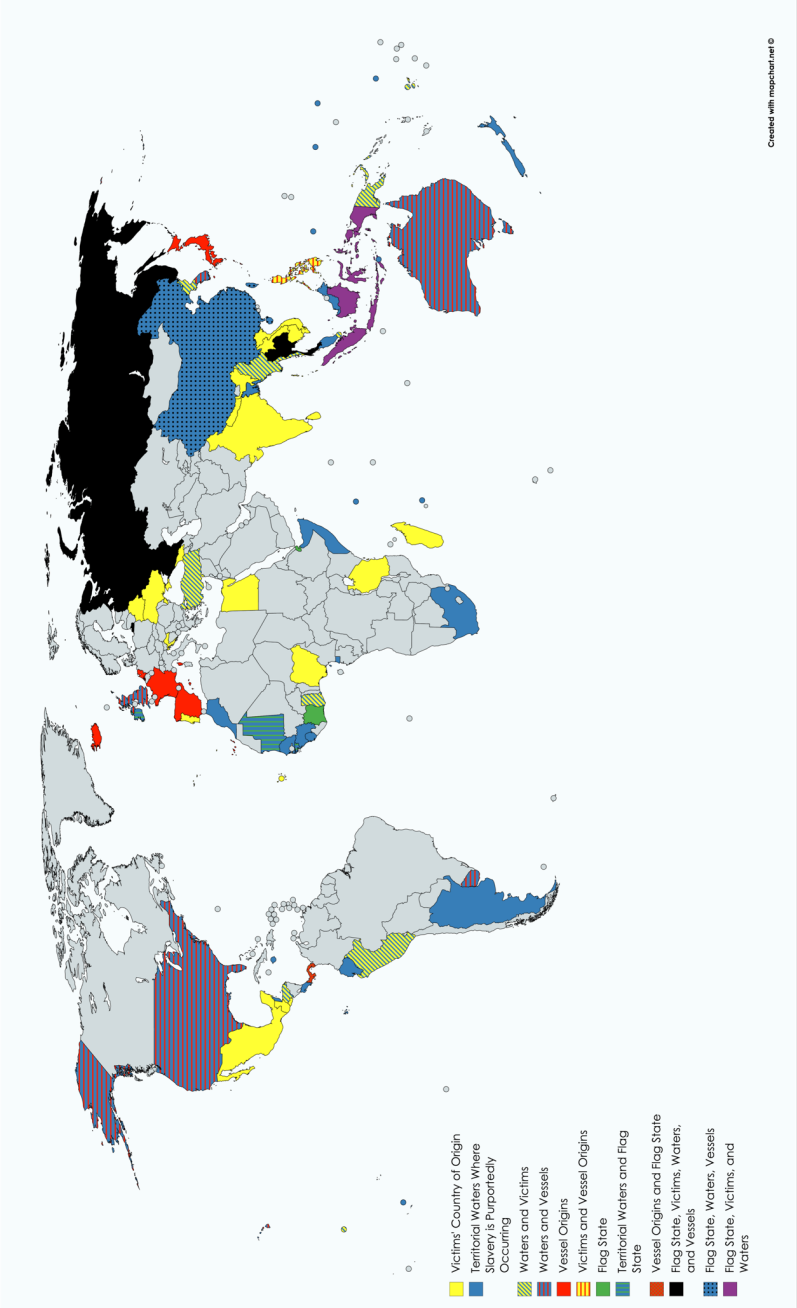

Figure 10. Map of the world depicting which countries participants identified as being origin countries for victims and vessels, flag states, and countries whose territorial waters are hotspots for vessels using forced labor slavery.

was converted to an adjacency matrix, structural metrics were calculated (Table 7). Map composition was then further elucidated by using these metrics to rank the top 10 transmitter, receiver, and ordinary variables, and the 10 most central variables (Table 8).

Map Comparisons

Quantitative pairwise comparisons of map composition determined two distinct groups with high levels of similarity in variable inclusion (i.e., more than 50% of the pairwise comparisons yielded a Phi coefficient and Yule Q coefficient of 0.7 or higher). The first grouping was participants with at least 20-29 years of experience and whose organizational focus was on maritime crime and regulations. Similar pertinent variables in this group's maps included transshipment and supply chain complexity. The second grouping was participants whose regional focus was Southeast Asia and who were currently or previously employed as fishers. Their similar pertinent variables included xenophobia, racism, and marginalization of small-scale fishers.

Table 6

Present/Absent Variable Index for Individual Participant Maps

Common Variables ($n \geq 22$)	**Partially Common Variables ($2 \leq n \leq 21$)**		**Uncommon Variables ($n = 1$)**
Regulatory problems and challenges	Consumer demand	Increased fishing capacity	Community accountability
Illegal, unreported, and unregulated fishing	Social vulnerabilities	Wildlife crimes	Fishermen perceived as disposable people
Profit margins	Fishing costs	Fishing safety	Limited data
Fishing effort	Overfishing	Market prices for fish	Marine exploitation
	Use of foreign and migrant workers, often undocumented	Risk	Ocean warming

	Government inaction	Seeking of cost-cutting measures	Phantom owners
	Race to fish	Disposable vessels	Seafood certification schemes
	Labor shortages	Political instability	Shell companies
	Racism	Geographic remoteness	Subsidies
	Supply chain complexity	Globalization	
	Transshipment	Other transnational crime	
	Catch-per-unit-effort	Presence of transnational criminal syndicates	
	Lack of deterrents	Underdeveloped economy (national)	
	Marginalization of small-scale and/or legal fishers	Capitalism	
	Fisheries interventions and regulatory reforms	Consumer disconnect	
	Monopolization of resources	Governance	
	Xenophobia and stricter immigration laws	Licensing schemes	
	Demand for cheap labor	Nationalism	
	Power differentials	Normalizes exploitive practices	

Figure 11. Number of Models Including Each Variable

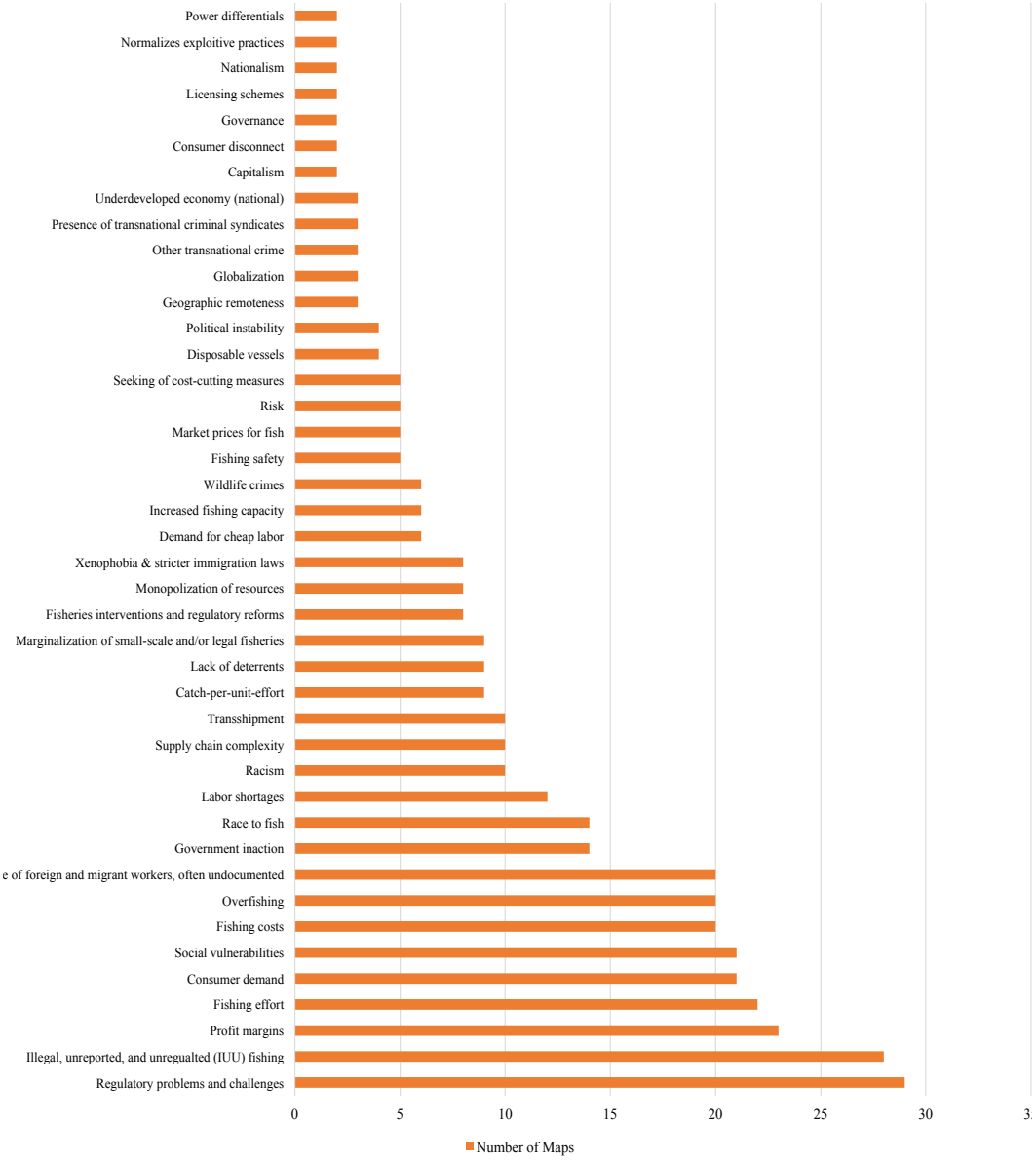

Figure 11. Variables included in at least two participant maps, ranked by number of appearances.

Table 7

Structural Metrics of Individual Participant Models

	Vertices (*N*)	Edges (*E*)	Density (*D*)	Connectedness (*C/N*)	Transmitter Variables (*T*)	Receiver Variables (*R*)	Ordinary Variables (*O*)	Complexity (*C*)
1	*15*	30	0.14	2.00	3	0	12	0
2	16	33	0.14	2.06	1	3	12	3
3	12	21	1.16	1.75	3	1	8	0.33
4	16	27	0.11	1.69	2	2	12	1
5	9	17	0.24	1.89	1	1	7	1
6	10	14	0.16	1.40	2	0	8	0
7	11	13	1.12	1.18	3	2	6	0.67
8	11	16	1.15	1.45	2	1	8	0.5
9	11	16	1.15	1.45	1	2	8	2
10	10	16	0.18	1.60	1	1	8	1
11	7	10	0.24	1.43	3	0	4	0
12	12	17	1.13	1.42	3	2	7	0.67
13	6	6	0.20	1	3	2	1	0.67
14	8	11	0.20	1.38	1	1	6	1
15	9	10	0.14	1.11	2	2	5	1
16	10	12	0.13	1.20	3	1	6	0.33
17	8	12	0.21	1.50	1	1	6	1
18	12	22	0.17	1.83	2	2	8	1
19	14	20	0.11	1.43	3	4	7	1.33
20	21	33	0.08	1.57	5	4	12	0.8
21	13	18	0.12	1.38	4	1	8	0.25
22	12	16	0.12	1.33	5	1	6	0.2
23	15	20	0.10	1.33	5	1	9	0.2
24	9	12	0.17	1.33	5	1	3	0.2
25	17	25	0.09	1.47	4	2	11	0.5
26	15	20	0.10	1.33	5	1	9	0.2
27	5	5	0.25	1.00	3	1	1	0.33
28	9	13	0.18	1.44	0	1	8	Infinity
29	12	16	1.12	1.33	2	1	9	0.5
30	14	21	1.16	1.50	5	0	9	0
31	13	15	0.10	1.15	5	2	6	0.4
32	7	7	0.17	1.00	0	2	5	Infinity
33	5	4	0.20	0.80	1	1	3	1
34	9	13	0.18	1.44	1	2	6	2
35	10	13	0.14	1.30	4	1	5	0.25
36	7	8	0.19	1.14	3	1	3	0.33
37	8	7	0.13	0.88	5	1	2	0.2
38	12	21	0.16	1.75	3	0	0	0
39	9	8	0.11	0.89	4	3	2	0.75
40	16	20	0.08	1.25	4	1	11	0.25
41	7	8	0.19	1.14	3	1	3	0.33
42	7	8	0.19	1.14	2	0	5	0
43	12	17	0.13	1.42	1	0	11	0
44	7	6	0.14	0.86	5	2	0	0.4

Table 8

Variable Rankings from Individual Participant Maps

Ranking	Transmitter Variables	Receiver Variables	Ordinary Variables	Degree Centrality (Total)	Degree Centrality (Mean)
1	Consumer demand (n = 20)	Forced labor slavery (n = 10)	Forced labor slavery (n = 34)	Forced labor slavery ($C_D[V_T]$ = 117.24)	Forced labor slavery ($C_D[V_{Mean}]$ = 5.21)
2	Regulatory problems and challenges (n = 14)	Profit margins (n = 8)	Fish stock declines (n = 27)	IUU ($C_D[V_T]$ = 56.95)	Fishing costs ($C_D[V_{Mean}]$ = 4.19)
3	Government inaction (n = 8)	Fishing costs (n = 6)	IUU (n = 23)	Profit margins ($C_D[V_T]$ = 55.84)	IUU fishing ($C_D[V_{Mean}]$ = 3.93)
4	Labor shortages (n = 7)	Wildlife crimes (n = 6)	Fishing effort (n = 18)	Fish stock declines ($C_D[V_T]$ = 55.82)	Fishing effort ($C_D[V_{Mean}]$ = 3.91)
5	Social vulnerabilities (n = 7)	Fishing effort (n = 3)	Overfishing (n = 17)	Regulatory problems and challenges ($C_D[V_T]$ = 45.14)	Fish stock declines ($C_D[V_{Mean}]$ = 3.38)
6	Use of foreign and migrant workers, often undocumented (n = 7)	Other transnational crime (n = 3)	Profit margins (n = 15)	Fishing effort ($C_D[V_T]$ = 44.98)	Power differentials ($C_D[V_{Mean}]$ = 3.24)
7	Racism (n = 6)	Supply chain complexity (n = 3)	Fishing costs (n = 13)	Fishing costs ($C_D[V_T]$ = 41.9)	Fisheries interventions & regulatory reforms ($C_D[V_{Mean}]$ = 3.08)
8	Fish stock declines (n = 5)		Regulatory problems and challenges (n = 13)	Overfishing ($C_D[V_T]$ = 35.58)	Increased fishing capacity ($C_D[V_{Mean}]$ = 2.64)
9	Lack of deterrents (n = 5)		Race to fish (n = 11)	Use of foreign & migrant workers, often undocumented	Presence of transnational criminal syndicates

			($C_D[V_T]$ = 35.25)	($C_D[V_{Mean}]$ = 2.58)
10	Xenophobia (n = 5)	Use of foreign and migrant workers, often undocumented (n = 11)	Race to fish ($C_D[V_T]$ = 24.43)	Profit margins ($C_D[V_{Mean}]$ = 2.43)

According to univariate, one-way analyses of variance (ANOVAs) there were no statistically significant differences in map structure (i.e., the mean number of vertices, edges, transmitter, receiver, and ordinary variables and the mean density, connectedness, and complexity) across participants regardless of organizational focus, education, and race (Table 9). However, mean map density differed amongst years of experience (F(3, 38) = 3.87, p = .02) and age (F(3, 38) = 4.07, p = .01). Specific to years of experience, Levene's Test for Equality of Variances was significant (F(3, 40) = 10.11, p < .001), and post hoc Dunnett's T3 testing indicated a significant difference (p = .016) in mean density between less than 10 years of experience ($\bar{x}$ = .66, s = .52) and 11-19 years of experience ($\bar{x}$ = .14, s = .04). For age, homogeneity of variance was not assumed (F(4, 39) = 103.88, p < .001), and post hoc Dunnett's T3 testing indicated a significant difference (p = .04) in mean density between 40-49 years ($\bar{x}$ = .54, s = .49) and 60-69 years ($\bar{x}$ = .11, s = .03). Additionally, the mean number of vertices (F(3, 38) = 3.94, p = .006) and edges (F(3, 38) = 4.13, p = .005) differed across region, and were the only statistically significant findings after the application of the Bonferroni adjustment. Regarding vertices, Levene's Test for Equality of Variances was not significant (F(5, 38) = 1.43, p < .24), and post hoc Tukey's testing indicated a significant difference (p = .019) in mean vertices between Africa ($\bar{x}$ = 7.33, s = 2.08) and North America ($\bar{x}$ = 15.0, s =

2.65). Assuming homogeneity of variances, ($F(5, 38) = 1.26$, $p = .30$), post hoc Tukey's testing indicated a significant difference ($p = .019$) in mean edges between Southeast Asia ($\bar{x} = 13.13$, $s = 4.66$) and North America ($\bar{x} = 26.33$, $s = 6.11$); a significant difference ($p = 0.2$) between Africa ($\bar{x} = 9.33$, $s = 3.79$) and North America ($\bar{x} = 26.33$, $s = 6.11$); and a significant difference ($p = .023$) between the Pacific ($\bar{x} = 9.67$, $s = 2.89$) and North America ($\bar{x} = 26.33$, $s = 6.11$). Lastly, mean connectedness differed by years of experience ($F(3, 38) = 2.98$, $p = 0.4$). Assuming equal variances ($F(3, 40) = .38$, $p = .77$, post hoc Tukey's testing indicated a statistically significant difference in mean connectedness ($p = 0.48$) between 20-29 ($\bar{x} = 1.20$, $s = .28$) and 30-39 ($\bar{x} = 1.56$, $s = .32$) years of experience.

For demographic variables with only two groups (i.e., gender and former employment as a fisher), independent samples t-tests did not find statistically significant differences in map structure (i.e., the mean number of vertices, edges, transmitter, receiver, and ordinary variables and the mean density, connectedness, and complexity) (Table 10). Whether the interview was recorded and interview modality were also assessed. There were no statistically significant differences in map structure metrics based on interview modality. However, statistical differences were noted in number of map edges, connectedness, number of transmitter, receiver, and ordinary variables, and complexity amongst participants that were recorded and not recorded (Table 10).

Table 9

Univariate Analyses of Variance (ANOVAs) Comparing Map Structure Across Participants

	Organizational focus	**Region**	**Years experience**	**Education**	**Age**	**Race**
Vertices	$F = .82$, $p = .49$	$F = 3.94$, $p = .006$**	$F = 2.03$, $p = .13$	$F = 1.15$, $p = .34$	$F = .81$, $p = .53$	$F = .99$, $p = .38$
Edges	$F = 1.52$, $p = .23$	$F = 4.13$, $p = .005$**	$F = 2.87$, $p = .05$	$F = 1.76$, $p = .17$	$F = .44$, $p = .78$	$F = 1.32$, $p = .28$
Density	$F = .25$, $p = .86$	$F = .55$, $p = .74$	$F = 3.87$, $p = .02$*	$F = 1.02$, $p = .39$	$F = 4.07$, $p = 0.01$*	$F = .55$, $p = .58$
Connectedness	$F = 1.66$, $p = .19$	$F = 1.85$, $p = .13$	$F = 2.98$, $p = .04$*	$F = 2.30$, $p = .09$	$F = .26$, $p = .90$	$F = 1.42$, $p = .26$
Transmitter variables	$F = .55$, $p = .65$	$F = 1.15$, $p = .35$	$F = .17$, $p = .92$	$F = .76$, $p = .52$	$F = .43$, $p = .78$	$F = 1.25$, $p = .30$
Receiver variables	$F = .16$, $p = .92$	$F = 1.41$, $p = .24$	$F = 1.71$, $p = .18$	$F = 2.55$, $p = .07$	$F = .51$, $p = .73$	$F = .98$, $p = .39$
Ordinary variables	$F = .40$, $p = .75$	$F = 2.38$, $p = .06$	$F = 2.52$, $p = .07$	$F = 1.05$, $p = .38$	$F = .64$, $p = .64$	$F = .90$, $p = .42$
Complexity	$F = .49$, $p = .69$	$F = 1.08$, $p = .39$	$F = .93$, $p = .43$	$F = 2.66$, $p = .06$	$F = .36$, $p = .84$	$F = 2.08$, $p = .14$

Note. For each F statistic, the between group degrees of freedom were three, and the within group degrees of freedom were 38.
*$p < .05$
** $p < .008$ (Bonferroni correction)

Assuming equal variances across all pairwise comparisons[5], participants that were not recorded had a higher mean number of edges ($\bar{x} = 17.81$, $s = 7.59$) and ordinary variables ($\bar{x} = 7.57$, $s = 2.77$) and higher mean connectedness ($\bar{x} = 1.51$, $s = .28$) and complexity ($\bar{x} = .84$, $s = .69$) than participants who were recorded (i.e., edges ($\bar{x} = 13.17$, $s = 6.12$), ordinary variables ($\bar{x} = 5.52$, $s = 3.55$), connectedness ($\bar{x} = 1.23$, $s = .24$), and complexity ($\bar{x} = .38$, $s = .44$)). Participants who were recorded; however, had a higher

[5] Levene's Test for Equality of Variances: edges ($F = .17$, $p = .68$), ordinary variables ($F = .3.96$, $p = .055$), connectedness ($F = .26$, $p = .61$), complexity ($F = 2.31$, $p = .14$), and transmitter variables ($F = 2.69$, $p = .11$).

mean number of transmitter variables ($\bar{x}$ = 3.26, s = 1.74) than participants who were not recorded ($\bar{x}$ = 2.33, s = 1.11). Connectedness was the only finding that was statistically significant after the application of the Bonferroni correction.

Table 10

Independent Samples t-Tests Comparing Map Structure Across Participants

	Gender	**Former employment as fisher**	**Interview modality**	**Recording**
Vertices	$t(42) = -.90$, $p = .37$	$t(42) = -.34$, $p = .74$	$t(42) = 1.35$, $p = .18$	$t(42) = 1.10$, $p = .28$
Edges	$t(42) = -.21$, $p = .84$	$t(42) = -1.16$, $p = .25$	$t(42) = 1.48$, $p = .15$	$t(42) = 2.24$, $p = .05$*
Density	$t(36.7) = 1.41$, $p = .17$	$t(12.4) = -1.74$, $p = .11$	$t(42) = .77$, $p = .98$	$t(34.5) = 1.43$, $p = .16$
Connectedness	$t(42) = .49$, $p = .63$	$t(42) = -1.94$, $p = .06$	$t(42) = .75$, $p = .46$	$t(42) = 3.60$, $p = .001$**
Transmitter variables	$t(42) = -1.40$, $p = .17$	$t(42) = .68$, $p = .50$	$t(28.2) = .61$, $p = .55$	$t(37.7) = -2.13$ $p = .04$*
Receiver variables	$t(42) = .59$, $p = .56$	$t(42) = .63$, $p = .53$	$t(42) = -.36$, $p = .72$	$t(42) = 1.54$, $p = .13$
Ordinary variables	$t(42) = -.77$, $p = .44$	$t(42) = -1.10$, $p = .28$	$t(42) = 1.60$, $p = .12$	$t(37.1) = 2.13$, $p = .04$*
Complexity	$t(40) = 1.34$, $p = .19$	$t(11.8) = -.66$, $p = .52$	$t(42) = .18$, $p = .86$	$t(40) = 2.52$, $p = .02$*

* $p \leq .05$
** $p \leq .01$ (Bonferroni correction)

Map Aggregation

To simplify the quantitative aggregation of maps, additional coding occurred after individual map analyses to further reduce the 53 map variables. As a result, market prices for fish was collapsed into consumer demand, fishing costs was collapsed into profit margins, capitalism and globalization were collapsed into race to fish and re-characterized as a global race to fish, presence of transnational criminal syndicates was collapsed into other transnational crime, seafood certification schemes was collapsed into

consumer disconnect, and xenophobia, racism, and nationalism were grouped together and recoded as discrimination. This additional coding is further clarified in the codebook (Appendix C). When variables were collapsed or re-characterized, vector multiplication was used to determine the strength of the relationship between the now collapsed variables and other system variables. Other variables, such as risk, were eliminated prior to vector multiplication since they functioned more as pathway descriptors than distinct variables.

The vector multiplication of each of the 44 participant maps' adjacency matrices yielded the aggregated consensus map represented in Figure 12 (*aim one*). Table 11 lists the aggregated map's structural metrics, derived from the quantification of each relationships' strength (*aim two*). Within the map, there were four transmitter variables (global race to fish, political instability, geographic remoteness, and underdeveloped economies) and two receiver variables (wildlife crimes and other transnational crime). Excluding forced labor slavery, the outcome of interest, the five most central variables in the map were profit margins, IUU fishing, regulatory problems and challenges, overfishing, and fish stock declines (Table 12). Each of the transmitter most central variables were evaluated as potential mediators and moderators of the relationship between fish stock declines and forced labor slavery (*aim three*). A definition for each variable used in the aggregated map is included in the study's codebook in Appendix C. Each pathway is also further explicated below using qualitative data from participant interviews (*aim one*).

Figure 12. Cumulative, Consensus Map

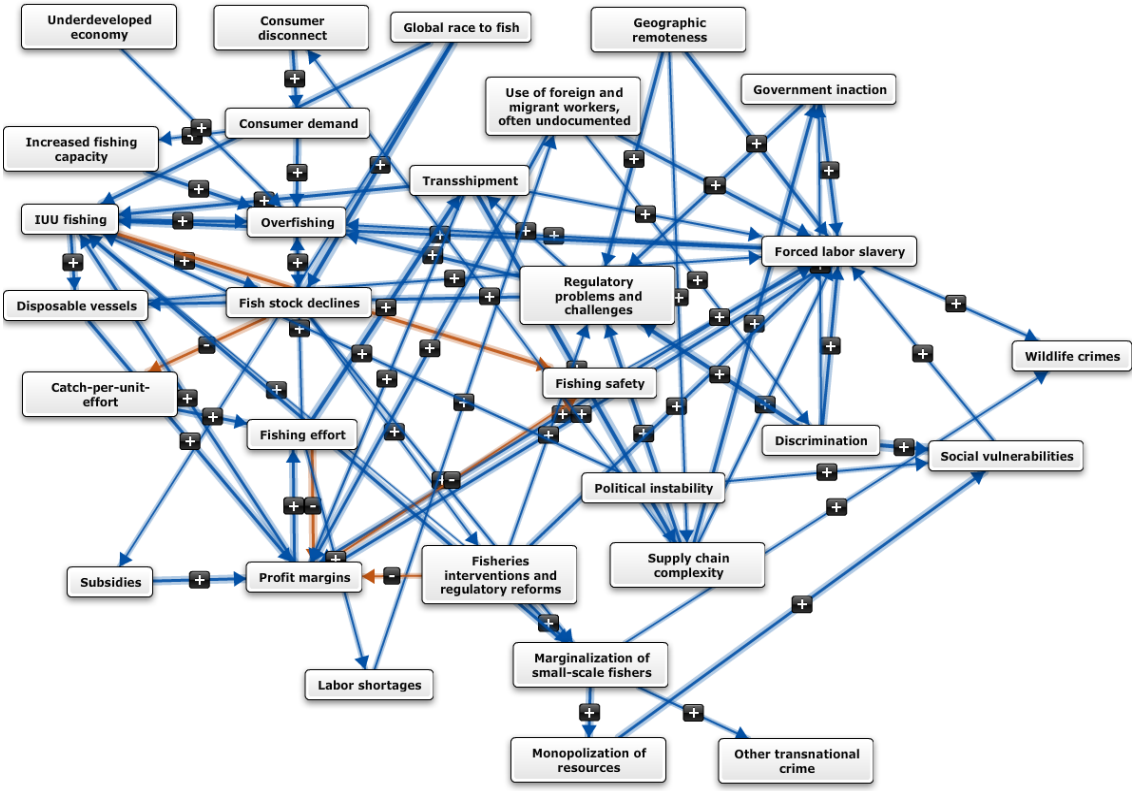

Figure 12. The overalls study's cumulative and aggregated consensus map, produced in the Mental Modeler software by using vector multiplication to combine the 44 participant's individual adjacency matrices which corresponded to their individually constructed models.

Table 11

Cumulative and Aggregated Consensus Map Structural Metrics

Vertices (*N*)	Edges (*E*)	Density (*D*)	Connectedness (*C/N*)	Transmitter Variables (*T*)	Receiver Variables (*R*)	Ordinary Variables (*O*)	Complexity (*C*)
30	70	0.08	2.33	4	2	24	0.5

Table 12

Cumulative and Aggregated Consensus Map Variable Indices

Variable	**Indegree**	**Outdegree**	**Centrality**	**Type**
Forced labor slavery	5.56	2.19	7.75	Ordinary
Profit margins	4.72	2.14	6.86	Ordinary
IUU fishing	3.50	2.55	6.05	Ordinary
Regulatory problems and challenges	3.02	1.70	4.72	Ordinary
Overfishing	3.86	0.72	4.58	Ordinary
Fish stock declines	2.30	1.50	3.8	Ordinary
Fishing effort	1.22	2.50	3.72	Ordinary
Transshipment	1.34	2.28	3.62	Ordinary
Supply chain complexity	1.22	1.89	3.11	Ordinary
Discrimination	0.33	2.61	2.94	Ordinary
Fisheries interventions and regulatory reforms	0.47	2.25	2.72	Ordinary
Marginalization of small-scale fishers	1.00	1.69	2.69	Ordinary
Social vulnerabilities	1.84	0.39	2.23	Ordinary
Disposable vessels	1.11	1.11	2.22	Ordinary
Use of foreign and migrant workers, often undocumented	0.33	1.81	2.14	Ordinary
Government inaction	0.89	1.11	2.00	Ordinary
Global race to fish	0	1.94	1.94	Transmitter
Consumer demand	0.50	1.09	1.59	Ordinary
Geographic remoteness	0	1.58	1.58	Transmitter
Monopolization of remoteness	0.69	0.81	1.50	Ordinary
Catch-per-unit effort	0.67	0.61	1.28	Ordinary
Subsidies	0.25	0.83	1.08	Ordinary
Increased fishing capacity	0.42	0.61	1.03	Ordinary
Fishing safety	0.75	0.11	0.86	Ordinary
Consumer disconnect	0.31	0.50	0.81	Ordinary
Labor shortages	0.33	0.33	0.66	Ordinary
Wildlife crimes	0.64	0	0.64	Receiver
Political instability	0	0.39	0.39	Transmitter
Underdeveloped economy	0	0.22	0.22	Transmitter
Other transnational crime	0.19	0	0.19	Receiver

Explication of the Consensus Map's Social-Ecological System

Fish stock pressures. The first issue identified by participants, and supported by existing empirical data was the decline of fish stocks in various territorial and international waters globally. As noted by one participant who identified as a former or current fisher, "Stocks are declining. Everyone knows that. Even people who are not working in or with the sector know that. The problem is so pervasive that fish stocks is a topic of conversation in elections, town hall meetings, etcetera." Multiple participants across differing regions also described the declines as "fast and extreme," beginning around 2010, and resulting in cumulative fish hauls for fishermen decreasing anywhere from 30 to 75% in five years or less.

Per participants, both overfishing and illegal, unreported, and unregulated (IUU) fishing increased fish stock declines. Examples of IUU activities described by participants included underreporting or not reporting catch; the use of environmentally damaging methods that, in part, yielded high rates of bycatch; failure to obtain fishing licenses; turning off or manipulating vessel tracking devices; and high-grading wherein poorer quality fish already caught and likely dead were thrown overboard to accommodate higher value fish. One of the drivers of IUU noted by participants was political instability (e.g., civil war and disease outbreaks). For example, multiple participants relayed an increase in IUU fishing in the Gulf of Guinea during the West Africa Ebola outbreak because governments with already limited capacity to prevent IUU had to reallocate funds to more emergent issues. Additionally, IUU fishing increased

overfishing, because catch limit and quota calculations did not account for illegally harvested fish—which could compromise as much as one-third of all landed fish. Therefore, catch thresholds were based on an incorrect, lower cumulative haul which likely overestimated the stock size, resulting in the legalized overexploitation of the stock beyond sustainable levels. Participants also reported fishing in no-take areas (i.e., areas where fishing activities have been banned to help stocks recover or to conserve declining stocks).

However, not all overfishing (i.e., unsustainable fishing to such an extent that stock depletions exceed replacement and recruitment causing the stock to decline) was caused by illegal or unregulated activity. Regulatory problems and challenges increased overfishing, subsequently increasing fish stock declines, which are a byproduct of overfishing. Some participants even described current fisheries regulations as "legalizing" overfishing because economic self-interests undermined national and international cooperation creating differentiated, rather than common, fishing responsibilities that exceed the capacity of shared or common waters. Consequently, this "low degree of transboundary coordination and cooperation" resulted in uncomprehensive, piecemeal regulations with too narrow of scopes and numerous loopholes that left many overly exploitive fishing activities unregulated. This lack of cooperation in implementing regulations then also carried over into a lack of transboundary enforcement of regulations, particularly concerning IUU fishing, which participants ubiquitously identified as a transnational issue. As a result, a lack of political

will predicated on economic self-interests further eroded international coordination and cooperation.

Economic consequences of fish stock declines. During the mapping activity, participants described fishing as becoming "more difficult and more expensive," explicating a chain reaction where fish stock declines decreased catch-per-unit-effort, and the fishing sector responding with increased fishing effort (e.g., fishing farther, longer, or deeper, deploying nets more frequently, and using fishing gear more indiscriminately). The increased fishing effort decreased profit margins. As one participant described:

> When stocks decline, catches decline. When catches decline, profits decline because they are spending the same effort or more effort, which is going to cost even more, but have less product to sell, or the quality of the product has diminished because the fish are smaller, which means they are going to get less money for that fish.

This increased effort then increased overfishing:

> Overfishing causes catches to decline, but it's a vicious cycle because as catches decline you have more effort to still maintain your catches, so as catches decline overfishing increases. And this type of overfishing is even more dangerous, because you are more likely to be catching, smaller, younger fish which will first, make it harder for the stock to reproduce and maintain its population, and second, which will generate less profit.

Drivers of overfishing. Despite the narrowing profit margins, participants described two main mechanisms perpetuating overfishing. Foremost, primarily in

developed countries, consumer demand increased overfishing. Participants explained that the increased consumer demand was a more recent phenomenon and driven by the portrayal of seafood's wholesomeness (e.g., its health benefits and that it is more humane than other animal protein sources), relative inexpensiveness, and product diversity. Unlike other agricultural activities, when demand increased overfishing and fishing effort, profits decreased because "at some point the total cost needed to sustain the activity exceeds the revenue earned from the product because you are not growing your product, you are exploiting a naturally occurring resource." As a result, one participant noted:

> Consumers have a degree of responsibility for overfishing because we leverage power over the price of the product. We want cheaper and cheaper seafood delivered en masse, and the price we are willing to pay for it is not reflective of the true cost of labor production, but because of the diversity of choices, we as consumers can keep the cost low, and our disconnect from how fish get from the ocean to our plates—that is we can't see the activity like we see, say farming—increases our consumer demands while helping us ignore the true cost of production.

Another participant, who identified as a former or current fisher, also added:

> It feels like the fishing industry is just out of options. No one knows what to do. If we try and raise the cost of a fish, consumers just won't buy it. So then we are forced to lower the price again. And now there are even more types of fish that

people are eating. And of course, environmentalists and their organizations are wanting people to eat all different types of fish that are more sustainable. Which makes sense, but no one is considering the consequences of these actions on those of us in the industry. Eating other types of fish may lead to importing more fish, which further burdens our local industry by reducing our profits even more.

Participants also described a series of cause and effects that started with consumer demand and ended with IUU fishing. While they described commercial demand for fish as expanding throughout the sector, the demand was greatest for cheap fish, which when coupled with product diversity, kept consumer costs down. However, "the market still demands consistent quality and size so you have to fish farther and deeper, dump your catches, and fish illegally." The illegally caught fish then "flooded the market with cheap product" perpetuating a cycle wherein "some fish prices, like canned tuna, haven't changed in over 30 years." Therefore, IUU was labeled as a financially motivated response, and "an effort to maximize profits."

In developing countries, consumer demand also existed, driven by growing populations and a lack of alternative food sources. However, most participants described overfishing in developing countries' territorial waters being caused by either IUU or "legal" overfishing through "licensing schemes." Most of these developing countries had small and underdeveloped economies, which disproportionately relied on fishing to support impoverished populations. Lacking the infrastructure to store and transport fish within the country though, selling fishing licenses to foreign countries was "a substantial and much-needed source of income to support development." As a result, these licensing

schemes created an increased fishing capacity, where "too many boats are fishing for too few fish," thus increasing overfishing.

These two mechanisms intersected when fish consumption in primarily the United States, the European Union countries, and China became too great and grew too fast. This increased consumer demand led vessels that had already overexploited their own stocks in their territorial waters to look for new areas to fish, which is when developing countries' territorial waters became a target. Participants described these waters as historically resource rich and less exploited since the local communities lacked the capacity. The arrival of foreign fleets thus increased fishing capacity to the point of overfishing. As articulated by participants:

> In a lot of developed countries where there is high demand for cheap seafood, the coastal waters do not have productive enough fisheries to satisfy demand anymore because they've already been overfished, so then these countries' fishing fleets go fish in other, poorer, countries' territorial waters.

> You also have huge power differences between these developed and developing countries. The vessels' countries are rich and powerful, and these poorer countries are still developing their economies and many are extremely desperate so they will take the money being offered for licenses regardless of environmental regulations. There are lots of agreements about fishing licenses that happen in secrecy. But the amount of money these developed countries, primarily western

countries and China offer, it's a lucrative cash source for these very poor countries.

The race to fish—defined by participants as a profit-driven fishing motivation, versus tradition or subsistence, that is rooted in capitalism and that creates extreme global competition for scare fish resources—also increased fish stock declines and IUU fishing, and was identified by participants as the reason that the fishing industry often increased effort instead of reducing capacity when stocks declined. Not only did the race to fish perpetuate overfishing, but participants also linked it to the power differentials and exploitation described between developed and developing countries. The race to fish compounded increases in IUU fishing caused by regulatory problems and challenges, because countries such as China and Thailand "preyed upon" the poorest of developing countries' waters because they "knew that they were out of reach of authorities and that the developing countries lacked the capacity to enforce their own environmental regulations, thus reducing their risk."

Forced labor slavery as a response to decreasing profits. When fish stocks declined and effort increased, reducing profit margins, owners of fishing companies and captains of fishing vessels sought ways to cut costs and increase profits. IUU fishing was one such strategy, which is why participants noted that decreased profit margins increased IUU fishing. Per participants, this is also why decreased profit margins increased forced labor slavery—because "cutting labor costs is an attempt to protect profits." Overall there was a lack of control over production, and few fixed costs. "Unlike other agricultural activities, there is no investment in the commodity itself—the fish."

And one of the only other competitive advantages would be investment in new technologies and equipment. However, most participants reported that in comparison to using forced labor, technology was perceived as an expensive, long-term investment; whereas, using forced labor slavery was a quick and inexpensive solution. Further, fishing operations in general were described as labor-intensive, with crew wages typically the largest cost—constituting 40-50% of operating costs when paid fairly. The use of forced labor slavery then increased profit margins, reinforcing the use of forced labor to offset increasing costs. As detailed by a participant identifying as a former or current fisher:

> When fishing effort increases, your costs also increase, which leads to more labor abuses such as withheld wages. All of the other stuff like the shootings and the beatings is to keep power over them so they can continue to withhold wages. So then when your abuses increase, your cost-per-unit of effort decreases, which means you are reducing your cost pressures which are threatening your profit.

The multitude of labor abuses detailed by participants included: misleading contracts; bonded debt; wage theft; a lack of overtime pay; payments amounting to less than minimum wage; dangerous working conditions and a lack of safety equipment; threats to report to immigration officials; no access to healthcare after suffering injuries or illness spurred by working conditions; at sea for years at a time and contact with family forbidden; inadequate housing on the vessel including living quarters that lacked electricity and sanitation consistent with humanitarian standards; unfree to leave boat when docked; food and water withheld; immigration and employment papers confiscated,

imprisoned in cages and other sub-humanitarian apparatuses; tricked onto vessel; kidnapped; working for more than 24 hours without sleep and other forms of extreme sleep deprivation; threats to family; forced use of drugs (i.e., amphetamines to stay awake and work all night); false promises and a failure to honor commitments in contract; and murder.

Related cost-cutting measures. Of the other strategies participants described as being employed to offset decreasing revenue and increasing costs, many were related to forced labor slavery. For example, participants disclosed that IUU fishing and decreasing profit margins decreased safety and that subsequently decreased safety increased forced labor slavery, with participants characterizing disregard for crew safety as a precursor to more egregious labor abuses.

> When the vessels are generating less profits, they have less money to invest in maintenance and repairs and safety equipment, which contributes to the unsafe and inhumane working conditions that constitute forced labor.

Transshipment, when fishing vessels tie up to reefer or mother ships in the middle of the ocean to refuel and unload fish catch to prevent coming to port for supplies or catch unloading, was also described as increasing profit margins because it reduced fuel costs and the time needed to traverse between open, international waters and shore. While purportedly posited by some in the sector as a strategy for improving fishing efficiency, participants suggested that it increased IUU because it allowed legally caught fish to be "mixed" with illegally-caught fish rendering traceability impossible, and decreasing the risk of getting caught illegally fishing. It also increased forced labor slavery because crew

were being traded at sea to other vessels without their consent, keeping some crew members at sea for up to a decade. By keeping crew at sea, hidden from authorities and assistive services, users of forced labor slavery again reduced their risk of being caught.

Disposable vessels were also identified as increasing profit margins (because they reduced costs) and increased forced labor slavery. IUU fishing also increased the use of disposable vessels. As summarized by a participant:

> One reason that both IUU and forced labor slavery are appealing as ways to reduce costs, are that because even though these illegal activities are already low risk of getting caught because of regulatory challenges, they essentially become even less risk, or minimal, or zero risk because they will often use old vessels that are poorly maintained and lack more advanced technology. These vessels are cheaper up front, already reducing costs, but they are then essentially disposable. They lack safety equipment, etc. Anything that would drive up the cost, it would lack, because the idea is that you want this boat and equipment to be disposable should you get caught illegally fishing or using illegal labor, or both. And they do. They do abandon boats. They even abandon boats with crew on them. And of course the crew was forced labor, because again to lower your risk you don't want to invest money into crew just like you don't want to invest in technology. Your crew also needs to be disposable.

Indeed, six out of 44 (13.6%) participants had direct contact with forced labor slavery victims that had been stranded at sea when the captain abandoned the vessel either after

getting caught illegally fishing or using forced labor slavery, or was under the imminent threat of getting caught.

One of the most prevalent tactics expressed by participants for decreasing costs within the industry was the use of foreign and migrant laborers, often undocumented, as crew members. In delineating how migrant workers increased profit margins, one participant recounted:

> They can pay them [migrant workers] less money than others, and they are typically willing to stay in these jobs for several years because they have no other alternative employment opportunities.

And while using migrant labor may be so ubiquitous that it no longer supplies a competitive advantage, "using local labor is perceived as making you less competitive in the global market—especially for large corporations—because you have to pay them higher wages." Compounding this issue was what some participants described as a more readily available and mobile supply of migrant workers, whose mere "presence [in the sector] discouraged them [companies and boat owners and captains] from investing in technological solutions to increase labor productivity and efficiency as a means of reducing costs and/or increasing revenues."

Participants also outlined a series of events wherein government subsidies increased profit margins by lowering fishing costs and thus "delaying the tipping point of when fishing becomes unprofitable." And the reason why subsidies were even being used was because of the "race to fish:"

> Now you have this unprecedented international competition in the race to fish, that was really caused by all these countries overfishing their own waters. But because the fuel and just getting to these international waters are so expensive, subsidies are one of the only reasons they can afford to fish in these waters. But these subsidies are just delaying the inevitable, which is why you still have the use of other cost-cutting measures such as the use of forced labor.

Axes of structural inequalities. While all the aforementioned measures, including forced labor slavery were rationalized as economically justifiable actions in a competitive, globalized industry, participants also detailed various systemic structures supporting this rationalization. For example, when fishing effort increased, labor shortages also increased.

> With just regular effort, fishing is already one of the most labor intensive, hardest, jobs there is, and one of the most dangerous. Everyone knows this. No one wants these jobs. But then when fishing effort increases because of dwindling stocks, fishing becomes an even less desirable job. Which means you can't find laborers who voluntarily want to enter the fishing workforce. So you have an increased demand for labor because you need more crew to fish the longer distances, the longer hours, to cast the nets more, but you have a dwindling pool of laborers. So you have to get them any way you can, which often means trafficking them or tricking them onto the boat, and then you get the abuses.

Labor shortages then increased the use of foreign and migrant laborers, often undocumented.

> Most crew are foreign (either immigrants or undocumented migrants). Low unemployment rates in the ports [of developed countries] means that even low-skilled workers can bypass fishing crew jobs. The only ones who cannot are often the undocumented migrants or a few immigrants… because of barriers they cannot obtain better employment. They take the jobs that no one else will take… Most citizens, non-migrant, non-immigrants don't want this kind of job because working conditions are unsafe, hazardous, and very difficult and the pay is low.

Regardless of whether they identified a link between fish stock declines and forced labor slavery, all 20 participants, whose organizational focus was either labor and human rights or immigration and migration included the use of foreign and migrant laborers, often undocumented, increasing forced labor slavery in their concept maps, and reiterated that the empirical data has long supported irregular migration as one of the primary risk factors for the use of forced labor slavery in the fishing industry, as it creates a vulnerable supply of laborers in sectors where "inequities between race and citizenship status maintain long-existing power hierarchies." This finding was also consistent across all regional foci.

> With increased globalization we are seeing more migration than ever before, including more irregular migration. But nationalistic, isolation policies are making migration more difficult, so now you have larger, irregular (often undocumented) migration flows so you have a ready and easily exploitable supply of victims.

These participants expanded upon this relationship, describing how the use of foreign and migrant workers, often undocumented, increased discrimination from nationalism, racism, and xenophobia—with these laborers perceived as "stealing jobs" despite most citizens not wanting to work in the fishing sector. This discrimination in turn increased forced labor slavery because it made labor abuses against foreign, migrant, and undocumented workers not only economically justified but also "socially acceptable so you see a lack of shame on part of the perpetrators."

> But the [labor] abuses stem from racism. Racism and xenophobia is the bubble that this relationship [fish stock declines and slavery] should be nested in.

> Labor abuses are socially acceptable because there is such a poor opinion, like hostilities and racism towards migrants and immigrants. This isn't just in Thailand. It's any country that is wealthier than the countries where their migrant labor force comes from—which is most. You see it in the US and the EU and UK too. So we supposedly want to help victims, but first and foremost we want to criminalize "illegal" working through detention, deportation etc. And because of misrepresentations of modern slavery in the media, most people in these more developed or developed countries think that "illegal" or undocumented work is a much bigger issue than forced labor or slavery so that gets priority.

Additionally, political instability and discrimination increased social vulnerabilities, defined by participants as the inability of people to withstand adverse impacts from multiple stressors (e.g., exclusionary attitudes that impact employment opportunities).

These impacts are due in part to discriminatory characteristics inherent in social interactions, institutions, and cultural values. But foremost, political instabilities were portrayed as a frequent impetus for migration, but then being a migrant increased a person's social vulnerability because of discrimination. Examples of social vulnerabilities that increased migrant worker's risk for exploitation included high rates of poverty and unemployment, language barriers, education disparities and low literacy rates, and a lack of support systems. This discrimination also increased government inaction, which participants defined as "complicit regulatory bodies" hampered by "pervasive corruption" wherein officials are "paid to look the other way and not ask questions because of the powerful, vested interests that benefit from the trade" and/or "complacency." In a domino effect, the government inaction then increased regulatory problems and challenges for curbing the use of forced labor slavery because it resulted in a lack of initiative to address regulatory failures and loopholes. As a result, this government inaction increased the use of forced labor slavery (versus other cost-cutting measures) because it lowered the risks associated with using forced labor slavery.

> The antipathy towards migrants from neighboring states means there are fewer social inhibitions about treating migrant laborers poorly, which also means that most, including government officials, police, immigration authorities, etc. fail to see anything criminally, culturally, or socially wrong with the use of forced labor as a means of increasing profit.

> You have people—company owners, captains—who just won't follow the rules and there are no repercussion for them because governments are complicit. So they just don't follow the rules. Take for example new regulations requiring bank-to-bank transfers for fishermen's wages. Oh, but these rules aren't enforced because of the inequalities created by racism—so these poor fishermen can't access bank services. So then there is still the presence of a middleman or recruiter or agent who is going to supposedly do the bank-to-bank to transfer.
>
> Forced labor is the go-to cost saving strategy because it is VERY low risk. All of these social vulnerabilities lack language barriers, legal challenges like the high cost of legal assistance and legal status issues if the victim is undocumented, and just all the discriminatory attitudes. These factors all add up to make forced labor a surprisingly low-risk activity.

As a result, while the use of foreign and migrant laborers, often undocumented, discrimination, social vulnerabilities, government inaction, and regulatory problems and challenges were all individually risk factors for forced labor slavery, participants described their convergence in the fishing industry to create a supply of extremely vulnerable laborers to meet the demand for cheap labor created by the overfishing-induced fish stock declines.

Regulatory problems and challenges. Already described in various pathways and relationships, such as regulatory problems and challenges increased overfishing and disposable vessels, and discrimination increased regulatory problems and challenges,

participants outlined a litany of issues with environmental, human rights, and labor regulations. Foremost, participants characterized regulations as siloed in that each problem was governed by its own policies that were not concerned with or intersected with policies and regulations from interrelated issues. For example, fisheries authorities may board a vessel to investigate for IUU fishing, but would likely not assess or question the crew concerning labor conditions, because despite the co-occurrence of these problems, "most governments consider IUU to only be an environmental crime." As a result, "segregated inspections create an environment for illegal activities to flourish. We need to look at safety, labor, and environmental practices together, not separately." Additionally, there were many stages in the recruitment process from when a worker was recruited to work on the vessel to the actual abuse, and each of these steps were regulated by different laws. And laws could also differ in some countries based on the vessel size. This bureaucracy and lack of interconnected policies thus created regulatory loopholes that were easily exploited by perpetrators.

Similarly, participants chronicled isolated regulatory practices between local, regional, and international institutions and governing bodies. On a more micro level, participants recounted cases where a lack of cooperation existed amongst relevant agencies and departments (again divided by and hyper focused on specific issues), and on a more macro level, cooperation between countries and all relevant regional and international bodies was also characterized as lacking. As a result, participants described a "distribution of competence" and a "diffusion of responsibility" in which it was unclear which agency or country should take the lead, and a lack of data and information sharing

between actors. Flags of convenience was the problem most cited by participants as exemplifying these issues. Some participants also depicted how this lack of coordination resulted in a displacement of the problem versus a real solution.

> These problems happen both in and out of the EEZs. Sometimes one country will implement a new regulation, and it may have some success, but in reality you have to look at the regional picture, because it likely just displaced the problem to another area or another country's waters.

Problems with cooperation and enforcement exacerbating one another were detailed when participants discussed such international regulations as the Port State Measures. In the case of the Port State Measures, intended to reduce IUU fishing, it has yet to be universally adopted. As of March 1st, 2018, it was ratified by just 52 countries. Participants cautioned that when such measures have not been universally adopted, the potential exists to displace the problem instead of solve or address the problem's root causes.

> It is possible that the Port State Measures will create ports of convenience similar to flags of convenience. Though it has now finally entered into force, not every country with a port is party to the agreement. We already see the use of these ports of convenience and I suspect this practice will increase and vessels engaging in IUU will use these ports of convenience that are in countries that are not part of the agreement. There is no incentive not too. And to get all countries to agree to the measure you would likely have to dilute its regulations to such an extent that the measure would be futile.

Even if the political will existed to develop intersectional regulations, local or regional authorities, particularly in developing countries, would likely lack the capacity to enforce such progressive measures. For example, in the scenario detailed earlier, where authorities may be investigating IUU fishing, the vessel's crew would likely be comprised of foreign or migrant laborers. Consequently, local or regional authorities may lack the ability to communicate with crew members based on language differences. This lack of capacity was evident in other scenarios recounted by participants, and led to a lack of enforcement of regulations and/or weak monitoring of compliance with regulations. In particular, geographic remoteness increased regulatory problems and challenges because the spatial vastness and distance of fishing fleets was either too expensive or technologically unfeasible for monitoring, enforcement, and inspections, and thus allowed perpetrators to evade regulatory bodies.

Moreover, when monitoring and enforcement were effective or successful in catching a perpetrator, the penalties for violating regulations were too minimal to deter the behavior. In some countries, participants described the fines for illegal fishing to be as low as a couple of hundred dollars, or that officials could be bribed for even less money than the fine would have been because officials were so poor, and this poverty led to their corruption. And in countries where the fines were higher, or there could be the risk of arrest and detention, there was an increased use of the disposable vessels previously described that could ultimately be abandoned.

> The other problem is that the risk of getting caught is actually a fairly minimal risk. They know how to exploit legal loopholes and gaps so the most that happens to them is that the boat may be confiscated and/or they may be fined.

And in many instances where there were concerns of labor abuses, participants recounted crews being aided in obtaining a "nominal fraction" of lost wages and repatriated back to their country of origin, despite most of the human rights field advocating for criminal prosecution of perpetrators. Similarly, participants delineated numerous challenges to prosecution including most governments wanting to treat immigration, migration, labor conditions, and environmental crimes as separate issues. Because of the "criminalization of migration" stemming from "creeping global nationalism," participants reported that in most countries if the victims were undocumented immigrants or migrants, they would "be punished for immigration violations first and foremost." Reinforcing this lack of deterrents, victims were also purportedly "afraid to come forward and report labor abuses if they were engaged in IUU because they were fearful of being prosecuted or fined for IUU" which often took precedent over the labor concerns. Other barriers to using prosecution as a meaningful deterrent included the number of jurisdictions because of the number of stages in the recruitment process and supply chain already described, and that in most countries, labor abuses were interpreted as employment not criminal matters. This interpretation often resulted in cases being sent to civil courts not criminal courts, placing the burden of proof on victims.

> Pursuing legal action often places the burden on the victim. There are huge language barriers, lack of legal services, and it can be costly for victims because they may need to stay in the country where they were victimized, but if they were already here undocumented, then they can't work and they already likely just worked without wages, so earning income is their highest priority.

Further, when both IUU and forced labor cases were sent to criminal courts, participants noted the "threshold for what constitutes hard evidence is really high." This high threshold then became unrealistic and was further compounded by a lack of hard evidence because many captains and boat owners did not keep log books or they falsified them. And when circumstantial evidence was admitted, most cases ended in an acquittal of the perpetrator because discrimination against foreigners resulted in owners and captains being, "more credible than complaining migrants."

> But when we find victims, because they are foreigners, they are treated first and foremost like criminals by immigration officers. It is very hard for us to get them services because of this. And I think this plays off the long history of racism in this country. Prosecution is out of the question. Often the men have no evidence but each other. There are language barriers. The crews we see are often mixed, and the captain fosters racism and animosity between them, so they will not help each other. And the victims are given contracts that say all of these abuses are permissible. So the victims lack evidence. But it is forced labor because these men were exploited.

As a result, the consequences for illegal fishing and/or the use of forced labor, compounded by the lack of monitoring and enforcement failed to provide meaningful deterrents that increased the risk associated with these illegal activities. Thus, perpetrators of both environmental and labor crimes frequently changed their vessel name, registration, flag country, and disabled their automatic identification system to subvert regulations with "no fear of the law."

> All these countries can really do is fine them, and fines are not a deterrent. IUU, trafficking, these are economically rational decisions for these boat owners and captains. The risk is worth the reward.

Furthermore, as previously detailed, discrimination increased regulatory problems and challenges in that labor issues were not a priority for officials because victims of forced labor slavery were not citizens. Magnifying this relationship were reports that most countries' labor laws do not apply to persons who are not citizens and do not step foot on land. Therefore, these regulatory problems and challenges increased transshipment since transshipment kept victims at sea, and thus uncovered by labor protections. And transshipment itself was not an illegal activity. As a result, some participants depicted these regulations as legitimizing exploitation.

> Laws prevent them [victims] for getting help, or from leaving the situation. There are currently loopholes in most developed countries' laws, so the country where they are docked, is not responsible for human rights violations against foreign workers. 9/11 was also a factor. After that, countries wanting to trade with the US had to increase security. For example, putting up fencing around a port. That

> keeps the fishermen out and isolates them from getting help. And with the more recent crackdowns on immigration, and isolationism it is even worse. In many countries immigration and border control authorities refuse every fisherman's landing permit so they are not allowed to set foot on soil, and instead are kept on vessels. And if fisheries inspectors board the vessel, they are not responsible for checking on crew welfare. Not only does this limit any opportunities a fisherman may have to report bad conditions and make complaints, but it also means that the fishermen are not protected by that country's labor laws despite being in that country's waters. And if a captain has confiscated the victim's papers [i.e., passport] the situation is even more dire. It is legal impunity.

Other regulatory problems and challenges outlined by participants included lobbying efforts by the tuna industry in developed countries, particularly the United States, that influenced the creation (or absence thereof) of cooperative fishing regulations. And some participants from North America and Europe portrayed newer regulations as institutionalizing labor exploitation.

> There is also a legislative loophole that allows Hawaiian fleets to employ men from impoverished Southeast Asian and Pacific countries for a fraction of the cost they would have to pay American workers. It is a law that grants fishing licenses. So this law encourages fishing vessel captains to use foreign labor because it is cheaper and it allows them to pay foreign crew below minimum wage, but the same law prevents these fishermen from leaving the vessels. It legitimizes the exploitation of migrant workers.

Supply chain complexities. Participants portrayed the seafood supply chain as one of the most complex of any commodity due to the sheer number of steps in the chain, the number of times fish are aggregated, the geographic coverage (labeled as geographic remoteness increased supply chain complexity), and the length of time (seafood can remain in the chain for up to one year) from when a fish was harvested from the ocean to when it appeared on a plate. As such, participants reported this supply chain complexity increased consumer disconnect in that it was difficult for consumers to know if their fish products were ethically sourced and sustainably fished. In developed countries, consumers often relied on seafood certification schemes to better educate themselves and make informed choices as consumers; however, a recent inundation of these schemes into markets resulted in a lack of transparency and consistency that threatened their quality and their ability to appropriately inform consumer choices. Additionally, the consumer preference in developed countries to eat just fish filets made the chain more complex as whole fish were easier to trace and harder to fraudulently label. Due to the overwhelming nature of this supply chain complexity, government inaction also increased. Because transshipment mixed legally and illegally caught fish out of sight of authorities, it increased supply chain complexity by hindering traceability initiatives, which then increased forced labor slavery (depicted on the consensus map as supply chain complexity increased forced labor slavery). Lastly, due to the aforementioned barriers to cooperation between agencies and departments and countries and regional and international bodies, supply chain complexity also increased regulatory problems and

challenges since each step of the chain was likely to occur in a different geographic location.

> But of course traceability in such a large, globalized supply chain is incredibly hard. The more steps you have, and the more places that those steps happen in, the harder traceability becomes. Countries are not going to pay the costs of using improved technology for surveillance, particularly poorer countries. Thus the private companies are going to have do that. And because consumers are so disconnected from the seafood they eat, the pressure from consumers is just not there yet to make the private companies invest in this technology.

Fisheries interventions and regulatory reforms. Participants delineated two primary regulatory interventions—the implementation of marine protected areas (MPAs) and catch shares/quota systems—in response to declining stocks, overfishing, and IUU fishing (depicted as fish stock declines increase fishery interventions and regulatory reforms). Marine protected areas are swaths of the ocean with defined boundaries, that are designated as protected akin to a terrestrial protected area or national park. MPAs differ considerably in regards to their restrictions (no, limited, or highly regulated fishing, harvesting, boating, and tourism activities), enforcement, and size, and are more likely to be located in territorial waters versus the high seas. Catch shares or catch quotas are a managerial regulation in which the total catch limit for the year is established, and then each licensed fisherman and/or vessel is granted a percentage or portion of the established total allowable catch, typically through a fishing license.

While typically lauded by environmentalists and ocean conservationists, eight (25%) of the 32 participants who linked fish stock declines and forced labor slavery also reported fisheries interventions and regulatory reforms increased forced labor slavery. Though there are tensions resulting from a conflict of interests between regulating authorities and fishing communities about policies and interventions, only two of the eight participants who identified this relationship were current or former fishers. Overall, participants characterized some environmental policy interventions to reduce overfishing as not considering the social justice and human dimensions of the problem and proposed solution, particularly in non-coastal waters.

In particular, participants suggested MPAs lacking enforcement mechanisms increased the problem of forced labor slavery on fishing vessels because they created areas of more abundant fish stocks while simultaneously expelling legal fishers who may informally police an area against illegal activities.

> Protected areas are difficult to enforce. And most law abiding boats will stay out of the area, so now you don't have that natural accountability within the fishing community. You don't have the presence of these other boats to deter or report illegal activities. And then boats illegally fishing target these reserves because they know that fish are more abundant in these areas, and enforcement is almost non-existent.

As a result, MPAs reduced the risk of detection when using forced labor slavery while increasing the reward—more fish for a greater profit—with one participant reporting, "the probability of being detected using forced labor in a MPA is near zero. If you are

most likely to see forced labor with high profits and low risk of detection, bingo! That's a MPA." These participants also posited that increased forced labor slavery as a response to MPA implementation was most likely to occur when MPAs were "haphazardly implemented in a kneejerk response to drastic declines, public outcry, or intense scientific pressure."

> A lot of them were implemented too quickly and as a result are poorly implemented and not really enforced. Their initial goal was to protect the ecosystem and the fish, but I don't think they considered the socioeconomic consequences on fishermen and fishing companies at all. So now you have negative outcomes for both the fish and the fishermen. To be honest, they have done more bad than good.

> There was a rush to create MPAs because of the Sustainable Development Goals. But most of these MPAs lack enforcement because either that wasn't part of their implementation, or they were established in areas that lack the capacity to enforce them and there were no assistance funds disseminated to help with enforcement capacity. Without the enforcement, the low risk of using forced labor in general is now even riskier.

Alternatively, where MPAs had some enforcement mechanisms, their existence increased fishing effort (e.g., fishing longer, farther, and deeper to circumvent the protected area), thus increasing costs and decreasing profit margins and further justifying the use of forced labor slavery as an economically rational decision to maximize profits

even on "legal" and registered vessels. This increased effort and cost also marginalized small-scale fishing operations. For vessels and companies that did not resort to using forced labor slavery as a cost-cutting measure, many became financially overwhelmed and left the sector, consolidating power and capital in industrial operations more prone to using forced labor.

Similarly, catch shares implemented "haphazardly without careful consideration of the socio-economic consequences" (i.e., those lacking measures to prevent quota accumulation) were also detailed as increasing the marginalization of small-scale fisheries in that "they crippled the profitability of the sector by making fishing more expensive." As chronicled by participants, because distributed quotas or shares were based on historical landings, small-scale fishermen were not given a large enough share to make their fishing effort profitable. Also, other measures, such as the use of observers on board vessels to ensure compliance with regulations, resulted in additional expenses incurred by the vessel owner and/or fishing captain (i.e., fisheries interventions and regulatory reforms decreased profit margins). Further, some participants viewed the system as rewarding illegal behavior, by giving larger shares to fishermen and companies that had inflated their previous landings with illegal catch. Then when fishing was no longer profitable for small-scale fishers, they sold their quotas to larger competitors who had previously used illegal activity to gain a competitive advantage and were now rewarded with a "monopolization of the market" (described on the map as marginalization of small-scale fishers increases monopolization of resources) because there were no appropriate consolidation caps to prevent the accumulation of shares.

> So what happened was that it [catch share system] essentially privatized open access fisheries. The small-scale fishermen had no choice but to sell their sliver of quotas to larger competitors, because they could not catch enough fish under their quotas to make a profit. More medium-scale commercial fishers "rented" quotas from larger-scale commercial fishers who leased out their quotas. So if you are talking about labor and slavery issues, I would say it was comparably to sharecropping. They basically pay these exorbitant fees/rents just for the right to do the work, that is often the only work they know how to do.

The result of these systems was the consolidation, concentration, and accumulation of power and capital in the hands of a few "sea lords" at the expense of many small-scale fishers. Of note, the implementation of ineffective fisheries interventions and regulatory reforms was not the only driver of this marginalization. Fish stock declines and IUU fishing, which was perceived as providing a competitive advantage, also increased the marginalization of small-scale fishers.

> Stock declines wipe out small-scale fishing operations in general because these guys have really small profit windows to begin with, and it doesn't take much to collapse it and for them to end up losing money. This results in further consolidation of power. It is like get big or get out. And they lack the capacity to get bigger, so they get out, and the then you have the corporate takeover of fisheries.

> Most of the vessels that were lost during the rapid stock declines were small-scale commercial fishing vessels. The number of boats just declined because fishing was no longer economically viable. In a three-year span, the average cost of a trip doubled.

Once this marginalization of small-scale operations caused fishers to exit the industry, participants relayed multiple chain reactions. First, marginalization increased IUU fishing in that those that did not fold their operations were more likely to illegally fish by catching more fish or different fish than their share allowed, or high grading their fish amongst other illegal activities. Marginalization also increased other transnational crimes and wildlife crimes because collapsed small-scale fishers still possessed boats that were not being used. Therefore, participants shared reports of former fishers getting paid by transnational criminal syndicates to use their boats to smuggle and traffick people, drugs, and illegal wildlife across maritime borders because "they have this resource [the boat], and see it [smuggling] as the only opportunity to earn income with this resource they likely accrued debt for."

> For transnational criminal syndicates, fishing vessels are ideal receptacles for all kinds of illegal activity because they are so poorly regulated, and when they are regulated there is limited enforcement. Add onto that, the crippling of the sector from fish stock declines, stagnant market prices of fish, and increasingly expensive regulatory reforms you end up with hundreds of small-scale fishermen needing to use their boats, which they likely still have debt on, to generate an income.

This desperation to generate income by any means was also highlighted by participants describing the monopolization of resources that resulted from marginalization as increasing social vulnerabilities, particularly poverty and unemployment, that are then risk factors for becoming a victim of forced labor slavery. "This elimination of small-scale operations is often in places that are already socio-economically depressed, so you have really desperate people."

> So now you have fewer fish, increasing competition, and a consolidation of power because quotas are being purchased by the same foreign companies and pushing small-scale operations in poorer countries out. So quotas initially based on history, but if a later generation cannot use it or sells it out of desperation because they were too small to be profitable because of the fish stock issues, it's almost impossible for them to ever get it back. And these foreign countries prey on these small-scale fishermen knowing they are desperate for the cash. In response, some countries have made laws that so many crew members have to be local, to give locals, especially small-scale fishermen squeezed out, work. But they become vulnerable because [they] don't speak the same language and cannot communicate with other crew, captain, etc.

Further, the intersection of power consolidation and resource monopolization, in the context of an industry where discrimination and inequities are deeply rooted, created power differences that led to and normalized forced labor slavery.

> Labor abuses happen to fishermen all over the world. Doesn't matter if you are black, white, brown, green, or purple, if there are any inequities between you and

> the boat owner and/or captain, you are at risk. Could be that your religion is different, or your skin color or language. It doesn't matter. Could be anything. But it is really the inequitable access to fish and the consolidation of power that gives the abusers their power. The other things [e.g., physical violence, threats, wage withholding, etc.], the abusers just use these other things to keep their power.

Moreover, one participant who identified as a current or former fisher, described a sector management system under their catch share program that they perceived as institutionalizing IUU fishing and normalizing labor abuses. The participant recounted that they had been in the sector long enough to remember when fishers were organized under unions, which provided some social protections. However, unions were now rare, and to help promote social organization, sector management systems were implemented to help fishers self-organize. At the same time, the leaders of these micro-organizations were also intended to be responsible for informal policing of the vessels under the sector organization; however, this participant noted that frequently the person with the most power led the organization, and this person's power was often derived from illegal activity (depicted on the map as fisheries interventions and regulatory reforms increased IUU fishing). Thus, corruption allowed labor abuses and illegal fishing to flourish with impunity.

> Because even catch shares are difficult to enforce, because you know people can fraudulently label their fish, they can mix illegally caught and legally caught fish, they can high-grade their fish, etc. We still don't have good ways to enforce this. So because there is no enforcement, or limited enforcement, or in some instances

> inequitable enforcement where small-scale fishermen's catch are more closely monitored than industrial fishing because the small-scale fishermen are closer to shore, thus it does not require as much capacity. I've heard a lot of fishermen say that the criminals are in charge of the enforcement under sector management.

Forced labor slavery's contributions to environmental degradation. Conversely, participants also identified forced labor slavery as a driver of pressures on fish stocks including increasing overfishing and IUU fishing. Specific to IUU fishing, using forced labor slavery reduced the risk of getting caught since most victims were undocumented migrants and immigrants who "kept silent" and "were afraid to be snitches out of fear that they would be deported if they reported the illegal activities their vessels were engaged in," which is consistent with participant descriptions of immigration and migration violations being perceived as more pressing than environmental and labor crimes. Regarding forced labor slavery increasing overfishing, participants depicted slavery as functioning like a subsidy that sustains overfishing and intensification of effort despite negative economic feedbacks. Slavery allowed company owners and vessel captains to increase effort, and potentially harvest more fish, without increasing costs.

> As a result the tipping point where it becomes uneconomical to fish more is pushed down the track. So you can keep fishing more and longer. So then this modern slavery also contributes to increased fishing pressures, because when your cost-per-unit effort decreases, you are going to increase your effort even further to make as much money as possible. Slavery functions like a subsidy. Exploiting

workers temporarily increases profitability, but in the long-term the overfishing caused by it is further diminishing profitability.

Participants also noted that forced labor slavery increased wildlife crimes, in particular, shark finning, trafficking of endangered species, and the illegal harvesting of marine species such as sea cucumbers. Some participants shared anecdotes from victims wherein shark finning was used as a threat and/or intimidation tactic. For example, victims would get thrown overboard and told they would only be rescued if they captured a shark. Other participants compared shark finning to IUU, in that in areas where shark finning is banned yet shark fins generate high monetary value, enslaved crew members are used to harvest the sharks because they will not report the crime when the vessel returns to land. This process was comparable for the trafficking of endangered species on vessels as well as the illegal harvesting of marine species such as sea cucumbers.

Case Scenario Executions

To explore how the system—and in particular forced labor slavery as an outcome—might react under a range of possible changes precipitated by interventions and/or a lack of action to prevent continued fisheries degradation, case scenario executions were performed to achieve aim four. Variables for each case scenario were identified based on degree of centrality in the model, meaning they were the most connected and/or had the highest absolute values of relationship weightings. For each scenario, four iterations were performed—with the increase or decrease strengthening each iteration. In total, 10 scenarios were performed. Increases and decrease in fish stock declines, overfishing, fishing effort, IUU fishing, and regulatory problems and

challenges. Of note, a key assumption for the regulatory scenario was that when regulatory problems and challenges were decreased (implying a more unified regulatory environment), unintended consequences did not outweigh the benefits of the regulatory changes.

Each scenario's impact was then evaluated by comparing the relative change in forced labor slavery to the baseline, steady state values by using hyperbolic tangents that resulted in a range of increases and decrease from -2 to 2 (Figure 13). For fish stock declines, fishing effort, and IUU fishing, the impacts on forced labor slavery were greater when the mental model variables were increased than when they were decreased. However, for regulatory problems and challenges, the absolute value of the change from the steady state was larger when the variable was decreased than increased. And for overfishing, increasing yielded no changes in forced labor slavery from the steady state.

When profit margins were manipulated in case scenarios, both the increasing and decreasing of the variable yielded increases in forced labor slavery, though the increase in forced labor slavery was higher when profit margins decreased. For example, when profit margins were decreased by -.25, -.5, -.75, and -1, the subsequent increases in forced labor slavery were .01, .02, .02, and .04. Whereas when profit margins were increased -.25, -.5, -.75, and -1, the increases in forced labor slavery were .03, .04, .06, and .09 respectively.

Figure 13. Forced Labor Slavery Mental Model Scenarios

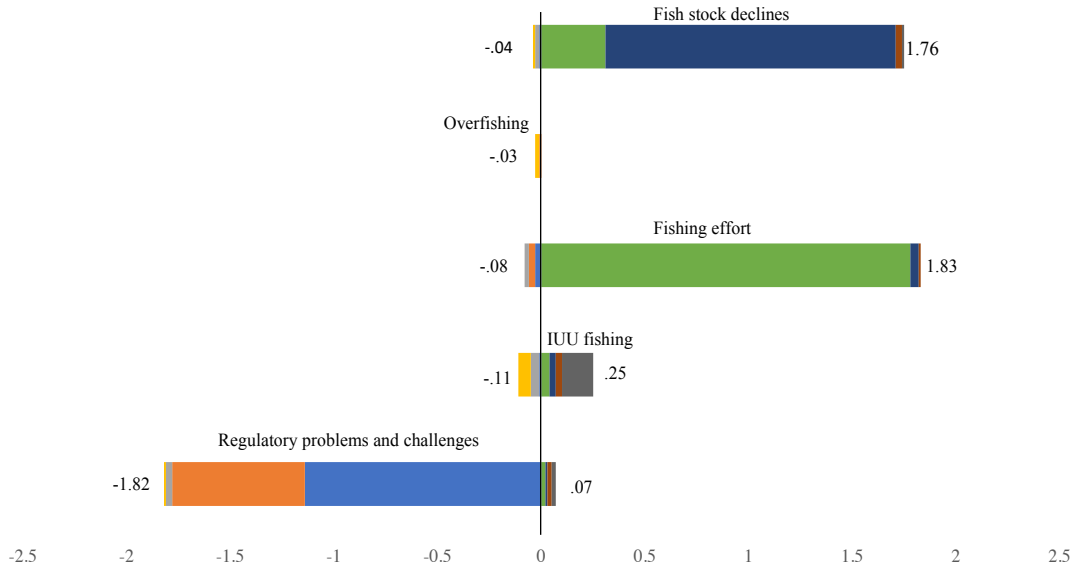

Figure 13. Numeric values represent the relative, predicted deviation in forced labor slavery from the steady state when pertinent central variables (i.e., mental model variables) were manipulated by decreases of -.25 (light blue), -.5 (orange), -.75 (light gray), and -1 (yellow) or increases of .25 (green), .5 (dark blue), .75 (brown), and 1 (dark gray). Changes from the steady state range on a scale of -2 to 2. All mental model variables were positively associated with forced labor slavery, thus increases and decreases in all five variables led to increases and decreases respectively in forced labor slavery.

Since forced labor slavery was the most central variable in the system, it was also manipulated to determine its impacts on other system variables in the event that forced labor slavery increased (Figure 14) or decreased (Figure 15). If slavery increased, the mental models suggested that profit margins and wildlife crimes would incur the greatest increases, with fishing safety decreasing. Whereas if slavery decreased, the outcome variable with the largest corresponding decrease was IUU fishing. Per the mental model scenario, decrease in forced labor slavery could also lead to decreases in profit margins, a -1.5 shift from the baseline state.

Figure 14. Impacts of Increased Forced Labor Slavery on System Variables

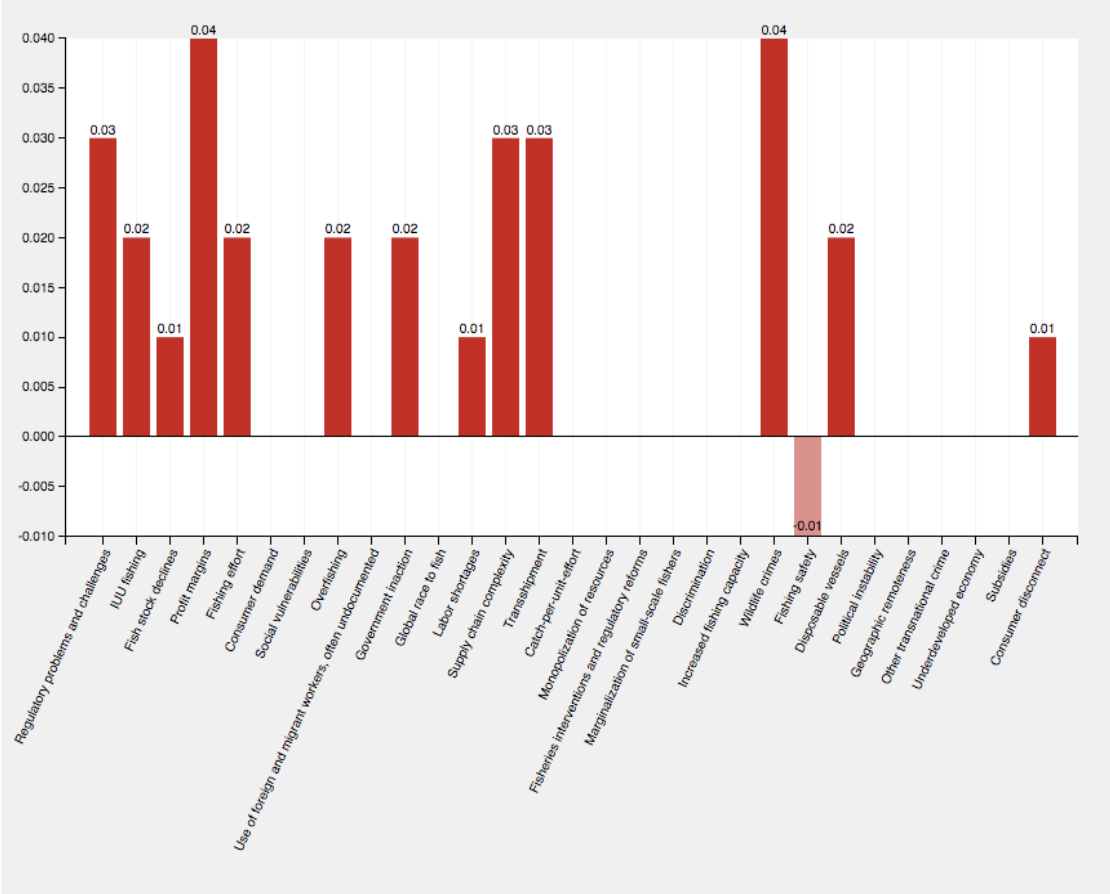

Figure 14. The hypothesized changes from the steady state (*y*-axis) for each system variable (*x-axis*) if forced labor slavery increases, based on the perceived connections between variables in the Mental Model scenario.

Though in the middle of the range for centrality, participants also discussed how fisheries interventions were having unintended social consequences that could potentially be increasing forced labor slavery. As a result another scenario was executed wherein fisheries interventions were increased, further decreasing profit margins, which did result in an increase of forced labor slavery by a 0.08 shift from the baseline (Figure 16). However, when the researcher manipulated the aggregate map by flipping the sign of the relationship between fisheries interventions and profit margins, so that an intervention

would increase profit margins, the subsequent increase in forced labor slavery was reduced to a 0.02 increase from the baseline.

Figure 15. Impacts of Decreased Forced Labor Slavery on System Variables

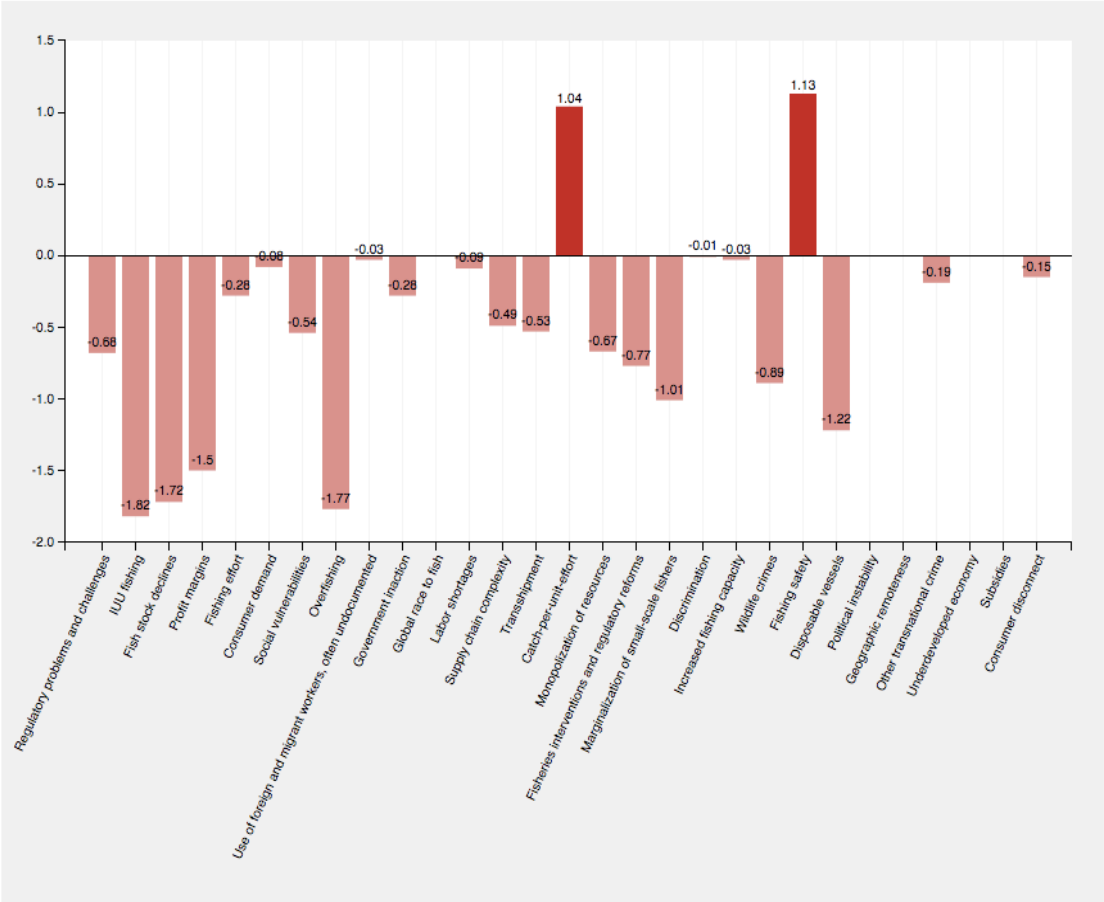

Figure 15. The hypothesized changes from the steady state (*y-axis*) in each system variable (*x-axis*) if forced labor slavery decreases, based on the perceived connections between variables in the Mental Model Scenario.

Figure 16. Potential Impacts of Fisheries Interventions on Forced Labor Slavery

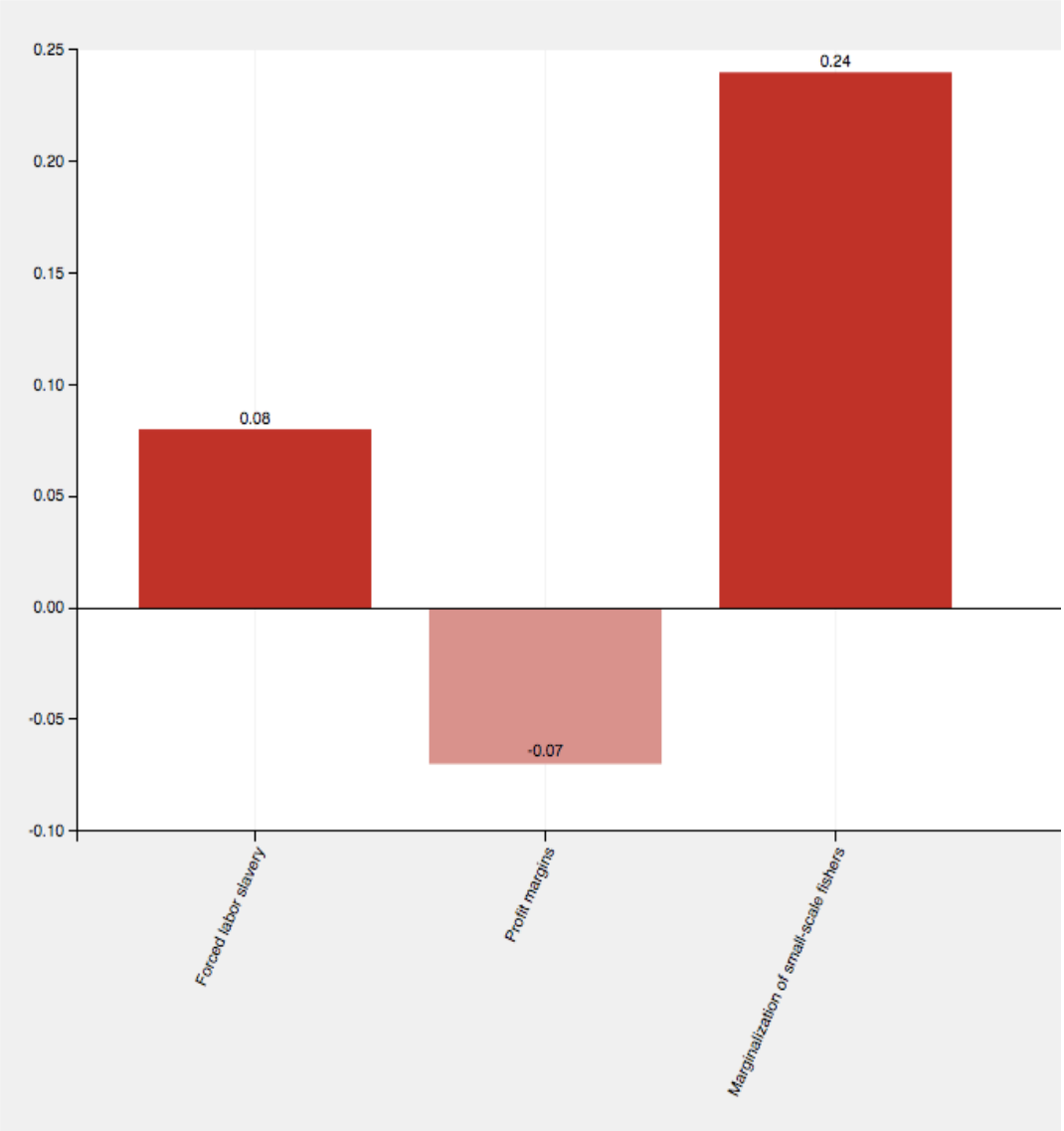

Figure 16. Predicted changes from forced labor slavery's steady state (*x-axis*) if fisheries interventions are increased, based on the assumption of participants that fisheries interventions decrease profit margins.

Chapter Five: Discussion

Study Findings

Overall, the study found preliminary evidence supporting fish stock declines as a driver of forced labor slavery, but that many challenges and barriers exist for determining, with greater certainty, the strength of the relationship. Foremost, all participants noted a lack of rigorous, longitudinal data for forced labor slavery counts on fishing vessels, despite most participants sharing anecdotally that the number of victims they were encountering had been steadily increasing since approximately 2008 to 2010. Early fish stock declines were first noted in the 1940s (Graham, 1943; Russell, 1942). However, the aggregation of study participants' noted increases in forced labor slavery victims on fishing vessels around the same time frame (2008-2010) suggests that: 1) a timescale exists wherein there is a lag between when stocks begin to decline and forced labor slavery starts to increase, and 2) a tipping point exists in that stock declines have to reach a certain threshold of severity, or decline drastically in a short enough time period to tip the system and result in forced labor slavery as an outcome.

Challenges to estimating forced labor slavery prevalence. Estimating the prevalence of forced labor slavery on fishing vessels is further hindered by difficulties in identifying victims and understanding what is and what is not forced labor slavery. While this is a challenge for all sectors, as one participant noted, "fishing just looks like

slavery" in that fishing is consistently one of or the most dangerous profession and even non-abused fishers work excessively long hours during hauls, are at sea for several months, and earn wages less than standard national minimum wage thresholds. However, this sentiment is harmful because it can minimize the experiences of victims; it allows non-abused workers in all sectors to appropriate the experiences of those ensnared in forced labor slavery; and it likely leads to underestimation of the problem's prevalence. Similarly, in this study the researcher noted even key stakeholders that have worked in the field for several years were hesitant to label labor abuses as modern slavery, despite the situations they described meeting the criteria for forced labor/modern slavery as delineated by the ILO (International Trade Union Confederation & Special Action Programme to Combat Forced Labor, ILO, 2008). Instead most participants qualified the abuses as "slave-like" or "resembling modern slavery." This hedging is likely a product of outsiders labeling human rights activists and scholars as hyperbolic.

And then compounding the problem, was the recent CNN investigation which uncovered African migrants being sold at an auction in Libya, akin to conceptions of historical slavery (2017). However, human rights scholars have affirmed the differences between modern and historical slavery for many years now, and that instances of persons being sold at auctions are nominal compared to debt bondage and other forms of modern slavery (e.g., Bales, 2016). This type of media recognition, though, reinforces a false image of what constitutes slavery to the public because it is more consistent with wide-spread hermeneutics of slavery, making it harder for people outside of the field to believe that slavery exists on fishing vessels if victims are not being sold in a public forum.

As a result, nuanced understandings of consent are overlooked or not explored, resulting in a multitude of legal definitions for forced labor slavery that ignore the crux of the issue—informed consent (Bales, 2017). Thus, this habit of not emphasizing and understanding consent also makes it difficult to prosecute offenders because when people interpret the law, they misconstrue consent, and typically not in the victim's favor (e.g., Saengpassa, 2018). This situation is then further exacerbated by the overwhelming scale of the problem, in that so many people and processes are involved in forced labor slavery on fishing vessels that no one appears to be accountable. The absence of an offender then makes it more difficult to identify a victim for prosecution purposes.

Furthermore, because victims are on vessels at sea and thus inaccessible for purposes of obtaining victim counts, estimations often rely on victims coming forward for purposes of reporting and/or seeking services. However, study participants described numerous barriers to victims coming forward including: punishment for undocumented migration, IUU fishing, and/or wildlife or transnational crimes; not wanting to lose their job out of hopes that they will eventually receive their wages; not wanting to be identified as a victim which would be shameful in their culture; not wanting to be "blacklisted" for future work; a lack of realization that they are a victim because they too do not understand what constitutes modern slavery; a lack of incentives for coming forward since wage recovery rarely occurs; and discrimination. As such, these barriers likely lead to further underestimation of the problem.

Interrelationships and processes. While the study could only provide a cursory understanding of the strength of the relationship between fish stock declines and forced

labor slavery, it did yield a clearer understanding of the processes and interrelationships that connect these two phenomena. Analyses of the consensus and individual maps suggests that key variables confounding the relationship between fish stock declines and forced labor slavery are regulatory problems and challenges, fishing effort, profit margins, and IUU fishing. Of note, all four of these variables were listed as common variables in the individual map analyses as they were included in more than half of the participant maps, and all four were in the top six most central variables in the consensus map—excluding forced labor slavery. Without better quantitative data, though, it is difficult to determine with greater certainty whether each variable functions as a mediator or moderator, but the preliminary qualitative data in conjunction with the individual maps suggests the following.

Regulatory problems and challenges may moderate the relationship between fish stock declines and forced labor slavery as participants described it as strengthening the relationship. Many participants also identified this as a key point of intervention, and indeed during case scenario executions the decrease of regulatory problems and challenges yielded the highest decrease on forced labor slavery of all scenarios. However, when regulatory problems and challenges was increased, it resulted in a nominal increase in forced labor slavery suggesting that if it is a moderator, its interactions weaken the effects between fish stock declines and forced labor slavery.

On the other hand, fishing effort and profit margins may mediate the relationship between fish stock declines and forced labor slavery. Describing fishing effort as driving declines in profit margins, participants described both of these variables as the impetus

for using forced labor slavery as a response to fish stock declines, thus detailing a scenario wherein fishing effort and profit margins may explain the relationship. The results from the case scenario analyses support this conclusion in that decreases in fishing effort caused nominal decreases in forced labor slavery and decreases in profit margins still produced increases in forced labor slavery, albeit smaller in value than the increases provided by decreasing profit margins. Thus the presence of increased effort and declining profit margins may explain the relationship.

Though IUU fishing was one of the most common variables in individual maps and one of the most central variables in the consensus map, the findings from the case scenario executions supported the participants' ambiguity around its role in the system. While other variables such as regulatory problems and challenges and fishing effort had nominal impacts on forced labor slavery in one scenario (either increasing or decreasing), the impacts in the inverse scenario were substantial. However, IUU fishing had nominal influence on forced labor slavery when increased and decreased. Thus, it may be impacted by the same factors, processes, and relationships as forced labor slavery, and coexist in the system, but it may have less direct influence on forced labor slavery and therefore not interact with the relationship between fish stock declines and forced labor slavery. Instead, it may be more important to consider forced labor slavery's influence on IUU fishing. During the qualitative interviews, several participants detailed how using forced labor slavery helped vessels engaging in illegal fishing activities keep their activities secret or hidden. And as represented in Figure 15, when forced labor decreased, IUU fishing had the largest absolute value shift from the baseline of any variable in the

mental model (a decrease of 1.82), though when forced labor slavery was increased, it only increased by a value of .02.

Results from the study also provided tentative empirical support for Bales' (2016) and Brashares et al.'s (2014) hypotheses that while fish stock declines may initiate the increase in forced labor slavery in the sector, the system self-perpetuates through feedback loops as forced labor slavery increases fishing effort and overfishing, thus further declining stocks. Indeed, forced labor slavery was the most central variable in the consensus map, suggesting that it has influence over many aspects of the ecological system, and not just the social system. In addition, in the mental model scenario represented in Figure 15, when forced labor slavery decreased the greatest impacts were in the ecological system on IUU fishing (-1.82), overfishing (-1.77) and fish stock declines (-1.72).

While not as central of a variable to the social system, the role of consumer demand was important to individual models. Based on counts of participant models, consumer demand was the most frequently identified transmitter variable, reflecting an ideology that consumers have the power to change the system. However, during map aggregation, other effects on consumer demand, particularly relationships where consumer demand was on the receiving end of influences from supply chain complexity and consumer disconnect through seafood certification schemes, transposed the variable to an ordinary variable. This shift is notable, and may have possible social justice implications for consumption.

Previous research indicates that persons are willing to pay more for ecologically and socially sustainable fish, but that they have difficulty understanding and choosing between the discrete and numerous seafood certification schemes, suggesting that these schemes are not meeting their education objectives (McClenachan, Dissanayake, & Chen, 2016). In addition, the trustworthiness of these schemes, due in part to transparency and conflict of interest concerns, has recently been questioned by experts (e.g., Webster, 2016). Since study participants noted that low-value fish (e.g., canned, white albacore tuna) are the type of fish most likely to be harvested using forced labor slavery—and canned fish is marketed as an inexpensive, nutritious, and high-protein food source for low-income and food insecure persons—there should be concern about how time and material/financial poverty interact with consumer demand and disconnect. For example, "the working poor" may be more inclined to purchase these seafood products since they are low-cost and nutritious and because these persons likely lack the privilege of excess time to self-educate about the credibility and reliability of seafood certification schemes. Thus, there should be cognizance of how this issue is framed by stakeholders, otherwise rhetoric could lead to the blaming of poor people's consumption for unsustainable and unjust fisheries practices.

Toward a universal theoretical model. Though frequently framed and/or presented as a problem in Southeast Asia (e.g., EJF, 2014, 2015a, 2015b; FishWise, 2014), the data presented in Figure 10 suggests that forced labor slavery is a global problem. Developed countries, like the United States and European Union member states, are exploiting legal loopholes that do not require them to provide labor protections to

fishers to justify their declarations that there are no victims in their waters or on their fleets. Without labor protections, there can be no violations, and therefore no victims. However, while the prevalence of the problem could be the highest in Southeast Asia, the field is doing an egregious disservice to victims globally, and itself, by hyper focusing on Southeast Asia as it minimizes the role developed countries play in perpetuating a stagnant regulatory environment. Additionally, the relatively few statistical differences between demographically varied groups suggests that a universal framework may be useful in guiding future research and interventions in a globalized industry, while using specific proxies for each construct to tailor the framework to a specific region or locale.

Building upon Figure 1, Figure 17 represents the use of participants' knowledge to refine Figure 1's social-ecological system components, organization, and their interrelationships, achieving the study's first specific aim. Most of the original framework's contextual constructs, main relationship variables, and interrelationships were validated in the study. However, changes from Figure 1 to Figure 17 include: 1) the addition of a political context construct intended to represent the national environment's influences on a country's citizens, 2) collapsing the cultural context into the socioeconomic context as participants described discrimination, in particular, as being closely related and highly influential to the main relationship, 3) eliminating the variable of "demand for cheap labor increases" due to redundancy, and 4) adding arrows to show that while contextual constructs influence the main relationship, the main relationship also influences the contextual constructs. Table 13 then lists the variables from the

consensus map that were not represented in the theoretical framework's constructs as proxies for the contextual constructs.

Figure 17. Theory of Fish Stock Declines and Forced Labor Slavery

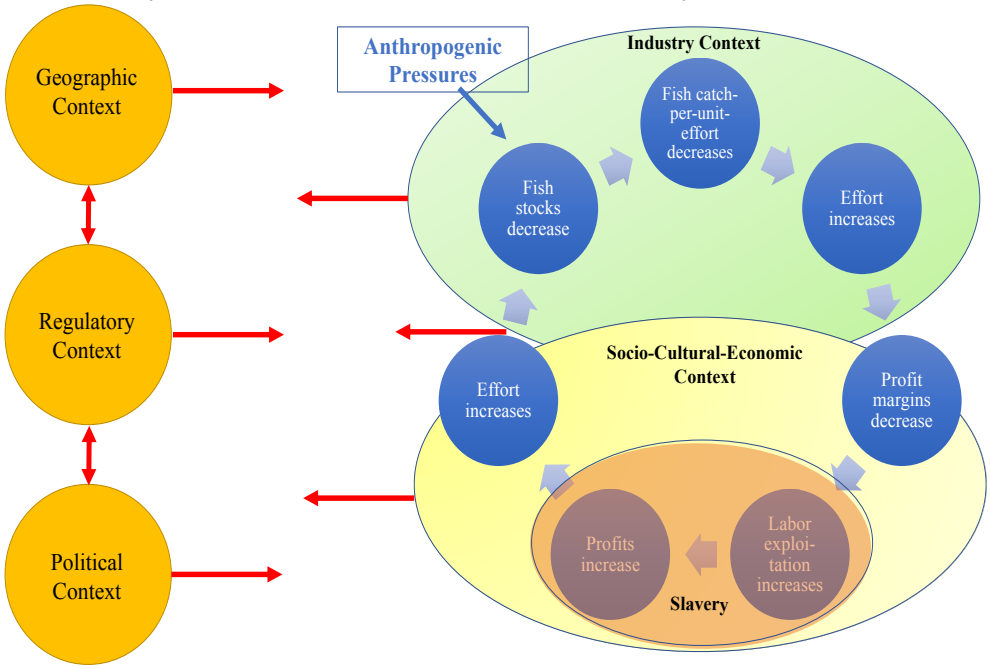

Figure 17. Coupled social-ecological systems' interactions linking fish stock declines and forced labor slavery.

Table 13

Consensus Map Variables as Proxies for the Theoretical Framework's Constructs

Geographic Context	**Regulatory Context**	**Political Context**	**Industry Context**	**Socio-Cultural-Economic Context**	**Anthropogenic Pressures**
Geographic remoteness	Fisheries interventions	Underdeveloped economy	IUU fishing	Discrimination	Consumer disconnect
Use of foreign and migrant workers (i.e., high rates of migration/migrants)	Government inaction	Increased fishing capacity	Disposable vessels	Social vulnerabilities	Consumer demand
	Regulatory problems and challenges	Race to fish	Subsidies		Overfishing

	Other transnational crime	Political instability	Labor shortages
	Wildlife crimes		Transshipment
			Fishing safety
			Supply chain complexity
			Marginalization of small-scale fishers
			Monopolization of resources

Recommendations for Future Research

The researcher's long-term research agenda includes using mixed methods research that considers varied and diverse knowledge sources as data—in part, to expand beyond the human rights field's data limitations—to compile a list of evidence-based factors that contribute to slavery on fishing vessels and to move from conceptualization to quantification of how these factors uniquely contribute to the problem, and how they interact with each other to create a supply and demand that allows slavery to persist in the fishing sector. As such, the Theory of Fish Stock Declines and Forced Labor Slavery framework should be used to guide future empirical testing, and this empirical testing should also be used to continue to validate the framework. While FCM provided the next step in confirming conceptualization of the linkages, as research about the relationship between fish stock declines and forced labor slavery progresses, it should advance along the continuum from conceptualization to quantification. As noted on page 34, structural equation modeling would likely be the most rigorous approach to quantitatively testing the relationship and the end of this continuum. However, this study identified several

pathways where better quantitative data is still needed before a SEM approach could be undertaken.

While this dissertation's analysis of the pertinent constructs and their interrelationships that contribute to the links between fish stock declines and forced labor slavery corroborated NGO investigations about the importance of IUU fishing; transshipment and lack of traceability and transparency due to supply chain complexity; the use of undocumented migrant workers; and regulatory gaps in environmental and labor laws (EJF, 2015; FishWise, 2014, ILO, 2013a, UNODC, 2013), the emergence of environmental policies' potential contributions to forced labor slavery is a timely and pertinent knowledge gap. In addition to this study's findings represented in Figures 14 and 15 wherein increases and decreases in forced labor slavery respectively increase and decrease IUU fishing, overfishing, and fish stock declines, prior theoretical (Brashares et al., 2014) and empirical (Bales, 2016) research suggests the use of forced labor slavery could be increasing overfishing. In September 2018, the United Nations will begin two-and-a-half year negotiations for a new internationally binding high seas treaty under the UN Convention on the Law of the Sea with a goal of strengthening Regional Fisheries Management Organizations' catch share/quota systems and more readily establishing large-scale marine protected areas on the high seas to curb overfishing in international waters and advance greater protections for biodiversity (High Seas Alliance, 2017; UN, 2017). Without understanding how these environmental measures impact the use of forced labor slavery on fishing vessels, these policies may undermine their own conservation objectives, thus perpetuating a cycle wherein fish stock declines are a driver

of forced labor slavery and use of forced labor slavery is a driver of overfishing-induced fish stock declines. As such, retrospective time-series research designs offer an efficient way to better understand the impacts of MPAs and catch share/quota programs on forced labor slavery counts in areas where forced labor slavery data is collected via Gallup-style polls.

Considering the ambiguity and unclear findings around the connections between forced labor slavery and IUU fishing, this relationship also needs to be explored and explained further. Along with obtaining counts of the number of "disposable vessels," these are areas where the human rights/slavery field can and should apply innovative and emergent technologies such as the use of drones. Though some NGOs have started using satellite data obtained from vessel automated identification systems (AIS) to identify vessels that have "gone dark" or turned off their AIS to engage in illegal activity without being tracked (e.g., FAO, 2017b; Malarky & Lowell, 2018), the scale of the problem and data needed may be too great to effectively or efficiently use this type of data as it requires mining billions of satellite transmissions and then closely studying patterns to ascertain if a ship is "going dark" for illegitimate or legitimate reasons. "Going dark" is legal under certain circumstances, most notably, to evade pirates in dangerous waters. The use of drones may also be able to provide more reliable and valid data since the control over data collection will belong to researchers instead of relying on vessel compliance, which is known to be problematic.

Additionally, wildlife crime was only included in six participant maps. However, in all six maps, the variable functioned as a receiver of the effects from forced labor

slavery. When the individual maps were aggregated, the relationship strength was maintained, suggesting reliability amongst these six participants in how they viewed forced labor slavery impacting wildlife crimes. Though a multitude of studies have explored the socio-cultural and economic drivers of wildlife crimes (e.g., Challender & MacMillan, 2014; Duffy, St. John, Büscher, & Brockington, 2016), there has not yet been an exploration into how social conflicts, like forced labor slavery, may help facilitate the processes of these crimes. Since wildlife crimes are a major threat to biodiversity loss (Sodhi, Koh, Brook, & Ng, 2004), this is another emergent pathway that should be prioritized for future research.

Study Implications

Findings from this dissertation suggest a need for transdisciplinary research to inform intersectional and holistic policies in order to produce more cost-effective policy-based interventions, waste less fiscal resources on interventions that are producing unintended consequences that undermine the intervention rather than mitigate the problem, and a reduction in both fish stock pressures and forced labor slavery victims on fishing vessels. To date, the social justice and human dimensions of environmental policy interventions to reduce overfishing are often not considered in non-coastal waters.(De Santo, 2013; Gruby, Gray, Campbell, & Acton, 2016). With the upcoming negotiations of the new high seas treaty, this could provide an opportunity to begin to address fish stock pressures and declines and slavery under the same, unified regulations. However, the same model also needs to be replicated at regional, national, and subnational levels. As noted by participants during their interviews, if holistic regulations are implemented, then

reverberations occur throughout the whole process—making every step more holistic. In particular, authorities boarding a vessel for fishing violations could also possess the authority (and ideally the training and resources) to simultaneously investigate for labor abuses. However, when developing more holistic and cooperative policies, policy makers must be sensitive to the potential of overreach by developed countries when countries of varying identities (e.g., economic status) are involved in collaborative negotiations.

Furthermore, analyses of potential interventions to reduce forced labor slavery and forced labor slavery's impacts on profit margins suggests that once a vessel, captain, or owner is economically driven to use forced labor slavery, and justifies it, they are unlikely to stop using forced labor—even if stocks rebound. This is likely due to the competitive advantage they have now gained, and the maximized profits the advantage yields. To stop using forced labor slavery would reduce their profits. This conclusion is supported by the finding in Figure 13 that regulatory problems and challenges—and not fish stock declines, fishing effort, or overfishing—was the only variable in the mental model scenario that produced substantial decreases in forced labor slavery. In addition, when forced labor slavery increased, it generated the largest impacts on profit margins (Figure 14) and when forced labor slavery was decreased, it resulted in a decrease in profit margins of a -1.5 from the baseline.

These findings in regards to profit margins imply that fields addressing both the ecological and social systems, and their interface, need to shift their approaches from reactive to preventive. In order to do this, there must be a greater emphasis on research, particularly research that is collaborative, transdisciplinary, and transparent. As such,

mutual respect and understanding for different methodological approaches and varying definitions of what constitutes empirical data must be built across disciplines. And as Bales (2017) noted, human rights experts and NGOs must be willing to publicly share their data to build effective collaborations that translate into improved practices, and they must be more transparent about their methods and approaches and subject the data to critiques and peer-review.

One potential challenge to this shift from reaction to prevention is that forced labor slavery essentially functions as a subsidy in the fishing sector—prolonging the industry's inevitable collapse due to unprofitability. And to date, there has been a lack of political will to end traditional financial subsidies in the sector, despite recognition that subsidies drive IUU fishing and overfishing. In fact, renegotiating and/or eliminating fisheries subsidies first appeared on the Ministerial Conference of the World Trade Organization's agenda in 2001 (Whalén, 2017). However, despite the inclusion of eliminating harmful fisheries subsidies by 2020 in Sustainable Development Goal 14 target six (UN Development Programme, 2018), the Eleventh Ministerial Conference of the WTO, held in December 2017, deferred any advancements toward policy-based action on the matter again (Whalén, 2017).

On the other hand, with the recent media attention afforded to labor abuses in the fishing sector, numerous working groups (e.g., Conservation International's Social Responsibility in Global Fisheries and Aquaculture Program) have formed to ensure not only sustainable fisheries, but socially responsible fisheries. Unfortunately, reports from labor rights stakeholders and NGOs suggest the human and labor rights fields and their

expertise are being excluded from these working groups. In addition, data and evidence produced by the human and labor rights fields are often not considered in these working groups because the data is obtained through methods that diverge with the biological and ecological sciences' methods and definitions of knowledge. Without the integration of this expertise, though, the risk for creating policies and interventions that unintentionally exacerbate forced labor slavery remains.

Because of these transdisciplinary challenges and the historical treatment of these two problems as separate issues, there is also likely a role for a discipline to claim expertise as the facilitator of the integrating of the differing disciplinary knowledge, methodologies, philosophies, and approaches. Social workers, by nature of their training, already have expertise in systems thinking and situating persons within environmental contexts laden with structural barriers; are trained in both quantitative and qualitative research methodologies that recognize inclusive definitions of empirical data; and are comfortable bringing together large and diverse groups of people—including stakeholders whose voices may have historically been obscured—for a multitude of purposes including problem solving, intervention development, policy change, domestic and international community development, and advocacy. Despite the calls to action noted on page 31, and an obligation based on the profession's values, social work as a whole still has yet to engage in issues of environmental degradation and slavery separately, let alone linked. By carving out expertise in this novel transdisciplinary facilitation role, social work could avoid "turf wars" with more established disciplines in this space with similar areas of expertise and applied research approaches such as human

geography and international development. Additionally, it would allow social work professionals to center social justice in research and practice approaches, particularly since this facet of the profession is unique in comparison to other social sciences engaging in this space.

Study Limitations

FCM's primary limitation is that quantitative analyses are based on connection weightings, which each participant subjectively quantifies. While SEM would be the more rigorous quantitative methodological approach to test hypotheses about the relationship between fish stock declines and human slavery, the research question is not yet amenable to quantification for multiple reasons. Foremost, while the researcher developed a theoretical framework from an extensive review and amalgamation of empirical and theoretical literature, there is a paucity of empirical research validating the inclusion and exclusion of pertinent constructs. Additionally, the overall research question is not amenable to quantification since longitudinal data is lacking for some constructs in the proposed framework. In particular, longitudinal slavery data is almost non-existent due to the inaccessibility of the hidden study population and the activity's illegality (IOM, 2008). Time, cost, and safety constraints also hinder researchers' abilities to collect longitudinal slavery data that could be geotagged to sites (i.e., ports) for fish stock assessment measures.

As a result of FCM's subjective quantification, non-probability sampling, and the small sample size, the findings from the study cannot be interpreted as causality. As noted on page 37, the sample also failed to recruit any stakeholders working specifically

in South America. And while enrollment in the study was contingent upon having direct contact with fishers, only 25% of the sample identified as a former or current fisher, and thus had first-hand knowledge of activities at sea. Moreover, though almost 50% of the study sample elected to not have their interviews recorded, the lack of recordings did not appear to impact the study's findings since the main unit of analysis was the cognitive map created by the participant versus an interview transcript. This conclusion is supported by the univariate analyses for interview modality reported in Table 1 on page 43.

Additionally, the numeric values produced by FCM's case scenario executions to describe shifts in a variable from the baseline are difficult to interpret and lack meaning outside of comparisons within the study. While they can be compared to other variables in the model, they have little practical relevance as they do not represent percentages, odds ratios, or other more typical predictive measures produced by statistical analyses.

Lastly, while the participants brought longitudinal and historical knowledge into their interviews and maps, the study itself employed a cross-sectional design. Without multiple interviews with the same stakeholders over a substantial period of time, it is difficult to generate conclusions about the previously discussed issue of timescale.

Conclusion

Based on an assessment of the vulnerabilities and risk factors presented in this study, it is plausible to conclude that fish stock declines are increasing forced labor slavery, and that in turn, forced labor slavery is placing more pressure on fish stocks, accelerating their decline. As such, this study's results point to a compelling need for

innovative transdisciplinary research employing the newest technologies to understand the strength of the relationship between fish stock declines and forced labor slavery; more comprehensive and holistic policies at the international, regional, national, and subnational levels; and social-ecological interventions which are assessed for unintended consequences prior to wide scale implementation.

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Appendix A: Definitions

Though lacking formal and standardized global definitions, these terms are often used to describe the scale and scope of fisheries and the vessels used within them.

Descriptive	Term	Definition
Social Characteristic	*Artisanal*	Traditional fisheries involving fishing households; can be for subsistence or commercial purposes; typically small-scale; may not use vessels, but if so, typically short-haul
	Industrial	Fisheries involving enterprises/companies that fish for commercial purposes; large scale; can be short or long-haul
Purpose	*Recreational*	Harvesting fish for fun or sport
	Subsistence	Harvesting fish for household consumption, fish are not sold or traded into informal or formal markets
	Commercial	Harvesting fish to generate a profit from selling the fish
Scale	*Small*	Small gear and vessel size; fishers typically self-employed but not always; typically low technology and capital, but not always
	Large	Large gear and vessel size; fishers part of an employed crew; high technology and capital
Haul	*Short*	Short fishing trips, typically close to shore
	Long	Longer fishing trips, typically on the high seas beyond territorial waters
Most Common Commercial Vessels	*Seiners*	Vessels that use large nets to harvest fish nearer the surface of the water
	Line Vessels	Vessels that use fishing lines (instead of nets) with baited hooks attached
	Trawlers	Vessels that drag large nets in deep water or along the seabed/sea floor

Appendix B: Study Materials

Recruitment Email

Hello,

My name is Jess Sparks and I am a doctoral candidate at the University of Denver, Colorado, USA. For my dissertation research, I am studying forced labor and slavery on fishing vessels by interviewing staff affiliated with NGOs working with fishers around these issues. I am writing to invite you to participate in the research study. You are eligible to participate if you are aged 18 years or older, can participate in an interview conducted in English, are affiliated with a NGO registered with a government, and have direct contact with fishers.

If you decide to participate in this study you will be asked to share your thoughts about forced labor and slavery on fishing vessels, based primarily on knowledge and information that fishers have provided to you in your work and your own observations and experiences. The interviews will last approximately 90 minutes.

This study is completely voluntary, and you can choose to be in the study or not. If you'd like to participate or if you have any questions about the study please email me at Jess.Sparks@du.edu.

Also, please feel free to forward this email to others who may be interested in participating in the study.

Thank you very much for your time.

Sincerely,

Jess Sparks, MS, MSW, LICSW

Recruitment Flyer

UNIVERSITY of DENVER
GRADUATE SCHOOL OF SOCIAL WORK

Seeking Participants

for a study on **Forced Labor and Slavery on Fishing Vessels** being conducted by researchers at the University of Denver Graduate School of Social Work

Participants must be:

- Aged 18 years or older,
- Working for a NGO registered with a government,
- Have direct contact with fishers during your work, and
- Able to complete an interview in English

Eligible participants will complete a 90-minute interview either in person or on a computer.

For more information contact the principle investigator, Jess Sparks, at:

Jess.Sparks@du.edu or +1 (636) 368 6157

Interview Script

As a reminder, please use pseudonyms to identify yourself, colleagues, or fishers during the interview, and do not name your organization.

Demographic Questions:

1) Please provide a pseudonym that we can use throughout the interview to keep your identity confidential.
2) Does your organization primarily focus on anti-slavery and labor abuse issues, environmental issues, or both?
3) What country do you currently work in?
4) What is your discipline?
5) Please describe your training and educational background such as your highest degree earned and any specialized training you have received for your job.
6) What is your age?
7) What race(s) and ethnicity(ies) do you identify with?
8) How do you identify your gender?
9) Have you previously worked on a fishing vessel? If yes, please describe your primary employment activities.
10) How long have you worked with fishers around issues of forced labor and slavery?
11) What kind of work have you done/do you do with the fishing community?
12) Which fishing communities do you primarily interact with?

a. Possible prompt if not stated above: Would you describe these communities primarily as small-scale, large-scale, or artisanal fisheries?

b. Possible prompt if not stated above: Where do these communities primarily fish at?

13) Please describe the socio-economic composition of the fishing communities that you primarily interact with (e.g., migration status, race/ethnicity/tribe/case, religion, education levels)?

14) How did most of the fishers decide to enter the fishing sector?

15) Please tell me about the work experiences the fishers have described to you (including how long they have worked in the fishing industry, and what activities they currently or in the past, have participated in?)

Migration Questions:

16) Where do the fishers live? How far are their homes from the landing site?

17) Do they live there all year long? If they do not live there all year, where else do they live?

18) Where is their place of birth/origin?

For individuals reporting that they were not born in the participant's home country or near the home country's major fishing ports:

a) When did they begin residing in [insert location]?

b) How and when did they decide to come to [insert location]?

c) How did they reach [insert location]?

d) How did they find work when they first moved to [insert location]?

e) What was their occupation prior to leaving their place of origin?

f) Have they considered returning to their place of origin?

For individuals reporting that they were born in the participant's home country and near the major fishing ports:

a) Can you describe any relationships that you are aware of, if any, that migrant fishers have with non-migrant fishers in the sector?

b) What impact has migration had on access to jobs in the fisheries?

c) Has migration in some way affected the relationships between employers and employees in the fisheries sector?

Cognitive Map Facilitation:

Explain what we are mapping and why. How researcher will be recording the important things that they mention, but can and should correct them! Give a neutral example of a map.

Interviewer will record key variables mentioned in the following with each question used as a heading.

19) Can you tell me about any changes that fishers have noticed in fish stocks?

If described changes in question 11:

a) What do fishers think are causing the changes in fish stocks?

b) What do fishers think could prevent these changes?

The interviewer will repeat back to the participant the list of key variables generated based on the participant's response. The interviewer will then ask, "Do you think these things accurately describe what you just told me? Are there any things that you want to

add or take away?" *Once the list is finalized by the participant, the interviewer will ask the participant to define each variable. The interviewer will then ask the participants*, "identify two things that you think are related or that affect each other." *When the participant identifies two variables, the interviewer will ask*, "how are these things related?*" To ascertain fuzzy causality and the relationship's direction, probing questions may include,* "Does one of these things cause the other one? When [insert causal variable] increases, does [insert outcome variable] increase or decrease?" *An arrow pointing away from the cause and toward the effect will be drawn. A green arrow will indicate a positive relationship (meaning that as one variable increases, so too does the other variable), and a red arrow will indicate a negative relationship (meaning that as one variable increases, the other decreases). The interviewer will also note a + sign for promoting relationships, a – sign for inhibiting relationships, and a 0 for neutralizing relationships. The interviewer will then ask the participant*, "do you think the relationship is weak/low, medium strength, or strong/high." *Once the participant assigns a qualitative weighting, then they will be asked to assign a quantitative weighting that corresponds with the qualitative weighting (Table 2). For example, if the participant describes the relationship as weak, they will be asked to pick a number (to the one tenth) from 0.1 to 0.3 for positive relationships and from -0.1 to -0.3 for negative relationships. This process is repeated until the participant no longer identifies any further relationships.*

The interview then resumes, and the interviewer will continue recording key variables.

c) Are there any other changes that fishers have reported in the fishing sector when fish stocks change?

The interviewer will repeat back to the participant the list of key variables generated based on the participant's response. The interviewer will then ask, "Do you think these things accurately describe what you just told me? Are there any things that you want to add or take away?" *Once the list is finalized by the participant, the interviewer will ask the participant to define each variable. The interviewer will then ask the participants*, "identify two things that you think are related or that affect each other." *When the participant identifies two variables, the interviewer will ask*, "how are these things related?" *To ascertain fuzzy causality and the relationship's direction, probing questions may include,* "Does one of these things cause the other one? When [insert causal variable] increases, does [insert outcome variable] increase or decrease?" *An arrow pointing away from the cause and toward the effect will be drawn. A green arrow will indicate a positive relationship (meaning that as one variable increases, so too does the other variable), and a red arrow will indicate a negative relationship (meaning that as one variable increases, the other decreases). The interviewer will also note a + sign for promoting relationships, a – sign for inhibiting relationships, and a 0 for neutralizing relationships. The interviewer will then ask the participant*, "do you think the relationship is weak/low, medium strength, or strong/high." *Once the participant assigns a qualitative weighting, then they will be asked to assign a quantitative weighting that corresponds with the qualitative weighting (Table 2). For example, if the participant describes the relationship as weak, they will be asked to pick a number (to the one tenth) from 0.1 to*

0.3 for positive relationships and from -0.1 to -0.3 for negative relationships. This process is repeated until the participant no longer identifies any further relationships.

The interview then resumes, and the interviewer will continue recording key variables.

20) Have fishers ever described any changes in labor conditions in response to fish stock changes? If yes, can you describe these changes in labor conditions?

The interviewer will repeat back to the participant the list of key variables generated based on the participant's response. The interviewer will then ask, "Do you think these things accurately describe what you just told me? Are there any things that you want to add or take away?" *Once the list is finalized by the participant, the interviewer will ask the participant to define each variable. The interviewer will then ask the participants*, "identify two things that you think are related or that affect each other." *When the participant identifies two variables, the interviewer will ask*, "how are these things related?" *To ascertain fuzzy causality and the relationship's direction, probing questions may include,* "Does one of these things cause the other one? When [insert causal variable] increases, does [insert outcome variable] increase or decrease?" *An arrow pointing away from the cause and toward the effect will be drawn. A green arrow will indicate a positive relationship (meaning that as one variable increases, so too does the other variable), and a red arrow will indicate a negative relationship (meaning that as one variable increases, the other decreases). The interviewer will also note a + sign for promoting relationships, a – sign for inhibiting relationships, and a 0 for neutralizing relationships. The interviewer will then ask the participant*, "do you think the relationship

is weak/low, medium strength, or strong/high." *Once the participant assigns a qualitative weighting, then they will be asked to assign a quantitative weighting that corresponds with the qualitative weighting (Table 2). For example, if the participant describes the relationship as weak, they will be asked to pick a number (to the one tenth) from 0.1 to 0.3 for positive relationships and from -0.1 to -0.3 for negative relationships. This process is repeated until the participant no longer identifies any further relationships.*

The interview then resumes, and the interviewer will continue recording key variables.

21) How, if at all, have fishers described changes in fishing practices when fish stocks change?

The interviewer will repeat back to the participant the list of key variables generated based on the participant's response. The interviewer will then ask, "Do you think these things accurately describe what you just told me? Are there any things that you want to add or take away?" *Once the list is finalized by the participant, the interviewer will ask the participant to define each variable. The interviewer will then ask the participants*, "identify two things that you think are related or that affect each other." *When the participant identifies two variables, the interviewer will ask*, "how are these things related?" *To ascertain fuzzy causality and the relationship's direction, probing questions may include*, "Does one of these variables cause the other one? When [insert causal variable] increases, does [insert outcome variable] increase or decrease?" *An arrow pointing away from the cause and toward the effect will be drawn. A green arrow will indicate a positive relationship (meaning that as one variable increases, so too does the*

other variable), and a red arrow will indicate a negative relationship (meaning that as one variable increases, the other decreases). The interviewer will also note a + sign for promoting relationships, a – sign for inhibiting relationships, and a 0 for neutralizing relationships. The interviewer will then ask the participant, "do you think the relationship is weak/low, medium strength, or strong/high." *Once the participant assigns a qualitative weighting, then they will be asked to assign a quantitative weighting that corresponds with the qualitative weighting (Table 2). For example, if the participant describes the relationship as weak, they will be asked to pick a number (to the one tenth) from 0.1 to 0.3 for positive relationships and from -0.1 to -0.3 for negative relationships. This process is repeated until the participant no longer identifies any further relationships.*

The interview then resumes, and the interviewer will continue recording key variables.

22) When I mention fish stocks and labor conditions what comes to mind based on your conversations with fishers?
23) How, if at all, do you think changes in fish stocks affect labor conditions based on your interactions with fishers?
24) What other things come to mind or are important when you think about how fish stocks affect labor conditions based on your interactions with fishers?

The interviewer will repeat back to the participant the list of key variables generated based on the participant's response. The interviewer will then ask, "Do you think these things accurately describe what you just told me? Are there any things that you want to add or take away?" *Once the list is finalized by the participant, the interviewer will ask*

the participant to define each variable. The interviewer will then ask the participants, "identify two things that you think are related or that affect each other." *When the participant identifies two variables, the interviewer will ask*, "how are these things related?" *To ascertain fuzzy causality and the relationship's direction, probing questions may include*, "Does one of these things cause the other one? When [insert causal variable] increases, does [insert outcome variable] increase or decrease?" *An arrow pointing away from the cause and toward the effect will be drawn. A green arrow will indicate a positive relationship (meaning that as one variable increases, so too does the other variable), and a red arrow will indicate a negative relationship (meaning that as one variable increases, the other decreases). The interviewer will also note a + sign for promoting relationships, a – sign for inhibiting relationships, and a 0 for neutralizing relationships. The interviewer will then ask the participant*, "do you think the relationship is weak/low, medium strength, or strong/high." *Once the participant assigns a qualitative weighting, then they will be asked to assign a quantitative weighting that corresponds with the qualitative weighting (Table 2). For example, if the participant describes the relationship as weak, they will be asked to pick a number (to the one tenth) from 0.1 to 0.3 for positive relationships and from -0.1 to -0.3 for negative relationships. This process is repeated until the participant no longer identifies any further relationships.*

The interview then resumes, and the interviewer will continue recording key variables.

25) How, if at all, do you think changes in labor conditions affect fish stocks based on your interactions with fishers?

26) What other things come to mind or are important when you think about how labor conditions affect fish stocks based on your interactions with fishers?

The interviewer will repeat back to the participant the list of key variables generated based on the participant's response. The interviewer will then ask, "Do you think these things accurately describe what you just told me? Are there any things that you want to add or take away?" *Once the list is finalized by the participant, the interviewer will ask the participant to define each variable. The interviewer will then ask the participants*, "identify two things that you think are related or that affect each other." *When the participant identifies two variables, the interviewer will ask*, "how are these things related?" *To ascertain fuzzy causality and the relationship's direction, probing questions may include*, "Does one of these things cause the other one? When [insert causal variable] increases, does [insert outcome variable] increase or decrease?" *An arrow pointing away from the cause and toward the effect will be drawn. A green arrow will indicate a positive relationship (meaning that as one variable increases, so too does the other variable), and a red arrow will indicate a negative relationship (meaning that as one variable increases, the other decreases). The interviewer will also note a + sign for promoting relationships, a – sign for inhibiting relationships, and a 0 for neutralizing relationships. The interviewer will then ask the participant*, "do you think the relationship is weak/low, medium/moderate strength, or strong/high." *Once the participant assigns a qualitative weighting, then they will be asked to assign a quantitative weighting that corresponds with the qualitative weighting (Table 2). For example, if the participant*

describes the relationship as weak, they will be asked to pick a number (to the one tenth) from 0.1 to 0.3 for positive relationships and from -0.1 to -0.3 for negative relationships. This process is repeated until the participant no longer identifies any further relationships.

The interview then resumes, and the interviewer will continue recording key variables.

27) When I mention fish stocks and labor conditions, does anything else come to mind?

The interviewer will repeat back to the participant the list of key variables generated based on the participant's response. The interviewer will then ask, "Do you think these things accurately describe what you just told me? Are there any things that you want to add or take away?" *Once the list is finalized by the participant, the interviewer will ask the participant to define each variable. The interviewer will then ask the participants*, "identify two things that you think are related or that affect each other." *When the participant identifies two variables, the interviewer will ask*, "how are these things related?" *To ascertain fuzzy causality and the relationship's direction, probing questions may include*, "Does one of these things cause the other one? When [insert causal variable] increases, does [insert outcome variable] increase or decrease?" *An arrow pointing away from the cause and toward the effect will be drawn. A green arrow will indicate a positive relationship (meaning that as one variable increases, so too does the other variable), and a red arrow will indicate a negative relationship (meaning that as one variable increases, the other decreases). The interviewer will also note a + sign for*

promoting relationships, a – sign for inhibiting relationships, and a 0 for neutralizing relationships. The interviewer will then ask the participant, "do you think the relationship is weak/low, medium strength, or strong/high." *Once the participant assigns a qualitative weighting, then they will be asked to assign a quantitative weighting that corresponds with the qualitative weighting (Table 2). For example, if the participant describes the relationship as weak, they will be asked to pick a number (to the one tenth) from 0.1 to 0.3 for positive relationships and from -0.1 to -0.3 for negative relationships. This process is repeated until the participant no longer identifies any further relationships.*

28) Can you tell me about any experiences, if any, that fishers have shared with discrimination based on their gender, race, tribe, caste, or immigration or migration status in the fisheries sector?
29) Are there groups of fishers who are more likely to experience discrimination in the fisheries sector? Who are they and why do you think they face more discrimination?

Appendix C: Codebook

Catch-per-unit effort: The number of fish caught per some standardized unit of effort (e.g., distance traveled, hours fished, type of gear used).

Consumer demand: The quantity, quality, and price of fish demanded by consumers of seafood.

Consumer disconnect: The disconnect between consumers and the seafood they eat, including disconnect from where and how the seafood is harvested, processed, and imported into their own countries and markets. In developed countries, consumers often rely on seafood certification schemes to better educate themselves and make informed choices as consumers; however, a recent inundation of these schemes into markets has resulted in a lack of transparency and consistency that threatens their quality and their ability to appropriately inform consumer choices.

Discrimination: Derived from racism, xenophobia, and nationalism, the unjust, inequitable, and systematic biased treatment of groups of persons based on specific characteristics and traits.

Disposable vessels: Old, dilapidated vessels that are not equipped with modern technology and therefore, when confiscated for illegal activity can easily be abandoned without huge financial losses.

Fisheries interventions and regulatory reforms: Strategies for mitigating overfishing.

Fishing effort: Includes distance traveled, number of hours fishing, number of times nets/gears cast, depth of fishing, number of crew needed to fish.

Fishing safety: Methods and equipment to protect fishers from danger, risk, or injury incurred while fishing.

Fish stock declines: Changes in spatial distribution, size, abundance, and aggregation of fish.

Forced labor slavery: "The involuntary entry and holding of people at a workplace through force, fraud, or coercion for purposes of forced labor so that the slaveholder can extract profit" (Free the Slaves, 2017, para. 1).

Geographic remoteness: Distance of vessel from land and/or inhabited areas.

Global race to fish: Rooted in capitalism, a profit-driven fishing motivation, versus tradition, subsistence, etc., that creates extreme global competition for scarce fish

resources and that perpetuates more developed countries exploiting less developed countries' territorial waters.

Government inaction: Lack of political will to address large-scale problems spurred by corruption, complacency, complicity, and/or collusion.

Illegal, unreported, and unregulated fishing: A classification of fishing activities wherein vessels operate in direct violation of binding and non-binding regulatory measures, or vessels purposefully exploit regulatory loopholes to evade regulatory measures with impunity (e.g., using a flag of convenience).

Increased fishing capacity: Adding more vessels to a fleet than the oceans and/or stocks can support.

Labor shortages: Not having enough laborers to meet the demand for crew.

Marginalization of small-scale fishers: When small-scale fishers, including small-scale commercial fishers, are forced out of the sector because of a consolidation of power and/or wealth in the hands of corporations, or when fishing becomes so expensive only corporations can afford it.

Monopolization of resources: Only certain individuals or companies have access to fish because of barriers that disproportionately impact vulnerable and/or less powerful groups.

Other transnational crime: Crimes that occur across international borders with wide-scale impacts across the greater international community. The distinction as transnational suggests these crimes pose greater law enforcement challenges in developing impactful strategies. Examples include drug, human, and arms trafficking, people smuggling, etc.

Overfishing: Unsustainable fishing to such an extent that stock depletions exceed replacement and recruitment and the stock declines.

Political instability: A government's inability to support or meet their citizen's basic needs.

Profit margins: The amount of revenue garnered by selling and/or trading fish that exceeds the fishing costs.

Regulatory problems and challenges: Harmful barriers to strengthening fishing, labor, and human rights standards that are difficult to overcome due to the amount of political will and cooperation needed amongst authorities with varying interest and inequitable power. Examples include enforcement difficulties, lack of cooperation between entities, loopholes in policies and between policies, and too many regulatory bodies and jurisdictions.

Social vulnerabilities: The inability of people, organizations, and societies to withstand adverse impacts from multiple stressors to which they are exposed. These impacts are due, in part, to characteristics inherent in social interactions, institutions, and cultural values. Examples include poverty, language barriers, and education disparities.

Subsidies: A sum of money granted by the government to assist an industry or business so that the price of a commodity (here fish) or service (fishing) may remain low, competitive, or profitable.

Supply chain complexity: The steps that it takes to get seafood from the ocean to a consumer's plate. Complexity comes from the number of steps, number of locations/countries/sites, number of regulatory bodies, etc.

Transshipment: When fishing vessels tie up to reefer or mother ships in the middle of the ocean to refuel and unload fish catch so that they do not have to come to port for supplies or unloading.

Underdeveloped economy: Countries with small economies that struggle to provide citizens with basic services (i.e., healthcare, education, etc.).

Use of foreign and migrant workers, often undocumented: Knowingly using available migrant and/or foreign workers, or illegally recruiting and smuggling foreign and migrant workers into the vessel's country of origin, to crew a vessel with the explicit intention of paying these workers less than available and more skilled domestic crew.

Wildlife crimes: The violation, either purposeful or unintentional, of regulations intended to protect and conserve wildlife. Examples include shark finning, the harvesting of sea cucumbers, and trafficking of endangered species such as pangolins.