



Ambitious subsidy reform by the WTO presents opportunities for ocean health restoration

Christopher Costello^{1,2}  · Katherine Millage¹ · Sabrina Eisenbarth³ · Elsa Galarza⁴ · Gakushi Ishimura⁵ · Laura Lea Rubino⁶ · Vienna Saccomanno¹ · U. Rashid Sumaila^{7,8} · Kent Strauss²

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Abstract

The World Trade Organization (WTO) is in a unique position to deliver on Sustainable Development Goal (SDG) 14.6 by reforming global fisheries subsidies in 2020. Yet, a number of unanswered questions threaten to inhibit WTO delegates from crafting a smart agreement that improves global fisheries health. We combine global data on industrial fishing activity, subsidies, and stock assessments to show that: (1) subsidies prop up fishing effort all across the world's ocean and (2) larger subsidies tend to occur in fisheries that are poorly managed. When combined, this evidence suggests that subsidy reform could have geographically-extensive consequences for many of the world's largest fisheries. While much work remains to establish causality and make quantitative predictions, this evidence informs the rapidly-evolving policy debate and we conclude with actionable policy suggestions.

Keywords Fisheries subsidies · Overfishing · Sustainable development goals · World trade organization · Fisheries management

Handled by Carolyn Lundquist, University of Auckland Institute of Marine Science, New Zealand.

✉ Christopher Costello
costello@bren.ucsb.edu

¹ Bren School of Environmental Science and Management, University of California, Santa Barbara, Santa Barbara, CA, USA

² Department of Economics, University of California, Santa Barbara, Santa Barbara, CA, USA

³ Land, Environment, Economics and Policy Institute, University of Exeter Business School, Exeter, UK

⁴ Research Center, Universidad del Pacífico, Lima, Peru

⁵ Faculty of Agriculture, Iwate University, Morioka, Japan

⁶ Environmental Defense Fund, New York, NY, USA

⁷ Institute for the Ocean and Fisheries, The University of British Columbia, Vancouver, BC, Canada

⁸ School of Public Policy and Global Affairs, The University of British Columbia, Vancouver, BC, Canada

Introduction

Though global awareness of the ecological and economic benefits of fisheries management reform is increasing, the tragedy of the commons still plagues much of the world's ocean. For example, fishing on the high seas has increased to the point where cost now exceeds revenue (Sala et al. 2018), and fisheries lacking formal assessments—from which the majority of global catches originate—are more likely to be overfished or experiencing overfishing than their assessed counterparts (Costello et al. 2012; Hilborn et al. 2020). One explanation for these phenomena is that subsidies for fuel, vessel construction, and other “capacity-enhancing” activities are artificially lowering fishing costs and enabling these economically irrational and wasteful increases in fishing pressure. Indeed, governments around the world collectively distribute an estimated US\$35 billion per year to the fishing industry, nearly US\$22 billion of which is thought to be in a form that incentivizes increased fishing (Sumaila et al. 2019). Because this represents a large fraction of fishing costs worldwide, these subsidies may be driving overfishing in many areas.

It is tempting to think that removing these harmful subsidies—for example eliminating subsidies on fuel—will

automatically restore ocean health. But this belief oversimplifies a complicated interplay between subsidies, fisheries management, and ecosystem health. In this paper we inform an active current debate about global fisheries subsidy reform by assessing this interplay. Specifically, we combine current data on vessel tracking, stock assessments, and fisheries subsidies to examine two important fundamentals of the fisheries subsidy economy: (1) How geographically extensive is subsidized industrial fishing effort in the world's ocean, and (2) are fisheries management and subsidy intensity related?

The first question is important because it helps us understand the likely consequences of subsidy removal for the world's largest fisheries. If subsidized industrial fisheries occur only in distinct parts of the ocean, then while those areas may benefit from subsidy reform, the global consequences are likely to be modest. But if subsidies are propping up industrial fisheries all over the world, then the global impacts of reform could be substantial.

The second question is important because it helps determine the strength of the relationship between subsidies, overfishing, and the efficacy of fisheries management. In well-managed fisheries the link between subsidies and overfishing is likely to be weak. There, subsidies simply represent a transfer of funds from taxpayers to fishers, so changes in subsidies would not be expected to have major repercussions for ocean health. But in poorly-managed fisheries, fishing effort is likely to be more responsive to fisheries economics, and therefore, to subsidies. Therefore, removing subsidies in well-managed fisheries is likely to have small effects on sustainability (Sakai 2017), but removing subsidies in poorly-managed fisheries could have much more significant effects (Sumaila et al. 2013).

Given the potential consequences at stake, it is of little surprise that the World Trade Organization (WTO) has been debating subsidy reform for nearly two decades. Over the next few months, the WTO is poised to finally deliver on the United Nations (UN) Sustainable Development Goal (SDG) 14.6 to prohibit certain fisheries subsidies that contribute to overcapacity, overfishing, and illegal fishing (UN General Assembly 2015). But the efficacy of alternative proposals under consideration hinge on the answers to the questions we pose here; we intend this analysis to inform that rapidly-evolving policy debate.

How geographically extensive are subsidies globally?

Fisheries subsidies that directly incentivize more fishing amount to around US\$22 billion per year (Sumaila et al. 2019). This represents an enormous share of global capture fisheries revenue [about 17% of value estimated by FAO

(2018)], so there is at least the potential for global impact from their removal. Yet while we have some country-level estimates of these subsidies, because fishing fleets can fish all over the world, no study has examined the global geographical extent of subsidy-enhanced fishing effort.

We do so here by coupling new global estimates of subsidies with real-time, vessel-level tracking of fishing effort for the majority of the world's industrial-scale fishers (all data and code used is available at <https://github.com/emlab-ucsb/sustain-sci-subsidy-reform-paper>). Briefly, we focus on subsidies with the potential to be capacity enhancing (i.e. "harmful"); these make up more than 80% of total fisheries subsidies in Thailand, Peru, Myanmar, China, and Spain, but less than 40% in the USA, New Zealand, the UK, and Canada. Nonetheless, countries engaged in widespread industrial fishing provide significantly higher subsidies than do lower-income countries, which are often primarily dependent on small-scale or artisanal fisheries. We therefore focus analysis on the large-scale industrial fisheries of the world.

Using real-time vessel tracking with billions of GPS coordinates of fishing activity, we allocate each country's harmful subsidies from Sumaila et al. (2019) in proportion to fishing effort from Global Fishing Watch (Kroodsma et al. 2018), wherever in the world that fishing effort occurs. Then, for each 1×1 -degree pixel in the ocean we determine the subsidy-weighted fishing effort by all countries that fished in that pixel (in 2018). This provides us with an estimate of the "subsidy intensity" of fishing effort (measured in US\$/KWh) in every pixel in the ocean, see Fig. 1a. The figure reveals two important results. First, subsidy-enhanced fishing occurs in all corners of the world. It is hard to find an area with fishing effort that is not propped up, at least to some extent, by fisheries subsidies. Second, the figure shows that there is quite a significant amount of heterogeneity in the subsidy intensity of fishing around the world. To see how this adds up to large geographic regions, we aggregated by FAO Major Fishing Area (Fig. 1b); the Eastern Indian Ocean and Southeastern Pacific show significantly higher subsidy intensities of fishing effort than in, say, the Northeast Atlantic and Southwest Pacific. This observed heterogeneity could be explained by disparate approaches to fisheries subsidization undertaken by different countries, or by the distribution of high value fish stocks. Nevertheless, the question of why this heterogeneity exists in the first place is an interesting avenue for future research.

Are fisheries management and fisheries subsidies related?

Many fisheries subsidies are well-intentioned. They have been put in place to create new economic opportunities, support the livelihoods of fishers, or improve food security.

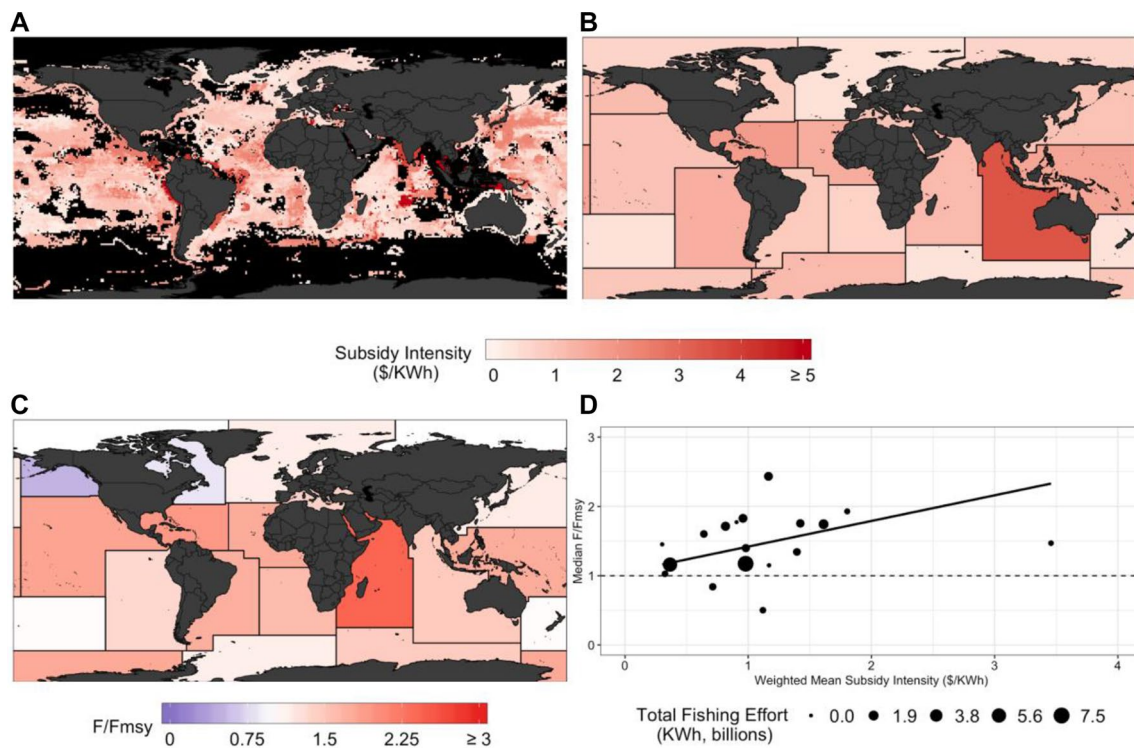


Fig. 1 Geographic heterogeneity exists in both fishery subsidy provisioning and fishery management, though there may be some correlation between the two. **a** Shows the weighted average intensity (\$/KWh) of capacity-enhancing (“harmful”) fishery subsidies aggregated by 1×1 -degree latitude/longitude. **b** Shows the weighted average intensity (\$/KWh) of capacity-enhancing (“harmful”) fishery

subsidies aggregated by FAO Statistical Area. In both levels of aggregation, subsidy intensities are weighted by the total fishing effort associated with each point (in KWh). **c** Shows the median F/F_{MSY} by FAO Statistical Area. **d** Shows the effort-weighted regression between subsidy intensities and F/F_{MSY} by FAO Area

Whether a capacity-enhancing subsidy ends up doing fishing communities more harm than good hinges crucially on the extent of fisheries management.

It is instructive to examine two contrasting scenarios. Consider first the effect of a subsidy in an already well-managed fishery. While “well-managed” can mean lots of things, it generally refers to a situation in which fishing pressure is controlled or incentivized, such that fishing is limited to sustainable levels (Hilborn et al. 2020). Subsidizing such fisheries can have important consequences for fishers’ incomes, but may have little effect on sustainability simply because the management system has already ensured sustainability; here, subsidies will transfer money to fishers, but may not endanger the health of the resource (Sakai 2017).

In contrast, consider the effects of a subsidy in a poorly-managed or open access fishery. Typically, such subsidies lower fishers’ costs, which enables them to venture deeper and farther from port, fish more days per week, and increase their effort using more efficient vessels or more effective fishing gear. Because fishing effort is not controlled, increased fishing effort results in temporary increased catch—which delivers a short-term financial gain—but ultimately diminishes stock size, compromising the ecological

basis of the fishery, and possibly leading to lower long-run catches (Sumaila et al. 2013) and profitability (Heymans et al. 2011). Ultimately, subsidized fishers may end up worse-off than they were before they were given subsidies. Additional subsidy provisioning in poorly-managed fisheries only perpetuates this cycle, eventually driving stocks to the point of collapse. Fishing behavior in the absence of strong management is generally driven by profit (higher profit leads to more fishing pressure), so this downward spiral can only be avoided if subsidies are sufficiently decoupled from fishing costs.

WTO Members have struggled to agree upon which types of subsidies should be removed and which countries should be required to do so. The main position being taken by many international organizations is that reducing, or perhaps completely eliminating, capacity-enhancing subsidies will pay dividends to ocean health. As there are a number of political and economic reasons for governments to provide subsidies to the fishing industry, this strong position has received much opposition. Reduction, or complete removal, of subsidies is undoubtedly going to be unpopular with recipient fishers, as well as others that depend on the fishing industry for their livelihoods. Do the potential benefits of reforming

subsidies therefore justify the costs? Some have argued that they do (Cisneros-Montemayor and Sumaila 2019), and we contribute to the debate here by providing evidence on the link between fisheries management and capacity-enhancing subsidies in industrial fisheries.

To gain traction on this question, we ask whether fisheries management is correlated with harmful subsidy provision. We invoke our earlier results on the subsidy intensity of industrial fishing effort in each FAO region. Then for each region we use stock assessments and data-poor methods to extract the median fishing pressure among all fish stocks for which we have estimates of fishing pressure [see Costello et al. (2016)], shown in Fig. 1c. Fishing pressure (F) relative to that which would yield the maximum sustainable yield (F_{MSY}) is often an indication of the strength of management; fishing pressure above that target is often indicative of weak management, while fishing pressure below or equal to that target might suggest that there are effective effort controls in place. Finally, Fig. 1d plots fishing pressure against subsidy intensity for each FAO region, where bubble size indicates total fishing effort. The regression line in Fig. 1d shows the effort-weighted regression line, which indicates a positive correlation between industrial fishing pressure and subsidy intensity.¹ In other words, places in the world with worse fisheries management (those with fishing pressures above their target levels) tend to also be propped up by the highest industrial subsidy intensities.

This result provides the first global empirical evidence to support what many WTO delegates have been saying for years: Removing harmful fisheries subsidies is likely to have important conservation implications for many of the world's fisheries. Industrial fisheries managed without stringent catch or effort limitations are likely to see decreases in effort or capacity as a result of removing harmful subsidies as costs rise and fishing effort naturally wanes. Additionally, fisheries with poor management are more likely to have worse stock statuses and trends than their assessed counterparts (Hilborn et al. 2020). Therefore, the same fisheries seeing decreases in effort or capacity may have the greatest potential for biological gains.

A policy path forward

We have shown that subsidy-enhanced industrial fishing effort is geographically ubiquitous in industrial fisheries around the world and that the places with more subsidies

also tend to be the worst managed. While much work remains to establish causality and make quantitative predictions, this evidence is at least suggestive that subsidy reform could have large, and geographically-extensive consequences for many of the world's largest fisheries.

Yet, while reforming harmful subsidies seems straightforward in theory, it is extremely nuanced and complicated in practice. An enormous obstacle is the asymmetry between the timing of benefits and costs of subsidy reform. Many fishers stand to suffer large short-term losses from reforming subsidies. While subsidizing any economic sector creates vested interests who will oppose subsidy removal, fisheries are in a special class because the reform is likely to eventually increase resource stocks, which will improve fishers' livelihoods in the long-term, particularly in poorly-managed fisheries. Related industries, such as fish processing, may also benefit from fishery recovery. Another likely co-benefit is that the small-scale fisheries not considered in this analysis may also benefit greatly from removal of capacity-enhancing subsidies to industrial fishers. This arises because reduced industrial fishing can allow fish stocks to rebuild, thus allowing small-scale and artisanal fishers to compete on a more level playing field (Sumaila et al. 2014). Care must be taken to ensure that subsidy reforms intended for the industrial fleet are indeed focused there and not unintentionally shunted to artisanal fishers.

We therefore encourage the WTO to remain focused on reaching an agreement, and to avoid unnecessary loopholes that could undermine otherwise effective disciplines. We propose the following set of policy recommendations for consideration by the WTO that could help to ease the transition:

Be ambitious

Fisheries are globally interconnected (Ramesh et al. 2019), and we have shown that subsidies affect fishing effort in all corners of the ocean. Globally-coordinated subsidy reforms therefore have the greatest potential to unleash benefits for fish stocks, fishers, consumers, and taxpayers. But the realization of these benefits is entirely dependent on the WTO's willingness to lead with ambition and make decisions with the long-term goal of global fisheries sustainability in mind. Stringent caps on capacity-enhancing subsidies, coupled with incentives for improved fisheries management, where it is incumbent on the subsidizing country to show they are not subsidizing overfishing or fishing on overfished stocks, would be a practical and effective path forward. Given the interdependencies between fisheries, and that management systems are rarely perfect, we encourage well-managed fisheries to lead by example and to not seek exceptions that have the potential to introduce loopholes that might undermine an effective agreement. Safeguards should also be put in place

¹ The Eastern Indian Ocean is an outlier. We believe that the subsidy intensity of fishing calculated for this region is likely to be an overestimate because a disproportionately high proportion of industrial vessels fishing in this region do not carry AIS.

to ensure that any exceptions do not allow for excess capacity to leak into other fisheries.

Repurpose subsidies to ease the transition

The largest hurdle to subsidy reform is the short-term cost that is imposed on incumbent fishers who have grown accustomed to the subsidy. These are often the most marginalized members of society, so this situation must be handled with great care. We argue here that subsidies need not be “removed”—rather, they could be repurposed to support livelihoods during the stock rebuilding phase, which typically lasts between 5 and 20 years (Costello et al. 2016). Global governments could repurpose some or all of the roughly US\$22 billion they annually distribute as harmful subsidies to directly support fishers’ incomes without incentivizing overfishing. For example, this funding could support business development skills for fishers, be given to fishers as lump sum cash transfers, or be used to develop and institute management reforms (Martini and Innes 2018)—all of which would support low-income fishers, particularly in developing countries (Mourougane 2010). The best way to repurpose subsidies will undoubtedly differ across countries.

Promote cross-country technical and financial assistance

When one country removes its subsidies, other countries benefit from the resulting stock recovery (Bayramoglu et al. 2018). This is made apparent in our analysis presented above where a great deal of industrial fishing effort occurs outside of the flag nation’s EEZ. Thus, side agreements between countries—e.g., the transfer of technical or financial assistance for fisheries management or stock assessments from countries that experience the smallest short-run costs to countries that experience the greatest short-run costs—may help to alleviate some of the short-term costs of reforming subsidies, particularly for developing countries. However, this must be done in a way that does not inadvertently create new incentives for overfishing, something that should be addressed by the WTO.

Simultaneously reform fisheries management

Given the persistence of capacity-enhancing subsidies in fisheries with poor fisheries management (Fig. 1d), the benefits of ambitious subsidy reform in these fisheries could be magnified dramatically if it was coupled with improved fisheries management (of national fisheries, straddling stocks, and even high seas stocks). Therefore, the best way to support the livelihoods of fishers is to also improve fisheries governance. Coupling fisheries management reforms with subsidy removal is a powerful combination that should be

pursued. There are many different approaches to fisheries management that can be effective, and the goals and context of each fishery will ultimately dictate the best solution for that fishery. For example, rights-based fisheries management, which has been shown to raise catch, profits, and biomass for many stocks, provides one possible collection of approaches that have proven to be effective (Melnychuk et al. 2012; Costello et al. 2016; Sumaila 2018), and can be carefully designed to fit the context of each fishery.

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