Ruling the Sea: Institutionalization and Privatization of the Global Ocean Commons

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Abstract: Maritime issues have gained international prominence in recent decades, fueled by the decline in global fishing catches, the scramble for oil and mineral resources, and states' desire to lay sovereign claims to their maritime spaces. States are willing to use militarized force to defend their maritime claims, as the UK-Iceland "Cod Wars" and militarized confrontations between Greece and Turkey in the Aegean Sea demonstrate. This paper evaluates two primary mechanisms for resolving maritime conflicts: 1) the creation of private ownership of maritime zones in the form of Exclusive Economic Zones (EEZs), and 2) the creation of an institution, the United Nations Convention on the Law of the Sea (UNCLOS), to establish standards for maritime claims and the resolution of disputes. We evaluate the effects of UNCLOS and EEZs on the peaceful and militarized management of maritime claims in the Western Hemisphere and Europe (1900-2001) and the long-run effects of privatization and institutionalization on marine fishing stocks (1950-2003). Our analyses suggest that declared EEZs work efficiently for helping states to reach agreements over maritime claims in bilateral negotiations, while membership in UNCLOS prevents the outbreak of new claims and promotes more frequent third party management efforts. We also find a U-shaped relationship between marine catches and the duration of UNCLOS/EEZ commitments, indicating that fish stocks initially decline and then recover positively after the implementation of conservation policies.

Previous versions of this paper were presented at the 2007 Annual Meeting of the American Political Science Association, August 30-September 2, Chicago, IL, the 2007 Annual Meeting of the International Studies Association, February 28-March 3, Chicago, IL, and the Department of Political Science at the University of Iowa. We thank John Conybeare, Stephen Long, Erik Melander, and Bill Reed for useful comments on previous drafts.

Battle on the high seas has often been the subject of dramatic chronicles, ranging from the Battle of Salamis or the Invincible Armada to pirates, treasure fleets, and massive clashes between battleships or aircraft carriers. Conflicts on the seas still occur today, but now they involve fishing trawlers and coastal patrol vessels rather than galleons or dreadnoughts. Today's conflicts are no longer driven by the lure of treasure, expansion, or bloodlust, but by more mundane concerns such as fishing. Yet today's maritime disputes are not trivial, occurring quite frequently -- and often between states that normally avoid militarized conflict, such as pairs of democracies (Mitchell and Prins, 1999). The over-fishing and exploitation of the ocean's resources, combined with the difficulties in establishing clear ownership over such resources as migratory fish stocks, generates numerous potential flash points for armed conflict.

The sea's role in providing a state with power and resources is now more important than ever. Tens of millions are employed in the harvesting of the sea's resources, and many millions more benefit from the consumption of these resources (UN FAO, 2006). As populations expand, these needs become more pressing and insistent. Garrett Hardin's (1968) "Tragedy of the Commons" provides a dramatic account of the effects of unhindered resource use and a chilling portent of the consequences of continued degradation of the global commons.

Multiple solutions have been suggested to address problems associated with joint management of common property resources (CPRs), such as the ocean's fishing stocks. A Leviathan or coercive *authority* can be established to prevent exploitation of resources through monitoring, sanctioning, and exclusion. Oceanic resources could be *privatized*, creating incentives for actors to manage their resources more efficiently. International *institutions* could also be created to help states manage these resources in a cooperative fashion. However, there is

little systematic empirical evidence on the efficacy of these various solutions to maritime CPR problems (Grafton et al., 2000).

This paper compares two of these broad solutions for the management of maritime CPRs: privatization in the form of Exclusive Economic Zones (EEZs) and institutionalization via the United Nations Law of the Sea Convention (UNCLOS). Using data from the Issue Correlates of War (ICOW) project and the UN Food and Agriculture Organization, we find that privatization through EEZs works best for managing maritime conflicts by promoting more frequent and more successful bilateral negotiations. UNCLOS is more successful at preventing the origin of new maritime claims and at promoting third party efforts to settle existing claims, although it has no systematic impact on the success of those efforts. Neither UNCLOS nor the establishment of EEZs has had much of an effect on militarized conflict over maritime resources, although UNCLOS members challenging the maritime status quo are more likely to employ militarized force to pursue their issue related goals. With respect to recovery of maritime fishing stocks, we find that both EEZs and UNCLOS have significant effects on marine catches, although these conservation policies take 15-25 years to produce noticeable results. Our analyses demonstrate the feasibility of different solutions to the tragedy of the commons, moving beyond approaches that focus on one solution to the exclusion of others.

THE MANAGEMENT OF THE SEA

For a resource that covers nearly three quarters of the earth's surface and has been at the center of human culture, frameworks for the governance of the sea have been slow to develop. One of the most central and enduring debates regarding sea resources arose as states began to have the capacity to protect waters close to their territory, navigate and use the seas for trade, and to use

these resources to further their imperial ambitions. This debate pitted the sovereignty demands of coastal states against the wish for unhindered navigation by the maritime powers. Eventually, the debate led to a compromise in which states gained sovereignty over a limited expanse of water – the "cannon shot" rule -- while maritime powers gained freedom of the seas outside of those limited areas (Pratt and Schofield, 2000: 3). This rule, along with other attempts to create territorial sea limits, provided the first attempt at privatization of the ocean's CPRs.

The debate continued throughout the twentieth century, as the "cannon shot" rule was considered ambiguous. Many states unilaterally began to adopt a 3 nautical mile territorial sea limit. Maritime powers sought to enshrine the 3 nautical mile limit as a universal rule, but were unsuccessful in reaching an agreement during the Hague Codification Conference of 1930. This failure resulted in a period of "creeping coastal state jurisdiction", as states began to expand their sovereignty beyond the 3 nautical mile limit, and coastal states and maritime powers once again conflicted over sovereignty versus navigation rights (Pratt and Schofield, 2000: 3-4).

The wave of decolonization after World War II, the burden of increasing populations and resource demands, and improving technology to exploit the sea's resources, increased the expansion of territorial waters. The Truman Declaration of 1945 was one of the farthest ranging declarations of sovereignty, stating that "the United States regards the natural resources…of the continental shelf beneath the high seas but contiguous to the coasts…as appertaining to the United States, subject to its jurisdiction and control" (Pratt and Schofield, 2000: 3). While no precise limit was established, this declaration encouraged states to claim jurisdiction over areas beyond their territorial sea. In 1952, Chile, Ecuador, and Peru declared jurisdiction over an area 200 nautical miles from their coasts (Pratt and Schofield, 2000: 3), resulting in a series of disputes over fishing rights with other countries, including the United States and Canada.

The amalgamation of rules, territorial limits, and sovereignty claims that began with the Truman Declaration reduced the ability of states to transit waters and exploit the resources of the sea, and led to situations in which the sea was used recklessly. Two unsuccessful conferences in 1958 and 1960 attempted to create a uniform standard for territorial seas.[1] A third conference that began in 1974 was more successful, culminating in the 1982 United Nations Convention on the Law of the Sea (UNCLOS). This agreement updated and expanded a series of conventions that had been created in 1958. In addition, UNCLOS established a consistent set of limits for territorial and contiguous seas, navigation rights, seabed usage, and dispute adjudication. The adoption of UNCLOS in 1982 represents a significant example of international cooperation regarding one of the most important global resources.[2]

Perhaps the most significant portion of the UNCLOS agreement is the creation of a set of definable limits for maritime boundaries. Article 3 of the agreement limits the breadth of the territorial sea to 12 nautical miles. To compensate for this relatively short expanse, Part V of the Convention established the exclusive economic zone (EEZ), an area beyond the territorial sea with a breadth of 200 nautical miles. States have sole rights over the exploitation of all the resources in their EEZ, whether natural or mineral. For many states, particularly resource-poor island states, the expansion of their territory and resource base was a "virtual revolution"

[1] While no agreement was reached on territorial seas, the 1958 conference (UNCLOS I) led to the creation of four Conventions: Territorial Sea and Contiguous Zone, Continental Shelf, High Seas, and Fishing and Conservation of the Living Resources of the High Seas. The second conference in 1960 (UNCLOS II) came close to an agreement on territorial seas but failed by a single vote (Pratt and Schofield, 2000:4)

[2] The United States supported most of the provisions in the 1982 UNCLOS agreement, but it objected to the provisions regarding deep seabed mining. One point of contention was the designation that mineral resources outside of national jurisdiction were a "common heritage of mankind" and subject to the control of a supranational regulatory agency, the International Seabed Authority (ISA). Other opposition stemmed from the United States' lack of authority in the decision making process of the ISA and the allocation of mining rights on principles inconsistent with free market principles (Bandow, 2005; Browne, 2005). The United States has not been a signatory on either the original UNCLOS agreement or the 1994 amendments to the original convention. However, the Bush Administration moved to a more supportive position of UNCLOS ratification in 2007 because it would allow the U.S. military to move more freely in open seas. The Senate Foreign Relations Committee voted in favor of ratification by a vote of 17-4 on October 31, 2007 (http://www.reuters.com/article/latestCrisis/idUSN31335584).

(Borgese, 1995: 14). This provision effectively placed over 38 million square nautical miles of the ocean under some sort of national jurisdiction. All told, nearly 87 percent of all known and estimated reserves of hydrocarbons, and nearly 99 percent of all fisheries, are now under national jurisdiction (Borgese, 1995: 14). These include estimates of nearly 240-300 billion tons of oil in known reserves and vast mineral wealth found in deep sea nodules (UN, 1998). Lastly, the convention also established a comprehensive dispute settlement system, which is obligatory for all signatory states (Borgese, 1995).

MANAGING COMMON PROPERTY RESOURCES

Hardin's (1968) "Tragedy of the Commons" presents a stark vision of the problems inherent with "common property resources" (CPRs) – resources characterized by low excludability, yet high rivalry. In other words, the use of the resource cannot be excluded, but the benefits obtained from the resource detract from other actors' abilities to obtain benefits. The resources of the sea represent a global commons of enormous wealth and bounty. Overall, approximately 103 million tons of fish are caught each year for human consumption, and fish provide more than 2.6 billion people with at least twenty percent of their average animal protein intake (UN FAO, 2006: 5). The resources of the sea are also a tremendous source of wealth and energy for states. The global fishing industry employs some 41 million people and has an annual impact of at least $183 billion, including $71.5 billion in exports in 2004 (Borgese, 1998: 61; UN FAO, 2006: 6-7). Energy resources of the sea contribute another $138 billion (Borgese, 1998: 61), and offshore oil provides at least 30 percent of global oil production (Odell, 1997: 18). It is also estimated that nearly 1.5 trillion tons of mineable manganese nodules exist on the ocean floor, representing a nearly limitless supply of metal for global consumption (Payne, 1978: 937).

Because states frequently compete over these resources, managing the exploitation of the resource remains paramount. Aristotle once lamented, "what is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest" (Ostrom, 1990: 2). The exploitation of common property goods, if unresolved, leads to situations of ruin. Such a fear is not unfounded in the fishing industry, as some three-fourths of the world's major fisheries are currently being exploited at or beyond their maximum sustainable limits -- a figure that has worsened considerably since the 1970s.[3]

Theorists have devised three primary solutions for allocation of common property resources. The first advocates ceding control of resources to the state or another *authority* figure, which uses coercive force to prevent the abuse that is done through individual over-usage of the resource. This option resembles a Hobbesian approach to allocation issues and has dramatically been called "recourse to the Leviathan" (Ostrom, 1990: 9). Such approaches advocate the intervention of government agencies to manage the good, and perhaps the need for military power to prevent resource abuse (Ostrom, 1990). The second solution suggests that the *privatization* of the resource encourages sustainable management techniques because the consequences of exploitation are no longer directed towards all users, but rather to the user who is exploiting the resource. The third solution views the creation of *institutions* as a way to avoid the costs associated with the leviathan and the distributional problems of privatization. Well-designed institutions can become largely self-regulating and encourage individuals to act in ways that benefit themselves and the resource. We discuss these solutions in more detail in the next three sections.

[3] It is estimated that in 2005, around half of the world's major fish stocks were already being fully exploited near their maximum sustainable limits, and another quarter were overexploited, depleted, or recovering from depletion. The proportion of underexploited or moderately exploited fish stocks declined from 40% of the world total in 1974 to only 23% in 2005 (UN FAO, 2006: 29-33); see also Bailey (1996) and Alverson and Dunlop (1998).

Authority Solutions to CPR Problems

With respect to global maritime resources, the International Seabed Authority (ISA) comes closest to an authority-based solution. The ISA was established through the United Nations Law of the Sea Convention in 1982, and came into force in 1994. Its authority covers activities on those portions of the seabed lying beyond individual states' jurisdiction, which are designated as "the common heritage of mankind" or "the Area". While the ISA's activities so far have been typical of any international institution -- with an executive Council, a policymaking Assembly with representatives of all member states, and a Secretariat to handle day-to-day activities -- another more Leviathan-like organ will be created in the future. This final organ, the Enterprise, will be activated once deep-sea mining becomes commercially feasible. The Enterprise will be empowered to conduct exploration and exploitation of deep-sea minerals on behalf of the international community.[4] For now, though, the ISA does not have any explicit authority-based solutions for the seabed. We leave discussions of the effectiveness of authority solutions to future research.[5]

Privatization and the Sea

Advocates of a second solution to CPR problems suggest that "the only way to avoid the tragedy of the commons in natural resources…is to end the common property system by creating a system of private property rights." (Ostrom, 1990: 12) At a domestic level, this has led to the creation of property and title rights, or enclosure of the commons (Wijkman, 1982). Allocating the resource through ownership principles focuses the harm of "negative externalities" from the

[4] This mechanism is described in the following document on the ISA's web site: <http://www.isa.org.jm/files/documents/EN/Brochures/ENG2.pdf>

[5] The ISA may also be a mechanism for dealing with the increasing problem of illegal fishing, largely in response to moves to privatize large areas of the sea. For example, more than $1.6 billion of illegal seafood enters the European market each year, which has resulted in surging fish prices in the European market (http://www.nytimes.com/2008/01/15/world/europe/15fish.html?ref=world).

diffuse users of a common property resource to the single owner of a resource. As a result, owners devote greater resources and interest to the preservation and maintenance of their individual allocation. In terms of fisheries, this can be seen by the partial enclosure of the commons through the creation of Exclusive Economic Zones (EEZs).

Within their EEZ, states have jurisdiction and are free to manage, develop, and exploit all resources within the sea, the floor, and subsoil from their continental shelf with a boundary at 200 nautical miles or to the edge of the continental margin.[6] This idea gained widespread support amongst both developed and developing states. During the first substantive conference of UNCLOS in 1974, 100 out of 143 participating states supported the idea (Pratt and Schofield, 2000: 4). By the time a preliminary text was made ready in 1977, 29 states had made a formal EEZ claim; by the signing of UNCLOS in 1982, 59 states had done so (Pratt and Schofield, 2000: 4).

While privatization is an attractive solution, its primary drawback is the potential for the creation and/or exacerbation of resource distributional inequities. It has been admitted that the formalization of EEZs as part of the UNCLOS agreement "has increased, rather than decreased, inequality among states, giving more to the already well-endowed richer states" (Borgese, 1995: 15). One of the most significant problems is that the subdivision of the commons is not homogenous. Merely allocating equivalent portions of the commons does not mean that all users will get an equal share. States may be tempted to seek larger shares of the commons to put more resources under their private control; a lack of information about the resource will also complicate negotiations regarding the distribution of a resource since a state risks getting a worthless share (Wijkman, 1982). In addition, the migratory nature of fish stocks and the

[6]This is discussed in a UN Division for Ocean Affairs and the Law of the Sea web page, available at: <http://www.un.org/Depts/los/convention_agreements/convention_historical_perspective.htm>.

interconnectedness of the ocean's ecosystem mean that resources cannot be managed solely within the EEZ, leading to problems with fishing fleets pursuing migratory fish stocks just outside of other states' EEZs (Borgese, 1995; Bailey, 1996).[7] Since some resources can move between EEZs, each state has incentives to exploit the resource before another does the same.

Institutionalization and the Sea

Authority and privatization solutions can be problematic since they are relatively insensitive to time, place, and culture and cannot be imposed without high costs (Ostrom, 1990). As a result, the creation of institutions to manage resources is seen as a preferable third option. Institutions are designed by those who use the resource, and rules can be created that are closely aligned to the conditions of the resource. Appropriators depend heavily on the resource, which gives them incentives to monitor and report infractions, as well as to follow rules that have been established.[8] The creation of mechanisms for enforcement and conflict resolution allows appropriators to "initiate long-term arrangements that they could not otherwise undertake" (Ostrom, 1990: 17).

By evaluating a number of institutions charged with governing and managing common property resources (CPRs), Ostrom (1990) identifies eight design principles associated with successful CPR institutions: clearly defined boundaries, congruence between appropriation rules and local conditions, collective choice arrangements, monitoring, graduated sanctions, conflict

[7] Spain and Canada's "Turbot War" illustrates the conflict that can arise in such a situation. In 1994, after a study that indicated that turbot numbers had declined by two thirds since 1992, Canada implemented sharp cuts in its 1994 quota for turbot and asked the EU to do the same for 1995 (Song, 1997). The Northwest Atlantic Fisheries Organization (NAFO) agreed to set a total allowable catch of 27,000 tons for 1995, 60 percent of which would be allocated to Canada, while 12 percent was to be given to the EU (Song, 1997). Displeased at the result, the EU unilaterally set its quota at 69% of the total allowable catch set by NAFO. In response, Canada made it a crime for Spanish and Portuguese trawlers to fish for turbot off the Newfoundland coast outside of the EEZ. After this law, a series of confrontations resulted between Canadian fisheries vessels and EU trawlers which culminated in the capture of the Spanish trawler, the *Estai.* This action was roundly criticized by Spain, which later sent a naval patrol vessel to protect Spanish ships in the region. In the subsequent weeks, Canadian authorities cut the nets of several Spanish trawlers. The conflict ended in April 1995 when the EU and Canada signed an agreement.

[8] Appropriators refer to the individuals or groups who have the ability to extract resource units (fish, oil) from the resource system (the sea) (Ostrom, 1990).

resolution mechanisms, minimal recognition of rights to organize, and collective choice arrangements. Designed through the input of resource appropriators, UNCLOS represents the most comprehensive attempt to manage a global CPR; in fact, it has been called the "strongest comprehensive global environmental treaty negotiated to date" (Oxman, 1994: 169). UNCLOS established conventions for private property rights with respect to resources of the sea, and yet its breadth and scope was much more significant, creating mechanisms for dispute resolution.

Table 1 provides an overview of our analysis of the UNCLOS treaty with respect to Ostrom's design principles for successful CPR institutions (Ostrom 1990: 185-187). Our inspection of the UNCLOS agreement suggests that the institution is deficient in five characteristics: clearly defined boundaries, congruence between rules and conditions, collective choice arrangements, monitoring, and graduated sanctions.[9] The presence of these characteristics would enhance the ability of appropriators to make credible commitments to follow the rules (Ostrom, 1990: 186). While UNCLOS provided the first wide-ranging agreement on the distribution of the resources of the sea, these deficiencies in its design characteristics imply that UNCLOS does not adequately address distributional problems, nor allow for the creation of credible commitments among the allocating parties. Let us look at each of these deficiencies in turn.

First, the creation of clear boundaries is an important design feature of successful institutions because it determines who can and cannot use the resources (Ostrom, 1990: 91). While UNCLOS popularized the concept of EEZs, the boundaries themselves are not clear, nor

[9] In particular, "clearly defined boundaries" refer to the need for well-established rules that define who appropriators are and where the resources can be extracted from. "Congruence between rules and conditions" mean that the rules that govern the extraction of resource units are related to the conditions in specific areas and that appropriative rules are related to the provision of "labor, materials, and/or money" (Ostrom, 1990: 92). "Collective choice arrangements" allow those that are affected by the rules to modify them. "Monitoring" in this regard means that appropriators are accountable to the monitors, or are themselves the monitors. "Graduated sanctions" are a design feature in which sanctions are scaled to "the seriousness and the context of the offense" (Ostrom, 1990: 94).

are the boundaries adequate for the resource unit. Particular boundary problems result from the creation of straight baselines for states with uneven coasts, the definition of continental shelf, the EEZ implications of islands, and the issue of straddling fish stocks (Pratt and Schofield, 2000).[10] This uncertainty actually magnifies rather than resolves the distributional problem by encouraging exploitative behaviors (Wijkman, 1982), undermining an allocator's ability to make a credible commitment to responsible resource use. The uncertainty of these borders can also become a point of conflict between states (Hodgson and Smith, 1979). For example, one of the most significant disagreements over maritime boundaries involve the potentially oil rich Spratly Islands in the South China Sea. China, Vietnam, Malaysia, the Philippines, and Brunei all claim part of the mostly uninhabited island chain. China and Vietnam appear to have the greatest claim over the islands, based on their historical actions, yet the other claimants have the advantages of proximity and international law (Charney, 1995: 728-729). Not only is the ownership of uninhabited islands in the Spratly Islands problematic, there are also divergent claims about the shape of claimed maritime zones, such as China's assertion of a U-shaped traditional sea boundary line (Pratt and Schofield, 2000: 82).

The creation of clear boundaries is difficult in many contested maritime areas. Another important design element that Ostrom (1990) identifies for a strong institutional solution to resource management is the minimal recognition of rights to organize. She asserts that

[10] Specifically, baselines refer to the "low water line along the coast as marked on large-scale charts officially recognized by the coastal state" (Pratt and Schofield, 2000:5). Straight baselines allow for a state with jagged coastlines or "fringes of islands" to draw straight lines connecting two points of its coast to prevent situations where pockets of non-territorial seas are surrounded by expanses of territorial sea. This, however, leads to a variety of definitional questions regarding what constitutes a jagged coastline or "fringes of islands" (Pratt and Schofield, 2000:5). Debates over the continental shelf have occurred because, in some areas, the shelf extends beyond the EEZ. In addition, states' rights over the continental shelf need not be expressed publicly (Pratt and Schofield, 2000: 7). Islands have been an issue in UNCLOS because islands incapable of supporting "human habitation or economic life" cannot be used for the creation of EEZs (Pratt and Schofield, 2000: 8). This has led to controversy among states and has been exacerbated by the lack of guidance as to what constitutes an ability to support human habitation or economic life. While straddling stocks have been addressed in subsequent agreements, the inability of EEZs to reflect their movements have led to defensive measures on the part of states whose EEZs the fish migrate from and exploitative behaviors from consuming states (Bailey 1996).

institutions are more effective if members can make informal arrangements between themselves without resorting to an overarching authority. The ability to which appropriators can set their own rules is unclear within UNCLOS. States are given a wide range of autonomy (Huppert and Knapp, 1999), but the ability of those who extract resources to make their own rules is under the authority of the state. UNCLOS is effective in this regard only as far as state laws allow appropriators to make their own arrangements.

Furthermore, the inability of the convention to adapt to local conditions undermines the ability of states to make credible commitments and perpetuates distributional problems. Given that some states are the beneficiaries of plentiful EEZs, while others are not, this variability further exacerbates tensions between states (Mandel, 1980). While UNCLOS does allow for some collective choice arrangements, the process is very difficult.[11] As a result, states are unable to make modifications to the treaty if problems arise without first expending significant effort. While states can make declarations when accepting the jurisdiction of UNCLOS, any expressed reservations do not have the force of law. These two components hinder the creation of rules that keep monitoring costs low. As a result, appropriators are unaware of others' compliance and are less likely to make a contingent commitment to also comply (Ostrom, 1990: 187).

The convention does, however, conform to the monitoring design principle. It maintains that any monitors should be held accountable by the appropriators – in this case, states (Ostrom, 1990). Various sections of the UNCLOS Convention (Parts II, V, & XII) lay out the guidelines for how states monitor activity in their designated areas. States are to concern themselves both

[11] There are two ways this can be done. First, states can amend the convention, but this may be done only after ten years of the Convention entering into force. At that point, the Secretary General distributes the proposed amendment, and, if a year passes without favorable replies from half of the signatories, a conference is called. At the conference, every effort should be made to have a decision on the amendment made by consensus. In the second way, a state submits a proposed amendment to the Secretary General who distributes it. If a state objects within a year, the amendment is rejected. Similarly, if no objections are heard in the same time period, the amendment is passed.

with the activity of their own nationals as well as with the activity of foreigners in their area. While the monitoring system is consistent with good design principles, the sanctioning system is not. The convention does not allow for graduated sanctions, which Ostrom (1990) cites as being critical for an effective CPR institution. A system of graduated sanctions recognizes that compliance may be difficult at times, but that repeated non-cooperation is not allowed. Section 9, Part XII of the charter covers state responsibility and liability in cases of non-cooperation. This section merely says that states are held liable for any damages caused by their nationals when they are in noncompliance with the agreement. This liability, though, is under a state's own domestic law. There are no fines or other punishments for breaking the Convention. Far from having graduated sanctions, UNCLOS has none at all.

Because UNCLOS lacks many of the characteristics Ostrom cites as necessary for an enduring CPR institution, the ability of appropriators to make contingent commitments to responsible resource use is limited. In addition, UNCLOS does not adequately address distributional shortcomings inherent in privatization through EEZs. Appropriators operate without knowing if fellow appropriators follow the Convention, and, they may conclude that the long-term benefits of exploitative practices exceed the benefits of committing to a long-term strategy, such as those contained within the Convention.

However, UNCLOS is a strong institution when evaluated as a means of resolving conflicts over maritime resources. One of the most significant features of UNCLOS is its commitment to be a comprehensive and universally accepted delineation of maritime law (Boyle, 1997) and an institution with a strong and wide-ranging conflict resolution system. As such, UNCLOS follows Ostrom's (1990) design element that CPR institutions have well-developed conflict resolution mechanisms. Signatories to the convention are mandated to peacefully

resolve their maritime claims. If disputes arise, states initially may choose one of two dispute settlement procedures – conciliation or negotiation, in either a bilateral or regional setting (Borgese, 1995). If these methods are not acceptable to the parties, then states must choose from one of four additional options – arbitration, the International Tribunal on the Law of the Sea, the International Court of Justice, or "special arbitration" involving a qualified international organization (Borgese, 1995: 32). If a decision still cannot be reached, arbitration is selected. Regardless of the method chosen, all decisions are binding upon the signatories.

Lastly, a feature of many successful institutions is that the layers of regulation and enforcement are nested within each other. This is certainly the case in UNCLOS. Individual citizens and companies are first regulated by their own state, and then states themselves are regulated by the Convention. This allows problems to be addressed at the appropriate level.

HYPOTHESES ON THE MANAGEMENT OF MARITIME CLAIMS

The analysis of privatization and institutional solutions for managing the global ocean commons provides a great deal of insight into how countries are likely to manage disagreements over maritime zones, what we call *maritime claims*. Consider, for example, the disagreement that occurred in the "Cod Wars" between Iceland and Great Britain. Iceland increased its claims to territorial sea limits around its territory to four miles in 1952, to twelve miles in 1958, to fifty miles in 1972, and to 200 miles in 1975.[12] The British government protested each of Iceland's attempts to extend sovereignty over its maritime space. In the context of these competing maritime claims, the two governments engaged in both militarized and peaceful interactions, including a series of bilateral and multilateral negotiations, as well as adjudication of the conflict with the assistance of the International Court of Justice. Our empirical analyses focus on five

[12] This information is taken from the Issue Correlates of War (ICOW) codesheets for the Cod War cases.

militarized and peaceful dimensions of maritime claims: (1) the outbreak of militarized conflict over the maritime issue, (2) the onset of peaceful negotiations over the issue, (3) the effectiveness of peaceful negotiations when they occur (i.e. striking an agreement), (4) the onset of new maritime claims, and (5) changes in states' marine fish catches. We now consider how privatization and institutional solutions might affect each of these dimensions.

If privatization is an optimal solution (Conybeare 1980), then the establishment of EEZs should help to achieve many positive results. Once EEZs are established, thereby privatizing the resources within the declared zone, better resource use practices should be employed within the EEZ boundaries than would be true in a world of maritime anarchy. These better practices should create greater stocks of maritime resources within the EEZ, although it might take time for appreciable changes to occur. To the extent that resources such as migratory fish stocks are free to leave EEZs, this should be a benefit to other users as the resources move to the remaining ocean commons. There should be less armed conflict over maritime resources than without privatization, because there would be little ground for demanding a share of another state's privatized area. There should be more peaceful negotiations over maritime issues, too, as outsiders seek the right to cooperate in the sharing and harvesting of resources in or near declared EEZs. Such negotiations should also see a greater chance of success than under anarchy, as each side sees the benefits of cooperation in this area. Lastly, privatization should also prevent the occurrence of new claims. Since the establishment of EEZs is done by a publicly delineated set of rules, then states should not face ambiguity in determining what is theirs and what is not.

Yet privatization may be problematic if EEZs create severe distributional inequalities between maritime states, if there is uncertainty over the appropriate standards to use in

determining the boundaries between neighboring states' EEZs, or if resource extraction outside EEZ areas compromises the amount of resources available inside the privatized zone. Canada, for example, has monitored fishing outside its 200 mile EEZ in order to prevent over-fishing in the commons space, a practice that reduces the amount of fish available for Canadian fishermen to extract. Furthermore, EEZs are only likely to have these positive effects if the declared EEZ is accepted by actual or potential rival states. For example, before UNCLOS took effect and institutionalized support for the 200-mile EEZ, potential challengers may have been unlikely to recognize or accept unilateral 200-mile declarations; as noted above, the "Cod Wars" between Iceland and the United Kingdom followed unilateral declarations made by Iceland.[13]

The effect of privatizing vast tracts of ocean on fish catches has been mixed. On one hand, the total worldwide fishery production has increased, nearly doubling in the period from 1982 to 2005 (UN FAO, 2008). Industry has also begun to invest heavily in aquaculture, raising many fish that would have traditionally acquired through the capture process. In addition, many fisheries characterized by declining yields have begun to show signs of recovery. At the same time, however, privatization has also encouraged the plunder of other fisheries, particularly by arrangements between landlocked countries and shortsighted leaders of poor coastal countries (Smith and Wilen, 2002). In addition, several highly publicized fishery failures such as Peruvian anchovetta, Grand Banks cod, and Alaskan King Crab have not shown any signs of recovery (Bailey, 1996; Smith and Wilen, 2002: 35)

In either case, the privatization of the ocean has introduced “enormous new institutional, administrative, and enforcement issues” for every coastal state (Smith and Wilen, 2002: 33). At the outset, very few states had the capacity to properly administer these areas. This uncertainty

[13] Addressing the actual content of EEZ declarations -- particularly with respect to prevailing international standards of the time -- lies beyond the current scope of this paper, but should be considered in future work.

led to a period of learning for both states and resource appropriators as rules and procedures were fine-tuned. For appropriators this led to a decrease in efficiency and the amount of fish captured (Grafton et al., 2000). Over time, catches and efficiency began to increase as both appropriators and states became accustomed to the resources and responsibilities inherent with the EEZ.

The institutional solution arose in part to handle these thorny issues of privatization. Having access to the institution's rules for dispute resolution should help potential adversaries resolve their maritime issues through peaceful negotiations rather than militarized conflict -- particularly through the use of third party settlement techniques, as specified in the convention. The strength of the dispute mechanism provisions should also make these peaceful negotiations more successful than they would have been without UNCLOS, which was designed to create accepted standards for the resolution of conflicts. This should be particularly true to the extent that the parties use binding third party assistance (as provided under the convention) or involve the activity of international organizations or institutions rather than states. Because the reputation costs for reneging are enhanced, uncertainty about states' resolve and preferences is diminished, and the institution has resources at hand for securing more credible commitments (Mitchell and Hensel 2007). Besides its ability to handle existing disputes, UNCLOS also created guidelines for the ownership of maritime spaces as well as rules governing resources in the "Area", existing outside states' jurisdiction, and so should prevent new claims and conflicts from arising in the first place. On the other hand, as discussed above, the design of UNCLOS is a mixed bag. Some features of the institution -- such as its dispute resolution and monitoring systems -- are appropriate for managing resource conflicts. Yet other institutional features necessary for effective resource management (e.g. clear boundaries, ability to change/adapt rules) are lacking in UNCLOS.

Given that one goal of the creation of EEZs and the establishment of UNCLOS is to help conserve living resources of the sea, it is important to assess the effects of these political solutions on oceanic resource stocks. EEZs seek to transfer the costs of the resources to its users by privatizing vast tracts of ocean adjacent to states, while UNCLOS makes it incumbent upon states to undertake conservation measures, in whatever form, and to cooperate with one another in such activities (§2 Art 117-120).[14] We believe that the benefits of implementing EEZs and UNCLOS are not immediate, and instead, occur only with the passage of time. In fact, this holds for two reasons: one at the biological level and the other at the resource appropriator level.

Beginning with the latter, we believe that any change to a new allocation regime will face a number of initial complications. A new commitment to conservation may limit the total amount of resources that can be sustainably extracted, which will result in fewer numbers of resource units per appropriator. Resource appropriators may also be subject to new allocation rules, such as Individual Transferable Quotas (ITQs), which may carry with them a "learning curve" (Grafton et al., 2000).[15] For example, the creation of ITQs in British Columbia gained a longer fishing season for fishermen, although this posed new difficulties in terms of locating halibut, which resulted in short term efficiency losses (Grafton et al., 2000: 705). After the initial three years, however, fishermen began to see declines in their fuel expenses, labor costs, and equipment losses and saw increases in safety and profit (Grafton et al., 2000). Thus changes in allocation rules may improve resource stocks in the long run, but often at expense to appropriators in the short run.

Biological studies of marine life also suggest a non-linear relationship between conservation efforts and resource stocks (Hutchings, 2001). The ability of resource stocks to

[14] http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm
[15] Individual Transferable Quotas (ITQs) refer to predetermined allocations of a total allowable catch (TAC) which are granted to fisheries and can be bought, sold, and leased to others.

rebound is conditional on the type of fish, habitat, and a variety of other factors not directly attributed to the harvesting of the resource (Hutchings and Reynolds, 2004). On average, populations returned to 39% of their pre-collapse size when fishing was reduced, compared to 29% when fishing remained constant (Hutchings and Reynolds, 2004: 300).[16] However, reductions in mortality had no detectable effect on recovery five to fifteen years later. Hutchings' (2001) analysis of 90 marine fish stocks indicated that over a twenty year period (15 year collapse and 5 year recovery), 41% of the fish stocks continued to decline, 51% showed some signs of recovery, and 8% had fully recovered (309). Specifically, herrings and related fish (called clupeids) showed the greatest propensity for recovery, while pollack and cod (called gadids) and some clupeids showed no recovery at all. The biological and resource appropriator explanations predict a U-shaped relationship between conservation policies and fishery stocks.

The five hypotheses evaluated in this paper are summarized below. We expect both privatization and institutionalization to make generally positive contributions to the management and settlement of maritime claims, although our institutional analysis of UNCLOS suggests that its shortcomings may hamper the ability of the institution to effectively manage maritime conflicts between UNCLOS members. EEZs, on the other hand, might promote better fishery catches for states, but enhance distributional inequities between states, which could lead to new maritime claims. It should be noted that the hypotheses that we evaluate are not exhaustive, but represent an important first effort to compare privatization and institutional solutions for the management of maritime issues.

Militarized Management of Maritime CPRs

Hypothesis 1: The establishment of exclusive economic zones (EEZs) and/or joint membership in UNCLOS reduces the likelihood of militarized conflict over maritime issues.

[16] Collapse refers to "the greatest 15-year decline in adult biomass" for any particular specie of fish (Hutchings and Reynolds, 2004: 298).

Peaceful Management of Maritime CPRs
Hypothesis 2: The establishment of exclusive economic zones (EEZs) and/or joint membership in UNCLOS increases the likelihood of peaceful negotiations to manage maritime issues.

Success of Peaceful Management Attempts
Hypothesis 3: States are more likely to reach agreements in negotiations over maritime issues if they have established EEZs and/or if they jointly belong to UNCLOS.

Prevention of New Claims
Hypothesis 4: States that have established EEZs and/or are joint members of UNCLOS are less likely to set forth a new maritime claim.

States' Marine Catches
Hypothesis 5: There is a U-shaped relationship between growth in marine catches and the number of years since a state established an EEZ and/or joined UNCLOS.

RESEARCH DESIGN

We test our hypotheses using data on contentious maritime issues from the Issue Correlates of War (ICOW) project.[17] The ICOW project defines maritime claims as follows:

> A maritime claim involves explicit contention between two or more states over the access to or usage of a maritime area. Official representatives of the government of at least one state must lay explicit claim to a maritime area being administered or claimed by at least one other state. "Official representatives" include such individuals as a country's head of state, foreign minister, and other legitimate political or military officials speaking on behalf of the state's government. (ICOW Maritime Codebook, page 1).

Our analyses include all available maritime claims data coded by ICOW from 1900-2001 in the Western Hemisphere (North, Central, and South America and the Caribbean) and Europe.[18] Our analyses employ two ICOW datasets, the claim dyad-year data and the settlement attempt data.

[17] For descriptions of the ICOW data, see Hensel (2001) and Hensel, Mitchell, Sowers, and Thyne (2008).
[18] The ICOW Project identifies a set of potential maritime claims through shared or potentially overlapping maritime zones (Pratt and Schofield, 2000). Extensive news searches are conducted using a variety of sources including the *New York Times*, the *London Times*, Lexis-Nexis, Facts on File, Keesings Contemporary Archives, JSTOR, and relevant books. ICOW coders assemble these stories into chronological order by dyad and claimed area and then determine whether an issue claim exists according to the coding rules. For cases that qualify, an extensive chronology is created using the collected news stories. Attempts by the parties themselves to resolve the issue or attempts by third parties to help settle the issues peacefully are identified in the chronologies and then each attempt is coded separately. See <http://www.icow.org> for the codebooks and publicly available data sets.

The claim dyad-year data includes a separate observation for each year of every dyadic claim. For example, the maritime conflicts over the Gulf of Fonseca involve three dyads: El Salvador-Honduras (1900-1992), Honduras-Nicaragua (1912-present), and El Salvador-Nicaragua (1913-present). Thus there are a total of 272 claim dyad years for the Gulf of Fonseca maritime claim (through 2001). In the Western Hemisphere and Europe, there are a total of 3,231 claim dyad-years from 1900-2001. This data set will be used to test hypotheses about when the claimants attempt various forms of militarized and peaceful conflict management.

The settlement attempt data records all attempts to manage or settle the issues involved in a claim peacefully. Coded peaceful settlement attempts may involve bilateral negotiations, negotiations with non-binding third party assistance (inquiry, conciliation, good offices, or mediation), or submission of a claim to binding arbitration or adjudication. There have been 496 peaceful attempts to settle maritime issues (63% bilateral, 33% involving non-binding third party assistance, and 4% involving binding third party activities) in the Americas and Europe. This data set will be used to test the hypotheses about the conditions under which peaceful management efforts will be successful.

Finally, our analyses of claim origins require a set of dyadic relationships that might plausibly experience a maritime claim in the Western Hemisphere or Europe. For this purpose, we created a data set for each of these two regions that includes all dyads composed of two coastal states in the region -- recognizing that landlocked states such as Bolivia are highly unlikely to become involved in maritime claims, but that any two coastal states might, even if they are separated by hundreds of miles of sea -- as well as all dyads composed of one coastal state in the region and one major power. This data set includes almost every maritime claim that

did begin in either region, without including a large number of extraneous cases that seem to have essentially no chance of a maritime claim beginning.[19]

Dependent Variables

Our first three hypotheses focus on the peaceful and/or militarized management of maritime claims, as well as the success of those efforts. In analyses employing the claim dyad-year data, we utilize three dependent variables: 1) the number of militarized dispute onsets over the maritime issue in a given year[20], 2) the number of bilateral negotiations per year, and 3) the number of third party settlement attempts per year (binding and non-binding). Militarized disputes occurred in 90 maritime claim dyad-years (2.8% of the total observations). There were a total of 237 dyad-years (7.3%) with one or more bilateral negotiations (the range is 0-5 negotiations per year) and a total of 142 dyad-years (4.4%) with one or more third party settlement attempts (the range is 0-5 attempts per year).

In analyses employing the settlement attempt data, we examine only those efforts to settle part or all of the underlying maritime issue. This means the exclusion of what are called "procedural" and "functional" settlement attempts, which involve efforts to set the stage for future negotiations (such as planning a future round of talks or agreeing to submit a claim to arbitration) or efforts to address the usage of an issue without settling the issue itself (such as agreeing to share oil revenues from a disputed maritime zone without settling the question of

[19] The only maritime claims between claimants that are not included in this data set are Canada/Spain and Argentina/Bulgaria, both of which involve an extraregional minor power (and including all such cases would dramatically multiply the number of observations in order to identify just two more cases); several cases in which the European Union was an active claimant (there is no way to prevent such cases from dropping out of our analyses because none of the other variables we need are collected for non-state actors like the EU); and several cases involving non-European states contending over the Caspian Sea (which are not included here because the other states in question -- while being located directly across a body of water -- are not considered European).

[20] Militarized attempts to settle maritime issues are identified using version 3 of the Correlates of War Projects' Militarized Interstate Dispute data set (Ghosn, Palmer, and Bremer, 2004). Each militarized dispute that occurred between two adversaries was examined to determine whether the dispute involved an attempt to change the maritime status quo with respect to that specific claim. Militarized disputes over non-maritime issues were excluded. We did estimate models using all militarized disputes and found the results identical to those reported herein.

who owns the zone). We measure success by whether a given settlement attempt produced a treaty or agreement; agreements were reached in 275 of 496 peaceful settlement attempts (55%).

In the analyses of new claim origins (Hypothesis 4), the dependent variable is a dummy variable indicating whether at least one new maritime claim began in the dyad during the year of observation. New claims began in 132 of the 75.549 dyad-year observations (0.17%). Finally, to evaluate Hypothesis 5, data on state level marine fish catches (1950-2003) were generated using the United Nations Food and Agriculture Organization's (FAO) statistical package, FISHSTAT (Version 2.3). The measure we employ is the annual change in the number of fish (tons) caught in major marine areas; missing values are interpolated. The marine catch variable in levels is nonstationary (increasing mean and variance over time), which necessitates the use of the first differenced measure.

Independent Variables

Our primary theoretical variables focus on the effects of membership in the United Nations Law of the Sea Convention (UNCLOS) and declared exclusive economic zones (EEZs). Membership in UNCLOS was collected from the United Nations' Law of the Sea website.[21] We use two dummy variables to indicate UNCLOS membership status for a given pair of states: *One UNCLOS Member* equals one if only one state in a dyad is an UNCLOS member and zero otherwise; and *Two UNCLOS members* equals one if both states have signed and ratified the UNCLOS agreement. The omitted category includes pairs of states in which neither belongs to UNCLOS. We create similar measures for EEZs, based on information reported in Pratt and Schofield (2000): *One Declared EEZ* is coded one if only one state in a dyad has a declared exclusive economic zone and zero otherwise, while *Both Declared EEZs* is coded one if both

[21] The web site is located at <http://www.un.org/Depts/los/index.htm>.

states in a dyad have declared EEZs and zero otherwise. The omitted category includes pairs of states in which neither has a declared EEZ.[22]

Table 2 reports the frequencies for the UNCLOS and EEZ variables for all state-years in the COW interstate system (1900-2001). The vast majority of countries -- 4475 of the 5410 observations (82.7%) – did not belong to UNCLOS or have declared EEZ boundaries.[23] A little fewer than 15% of the observations had declared EEZs, 40.4% of which (322 of 797) involved UNCLOS members. About 8.5% of the observations feature states that belonged to UNCLOS, 70.7% of which (322 of 460) also had declared EEZs. Declaring EEZs has thus been a more common approach to managing maritime areas than joining UNCLOS -- dozens of states had already declared EEZs by the time UNCLOS was created, and many states that have joined UNCLOS did not do so immediately -- although the two institutions are clearly linked.

Beyond the impact of maritime institutions, we also include several control variables that are likely to affect the way that maritime issues are managed. We control for the effects of recent militarized disputes, which have been shown to increase the likelihood of future militarized confrontation in the rivalry literature (e.g. Diehl and Goertz, 2000). Our measure includes any militarized conflict over maritime issues in the ten years prior to the current observation. These events are weighted to have declining effects over time, with events in the most recent year before the observation contributing a value of 1.0 to the weighted score. Earlier events' weights decline by 10% each year (e.g. an event from five years ago has a weight of 0.5). Consistent with other research (e.g. Hensel et al, 2008), we anticipate that recent militarized

[22] The EEZ measures are treated as dummy variables for this first cut. In the future, we plan to record the miles for the EEZ limits, which will help to capture dynamic changes over time in states' EEZ declarations.
[23] This would be expected based on the analyzed time period because UNCLOS did not come into effect until the early 1980s, while EEZs were not actively utilized until after World War II.

history will be positively related to militarized attempts to settle maritime claims, although we also anticipate that peaceful negotiations will occur more frequently in such cases as well.

The salience or importance of the claimed maritime area should also affect the means that are chosen to attempt to resolve the claims, with highly salient claims being more likely to be managed through military conflict or bilateral negotiations and less likely to be submitted to a binding third party decision (Hensel 2001). The ICOW maritime data set measures issue salience through six indicators: (1) maritime borders extending from homeland rather than colonial or dependent territory, (2) a strategic location of the claimed maritime zone, (3) fishing resources within the maritime zone, (4) migratory fishing stocks crossing into and out of the maritime zone, (5) the known or suspected presence of oil resources within the maritime zone, and (6) relation of the maritime claim to an ongoing territorial claim. Several of these indicators reflect the difficulties inherent in privatizing the sea, especially the presence of migratory fish stocks that move between states' claimed maritime zones. We include a dummy variable for the presence of migratory fish stocks in the claimed maritime zone, because of this factor's close connection to the privatization and institutionalization approaches to management of CPRs, as well as its reflection of potential distributional problems for the maritime space. Each of the remaining five indicators above may contribute one point to the salience index for each claimant state to which it applies, producing a range from 0-10.[24]

How states bargain over contentious issues is also likely to be influenced by their relative capabilities, with more powerful states having stronger bargaining power. As the asymmetry in relative capabilities in a dyad increases, militarized settlement attempts may become less likely if the more powerful state can get what it wants through peaceful bargaining. Capability

[24] In most research using the ICOW data, the migratory fish stocks indicator is also added to this index, producing a range from zero to twelve.

imbalances should also promote bilateral negotiations and diminish the prospects for third party settlement. Power asymmetries should enhance the prospects for agreements, especially in bilateral negotiations, due to the stronger side's bargaining leverage. We use the Correlates of War Project's Composite Index of National Capabilities or CINC measure (Singer, Bremer, and Stuckey 1972) to create a relative capability measure by dividing the stronger side's CINC score by the total of the stronger and weaker states' CINC scores. This measure ranges from 0.5 (exactly equal capabilities) to 1.0 (the stronger state has all of the dyad's capabilities), with increasing scores moving away from parity. We turn now to our empirical analyses.

EMPIRICAL ANALYSES

We start by evaluating the bivariate relationships between our key variables in the ICOW claim dyad-year data set (N=3,231). These analyses involve pairs of states that have competing claims to a maritime area, in order to determine whether or not privatization (in the form of EEZs) or institutionalization (in the form of UNCLOS) have systematically improved the management of such claims. Hypothesis 1 suggests that EEZs and UNCLOS should reduce the likelihood of militarized conflict over maritime issues. Table 3 examines this hypothesis, and reveals that neither of these CPR solutions has had a systematic impact. Maritime claims have been slightly more likely to lead to militarized conflict when one (3.9% of observations) or both (3.7%) claimant states are members of UNCLOS than when neither is a member (2.6%), although this finding is not statistically significant ($p = .351$). There is absolutely no relationship between declared EEZs and militarized conflict over maritime claims, with the probability of conflict ranging from 2.7% to 2.8% ($p = .999$). It is safe to conclude that the hypothesis is not supported

by the bivariate tests, although we will later employ multivariate analyses to see whether stronger results are found when controlling for other potentially relevant factors.

While it appears that neither privatization nor institutionalization predicts state decisions to employ militarized force over maritime claims, we do find a stronger relationship if we control for the revisionist status of the states in the dyad. The challenger state is identified by the ICOW Project as the state challenging the status quo maritime boundary or resource extraction rights, while the target state is the state defending the status quo. If distributional issues are not resolved by the establishment of EEZs or through the institutional mechanisms created by UNCLOS, then challengers may be willing to employ militarized force as they are more likely to view the existing distribution of maritime resources as unacceptable. When controlling for revisionist types, we find a significant relationship between UNCLOS membership and militarization of maritime claims. Militarized disputes occur in 5% of claim dyad-years if the challenger belongs to UNCLOS, compared to 2.6% of claim dyad-years where the challenger state does not belong to UNCLOS ($\chi^2 = 4.63$, $p=0.031$). Thus we have some evidence that UNCLOS fails in its goal of promoting peaceful settlement of maritime claims if it fails to address potential distributional problems stemming from the agreement.

Hypothesis 2 suggests that EEZs and UNCLOS should promote peaceful negotiations over maritime claims. Table 3 examines this hypothesis empirically, and reveals generally stronger results than for militarized conflict. Bilateral negotiations are somewhat more likely when both states are UNCLOS members than when one or neither is a member, although this difference is not significant ($p = .153$). Bilateral talks occur in 14.6% of the observations when

both claimants have declared EEZs, as opposed to 10.5% when one has a declared EEZ[25] and only 5.0% when neither has a declared EEZ ($p < .001$).

In contrast, declared EEZs have no systematic impact on the probability of third party settlement attempts ($p = .547$), although UNCLOS membership significantly increases the likelihood of third party involvement. Third party activities occur in 10.1% of all observations when both states are UNCLOS members, as opposed to 3.9% when one is an UNCLOS member and 4.2% when neither state is a member ($p = .013$). Both elements of Hypothesis 2 receive some support; declared EEZs increase the likelihood of bilateral negotiations and UNCLOS membership increases third party settlement activities. These results suggest that privatization and institutional solutions are relatively effective at promoting more frequent peaceful negotiations over maritime claims, although they do so through different mechanisms. Declared EEZs promote states' efforts to resolve maritime conflicts on their own, while institutional membership in UNCLOS encourages more community-oriented, third party-based efforts to resolve maritime concerns.

For Hypothesis 4, we find that both joint declaration of EEZs and joint membership in UNCLOS appear to depress the development of new maritime claims. In the case of EEZs, new claims develop in 0.2% of all observations where neither claimant has EEZs, as compared with only 0.12% when one state has EEZs and 0.11% when both have them. This effect may be small in magnitude, but it is significant ($p = .036$). With regards to UNCLOS, new claims develop in

[25] This suggests a possible monadic effect, whereby negotiations are more likely if either state has privatized the resource by declaring an EEZ than when neither has. The hypothesized dyadic effect remains stronger, though, and we leave the possibility of a monadic effect to future research.

0.2% of the observations when neither state is a member, but only 0.07% when one state is and 0.04% when both states are members.[26]

We turn now to multivariate analyses to evaluate these hypotheses. The measures for our three dependent variables are event counts, reflecting the frequency of militarized, bilateral, and third party settlement attempts in a given dyad-year. Several event count models are available, with the choice typically hinging on the relationships between event counts over time and across units. The Poisson model assumes that events are independent, or that the choice of negotiations or militarized force in one instance has no effect on the choice of negotiations or force in another instance. Of course, this assumption is most likely unreasonable in the data we analyze because prior attempts, both failed and successful, have significant effects on the probability of future settlement attempts (Hensel 2001).

It is also possible that events are related across units, or dyads, as well. Negotiations between the United States and Canada regarding the Gulf of Maine are not likely to be completely independent of negotiations over the Juan de Fuca Strait and Dixon Entrance because the countries often negotiate multiple maritime flashpoints concurrently. To deal with these potential non-independence and unit heterogeneity issues, we employ a negative binomial model that clusters standard errors by dyads. Unlike the Poisson model that assumes equality between the mean and variance of the event counts, the negative binomial allows for over-dispersion where the variance exceeds the mean. The negative binomial model employs the Poisson model

[26] The UNCLOS data ranges across the universe of cases, which may prove problematic as this incorporates two kinds of zeros. Both states might not be a party to UNCLOS because they chose not to sign it (post-1982), or because the agreement did not yet exist (pre-1982). We ran a separate analysis where we controlled for only those claims in existence after 1982. There, we found that the percentage of new claims in cases where neither party was a member of UNCLOS fell slightly from 0.2% to 0.16%, but that the percentages for one member and dual membership remained the same at 0.07% and 0.04% respectively. This analysis remained statistically significant ($p = 0.04$).

as a baseline and then tests whether the over-dispersion parameter, α, is significantly different from zero (Long, 1997).[27] The estimated negative binomial models are presented in Table 4.

Consistent with the bivariate findings, UNCLOS membership and declared EEZs have no systematic effect on the militarization of maritime claims, which leads us to reject Hypothesis 1. Even after controlling for other potentially relevant factors, such as characteristics of the claimants and the overall salience level of the maritime claim itself, neither privatization nor institutionalization has had a meaningful impact on the likelihood of militarized conflict arising over the claim. As noted earlier, this does not capture distinctions between the challenger and target state. In a followup analysis that separates out the effect of EEZ declarations and UNCLOS membership between the challenger and target state in each claim, the effect of UNCLOS membership for the challenger state is positive and weakly significant ($p < .08$) in multivariate analyses, while UNCLOS membership for the target state and EEZ declarations by either state have no systematic effect on claim militarization.

While neither EEZs nor UNCLOS have had much success at preventing maritime militarized conflict, the presence of migratory fish stocks in the area covered by the maritime claim significantly increases conflict ($p < .02$); the remaining portions of the salience index have no significant effect ($p < .48$). The presence of migratory stocks exacerbates distributional problems for privatization and mitigates the potential positive effects of privatization on joint management of maritime CPRs. However, further analysis using statistical interactions between EEZ declarations or UNCLOS membership and migratory fish stocks did not reveal any significant interaction, so these two approaches to CPR management have not been systematically more successful at avoiding distributional conflict. Two other control variables

[27] We also estimated logit models, which recode the event count variables as dichotomous variables, and find identical results to those reported herein. We also find no evidence for over-dispersion in the data, as none of the estimated alpha parameters in the negative binomial models is significant.

have significant effects, consistent with previous research: conflict is more likely when there has been a greater history of recent armed conflict over the same issue ($p < .001$) and less likely when the disparity in relative capabilities is greater ($p < .06$).

Turning to peaceful claim management (Hypothesis 2), EEZs have a positive and significant effect on bilateral negotiations if one or both states in a dyad have declared EEZs ($p < .001$ for both variables), although the substantive size of the effect is larger for dyads where both states have EEZs. Interestingly, UNCLOS membership for one state in a dyad makes bilateral negotiations significantly less likely ($p < .07$) in a given dyad-year, while joint UNCLOS membership has no systematic effect ($p < .54$). It appears that the threat of suing through an international court or turning to third party arbitration has had no significant out of court effects with respect to bilateral talks in these regions to date, and that privatization of the resource has had a much more powerful influence on bilateral negotiations.

In contrast, the results in the third model demonstrate that pairs of UNCLOS members prefer third party solutions for managing contentious maritime issues ($p < .001$), while the remaining UNCLOS and EEZ variables have no systematic effects. It is quite interesting that privatization encourages parties' own efforts to resolve their disagreements over resources of the sea, while institutionalization increases third party involvement in the dispute settlement process. As with the bivariate analyses earlier, we find mixed support for Hypothesis 2. UNCLOS and EEZs have significant but varying effects on peaceful negotiations. EEZ declarations by one or both sides increase bilateral negotiations, while not affecting third party activities over the issues. In contrast, UNCLOS membership increases third party involvement in managing issue, but has little impact on bilateral negotiations.

Among the control variables employed in Table 4, the presence of migratory fish stocks has been a significant ($p < .02$) motivator of both bilateral and third party efforts to manage or settle maritime issues. While this factor has already been found to increase the propensity for armed conflict, it has also prompted the claimants to seek peaceful resolution of their differences. Additional analyses suggest no significant interaction between migratory fish stocks and either form of peaceful issue management. A greater history of recent militarized conflict is also a significant promoter of both bilateral and third party activities ($p < .001$), while a greater capability imbalance reduces the likelihood of bilateral negotiations ($p < .04$).

Hypothesis 3 suggests that EEZs and UNCLOS should improve the success rates of peaceful negotiations over maritime claims; Table 5 reports logit analyses to test this hypothesis. The privatization solution of joint declared EEZs appears to have the edge for successful management of maritime CPRs. Once two states have declared maritime boundaries, this makes it easier to agree upon further delimitation or resource use issues that arise ($p < .02$), although there is no corresponding effect from only one state's EEZ declaration ($p < .84$). This indicates that maritime conflicts are managed more successfully by states that view exclusive economic zones as a legitimate and fair tool for establishing ownership and usage of maritime space. UNCLOS membership, on the other hand, has no significant effect on the success of negotiations, whether one ($p < .99$) or both states ($p < .52$) are members. This may reflect a lack of binding attempts for the resolution of maritime disagreements in general, as institutions' non-binding activities are often less effective in managing issues than are the claimants' own bilateral efforts (Mitchell and Hensel 2007). The European Union, for example, has never produced a successful agreement in 10 non-binding attempts to resolve maritime claims between European

states, while the 3 binding cases involving the European Court of Justice have achieved success (Hansen, Mitchell, and Nemeth 2008).

Consistent with these general arguments about the importance of settlement type, we find that agreements are much more likely when binding third party techniques are employed ($p < .01$) and less likely when non-binding techniques are used ($p < .04$), compared to the default category of bilateral negotiations. While the presence of migratory fish stocks was found earlier to make peaceful techniques more likely to be used, there is no corresponding effect on the effectiveness of these techniques ($p < .63$), nor is there a systematic impact for the remaining control variable measures of issue salience, recent armed conflict, or relative capabilities.

In Hypothesis 4, we suggest that the presence of EEZs and UNCLOS membership should prevent new claims from arising. Table 6 reveals that new claims are less likely to emerge when one or both potential claimants are members of UNCLOS ($p < .009$ and .008, respectively). This likely reflects the use of UNCLOS in providing guidelines for the allocation of maritime resources. Separate analyses on the type of new claim show that the dampening effect of UNCLOS membership is generally robust across types. Joint membership in UNCLOS reduces the likelihood of new resource and fishing claims at the standard level of significance ($p < .05$ in both cases). It also reduces the likelihood of new migratory and oil claims near the standard level of significance ($p < .11$). The only type of claim that UNCLOS fails to depress is new claims to maritime zones with strategic value, where it has the opposite effect, although the variable fails to meet statistical significance ($p < .12$).

However, the declaration of EEZs has no effect on the development of a new claim, whether both states have declared them ($p < .381$) or only one member of the dyad has an EEZ ($p < .184$). This may suggest that EEZs, as a mechanism for privatization, may not adequately

address potential distributional conflicts and thus cannot prevent new claims from arising. When examining different claim origins, the results were the same across all types; joint EEZ declarations fail to prevent any type of new claim from arising.

Our final analyses consider the effects of EEZs and UNCLOS on marine fish catches in order to determine if these policies have any serious implications for the health of oceanic resources. Hypothesis 5 predicts a U-shaped relationship between the duration of EEZ/UNCLOS commitments and changes in marine catches. We evaluate this hypothesis in Table 7, entering the number of years for EEZs and UNCLOS for each state in a given year, as well as the squared values of these variables. Beginning with the privatization solution (Model 1), we find support for a U-shaped relationship between the establishment of EEZs and changes in marine catches; the coefficient for EEZ years is negative, while the coefficient for EEZ years squared is positive. The relationship is plotted in Figure 1; we can see that it takes about 23 years for fish catches to experience positive growth, a finding consistent with the biological literature on the recovery of fish stocks (Hutchings and Reynolds 2004). We find a similar U-shaped relationship between UNCLOS and changes in marine catches (Model 2). The conservation efforts embedded in UNCLOS seem to be quite effective, as it takes only 15 years for a growth in marine catches to occur. These findings provide renewed optimism for political solutions to CPR problems.[28]

[28] We estimated these models including several additional variables that might plausibly affect fish catch (such as a state's population or overall national capabilities and the year of observation) and the results were unchanged. Inclusion of capabilities measures results in the loss of over 2,000 cases for estimation because the COW dataset ends in 2001. These additional results are available from the authors upon request.

CONCLUSION

The resources of the sea have long been a source of competition between states, although the pressing nature of these common property resource (CPR) problems has become more acute over time. States' ability to extract oceanic resources has increased substantially through technological advances, and rapidly growing human populations have increased the demand for fishing, mineral, oil, and other maritime resources. This creates a tragedy of the commons where everyone has incentives to over-exploit maritime resources for their own advantage, leading to diminishing resource supplies for all.

Social scientists have devised several solutions to CPR problems, including coercion, privatization, and institutionalization. In this paper, we compare two prominent solutions for managing maritime resources: privatization in the form of exclusive economic zones (EEZs) and institutionalization via the United Nations Law of the Sea Convention (UNCLOS). We examine the effects of EEZs and UNCLOS on efforts to resolve competing interstate claims to maritime zones in the Western Hemisphere and Europe (1900-2001). We find that privatization through EEZs seems to be quite effective, as it promotes more frequent bilateral negotiations between disputing parties and enhances the chances that negotiations will produce agreements. On the other hand, UNCLOS is successful for bringing third parties to the conflict management table, which may facilitate the long run stability of agreements reached to resolve maritime claims (Mitchell and Hensel 2007). UNCLOS is also effective for preventing the onset of new disagreements over maritime areas. Our analyses suggest that privatization and institutionalization are differentially suited to promoting the long-run recovery of threatened fish stocks; there is no single optimal solution for problems associated with maritime CPRs.

While our theory and empirical analyses help us understand various solutions to the tragedy of the oceans commons, future research will refine and expand these analyses further. First, we would like to examine distributional problems more carefully. The presence of migratory fish stocks -- one important indicator of distributional problems related to maritime resources -- has been shown to have an important impact on the likelihood that various issue management techniques will be chosen, although not on their effectiveness. In future work, we would like to go further in measuring potential problems with the creation of fixed maritime boundaries, which will help to identify specific situations where EEZs might be expected to face the greatest difficulties and UNCLOS might have the greatest impact.

Second, we examine the effects of EEZs in our empirical analyses, but our indicator is rather simple, capturing a dichotomous effect of having a declared zone or not. In the future, we plan to code further details, such as the specific extent of states' EEZ claims (e.g. number of miles), which will allow us to track changes in EEZ boundaries more carefully over time. At least before the creation of UNCLOS, larger claims may have stronger effects on armed conflict because of their perceived excessive nature, such as Iceland's unilateral claims that provoked the Cod Wars. Once UNCLOS institutionalized the 200-mile EEZ boundary level, though, 200-mile claims should have little effect on conflict, at least for relations between UNCLOS members, but stronger effects on peaceful negotiations.

We would also like to do more to distinguish between the monadic and dyadic effects of EEZ declarations and UNCLOS membership. Our primary analyses have distinguished between situations where neither, one, or both states have employed each approach, but we have not done much to distinguish between the role of the challenger and target state. Future work could benefit from more of a focus on each state's decision to declare an EEZ or join UNCLOS; there

may be an important difference between a challenger state that has declared its own EEZ, but faces a target that has not, and a distant challenger that seeks to exploit resources that a target state has already attempted to privatize.

Finally, we would like to compare UNCLOS and EEZs to other treaties or institutions that might help to manage maritime conflicts. We are able to evaluate the institutional effectiveness of UNCLOS by applying Ostrom's (1990) design principles, although the lack of multiple institutional solutions limits the scope of our analysis. A research design that compared multiple institutions for managing the ocean commons would be more desirable. We discussed one important and possible comparison institution, the International Seabed Authority, noting that the distinctive authority-based element of the ISA has not yet been created. Another potentially useful treaty is the UNCLOS-related agreement on Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, which was opened for signature in 1995 and entered into force in late 2001 -- leaving too little time when it was in force to investigate its effects with our current 1900-2001 data on maritime claims.[29] Furthermore, some regional institutions, like the European Union, have explicit policies about ownership of maritime areas and exploitation of marine resources. In future work, we hope to utilize Ostrom's CPR institutional typology to investigate the possible value of these institutions for the management of future maritime issues, which will also create richer possibilities for a comparison of different institutional solutions to the tragedy of the global commons.

[29] For more details see the UN web site about the agreement:
<http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm>

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Table 1: UNCLOS and Institutional Design Elements

Design Feature:	UNCLOS Principle?	Where in UNCLOS?	Description
Clearly Defined Boundaries & Memberships	Unclear & Contingent on State	Part II, Part IV, Articles 56, 63, & 64 of Part V	UNCLOS allows for the creation of EEZs but there exist definitional debates. Also resources such as fisheries migrate, making borders fluid. Allocation rules are not based on provisions. Allocators determined by states.
Congruence between Rules and Conditions	No	Articles 69, 70, & 71 of Part V	UNCLOS as a global agreement does not make allowances for local conditions (e.g. scarcity within EEZs)
Collective Choice Arrangements	Yes, but difficult	Article 309, 312, and 313 of Part XVII	There are two main ways to amend UNCLOS, but these are time-consuming and difficult.
Monitoring	Contingent on State	Section 4 of Part II, Article 62 of Part V, Sections 4-6 of Part XII	The Convention lays out guidelines for how states monitor activity in their designated areas.
Graduated Sanctions	No	Section 9 of Part XII	States are held liable for damages caused by their nationals in violation of the agreement. No fines or punishments for breaking the Convention.
Conflict Resolution Mechanisms	Yes	Articles 59, 63, 74, & 83 of Part V, Part XV	Signatories are mandated to peacefully resolve maritime claims. If conflicts over claim arise states can choose conciliation or negotiation. If these are not acceptable, they must choose among arbitration, the International Tribunal on the Law of the Sea, the International Court of Justice, or special arbitration involving a qualified international organization. If not, arbitration is selected. Decisions are binding.
Minimal Recognition of Rights to Organize	Contingent on State	Article 61, 62, & 73 of Part V	States are given autonomy under UNCLOS, but the ability of appropriators to make their own rules is governed by state authority.
Nested Units	Contingent on State	Article 56, 73 of Part V; Article 123 of Part IX; Section 2 & 5 of Part XII;	Individual citizens and companies are first regulated by their own state, and then states themselves are regulated by the Convention.

Table 2: UNCLOS Membership and Declared Economic Exclusive Zones for All States, 1900-2001

Frequency Row Percentage Column Percentage	NO DECLARED EEZ	DECLARED EEZ	Total
NOT AN UNCLOS MEMBER	4,475 (90.4%) (97.0%)	475 (9.6%) (59.6%)	4,950 (91.5%)
UNCLOS MEMBER	138 (30.0%) (3.0%)	322 (70.0%) (40.4%)	460 (8.5%)
Total	4,613 (85.3%)	797 (14.7%)	5,410

Table 3: UNCLOS Membership, EEZs, and the Management of Maritime Claims,
ICOW Maritime Claim Dyad-Years 1900-2001[30]

A. Declared EEZs (N = 3231)

Declared EEZs:	Militarized Dispute(s) No	Militarized Dispute(s) Yes	Bilateral Negotiations No	Bilateral Negotiations Yes	Third Party Activities No	Third Party Activities Yes	New Claim No	New Claim Yes	N
Neither	2124	61 (2.8%)	2076	109 (5.0%)	2083	102 (4.7%)	52968	106 (0.20%)	2185
One	592	17 (2.8%)	545	64 (10.5%)	586	23 (3.8%)	13232	16 (0.12%)	609
Both	425	12 (2.7%)	373	64 (14.6%)	420	17 (3.9%)	9417	10 (0.11%)	437
	$\chi^2 = 0.003$ (p = .999)		$\chi^2 = 61.08$ **(p < .001)**		$\chi^2 = 1.207$ (p = 0.547)		$\chi^2 = 6.676$ (**p = .036**)		

B. UNCLOS Membership (N = 3231)

UNCLOS Members:	Militarized Dispute(s) No	Militarized Dispute(s) Yes	Bilateral Negotiations No	Bilateral Negotiations Yes	Third Party Activities No	Third Party Activities Yes	New Claim No	New Claim Yes	N
Neither	2744	74 (2.6%)	2618	200 (7.1%)	2699	119 (4.2%)	62079	124 (0.20%)	2818
One	292	12 (3.9%)	280	24 (7.9%)	292	12 (3.9%)	8592	6 (0.07%)	304
Both	105	4 (3.7%)	96	13 (11.9%)	98	11 (10.1%)	4946	2 (0.04%)	109
	$\chi^2 = 2.10$ (p = .351)		$\chi^2 = 3.76$ (p = .153)		$\chi^2 = 8.76$ **(p = .013)**		$\chi^2 = 12.74$ **(p = .002)**		

[30] The management variables (bilateral negotiations, third party settlements, and militarized disputes) are coded dichotomously in this table, with one or more attempts of each type counting under the "yes" category.

Table 4: Negative Binomial Analyses of the Effects of UNCLOS and Declared EEZs on the Management of Maritime Claims

Variables	Model 1: Militarized Dispute(s)	Model 2: Bilateral Negotiations	Model 3: Third Party Activities
Theoretical Variables			
One Declared EEZ	0.09 (0.34)	1.03 (0.30)***	0.03 (0.35)
Both Declared EEZs	0.04 (0.42)	1.34 (0.31)***	- 0.37 (0.38)
One UNCLOS Member	0.25 (0.33)	- 0.55 (0.29)*	0.61 (0.52)
Both UNCLOS Members	0.33 (0.59)	0.28 (0.46)	1.46 (0.41)***
Control Variables			
Migratory Fish Stocks	0.67 (0.26)**	0.72 (0.31)**	0.75 (0.30)**
Other Issue Salience	0.05 (0.07)	- 0.01 (0.05)	- 0.03 (0.06)
Recent Militarized Disputes	0.96 (0.13)***	0.48 (0.14)***	0.93 (0.19)***
Capability Imbalance	- 1.50 (0.80)*	- 1.97 (0.92)**	- 1.16 (1.12)
Constant	- 3.36 (0.73)**	- 1.59 (0.86)*	- 2.54 (1.09)**
Alpha	0.14 (0.77)	3.38 (0.90)	5.95 (1.87)
N	3156	3156	3156
Log-likelihood	-382.90	-949.00	-612.53
Chi-square	241.94 ($p < .001$)	62.70 ($p < .001$)	42.29 ($p < .001$)

* $p < .10$, ** $p < .05$, *** $p < .01$
Standard errors are clustered by dyad.

Table 5: Logit Analyses of the Effects of UNCLOS and Declared EEZs on the Success of Peaceful Settlement Attempts

Variables	Did Attempt Reach Agreement?
Theoretical Variables	
One Declared EEZ	- 0.07 (0.36)
Both Declared EEZs	0.78 (0.32)**
One UNCLOS Member	- 0.01 (0.45)
Both UNCLOS Members	0.29 (0.44)
Control Variables	
Non-Binding 3rd Party Activity	- 0.68 (0.33)**
Binding 3rd Party Activity	2.80 (0.95)***
Migratory Fish Stocks	0.16 (0.34)
Other Issue Salience	- 0.10 (0.08)
Recent Militarized Disputes	- 0.13 (0.34)
Capability Imbalance	- 1.61 (1.02)
Constant	1.62 (0.94)*
N	274
Log-likelihood	-171.71
Chi-square	40.17 ($p < .001$)

* $p < .10$, ** $p < .05$, *** $p < .01$
Standard errors are clustered by dyad.

Table 6: Logit Analyses of the Effects of UNCLOS and Declared EEZs on New Claim Onset

Variables	Did New Claim Emerge?
Theoretical Variables	
One Declared EEZ	- .423 (.319)
Both Declared EEZs	- .314 (.359)
One UNCLOS Member	- 1.133 (.431)***
Both UNCLOS Members	- 1.717 (.651)***
Control Variables	
Joint Democracy	.722 (.233)***
Capability Imbalance	1.113 (.908)
Constant	- 7.445 (.823)***
N	75,749
Log-likelihood	- 952.032
Chi-square	27.12 ($p < .001$)

* $p < .10$, ** $p < .05$, *** $p < .01$
Standard errors are clustered by dyad.

Table 7: Regression Analyses of Changes in Marine Fishery Catches

Variables	Model 1: EEZs	Model 2: UNCLOS
EEZ Years	-4743.8 (2298.2)**	
EEZ Years Squared	201.0 (106.6)*	
UNCLOS Years		-5461.3 (2280.8)**
UNCLOS Years Squared		355.4 (165.7)**
Constant	12492.7 (2372.7)***	11315.0 (2388.0)***
N	7381	7381

* p < .10, ** p < .05, *** p < .01

Figure 1: Effect of # of EEZ years (x) on change in marine catches (y)

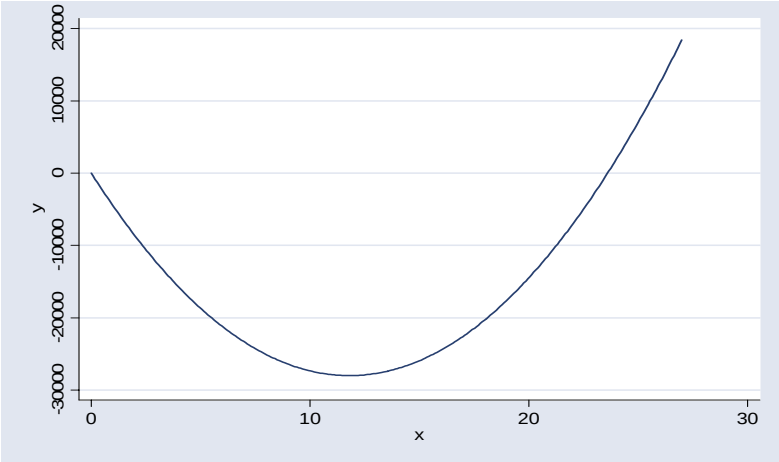

Figure 2: Effect of # of UNCLOS years (x) on change in marine catches (y)