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# WARMER OCEANS AND HOTTER TENSIONS: FISH, CONFLICT, RESOURCE COMPETITION & CLIMATE CHANGE

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**Abstract:** *This paper explores the intensifying relationship between climate change and international conflict over fish as a commodified, yet vulnerable, natural resource. Fish disputes ranging from diplomatic tensions to Militarized Fishing Disputes (MFDs) are increasingly frequent, fueled by overexploitation, ecological degradation, and a legal vacuum in high seas governance. Using a quasi-experimental design, this study evaluates whether climate-induced variability, proxied by El Niño and La Niña events, contributes to a rise in fishing conflicts by altering fish migration and availability. Drawing on conflict datasets and climatological indices, the study investigates causality while accounting for key confounding factors. The research builds on Resource Conflict Theory and commodification frameworks to demonstrate how fish, as a renewable yet ungoverned resource, have become a flashpoint of geopolitical competition. Through case studies and historical precedent, it also examines how state behavior, economic incentives, and regulatory shortcomings converge to fuel tensions in warming oceans. The findings highlight the urgent need for global cooperation and enforceable maritime governance to mitigate climate-related conflict escalation.*

**Key words:** Climate Change and Conflict, Commodification of Fish

## Introduction

Militarized Fishing Disputes (MFDs)One thinks little of the international politics behind the fish in their Filet-O-Fish burger at McDonald's. Yet, fish are at the center of many international disputes, some of which are militarized and known as Militarized Fishing Disputes (MFDs), government sanctioned actions, threats, and use of force between two or more states. Moreover, conflict over fish more aptly put, fishing rights is on the rise and is a potential blind spot in international security, becoming a flashpoint for conflict. This is not so far-fetched, as conflict over fish has precedents, such as Iceland's disputes with England or the "Turbot War" between Canada and Spain which divided NATO. Canada will likely be in the spotlight again when fragile Arctic fisheries open due to climate change (Hirshleifer, 1989). As such, climate change should amplify conflict over commodities, including fish, as this paper seeks to prove through a quasi-experiment and subsequently explain the mechanisms at play. It will also address other confounding variables contributing to the increased prevalence of fishing conflicts and MFDs.

Firstly, by exploring the historical relationship between commodities and conflict, the paper establishes that fish are indeed a commodified resource under significant pressure from human activity. It then outlines the methodology of a quasi-experiment designed to demonstrate that this pressure, influenced not only by climate change but also by other factors, may contribute to increased conflict. The experiment seeks to establish a causal link between climate change and conflict by using El Niño and La Niña oscillations as instrumental variables for climate variability. Conflict levels during these events, as measured by the Oceanic Niño Index (ONI), are categorized by intensity (ranging from weak to very strong) to assess whether stronger events correlate with higher levels of conflict. The control group consists of periods that the ONI defines as neither El Niño nor La Niña. Conflict levels are measured using historical data captured in previous research by Spijkers et al. (2019), which utilized the LexisNexis Academic database. The paper then interprets the results to explore potential underlying mechanisms.

## Commodities and Conflict

The connection between conflict and commodities was first explored by Malthus in 1798, positing that as populations increased and environmental degradation worsened, conflict over resources would ensue (Malthus, 1798). Thus, launching what is known as Resource Conflict Theory. This is hardly a groundbreaking postulation as it is a simple supply and demand equation. The fact that the prediction came in 1798 is what makes it remarkable, and we appear to be living in his prophecy. More recently and usefully, Hirshleifer (1989) delved into research on commodities, the state, and wealth production, proposing that actors pursue wealth at the expense of other states interests. While these theories have been widely applied to commodities, they have been less extensively considered in the context of renewable resources, although growing interest is evident.

Rafael Reuveny and John W. Maxwell (2001) conducted research on groups dependent on single renewable resources, focusing on less developed societies with high resource dependency. They omitted more industrialized societies, as their diversified economies were considered to mitigate the impact of dependence on a single renewable resource. However, the industrialization of fishing is highly relevant to a study on fish as a commodity. For instance, China has depleted its fish stocks and has turned to other states' stocks as well as the high seas, creating problems for other industrialized societies.

Stefano et al. (2015), contend that commodification of fish first occurred with the establishment of salmon hatcheries, which in turn allow human activity to overlook the critical need for habitat protection. Stefano et al. (2015) further contend that the commodification of fish has propelled them beyond the “socio-ecological metabolic rate of exchange” (Stefano et al., 2015). Essentially, human demand for fish has surpassed their natural capacity for resource renewal, turning them into a crucial state resource that requires management and protections. While Stefano et al. (2015) may be correct regarding the impacts of humans on fish as a sustainable resource, what they refer to as the beginning of commodification could be better described as the onset of artificially generating fish stocks through farming to match human demand. However, anthropogenic fish generation has not adequately offset the depletion of fish stocks, such as Pacific blue fin tuna, which have seen populations decline by 97.4 percent from their historical levels (Nickson, 2016). Climate change further exacerbates this issue by depleting fish populations, through various mechanisms, leading to heightened competition for remaining stocks. Already, states that have exhausted their own fish stocks are turning to the high seas and other nations' territorial waters, signaling potential future conflicts over fishing rights. The final issue of fish is that their populations fluctuate while demand does not make their renewability both a feature and a bug.

However, none of Stefano’s et al’s (2015) conclusions are groundbreaking as fish have been recognized as a commodity for thousands of years. In fact, global fish stocks are a crucial resource for nearly 3 billion people despite their massive decline in numbers (Dahlet et al., 2021). Nevertheless, current international maritime law, such as the 1982 United Nations Fish Stocks Agreement, has proven inadequate in efficiently regulating the utilization of fish resources among nations. This inadequacy is evident in the alarming 50 percent decrease in overall fish populations and a particularly noteworthy 70 percent decline in combined tuna populations, a highly commodified species (McDonald, 2014). Additionally, there has been an up to 83 percent reduction in overall breeding populations (Hutchings et al., 2004), all while the world’s appetite for fish on a per capita basis increase (Greenberg, 2011).

The challenge of managing international fish resources is particularly complex due to the presence of these resources in international waters, where no single nation has jurisdiction. Furthermore, the migratory nature of various commodified fish, such as tuna, leads to fish stocks being situated in different countries' jurisdictions at various times of the year. For a state to maximize their economic gains from fishing, there is an incentive to extract as much fish as possible while they are within their territory and before they migrate to another state's territory. This practice, however, can severely damage the renewability of fish stocks. There is then the issue of the High Seas where no country can exercise sovereignty over fish, so who can enforce quotas? To address the issue, the United Nations has recently drafted the High Seas Treaty, establishing international laws that, at least in theory, could be enforced through the use of force.

Fish are also unique in that, as a renewable resource, they require no input from humans, only for humans to exercise restraint. Some states do have fishery programs where they do breed and introduce fish to their waters, but the incentive to breed migratory fish is low as the state cannot monopolize those species. There is no incentive to create expensive fishery programs for fish that will leave their territorial waters and be exploited by other states, resulting in a net loss for the state.

Nevertheless, in most cases where fish resources have been exhausted, as little as ten years of restraint has been enough to regenerate the resource (Greenberg, 2011). Albeit, this has not been the case with Canada's Cod. It has become a lamentation dating back to 1600 that the sea was so black with cod that a human could have walked on it (Goethel, 2021). Yet, after decades of fishing regulation, Canada's cod populations teeter on the brink of collapse. Overall, Canada's cod serve as a warning against doing too little, too late. Fish then, as a renewable resource that 'merely' requires restraint for management, fish become a tragedy of the commons (when actors overconsume a resource at the expense of society), representing the convergence of industry, state rights, territorial control, and climate change leading to MFDs. It is a tragedy of the commons compounded by yet another tragedy: climate change. But just how much of a threat multiplier is climate change when it comes to conflicts over fish? Fish, as a renewable resource that 'merely' require restraint for management, can become a tragedy of the commons—where actors overconsume a resource at the expense of society. This represents the convergence of industry, state rights and territorial control, leading to Militarized Fishing Disputes (MFDs). It is a tragedy of the commons compounded by yet another tragedy: climate change. But just how much of a threat multiplier is climate change when it comes to conflicts over fish? Is climate change even a cause of these conflicts, or are other variables causal?

**Climate Change Experiment**

Climate change impacts fish populations in various ways, but it also alters the migratory patterns of migratory and straddling fish—those that migrate or occur in the Exclusive Economic Zones (EEZs) of one or more states. Specifically, climate change is poised to significantly alter the migration patterns of highly migratory fish, already exerting an impact on Malaysia's fishing industry (Tan, 2024). Given the migratory nature of key commodified fish, such as tuna, the unique tragedy of the commons they present is subject to migration itself. Climate change has the potential to significantly exacerbate the patterns of fish populations, disrupting and displacing industries, compounding the challenges of overfishing and environmental degradation. Considering then the dynamics of territorial control, the impact of climate change and its future implications, and the competition among states, it is imperative to determine whether the depletion of fish stocks due to migration and other climate change related effects or if fishing activities are merely employed to reinforce a state's EEZ claims. These issues gain heightened relevance in the Indo-Pacific as these states are presently engaging in rearmament (Medcalf, 2020). This study then seeks to ascertain the causation between fish as a commodity and conflict in the context of climate change, employing El Niño as an instrumental variable (previously utilized for predicting tuna migration and abundance) (Lehody et al., 1997). In this way, El Niño will represent the effects of climate change's future impact.

**Methodology**

This research broadly argues that fishing conflict is increasing and more specifically contends that climate change will intensify competition over commodities such as fish, thereby leading to greater conflict than would occur without climate change. To demonstrate the effect of climate change, a quasi-experiment was conducted using El Niño–Southern Oscillation (ENSO) events. These oscillations represent the strongest source of interannual climate variability on the planet and significantly impact both marine and terrestrial ecosystems (Grothe et al., 2019). This made a quasi-experimental design appropriate for establishing a causal relationship between climate change and rising conflict, particularly since isolating variables or ethically manipulating them is not feasible. El Niño and La Niña events were used as instrumental variables to capture variations in ocean temperatures: El Niño reflects warmer conditions (analogous to climate

change), while La Niña represents cooler conditions. Months that do not fall under either event serve as a control group, representing neutral conditions. The level of conflict during each of these periods is then measured to assess the relationship between climate variability and fishing-related conflict. The research data for the total quantity of conflict is based on Spijkers et al.'s (2019) research, which has been used for various studies on fishing and conflict to develop an international fishery conflict database. The data was collected from 1974 to 2016 using various key word searches to compile articles from LexisNexis Academic database (Spijkers et al., 2019). The data was further cleansed to eliminate duplicates, as Spijkers et al.'s research captured articles and syndications, as well as larger events being reported by multiple media outlets (Spijker et al., 2019). These were apparent in the data as they would occur next to each other as events were recorded by date. If left unaddressed, these duplicates would distort the data. The data produced by Spijkers et al. had dates provided by month, so the measurement of incidents is on a per-month basis.

**Confounding Variable**

A confounding variable in using data this way is the increased prevalence of media, making it easier to report on incidents that fit the study's search criteria as the study progressed. Consequently, there would be more reports with the advent of the internet and other advances in communication. To control this variable as much as possible, this paper breaks the data into pre-2000 and post-2000 groups.

**Operationalization**

El Niño and La Niña oscillations were operationalized by data events captured by the Oceanic Niño Index (ONI), the standard that the National Oceanic and Atmospheric Administration (NOAA) uses for classifying these events by capturing sea surface temperatures (NOAA, 2024). Additionally, El Niño and La Niña occur at irregular intervals, approximately every two to seven years, adding an element of randomness that enhances the internal validity of the experiment. The baseline for measuring El Niño and La Niña events is based on centered 30-year base periods updated every five years as produced by ONI, with the base being 0. El Niño events were classified as anything above a +0.5-degree temperature change, while La Niña events were anything greater or equal to a -0.5-degree temperature change.

Events were then classified as either weak (+/- 0.5 to 0.9), moderate (1.0 to 1.4), strong (1.5 to 1.9), or very strong (≥ 2.0), and the duration was calculated in months according to the ONI. Weak events were analyzed separately to see if there was a correlation between weak events and the number of incidents. A second group of moderate to very strong events was also created to examine if there was a stronger correlation than with weak events. Should a relationship be found between severity and increased conflict there is a stronger argument for causality. Notably, La Niña produced no "very strong" events. Finally, a control group of -0.5 to 0.5 in temperature change from 0 was classified as non-events as they were neither El Niño or La Niña events. Therefore, results could be measured against the control group as well as comparisons made between El Niño and La Niña.

**Hypothesis**

If climate change truly impacts the amount of conflict over fish, then the data should show that El Niño has a higher number of incidents than both La Niña and the control group. In theory, this includes weaker El Niño events, with stronger El Niño events producing an even higher number of incidents. Conversely, La Niña should have fewer events than both the control group and El Niño, including weaker La Niña events, with stronger La Niña events producing even fewer

incidents. Additionally, since the data is split into pre-2000 and post-2000 periods, there should be a higher rate of incidents per month in the post-2000 period compared to the pre-2000 period, given that period has a warmer climate. Therefore, the trend should show an increasing number of incidents. However, this latter statement can be confounded by various other pressures that would also produce more incidents per month.

### Limitations

In addition to the confounding variables associated with increased media prevalence, the paper does not capture the severity of events. It only captures the total number of incidents whereas severity could paint a different picture. The paper also does not account for fluctuations in the number of fishing vessels per year or the growth of various states' navies since 1974. Moreover, the keyword search method used by Spijker et al. (2019) may have introduced selection bias and excluded certain events. Their definition of fisheries conflict was constrained to incidents "related to access to a fishery resource or management of a fishery resource." A broader definition might reveal a greater prevalence of territorial disputes, rather than solely fishing-related conflicts.

### Data and Results

As expected, there is an increase in total events on average over time. Notably, there is a spike in total events from 1996 to 1998 and a drop in events from 2000 to 2005, suggesting that Spijkers et al.'s (2019) study is not overly affected by the confounding variable of increased media coverage. The above table also highlights a low in conflict from 2002 to 2004, despite an increase in reporting methods compared to the low between 1982 and 1984. Again, this indicates that the increase in events post-2000 is not solely due to improved reporting. Other variables, such as fewer fish and increased competition, are likely to have contributed more significantly. This indicates that the dependent variable, the amount of conflict as determined by the media, is accurate enough to capture trends. Another important trend in this table is the increased volume in beginning in 2009-2010, perhaps coinciding with an increasingly confident China who asserts their claims on the Nine-Dash-Line. Absent from this data, but noted by Spijkers et al.'s study, is that the conflict has shifted from Europe and North America to the Pacific. Their study found not only an increase in the amount of conflict, as noted by the above table, but also an increase in severity (Spijker et al., 2019).

**Figure 01: Total Number of Conflict Incidents Per Year**

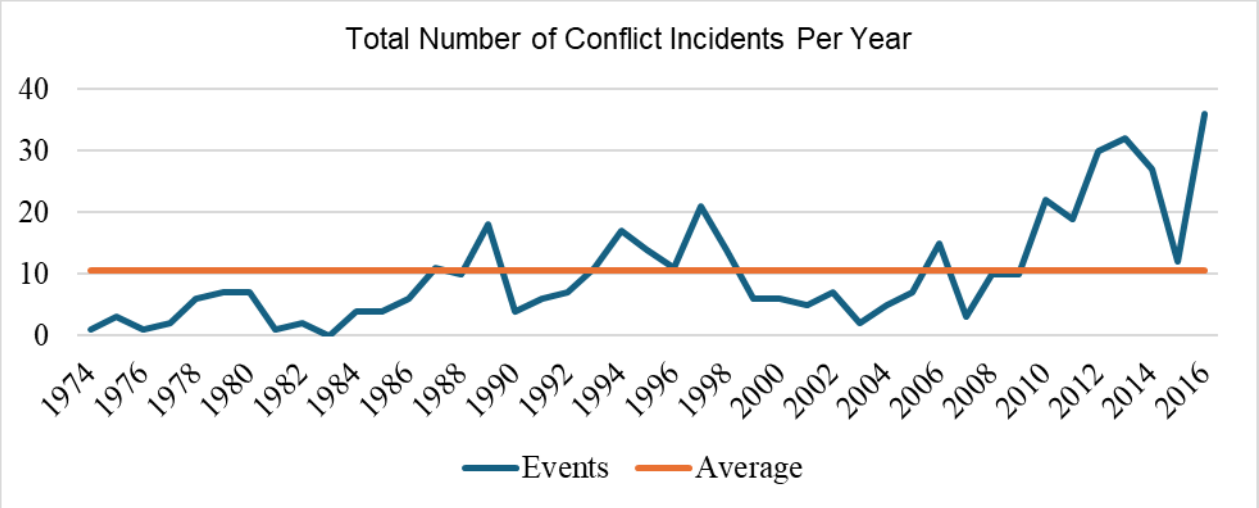


**Table 01: El Niño**

| El Niño | | | | | | | |
|---|---|---|---|---|---|---|---|
| Moderate to Very Strong | | | | Weak | | | |
| Year | Months | Incidents | Ratio | Year | Months | Incidents | Ratio |
| 1974 | - | - | - | 1974 | - | - | - |
| 1975 | - | - | - | 1975 | - | - | - |
| 1976 | - | - | - | 1976 | 5 | 1 | 0.2 |
| 1977 | - | - | - | 1977 | 6 | 1 | 0.17 |
| 1978 | - | - | - | 1978 | - | - | - |
| 1979 | - | - | - | 1979 | 4 | 5 | 1.25 |
| 1980 | - | - | - | 1980 | - | - | - |
| 1981 | - | - | - | 1981 | - | - | - |
| 1982 | 6 | 0 | - | 1982 | 4 | 0 | - |
| 1983 | 4 | 0 | - | 1983 | 1 | 0 | - |
| 1984 | - | - | - | 1984 | - | - | - |
| 1985 | - | - | - | 1985 | - | - | - |
| 1986 | 3 | 1 | 0.33 | 1986 | - | - | - |
| 1987 | 10 | 10 | 1 | 1987 | 2 | 1 | 0.5 |
| 1988 | - | - | - | 1988 | 1 | 1 | 1 |
| 1989 | - | - | - | 1989 | - | - | - |
| 1990 | - | - | - | 1990 | - | - | - |
| 1991 | 3 | 2 | 0.67 | 1991 | 6 | 3 | 0.5 |
| 1992 | 4 | 3 | 0.75 | 1992 | 1 | 0 | - |
| 1993 | - | - | - | 1993 | - | - | - |
| 1994 | 3 | 1 | 0.33 | 1994 | 2 | 8 | 4 |
| 1995 | 2 | 2 | 1 | 1995 | - | - | - |
| 1996 | - | - | - | 1996 | - | - | - |
| 1997 | 8 | 21 | 2.625 | 1997 | 1 | 0 | - |
| 1998 | 3 | 8 | 2.67 | 1998 | 1 | 0 | - |
| 1999 | 4 | 2 | 0.5 | 1999 | 1 | 3 | 3 |
| **(1974 to 1999) Total:** | 50 | 50 | 1 | **(1974 to 1999) Total:** | 35 | 23 | 0.65 |
| 2000 | - | - | - | 2000 | - | - | - |
| 2001 | - | - | - | 2001 | - | - | - |
| 2002 | 4 | 2 | 0.5 | 2002 | 4 | 3 | 0.75 |
| 2003 | - | - | - | 2003 | - | - | - |
| 2004 | - | - | - | 2004 | 7 | 3 | 0.43 |
| 2005 | - | - | - | 2005 | 1 | 0 | - |
| 2006 | - | - | - | 2006 | 5 | 5 | 1 |
| 2007 | - | - | - | 2007 | - | - | - |
| 2008 | - | - | - | 2008 | - | - | - |
| 2009 | 4 | 4 | 1 | 2009 | 3 | 1 | 0.33 |
| 2010 | 2 | 8 | 4 | 2010 | 1 | 1 | 1 |
| 2011 | - | - | - | 2011 | - | - | - |
| 2012 | - | - | - | 2012 | - | - | - |
| 2013 | - | - | - | 2013 | - | - | - |
| 2014 | - | - | - | 2014 | 4 | 9 | 2.25 |
| 2015 | - | - | - | 2015 | - | - | - |
| 2016 | 8 | 42 | 5.25 | 2016 | 4 | 6 | 1.5 |
| **(2000 - 2016) Total:** | 18 | 56 | 3.11 | **(2000 - 2016) Total:** | 29 | 28 | 0.97 |
| **(1974-2016) Total:** | 118 | 156 | 1.32 | **(1974-2016) Total:** | 99 | 74 | 0.74 |

The data perfectly conforms to the hypothesis, showing that the weak group produced fewer incidents per month than the moderate to strong group over all time periods. From 1974-1999, the strong group produced 49 percent more incidents per month than the weak group. From 2000 to 2016, the strong group produced 221 percent more events per month than the weak group. Overall, the strong group produced 78 percent more than weak group. Additionally, from 1974 to 1999, there were fewer incidents in both the moderate to very strong group and the weak group as compared to 2000-2016. Notably, there were two “very strong” El Niño events, the first from 1997/98 and the second in 2015/16. Both these events produced more than double the average incidents per month within their respective time period than other El Niño events. This further confirms that warmer temperatures produce more incidents per month.

There were also eleven occasions when there was both strong and weak El Niño events present in the same year. Even within these years, indicating a most similar method, the strong group produced more incidents per month. Of these eleven times, the stronger group produced more incidents per month eight out of eleven years. Again, this further confirms that warmer temperatures produce more conflict over fishing and points towards a causal relationship. It is also possible that in the three years where the weaker El Niño events produced more incidents within the same month, tensions were already flared up by the warmer events that preceded the weaker El Niño events and the conflict simply continued into the weaker El Niño months.

Unlike El Niño, La Niña does not fully conform to the hypothesis, which posits that warmer temperatures lead to more conflict and implies that cooler temperatures would lead to less conflict. While it is true to an extent in that La Niña produced fewer events per month than El Niño, the stronger La Niña (cooler temperatures) resulted in more conflict than weak La Nina events. From 1974 to 1999, the weaker group produced 72 percent more incidents per month than the strong group. From 2000 to 2016, the stronger group produced 78 percent more events per month than the weak group.

This suggests that cooler temperatures generally reduce conflict, but that even colder temperatures have little effect and even the opposite effect. Arguably, this is because the mechanism at play involves diminishing effects as temperatures decrease, with a threshold at which the effect occurs. For example, fish do not migrate due to cooler temperatures, only due to warmer temperatures beyond a specific threshold. However, stronger La Nina events may cause more adverse weather effects than weaker La Nine events increasing the reliance on fish. For example, we know that La Nina produces an increase in cyclone activity which may damage terrestrial crops forcing people to supplement their diet with more fish (University of Ottawa, 2024). In any case there is certainly scope for further study on the mechanism at play, especially because climate change will bring with it stronger La Nina events.

Finally, in 1997-98, La Niña (Table two) produced a much higher than average number of incidents per month. This seems uncharacteristic for La Niña and is not predicted by the hypothesis. However, this particular La Niña event followed a very strong El Niño event, which could have affected migratory fish populations or even caused a spillover effect from hostilities that began during El Niño but persisted for some time afterward. In any case, the 1997-98 La Niña event was included in the overall data, increasing La Niña’s overall average.

## Table 02: La Niña

| Moderate to Strong | | | | Weak | | | |
|---|---|---|---|---|---|---|---|
| **Year** | **Months** | **Incidents** | **ratio** | **Year** | **Months** | **Incidents** | **ratio** |
| 1974 | 3 | 0 | - | 1974 | 7 | 1 | 0.14 |
| 1975 | 8 | 2 | 0.25 | 1975 | 4 | 1 | 0.25 |
| 1976 | 1 | 0 | - | 1976 | 2 | 0 | - |
| 1977 | - | - | - | 1977 | - | - | - |
| 1978 | - | - | - | 1978 | - | - | - |
| 1979 | - | - | - | 1979 | - | - | - |
| 1980 | - | - | - | 1980 | - | - | - |
| 1981 | - | - | - | 1981 | - | - | - |
| 1982 | - | - | - | 1982 | - | - | - |
| 1983 | 1 | 0 | - | 1983 | 4 | 0 | - |
| 1984 | 2 | 0 | - | 1984 | 2 | 1 | 0.5 |
| 1985 | - | - | - | 1985 | 7 | 1 | 0.14 |
| 1986 | - | - | - | 1986 | - | - | - |
| 1987 | - | - | - | 1987 | - | - | - |
| 1988 | 8 | 5 | 0.625 | 1988 | 1 | 2 | 2 |
| 1989 | 2 | 1 | 0.5 | 1989 | 2 | 0 | - |
| 1990 | - | - | - | 1990 | - | - | - |
| 1991 | - | - | - | 1991 | - | - | - |
| 1992 | - | - | - | 1992 | - | - | - |
| 1993 | - | - | - | 1993 | - | - | - |
| 1994 | - | - | - | 1994 | - | - | - |
| 1995 | 3 | 1 | 0.33 | 1995 | 3 | 2 | 0.67 |
| 1996 | - | - | - | 1996 | 2 | 0 | - |
| 1997 | - | - | - | 1997 | - | - | - |
| 1998 | 6 | 5 | 0.83 | 1998 | 1 | 1 | 1 |
| 1999 | 12 | 6 | 0.5 | 1999 | - | - | - |
| **(1974 to 1999) Total:** | **46** | **20** | **0.43** | **(1974 to 1999) Total:** | **35** | **9** | **0.25** |
| 2000 | 2 | 1 | 0.5 | 2000 | 10 | 5 | 0.5 |
| 2001 | - | - | - | 2001 | 2 | 1 | 0.5 |
| 2002 | - | - | - | 2002 | - | - | - |
| 2003 | - | - | - | 2003 | - | - | - |
| 2004 | - | - | - | 2004 | - | - | - |
| 2005 | - | - | - | 2005 | 3 | 1 | 0.33 |
| 2006 | - | - | - | 2006 | 2 | 3 | 1.5 |
| 2007 | 5 | 1 | 0.2 | 2007 | 3 | 2 | 0.66 |
| 2008 | 3 | 3 | 1 | 2008 | 5 | 3 | 0.6 |
| 2009 | - | - | - | 2009 | 2 | 1 | 0.5 |
| 2010 | 7 | 13 | 1.85 | 2010 | 1 | 0 | - |
| 2011 | - | - | - | 2011 | - | - | - |
| 2012 | - | - | - | 2012 | 3 | 7 | 2.33 |
| 2013 | - | - | - | 2013 | - | - | - |
| 2014 | - | - | - | 2014 | - | - | - |
| 2015 | - | - | - | 2015 | - | - | - |
| 2016 | - | - | - | 2016 | - | - | - |
| **(2000 - 2016) Total:** | **17** | **18** | **1.06** | **(2000 - 2016) Total:** | **31** | **23** | **0.74** |
| **(1974-2016) Total:** | **109** | **58** | **0.53** | **Total:** | **101** | **41** | **0.41** |

**Table 03: Control Group: Neither El Nino or La Nina (Moderate to Strong)**

| Year | Months | Events | Ratio |
|---|---|---|---|
| 1974 | 2 | 1 | 0.5 |
| 1975 | - | - | - |
| 1976 | 4 | 0 | - |
| 1977 | 7 | 1 | 0.14 |
| 1978 | 12 | 5 | 0.42 |
| 1979 | 8 | 2 | 0.25 |
| 1980 | 11 | 6 | 0.55 |
| 1981 | 12 | 1 | 0.08 |
| 1982 | 2 | 2 | 1 |
| 1983 | 2 | 0 | - |
| 1984 | 8 | 3 | 0.38 |
| 1985 | 5 | 2 | 0.4 |
| 1986 | 7 | 4 | 0.57 |
| 1987 | - | - | - |
| 1988 | 2 | 2 | 1 |
| 1989 | 8 | 17 | 2.13 |
| 1990 | 12 | 4 | 0.33 |
| 1991 | 3 | 1 | 0.33 |
| 1992 | 7 | 3 | 0.43 |
| 1993 | 12 | 11 | 0.92 |
| 1994 | 7 | 7 | 1 |
| 1995 | 4 | 9 | 2.25 |
| 1996 | 10 | 11 | 1.1 |
| 1997 | 3 | 0 | - |
| 1998 | 1 | 1 | 1 |
| **(1974 to 1999) Total:** | 149 | 93 | 0.62 |
| 1999 | - | - | - |
| 2000 | - | - | - |
| 2001 | 11 | 5 | 0.45 |
| 2002 | 4 | 2 | 0.5 |
| 2003 | 11 | 2 | 0.18 |
| 2004 | 5 | 2 | 0.4 |
| 2005 | 8 | 6 | 0.75 |
| 2006 | 5 | 7 | 1.4 |
| 2007 | 4 | 0 | - |
| 2008 | 4 | 4 | 1 |
| 2009 | 3 | 4 | 1.33 |
| 2010 | 2 | 0 | - |
| 2011 | 1 | 0 | - |
| 2012 | 9 | 23 | 2.55 |
| 2013 | 12 | 32 | 2.67 |
| 2014 | 8 | 18 | 2.25 |
| 2015 | - | - | - |
| 2016 | - | - | - |
| **(2000 - 2016) Total:** | 87 | 105 | 1 |
| **(1974-2016) Total:** | 236 | 198 | 0.83 |

Conforming to the hypothesis, the control group (Table three) produced more events per month than the La Niña (Table two) group in all year categories and far fewer incidents per month than the strong El Niño (Table one) group. However, it did produce only slightly more incidents per month compared to the weak El Niño years. While this difference is not statistically significant, it may indicate some resilience to slightly warmer ocean conditions for various reasons. This is a positive sign for policymakers, suggesting that the planet can handle some level of stress, and that the situation is not hopeless.

**Table 04: Overall Results Comparison**

| | Months | Incidents | Incidents Per Month |
|---|---|---|---|
| **La Niña 1974-2016** | 210 | 99 | 0.47 |
| **Neutral 1974-2016 (Control Group)** | 236 | 198 | 0.83 |
| **El Niño 1974-2016** | 217 | 230 | 1.06 |

**Data Summary**

As hypothesized, from 1974 to 2016, El Niño (Table one produced more incidents per month than the control group, resulting in a 28 percent increase and 126 percent more than La Niña (Table two)). Also as expected, the control group (Table three) produced 83 percent more incidents per month than La Niña (Table two), despite La Niña's ability to cause large weather disruptions through increased cyclone activity. The leaves one to want at the mechanism. why does a warmer ocean increase conflict? This is an important question for policymakers to address in order to mitigate the link between conflict and climate change. The mechanisms causing an increase in conflict are multifaceted, and these, in addition to other factors, explain the rising trend of conflict over fish. First, an understanding of international law of the sea is necessary.

**Mechanism**

Overall, the effect of warmer temperatures increases the scarcity of fish while food demand rises due to a growing human population. Additionally, and in the short term, El Niño can compound pressure on fish by affecting terrestrial food sources, leading to decreased crop yields and droughts, which deepen dependence on fish (Rojas et al., 2014). A longer-term implication might be that people become more reliant on crops that reliably produce a yield during El Niño events, leading to monoculture. This could result in future failures, similar to the Irish potato famine, causing a short-term reliance on resources like fish. Monoculture is not solely due to El Niño; for example, as China continues its international fishing efforts, it has shifted Filipino fishermen towards prawn farming, making these local fishing economies highly dependent on a single species *(*Riñoza and Jason Gutierrez, 2021). Should prawn farming fail, fishermen might become more willing to engage in conflicts with Chinese fishermen. Notably, the pressure of prawn farming has already led to the use of exorbitant amounts of antibiotics to keep prawns alive, highlighting the vulnerability of prawn farming. The use of such medications also carries additional health implications, such as accelerating antibiotic resistance in humans.

Warmer waters also have a relatively immediate effect on fish populations and the location of fish. During El Niño, and by default warmer temperatures, many different species of fish become displaced from their normal ranges. These species fall under two classifications: highly migratory fish and straddling fish stocks. Straddling stocks, such as pollock, migrate between or occur in both the exclusive economic zone (EEZ) of one or more states and the high seas (United

Nations, 2024). Highly migratory fish travel long distances and often cross domestic and international boundaries (NOAA, 2024).

Fish migrate due to the lack of upwelling events, which bring plankton closer to the surface and require cooler temperatures. Consequently, the fish swim to cooler waters, leaving one state's EEZ for another state's EEZ or the high seas. Recall that even the control group had an 83 percent increase in conflict compared to La Niña, a weather pattern that allows for greater upwelling events. This suggests that upwelling events (food abundance for fish) play a large role in regulating conflict over fish and the lack of upwelling events play a larger role than other variables. These effect of the lack of upwelling events are particularly strong in the Asia-Pacific region and the highly contested South China Sea, where significant pressure is placed on fish populations (Hendrix, 2024). As fish move to cooler waters in search of food, the effect of El Niño is that it creates scarcity in some regions and abundance in others, potentially displacing fishing fleets and increasing competition for fish in both the areas they have migrated from and the areas they have migrated to. This displacement may push international fishing fleets to the high seas, leading to increased competition in those regions, as no country has jurisdiction over the high seas fish—a true tragedy of the commons. In any case, one states tragedy is another's opportunity, especially for straddling fish stocks that might leave a well-protected EEZ for one that is heavily exploited.

**The China Effect**

China having not managed its EEZ in accordance with Article 61 of UNCLOS has depleted its fish stocks, leading to the displacement of its massive and heavily subsidized distant water fishing fleets, comprising 564,000 vessels steeply down from 1,072,000 vessels (Meyers et al., 2022). Nonetheless, a fleet of half a million fishing vessels certainly has the capacity to impact fishing practices significantly. China's fishing fleet has become much more efficient, even utilizing 'mother' ships that eliminate the need for smaller vessels to return to port, allowing for more time spent fishing (Myers et al., 2022). Distinctly, China strategically employs part its fishing fleets as a paramilitary force to bolster its maritime claims in East Asia, participating in what are commonly referred to as grey zone operations (Yatsuzuka, 2023). This exacerbates already fragile multilateral relations in the region. Furthermore, China's fishing fleet has extended its operations to the coasts of other states, reaching as far as Ecuador's Galapagos Islands, where they operate around the clock, 365 days a year, and are known to engage in illegal practices like shark finning (Shuxian and Panter, 2021).

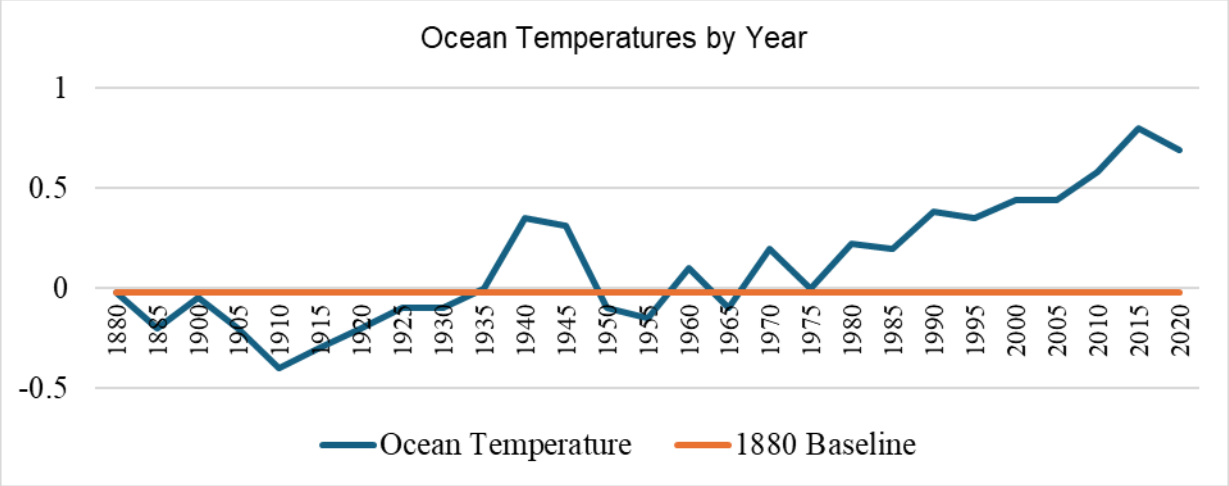
In November 2023, a Chinese flotilla of 38 ships, including 28 fishing vessels alongside five military ships, entered Filipino territorial waters and fired their water cannons on a Filipino fishing vessel, though no serious injuries resulted. Meanwhile, Japan had arrested a Chinese fishing captain who collided with two Japanese coast guard ships, followed by another incident where a Japanese Maritime Self-Defense Destroyer 'collided' with a Chinese fishing vessel (Panda, 2020). More recently, two Chinese fishermen drowned after being chased down by Taiwanese maritime enforcement (Guzman et al., 2024). Note that Taiwan and China are already at odds and given enough pressure on relations a fishing incident might trigger an escalation of hostilities, particularly if nationalist fishermen become involved. The infringement of foreign fishing vessels might further destabilize a region already under pressure from El Niño. For example, El Niño could cause land-based weather patterns, such as drought, forcing farmers to become fishermen. Should El Niño cause other reasons for economic contraction, it is not

unthinkable to see many people turn to the sea for their livelihood. This was the case during my fishing trip in Bali, Indonesia, where my fishing guides became spearfishermen during COVID to provide for their families due to the collapse of tourism. This pattern could be reinforcing, where already strained fish populations come under further pressure. COVID also helps to explain why Australia now sinks nearly four times as many ships since pre-COVID, given that Indonesia could not rely on tourism (Casben, 2022). Additionally, given that China has depleted its own fishing resources and encroaches on other states' EEZs, there could be clashes with local fishermen. These local fishermen, due to a terrestrial El Niño event, might be more desperate to make their living on the sea and will become more persistent in opposing China's fishing fleets.

Mechanism of Overall Trend

However, the data shows that it is not just El Niño months that exhibit an increased trend in conflict. Both the control group, La Niña, and the overall data indicate a rise in the amount of conflict surrounding fish. Given that warmer waters during El Niño produce less plankton, which in turn shifts fish populations, the concern extends to warmer oceans in general and more permanent displacement of fish to the Arctic. The graph below from NOAA National Centers for Environmental Information (NCEI) highlights how much warmer our oceans are becoming, suggesting that the world should expect an ongoing increase in conflict over fish due to the permanent alteration of fish locations. Notably, northern countries stand to benefit from these shifting populations as fish seek cooler waters in the north. However, this could also lead to concerns if foreign fishing fleets follow the fish. For example, China already claims to be a "near Arctic state" as it eyes the riches of the Arctic. In fact, the Canadian Navy has been tracking Chinese 'research' vessels in the Arctic and NORAD has incepted Chinese aircraft illegally entering Canadian air space (Brewster, 2024).

**Figure 02: Ocean Temperatures**




Source: NOAA National Centers for Environmental Information (NCEI)

**Conclusion**

The data is clear: warmer weather leads to more conflict over fish, raising concerns about future disputes, while declining fish populations threaten overall food security. More conflict was evident in both El Niño and La Niña years compared to the control group. This suggests that while warmer oceans may not always directly cause conflict, they can exacerbate existing tensions. However, this study does not claim climate change to be the sole cause of conflict; rather, it highlights that

climate change can act as a threat multiplier, intensifying existing tensions. Additionally, the observed pattern of strong El Niño events suggests that the link between El Niño and conflict may be stronger from 2000 to 2016 compared to the earlier period from 1974 to 2000. Given the trend of rising temperatures and more intense El Niño events, we might expect continued or increased conflict in the future, from 2017 onward. In conclusion, this paper underscores how climate change is contributing to increased conflict, highlighting one of several threat multipliers. It is crucial for states to prepare for increased instability partly due to climate change, rather than merely hoping to control it. This preparation does not necessarily mean increasing defence spending but involves working with international organizations and forming bilateral agreements to minimize the impact of climate change on conflict and international relations. After all, as a renewable resource fish are one thing that deserves cooperation, not competition.

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