

# Mastering the Commons

## The Quest to Maintain Sustainability in the Maine Lobster Industry

by

Nicole Tucci

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Professor Marti G. Subrahmanyam

Faculty Advisor

Professor David Yermack

Thesis Advisor

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## Abstract

The Maine Lobster industry sheds light on an all-too-familiar issue seen in most U.S fisheries today: the existence of a common-pool problem – the oceanic version of the “tragedy of the commons” – that has threatened ocean sustainability due to extreme amounts of overfishing. Like all common-pool resources, the lobster fishery faces two challenges: (1) limiting access to a resource, (2) managing subtractability, where the use of the resource by one individual automatically results in less for the others. However, unlike other fisheries management today, the lobster industry has figured out how to allow some individuals and groups to control access to the resource while creating an environment where rules and conservation ethics are self-imposed to limit exploitive efforts significantly.

## **Current State of Marine Fisheries**

The twenty-first century has opened up on the brink of marine fisheries being devastated beyond recovery, as nearly 90% of our world's harvested fish stocks are being overexploited.<sup>1</sup> There is a consensus amongst scientists that poor fisheries management is the key reason for overfishing, which causes fish stocks to be pushed beyond their biological limit. The reason for this practice is that federal governments place regulations on marine fisheries that entice a “gold rush mentality” among the fishermen. In this way, they are incentivized to catch as many fish as possible in the shortest amount of time to obtain a higher proportion of the quota.<sup>2</sup> As a result, fishermen with similar interests compete rather than cooperate, resulting in ultimate suffering for the fish industry.<sup>3</sup>

Understanding that there is a dire need to change the way fishing industries are managed, we look to the Maine lobster industry, as these unfortunate current circumstances are strikingly similar to the conditions Maine was able to overcome during the early 1900s. Namely, lobsters, once plentiful, were over-exploited by an industry, to the point where fishermen could no longer make a living, as catches decreased to detrimental lows. Yet, despite these circumstances, the lobster fishermen recognized that since humans were the cause, they could also be the solution. Thus, they took matters into their own hands by lobbying the government to implement conservation regulations over the course of 150 years to resolve the overfishing issues they had encountered in the early 1900s. In doing so, they succeeded in overcoming a negative growth rate of -2.35% annually between the

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<sup>1</sup> “The United Nations Conference on Sustainability.” *90% Of Fish Stocks Are Used up – Fisheries Subsidies Must Stop*, 3 July 2018, [unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=1812](http://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=1812).

<sup>2</sup> Yesaki, Mitsuo, et al. *Steveston Cannery Row: an Illustrated History*. Peninsula Pub. Co., 2005.

<sup>3</sup> Greentumble. “Steps to Help Fish Stocks Recover.” *Greentumble*, 30 Aug. 2019, [greentumble.com/steps-to-help-fish-stocks-recover/](http://greentumble.com/steps-to-help-fish-stocks-recover/).

years of 1880 to 1933 and achieved a positive 7% growth rate year over year, from 1933 to 2016 (as seen in Figure A).<sup>4</sup>

The above information is all the more momentous given that sustainability regulations in America were not established until 1969, when the National Environmental Policy Act was put in place to commit the United States to sustainability. The act declared that it was a national policy “to create and maintain conditions under which humans and nature can exist in productive harmony, which permit fulfilling the social, economic and other requirements of present and future generations.”<sup>5</sup> Remarkably, 150 years before the National Environmental Policy Act, and even sustainability factoring into most business sectors, the Maine lobster industry had committed itself to sustainable practices from as early as the 1800s, making them the oldest continuously operated industry to champion sustainability. Thus, we must turn to the Maine Lobster industry to understand how they have achieved this title, and if they are a positive example for other Marine fisheries in mastering the commons.

### **Background of Maine Lobster Industry – Lessons Learned**

Being one of the oldest continuously operated business sectors in North America dating back to the early colonial times, the Maine lobster industry has witnessed firsthand the outcome of a common pool resource being overexploited for economic gain when regulations are not adhered to. Particularly, when lobster was first discovered as a viable source of protein in the 16-1700s, the shellfish were so plentiful that anyone could have harvested them by hand along the shorelines.<sup>6</sup> Given that the means to transport lobsters

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<sup>4</sup> “Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

<sup>5</sup> “Learn About Sustainability.” *EPA*, Environmental Protection Agency, 20 Apr. 2020, [www.epa.gov/sustainability/learn-about-sustainability](http://www.epa.gov/sustainability/learn-about-sustainability).

<sup>6</sup> “Lobsters.” *Gulf of Maine Research Institute: Lobstering History*, [www.gma.org/lobsters/allaboutlobsters/lobsterhistory.html](http://www.gma.org/lobsters/allaboutlobsters/lobsterhistory.html).

far distances were unavailable during these early colonial times, lobster catches remained steady, as they were only consumed locally. It was not until the invention of the railway system and the smack boat – a sailing vessel with a circulating seawater tank – in the early 1800s that the commercial lobster fishing industry expanded. These technological innovations opened up the possibility to access new foreign and domestic markets, which resulted in the demand for lobsters to grow exponentially. However, this increase in demand quickly outgrew the slow pace of the live-lobster industry (trap catching), opening up the opportunity for the lobster canning industry to emerge in the 1840s. Canning proved to be extremely efficient when processing lobster as the canning process was able to meet all domestic and foreign demand while solving difficulties associated with shipping live lobsters. In addition, the canneries increased the economic value of lobster, resulting in over 9,000 shipyards to be constructed following the opening of the first cannery, putting Maine as the national leader in lobster shipping vessels by 1860.<sup>7</sup> Unfortunately, with such an abundance of lobsters in combination with high demands and profit margins, there was an incentive for fishermen to secure as many lobsters as possible, creating a surplus of fishermen extracting lobsters from the common-pool without restriction to sex, size, amount, or negative implications this behavior would have on the future.

In the short run, this “gold-rush” mentality instigated by the canning industry had proven to be economically profitable, increasing the value of lobster by 33% from 1840 to 1870.<sup>8</sup> However, this glory was only short-lived, as the long-term impacts of rapidly extracting a resource from a common-pool with no restrictions resulted in clear signs that

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<sup>7</sup> <https://www.mainehomeconnection.com/docs/13.MaineEconomicHistory.pdf>

<sup>8</sup> “Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

the canneries were causing serious damage by the 1860s. Explicitly, the canneries were so efficient at processing the lobsters that they were soon forced to work with smaller lobsters (less than ½ a pound), which ultimately depleted the breeding stock. Furthermore, this efficiency created high volumes of food waste as it took five pounds of lobster to obtain a single pound of canned lobster. As a result, by the 1860s, the cannery industry abused the resource to a point where 20% of the canneries themselves could not afford to stay in operation, as there were not enough lobsters in the ocean to produce a significant amount of product<sup>9</sup>. These impacts went beyond just the canners, with the live-lobster industry significantly suffering as a result, as fishermen were unable to catch enough lobsters to make a living. When questioned about any warning passed down from lobster fishermen during the canning period, in an interview on January of 2019, with Captain Jack, a 65-year-old lobster fisherman in Maine, he recounted his grandfather's statement that “he [would] never forget looking down at the water as [he] was pulling up an empty trap, and all [he] could think of is what had [they] all done.”<sup>10</sup> Not only does this statement attest to the fact that lobstermen were fearing the fate of the industry as catches dropped to detrimental lows of 5,513,705 pounds by the early 1900s, but more importantly, that they recognized humans – not natural climate cycles – were to blame for the depletion of the resource.<sup>11</sup> This might have been the most significant turning point for the industry, as the lobstermen internalized the fact that they had to regain control over the resource to reduce uncertainties about the industry, have a stable income, and ensure the health of the live-lobster industry far into the future.

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<sup>9</sup> “Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

<sup>11</sup> *Ibid.*

## **Regulations that Built the Industry**

Typically, when industries are efficient and produce high profit margins, they are encouraged by the government and company leaders alike to continue proceeding, regardless of techniques. Yet, contrary to industry standards, the lobstermen responded to an exploitive industry by successfully lobbying with the state government early on for conservation laws, which ultimately allowed them to solve collective action dilemmas and have higher long-run profits.

To specify, during the 1860s, the toll of the canning industry caused the value of lobster to reach detrimental lows of less than \$300,000, and catches decreasing by 60%, as shown in Figure B.<sup>12</sup> Knowing that they were on the brink of being unable to recover the lobster population, the live-lobster industry banded together to lobby the government for a minimum size restriction on lobsters able to be sold, and the forbidding of removing female lobsters with eggs attached, as depicted in Figure C. The main motivation behind these regulations was to prevent the canneries from “*slaughtering* millions of small lobsters,” for the purpose of protecting the juvenile lobsters and breeding stock, in hopes of recovering the extremely depleted lobster population.<sup>13</sup> When these conservation laws were first brought to the attention of industry regulators in the 1860s, they tried to blame it on natural temperature cycles rather than the business. It wasn't until the 1870s when the Maine lobster fishermen were unable to meet consumer demand that the very stability of Maine's economy was threatened. It was only after this point in the late 1870s where catches were at record lows that the state legislature increased the minimum size to 10.5 inches and forbade the taking of female lobsters with eggs attached. The implementation of this

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<sup>12</sup> “Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

<sup>13</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 81.

conservation law was the first success for the lobster fishermen on their journey to one of the most sustainable fisheries as it succeeded in putting the last of the canneries out of business.

However, given that no action was taken by the state government until the industry itself was on the verge of collapse, the lobstermen were still experiencing the negative implications of depleted lobster stocks into the 1900s. Lobster catches were decreasing annually by 7% from the 1870s to the early 1900s, resulting in a loss of over 30% in value year over year.<sup>14</sup> At this point, the lobstermen had developed a mutual “sense of vulnerability,” where they realized that all of their livelihoods and ability to support their families directly depended on the lobster resource.

Therefore, given that from the time the conservation regulation was put in place from the 1870s to 1917, lobster catches were still decreasing by 2% annually, resulting in the lobstermen wanting further regulations to protect the lobsters from being overfished.<sup>15</sup> Learning from the past, they did not want to wait until the state or federal government took action, as it could possibly be too late by then for the lobster stock to replenish. For this reason, they made the formal conservation law of not taking female lobsters with eggs a step further into an informal law called the *V-notching program*. This program stated that a lobster with a V-shaped notch cut into one of the side flippers is critical to be returned into the ocean for reproduction, thus protecting the lobster breeding stock that was proven to produce eggs. What is critical to note is that although this program is 100% voluntary and not enforced by the government, over 80% of fishermen were cooperative when the law was first enacted, and roughly 100% cooperate today.<sup>16</sup> In an interview, Zachary Barn,

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<sup>14</sup> “Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

<sup>15</sup> Globally Sustainable Fisheries Possible With Co-Management.” *NSF*, [www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=118328](http://www.nsf.gov/news/news_summ.jsp?cntn_id=118328).

<sup>16</sup> Globally Sustainable Fisheries Possible With Co-Management.” *NSF*, [www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=118328](http://www.nsf.gov/news/news_summ.jsp?cntn_id=118328).

a researcher for Marine Resource Management, explained the high percentage of compliance with the program despite not being a law because “it wasn't that lobstermen would feel shameful if they took a v-notched lobster, rather it was the social pressure around them”.<sup>17</sup> In this respect, they forwent the short-term profits that could be made from harvesting these v-notch lobsters because of the mutual sense of vulnerability they felt during the downturn in combination with the personal effect it had on their livelihood. Thus, in this rare case, the lobster fishermen discovered how to place boundaries on the common pool resource that they could consistently follow. This new practice proved overall beneficial for the industry, as by abiding by the v-notch rules, they succeeded in decreasing the growth rate to only -1% annually compared to -7% annually a few years prior.<sup>18</sup>

Although these were positive results for the fishermen, they knew they had to do more to recover, as the value of lobster had decreased roughly 44% annually from 1900 to 1930.<sup>19</sup> Thus, given that it was not economically efficient to raise the already implemented minimum size, the lobstermen proposed a *double gauge law* that specified both a minimal size to protect small lobsters and a maximum size to protect the larger breeding stock. The lobstermen felt they knew the resource better than any regulator ever could, and thus stated to the legislature that “if a double gauge measure is passed, lobster will continue to increase from year to year and no one will ever have to feel disturbed about the depletion of the lobsters on the Maine Coast so long as a double gauge measure is enforced”.<sup>20</sup> This was an extremely powerful statement during a time when there were not many studies done on

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<sup>17</sup> Barn, Brian. “Understanding Social Pressures in the Maine Lobster Industry.” 2020.

<sup>18</sup> “Fisheries.” *Fisheries* | National Oceanic and Atmospheric Administration, [www.noaa.gov/fisheries](http://www.noaa.gov/fisheries).

<sup>19</sup> “Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).”

<sup>20</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 88.

sustainable regulations, and thus attests to how connected these lobstermen were to the resource to believe that one regulation would change the course of the industry forever. Despite the lobstermen's confidence in how this new law would benefit the public, it still took over thirteen years of unwavering lobbying from the lobstermen to have the law passed by legislation. The lag period between the proposal of the double gauge law and its implementation by the government resulted in another negative growth period of -3% annually between 1917 and 1933.<sup>21</sup> It was only this negative tangible growth that convinced the Maine legislature to pass the bill, providing for a 3 1/16-inch minimum and 4 1/2-inch maximum carapace measure.<sup>22</sup> This law succeeded in conserving two extremely important parts of any live resource: it conquered the large lobsters that were the most reproductive while also allowing the Maine fishermen to catch the smaller marketing size lobsters that would generate a steady income for themselves and also support the Maine economy. The success of the double gauge law was evident by the industry experiencing its first positive growth period since the early 1900s, as pounds of lobster caught grew 2.5% yearly between 1933 and 1978.<sup>23</sup>

In the subsequent years, the lobstermen also proposed that an *escape vent* be inserted into each lobster trap to allow small sub-legal lobsters to escape before they were hauled up. There was little hesitation in passing this law, as it was the first that garnered support from the Department of Marine Resources, the leadership of the Marine Lobsters Association, and members of the legislature's committee on Marine Resources, given they understood the economic value of the lobster fishermen's ideas from their last two law proposals. Moreover, the escape vent law directly complemented the double gauge law, as

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<sup>21</sup> Most Recent Maine Commercial Landings." *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

<sup>22</sup> *Title 12, §6436: Egg-Bearing Lobsters; v-Notched Lobsters*, [legislature.maine.gov/statutes/12/title12sec6436.html](http://legislature.maine.gov/statutes/12/title12sec6436.html).

<sup>23</sup> *Ibid.*

it increased the efficiency for the lobstermen to pull up traps and decreased the mortality rate to further preserve the resource. In the following years after this third regulation, the lobster industry saw a record-breaking growth rate for the first time since the 1800s of roughly 4% annually between 1978 and 1995, and a 1.5% annual increase in value.<sup>24</sup>

Therefore, based on the conservation regulations, v-notching program, double gauge law, and escape vent, we are able to see that by the lobster industry giving up short-term profits for long-term gain, they were successfully able to practice sustainability while ensuring that the industry was profitable for themselves and generations to come. In addition, the way they proceeded with the regulations at the time was unprecedented, as they were created from the bottom up, showing that it was the fishermen who had long been focusing on sustainability and had more influence over legislation than any other group.

However, it is to a large extent without question that these new regulations would not have been achieved, had it not been for the lobster fisherman's ability to lay claim to a specific area of a shared pool. Claiming the property of a common pool can only be understood by grasping the rare conditions that the Maine lobster industry implemented to foster a strong sense of community that has persisted for centuries.

### **Harbor Gangs and Territoriality**

To delve into how conservation laws were able to be implemented as early as the 1800s, it is critical that the Maine harbor gangs be analyzed, as they have served as the basis for the laws to be built on. The harbor gangs consist of a cluster of social units that are composed of lobster fishermen from the same area that exist on almost every mid-

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<sup>24</sup> Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).”

coastal Maine harbor and island. These harbor gangs dramatically differentiated the lobster industry from other fisheries due to their proven ability to self-enforce conservation laws, foster a sense of stewardship amongst fishers, and most distinctly, *claim* and *defend* specific fishing areas in the ocean. These attributes fostered by the harbor gangs do not exist in any other fishery around the world, and thus signify that a different tradition has prevailed in the Maine lobster industry. Namely, that the territory of the ocean as regarded by the State of Maine and Federal Government is public property, but nonetheless is not considered in this way by the lobster fishermen. Rather, they implemented a local fishing territoriality system rule that serves as an informal private property system.

Although the state does not formally recognize these territories “owned” by the gangs as legally upheld, they are protected dearly amongst lobster fishermen as they have long-standing codes of conduct that define their career and the use of the resource. This strong sense of ownership over a piece of common property is highlighted in the way these gangs defend “their” fishing territory against the intrusion of an interloper.<sup>25</sup> Notably, when any non-gang lobster fishermen tries to fish in “their” area and take “their” resource, they are often met with threatening verbal messages by members, and in some instances, the molestation of their gear, such as the destruction of traps.<sup>26</sup> Frequently, these actions alone are enough to cause the interloper to swiftly leave the area. However, if they persist, the gang will further sanction the intruder by cutting their trap lines. Critical to note is that not only is it shameful for fishermen to cut another fisherman’s line, but it is also deemed illegal by the state of Maine and will result in sanctions. Yet, it appears the lobster fishermen are methodical in planning this specific action as a way of punishing the

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<sup>25</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 27.

<sup>26</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 27.

interloper because it does not upset them enough to start a feud but makes fishing in the area unprofitable for them. This action is relevant because it gets right at the heart of their goal to limit the intruder's ability to exploit the gang's resources and lessen their catch.<sup>27</sup> Anthropologist Evans-Pritchard (1940) explains the success of these actions in terms of the psychological threat of a feud alone being enough to maintain peace, as individuals tend to avoid threatening situations.<sup>28</sup> Thereby, since the lobster industry has had the withstanding threat of keeping the territoriality system and social organization within it for so long, there has been little trouble amongst lobster fishermen as everyone generally understands the norms of where they can fish.<sup>29</sup> Significant to note here is that the actions of the harbor gangs over “their” territory shows that there are two distinct groups with different kinds of authority *claiming* the same inshore water. One factor is that the State and Federal Law has defined the area as public property, and the other is that the individual social society that has developed its own local rules for the area. Through interviews conducted with over 35 Maine lobstermen, it is apparent that the existence of this system is known by all, and even state fisheries have mentioned that there is a tactical acceptance of this traditional territory system. Hence, it appears that the lobster industry is operating in an encapsulated political system, or a system within a system, as a way of establishing a local level organization that the lobstermen developed informally that has successfully allowed them to capture “their common”.<sup>30</sup>

However, laying claim over “their ” specific territory and defending it is only one aspect of the system. Another layer is created by the fact that one must also be granted

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<sup>27</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 27.

<sup>28</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 29.

<sup>29</sup> Ibid.

<sup>30</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 24.

entrance into the gang before they can go lobster fishing at all. Ultimately, it seems these acts exist because, just as any business views competition, it signals a threat to the already existing businesses. Likewise, the lobster industry is taking the same approach as they see more fishermen in the harbor indicating more competition and fewer lobsters for those already established in the business. In this way, they put up high barriers to entry into the industry, as admission into a gang is no easy feat.<sup>31</sup> Accordingly, anyone seeking to enter the lobster industry will typically receive at least a small amount of gear abuse from those already established in the business, as a way of teaching them the rules of “their” territory. This small threatening act gradually halts after a few months if the newcomer can withstand this time of “initiation” by showing that he has the technical skills required to be a lobsterman, and also informally agree to operate within the particular social environment the lobster gangs created. Although age, family history, residence, and education typically play a part in gaining entrance into a harbor gang, over 65% of Maine lobster fishermen have determined that the most crucial factor influencing entry into a harbor gang is one's willingness to abide by local norms and the conservation law.<sup>32</sup> In a like manner, it seems that this system of territoriality created by the harbor gangs forces all members within each gang to adhere to elaborate interactions with one another, where cooperation has to be balanced with competition, openness, sharing, and self-interest.<sup>33</sup>

All of these facts indicate that this system of territoriality established by the harbor gangs hundreds of years ago created the social organizations that have made it possible to develop rules and fishing practices that confer joint benefits for the lobster fishermen as a

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<sup>31</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 24

<sup>32</sup> Tietenberg, Thomas H., and Lynne Lewis. *Environmental & Natural Resource Economics*. Pearson, 2014.

<sup>33</sup> Tietenberg, Thomas H., and Lynne Lewis. *Environmental & Natural Resource Economics*. Pearson, 2014, pg. 13.

whole. Notably, their defense strategy acts as the element that ensures the territory, they “own” achieves maximum utility and utilization. The addition of just one more actor (a lobster fisherman) would make the other actors already operating in the system worse off as their catches would decrease, resulting in a smaller income and less benefit for those participating in the industry. Therefore, it seems that a sense of “ownership fishing” is established, combined with generations of use that convey the established fishing rights to the local culture, if not in the eyes of the law. Thus, it can be said that the lobster industry has solved one collection action dilemma by generating rules and practices that limit entry into the harbor gang and defense of their territory. Thereby, this system featuring lobster fishing territories has stood as the baseline institution that has laid the foundation for other conservation rules to be derived to protect the lobster as a resource in the future.

### **Implementation of Co-Management**

In combination with the sense of stewardship cultivated by the harbor gangs, and the feeling of mutual vulnerability that was experienced from the negative impacts of the canning industry, the lobstermen recognized that sustainability was not simply a goal for them, but a way of life. To safeguard their truth, the lobstermen wanted to be in control of how their resource would be managed and deflect any external pressure from outside governments such as federal and state laws. During an interview, a sternman in Maine named Brian Lancose stated that “when you work as closely with a natural resource as we do, you respect it more than any politician, scientist, or businessperson could”.<sup>34</sup> Brian’s words speak directly to the sense of ownership and accountability the lobster fishermen felt towards conserving the resource for those who economically depended on it, and the

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<sup>34</sup> Lancose, Brian. “Honors Thesis Interview - Sustainability .” 2 Jan. 2019.

ecosystem alike. Given this perspective, the lobster fishermen understood that without adopting better fisheries management practices, which would allow those who knew it best to have some control over the implementation of regulations, the resource and economy alike would be worse off. This persistent feeling of responsibility to the lobsters motivated the fishermen to take the radical step of incorporating co-management as the most recent dynamic law.

As a management system itself, co-management specifies that responsibility and authority for conserving marine species be shared between agencies, government, and members of the fishing industry alike.<sup>35</sup> The most notable aspect of this co-management design is that it delegates the lobster license holders themselves as the main rule-making body with management control over certain elements while the Department of Marine Resources and state legislature retain the second line of defense in authority for management. Due to this setup, the co-management system established a framework for the Commissioner of Marine Resources to create lobster policy management zones (A, B, C, D, E, and F), as shown in Figure D, to be managed by an elected council of lobster license holders, whom would have the power to propose rules on three things: (1) the maximum number of traps each license holder is permitted to fish (in essence, a trap limit); (2) the number of traps allowed to be fished on a single line; and (3) the time of day when lobster fishing is allowed. When one of these laws are proposed, it has to pass by two-thirds of the license holders in the zone, and if it does, the zone council is then obligated to convey the results of the referendum to the Commissioner of Marine Resources.<sup>36</sup> If the

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<sup>35</sup> Acheson, James, Terry Stockwell, and James A. Wilson. "Evolution of the Maine Lobster Co-management Law." *Maine Policy Review* 9.2 (2000) : 52 -62, <http://digitalcommons.library.umaine.edu/mpr/vol9/iss2/7>.

<sup>36</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003.

referendum is judged to be “reasonable” by the commissioner, then the rules will become departmental regulations enforceable by the warden.

To test how supported this type of management was by the lobstermen themselves, a survey was sent out to 1,057 lobstermen. Figure E shows that 73.5% of participants were in support of the co-management system. This incredibly high percentage attests to the fishermen’s confidence in placing laws and rules on themselves that are beneficial to the resource while at the same time serving their own self-interests of maximizing their profits. Equally, these overwhelming results attest to the lobster fishermen’s understanding that without adopting better fisheries management practices that allowed those working close to the resource to have some control over the implementation of regulations, the resource and economy alike would be worse off. Accordingly, in the spring of 1995, the “zone management law” was officially passed, whereby within only a few years after the law's implementation, the Zone Council quickly handled issues the legislature failed to; namely, the very contentious issues of recommending trap limits, fishing times, number of traps on a line, and limited entry, that had existed for over a decade, unable to be solved by top-down management.<sup>37</sup>

### **Co-Management Law Impacts**

The significant impact of the co-management law is highlighted when comparing Maine’s Compounded Annual Growth Rate from 1997 to 2018 to the neighboring lobster fishing territories of New Hampshire, Massachusetts, and Rhode Island. Namely, prior to implementing the co-management system, from the years 1850 to 2018, all four states had a roughly similar growth rate of 3% annually.<sup>38</sup> However, when Maine implemented the

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<sup>37</sup> Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003, pg. 100.

<sup>38</sup> “Fisheries.” *Fisheries* | National Oceanic and Atmospheric Administration, [www.noaa.gov/fisheries](http://www.noaa.gov/fisheries).

co-management system, their CAGR grew 7%, reaching a growth rate of 10% year over year, as highlighted in Figure F. Comparatively, neighboring states, who did not implement such a system but rather allowed regulations to be imposed on them from the top down, experienced either negative growth rates or little to none. Specifically, Rhode Island experienced a -5% annual growth rate from 1997 to 2018 and Massachusetts had only 1% annual growth.<sup>39</sup>

To show how Maine's growth rose so steadily, when accounting for the time elapsed between each law that was implemented in the co-management system year over year, we are able to see the steady rise in catches and value that pursued from each additional implementation of a regulation by the Zone Councils in Figure G. Namely, the first issue they tackled was setting trap limits that ultimately increased the catch size in pounds of lobster and value. The general purpose of implementing this practice was that it would act as a "trap ceiling", similar to placing a price ceiling on rent for apartments in certain metropolitan areas. Just as a price ceiling maintains the quantity and quality of housing available for certain groups that keeps demand high while maintaining a stable supply, the lobster industry wanted to incorporate similar standards for a natural resource. However, it is important to note that the price ceiling was implemented from a top down approach, whereas the trap ceiling was a bottom up management approach. Specifically, the fishermen themselves desired to put in the trap ceiling to benefit everyone in the industry, as fishermen would then be able to catch a sufficient amount of lobsters while lowering the cost of bait, fuel, labor, and trap congestion.<sup>40</sup> From the time the law was enacted in 1995, in just two years' time, by 1997, growth in the numbers of catches rose

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<sup>39</sup> "Fisheries." *Fisheries* | National Oceanic and Atmospheric Administration, [www.noaa.gov/fisheries](http://www.noaa.gov/fisheries).

<sup>40</sup> "Most Recent Maine Commercial Landings." *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

12.42% annually with the value of the catch also increasing significantly to 13.5% annually.<sup>41</sup> Given that growth rates had all been less than 8% year over year prior to the co-management law, it signals a significant jump in both catch size and value. In addition, it proves that the limit was able to solve the distributional issue of those who were exploiting the resource – fishing over the maximum allowable number of traps – as they were now mandated by law to decrease their catch to a number in line with where the lobster could reproduce and replenish their own stock yearly. Restricting the amount of traps one could fish also aided in eliminating the fear of over depleting the resource to its lowest levels due to overexploitation, as was the case in the 1930's. Rather, the limit provided valid evidence that one does not need to work independently to beat out their competition by catching as many fish as possible in the shortest amount of time to maximize their own profits and self-interests; instead, one could be successful by working collectively through the joint actions of lobstermen to earn and catch a greater amount.

Moreover, the lobstermen recognized that limiting the number of traps would only decrease overexploitation in the short run, as new entrants could still enter the fishing industry with no legal implications. The threat of new entrants causing congestion in the industry motivated the lobstermen to pass the “Limited Entry Ratio” system that was fully in effect by 1977. The law only allowed for a specific ratio of licenses to be issued each year for those that were not going to renew their license in the specific zone they were assigned to. For instance, a five to one ratio meant that one new license holder would be allowed to fish in the zone for every five who did not renew their license. This rule existed explicitly to limit entry into the “common-pool” and access to the lobsters as a resource.

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<sup>41</sup> “Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).”

From the time the law was put forth in 1997, to 1999 when it had been functioning, the industry immediately began to see an increase in value of 13.24% annually and a rise in the pounds of lobster caught by 6.7% year over year.<sup>42</sup> In particular, with these three new laws enacted, the value was increasing more than the pounds of lobster caught because they were successfully limiting the supply in a market that was already seeing increasingly high demand, which allowed them the ability to increase their lobster prices per pound, and thereby, income.

Although these regulations directly solved the current problems at the time, the lobstermen wanted to put further control on the stability of this system to ensure it would not be corrupted in the future by new entrants into the industry. Therefore, they needed to put in place a system that guaranteed those who received a license after the current fishermen retired or deactivated their license would follow the same conservation regulations and adhere exactly to the standards that those before them put in place. Accordingly, to be granted entrance into the industry, the lobstermen put forth an apprentice program where a person of eight years of age or older was able to obtain an apprentice license to begin a set training program. Once receiving this permit, they then had to complete a minimum of 200 days of work on the water, and at least 100 hours of working with a licensed lobsterman who acted as a sponsor with the responsibility to log and vouch for the number of hours worked.<sup>43</sup> This program was critical because it acted as a barrier to entry, weeding out those who were not willing to adhere to the cultural norms and regulations that the lobster industry had held onto so dearly. Likewise, when

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<sup>42</sup> "Fisheries." *Fisheries* | *National Oceanic and Atmospheric Administration*, [www.noaa.gov/fisheries](http://www.noaa.gov/fisheries).

<sup>43</sup> *Title 26, §3202: Maine Apprenticeship Program; Eligibility and Registration Procedure*, [legislature.maine.gov/statutes/26/title26sec3202.html](http://legislature.maine.gov/statutes/26/title26sec3202.html).

interviewing Maine lobstermen, interviewers pointed to the fact that the single most crucial factor that influenced whether someone would be able to enter the industry or not was whether they could abide by the local norms and conservation laws. Moreover, despite the substantial progress the prior two regulations realized, the 7% annualized growth in the pounds of lobster caught from the inception of the program in 1999 to the time it was in full effect in the late 2000s called attention to the success of this initiative, as the system insured all members entering the industry would adhere to the specifics of a cooperative fishing environment where competition was balanced with openness, sharing, and self-interest. At the same time, the program safeguarded the sustainability of the industry by reassuring that those entering understood precisely how important sustainability is for the lobsters and the exact way to maintain it.

In combination, taking into account the five years total that it took for the co-management law to be fully in place, from the time it was passed in 1995 to when all five laws were in place, the industry had experienced a 5.52% annual increase in the number of pounds of lobster caught.<sup>44</sup> This growth rate is all more significant given that it takes a lobster seven to ten years to even reach a minimum size, while also having molting seasons where its shell sheds and it cannot be sold on the market. Both factors in the cyclical downturns during the winter months of each year are shown in Figure G. These biological functions are evidence for why the growth factor was so relevant for the lobster industry from 1995 to 2000. Remarkably, during this same timeframe, the value increased by 10.27% year over year.<sup>45</sup> The growth in value proves that when fishermen use cooperative and interactive tactics while pursuing the same resource, they are able to earn significantly

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<sup>44</sup> “Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).”

<sup>45</sup> *Ibid.*

more than when they are trying to pursue their own self-interest. In other words, solving the collective dilemma proves that individuals are better off cooperating, rather than fishing with a competitive mindset that typically discourages joint action leading to the “gold-rush mentality” seen in most fisheries in 2020. As a whole, the lobstermen demonstrated that by putting a cap on the amount of resources we can take, limiting entrance into the industry, and implementing a training system for new entrants, it is possible to not only “capture the commons” and solve collective action dilemmas, but to also put in place sustainable protocols to be followed for the benefit of the resource and for those that depend on it for their livelihood.

Presently, the positive effects of these regulations are being realized to an even greater extent when analyzing the linear relationship between the restriction of access into the industry compared to catches, as depicted in Figure H. When taking the log of the pounds of lobster caught per year divided by the number of lobster license holders, the graph shows a direct linear relationship from 1997, when the restriction on licenses was put in place, followed through to its existence today. The shifts in license holders prior to the implementation of the limited entry requirements can be accounted for by fishermen leaving the industry from the mid 1800s to early 1900s due to the lack of lobsters available, and then a spike around the 1950s when the conservation laws were in full effect that resulted in increasing the supply of lobster increasing. In addition, there was a “grace period” where license holders were not required to hand in their license right at the start of the implementation of the law; rather, the period allowed the number of license holders time to achieve the desired ratio within each zone over time. Yet, as the graph shows in Figure H, not only in 1997 was there a start to the leveling off of license holders, but value

also increased from \$220,253,068.23 that year with 6,937 license holders, to \$575,461,184.95 with less than 6,000 license holders in 2016 or a 5.2% annual growth.<sup>46</sup>

The striking positive results from the further implementation of regulations in the co-management system attests to the fact that everyone wins when fishermen work together to promote sustainable fishing practices. The lobster fishermen have thus proved that they have risen to the challenge of rebuilding a depleted fish stock through their marked improvements that stemmed from future regulations being implemented. Thus, as the awareness of the benefits of cooperation are realized, the tragedy of the commons will become a problem of the past time.

### **Future Outlook**

While the success of this system disproves the idea that fishermen will never pass rules or laws that limit themselves for the greater good of the resource they are sharing, the question still remains if this system implemented by the Maine lobster industry can be used in the future. However, the findings in this paper show that when a community-based co-management system is implemented, it serves as a realistic solution to sustain aquatic resources and the livelihoods of communities depending on them. Notably, when a randomized sample of 133 co-management practices by the National Science Foundation was taken in both industrialized and developed countries, 65% ranked positive in their ability to implement community-based co-management systems as displayed in Figure I.<sup>47</sup> The fisheries management team at the University of Washington also agrees that these findings further illustrate the world's growing ability to manage fisheries sustainably.<sup>48</sup> It

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<sup>46</sup> Most Recent Maine Commercial Landings." *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html)."

<sup>47</sup> "Competition for the Management of Operations and Maintenance of the National Ecological Observatory Network (NEON)." *NSF*, [www.nsf.gov/pubs/2020/nsf20530/nsf20530.htm](http://www.nsf.gov/pubs/2020/nsf20530/nsf20530.htm).

<sup>48</sup> *Ibid.*

is also encouraging to see that overall, when fisheries management is being changed, it is incorporating the human dimension as a key component in solutions, given that we are the ones causing the damages in our oceans. Thus, when we find ways to take back control by implementing community-based co-management, fishers are then capable of self-organizing, maintaining their resources, and achieving sustainable fisheries, just as the lobster industry did.<sup>49</sup>

However, it should be noted that based on statistical analysis, co-management will most likely fail when social cohesion and clear incentives are not in place that serve to give fishers security over the amount they can catch and the area in which they can fish is protected.<sup>50</sup> Therefore, when implementing this system for different marine species, there needs to be a concrete understanding of the ecological, social, and economic interactions that hold shared responsibilities for management in order to yield a sustainable well-being for the ecosystem and fishers alike. Ultimately, the Maine lobster industry is living proof that globally sustainable fisheries management is possible with co-management under limited central government when communities of fishers are proactively engaged to reduce the disastrous effects of overfishing the world is currently facing.

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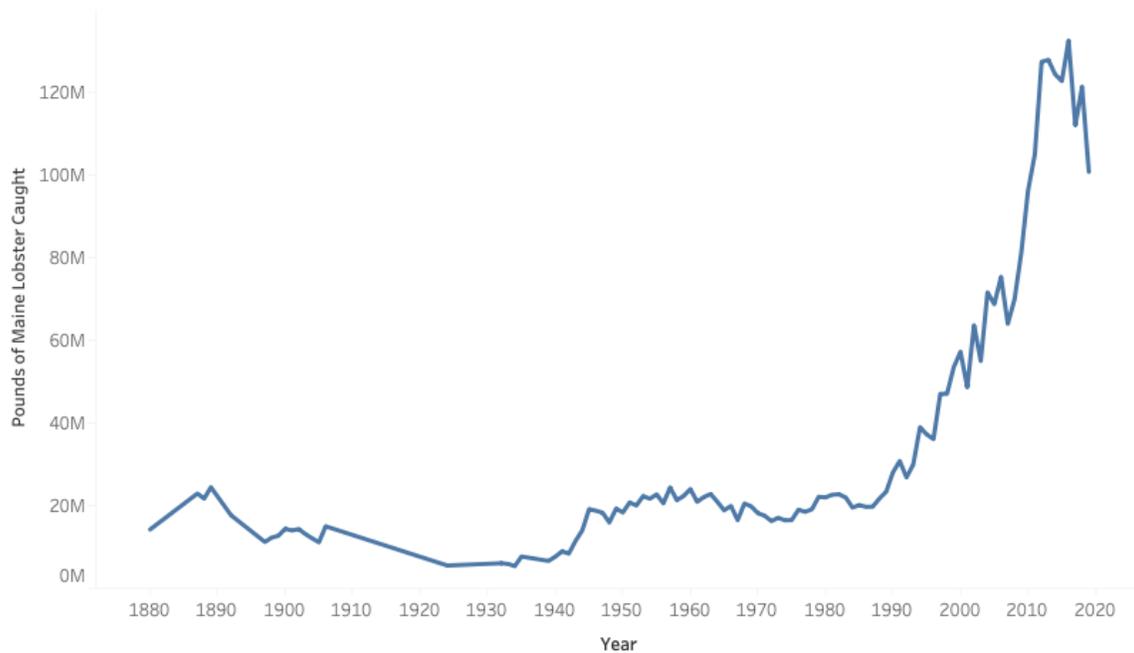
<sup>49</sup>“Co-Management Holds Promise of Sustainable Fisheries Worldwide.” *UW News*, [www.washington.edu/news/2011/01/05/co-management-holds-promise-of-sustainable-fisheries-worldwide/](http://www.washington.edu/news/2011/01/05/co-management-holds-promise-of-sustainable-fisheries-worldwide/).

<sup>50</sup> “Co-Management Holds Promise of Sustainable Fisheries Worldwide.” *ScienceDaily*, ScienceDaily, 7 Jan. 2011, [www.sciencedaily.com/releases/2011/01/110105131741.htm](http://www.sciencedaily.com/releases/2011/01/110105131741.htm).

## Appendix:

### Figure A

Pounds of Maine Lobster Caught from 1880 - 2020



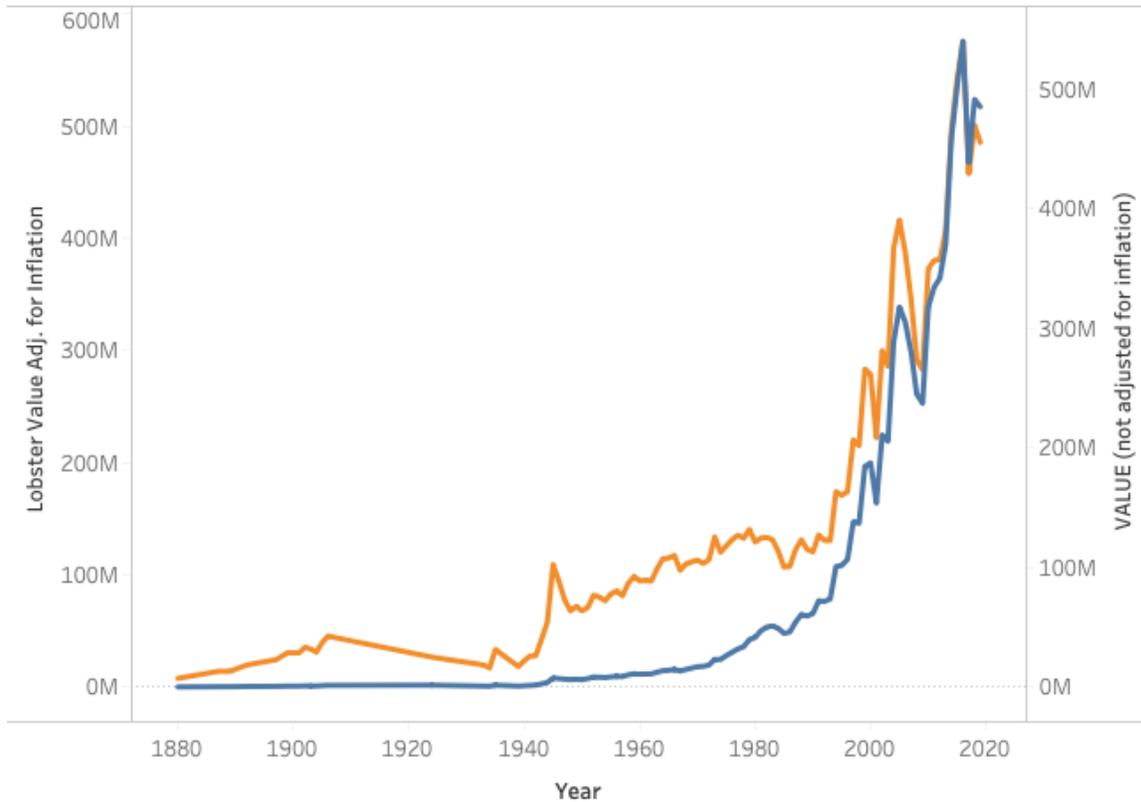
The trend of sum of Pounds for Year.

The Maine Lobster industry began experiencing a negative -1% growth rate annually from 1880 to 1917 as a result of the canning industry overexploiting the lobster fishing stocks. This negative growth rate increased to -3% annually between the years of 1917 to 1933, due to a lack of government reaction in an efficient manner to the requests of lobstermen to implement conservation regulations. It was not until after 1933 that the lobstermen were able to start implementing their own regulations resulting in a 6.5% growth rate year over year from 1933 to 2016.

**Source:** "Globally Sustainable Fisheries Possible with Co-Management." *NSF*, [www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=118328](http://www.nsf.gov/news/news_summ.jsp?cntn_id=118328).

***Figure B***

**Lobster Values in Maine Adjusted for Inflation**



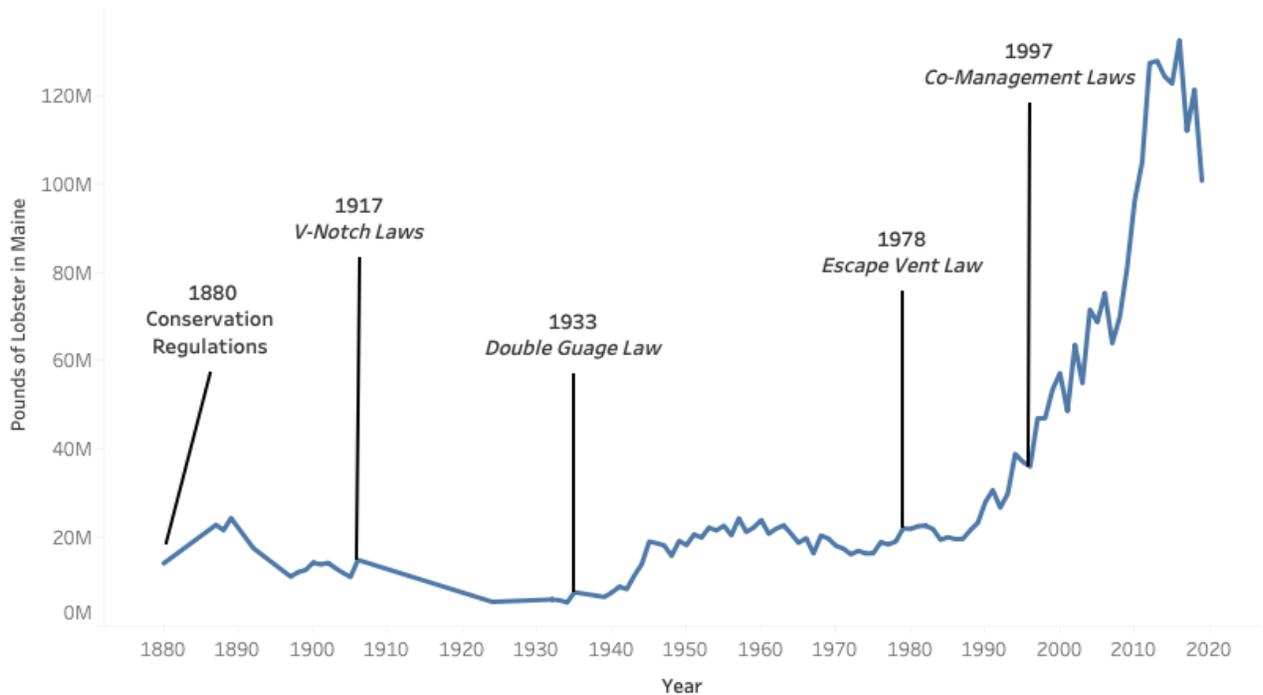
The trends of Value Adjusted for Inflation and VALUE (not adjusted for inflation) for Year. Color shows details about Value Adjusted for Inflation and VALUE (not adjusted for inflation). The view is filtered on Year, which keeps non-Null values only.

The above chart highlights the value of lobster in Maine adjusted for inflation compared to the pounds of lobster caught in Maine each year. It serves to highlight that from the 1880s to mid 1900s, the toll of the canning industry caused the value of lobster to decrease to detrimental lows of less than \$300,000, and catches decreased by 60%. It was not until more than 50 years later that the lobster industry was able to experience their first positive growth of 2.9% annually between 1941 and 1943.

**Source:** Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

***Figure C***

**Regulations in the Maine Lobster Industry**

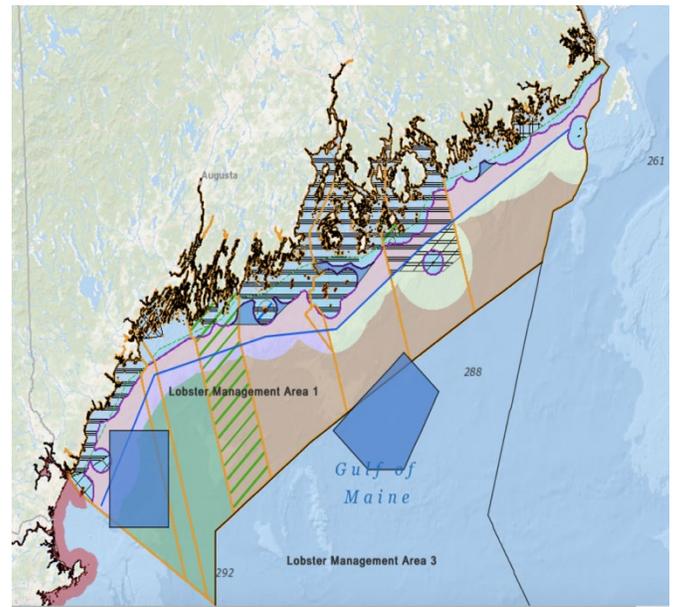
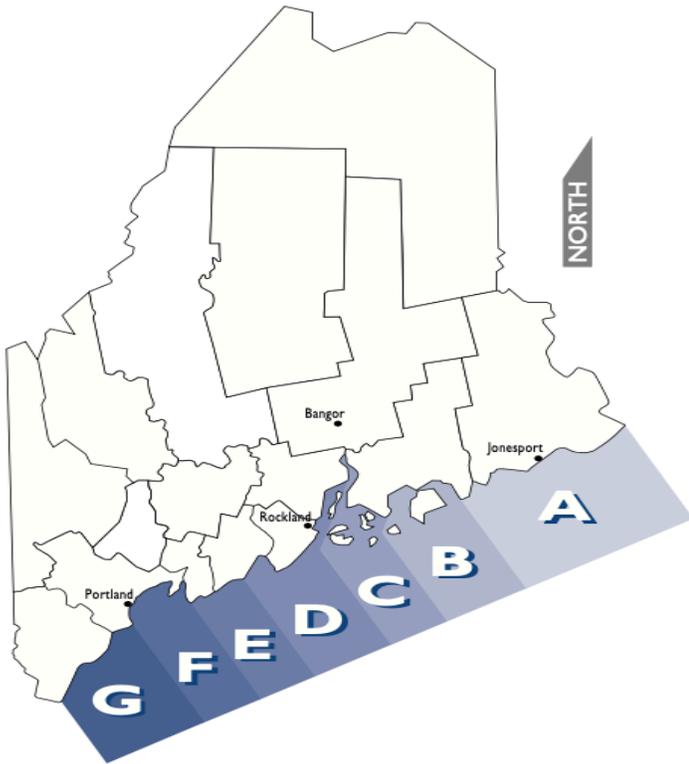


The trend of sum of Pounds for Year.

The regulations in the Maine Lobster Industry chart depicts the change in growth rates year over year of lobster catches as conservation regulations were implemented. We are able to see that after 1917, with every additional conservation regulation added, there was a positive spike in lobster catches at an average of ten years after its implementation. The lag of immediate growth is due to the fact that it takes a lobster a minimum of seven years to reproduce, and thus takes the industry a substantial amount of time to recover.

**Source:** Most Recent Maine Commercial Landings.” *Commercial Fishing Landings Data: Maine Department of Marine Resources*, 2019, [www.maine.gov/dmr/commercial-fishing/landings/index.html](http://www.maine.gov/dmr/commercial-fishing/landings/index.html).

***Figure D***



The figures above depict how the coastline of Maine is sectioned off to accompany for the zone management law to work. Notably, there are A, B, C, D, E, F, and G zones that are each managed by an elected council of lobster license holders who have the power to propose rules on three things: (1) the maximum number of traps each license holder is permitted to fish (in essence, a trap limit); (2) the number of traps allowed to be fished on a single line; and (3) the time of day when lobster fishing is allowed. The image on the right shows how the zones appear based on geographical measurements.

**Source:** Acheson, James, Terry Stockwell, and James A. Wilson. "Evolution of the Maine Lobster Co-management Law." *Maine Policy Review* 9.2 (2000) : 52 -62, <http://digitalcommons.library.umaine.edu/mpr/vol9/iss2/7>.

***Figure E***

**Question: Were you in favor of the zone management concept when the zone management law was passed in 1995?**

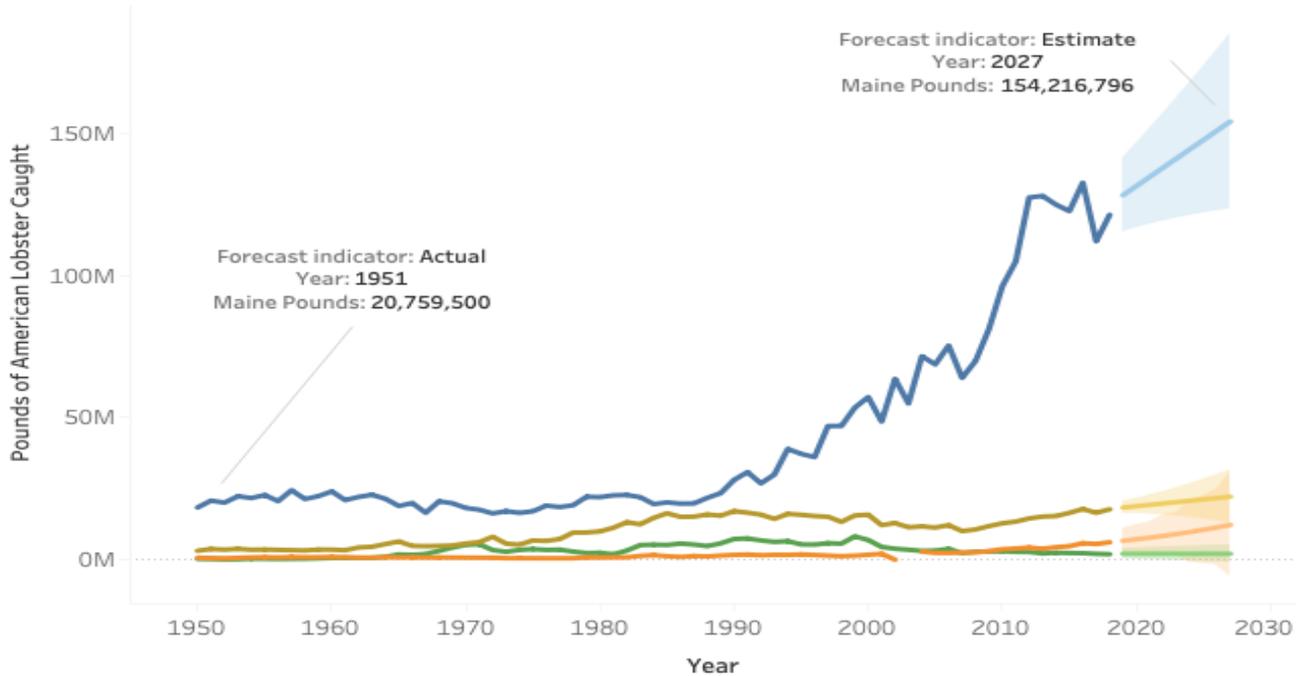
<b>Answer:</b>	<b>No</b>	<b>Yes</b>	<b>Total</b>
<b>Number:</b>	<b>280</b>	<b>777</b>	<b>1,057</b>
<b>Percentage:</b>	<b>26.5</b>	<b>73.5</b>	<b>100</b>

Out of the sample of 1,057 lobstermen that were asked to fill out a questionnaire regarding if they were in favor of the zone management concept in 1995, there was an overwhelming 73.5% support rate in favor of the co-management system.

**Source:** Acheson, James M. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. University Press of New England, 2003.

***Figure F***

**Forecasted Expected Pounds of Lobster Per Year  
(ME, MA, RI, & NH)**

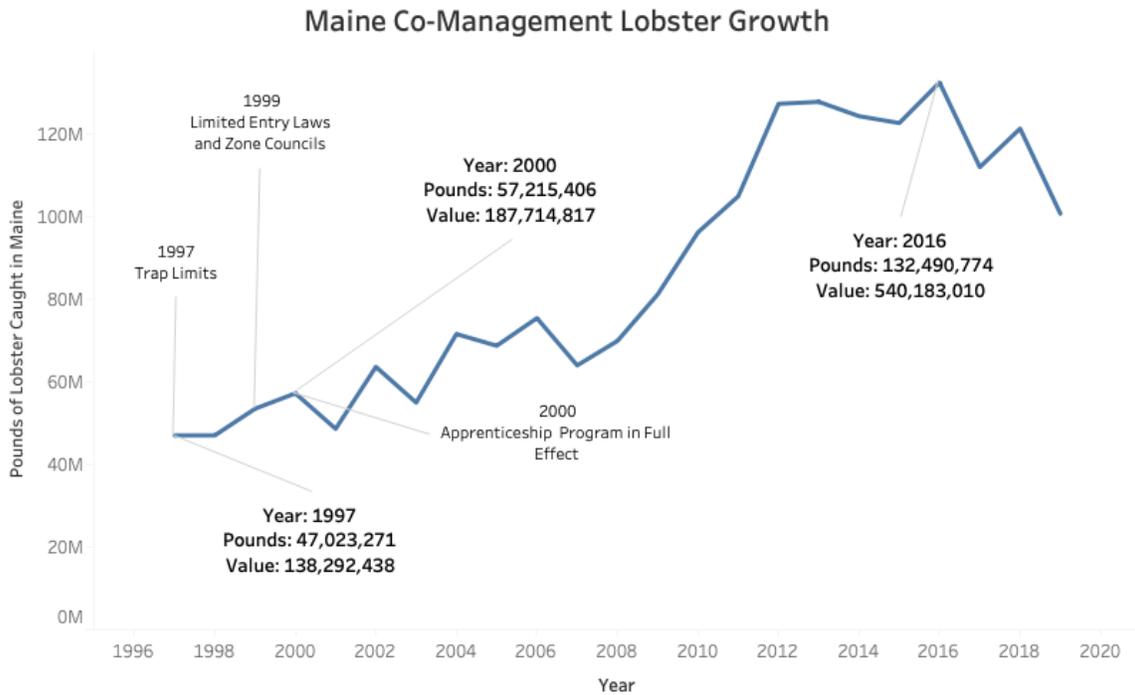


The trends of Maine Pounds, Mass. Pounds, NH Pounds and RI Pounds for Year. Color shows details about Maine Pounds, Mass. Pounds, NH Pounds, RI Pounds and Forecast indicator.

Following the implementation of the co-management law in 1997, Maine’s growth rate per year grew 7% prior to implementing the co-management system, reaching a growth rate of 10% annually. Comparatively, neighboring states, who did not implement such a system but rather allowed regulations to be imposed on them from the top down, experienced negative growth rates, or little to none. Specifically, Rhode Island experienced a -5% growth rate from 1997 to 2018 and Massachusetts had only 1% growth.

**Source:** “Globally Sustainable Fisheries Possible With Co-Management.” *NSF*, [www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=118328](http://www.nsf.gov/news/news_summ.jsp?cntn_id=118328).

***Figure G***

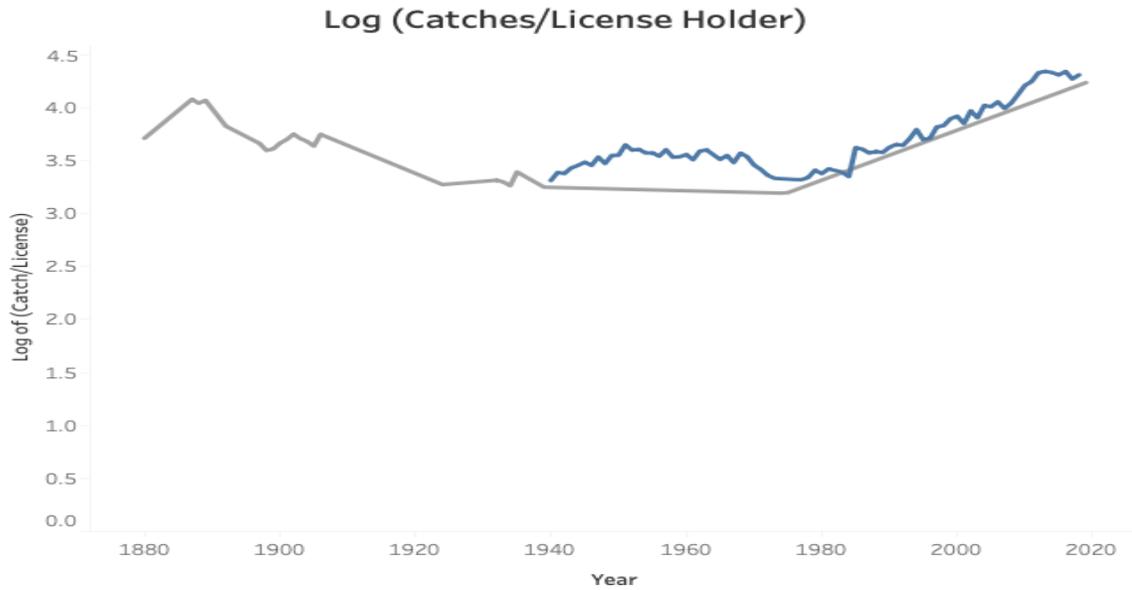


The trend of Pounds for Year. Color shows details about Pounds. The view is filtered on Year, which ranges from 1997 to 2019.

The timeline above depicts the sequential order of stages of the regulations put in place by the lobstermen to limit access to the common pool and mitigate any overfishing incentives. The success of the system is apparent as the annual growth for the industry grew to 10.53% annually, compared to a .53% annual growth rate in between years of 1880 and 2000.

**Source:** "Globally Sustainable Fisheries Possible With Co-Management." *NSF*, [www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=118328](http://www.nsf.gov/news/news_summ.jsp?cntn_id=118328)

**Figure H**

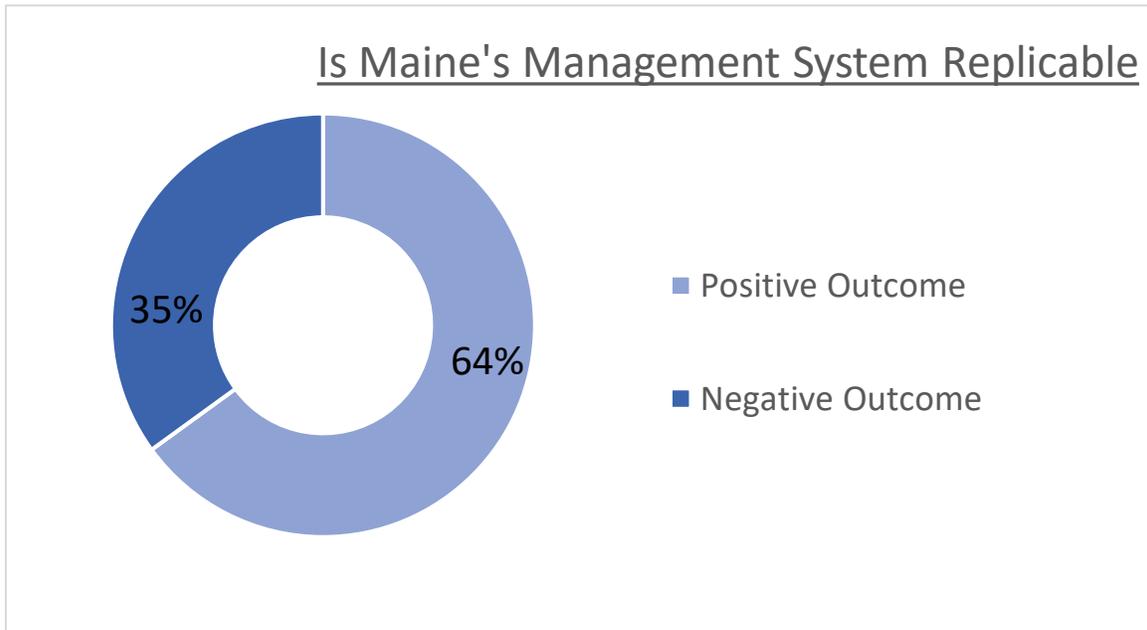


The trend of sum of Log of (Catch/License) (actual & forecast) for Year. Color shows details about Year (group). Details are shown for Forecast indicator.

The graph above depicts the relationship between the amount of lobster caught per year in pounds in Maine and the number of license holders in Maine. More specifically, the log was taken of the pounds of lobster caught per year divided by the number of license holders to highlight the linear relationship of the pounds of lobster increasing as the number of license holders decreased.

**Source:** "Globally Sustainable Fisheries Possible With Co-Management." *NSF*, [www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=118328](http://www.nsf.gov/news/news_summ.jsp?cntn_id=118328)

**Figure 1**



A recent study regarding other co-managed fisheries around developed and industrialized countries shows that out of 130 fisheries in 44 nations, 64% have succeeded in satisfying the criteria that is needed for the co-management system to be profitable (minimum government control and a community-based territoriality system).

**Source:** "Globally Sustainable Fisheries Possible With Co-Management." *NSF*, [www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=118328](http://www.nsf.gov/news/news_summ.jsp?cntn_id=118328).