Complex Linkages between Forced Labor Slavery and Environmental Decline in Marine Fisheries

Recent media attention on human rights abuses in the fishing sector, precipitated by undercover investigations from non-governmental organizations and investigative journalists (e.g., Environmental Justice Foundation [EJF] 2014, 2015a, 2015b; Mendoza et al. 2016), has prompted calls from the scientific community for increased transdisciplinary and empirical research of fisheries' social dimensions such as labor (Kittinger et al. 2017). Given views that social and ecological systems are interdependent (Ostrom 2009), the need for theory development to explicate pathways for how this interdependence occurs and the potential for using policy and practices for intervention and prevention exists. Integrating ecological data and economics and human rights theory, Brashares et al.'s (2014) Wildlife Decline and Social Conflict framework offered a hypothesis about the negative association between fish stock declines and child slavery. Yet, more precision in terminology, pathways, and feedbacks may be warranted. With the aim of exploring empirical, conceptual, and theoretical support for Brashares et al.'s (2014) pathways, the presented revised theory posits how forced labor slavery and environmental decline in marine fisheries may be linked.

For modern, forced labor slavery, empirical testing is limited by risks to researchers, prohibitive costs and time requirements, a dearth of baseline data, and the study population's hidden nature. When considering linkages between forced labor slavery and environmental decline in marine fisheries, these challenges are further compounded by the physical inaccessibility of fishing vessels sailing hundreds of miles from shores (Stringer and Simmons 2015). Instead starting with a theoretical framework can help elucidate how and when the potential for labor exploitation occurs in the fisheries sector; identify feedbacks wherein forced

labor slavery contributes to environmental decline; and inform labor and fisheries practices, management, and policies in the absence of empirical data to simultaneously minimize labor abuses of fishers and environmental decline. Further, to help advance fisheries toward the eradication of human rights violations and the human rights sector toward prevention, a framework can provide guidelines and origins for data collection, ensuring more efficacious resource use, and can be modified once empirical evidence is generated.

The potential connections between environmental decline and exploitative labor practices in marine fisheries are important to consider. Due to human dependence on fish for food, livelihood, and nutrition (Food and Agriculture Organization of the United Nations [FAO] 2014, 2016), human well-being cannot be disentangled from healthy ecosystems and sustainable fisheries use. From the social systems perspective, if shocks to fisheries create economic pressures within a pre-existing context of social vulnerability already known to yield slavery, then fish stock declines may exacerbate and accelerate the use of forced labor slavery in the sector by providing an economically rational tipping point into the practice. Thus, failing to recognize how environmental decline contributes to and compounds social vulnerabilities could undermine interventions aimed at eradicating slavery. These interventions risk being siloed within social systems and ignoring ecological feedbacks. From the ecological systems perspective, not considering the extent of unique environmental pressures produced by the use of forced labor slavery could subvert attempts to stabilize stocks and to efficiently maximizing sustainable yields. Thus, when stocks decline, social consequences may increase vulnerabilities for fish dependent persons (e.g., Golden et al. 2016; Perry and Sumaila 2007). As a result, these feedbacks create a multifaceted problem that requires multiple and holistic interventions and policies that address fisheries' environmental and labor challenges in conjunction. This paper

will consider such associations by defining what constitutes forced labor slavery in the 21st century. Brashares' (2014) original framework and critique will be presented along with a revised framework, and diverse knowledge sources to support pathways.

Defining forced labor slavery

The International Labour Organization's (ILO) Convention Concerning Forced or Compulsory Labor (1930) defines forced labor as "all work or service which is extracted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily" (Convention 29, Article 2). The ILO's Special Action Programme to Combat Forced Labour suggests 11 indicators to identify potential victims of forced labor slavery. While the presence of just one indicator could constitute a case of forced labor, it is often thought of as a continuum, based on victims' vulnerabilities and severity and number of indicators present (Special Action Programme to Combat Forced Labour 2012).

For this paper forced labor slavery will be 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 Salves 2017 What is Slavery?). Slavery was selected over human trafficking, a primarily legal term subjected to nuanced, and often conflicting, interpretations from diverse legal institutions influenced by various external forces (Bales 2017). Instead this definition centers victims' experiences, versus legal frameworks (Bales 2017), and is holistic enough to encompass all aspects of forced labor slavery while also noting the shift from historical to modern slavery. In his theory of modern slavery, Bales suggests that slavery as a construct should still be defined by the relationship between victim and perpetrator (consistent with historical slavery), but that that over time slavery has shifted from an owner-property relationship to a relationship where the victim is paid little (an unfair value) or no money (labor

exploitation) while the perpetrator's profits increase (2006). Other shifts include the transposition of unfreedoms from point of entry into the exploitative relationship (historical slavery) to the point of exit from the relationship (modern slavery) (Barrientos et al. 2013; Phillips and Mieres 2015; Stringer et al. 2016) and control of the victim at point of entry into the relationship being exerted by a person (historical slavery) to socioeconomic conditions (modern) (O'Neill 2011). Indeed, while some victimized fishers are purchased by boat captains (Chantavanich et al. 2016), many exhibit the semblance of agency at point of entry caused by desperation to meet basic needs and exploited by brokers and/or recruiters' deception (O'Neill 2011).

The shift from historical to modern slavery has further complicated the identification of forced labor slavery, and often exploitation in the fishing sector has been minimized as poor labor practices (Stringer et al. 2016). As a result, investigative journalism's contributions to eradicating abuses in the fishing sector exceeds the scientific community's, requiring researchers to improve their consideration and inclusion of equity, equality, and social justice in environmental and sustainability research (Kittinger et al. 2017). Whereas investigative journalism has confirmed and generated mainstream media attention about the presence of labor exploitation in the fishing sector, the scientific community can advance this work by linking social and ecological processes to outcomes such as forced labor. Additionally, though multiple white papers have credibly postulated bidirectional relationships between fish stock declines and forced labor slavery (see EJF 2015b; United Nations Office on Drugs and Crime [UNODC] 2011), empirical evidence is limited and improved research is needed to understand how strongly the issues are linked and the processes that facilitate these linkages.

Brashares' Wildlife Decline and Social Conflict framework

Brashares et al. (2014) offered a specific theoretical framework hypothesizing how fish stock declines may be driving increases in child slavery through an amalgamation of human rights, political ecology, conservation biology and ecology, public health, and economic theory (Fig. 1). Building on the UNODC's (2011) investigation that posited a potential relationship between declining fish stocks and human trafficking (section 1.5.4), the authors proposed that declining fish stocks force vessels to fish longer, farther from shore, and deeper in waters to maintain yields, increasing "production costs" (Brashares et al. 2014 p. 376). The framework hypothesizes cheap labor as an approach to offset increasing costs and continue harvesting fish species at a rate that would otherwise be cost-prohibitive, thus potentially increasing exploitative labor practices to the point of child enslavement (Brashares et al. 2014). While Brashares et al. emphasize child slavery, it is expected that their hypothesis is more relevant to exploited adult laborers, as indicators for child slavery must consider differing cultural norms around child work, particularly between developing and developed countries.

Citing a lack of empirical evidence for all pathways, critics denounced the framework for oversimplifying a complex problem and making too big of a conceptual leap from fishery declines to slavery, thus conflating the environment's role in perpetuating slavery (Mauda and Scharks 2014). Though Brashares et al. were unable to support their pathways with empirical data at publication, it does not mean the phenomenon under investigation is implausible, nor does it preclude future studies from empirically confirming the model. Scientific precedent exists for empirically uncorroborated models having great utility in directing future research and advancing understanding of complex phenomenon (e.g., string theory) (Dawid 2006; Dawid et al. 2015). And in the social sciences, common scientific practice is to move from hypothesis generation to empirical testing by formulating a framework, model, or theory which organizes

pertinent constructs (e.g., predictors, mediators, modifiers) into schemas to better predict outcomes and events under study (Jaccard and Jacoby 2010).

Though Mauda and Scharks (2014) cited literature from 2005 that did not consider environmental degradation as a driver of slavery (Surtees), current literature is beginning to consider larger environmental and market driven processes, including overfishing as a "key associated driver" of maritime crime (e.g., forced labor) (Pomeroy et al. 2016 p. 96) and how slavery may be escalating environmental degradation which in turn increases slavery (Bales 2016). Investigations also suggest the fishing industry is one of the biggest users of slave labor, with an estimated 1.8 million people enslaved in the agriculture/fishing sector (ILO and Walk Free Foundation 2017), including on fishing vessels originating from and/or berthed in the United States, Thailand, New Zealand, and Peru amongst numerous others (Bales 2016; EJF 2014, 2015a; FishWise 2014; ILO 2013; International Transport Workers Federation [ITF] 2006; Mendoza et al. 2016; Verité 2016; Yea 2014).

Mauda and Scharks' (2014) concerns about needlessly reallocating or misappropriating resources are germane. However, the persistence of forced labor slavery in marine fisheries (International Labor Rights Forum [ILRF] 2018) warrants a challenge to the dominant paradigm that has seemingly not produced reductions in the problem. This new discourse, instead, should consider contributing factors external to social vulnerabilities (e.g., environmental decline) that may influence the use of forced labor by creating a demand for free or cheap labor. And it should question the framing of slavery's contributions to illegal and overfishing, wherein isolated environmental policies lacking an understanding of forced labor slavery's contributions to environmental decline may inadvertently blame or punish slavery victims. This potentially more holistic understanding of social-ecological marine systems and subsequent appropriately targeted

and multifaceted interventions could also advance the field by shifting it from reactive to preventive practices. No economic or other incentive is known to cease using forced labor slavery once its use has generated increased profits. Therefore, to reduce the prevalence of this linked social-ecological injustice, interconnected interventions must prevent it before it happens.

Brashares' Wildlife Decline and Social Conflict framework revised

While Brashares' framework is sufficiently developed to encourage empirical testing to confirm pathways and link previously disparate research fields, a more robust discussion of underlying theories may provide non-experimental confirmation of pathways to repudiate previous critiques. Building upon Brashares' original framework, a revised framework with altered constructs is presented (Fig. 2). Tentative construct changes (Table 1) were made to be consistent with human rights literature and theory and to emphasize power differentials that incite exploitative labor relationships, giving the powerful economic advantages while commodifying human beings (Manzo 2005; Phillips and Mieres 2015). Support for each construct and pathway in the revised framework will be described below.

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Contextual Constructs

While forced labor slavery is a global phenomenon, not all fishers are enslaved, and context influences the labor relationship between fishers and employers. Important conditions explaining why forced labor slavery persists in the fishing industry include geographic, regulatory, cultural, socioeconomic, and industry contexts—all constructs derived from Bales' (2006) and Crane's (2013) theories of modern slavery (Fig. 2). These constructs also provide the indicators used to estimate the prevalence of slavery. Geographic, regulatory, and cultural

contexts create an environment that not only accommodates, but enables slavery. They also interact with each other and with the socioeconomic context, creating the slave labor supply, and the industry context, creating the "demand" for slave labor. Though the operationalization of these broad concepts varies by country and region, key indicators of each that should be assessed in future empirical work are described. Moreover, while the importance of each contextual construct and indicator in driving slavery may vary across regions, it is the confluence of these factors in creating no viable alternatives (either actual of perceived) for victims, which leads them into forced labor slavery experiences.

Geographic context

While forced labor slavery occurs in developed, transitional, and developing countries, geographic factors such as a high density of migrant laborers and geographic isolation appear to increase the use of forced labor slavery (Crane 2013; ILO 2005; Robertson 2011). Empirical evidence suggests that migrants are the most vulnerable population to forced labor slavery (Chantavanich et al. 2016; ILO 2005; International Organization for Migration [IOM] 2008; Wheaton et al. 2010). Their movement may be documented or undocumented, and is predicated on perceived opportunity in the form of higher wages or greater availability of work in the new area (Bales 2006, 2007; Chuang 2006; Robertson 2011; Wheaton et al. 2010). Brokers and recruiters working for boat owners target them through formal and informal mechanisms, in markets before their migration (offering "assistance" with their movement), and after their relocation in migrant reception centers (IOM 2008; Robertson 2011). Other pressures (e.g., population growth and environmental degradation) are also limiting work opportunities further inland, driving more migrants to coastal areas (Creel 2003), and thus the fishing sector.

Like other industries with high forced labor usage (particularly natural resource

extraction industries), fishing is an economic activity that occurs at specific sites, which can be hundreds of miles from shore (Crane 2013). This distinct separation and geographic distance minimizes contact between victims and law enforcement, family, civil society and aid organizations, and professional groups, intensifying fishers' dependence on their abusers which increases the perpetrator's power (Fletcher et al. 2005). Over time, the experience becomes normalized, and as enslavers continue to gain power, it lowers the amount of resources needed to dominate the victims—further reducing the cost of using slaves (Crane 2013). This isolation also limits the reach of regulatory powers. In localities with effective labor laws, inspectors or enforcement agents often cannot access vessels at sea for compliance monitoring, thus violations are unnoticed. And the plethora of geographic and physical boundaries transected by marine fishing vessels exposes loopholes in labor regulations even in developed countries (MacFarlane 2017). Vessels will also engage in transshipping, the use of mother ships or reefer ships to unload their catch, refuel, and restock in the middle of the ocean to prevent berthing in ports. Using transshipping, some vessels have reportedly remained at sea for several years (EJF 2015a). As a result, the geographic context shapes the regulatory context because illegal practices like slavery persist in industries that "operate beyond the oversight of regulations and other formal institutions" (Crane 2013 p. 54).

Regulatory context

While the Universal Declaration of Human Rights illegalizes slavery everywhere, ineffective governance fosters environments where forced labor slavery still thrives. The use of forced labor slavery most frequently occurs in countries characterized by government complicity, political instability, high levels of corruption, limited regulations, regulatory failures, and poor natural resource (fisheries) management (Bales 2016; Crane 2013; Pomeroy et al. 2016). And

despite the Universal Declaration of Human Rights and subsequent conventions, international frameworks do not "translate into real protections unless they are incorporated into national legislation and implemented effectively" (ITF 2006 p. 9).

Pomeroy et al.'s (2016) theoretical 'fish wars' framework also posited that in the absence of effective governance in fisheries, natural resource scarcity can result in increased social conflict (including human trafficking and forced labor). The social conflict contributes to the environmental degradation through feedback loops predicated on increased competition. Examples of weak governance in fisheries include corruption, lack of stakeholder participation, political will and capacity, weak institutional capacity and capabilities, poor enforcement, and inadequate information and data. Investigative case studies also suggest that vessels using forced labor are often disregarding international and national environmental regulations and engaging in illegal, unreported, and unregulated fishing (IUU) fishing (EJF 2015b). IUU activities may involve knowingly violating catch quotas; purposefully not reporting, under reporting, or falsifying catches; fishing without a license; fishing in protected areas; catching certain species that are illegal; and using illegal fishing gears. The persistence of IUU is often facilitated by regulatory corruption, limited enforcement capacity, and loopholes in policies rendering the environmentally destructive fishing activities unregulated but not necessarily illegal (Global Ocean Commission 2013).

However, forced labor slavery is not just limited to fisheries in developing countries. It also occurs in developed and transitional countries because the fishing industry is often part of the informal economy— industries that lack employment security, benefits, and labor laws and regulations—making laborers more vulnerable to exploitation (Hart 1973).

Cultural context

Deep-rooted discriminatory beliefs and social inequalities within cultural contexts exclude groups of people from rights and protections and inhibit equitable development, particularly economically, by assigning these groups a subordinate status in society—thus making them more vulnerable to slavery (Crane 2013; Free the Slaves 2017). For migrants, this discrimination may occur in both their origin and destination countries. In certain geographic regions these discriminations are institutionalized by the regulatory context. Even if labor laws and regulations exist, they may not be applied equitably, or can legally discriminate against an individual based on gender, race, tribe, caste, religion, or immigration/migration status, resulting in most forced labor slavery victims identifying with at least one minority group (Crane 2013; Upadhyaya 2008). For example, in many countries, foreign-born, migrant workers are exempt from local labor laws. Additionally, in some countries, types of permissible work are determined by informal norms regarding social membership. As a result, entire groups of already vulnerable people become further marginalized which means they will also disproportionately incur socioeconomic challenges.

Socioeconomic context

Geographic, regulatory, and cultural contextual variables combined create structural vulnerabilities that exacerbate socioeconomic inequalities. These socioeconomic inequalities may include wealth gaps, and disparities in income, poverty and education levels, and access to financial institutions (Andrees 2008; Bales 2006, 2007; Crane 2013). The inequalities may also occur intercountry (e.g., Thailand's economic growth relative to poorer neighboring countries like Cambodia and Laos that facilitates migration from Cambodia into Thailand) or intracountry (e.g., Myanmar's economic growth that is creating greater income inequality between skilled low-skilled works). Regardless, the powerful dominate the vulnerable by exploiting these

inequalities (Barner et al. 2014). Factors that can moderate the relationship between socioeconomic vulnerabilities and forced labor slavery include access to affordable credit and education (including literacy and language skills). However, migrant populations often lack both, and culturally entrenched discrimination further limits their access, increasing their desperation and vulnerability to coercion (Andrees 2008).

Combined, socioeconomic inequalities create a surplus population vulnerable to forced labor slavery (the slave labor "supply"). The increased availability of "cheap labor" then causes the price of slaves to decrease, further inflating slaveholder's profits (Bales 2012; Crane 2013). This socioeconomic context also interacts with the contextual constructs in that migrant populations (geographic) are adversely incorporated into society, and thus the society's fishing sector, because of laws (regulatory) and discrimination (cultural). This adverse incorporation reinforces poverty, thus a population vulnerable to slavery persists (Phillips and Mieres 2015).

Industry context

Whereas the socioeconomic context provides the "supply," the industry context creates the "demand." Research suggests that modern forced labor slavery is most likely to occur in industries reliant on manual labor, exhibiting high labor intensity and low technological development, and operating in the informal economy under poor regulations (Bales 2012, 2016; Chuang 2006; Crane 2013; ILO 2009). Motivated by profits, forced labor slavery represents an economically rational decision to employers because it is "an opportunity to reduce the main costs driving profitability" (Crane 2013 p. 54; Wheaton et al. 2010). Because labor is often one of few production elements employers can control, the economic benefits of forced labor slavery are greater in labor intense industries where profit margins at the supply chain's source are increasingly narrow, such as fishing (Crane 2013; Hamilton-Hart and Stringer 2016). Since

fishing already has a propensity for using forced labor slavery, it is not implausible to consider that fish stock declines and forced labor slavery are linked issues, especially considering that many adaptations to stock declines (e.g., increased effort) likely constrain profits further. Then the use of forced labor incentivizes increased pressures on stocks by delaying overfishing's unprofitability.

Empirical pathways

Declining fish stocks decrease fish catch-per-unit-effort

Though the discourse about how dire stock declines are continues between conservation and fisheries management approaches (Worm et al. 2009), in 2013, an estimated 31.4% of marine fish stocks were overfished beyond biologically sustainable levels. This was a more than 20% increase from 1974 (FAO 2016). While management strategies have been effective in stabilizing some stocks, a global meta-analysis of overfished stocks determined that many stocks will likely take substantially more time to recover than initially predicted—even under aggressive, best-case scenario conservation and management approaches (Neubauer et al. 2013).

When marine fish stocks decline, catch-per-unit-effort (CPUE) also decreases (Daskalov 2002; Pauly and Zeller 2016; Pontecorvo and Schrank 2012, 2014; Tsikliras et al. 2015; Watson et al. 2013). While there are examples of CPUE increasing amidst stock declines (Harley et al. 2001; Rose and Kulka 1999), this outcome is dependent on numerous other factors such as fishing fleet efficiency, changes in fishing technique and skill level, and technology advancements (Maunder et al. 2006)—all which typically require substantial financial capital. Since forced labor slavery, in all industries, is used to increase profit because it requires limited financial investment, vessels using slave labor are unlikely to be motivated to expend financial capital into new technologies.

Others suggest that declining catch may be an indicator of better fishery regulations (Worm et al. 2009). While this may be relevant for some marine areas, it is not pertinent to the proposed framework since all slavery activities are illegal and occur outside the realm of labor and other regulations. Further, the observed co-occurrence of IUU fishing and forced labor slavery in investigative case studies from Thailand (see EJF 2015b) suggests that forced labor slavery may be more likely to occur on vessels fishing in unregulated areas or areas where fishery regulation enforcement is unfeasible or non-existent—consistent with the use of forced labor slavery in deforestation (Bales 2016). Illegal fishing also frequently results in non-compliance with other environmental, national, and international regulations and actions (Agnew et al. 2009). While the economic benefits of IUU already far exceed the risks of being apprehended or fined (Sumaila et al. 2006), the use of slave labor likely further reduces the risk. However, more robust empirical data is still needed.

Declining fish catch-per-unit-effort increases effort

When CPUE decreases, vessels fish longer, deeper, and further, increasing effort (Bell et al. 2016; Gascuel et al. 2016; Hutchings and Myers 1995; Pontecorvo and Schrank 2014; Tsikliras et al. 2015; Watson et al. 2013). Critics of Brashares et al.'s original framework, citing contrary evidence, argued that fish stock and catch declines lead to decreased effort (Smith 2014). However, Smith's cited findings were less precise and more speculative, relying on predictive modeling for future forecasting that used cross-sectional data (Liese et al. 2007) or data from a 14-year period at best (Bjørndal and Conrad 1987). The study of Kenyan fishers questioned about their willingness to exit the artisanal fishing industry in light of hypothetical fish decline scenarios (Cinner et al. 2009) is also likely not applicable, since artisanal fisheries often diverge from industrial fisheries in terms of motivation (i.e., subsistence versus profit).

While investigations have uncovered slavery victims on short and long-haul vessels and on boats fishing in territorial waters and the high seas (Chantavanich et al. 2016; Mendoza et al. 2016), the commercial nature of the fishing vessel appears to be a common characteristic.

In contrast, data suggesting increased effort amidst stock and catch declines used more robust and rigorous methodologies, including longitudinal data sets with more time points. Bell et al. (2016), calculated effort and catch using a global sample generated by the FAO and other sources over a 62-year period, 1950-2012. Watson et al. (2013), aggregated data from the European Union, FAO, global tuna commissions, and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), arguably one of the more reputable regional fishery management organizations, over a 56-year period, 1950-2006. Further, Hutchings and Myers (1995), created a 450-year historical reconstruction of Northern cod catch and effort based on iterative analyses of archival records, the North Atlantic Fishery Organization's database (1954-1994), and a spatial analysis of effort using historical documents. While it is likely scenarios exist where declining CPUE does not lead to increased effort based on contextual factors, the rigorous studies described suggest that numerous scenarios exist where CPUE does lead to increased effort, and it is in these fisheries that forced labor slavery is likely to occur.

Increased effort decreases profit margins

Applying Clark's (1990) 'stock effect' to fishing, White et al. concluded that "the cost to catch a fish increases as the density of a fish population declines…thus more intensive fishing pressures [increased effort] may compromise profit" (2008 p. 371). Fish stock declines in coastal areas have driven fishing vessels out to the high seas; yet the technology and other increased effort costs associated with high seas and deep sea fishing are so exorbitant that many types of

fishing and fisheries are not profitable without government subsidies or other cost-cutting measures in relation to labor expenses (Gjerde et al. 2013; Sala et al. 2018).

Research reliably estimating fishing costs, which directly impacts profit margins, is limited. However, a longitudinal study coupling global catch and economic data from 1951-1999 found a 95% revenue decline during the study period (Sethi et al. 2010). If revenue is decreasing and cost is increasing, it is expected that profit margins would also decrease.

Theoretical pathways

Theoretical pathways are the relationships between constructs which are supported by an integrated set of disciplinary theories which are used to explain the processes of why and how forced labor slavery persists.

Decreased profits increase demand for cheap labor

Increases in demand for cheap labor are an adaptation to profit losses driven by economic motives. The Domar Serfdom Model postulates that businesses are constantly seeking economic gains, which are typically made through production control. However, when production is scarce, it becomes more economically advantageous to own the labor force instead of production (Domar 1970). The hypothesis initially described increases in agricultural serfdom in the 16th and 17th century as a response to land scarcity, and was broadened by Domar to include production scarcity, with production encompassing resources and capital (1970). It is plausible the model would apply to natural resources, like fish, as other economists have identified fish functioning as capital (Brown 2000). Fish in marine ecosystems are considered a global common good that no particular party owns, and with the increase in high seas fishing and the presence of government subsidies (Gjerde et al. 2013), production ownership is frequently limited to a single

element—labor. As such, unfree labor functions like government subsidies, delaying the tipping point from profitable to unprofitable (Sala et al. 2018).

Consistent with other commodity-oriented global value chains (GVCs), when fishing profits decrease market pressures drive owners or operators to resort to measures to remain competitive (Chantavanich et al. 2016). Fishing is a profit-driven industry, where net profit drives harvest decisions, creating a 'race for fish' that rewards fishers who can harvest the most fish and maximize individual economic gains by reducing input costs (Sethi et al. 2010). And in the fishing industry cheap, migrant labor (regardless of how it is obtained) is considered a legitimate, and one of the primary, strategies for remaining competitive (ITF 2006).

Increased demand for cheap labor increases forced labor exploitation

Labor ownership (i.e., slave ownership) makes fishing more profitable and gives owners or operators a competitive advantage, essentially rewarding the use of cheap labor. Because decreasing fish stocks intensify effort and decrease profits, it indirectly increases demand for cheap labor and creates market forces that make impoverished migrant workers more vulnerable to exploitative labor practices (Chantavanich et al. 2016; UNODC 2011). As noted in Crane's (2013) theory, in GVCs, when already narrow profits begin to dwindle because of increasing labor intensity, owners or operators will seek to zero their labor expenses, increasing the prevalence of forced labor exploitation because it becomes an economically rational decision.

Increased forced labor exploitation increases profits

Forced labor exploitation is an effective strategy for increasing profits because modern slavery is relatively inexpensive. Whereas slavery throughout the United States and Europe in the 17- and 1800s required the purchased of slaves, modern forced labor slavery relies on coercion and deception instead of purchase (Bales 2016). Additionally, there are almost no costs

associated with the coercion and deception since intermediaries (i.e., recruiters and brokers) and boat captains exploit the pre-existing vulnerabilities created by geographic, regulatory, and cultural factors, and accentuated by the socioeconomic predictors. Intermediaries deceive vulnerable persons (most often migrants) into these schemes by offering employment agreements with competitive wages that are never paid, or agreements with advanced wages, debt repayment, or equipment loans in exchange for labor until the "debt" to the employer is satisfied (i.e., debt bondage schemes which are one form of modern forced labor slavery). 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 (Bales 2006, 2007, 2012; ILO 2005; IOM 2008; O'Neill 2011; Yea 2014). When labor exploitation increases profits, modern slavery exists (Bales 2006, 2007).

Proposed pathways

Increased profit increases effort

Once slaveholders in the fishing sector have perfected their strategy for minimizing cost and maximizing profit, they will continue to exploit this strategy as long as two conditions are met (Bales 2016). The first condition is the continued existence of a supply of slave labor, generated by socioeconomic and other inequities. The second condition is the continued global consumer demand for fish, driven primarily by industrialized nations. Between 1960 and 2010, the annual per capita fish consumption increased from 9.9 kilograms to 19.2 kilograms, driven primarily by industrialized countries, and 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). While the least developed countries saw an increase as well, there annual per capita consumption was almost 50% less than industrialized

nations, despite the overreliance on fish for subsistence (FAO 2014). As such, Crane (2013) hypothesizes that enslaving migrants through forced labor exploitation will "effectively lock in low-price labor," institutionalizing the practice (p. 56).

Increased effort decreases fish stocks

Because perpetrators of forced labor slavery are profit motivated and already operating outside laws and regulations, it is unlikely they will comply with binding laws that lack enforcement or international soft laws bereft of punitive consequences for overfishing or slavery violations, or that they will comply with equipment restrictions and/or catch limitations if their actions are increasing profitability (Bales 2016). Thus the use of slavery could perpetuate overfishing by delaying the unprofitability. Additionally, if forced labor does further decrease the risk associated with IUU, then the increased use of slavery could contribute to even higher rates of IUU fishing—already an identified driver of overfishing and marine fish stock declines (FAO 2014; Global Ocean Commission 2013). However, though the co-occurrence of IUU fishing and forced labor slavery has been documented (see EJF 2015b), the relationship between the two problems remains poorly understood and under researched.

Conclusion

The proposed framework's utility is in connecting theories that have long been siloed in individual disciplines. These transformative connections thus have the potential to provide a strong foundation for future empirical testing; develop causal theories—including bidirectional and cyclic theories; identify modifiable factors as intervention points; and elevating the need for multiple entry points to address linked social-ecological problems. As the measurement of all forms of slavery evolves and continues to improve (Bales 2017; Larsen and Diego-Rosell 2017; Larsen and Durgana 2017), it is important to consider measurements beyond prevalence that will

further understanding of forced labor slavery—including its external contributing factors, contributions to environmental degradation, and most efficacious modification points.

The proposed framework and suggested construct definitions and indicators provides the basis for modeling case scenarios and identifying feedback loops in social-ecological systems. Rather than emphasizing a singular causal factor (either direction), the framework's application is intended to account for the complex, interrelatedness of variables in the linked system. Thus, elucidating an understanding of how social and ecological conditions interact to create feedbacks. Better identification of these feedback loops can also help model repercussions of policy and governance decisions—the most likely intervention mechanism. Too often policies are constructed to deal with problems in isolation, limiting the authority of enforcement means in addressing problems outside of this limited purview. Because multiple factors, that are themselves interrelated, contribute to slavery in the industry, research and interventions (including policy responses) need to be multifaceted and implemented in unison or complementary approaches.

While the proposed framework has not yet been empirically validated, and empirical evidence to support the relationship between natural marine environmental decline and forced labor slavery may be difficult to obtain, it is important to continue moving the field forward. Connecting theories that have long been segregated in individual disciplines provides a strong foundation for future empirical testing. Without this progress, the potential linkages between marine environmental decline and social conflicts will continue to perpetuate social-ecological injustices such as slavery in the marine fisheries sector which simultaneously perpetuates human rights violations and marine environmental degradation.

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