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Subsidies and allocation: A legacy of distortion and intergenerational loss

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One of the greatest threats to the conservation of transboundary stocks is the failure of Regional Fisheries Management Organizations (RFMOs) to equitably allocate future fishing opportunities. Across RFMOs, catch history remains the principal criterion for catch allocations, despite being recognized as a critical barrier to governance stability. This paper examines if and how subsidies have driven catch histories, thereby perpetuating the legacy of unfair resource competition between distant water fishing nations (DWFNs) and coastal States, and how this affects ongoing allocation negotiations in the Indian Ocean Tuna Commission (IOTC). Using limited publicly available data on subsidies to Indian Ocean tuna fleets, we show that subsidies have inflated catch histories of many DWFN's. As long as historical catch remains the key allocation criterion, future fishing opportunities will continue to be skewed in favor of DWFNs, in turn marginalizing half of the IOTC member States, which collectively account for a paltry 4% of the current catch. Without better transparency in past subsidies data, accounting for this distortion will be difficult. We provide alternative allocation options for consideration, with our analysis showing that re-attributing DWFN catch to the coastal State in whose waters it was caught may begin to alleviate this historical injustice.

KEYWORDS

allocation, catch history, equity, fishing opportunities, Indian Ocean Tuna Commission, intergenerational equity, subsidies, transboundary

Introduction

In international law, it is recognized that equal treatment can lead to inequitable outcomes (Shelton, 2007). Differentiating the most vulnerable, marginalized, and underdeveloped communities in policy decisions, thus, has been the norm, particularly for transboundary resources (Article 24 of UN Fish Stocks Agreement; UNFSA).

However, while international agreements may enshrine the principles of equitable access to shared ocean resources, in practice, these resources are often accumulated by a few (Österblom et al., 2020; Havice and Campling, 2021). Some critics have argued that this is due to existing political and economic systems, historical legacies, and existing norms (Österblom et al., 2020). Others have argued that it is due to economic and power asymmetries (Sumaila et al., 2015; Havice, 2021) with the allocation of future fishing opportunities historically favoring more advanced fishing nations (Hanich and Ota, 2013; Seto et al., 2021).

The reality may be that it is a combination of these factors, but it is this last point—i.e., how the allocation of fishing opportunities shapes equitable access—that we wish to examine here. Specifically, the relationship between past subsidization and future allocations. Subsidies, here, refer to financial contributions by government that confer benefits to a specific entity or industry. In fisheries, subsidies generally support a reduction in capital or operating costs, with the goal of either developing additional or maintaining existing capacity. Globally, it is estimated that upward of US$ 22 billion is spent on these types of capacity-enhancing subsidies annually (Sumaila et al., 2019).

Apart from the negative environmental impacts associated with overfishing that excess capital infusions encourage, subsidies pose barriers to attaining more equitable fisheries (Österblom et al., 2020). In the case of transboundary tuna fisheries, where resources are exploited by multiple countries, subsidized fleets outcompete non-subsidized ones, by operating at a capacity beyond what the economics of the fishery would otherwise dictate (Sala et al., 2018). This, in turn, can reduce the profitability for non-subsidized fleets (Ruseski, 1998; Schuhbauer and Sumaila, 2016) as productivity of the exploited tuna stocks are diminished (i.e., overfished).

While much of the discussion around the role of fisheries subsidies focuses on environmental outcomes, this contribution will examine another aspect: misrepresentation of catch history of the fishery and perpetuation of the legacy of unfair resource competition between wealthy distant water nations (DWFN) that were able to support the expansion of their fleets, and coastal states without such means nor opportunities (Sumaila and Vasconcellos, 2000). Specifically, we examine these effects in the ongoing negotiation for the allocation of future fishing rights at the Indian Ocean Tuna Commission (IOTC).

Management of tuna fisheries in the Indian Ocean

As highly migratory species that are exploited across multiple jurisdictions by coastal and foreign fleets, management and conservation of tuna and tuna-like species requires multi-national coordination (Bailey et al., 2010). The UN Convention on the Law of the Sea (UNCLOS) and its implementing agreement, the UNFSA, thus, mandate States to jointly manage their fleets through Regional Fisheries Management Organizations (RFMOs). However, in adopting measures for the conservation and management of these species, the UNFSA mandates that the special requirements of developing States are taken into account (Sinan et al., 2021a).

In the Indian Ocean, the IOTC is tasked with such responsibilities. Currently, the IOTC has a membership of 30 States: 23 coastal States and seven DWFN[1]. Given the diverse socio-economic conditions and national interests of these members, the IOTC, which requires in the majority of the cases that its management measures are based on consensus, has often fallen short in achieving its objectives, i.e., *"ensuring [. . .] the conservation and optimum utilization (Art V.1)"* of tuna stocks whilst ensuring *"the equitable participation of Members [. . .] in the fisheries and the special interests and needs of [. . .] developing countries. (Art V.2(b))"* (IOTC, 1993). There are clear disparities in catch and fishing capacity between the IOTC member States (Figures 1A,B). In 2018, half of the IOTC Member States accounted for 95% of the total catch, and of the highest valued species, with nearly one-third of tuna caught by DWFNs. Similarly, nine member States accounted for 95% of the total fishing capacity, while coastal developing States with negligible fishing capacity, such as Mozambique and Somalia, are often marginalized in the negotiations at the IOTC, despite their strong aspirations to engage in and develop their domestic fleets (Sinan et al., 2021b). Subsidies, if they remain unconstrained, are likely to further exacerbate these disparities as some IOTC member States are also large subsidizing nations (Figure 1C).

IOTC allocation negotiations and catch history

Due to increasing concerns over tuna stock status—seven stocks are overfished with overfishing occurring on skipjack (IOTC, 2020b)—the IOTC launched a new round of negotiations in 2010 to create a mechanism for allocating annual fishing opportunities, i.e., shares of the total allowable catch (Sinan and Bailey, 2020). The negotiations have matured in the last few years with proponents of the proposals putting weights (percentages) for each principle or criteria (Table 1). To date, proposed criteria by IOTC members can be broadly grouped into six categories: catch history; development status; equality; food, livelihood and economic dependency; considerations for members with no capacity or history of tuna fisheries but,

1 Distant water fishing nations are referred to States that do not have a coastline in the ocean space managed by the RFMO, but fish in those areas. Furthermore, under the EU membership, France, Italy, Portugal, Spain, La Reunion, and Mayotte operate in the Indian Ocean.

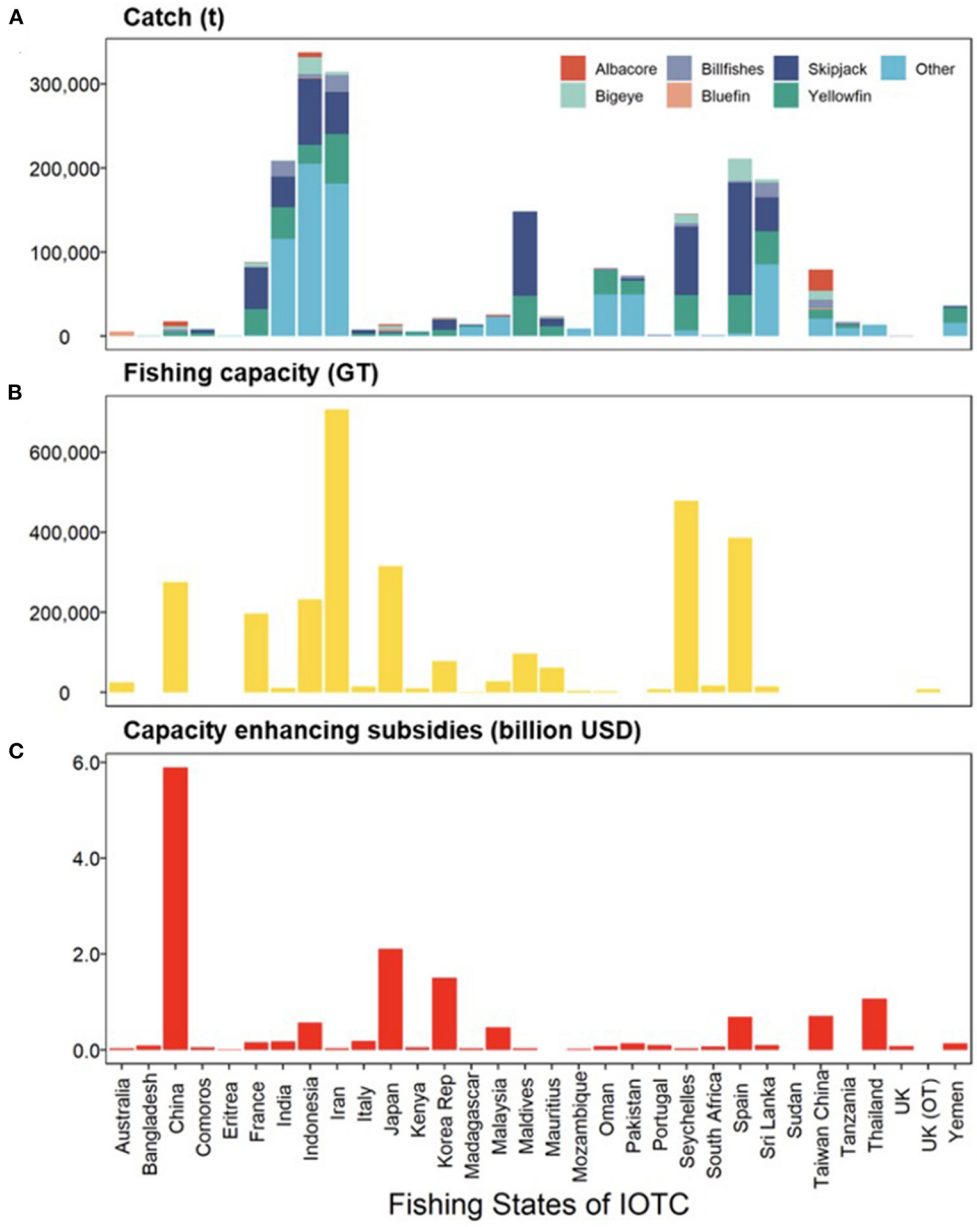

FIGURE 1
In 2018 Indian Ocean tuna catch **(A)** and fishing capacity **(B)** reported by the IOTC member States (IOTC, 2019, 2020a) and estimated total capacity-enhancing subsidies [**(C)**, Sumaila et al., 2019]: Total fishing capacity is reported, in gross tonnage (GT) of vessels above 24 m and vessels below 24 m operating in the high seas. The total catch for 2018 was 2.1 million metric tons and the total fishing capacity was 423,716 GT. Capacity-enhancing subsidies are defined as public payments for boat construction, renewal, and modernization; fishing access agreements; development programs; port development, infrastructure for market and storage, fuel subsidies and non-fuel tax exemptions. Note that the subsidy estimates represent subsidies provided to all domestic fleets and not explicitly for tuna fleets operating in the Indian Ocean. It is estimated that these countries spent around US$15 billion in 2018 on capacity-enhancing subsidies.

nonetheless, with aspirations to do so, and other "correctional factors" based on past scientific and financial contributions, and dependency on tuna imports for all members (IOTC, 2020c).

Key coalitions have emerged since 2018, coalescing around two sets of proposals—those submitted by the Maldives and the European Union (EU) (Table 1). The Maldives' proposals, with the support of 11 coastal member States, center on the rights of coastal States and the significance of their national waters to tuna fisheries, including those without a history of industrial/commercial catch. Thus, they propose

TABLE 1 Proposals submitted to the IOTC on the allocation of fishing opportunities since 2010 (IOTC, 2020c).

Proponent	Year	Baseline historical years	Historical Catch	Coastal States	Correctional factors	Dependency	New Entrants	All member States
Indonesia	2011	1999–2009						
Seychelles	2011	1981–2010						
Iran	2011	2000–2009	100%					
Korea	2011	1960–2009						
EU	2011	NA						
Japan	2012	NA	97%				3%	
Seychelles	2012	1981–2010						
EU	2012	2001–2011					3–5%	
Iran	2012	2001–2011						
Indonesia	2016	2010–2015					2.5–10%	
Iran	2016	2005–2015						
EU	2016	2005–2015					3–5%	
Seychelles	2016	1981–2010						
EU	2018	2000–2016	85%	8%	6%		1%	
Maldives	2018	NA						
EU	2019	2000–2016	85%	8%	6%		1%	
Maldives*	2019	2012–2016 2002–2016 5 best years from 1950 to 2016	60–80%	4.5–45%		4.5–20.5%		2.5%—7.5%
EU	2020	2000–2016	80%	12%	7%		1%	
Maldives**	2020	2012–2016 2002–2016 5 best years from 1950 to 2016	65%	8%	15%	7%		5%
Chair	2021	2012–2016 2002–2016 5 best years from 1950 to 2016						

Proposals that did not explicitly address the allocations between member States were not included. The nature of proposed mechanisms was identified by six categories of approaches: historical catch, coastal states, all member states, correction factors, dependency and new entrants (see text for explanation of these categories). Numbers (in percentage) represent the contribution (i.e. weighting) of these approaches to the final allocation. Gray shade implies that the proposal explicitly identified these approaches without detailing their contribution. Black shade indicates that the approach was not included in the proposal. The * symbol indicates that it was supported by 10 coastal States and the ** symbol indicates that it was supported by 11 coastal States.

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to curtail the impact of catch history on future allocations by giving higher weights to other considerations, including a proposal that allocations will not be reduced by more than 5% from baseline. Meanwhile, the EU, representing DWFNs, has proposed that catch history be the most important factor.

As the negotiations progressed, the EU reduced the weightings of catch history (from 85 to 80%) and increased the weightings for coastal States (from 8 to 12%; Table 1). The central difference between the two proposals is how tuna catches are attributed and how significant of a role such catch histories should play in defining future catch allocations (Abolhassani, 2018; Andriamahefazafy et al., 2020; Sinan and Bailey, 2020). While both groups recognize the role of catch history in future allocations—protecting their past investments in the development of Indian Ocean tuna fisheries (DWFNs), and the recognition of the social, cultural and economic importance and dependency of these countries to tuna fisheries (coastal States)—the significant difference is in how catch history is to be calculated and weighed. Moreover, in the Maldives proposals, catches taken within national waters of member States are to be attributed to the coastal State regardless of the nationality of the vessels, while in the EU proposals, catches are to be attributed to the flag States of the vessels regardless of the location of the catch (Sinan and Bailey, 2020).

Another area of disagreement is the catch history timeframe. The Maldives have proposed three timeframes— ive-year average (2012–2016), 15-year average (2002–2016), and best five years averaged from within the period between 1950 and 2016—while the EU has proposed an average from 2000 to 2016. Countries with an established history of fishing in the Indian Ocean prefer an extended timeframe, whereas countries that lack such history or have recently developed their fleets desire a shorter timeframe. For example, under the EU proposal, Japan's yellowfin tuna catch history baseline for a longer period (2000–2016) would be 11,095t whereas, under the recent five-year average proposal (2012–2016), it would be 3,751t. India, on the other hand, would increase their baseline by 50% if the 5-year average is used as opposed to the 15-year average (Figure 2).

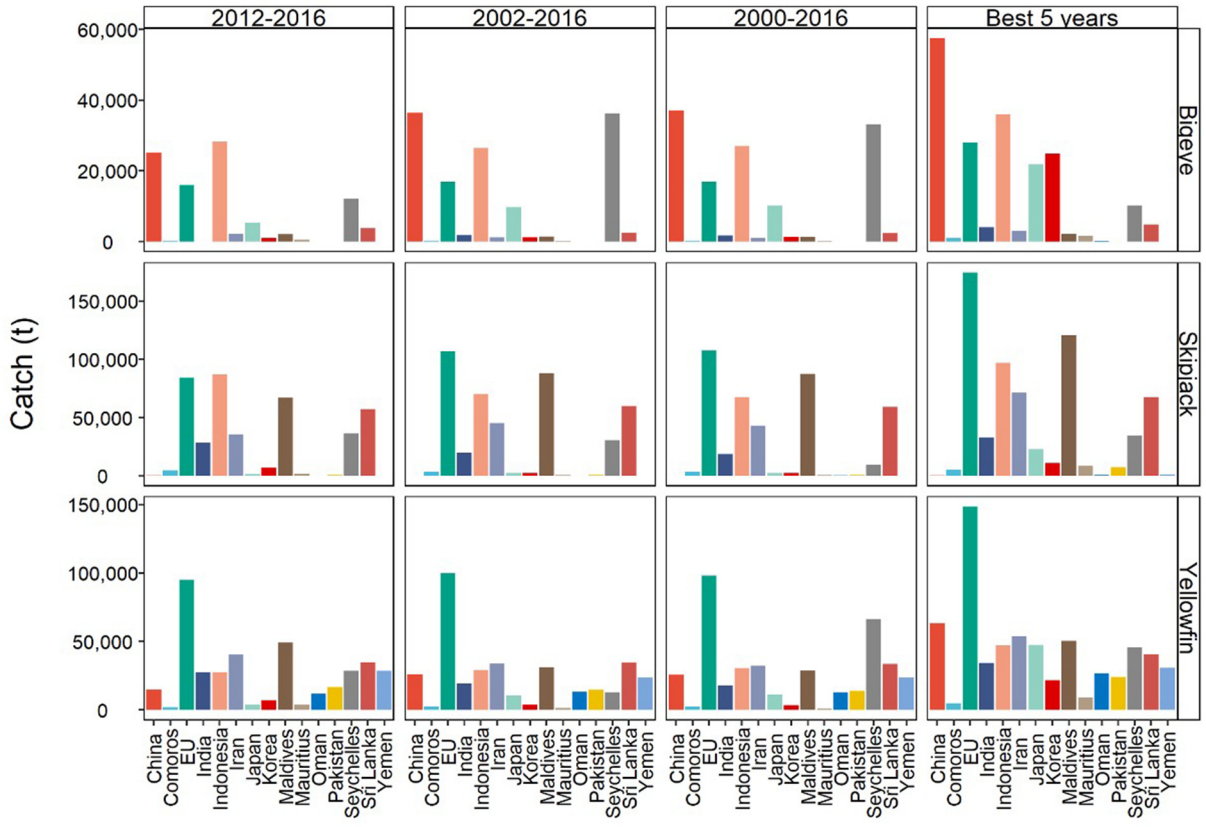

FIGURE 2
Top 10 countries catching tropical tuna (bigeye tuna, skipjack tuna and yellowfin tuna) in the Indian Ocean and the baseline catch histories that go into the calculation of the allocation mechanisms for the two proposals proposed in 2020 (IOTC, 2020a). Coastal countries have proposed three baselines (2012–2016, 2002–2016, and average of the best five years from 1950 to 2016). The EU has proposed the baseline from 2000 to 2016.

Since catch history has a significant weight, fishing opportunities would be largely allocated to States with current operations. For example, in the case of yellowfin tuna, the EU is allocated nearly one-fourth of the total allowable catch under its proposal (Figure 3). In the Maldives proposal, tuna caught in national waters is attributed to the coastal States. Thus, despite 65% of the total allowable catch being allocated based on catch history in this proposal, the allocation for the EU decreases significantly (Figure 3), as nearly half of the yellowfin caught by the EU fleet during 2000–2016 was in the EEZs of coastal States (IOTC, 2020a). As a result, aspiring coastal States and Small Island Developing States in the Indian Ocean benefit significantly (Figure 3).

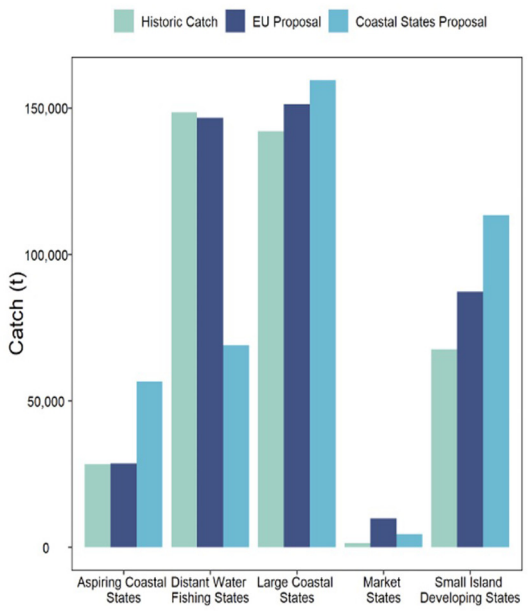

FIGURE 3
Average yellowfin tuna catch between 2000–2016 and the simulated allocation of yellowfin tuna catch under the EU and the coastal States proposal for the categories of countries used by Sinan et al. (2021b) in the IOTC (Details are provided in the Supplementary material).

Catch history built on subsidies

Irrespective of which proposals gain consensus, it is highly likely that the allocation of future fishing opportunities will be closely linked to catch history. Yet, this is distorted by the fact that some countries, particularly DWFNs, had the means to subsidize the development of their fleet in the past, while others did not.

For example, out of the entire EU fleet that operated in the Indian Ocean (IO) (63 vessels, 85,320 Gross Tonnage: GT), at least half of the vessels that operated in 2019 (69% of the gross capacity of the fleet) were subsidized for their construction and modernization *via* funds from EU's Financial Instrument for Fisheries Guidance (FIFG; Table 2). Between 2005 and 2019, the EU fleet in the IO caught nearly a quarter of the highest valued species managed by IOTC, i.e., tropical tuna (skipjack, yellowfin and bigeye). During this period, the EU fleet caught on average over 240,000t/year, 96% of which were caught by purse seiners. In 2019, for the EU purse seine fleet operating in the IO at least 82% of Spanish and 57% of the French gross capacity was constructed or modernized through subsidies. Furthermore, from 2000 to 2006, under the FIFG program, the EU spent EUR 883 million on fishing vessel construction (Skerritt et al., 2020). The EFF allocated an additional EUR 172 million from 2007 to 2013 and EUR 86 million under the European Maritime Fisheries Fund (EMFF) from 2014 to 2020, for vessel modernization and replacement (Skerritt et al., 2020).

For the identified 31 subsidized vessels in this study, the EU spent at least EUR 63 million for their construction and modernization. Another EUR 12.59 million was spent by national governments (i.e., France and Spain), totalling EUR

TABLE 2 Average catch, capacity of vessels (gross tonnage), and evidence linked capacity enhancing subsidies (vessel construction and modernization) spent through the European Union funds and member States contributions between 1998 and 2006.

Country	Vessel type	Avg catch (*t*)	Gross tonnage (GT)	Subsidized GT	EU subsidy (EUR)	Country specific subsidy (EUR)	Total subsidy (EU)
Spain	Purse seine	157,783	49,504	40,784	26,172,452	9,646,303	35,818,755
Spain	Longline	6,912	3,058	2,135	4,433,980	684,105	5,118,085
Spain	Supply vessels	-	2,535	-	-	-	-
France	Purse seine	69,188	27,196	15,618	32,251,588	1,976,559	34,228,147
France	Longline	1,557	890	162	523,666	284,293	807,959
Italy	Purse seine	5,471	2,137	-	-	-	-
Total		240,911	85,320	58,699	63,381,686	12,591,260	75,972,946.00

75.97 million as construction and modernization subsidies (Table 2). Vessel-specific EU subsidies were obtained from the published datasets for the EMFF by the European Commission for all member States, fishsubsidy.org[2] dataset and data compiled from other published reports. Importantly, these figures do not account for close to EUR 250 million that EU has paid to Comoros, Madagascar, Mauritius, and the Seychelles since 1986 (first agreement, with Madagascar), so that its fleet could operate under fishing access agreements (Le Manach et al., 2013).

While no records of subsidization specific to IOTC tuna fleets were available, similar histories of fleet subsidization can be seen in other DWFN. The Chinese government has prioritized the development of its distant water fleet since 1983, implementing capital credit and other fiscal measures, as well as through fuel subsidies (Mallory, 2016). These policies significantly increased the distant water fishing capacity in China, doubling its fleet from around 1,200 vessels in 2012 to 2,500 vessels in 2017 (Yu and Han, 2021). China continues to provide vessel construction subsidies, including US$660 million in 2017 (OECD, 2021). While we cannot ascertain what proportion of these subsidies were allocated toward its IO fleet, nor whether these programs directly contributed to the development of the IO Chinese fleet, Chinese longline fleet capacity did undergo a major expansion from 2012 to 2017, with its GT doubling from 17,981 GT to 36,214 GT. The Chinese tuna catch in the IO also nearly tripled (5,143t−13,794t) during this period.

Similarly, the Republic of Korea provided US$1.75 billion in fisheries subsidies in 2009, of which 45% were fuel subsidies (Lee and Choi, 2017). From 2010 to 2012, its distant water fleet received on average US$818 million as subsidies (Park, 2013). Vessel modernization and other fixed cost subsidies for the Korean fleet have continued, and in 2017, Korea spent around $948 million on these subsidies (OECD, 2021). In 2019, Korea operated 13 fishing vessels (11,082GT), out of which six vessels (5,309 GT: 48% of the total Korean capacity) belong to Dongwon Industries Co., Ltd and four vessels belong to Dongwon Fisheries Co., Ltd (4,320 GT: 39% of the total Korean capacity) in the IO. Between 2010 and 2012, the two companies received public payments of around $238 million for vessel and equipment modernization, foreign market, and investment development abroad (Park, 2013).

Japan currently does not have any subsidy programs specific to its distant water tuna fleets; however, the expansion of the distant water fleets had been a major component of its fisheries development policies in the second half of the twentieth Century (Swartz et al., 2010), and these vessels continue to qualify for various government-sponsored fisheries loan programs in support of fleet investment (JFC, 2020).

Developing countries have also increased the level of capacity enhancing subsidies in the last few years (Sumaila et al., 2019), however vessel level subsidies data was unavailable from these countries. For example, the Indonesian industrial (> 60GT) fleet is also publicly supported *via* fuel subsidies (Yusuf et al., 2015), but it is not possible to ascertain other capacity enhancing subsidies or how much was spent for Indonesian vessels operating in the IO.

Discussion

Environmental impacts of fisheries subsidies have been extensively discussed (Sumaila et al., 2010, 2019; Sala et al., 2018; Cisneros-Montemayor et al., 2020; Kumar et al., 2020). The capacity to subsidize a fishery at an industrial scale tends to be more prominent in developed States, providing an advantage when compared to the production capacity of non-subsidized fleets of developing States. For some DWFNs, depletion of domestic fish stocks has served as an impetus for fleet expansion, providing subsidies to construct distant water fishing vessels, tax incentives for fuel, and public payments to access waters of developing countries (He, 2015; Mallory, 2016; McCauley et al., 2018).

Subsidies are commonly provided to support and protect domestic emerging industries (Schrank and Wijkström, 2003). In the case of fisheries, however, subsidizing States have expanded fisheries for decades, to the detriment of stock status. Such is evident in the IO, where DWFNs benefited from government subsidization programs for over four decades. As argued here, these are poised to skew the allocation of future fishing opportunities in their favor. In doing so, the IOTC risks marginalizing half of its member States, which have had no economic means to develop their domestic fleets and currently lack access to fish despite their aspirations to fish. Furthermore, as historical catch is likely to be the principal criterion for allocating future fishing opportunities (Bailey et al., 2013; Serdy, 2016; Havice, 2021; Seto et al., 2021), countries that have not had a fishery are also forced to share the burden of responsibility for overexploitation of resources, though they did not participate in the overexploitation. Thus, allocation based on catch history without explicit recognition of the distortive effects of past subsidization efforts would represent the continuation of advantaging DWFN thereby undermining the development aspirations of coastal States.

Similar patterns have also emerged in other industries such as agriculture. Even though there are short term positive impacts on the African agriculture with the abolishment of EU agricultural export subsidies, the long-lasting favourable conditions and long-term investments in innovation has

2 Fishsubsidy.org (no longer active) aimed to increase transparency around fisheries subsidies data submitted by EU governments.

implications for the development of African agriculture (Kornher and von Braun, 2020).

Equitable allocation of future catch opportunities is an essential starting point for ensuring conservation of target species. This is critically important given the current status of IO tuna stocks. While multiple futures may exist, here we present four distinct ones along the spectrum, which may emerge in contemporary transboundary governance: (i) the legacy of subsidization continues to dispossess developing coastal states of future fishing opportunities; (ii) account for the role of subsidies in propping up historical catches and removing that effect (iii) attribute catches caught in coastal States waters to coastal States; and (iv) remove historical catch as a large contributor in the allocation formula. Only one of these four perpetuates the status quo and should be removed from future discussions moving forward. Accounting for subsidies in allocation is a challenge due to opacity in fisheries subsidies information, but since the IOTC agreement allows members to review economic and social aspects of tuna fisheries (Art V(2d)), the Commission could facilitate improving subsidies data relevant to tuna fisheries, in particular for capacity-enhancing subsidies. Without transparency in subsidies data, attributing catch caught in coastal States waters to coastal States in calculating catch history proves to be a simple fix as evident from the analysis. Catch attribution is consistent with LOSC and will better support the goals of Sustainable Development Goal (SDG) 14 (Davis et al., 2022). As migration patterns change with climate change, attributing catches could pave way to safe guard resources and mitigate the impacts on coastal communities. The last option is to remove catch history from an allocation mechanism. The drawback is that there are countries that have practiced fisheries for centuries and have developed a fishery without significant subsidies.

Conclusion

As Ostrom (1990) noted, a fair and equitable allocation mechanism is fundamental for the success of resource governance and conservation. IOTC allocation negotiations have so far centered around allocating 60–80% of the total catch based upon historical catches, but catch history is seen as a barrier to reaching equitable allocation decisions as it is often skewed toward countries that have provided subsidies to increase fishing capacity. Countries providing capacity enhancing subsidizes greatly benefit from these publicly supported funds in determining the future fishing rights, leading to an intragenerational loss. Even though the World Trade Organization (WTO) has recently negotiated to an agreement on harmful subsidies, the legacies of these subsidies will continue to impact developing coastal States that did not have financial capacity to subsidize their fleet. Without better transparency in past subsidies data, it would be difficult to account for it in the calculations. However, this analysis shows that attributing catch caught in coastal States waters by DWFN to coastal States in calculating catch histories cushions the impacts of subsidies and will support the goals of SDG14. However, if 'subsidized catch history' remains the basis for deciding future fishing opportunities, the legacies of inequity that result from past subsidization will remain for generations to come.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding authors.

Author contributions

Conceptualization: HS, CW, MB, and WS. Formal analysis: HS, FLM, and MC. Writing–review and editing: HS, WS, US, RF, DS, FLM, MC, and MB. Visualization: HS and CW. All authors contributed to the article and approved the submitted version.

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Conflict of interest

Author HS participated in IOTC meetings as a Maldivian delegate and chaired the Committee on Administration and Finance in IOTC during the research period. He worked and represented the Government of the Maldives in IOTC meetings prior to his research. Author FLM was a member of the EU's Long Distance Fleet Advisory Council (LDAC) from 2017–2019.

The remaining authors declare that the research was conducted in the absence of any commercial or financial

relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fhumd.2022.1044321/full#supplementary-material

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