



Potential ecological and social benefits of a moratorium on transshipment on the high seas



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ABSTRACT

One way that illegal, unreported, and unregulated (IUU) fish catch is laundered into the seafood market is through transshipments at-sea. This practice, which often occurs on the high seas (the areas of ocean beyond national jurisdiction), allows vessels fishing illegally to evade most monitoring and enforcement measures, offload their cargo, and resume fishing without returning to port. At the same time, transshipment at-sea can facilitate trafficking and exploitation of workers who are trapped and abused on fishing vessels. This study gives an overview of high seas transshipment as well as evaluates transshipment at-sea regulations across 17 Regional Fisheries Management Organizations (RFMOs), which are responsible for regulating fisheries on the high seas. Transshipment at-sea regulations have become increasingly strict in most RFMOs since the late 1990s. However, only five RFMOs have mandated a partial ban, and only a single RFMO, the South East Atlantic Fisheries Organization (SEAFO), has mandated a total ban on transshipment at-sea. A total ban on transshipment at-sea across all RFMOs would support the ability of oversight and enforcement agencies to detect and prevent IUU fishing and also likely reduce human trafficking and forced labor on the high seas.

1. Introduction

As coastal waters have been increasingly overexploited and global catch per unit fishing effort has decreased, fishing vessels have traveled further offshore and into areas beyond national jurisdiction, also known as the high seas, to capture fish [1,2]. Traveling to distant waters is costly, however, and the distant water fishing industry is kept afloat financially by various cost-reduction measures, including government-sponsored capacity-enhancing subsidies (especially fuel subsidies) [3], the use of forced labor [2], and by transshipments at-sea [4,5].

The United Nations Food and Agriculture Organization (FAO) defines transshipment as the “act of transferring the catch from one fishing vessel to either another fishing vessel or to a vessel used solely for the carriage of cargo” [6]. This practice of a fishing boat offloading its catch at sea and often restocking its supplies is common within many fishing industries, especially those fishing in distant waters. Transshipments at-sea allow these vessels to sell fish – both legally and illegally caught – to refrigerated vessels, which carry the catches to port and assist in the laundering of illegally caught fish [7,8]. Transshipment at-

sea is defended as economical as it allows fishing vessels to cut down on operational costs because a single cargo vessel can land the catch of several fishing vessels at port [9]. The efficiency in fuel use is also argued as an advantage of transshipment. But there are several notable disadvantages as well.

Illegal, unreported, and unregulated (IUU) fishing is among the most important factors contributing to fisheries overexploitation, and annual global losses to illegal and unreported fishing are valued at between US \$10 billion and US \$23.5 billion [10]. Transshipment allows fishing vessels to be resupplied without ever returning to port, thus evading monitoring and enforcement, and staying at sea for months, or even years at a time (Fig. 1). A study that identified potential transshipments at-sea via satellites showed that transshipments were more common in ocean regions with higher IUU fishing estimates [4,10].

Transshipment at-sea also likely facilitates human trafficking, forced labor, and other human rights abuses because it allows fishing boats to stay out at sea and avoid enforcement and civil society. Forced labor is another way to reduce fishing costs [2,11] and has been

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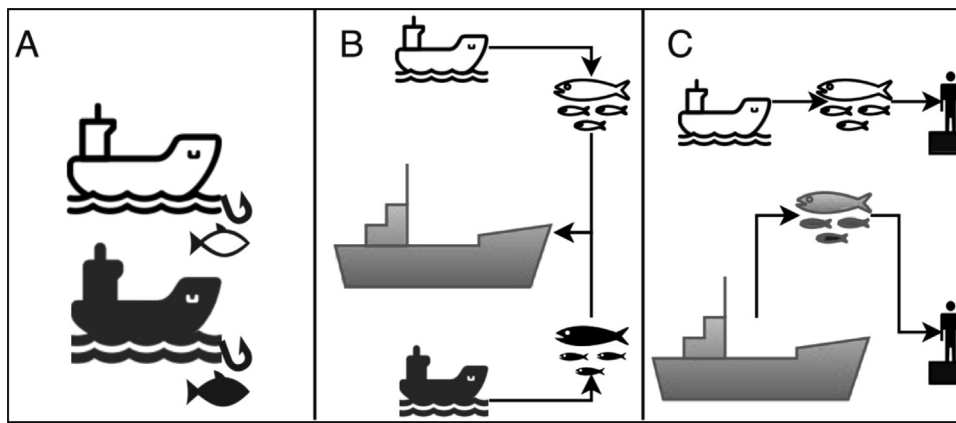


Fig. 1. Transshipment at-sea in the Seafood Supply Chain. (A) Legal (white) vessels and illegal (gray) vessels fishing on the high seas can (B) transship their catch to a (light gray) refrigerated cargo vessel and be refueled and resupplied, allowing them to stay at sea without returning to port. Legal and illegal catch are mixed aboard the cargo vessel, which then returns to offload at port along with legal fishing vessels (C), at which point inspection agents can no longer identify whether landed fish was legally or illegally caught. Illegal vessels can thus avoid returning to port for months or years at a time, and illegal fish is laundered into the seafood supply chain.

uncovered in recent years as unsettlingly common within the fishing industry [12–14]. Workers are largely recruited by manning agencies in developing countries, where they are made false promises of compensation, asked to pay “agency fees” later used as justification for indentured servitude, robbed of their documents, and sold into conditions that constitute slavery [12,15]. These fishermen are drastically underpaid or unpaid, and often held captive at sea for several years as fishing vessels receive supplies of food and fuel via transshipments at-sea [12,15]. Transshipments at-sea have also been linked to other forms of organized crime such as drug, weapon, and other wildlife trafficking [7]. Illicit practices during transshipments at-sea have been documented in the Indian Ocean [16], in the Atlantic off West Africa [15], in the Western Pacific, and in waters around Southeast Asia [17].

Many species groups are transshipped, including highly valuable fish [18]. For example, the tuna industry is heavily involved with at-sea transshipment practices [19], likely due to the logistics of fishing for highly migratory fish. Russian pollock, crab, and salmon have also been linked to high levels of IUU fishing [20]. Transshipments are poorly monitored in Russian waters and in the Bering Sea. Legal shipments of pollock and salmon have been documented to be mixed with illegal catch during high seas transshipments before being processed in China and shipped to the United States [20]. Wild shrimp in southeast Asia is also often purchased at sea and transshipped onto vessels destined for Thailand and China, where it is processed [20].

The United Nations Convention on the Law of the Sea (UNCLOS) gave coastal nations exclusive rights to exploit and manage fisheries resources beyond their territorial waters up to 200 nautical miles (nm) off their coasts, known as Exclusive Economic Zones (EEZs) [21]. Thailand has, for instance, temporarily banned transshipment in its territorial waters and mandated Thai vessels return to port within 30 days of being at sea [22,23], while Indonesia has implemented a permanent ban on transshipment at-sea for Indonesian vessels [24]. However, national authority does not extend to the high seas, which represent around two-thirds of the ocean.

In the face of overexploitation on the high seas, the United Nations Fish Stocks Agreement (UNFSA) [25] charged Regional Fisheries Management Organizations (RFMOs), international fishing bodies comprised mostly of fishing countries and highly influenced by industry stakeholders, with the role of managing fisheries on the high seas [26]. Although most transshipments at-sea occur within EEZs, an estimated 40% of transshipments occur on the high seas, outside of the jurisdiction of national authorities, and in RFMO-managed waters [4,5]. This paper focuses exclusively on those transshipments at-sea occurring on the high seas, where RFMOs are charged with fisheries management.

Broadly, the mandate of an RFMO can vary from managing fishing for highly migratory species across large areas (commonly known as a

“tuna-RFMO”), to managing several species in a particular region. The geographic size and the number of species managed differs greatly between RFMOs. Geographically, there is considerable overlap between RFMO boundaries. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) stands apart from other RFMOs as an international conservation treaty under the Antarctic Treaty System, although it also oversees fishing in the region [27]. This study focused on the 17 RFMOs (including CCAMLR) that govern areas of the high seas (see Table 1 for acronyms and full names). RFMOs differ from the larger group of regional fishery bodies (RFBs) by their enforceable management mandates that include binding legislation over members. The legal powers of RFMOs are dependent upon the measures and mandates decided by member states and vary in strength between RFMOs, but often include provisions such as preventing suspected illegal vessels from entering ports, landing cargo, or transshipping with member vessels [28].

Despite such binding measures, it is the flag state—the vessel’s country of registry—that bears sole responsibility for enforcement on the high seas. Foreign powers are generally prohibited from boarding another state’s vessels, seizing cargo, or arresting crewmembers [28], although certain RFMOs have included high seas boarding schemes in their provisions [29]. Some flag states are notorious for loose enforcement and a lack of oversight for fishing vessels. Often, vessel owners or operators may register their vessels under the flags of these countries despite having no affiliation to the flag state through nationality or other associations. These flags are commonly known as Flags of Convenience (FOC), but have also been referred to as Flags of Non-Compliance (FONC) [30]. Vessels flying these flags have been associated with IUU fishing practices [30], maltreatment of crew [31], and pollution of the marine environment [31,32].

Previous work has shown RFMOs have failed to fulfill their mandates to conserve fish and monitor and enforce legislation. Cullis-Suzuki and Pauly [33] evaluated the performance of 14 RFMOs in regards to the status of the fish populations for which each organization was responsible. They determined that roughly 67% of managed populations were depleted or overfished, and that fish biomasses had been largely declining, with some exceptions, since 1950 [33]. An updated evaluation found similar results, with three-quarters of high seas fish populations in poor condition [34]. Similarly, a performance assessment of by-catch and discard governance measures across RFMOs concluded that RFMOs have been largely ineffective in managing by-catch [35]. This was partially attributed to inadequate observer coverage: over two thirds of RFMOs employ only 60% of the surveillance methods needed to ensure compliance with by-catch measures, although the by-catch measures themselves were also found to be inadequate.

Table 1
The Regional Fisheries Management Organizations included in this study.

Acronym	Full name	Year entered into force	Year of Partial Transshipment at-Sea Ban	Year of Total Transshipment at-Sea Ban
IPHC	International Pacific Halibut Commission	1923	–	–
IATTC ^a	Inter-American Tropical Tuna Commission	1950	2009	–
GFCM	General Fisheries Commission for the Mediterranean	1952	2007	–
ICCAT ^a	International Commission for the Conservation of Atlantic Tunas	1969	2007	–
NAFO	Northwest Atlantic Fisheries Organization	1979	–	–
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources	1982	–	–
NEAFC	North East Atlantic Fisheries Commission	1982	–	–
NASCO	North Atlantic Salmon Conservation Organization	1983	–	–
NPAFC	North Pacific Anadromous Fish Commission	1993	–	–
CCSBT ^a	Commission for the Conservation of Southern Bluefin Tuna	1994	–	–
CCBSP	Convention on the Conservation and Management of the Pollock Resources in the Central Bering Sea	1995	–	–
PSC	Pacific Salmon Commission	1995	–	–
IOTC ^a	Indian Ocean Tuna Commission	1996	2008	–
SEAFO	South East Atlantic Fisheries Organization	2003	2006	2006
WCPCFC ^a	Western and Central Pacific Fisheries Commission	2004	2010	–
SIOFA	South Indian Ocean Fisheries Agreement	2012	–	–
SPRFMO	South Pacific Regional Fisheries Management Organization	2012	–	–

^a Denotes the tuna-RFMOs.

The importance of transshipment at-sea regulations has been discussed in various articles on possible solutions to IUU fishing and fisheries overexploitation [8,36,37] and the UN FAO international plan of action on preventing IUU fishing [38]. The International Labor Organization, the United Nations Office on Drugs and Crime, and environmental NGOs emphasize the need for governance action to address labor abuses alongside overfishing and sustainability concerns, and recommend bans on transshipments at-sea to prevent conditions that facilitate abuse [5,7,12,23,39]. Civil society groups, such as Greenpeace and the Environmental Justice Foundation, have supported total bans on transshipment at-sea [23,39], citing the documented illegal fishing and human rights abuse facilitated by the practice, while others have called for strict regulation [8,36].

Here, we examine RFMO regulations related to transshipment at-sea, including measures aimed at enhancing enforcement, and how these regulations have changed over time. In 2011, McTee [40] compared transshipment at-sea regulations among the five tuna-focused RFMOs and found that partial bans on certain vessel types had been mandated in all tuna-RFMOs except the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). However, this is the first study to examine all RFMOs' regulations. This study also attempts to identify the individual transshipment vessels operating on the high seas, as well as the prevalence of transshipment vessels flying FOCs on the high seas.

2. Methods

This study reviewed RFMO websites for resolutions and official documents to evaluate the stringency of transshipment at-sea regulations within each RFMO. RFMOs were assessed according to a set of ten criteria based on Lodge et al.'s "Recommended Best Practices for Regional Fisheries Management Organizations", which offered specific recommendations for RFMOs concerning transshipments, including requirements for observers, reporting, and statistical documents (See Table 2) [41]. This study did not consider RFMO legislation relating exclusively to transshipments at-port, as these transshipments occur under a distinctly different governance and oversight context. Transshipment at-sea regulations in RFMOs were evaluated from 1990 to 2015 (there were no RFMO regulated transshipments at-sea before 1990).

The first question for evaluation was whether the RFMO was in force in a given year, and the second through sixth questions were about the stringency of policies related to regulating transshipment at-

Table 2
10 Criteria questions used to assess transshipment at-sea regulations in Regional Fisheries Management Organizations (RFMOs).

Number	Question
1	Is the RFMO in force?
2	Is transshipment at-sea regulation mentioned in official RFMO legislation?
3	Is transshipment at-sea limited to pre-approved cooperating vessels?
4	Does the RFMO require reporting of transshipments at-sea?
5	Does the RFMO require an observer during transshipments at-sea?
6	Does the RFMO require validation of statistical transshipment at-sea documents, such as the total catch and vessel number?
7	Does the RFMO require a vessel monitoring system for vessels on the high seas?
8	Does the RFMO include vessels involved in illegal transshipments at-sea on an IUU list?
9	Is transshipment at-sea prohibited for some vessels?
10	Is transshipment at-sea prohibited for all vessels?

sea, such as reporting, statistical documentation, and observer requirements. Questions seven and eight evaluated enforcement requirements for transshipment at-sea regulations through vessel monitoring systems and the sharing of IUU lists that included reports of illegal transshipments at-sea, respectively. Questions nine and ten evaluated whether RFMOs had mandated a partial or a total ban on transshipment at-sea, and whether any of the tuna-RFMOs had updated their bans since the McTee [40] study (see Table 2).

The scores for each question were added up to total to a score (out of 10) for each year, a similar method to Cullis-Suzuki and Pauly [33]. An answer of "yes" to a question meant that the RFMO received one point, while an answer of "no" to a question meant that the RFMO received a total score equivalent to the question below (i.e., a total score of 0 is the result if the answer to the first question is "no"). In certain circumstances where an RFMO was able to fulfill the requirements of a higher ranked question without fulfilling a lower requirement, the RFMO was given one point for every requirement fulfilled (consistent with [33]). If an RFMO banned transshipment at-sea for all vessels in any given year, the most intensive form of regulation, then criteria questions 3 through 6 relating to observer, authorization and reporting requirements for transshipments at-sea were not applicable. In this case the points that would have corresponded to practices during transshipments at-sea, such as reporting and observer requirements, were still added to the RFMO score to adequately reflect more intensive

regulation.

In addition, available information was compiled to describe the transshipment industry as it operates in RFMOs. Fish carrier vessels are a necessary component in the transshipment at-sea process. They receive fish from fishing vessels and freeze it to transport back to port. The International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), Western and Central Pacific Tuna Commission (WCPFC), Commission for the Conservation of Southern Bluefin Tuna (CCSBT), and the South Pacific Regional Fisheries Management Organization (SPRFMO) provide online databases searchable by the public as well as a list of all the carrier ships registered to these RFMOs and the flag state under which they operate. This information was combined with whether these flag states provide FOCs according to the International Transport Workers' Federation (ITF), which provides a list of 33 countries that provide FOCs (see <http://www.itfglobal.org/en/transport-sectors/seafarers/in-focus/flags-of-convenience-campaign/>). In recent use, the term 'flag of convenience' is inconsistently defined and is often replaced by, or used interchangeably, with the term 'flag of non-compliance' [30]. However, in the context of the term's current use by the ITF, FOC countries are generally known for failing to comply with their duties as a flag state and looser or nonexistent enforcement tactics, often by vessel owners from other nations, and at times through the establishment of shell corporations [30].

3. Results

Table 3 shows the results of the 10 criteria question evaluation for each of the 17 RFMOs in the year 2015 listed in descending order of stringency (see [Supplementary Material](#) for list of most comprehensive source on transshipment at-sea regulations for each RFMO). All RFMOs except for the International Pacific Halibut Commission (IPHC) and the Pacific Salmon Commission (PSC) include at least some mention of transshipment at-sea in mandates, resolutions, or their original convention. This is likely because IPHC and PSC stand apart from the other RFMOs in that they operate primarily within national jurisdictions. Three RFMOs received a score of < 4, meaning that transshipment at-sea was discussed in official legislation and at most reporting was required but few other regulations were in place. 12 RFMOs received a score of > 7, meaning that official legislation included several agreed-upon regulations for transshipments at-sea in RFMO waters. Regarding monitoring and enforcement legislations: 12 RFMOs currently publish and share IUU lists to prevent vessels from easily perpetrating repeat offences; 13 RFMOs express in their mandates that transshipments at-

sea are to be tracked by vessel monitoring systems; and 10 RFMOs require that transshipments at-sea are conducted with an observer present.

The most stringent transshipment at-sea regulations – i.e., bans on transshipment by certain or all vessels – are however only present in six RFMOs, and only one of these RFMOs, the South East Atlantic Fisheries Organization (SEAFO) off the coast of Southwest Africa, banned transshipments at-sea for all vessels in 2006. The partial ban on vessels in the other five RFMOs: General Fisheries Commission for the Mediterranean (GFCM), Inter-American Tropical Tuna Commission (IATTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), Western and Central Pacific Tuna Commission (WCPFC), excludes large-scale pelagic long-line vessels (LSPLVs) in all cases. LSPLVs are, however, often the vast majority of fishing vessels, and therefore most vessels are excluded from the transshipment at-sea ban. In the WCPFC, for example, 58% of registered vessels are LSPLVs, while less than 1% are purse seiners. IOTC, ICCAT, and GFCM ban transshipment at-sea for all vessels except LSPLVs. GFCM additionally banned all transshipments at-sea of bluefin tuna. WCPFC and IATTC ban transshipment at-sea for purse seine vessels, and IATTC additionally bans transshipment at-sea for small longline vessels [40].

Transshipment at-sea regulations generally started increasing in the late 1990s (Fig. 2), and regulations never decreased in stringency for any RFMO. None of the tuna-RFMOs included any regulations on transshipment before 1997, and currently four of them – IATTC, ICCAT, IOTC, and WCPFC – include at least some bans. The mandates for transshipment at-sea regulations in the non tuna-RFMOs followed a pattern generally similar to the tuna-RFMOs: Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), North East Atlantic Fisheries Commission (NEAFC), and Northwest Atlantic Fisheries Organization (NAFO) improved the stringency of their regulations through the early 2000s, while GFCM started matching its transshipment at-sea regulations to ICCAT's models in 2007. The Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea (CCBSP) has included stringent regulations of transshipments at-sea since its original convention in 1995, while the North Atlantic Salmon Conservation Organization (NASCO) included mandates acknowledging and requiring the reporting of transshipments at-sea in 1992 but has not updated regulations since then.

The online databases of ICCAT, IOTC, CCSBT, WCPFC, and SPRFMO showed that as of November 2016, there were 472 carrier ships with current registrations in these five RFMOs (see [Supplementary Material](#)). This includes 401 registered vessels in the WCPFC, 81 in ICCAT, 68 in

Table 3
Transshipment at-sea Regulation Scores based on 10 Questions in the Year 2015 for 17 Regional Fisheries Management Organizations (RFMOs).

RFMO	RFMO in force	Regulation mentioned	Only cooperating vessels	Reporting required	Observer required	Statistical documents	VMS	IUU list	Some vessels prohibited	All vessels prohibited	Total Score
SEAFO	1	1	n/a	n/a	n/a	n/a	1	1	1	1	10
IATTC	1	1	1	1	1	1	1	1	1	0	9
ICCAT	1	1	1	1	1	1	1	1	1	0	9
IOTC	1	1	1	1	1	1	1	1	1	0	9
GFCM	1	1	1	1	1	1	1	1	1	0	9
WCPFC	1	1	1	1	1	1	1	1	1	0	9
CCAMLR	1	1	1	1	1	1	1	1	0	0	8
CCSBT	1	1	1	1	1	1	1	1 ^a	0	0	8
NAFO	1	1	1	1	1	1	1	1	0	0	8
SPRFMO	1	1	1	1	1	1	1	1	0	0	8
CCBSP	1	1	1	1	1	1	1	0	0	0	7
NEAFC	1	1	1	1	0	1	1	1	0	0	7
NPAFC	1	1	1	0	0	0	0	1	0	0	4
SIOFA	1	1	0	1	0	0	1	0	0	0	4
NASCO	1	1	0	1	0	0	0	0	0	0	3
IPHC	1	0	0	0	0	0	0	0	0	0	1
PSC	1	0	0	0	0	0	0	0	0	0	1

^a There are currently no vessels listed on the CCSBT IUU List.

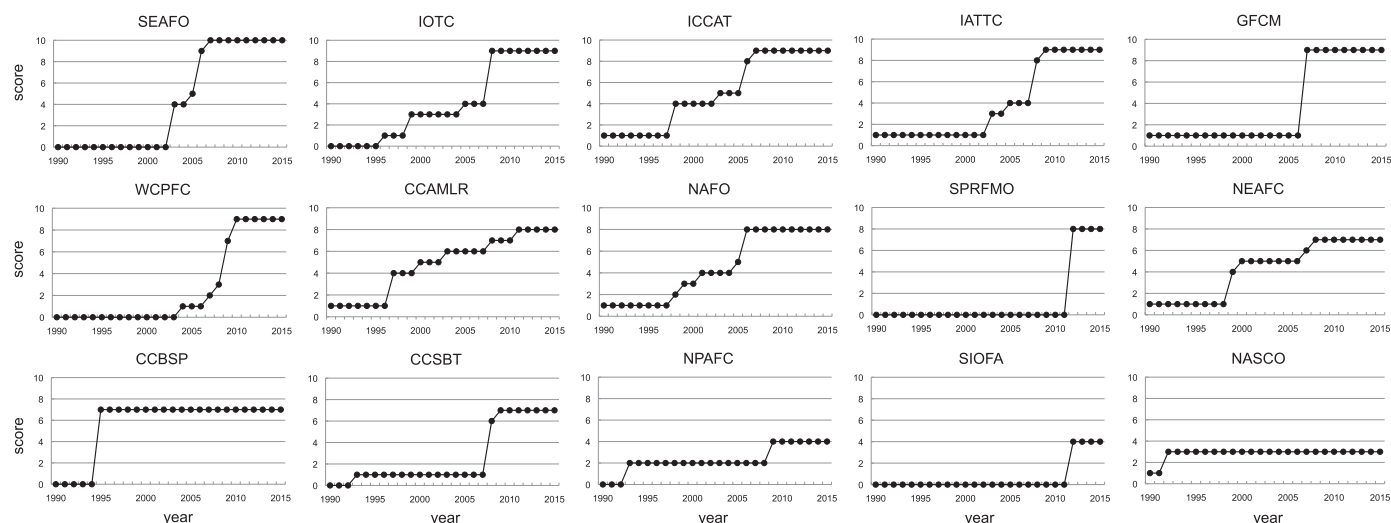


Fig. 2. Transshipment at-sea evaluation scores from 1990 to 2015 in all Regional Fisheries Management Organizations that have included transshipment at-sea regulations in official policies or mandates.

the IOTC, 79 in SPRFMO, and 37 in CCSBT. In terms of overlap, 102 ships are registered to more than one RFMO, with 40 registered to two RFMOs, 39 to three RFMOs, 16 to four RFMOs, and 7 to all five RFMOs. The WCPFC lists which carrier vessels are authorized for transshipment. Of the 401 WCPFC registrations, there are 274 fish carrier vessels listed as authorized to transship in the WCPFC, 58 listed as not authorized to transship in the WCPFC, and 69 with no information included in their online entry. Though these data are not comprehensive, and not all fish carriers engage in at-sea transshipment, this suggests that the transshipment industry operates on a large scale and that transshipment occurs in many high seas regions. Of the 472 ships, 169 are flagged to FOC states: 119 are flagged to Panama, 30 to Liberia, 16 to Vanuatu, one to Belize, one to the Marshall Islands, one to St. Vincent and Grenadines, and one to Malta.

4. Discussion

Transshipment at-sea is widely practiced on the high seas. Global Fishing Watch [4] found that 40% of transshipments at-sea are occurring on the high seas and identified 794 refrigerated carrier vessels worldwide, estimating this number to be about 90% of the globally active carriers – our smaller finding of 472 carrier vessels active in at least five RFMO areas is roughly consistent with the possible high seas transshipment fleet. Our results also show that over one third of fish carriers registered in five RFMOs are operating under FOCs, which are infamous for inadequate enforcement to prevent IUU fishing.

Most RFMOs have increasingly recognized the need to regulate transshipments over the last two decades to prevent associated IUU fishing. Six RFMOs have mandated a limited ban on transshipments at-sea for some vessels, but only one RFMO, SEAFO, has mandated a total ban. Despite increasing regulations and vessel-specific bans over the last two decades, transshipment at-sea is still recognized as a vector for IUU fishing and other crime on the high seas [19,42]. Moreover, high levels of transshipment at-sea activity and associated IUU fishing and human rights abuse have been documented particularly in tuna-RFMO waters [9,12,23] even with the adoption of vessel-specific bans; this indicates that limited partial bans are likely not enough to prevent IUU fishing and other high seas crimes during transshipments at-sea. Note that mandates of transshipment at-sea regulations do not necessarily imply implementation or compliance with these measures, but are indicators of the intended strength of the legislation. The extent of implementation of transshipment at-sea mandates is worth further study.

Divergent governance approaches among RFMOs, such as the

disparity in the legality of transshipment at-sea, have also been criticized for causing the congregation of illegal activity in areas with poorer governance [43], and a uniform moratorium on transshipment at-sea across RFMOs would help align and unify governance on the high seas. RFMOs might follow SEAFO's approach, which in 2006 first mandated an interim prohibition of transshipment at-sea, before adding a permanent prohibition of transshipment at-sea to its Conservation and Control Measures in 2015 [44]. SEAFO's interim prohibition on transshipments at-sea in 2006 stemmed from a "recogni[tion] [of] the lack of a comprehensive monitoring, control and surveillance system, in particular, at sea" [45]. The decision to add a permanent prohibition of transshipment at-sea to SEAFO's Conservation and Control Measures was made due to the perceived success of the interim prohibition; a detailed study on the impacts of the prohibition has not been conducted and would be desirable.

From the legal standpoint, RFMOs' governance structures present an obstacle to a complete prohibition on transshipment at-sea. RFMOs are typically overseen by a Commission. The Commission comprises representatives from all members, non-contracting parties, and some observers. Members can make proposals or recommendations at the Commission's annual or biannual meetings (in some cases, special meetings can be called). The number of contracting parties required to carry a recommendation into force varies from a simple majority (e.g. ICCAT), to a two thirds majority (e.g. IOTC), to a consensus-based/unanimous agreement (e.g. CCSBT, SEAFO, and WCPFC). In the case of ICCAT and IOTC, members have a time window in which they can object to a particular measure; if a member objects, it will not be bound. These procedures would make a comprehensive and binding ban on at-sea transshipment difficult to pass in RFMOs containing states whose fishing fleets rely on transshipment. In a consensus-based system, a holdout state can prevent a ban from being created. In a majority voting system, states that opt out will not be bound.

The economic costs to fishing vessels of a moratorium on transshipment at-sea pose a challenge to member agreement on a prohibition. During its discussions on whether to impose prohibitions for certain vessels to transship at-sea, the WCPFC specifically noted that "determining the practicability of high seas transshipments" involved an evaluation of whether prohibition would "cause significant economic hardship" or force a vessel to "make significant and substantial changes to its historical mode of operation" [46]. However, focusing attention on the convergence of crimes facilitated by transshipments at-sea, and the profit losses that could be associated with a failure to address these issues, may be an effective approach in having RFMOs consider a moratorium on transshipment at-sea while further studies on economic,

social and ecological impacts are conducted.

Recent developments suggest transshipment at-sea will come under increasing pressure from all aspects of society, including: increased public attention surrounding the issues of slavery in the seafood industry [14]; the pressure from the European Union on Thailand to tackle human rights abuses in its fisheries with the threat of an import ban [47]; the Marine Stewardship Council, the main eco-certification scheme for capture fisheries [48], is committed to traceability, which transshipment undermines; Thai Union, one of the world's largest seafood companies, stopped buying fish from vessels involved in transshipments at-sea in Thailand's territorial waters in 2014, and committed in 2015 to ban transshipment at-sea in its global tuna supply chain, although this commitment has not yet been realized [49,50]; Mars and Nestlé, two companies that sell fish, pledged to fully eliminate and suspend transshipped seafood from their supply chain, respectively [50]; and U.S. President Obama's authorization of a bill to prevent products produced under indentured servitude and slave-like conditions from being imported into the United States [51]. These developments will put pressure on fishing that fails to address human rights abuse and may also put pressure on RFMOs to enact measures that would help prevent human rights abuse in their convention areas. None of the RFMO conventions include any mandates on labor protections for crewmembers aboard fishing vessels, although there have been recent discussions of human rights abuses on the high seas at a WCPFC meeting to address increasing concerns in their management area [52].

Österblom and Bodin [53] theorized that a narrative of “organized crime” in the fishing industry is an effective means of mobilizing governance. They argued that an “organized crime” frame was behind effective political mobilizations to reduce IUU fishing in the Southern Ocean, the area managed by CCAMLR. The use of the “organized crime” narrative in relation to IUU fishing has not been widely adopted in regional governance discussions in areas outside of the Southern Ocean, and there may be an opportunity for garnering political support for improved governance efforts in other RFMOs [8]. The “organized crime” frame could be invoked to tie IUU fishing to human, drug, arms, and wildlife trafficking in RFMOs and potentially strengthen the case for a moratorium on transshipment at-sea as a means of tackling human rights abuse and other illegal activity on the high seas.

Stringent transshipment at-sea regulations, as opposed to a ban, do not necessarily address human rights abuse as legal transshipments at-sea could conceivably still allow vessels to trap and abuse workers under the current regulatory system. UNCLOS includes provisions for flag states to ensure that vessels flying their flags maintain standards for safety at sea, including safe labor conditions for crewmembers, but these are not part of the official duties of RFMOs [21]. UNCLOS also prohibits the transport of slaves aboard vessels on the high seas, and gives a foreign power the right to board a vessel that is suspected of carrying slaves. However, this provision has never been invoked to board a vessel suspected of trafficking in persons [28]. The International Convention for the Safety of Life at Sea (SOLAS) entered into force in 1974 with the aim of standardizing safety equipment and operational standards to protect seafarers and workers on the oceans. However, the mandates are limited to merchant vessels and do not apply to fishing vessels or protect fishermen [54]. The Maritime Labor Convention, which entered into force in 2013, also does not apply to vessels engaged in fishing [12], and although the Work in Fishing Convention under the ILO will enter into force in 2017, it has taken a decade to obtain only the ten ratifications needed for this to happen. Once in force, this Convention will so far only be binding on the countries that have ratified it [55]. RFMOs are well placed to help address human trafficking on the high seas through a uniform moratorium on transshipment at-sea, as fishing vessels would be forced to return to port and fishermen could not legally be trapped at sea.

It is important to note that mandates of transshipment at-sea moratoria would be insufficient without proper enforcement and compliance. This is an issue that has been particularly pronounced in

a management context as challenging to oversee as the high seas [56]. Illustrative of the gaps in control, in 2015, the Taiwanese fishing vessel *Hung Yu 212* received a new authorization for transshipment at-sea with the refrigerated cargo vessel *Tuna Princess* [57], despite being previously cited for IUU infractions [58,59]. The *Hung Yu 212* was also involved in the human trafficking of Filipino fisherman Eril M. Andrade [60]. Differing enforcement measures among flag states have also led to the registration of vessels under FOCs – our results show that 36% of the carrier vessels listed in five RFMO databases are registered to FOCs – and states that offer FOCs may prove unable or unwilling to enforce a transshipment ban. The Port State Measures Agreement, which came into force in June 2016, may address some of these issues, as carrier vessels entering ports without adequate transshipment paperwork consistent with the fish being offloaded could be caught for illegal transshipments, regardless of whether the carrier vessel was flagged to an FOC country [61]. However, a 2017 report by Oceana found that three of the eight countries that the refrigerated cargo vessels that engaged in likely transshipments visited most frequently (China, Ivory Coast, and Taiwan) have not yet ratified the Port States Measures Agreement [5]. More widespread ratification of this agreement is necessary to ensure it can effectively address illegal transshipments at-sea.

Global satellite technology to track vessel movements is one new and obvious way to monitor compliance with a moratorium on transshipments on the high seas. One means of satellite tracking involves using Vessel Monitoring Systems (VMS), which were initially designed to assist in maritime traffic management and to locate ships in distress. Effective fishery governance strategies utilize the system for monitoring, control, and surveillance measures, reducing flags and ports of convenience, and improving international law enforcement of IUU fishing [35,62,63]. The large number of RFMOs that include mandates requiring VMS indicates that improved satellite tracking technology could enhance enforcement operations. However, while RFMOs can require cooperating vessels to use VMS, this information is received by the flag-state and not necessarily shared with all other members of the RFMO or independent monitoring organizations [56]. Automatic ship identification systems (AIS), which are publicly broadcast unlike VMS, and are therefore more easily pooled across jurisdictional regions, may be able to fill some of the gaps in ocean enforcement [4], although tampering with these technologies remains an issue [56]. Policy reforms are required to ensure proper and comprehensive use of AIS technologies aboard fishing vessels and attention on improving enforcement is crucial to achieving goals of sustainable ocean management [56]. A moratorium of transshipment at-sea is likely the most effective kind of transshipment regulation in terms of facilitating enforcement and would enhance the effectiveness of satellite monitoring tools, as any satellite-sighted transshipments could immediately be tagged as IUU activity. Combined with improved satellite technology, the moratorium would also prevent vessels previously cited for IUU fishing, such as the *Hung Yu 212*, from being permitted to continue transshipping at-sea.

5. Conclusion

The RFMOs around the world are in a unique position with respect to transshipment, and are likely to come under increasing pressure to address this activity for both ecological and sociological reasons. Given the increased overexploitation of high seas fish [1], sizable economic losses to illegal fishing globally [10], documented IUU fishing associated with transshipments on the high seas [19], and ever-increasing concerns about forced labor [2,23], it would be prudent to invoke the precautionary principle and instate a moratorium on transshipment at-sea across all RFMOs. While most RFMOs have improved transshipment at-sea regulations over the last two decades, a moratorium on transshipment at-sea would provide the best ecological and social outcome for high seas fisheries. A total ban on transshipment at-sea is a primary

way to ensure that human trafficking can be combated alongside preventing the laundering of IUU catch.

The socioeconomic effects of an RFMO-wide moratorium would likely be fairly immediate, as vessels would be routed into EEZs and return to port more frequently, which would likely increase the costs of fishing but also improve trafficked fishers' opportunities of notifying authorities of human rights abuses. Ecological effects, however, would likely only become apparent over time, if the moratorium on transshipment reduced overfishing and IUU fishing. Reduced fishing pressure on the high seas could also offset economic losses of a ban on transshipment at-sea if fishing within EEZs subsequently becomes more productive. RFMOs might adopt a precautionary approach similar to SEAFO's, which included an interim prohibition on transshipment at-sea before implementing a permanent ban. The issue of IUU fishing and human rights abuses on the high seas deserve urgent attention, and a moratorium on transshipment on the high seas is one way to address both issues.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.marpol.2017.04.004](https://doi.org/10.1016/j.marpol.2017.04.004).

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