

Why Climate Change and State Subsidies Will Collide to Create Fishery Conflict

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Why Climate Change and State Subsidies Will Collide to Create Fishery Conflict

Abstract

Climate change, combined with rising global demand for seafood products, will lead to greater conflict over remaining fisheries. Warming and acidifying oceans are shifting the availability of oxygen and nutrients that are necessary to maintain fish stocks. These changes are likely to increase conflict, both interstate and intrastate, in several important ways. For one, the fish stocks that are already under stress from demand for seafood protein are also shifting location. Most significantly, scarcity will likely draw in greater state involvement in fisheries. As traditional fleets exhaust their territorial waters, domestic political pressure will lead to greater state investment in distant water fishing (DWF) fleets to access fish stocks on the high seas and in the Exclusive Economic Zones (EEZs) of other states. DWF fleets are destabilizing because they can easily access fishing zones with low levels of enforcement. Their industrial scale and low level of transparency means that they are also more likely to engage in Illegal, Unreported, and Unregulated (IUU) fishing activities. States are also more likely to intervene militarily to protect their state-support DWF fleets.

Introduction

The total global wild catch of fish leveled off in the 1980s, though fishing effort—measured in labor hours and capital investments in fishing vessels—has continued to increase. One third of global marine species are overfished or depleted, and another 59.9 percent of stocks were being fished at their maximum sustainable level. Thus, only 7 percent of species are currently underfished from a sustained yield perspective. Meanwhile, global seafood consumption has continued to rise at more than twice the rate of population growth since the 1960s.¹ Many of these figures would be considerably more dire if not for the rising role of regional fishery management organizations (RFMOs) and aquaculture. That said, a number of reports in the natural sciences predict that anthropogenic climate change, combined with further population growth and affluence, will squeeze this equation considerably further.² The resulting scarcity, large scale shifts in fishery access, and resultant state policies are virtually guaranteed to increase conflict over fisheries, and likely on a scale far larger than in the past. This is a significant statement, as fishery conflicts are neither new nor rare. Mitchell and Prins found that one quarter of militarized disputes between democracies in the second half of the 20th century concerned fisheries specifically.³ The Cod Wars between the United Kingdom and Iceland in the 1960s and 1970s are perhaps the most prominent examples of such conflicts, but they are by no means alone.

Existing literature on the effects of climate change and fisheries has correctly pointed to the increased likelihood of conflict.⁴ Largely left out of this discussion, at least thus far, has been the role of distant water fishing fleets, and state support of such fleets, in propagating that risk. Through a variety of mechanisms, anthropogenic climate change will reduce the total amount of edible sea life in the oceans as well as scramble the location of remaining fish. Forced to undertake greater effort to catch a declining number of fish, fishing industries in much of the world will pressure their respective governments for greater support in order to bolster their livelihood and remain in business. Many states will choose to encourage, via subsidies, the creation or expansion of distant water fishing (DWF) fleets, vessels capable of pursuing fish to all corners of the oceans.⁵ This subsidized expansion of DWF fleets will inevitably contribute to further degradation of ocean biomass as well as conflict between states. The long distance capabilities of DWF fleets mean that they can access much of the

world, thereby adding additional, if nonlocal, actors to any existing fisheries. Furthermore, the activities of DWF fleets are notoriously opaque, and large scale DWF operations can easily undertake illegal, unreported and unregulated (IUU) fishing, thus further destabilizing existing fisheries management.⁶ Thus, the challenges of climate change will induce states to invest in DWF fleets, and it is these fleets and their activities that are likely to induce conflict and further biodiversity loss. States may view their DWF fleets as proxy navies and may be inclined to use displays of hard power to protect their investments.

Climate Change and Fisheries

It is worth some discussion of how anthropogenic climate change will likely affect fisheries in particular. An increase in average ocean temperature is a relatively straightforward result of climate change, albeit one with especially wide-ranging effects for fisheries. Some 93 percent of the heat from anthropogenic climate change has been absorbed by the planet's oceans.⁷ The result is that the average ocean surface temperatures have increased 0.7 C between 1900 and 2016, and will rise another 0.6 to 2.0 C by 2100.⁸ Much of this warming will be concentrated in the Northern Hemisphere. Warming oceans have several important effects on fisheries. Rising temperatures will push many species to higher latitudes as they seek to maintain their preferred water temperature. Raising the temperature of water also decreases the solubility of oxygen, which means that warmer oceans can carry less of the oxygen that most aquatic organisms need to breathe. Thus, warming waters, especially when combined with agricultural runoff, are contributing to expanded dead zones in many coastal regions, where few species can survive. Rising surface temperatures are also likely to impact the intensity and direction of ocean currents, especially when combined with changes in ocean salinity as less of the planet's freshwater is kept in frozen storage. Weakened or shifting currents will change the nutrient distribution in the ocean, which will in turn change the location and productivity of fisheries.⁹

Ocean acidification is another important effect with wide-ranging impacts. While the planet's oceans have served as an enormous depot for much of humanity's carbon emissions, that carbon dioxide has not simply disappeared. Rather, it has been transformed into carbonic acid, gradually decreasing the pH of ocean water. Earth's oceans have absorbed 30 percent of all anthropogenic carbon emissions, and thus ocean acidity has

increased 26 percent since the dawn of the industrial revolution.¹⁰ While it is not yet clear what direct effect if any the decrease in pH will have on larger organisms, it is well established that coral and other shellfish are quite sensitive to water acidity. Because their shells are derived from basic limestone, many mollusks are unable to tolerate more acidic ocean water. The loss of coral is particularly problematic from a fisheries standpoint, given that a sizable portion of edible ocean species depend on coral reefs at some stage in their lifecycle. Thus, ocean acidification will likely reduce shellfish catches directly as well as other species more indirectly.¹¹

In all, the United Nations Food and Agriculture Organization (FAO) predicts that the maximum catch within the world's EEZs will decrease between 2.8 and 12.1 percent by 2050, depending on the concentration of greenhouse gases (GHGs) in the atmosphere by that time.¹² There are several reasons why the impacts are likely to be more dire than these figures might suggest. For one, globally commercial fishing employs 56 million people, and fish exports alone were worth \$152 billion in 2017.¹³ More than half of that figure originated in the developing world.¹⁴ Thus, even a single digit decline in total catch would represent a substantial economic loss, especially for coastal regions. Furthermore, the human population of 2050 is on track to be above nine billion, and thus demand for protein is all but certain to be higher as well. Much of the developing world depends on seafood for 30 to 70 percent of protein in their diet.¹⁵ Thus, even a small decline in total catch would likely have a substantial impact on food security. Second, the relatively low estimates of average global decline mask huge variation between regions. Fisheries near the poles are likely to see an expansion of available biomass, whereas those in tropical regions will see enormous decline. The fisheries of Greenland and Siberia, for example, are projected to increase under most scenarios, whereas some fisheries in the tropical Pacific will likely be eliminated entirely under most warming models.¹⁶ Thus, access to productive fisheries will be scrambled at best, with the greatest declines concentrated in the parts of the world with the most food insecurity and the highest dependence on artisanal fishing for protein. Furthermore, it is worth noting that 2050 is a relatively near milestone in the timeline of climate change. Continued warming beyond 2050 will increase the severity of the above trends. For instance, it is projected that unmitigated climate change will result in a decrease in global fisheries of between 16.2 and 25.1 percent by 2100.¹⁷

Climate Change and Fishery Conflict

The shifts brought about by climate change do not bode well for fisheries conflict. For one, increasing population and affluence, coupled with generally scarcer sea life, will likely lead to higher market prices for ocean products.¹⁸ The economic importance of fisheries will likely be increased for both small scale, artisanal fisheries and large commercial fleets alike. Higher market prices and harder to find quarries will provide incentive for state and nonstate actors alike to take increasingly drastic or risky actions to maintain their livelihoods. The result will be more conflict between states for access to fisheries, and more IUU fishing in general. In many cases the effects will be cascading in nature. For instance, the influx of large, commercial-scale Chinese fishing fleets into North Korean waters has largely pushed the small scale DPRK fishermen farther from port and into Russian waters in search of squid, despite the fact that DPRK fishing vessels are generally too small for such a voyage.¹⁹

Climate change will also make existing fisheries agreements more difficult to manage, even without expansion of DFFs. Many individual global fisheries are regulated by Regional Fishery Management Organizations, which cooperatively set rules for fishing stakeholders within a geographically bound area. For one, rising water temperatures and shifting nutrient flows are altering the range of fish. As many species have spread toward higher latitudes, some RFMOs have become less relevant since the species they focus on may have moved out of the management organization's jurisdiction. Those same species may have moved into a different RFMO, or into the EEZ of a specific state that was not a party to any previous agreement. This process creates a new stakeholder, and they may be uninterested in recognizing the interests of previous actors. Thus, many states, even those that were previously good-faith participants in RFMOs, may find themselves high and dry as fish populations shift. Iceland serves as a good example on both ends of this dynamic. Icelandic fisheries have suffered as traditional catches like capelin, Blue whiting and cod have moved further north into colder waters. This is significant, since cod fishing alone represents \$1 billion to the Icelandic economy. At the same time, mackerel have moved north into Iceland's EEZ. The north Atlantic mackerel fishery is co-managed by the European Union, Norway and the Faroe Islands. Icelandic fishermen have been relatively eager to

adapt to mackerel fishing in Icelandic waters as they've lost access to other species, and relatively uneager to fully abide by the rules of the existing mackerel RFMO. While Iceland is a member of the North East Atlantic Fisheries Commission (NEAFC), they have thus far unilaterally set their annual mackerel quotas. Iceland, Greenland, and Russia have been gradually increasing their own quotas for their domestic fishing fleets instead of agreeing to quotas set by the RFMO, much to the irritation of the EU.²⁰ The resulting diplomatic conflagration spread beyond fishing alone, and contributed the decision by Iceland to withdraw its application for membership into the EU.²¹ This chain of events is unlikely to be unique. Pinsky et al. have predicted that fisheries that straddle political boundaries will increase 35 percent by 2060 in an unmitigated emissions scenario.²²

Distant Water Fishing Fleets as a State Response to Climate Change

As domestic industries face declining catches from increased consumption and decreased supply, many will turn to their home governments for support in adapting to these changing circumstances. This support may include incentives for aquaculture, or job training, or myriad other measures, but in many cases it will aim to enhance distant water fishing as a remedy to declining catches. For example, Beijing recognized in the early 1980s that domestic marine resources were in decline, and prioritized the development of a distant water fishing fleet as part of the solution. Many of China's fishing subsidies are DWF specific, and the most recent Five Year Plan called for an expansion of the number of DWF vessels and the total catch from outside Chinese coastal waters.²³ With at least 3,000 qualifying vessels, China now operates the largest DWF fleet in the world, representing almost 40 percent of the world's total DWF capacity, and 36 percent of the world's DWF fishing effort.²⁴ Automatic Identification System data indicates that China's DWF fleet activity is currently heaviest in the central and south Pacific, the western Indian Ocean, and the coast of West Africa as well as the rest of East Asia.²⁵ Representatives from the DWF industry in China have supported the idea that China needs DWF to supplement its depleted domestic waters.²⁶

As the Chinese example indicates, DWF fleets are largely a creation of state policy. The fact that the global catch has largely leveled off while

fishing effort has increased substantially is a testament not only to human technology, but to the willingness of states to bolster their fishing fleets. Many governments subsidize their fishing industry, often through multiple mechanisms at once. Some subsidies are aimed at conducting fishery research and promoting the respect of marine conservation areas. Much more common, and broadly harmful, are subsidies aimed at building fishing capacity. One such example is the economic aid for building new boats or modernizing existing vessels long used by the EU and China, among others.²⁷ Tax reduction is also common. For instance, China treats fish landings from DWF fleets as domestic, and thus not subject to import taxes. Fuel subsidies are by far the most substantial example, especially in the case of DWF fleets, for whom fuel is often the most substantial cost of operation. Of the \$6.5 billion in fishing subsidies that Beijing doled out in 2013, for example, 94 percent was in the form of fuel subsidies.²⁸ Most dependent of all upon subsidies are the distant water fishing fleets that many states have turned to in order to maintain their place in the global fish market. Indeed, a substantial portion of DWF activities by the world's largest fleets (China, Taiwan, Japan, South Korea and Spain) would be entirely unprofitable without the aid of subsidies from their home governments.²⁹ This is especially significant given that these five countries represent 90 percent of the world's current DWF fishing vessels.³⁰

Furthermore, the trend in recent decades has been for fishing subsidies to rise, and many subsidies have been difficult to remove even under public criticism. China's total fuel subsidies for fishing increased more than 11,000 percent between 2006 and 2013, for example.³¹ Even when fishing subsidies have come under public criticism, such as in the European Union, pressure from domestic fishing industries and local regions dependent on them has made subsidies difficult to remove.³² Indeed, negotiations to remove subsidies that enhance fishing capacity have been ongoing within the World Trade Organization (WTO) for several years. China and certain subsets of the European Union have been loath to come to a strong agreement on this front, and the most likely line of compromise will be that only the developing world will continue to subsidize their fishing industry.³³ This too may provide a future loophole, as existing DWF fleets may be transferred via foreign flagging of vessels to the developing world, whereby subsidies could conceivably continue in much the same way. This is effectively how some Chinese DWF fleets already operate in West Africa. Dalian Mengxin Ocean Fisheries, a Chinese state-

affiliated firm, owns and operates thirty or more fishing trawlers in the EEZs of Ghana and Sierra Leone. Many of these vessels are registered within Ghana as belonging to local shell companies, who take a cut of the overall proceeds. Indeed, 90 percent of the trawling vessels registered in Ghana are Chinese owned and crewed. Such arrangements allow firms like Dalian Mengxin to effectively collect subsidies from the Chinese state while accessing Ghanaian fisheries, and it is not clear that the currently discussed WTO agreement will prevent this.³⁴

Of course, states may effectively bolster social harms from fishing in other capacities as well. Home governments may come to the aid of citizens caught fishing illegally in foreign or contested waters. This may take a number of forms, from legal pressure to military action. For example, Beijing has attempted to negotiate on behalf of Chinese fishermen who were caught overfishing within the EEZs of Indonesia and other Southeast Asian states.³⁵ At the other end of the spectrum are the naval escorts that the United Kingdom provided to UK fishing vessels during the Cod Wars with Iceland in the 1970s, culminating in forcible ramming and the exchange of fire between two erstwhile NATO allies.

DWF Fleets and Fishery Conflict

A global expansion of distant water fishing fleets is suboptimal for a number of reasons. For one, it is likely to accelerate overfishing, as each fleet attempts to mop up what it can before their competition does so. DWF fleets tend to be especially adept at engaging in IUU fishing activities on a large scale. For one, such vessels typically operate far from shore. Analysis of recent Automatic Identification System (AIS) data from ships shows that DWF vessels are most active on the high seas and in the EEZs of the developing world.³⁶ In other words, DWF fleets are most likely to operate in places of minimal governance and limited enforcement capacity. Most DWF fleets include reefer or factory ships that can take a cargo of raw fish from smaller vessels and process them at sea before taking them to foreign markets. This practice is known as transshipment, and it allows the fishing ships themselves to remain at sea and continue to catch fish rather than return to port. Because ports are where most accounting of catches can occur, transshipment tends to be opaque, and makes it easy to obscure the actual catch of a ship within a given area. Thus, even if a state has come to an agreement with a foreign power for access to a particular EEZ, transshipment makes it possible to obscure

how much fish were actually caught. Indeed, it is widely believed that transshipment has allowed China's DWF fleet to pass much of its catch as domestic, thereby allowing it to launder the proceeds of overfishing on the high seas and foreign EEZs.³⁷ China's total distant water catch is likely to be substantially higher than what is officially reported.³⁸ Furthermore, state-supported DWF fleets often rely on a large number of nearly identical ships that were produced at the same time, and are often given names that vary only by a single letter or number. This makes it more difficult for authorities to identify a particular vessel accused of IUU practices correctly. It is also easier to quickly change vessel names to avoid prosecution, a practice that is not uncommon in the world of IUU fishing.³⁹ Higher fish prices in the wake of climate change will increase the short term benefits of IUU practices for DWF fleets, and thus they are likely to continue. This is significant given that IUU fishing is already substantial, estimated at \$9 to \$17 billion a year in fish alone, or between \$26 billion and \$50 billion if the full economic effects are included.⁴⁰

Illegal, unreported and unregulated fishing is particularly problematic from a fisheries conflict perspective. A larger number of distant water fishing vessels means a larger number of competitive actors in fisheries across the globe, which is likely to complicate the operation of RFMOs. Distant fishing vessels may come from countries that are not party to existing fisheries management, and may feel little compunction about following such rules when they are far from their home government. RFMOs typically set a catch ceiling for a given year and then allot a certain level of catch to each of the agreeing stakeholders. Illegal fishing reduces the amount of sustainable catch available to everyone else, with the result that even legitimate actors will be unwittingly overfishing. While agreements can be adjusted to reflect new realities, the industrial nature of state supported DWF fleets means that enormous amounts of fish can be removed in a relatively short period. Thus, it is possible that a given fishery could be grossly overfished or decimated before RFMO actors have a chance to respond, especially in areas with limited governance or enforcement. The ease by which DWF fleets can engage in IUU fishing could potentially destabilize managed fisheries even when IUU is not occurring. The general lack of transparency around distant water fishing practices is likely to lead to suspicions of IUU fishing by other actors, whether justified or not, and the presence of foreign actors may present a convenient scapegoat for declining local catches.

The use of state supported DWF fleets is also significant because disputes may be followed with military protection or intervention by the home state. Spijkers et al. found that states were most likely to respond to fishery disputes with displays of “hard-line power.”⁴¹ The use of the British navy for protection of fishing vessels in Icelandic waters during the Cod Wars is one example. Note too that China maintains the People’s Armed Forces Maritime Militia (PAFMM), which has been used to reinforce fishing access in disputed areas of the South China Sea. Vietnam has deployed a similar service for its own fishing fleet.⁴² Some analysts have argued that fishing access may serve as a proxy for extraction of minerals or future militarization.⁴³ For example, Chinese fishing vessels receive a stipend to conduct their activities in the disputed South China Sea, despite a general lack of fishing profitability in that area currently.⁴⁴ At the very least, the reach of DWF fleets means that the home state can plausibly justify military protection of their fishing vessels on a wider geographic scale. State investment in DWF fleets is also likely to create or reinforce a domestic constituency that is dependent on said subsidies for economic survival. This not only makes such subsidies politically difficult to remove, but may also increase domestic pressure on the state to protect or expand fishery access abroad. Such a state would be more likely to intervene militarily to protect their large-scale investments in DWF.

Conclusion: An Avoidable Outcome

Climate change does not bode well for human conflict in general, and for fisheries conflict in particular. That said, it should be noted that increased reliance on DWF fleets and fisheries conflict are not foregone conclusions. The beggar-thy-neighbor nature of DWF development is not the only potential solution to declining catches. Indeed, there are a number of other methods of avoiding a classic tragedy-of-the-commons scenario, and several developments on the horizon may further ameliorate global fisheries. States may choose to bolster domestic aquaculture, establish and enforce protected marine zones to bolster aquatic populations, and take other actions to ensure that catch does not exceed sustainable yield within their EEZs. Where EEZs overlap and on the open ocean, states can choose to establish RFMOs to cooperatively enact much of the same protective policy to ensure that they can continue to catch fish well into the future, even in a warming ocean. Improved monitoring, control, and surveillance

has the potential to better police the high seas and jurisdictions with poor governance. This is perhaps best demonstrated by the research of Park et al., who used widely available commercial satellite photography to monitor the fishing activities within the notoriously opaque waters of North Korea.⁴⁵ However, even the universal use of Vessel Monitoring Systems (VMS), especially if enforced by the maritime insurance industry, would greatly improve the transparency of DWF.⁴⁶ Most importantly, the upside to the role of state-supported DWF fleets in promoting fishery conflict is that the state support can be removed. More than half of current DWF activity would be uneconomic without state activity, and thus it is likely that many would cease to operate if such subsidies were removed.⁴⁷ Thus, the outcome and compliance of current WTO talks of eliminating fishery subsidies is of great importance, especially on a rapidly warming planet.

Endnotes

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- ¹ *The State of World Fisheries and Aquaculture; Meeting the Sustainable Development Goals* (Rome: Food and Agriculture Organization of the United Nations, 2018), <http://fao.org/documents/card/en/c/19540EN/>.
 - ² The FAO's *State of World Fisheries and Aquaculture* is a good summary of much of this research.
 - ³ Sara McLaughlin Mitchell and Brandon C. Prins, "Beyond Territorial Contiguity: Issues at Stake in Democratic Militarized Interstate Disputes," *International Studies Quarterly*, 43, 1 (1999), 169-183, <https://www.jstor.org/stable/2600969>.
 - ⁴ Jessica Spijkers, Gerald Singh, Robert Blasiak, Tiffany H. Morrison, Philippe Le Billon, and Henrik Osterblom, "Global Patterns of Fishery Conflict: Forty Years of Data," *Global Environmental Change*, 57 (2019), <http://dx.doi.org/10.1016/j.gloenvcha.2019.05.005>; Elizabeth Mendenhall, Cullen Hendrix, Elizabeth Nyman, Paige M. Roberts, John Robison Hoopes, James R. Watson, Vicky W.Y. Lam, U. Rashid Sumaila, "Climate Change Increases the Risk of Fisheries Conflict," *Marine Policy*, 117 (2020), <https://doi.org/10.1016/j.marpol.2020.103954>.
 - ⁵ Distant Water Fishing refers specifically to fishing outside of the exclusive economy zone of the home country or neighboring countries. R.J.R. Grainger, & S.M. Garcia, "Chronicles of Marine Fishery Landings (1950-1994): Trend Analysis and Fisheries Potential," *FAO Fisheries Technical Paper* (Rome: Food and Agriculture Organization of the United Nations, 1996), <http://www.fao.org/3/W3244E/w3244e00.htm>.
 - ⁶ As defined by the FAO's IPOA-IUU Agreement, illegal fishing refers to "fishing activities conducted...in waters under the jurisdiction of a state, without the permission of that state or in contravention of its laws" or "in violation of...international obligations." Unreported fishing refers to "fishing activities which have not been reported, or misreported, to relevant national authorities." Likewise, unregulated fishing refers to "fishing activities that...are conducted by vessels without nationality, or by those flying the flag of a state not party to the [relevant] organization...or in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are in a manner inconsistent with state responsibilities for the conservation of living marine resources under international law." FAO, *International Plan of Action to Prevent, Deter and Eliminate Illegal*,

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- Unreported and Unregulated Fishing*, Rome: Food and Agriculture Organization of the United Nations, 2001, <http://www.fao.org/documents/card/en/c/71be21c9-8406-5f66-ac68-1e74604464e7>.
- ⁷ Tarub Bahri, Manuel Barange, Hassan Moustahfid, “Climate Change and Aquatic Systems,” *Impacts of Climate Change on Fisheries and Aquaculture: Synthesis of Current Knowledge, Adaptation and Mitigation Options* (Rome: Food and Agriculture Organization of the United Nations, 2018), <http://www.fao.org/3/I9705EN/i9705en.pdf>.
- ⁸ The variation is largely dependent on anthropogenic GHG emissions throughout the 21st century (ibid).
- ⁹ Bahri et al., “Aquatic Systems,” 2018.
- ¹⁰ Note too that there is large scale variation in acidity. For instance, Arctic waters are acidifying fastest, largely because colder water can absorb more CO₂ (ibid).
- ¹¹ Bahri et al., “Aquatic Systems,” 2018.
- ¹² These figures are derived from the IPCC’s lowest and highest estimates of GHG concentrations by 2050, with the lowest number assuming rapidly declining human GHG emissions, and the highest number assuming rapid expansion of anthropogenic GHG emissions. In short, the FAO estimates were bounded by the IPCC’s Representative Concentration Pathways (RCPs), or what the IPCC has considered likely climate scenarios (ibid).
- ¹³ Note that the total market value of all fish caught was far, far higher than exports alone. FAO, *The State of World Fisheries and Aquaculture; Meeting the Sustainable Development Goals*, 2018; Stimson Center, *Shining a Light: The Need for Transparency Across Distant Water Fishing*, (Washington, DC: Stimson Center, 2019). <https://www.stimson.org/wp-content/files/file-attachments/Stimson%20Distant%20Water%20Fishing%20Report.pdf>.
- ¹⁴ FAO, *The State of World Fisheries and Aquaculture*, 2018.
- ¹⁵ Ibid.
- ¹⁶ William W.L. Cheung, Jorn Bruggeman, and Momme Butenschon, “Projected Changes in Global and National Potential Marine Fisheries Catch under Climate Change Scenarios in the Twenty-First Century,” *Impacts of Climate Change on Fisheries and Aquaculture: Synthesis of Current Knowledge, Adaptation and Mitigation Options* (Rome: Food and Agriculture Organization of the United Nations, 2018), <http://www.fao.org/3/I9705EN/i9705en.pdf>.
- ¹⁷ Ibid.
- ¹⁸ Stefania Vannuccini, Aikaterina Kavallari, Lorenzo Giovanni Bellu, Marc Muller, and Dominik Wisser, “Understanding the Impacts of Climate Change for Fisheries and Aquaculture: Global and Regional Supply and Demand Trends and Prospects,” *Impacts of Climate Change on Fisheries and Aquaculture: Synthesis of Current Knowledge, adaptation and mitigation options* (Rome: Food and Agriculture Organization of the United Nations, 2018), <http://www.fao.org/3/I9705EN/i9705en.pdf>.
- ¹⁹ Jaeyoon Park, Jungsam Lee, Katherine Seto, Timothy Hochberg, Brian A. Wong, Nathan A. Miller, Kenji Takasaki, Hiroshi Kubota, Yoshioki Oozeki, Sejal Doshi, Maya Midzik, Quentin Hanich, Brian Sullivan, Paul Woods, David Kroodsma, “Illuminating Dark Fishing Fleets in North Korea,” *Science Advances*, 6, 30, (July 22, 2020), <http://doi.org/10.1126/sciadv.abb1197>.
- ²⁰ Kendra Pierre-Louis, “Warming Water, Moving Fish: How Climate Change Is Reshaping Iceland.” *The New York Times*, Dec 2, 2019, B1; Jon Henley, “Iceland Accused of Putting Mackerel Stocks at Risk by Increasing Its Catch,” *The Guardian*, November 21, 2019, <http://www.theguardian.com/environment/2019/nov/21/iceland-accused-of-putting-mackerel-stocks-at-risk-by-increasing-its-catch>.
- ²¹ Jessica Spijkers & Wiebren Boonstra, “Environmental Change and Social Conflict: The Northeast Atlantic Mackerel Dispute,” *Regional Environmental Change*, 17 (2017), 1835-1851, <https://doi.org/10.1007/s10113-017-1150-4>.

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- ²² Malin L. Pinsky, Gabriel Reygondeau, Richard Caddell, Juliano Palacios-Abrantes, Jessica Spijkers, William W.L. Cheung, “Preparing Ocean Governance for Species on the Move,” *Science*, 360, 6394 (2018), 1189-1191, <https://doi.org/10.1126/science.aat2360>.
- ²³ Tabitha Grace Mallory, “Fishery Subsidies in China: Quantitative and Qualitative Assessment of Policy Coherence and Effectiveness,” *Marine Policy*, 68 (2016), 74-82, <https://doi.org/10.1016/j.marpol.2016.01.028>.
- ²⁴ Stimson, *Shining a Light*, 2019.
- ²⁵ Ibid.
- ²⁶ Mark Godfrey, “Mawei Port Designation Reveals China’s Ambitions for African Fishing,” SeafoodSource, July 26, 2019, <https://www.seafoodsource.com/news/supply-trade/mawei-port-designation-reveals-china-s-ambitions-for-african-fishing>
- ²⁷ David Jolly, “EU Proposal for Fishing Industry Support Raises Eyebrows” *The New York Times*, Dec 2, 2011, <https://www.nytimes.com/2011/12/03/business/global/eu-proposal-for-fishing-industry-support-raises-eyebrows.html>; Mallory, “Fishery Subsidies in China,” 2016.
- ²⁸ Mallory, “Fishery Subsidies in China,” 2016.
- ²⁹ Enric Sala, Juan Mayorga, Christopher Costello, David Kroodsmas, Maria L.D. Palomares, Daniel Pauly, U. Rashid Sumaila, Dirk Zeller, “The Economics of Fishing the High Seas,” *Science Advances*, 2018, 4 (2018), <https://doi.org/10.1126/sciadv.aat2504>.
- ³⁰ Stimson Center, *Shining a Light*, 2019.
- ³¹ Mallory, “Fishery Subsidies in China,” 2016.
- ³² Jolly, “EU Proposal,” 2011.
- ³³ Mark Godfrey, “China’s Demand for Special Status a Sticking Point in WTO Fishing Subsidy Negotiations,” SeafoodSource, July 23, 2020, <https://www.seafoodsource.com/news/supply-trade/chinas-demand-for-special-status-a-sticking-point-in-wto-fishing-subsidies-negotiations>
- ³⁴ Mona Samari, “How Ghana’s Weak Penalties Are Letting Trawlers Off the Hook,” China Dialogue Ocean, October 3, 2019, <https://chinadialogueocean.net/10522-ghana-weak-penalties-let-trawlers-off-the-hook/>
- ³⁵ Agustinus Beo Da Costa & Ben Blanchard, “China Protests Seizure of Fishing Vessel by Indonesian Authorities,” *Jakarta Globe*, May 31, 2016, <https://jakartaglobe.id/news/china-protests-seizure-fishing-vessel-indonesian-authorities/>.
- ³⁶ Stimson, *Shining a Light*, 2019.
- ³⁷ Mallory, “Fishery Subsidies in China,” 2016.
- ³⁸ Sala et al., “Fishing the High Seas,” 2018.
- ³⁹ Samari, “Ghana’s Weak Penalties,” 2019.
- ⁴⁰ U.R. Sumaila, D. Zeller, L. Hood, M.L.D. Palomares, Y. Li, D. Pauly, “Illicit Trade in Marine Fish Catch and Its Effects on Ecosystems and People Worldwide,” *Science Advances*, 6, 9 (2020), <https://doi.org/10.1126/sciadv.aaz3801>.
- ⁴¹ Spijkers et al., “Fishery Conflict,” 2019.
- ⁴² Derek Grossmand & Logan Ma, “A Short History of China’s Fishing Militia and What It May Tell Us,” The Rand Corporation, April 6, 2020, <https://www.rand.org/blog/2020/04/a-short-history-of-chinas-fishing-militia-and-what.html>
- ⁴³ Leah Feiger & Mara Wilson, “The Countries Taking Advantage of Antarctica during the Pandemic,” *The Atlantic*, May 2020, <https://www.theatlantic.com/politics/archive/2020/05/antarctica-great-power-competition-australia-united-states-britain-russia-china-arctic/611674/>.
- ⁴⁴ Ian Urbina, “How China’s Massive Fishing Fleet is Transforming the World’s Oceans,” *Slate*, September 2, 2020, <https://slate.com/news-and-politics/2020/09/beijing-fishing-fleet-subsidies-north-korea.html>.
- ⁴⁵ Park et al., “Illuminating Dark Fishing Fleets,” 2020.

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- ⁴⁶ Stimson Center, *Shining a Light*, 2019.
⁴⁷ Sala et al, "Fishing the High Seas," 2018.