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An Analysis of V-Notching in the Maine Lobster Fishery

Kathleen A. Murphy
University of Maine

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AN ANALYSIS OF V-NOTCHING IN THE MAINE LOBSTER FISHERY

by

Kathleen A. Murphy

A Thesis Submitted in Partial Fulfillment
of the Requirements for a Degree with Honors
(Political Science)

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Advisory Committee:

Teresa R. Johnson, Associate Professor, School of Marine Sciences, Advisor
Yong Chen, Professor, School of Marine Sciences
Christine Beitzl, Assistant Professor, Department of Anthropology
Amy Fried, Professor and Chair, Department of Political Science
Margaret Killinger, Associate Professor, Honors College

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ABSTRACT

In the face of declining stock and catch, fisheries stakeholders worldwide are evaluating conservation practices necessary for sustainability. Contrariwise, the Maine lobster fishery's success in resource management, particularly with the v-notch law, stands as an exemplar for success. The v-notch law protects the reproductive stock via fishermen voluntarily marking egg-bearing females with a "notch" in the tail fin, indicating they may not be caught and sold. In 1948, lobstermen supported v-notch legislation having recognized the necessity of preserving their resource. This research provides an updated examination of the v-notch law's role today in conservation efforts. Through an analysis of legislation over the past ten years and oral history interviews reflecting current lobstermen's beliefs, this research assesses how lobstermen perceive and practice the law, while also exploring the broader historical and social-ecological context in which this law is situated.

To my mother, Carol Ann McEachern Murphy,
for her patience with me through this daunting process.

And

To my boyfriend, Nicholas Parlatore,
for giving me the opportunity to fall in love with lobstering.

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TABLE OF CONTENTS

INTRODUCTION	1
BACKGROUND	6
Legislation	6
Biology of the American Lobster	8
The Routine and Culture of Maine Lobstermen	11
Legislative History of the Maine Lobster Fishery	18
V-Notch Favorability.....	24
METHODS	27
Part 1: Review of Legislation and Supreme Court Case	27
Part 2: Oral History Interviews with Maine Lobstermen	28
RESULTS	32
Part 1: Legislative Review Results	32
Part 2: Interview Results.....	35
DISCUSSION.....	43
CONCLUSION	49
BIBLIOGRAPHY	50
AUTHOR’S BIOGRAPHY.....	54

TABLE OF FIGURES

Figure 1: Percentage of egg-bearing females with a notch by year.....4

Figure 2: Anatomy of the Lobster8

Figure 3: Parts of a Lobster Trap.....13

Figure 4: V-Notched Lobster.....13

Figure 5: Maine Lobster Management Zones.....24

Figure 6: Age Distribution28

Figure 7: Reported V-Notch Behaviors.....36

Figure 8: Reported Motivations for V-Notching.....40

INTRODUCTION

The Maine lobster fishery serves as an exemplar for struggling fisheries worldwide. The lobster industry is a powerhouse in the Maine economy and is experiencing an extended period of success, contrary to the worldwide trend of crisis in major fisheries. In 2017, Maine lobstermen landed over 110 million pounds of lobster, valuing over \$450 million, and lobster made up 76.2% of the total value of all Maine commercial fisheries landings in 2017 (Maine Department of Marine Resources, 2018). Consensus among lobster fishermen, resource management experts, and scientists points to Maine's unique conservation policies as the hallmark of the fisheries success (Acheson & Gardner, 2010; Le Bris et al., 2018). Extensive contributions from lobstermen themselves, combined with knowledge from scientists and dedicated legislators have resulted in a "multi-scale set of input rules that restrain fishing and have sustained the fishery" (Wilson, Acheson, & Johnson, 2013, p. 171).

Perhaps one of the most important conservation rules in the fishery is the v-notch law (Acheson & Gardner, 2011). Since 1948, fishermen have been protecting breeding females by marking a v-notch in their right center tail fin. Fishermen are not allowed to keep or sell lobsters with this mark. Wide industry support has led to thousands of fishermen v-notching, resulting in a large population of reproductive sized lobsters in the Gulf of Maine (Acheson & Gardner, 2010). As one fisherman put it, "If you do away with that law [the v-notch], you do away with the industry. It is that important" (Acheson & Knight, 2000, p. 223)

Common-pool resources present a classic collective action dilemma where there is “a divergence between what is in the interest of individuals and what is optimal for society” (Acheson & Gardner, 2011, p. 6). In fisheries it is in the self-interest of individual fishermen to catch as many fish as they can even though “a rule constraining exploitive effort would result in a sustainable fishery and larger catches” (Acheson & Gardner, 2011, p. 2). In many fisheries the collective action dilemma is not solved due to absent property rights, and in those conditions, fishermen do not constrain their behavior, leading to overexploitation (Feeny et al., 1990), or the tragedy of the commons (Hardin, 1968). The v-notch law is one example of how the lobster fishery has defied the common trend of not being able to solve collective action problems, which in turn has contributed to the fisheries production of record-breaking landings (Acheson & Gardner, 2011). By not taking v-notched lobsters, fishermen allow some lobsters to reproduce and contribute to bigger stocks in the future. The cost of v-notching to the individual (extra effort to notch while working and not selling notched lobsters) is ultimately outweighed by the benefits it provides to the group (bigger stocks resulting in more plentiful catches).

One of the biggest threats to collective action is the free-rider problem. Ostrom (2015) explains, “whenever one person cannot be excluded from the benefits that others provide, each person is motivated not to contribute to the joint effort, but to free ride on the efforts of others” (p. 6). Free-riding detracts from the lobstermen’s joint efforts to preserve their resource, choosing instead to benefit from the efforts of others without contribution. In this case, the contribution is v-notching egg-bearing females. In a worst case-scenario, all participants would choose to free-ride, resulting in no collective benefit. If only some participants provide while others free-ride, “less than the optimal level”

(Ostrom, 2015, p. 6) of collective benefit occurs. In terms of v-notching, fishermen who are free-riders, still benefit from the more plentiful stocks thanks to the v-notching efforts of other fishermen. Their lack of participation in this collective action has the potential to result in a less than optimal provision of the collective benefit for all fishermen, including themselves. Addressing the threat free-riders pose is important to sustaining a collective action solution.

Despite recent success and the fishery's ability to solve its collective action dilemmas in the past, the 2017 annual catch and price for lobster were down compared to previous years (Department of Marine Resources, 2018). The President of the Maine Lobstermen's Association, Dave Cousens, described it as the worst year in recent memory, saying, "I don't have a clue what's going on. People are very upset" (Trotter, October 2017). As the fishery deals with the first bad year in recent memory, fishermen and managers are looking to identify the cause of this decline so they can appropriately respond. One concern scholars have raised is that there may be a loss of "social memory" of strategies used to respond to threats and challenges facing the fishery in the past (Henry & Johnson, 2015). Social memory allows individuals and communities to consider past experiences to make informed decisions about present and future experiences and fosters the ability to appropriately and efficiently deal with threats (Folke, et al., 2005). Since younger fishermen have not had to respond to any substantial misfortune, such as extremely low catches, they may not have developed the same social memory as older generations and this may reduce their ability to proactively and appropriately respond to threats to their vocation and solve collective action problems as fishermen have in the past.

Contrary to the identification of v-notching as one of the most important conservation policies, data indicate that v-notching practices are declining. The percentage of egg-bearing lobsters with a v-notch peaked in 2008 and an impressive 79% of those sampled statewide were notched (Figure 1). Since then, the average has declined nearly every year and dropped to a low in 2013 at 59% (Figure 1). In Zone A, the compliance rate was extremely low at only 50% (Hall, 2014). Sampling from 2017 indicates a slight increase (Figure 1), but the percentage of legal eggers with a v-notch is still significantly below what it had been.

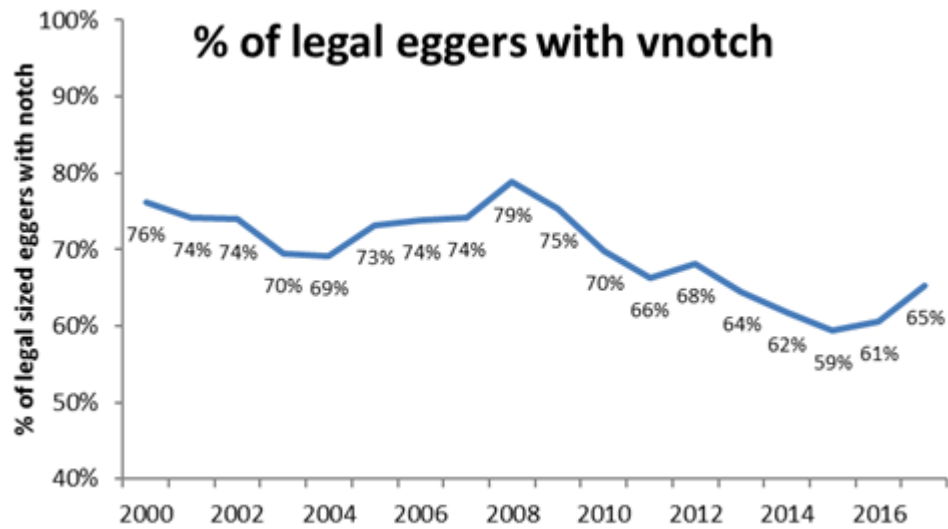


Figure 1: Egg-bearing females with a notch over time (Personal communication, Kathleen Reardon, April 4th, 2018)

Due to the importance of the v-notch law and concerns related to current practices and changing demographics in the fishery, this research provides an updated analysis of the v-notch law. The legislative changes in v-notching prior to the past ten years have been well documented (Acheson & Gardner, 2010; Acheson 1997). Creating this update required examination of how the v-notch law is being discussed in legislation and by fishermen today. First, the researcher reviewed v-notch relevant legislation and Maine

Supreme Court proceedings from the past ten years to update previous research of the v-notch law, and as such how it reflects the modern debate regarding the law. Second, an analysis of oral history interviews with Maine lobstermen provides essential insight into lobstermen's perceptions and practice related to the v-notch law.

This research aimed to assess through an analysis of modern v-notch legislation and interviews whether younger fishermen are less equipped for solving collective action problems due to the social memory they have constructed. The researcher expected that the oral history interviews would show different v-notching practices and perceptions in younger fishermen compared to older fishermen. More specifically, the researcher predicted that younger generation would v-notch less often and perceive the law less favorably than the elder generation. This prediction assumed that younger fishermen would be less effective at solving problems and addressing threats.

Understanding the v-notch law necessitates a familiarity with the lobster fishery. The following section outlines the current v-notch legislation, the biological makeup of the American lobster, specifics on lobstermen's routine and culture, history of the policy making in the fishery, and research on fishermen's perspectives of the v-notch law. Following this necessary background information, the researcher reviews the v-notch law in detail. Finally, the researcher presents data collected from the oral history interviews.

BACKGROUND

Legislation

In order to fully understand an updated examination of the v-notch law, it is important to become familiar with the law itself. One can find the v-notch law in Maine Revised Statutes Title 12: Conservation in Subchapter 2: Limits on Fishing and Prohibited Acts. The law is split into six sections: egg-bearing and v-notched lobsters, exceptions, permitted possessions and regulations, prima facie evidence, penalty for possession or egg-bearing lobsters, and penalty for possession of v-notched lobsters.

Section 1, *egg-bearing lobsters; v-notched lobsters*, dictates that a person may not take, transport, sell or possess any lobster bearing eggs or any female marked with a v-notch in the right flipper next to the middle flipper. It also asserts that any female lobster that is mutilated in a manner that could hide or obliterate that mark may not be taken (Maine Title 12, §6436). This section is particularly important as it establishes a zero-tolerance policy; **any** mark or mutilation on the right middle flipper is illegal to possess. Some lobstermen's difficulty interpreting this zero-tolerance policy will be discussed later in this paper.

Section 2, *exemptions*, explains that no violation occurs if the v-notched lobster is released back into the ocean immediately. This means that when a lobsterman pulls up a trap and takes out the lobsters to measure, any egg-bearing females or v-notched lobsters must be thrown back to the ocean immediately. If the designated v-notch flipper is missing or there is any question to whether a mark in it is a notch or not, it should be thrown back. Seafood processors/lobster pounds also may not possess these eggging,

notched, or questionable lobsters, barring the permit some pounds may have. There will be no violation in response to any lobster that is processed and sold to the department by a lobster pound owner who has a permit to do so (Maine Title 12, §6436).

Section 3, *permitted possession; regulations*, describes the permits issued to lobster pounds previously mentioned in Section 2. The commissioner may issue a permit for the holding and delivery of egg-bearing lobsters to the department by a lobster pound owner who holds a current wholesale seafood license. He or she may regulate the conditions and limitations under which these lobsters are handled and delivered (Maine Title 12, §6436).

Section 4, *prima facie evidence*, concerns evidence that would be enough to prove a fact in a court of law, unless rebutted. It states that the discovery of an egg-bearing lobster by a marine patrol officer in a pound not protected under the permits described in section 3 will be concerned prima facie evidence of a violation. Any lobster displaying a v-notched or mutilated right flipper is also evidence that the lobster is a v-notched female lobster (Maine Title 12, §6436).

Sections 5 and 6 outline the penalties for possession of egg-bearing and v-notched lobsters. These sections state that possession of either egg-bearing or v-notched lobsters is a Class D crime. For egg-bearing lobsters, the court will impose a fine of \$1,000 for each violation. There is also an additional three-tiered fine system for each lobster involved in the violation. The first tier is a fine of \$200 fine for each lobster involved, up to and including the first 5. The second tier, including any lobster more than 5, will receive a \$400 fine. Finally, If the number of lobsters cannot be determined, a fine of no less than \$2,500 and no more than \$10,000 will be imposed. Similarly, for the possession

of v-notched lobsters, the court will impose a fine of \$500 for each violation. For the first five lobsters involved in the violation, a fine of \$100 lobsters will be imposed. A fine of \$400 will be imposed for any lobsters beyond the first five. If the number of lobsters cannot be determined, a fine of no less than \$1,000 and no more than \$5,000 will be imposed (Maine Title 12, §6436). The penalties serve as strong deterrents to free-riders.

Biology of the American Lobster

To fully understand the v-notching law and practice, it is important to examine the

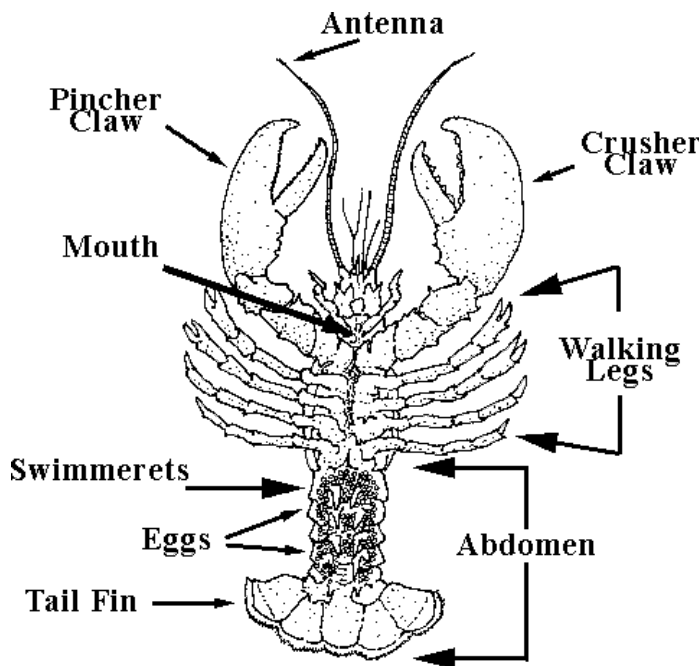


Figure 2: Anatomy of the Lobster (Gulf of Maine Research Institute)

biology of the lobster. The American lobster (*Homarus americanus*) is a hard-shelled, invertebrate crustacean native to the Gulf of Maine that lives on the ocean bottom. The head and mid-section of lobsters are covered by a hard shell known as the carapace. Lobstermen measure the carapace to determine whether it is of the

legal size for harvesting (between 3 ¼ and 5 inches). The lower half of the lobster is the abdomen. It is made up of six segments that are not fused together which allow the lobster for ample movement and flexibility. The first five segments of the abdomen contain swimmerets. Swimmerets assist with movement and carrying eggs. The last

segment is where the tail fin is located. The tail fin has a central telson with a pair of uropods on both sides and is where a v-notch is cut in a lobster (Factor, 1995).

When a lobster grows, it goes through a process known as “shedding.” This occurs when the body grows beyond the limits of its shell. Shedding begins roughly between June and August, at which time the shell splits along the bottom of the carapace and the lobster moves its way out of the shell. After the shed, the lobster becomes soft and weak and the shell feels paper-thin. After a few days, the shell hardens (Factor, 1995). Small lobsters can shed several times a year, whereas legal sized lobsters generally only shed once a year (Hughes & Matthiessen, 1962). If the lobster is notched, shedding causes the mark to become less defined and it will eventually disappear. Variation in how long a notch can last depends on the size of the notch, but it usually last approximately two sheds (Acheson, 2004).

It takes 6-8 years for a lobster to reach marketable size, meaning at minimum, a 3 ¼ inch carapace. Lobsters reach sexual maturation when the female's carapace is between 3.1 and 3.7 inches long. Male lobsters are mature at a much smaller size of 1.8 to 2.8 inches long (Krouse, 1972). Mating occurs after the shed occurs, when the female is soft and defenseless. During mating, the male deposits sperm in in the female seminal receptacle, where it remains up to a year until the eggs are mature (Factor, 1995). Around 50,000 eggs are extruded and “glued” to the female’s abdomen until they hatch 9-11 months later (Mackenzie & Moring, 1985). In Maine, conservation measures make it illegal to keep lobsters with a carapace that is over 5 inches long. This law protects bigger egg-bearing females, which produce a larger amount of eggs.

The goal of the v-notch law is to increase the number of reproductive lobsters in the Gulf of Maine, thus increasing the proportion of egg production. Researchers have examined the effect of v-notching on egg production (Daniel, Bayer & Waltz, 1989). After distributing a 3-year long questionnaire to fishermen and completing a stock survey, the researchers found that 29% of trapped non-egg bearing lobsters and 69% of egg bearing lobsters were v-notched. They also found that the size-frequency distribution of v-notched lobsters is biased towards larger females as opposed to the size frequency of unmarked females. The authors conclude that v-notched lobsters account for a significant proportion of mature female lobsters in traps and possibly in the population. Further, they comprise most of the ovigerous lobsters and consequently enhance the proportion of mature lobsters that are ovigerous. Due to these factors, the authors concluded that v-notching egg-bearing females contributes significantly to egg production in coastal Maine waters. Specifically, the research found that v-notched lobsters produced *nine* times more eggs annually than lobsters that were not notched (Daniel, Bayer & Waltz, 1989).

Lobsters, both juvenile and adult, are subject to predation by multiple organisms. They are primarily consumed by bottom feeding fish such as Atlantic cod, sharks, wolfish, pollock, and goosfish (MacKenzie & Moring, 1985). Predators are not the only threat to lobsters. Shell disease is increasingly effecting lobsters in the Gulf of Maine.¹ A leading lobster scientist, Dr. Richard Wahle from the University of Maine, explained shell disease: “It starts off as a bacterial infection. The bacteria digest the surface of the shell, creating nasty-looking pits” (Violo, April 2016). The disease affects both the health of the lobster and its marketability. There is some concern over if the v-notch affects

¹ The number of lobsters affected by shell disease are much higher in Southern New England where the water is warmer.

disease susceptibility because notching requires disruption of the lobster's shell and somatic tissue. Limited research on this specific topic exists. One of the few studies completed was a two-year tank study. The goal was to determine whether mortality, shell disease, and the rate of notch loss differed between groups of notched and unnotched lobsters (DeAngelis, et al., 2010). The researchers found that the while severity of shell disease between control and experimental lobsters showed some variability, the frequency of control and experimental lobsters with any degree of shell disease had only minor variation (DeAngelis, Cooper, Clancy, et al., 2010). Overall, the researchers concluded that the findings of the tank experiment indicated that v-notching did not have a significant impact on survival or disease susceptibility.

The Routine and Culture of Maine Lobstermen

For coastal communities, the lobster industry serves at the basis of local culture. Generational lobster fishing families have passed down traditional knowledge for decades and a sense of identity has flourished from it. The daily routine of lobster fishermen provides insight into the deep-seated culture that that provides context for understanding v-notching.

The working day for lobstermen begins in the very early morning hours before sunrise. They head to the dock where they assess the weather conditions. If the day be calm and clear, the captain and their crew will row out to their fishing vessels, fire it up, and steam out of the harbor where their traps await hauling. Using a chart plotter system, previously set lobster traps are marked with a buoy and toggle. When they arrive at a buoy, the captain will put the engine in neutral and use a stick with a hook, known as a gaff, to pull the buoy up into the boat. This buoy is attached to a warp, which is the rope

connecting the buoy to the trap. Lobstermen will then insert the rope into a hydraulic hauler. The hauler allows great lengths of rope and the heavy traps to be hauled up into the boat at a high speed. The trap at the end of the warp gets pulled up over the edge of the boat and is placed on the rail.

The lobster trap is a unique tool. In Maine, lobsters are caught in rectangular coated wire traps, sometimes referred to as pots. This is contrary to the misconception that Maine lobstermen still use wood traps, which are displayed by many tourist stores and destinations around in the state. The modern coated wire traps are two-chambered. The first chamber, known as the kitchen, contains the bait bag. The most popular bait fish is herring, but other species of fish are utilized.² Lobsters enter the trap because they are attracted to the chemical “scent” of the bait fish (Johnson & Atema, 2005). Once they are in the trap, they may find their way out again, or they may enter the second chamber called the parlor. This chamber is constructed to only allow undersized lobsters to get out

² Animal hide is another popular bait during certain seasons, or if the fishery is experiencing a herring shortage.

again through the escape vent. When a trap is pulled up, lobstermen generally pick lobsters out of primarily the parlor.

Once the trap is on the rail of the boat, the captain and crew set to work tending the traps. Traps can be set as a singular trap, but there may be multiple traps per line (known as a trawl). Lobsters found in the traps that are clearly too small are thrown back into the water. Lobsters that look like they could be legal are put in a cull box where they sit until the

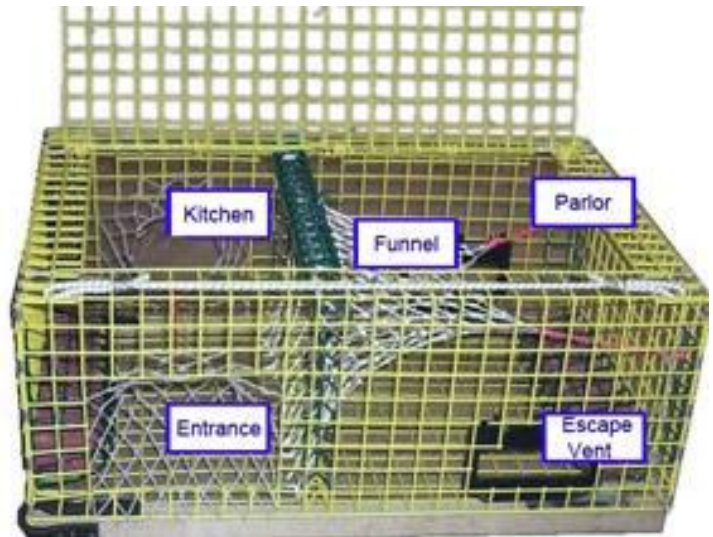


Figure 3: Parts of a Lobster Trap (Mortell, 2016)

crew has time to evaluate them. Various other sea creatures are caught and thrown back. The bait bag is replaced with a fresh one, the trap is then closed, and reset into the ocean in accordance to depth and surrounding gear before moving on to the next trap.



Figure 4: V-Notched Lobster (Photo credit: Robert F. Bukaty)

Fishermen measure lobsters in between hauling traps. Legal lobsters must have a carapace that is between 3¼ and 5 inches long (8.255 and 12.7cm). A measuring gauge is placed on the eye socket and runs across the back of the lobster. If the lobster is between meets the length requirements it may be kept. The lobsters must also be checked for a v-notch or eggs. Should it display either of these, it must be thrown back. If an eggling female is found not to have a v-notch, the captain or crew may cut a v-notch into the tail fin, indicating it is a reproductive lobster. The most common tools for notching are a knife, the measuring gauge, a tool designated specifically for v-notching. It is illegal to keep a v-notched or eggling lobster. Serious consequences are enforced for those who break these rules, both legally as outlined above, and socially.

Once the illegal lobsters are sorted out and thrown back to sea, the legal ones are banded and placed in storage. Banding a lobster is done with a metal tool allowing a rubber band to be placed around each of the lobster's claws. Banding protects captured lobsters from harming each other and the people handling them. To keep the day's catch alive, running seawater circulates through the storage.³

After hauling anywhere between 150-500 traps per day (Acheson, 1988), the lobsterman heads back to his or her harbor.⁴ The sternman works to clean and organize the boat while they head in. The daily catch is sold to a lobster dealer at the end of the day. Dealers weigh the lobsters and pay lobstermen at a price per pound. Often, when the lobsters are being sold, lobstermen refuel the boat and get more bait for the next day. After selling for the day, they put their boat back on the mooring and head home to rest

³ Lobster pounds will not purchase dead lobsters from lobstermen.

⁴ The number of traps hauled a day varies based on the size of the fishermen's operation (i.e. number of traps, boat length, boat speed).

up for the next long day, and the process is repeated. Full-time fishermen will repeat this process year-round when weather allows, whereas seasonal fishermen typically haul between April and November.⁵

The brief description provided above on the daily routine of a lobster fisherman may lead a person to believe there is little room for social interaction, however, this could not be further from the truth. Lobstermen have an incredible and complex social network known as a “harbor gang” (Acheson, 1988) Harbor gangs are made up of all the lobster fishermen who fish from any given harbor/port. Entrance into a harbor gang strongly influences many aspects of a lobsterman’s career (Acheson, 1988). The gangs are very familiar with their fellow members: “Every member of a harbor gang knows every other member by sight and reputation, regardless of their degree of interaction” (Acheson, 1988, p. 49). Within the gang, cliques and friendships are likely to form. Community relationships and generational ties to the lobster fishery are certainly of the utmost importance within these groups (Acheson, 1988). The trust and relationships that form in harbor gangs certainly contribute to deterring free-riding.

Harbor gang members interact with their peers while at sea through CB or VHF radio communication. Should two boats be near each other while hauling, it is common to stop and chat. Onshore, interactions between harbor gang members continue through socializing at fishing wharfs, or even each other's homes. In one study, a community of 133 fishermen surveyed in one community, 87 identified another lobster fisherman in the same harbor gang as their “best friend” (Acheson, 1988). Harbor gang members may help

⁵ The size and durability of a fisherman’s boat dictate the seasons they operate in. Winter weather is worse, thus smaller and lower-powered boats aren’t able to make it out.

each other with maintenance of boat engines, launching or hauling up a boat or dock, and some even do gear work at their shops together. When a member is experiencing personal problems, members may step in to help. A good example of this interdependence and community caring occurred several years ago in Southwest Harbor. A well-liked fisherman was diagnosed with an aggressive cancer. The harbor gang rallied around him and donated crates of their personal catch to be credited to his name, allowing him to make a paycheck when he was unable to haul. They raised thousands of dollars.

Harbor gangs rarely interact with other gangs, even if they are only a few miles away. Acheson (1988, p. 27) explains how “the geography of the Maine coast, with its long peninsulas, does not facilitate contact, nor does the competition between harbor gangs for fishing territory.” Stereotypes arise about other harbor gangs, many of which are extremely derogatory or negative. For example, fishermen from one harbor gang described another gang as “burnt-out cases from the Vietnam War” and identified their hobbies as “booze, dope, and girl swapping” (Acheson, 1988, p. 51).

Admission into a harbor gang also allows fishermen to place his or her traps in the gang's territory. This territory is not recognized by the state or in any legal capacity, but it is strongly enforced by fishermen themselves (Acheson & Brewer, 2000). Placing traps in an area outside of the gang's territory may result in a variety of pushback by the “owners” of that territory. Most often, this retribution manifests in the form of molesting gear. In addition to access to territory, admission into a harbor gang means admission into a network of valuable information on fishing locations and innovations (Acheson & Brewer, 2000). When a certain bait is working particularly well, or the lobsters have “dried up” from one spot, harbor gang members may tell their peers.

Harbor gangs can be helpful and friendly; however, they are not conflict free. There is a distinct social hierarchy allowing fishermen to measure themselves against one another in competition for status in the harbor gang. At the top of the hierarchy are “highliners.” They are fishermen who are defined as successful and have high incomes. Often these highliners have big and well-equipped boats, expensive trucks, nice homes, and other material objects to show for their hard fishing efforts (Acheson, 1988). At the bottom of the hierarchy are “dubs,” fishermen with a low income due to catching less than their peers. Their lack of success is often attributed to factors such as laziness, alcoholism, drugs, stupidity, or even who their family is. From highliners to dubs, lobstermen use each other as a point of reference in a pursuit to catch more lobsters and make the highest income.

The harbor gang social network also plays an important role in enforcing conservation laws and norms. Fishermen take violations of conservation laws very seriously because they are “strongly supported by the lobster industry and almost universally obeyed” (Acheson, 1988, p. 90). Fishermen participation in harbor gangs shows how their social structure has developed around protecting the fishery, specifically by punishing gang members who do not comply with the law. When a fisherman violates one of these regulations, for example by keeping a v-notched or illegal sized lobster, it is possible and rather likely that other fishermen in their harbor gang will take matters into their own hands. This peer-implemented punishment may manifest through a variety of means, though most commonly through the molestation of the perpetrators gear. Violators often become the topic of gossip and are looked down upon, perhaps even ostracized. This peer-implemented system for punishment serves as a strong deterrent to

the free-rider problem. An examination of the legislative history of the Maine lobster fishery will show how lobstermen developed the conservation ethic and routine they implement today.⁶

Legislative History of the Maine Lobster Fishery

To understand the full scope of the v-notch law, it is also important to examine how it has developed over time. Acheson (1997) provides a detailed examination of the three major legislative movements in the lobster fishery's history highlighting the key components of developing of the v-notch law.

Since approximately 1860, there have been three major movements defining the regulation of the fishery (Acheson, 1997). The first of these periods began in the 1840s when the commercial fishery began to emerge due to the invention of the smack, a method of transporting live lobster long distances (Acheson, 1997). This heavily fished, unregulated emergent commercial fishery had a negative impact on lobster stocks. The size of lobsters decreased, and by the 1880s, catches had declined dramatically (Acheson, 1997). The first regulations placed on the fishery were developed in response to these changes. The lobster canners were the first faction to lobby for conservation laws, contrary to their wasteful canning practices at the time. The successful lobbying by the canners led to a law forbidding the taking of egg bearing females, and later a prohibition on fishing for lobsters less than 10.5 inches head to tail from April to October (Acheson, 1997). These laws were created out of self-interest to the canners and did not stop the devastation to the fishery. In response, the self-interested and widely criticized canning industry was overtaken by the live lobster trade, who had gained favorability in the

⁶ For more information on harbor gangs, see: Waring, T. & Acheson, J. *Sustain Sci* (2018) 13: 21.

Maine Legislature (Acheson, 1997). They also lobbied for regulations to protect smaller lobsters. Although both these industries were self-interested in their legislative endeavors, conservation laws in 2018 still reflect ideas from these laws.

The 1880s-1920s continued to reflect devastation in the fishery. In response to this, the evolution of the v-notch law began. In 1917, the legislature passed a new law permitting the state's Sea and Shore Fishery Commission to purchase egg-bearing females. Once purchased, wardens would punch a hole in the tail, and release them. Lobsters with their tails punched were illegal to take or sell. This program became extremely pricey as wardens were purchasing 60,000 pounds of egg-bearing lobsters at market price by the mid-30s (Acheson & Gardner, 2010).

The second period of policy-making in the Maine lobster fishery began during the Great Depression when prices plummeted along with low catches. Licenses issued declined by 32% between the years of 1928 and 1933, evidencing the mass exodus of lobstermen from the industry. Many of those who remained in the fishery cut back to part-time (Acheson, 1997). The cause of the disaster could not be agreed on. Fishermen sought to blame Canadian imports for the low price, while wardens believed violation of conservation laws to be the culprit. Biologists also threw a hat into the ring, blaming the lack of protection of large breeding lobsters under "poverty gauge" law (Acheson & Steneck, 1997). The poverty gauge increased the minimum legal lobster measurements and was disliked by both lobstermen and biologists.⁷ Fishermen argued it continued to make the vast majority of the lobsters they caught illegal. They also believed it caused

⁷ During this time, the legal measurements were in terms of total lobster length, rather than the length of the carapace. The poverty change increased the length from 10.5 inches to 10.7 inches. Although this change seems small, the .2 of an inch change was significant.

them to catch lobsters that were too large and expensive to sell. The biologists were unhappy since they saw this law as conserving the adolescent lobsters and putting all fishing effort on large breeding size lobsters (Acheson, 1997). Whatever the cause may have been for the bust in the fishery, (research suggests all of these reasons may have merit (Acheson & Steneck, 1997)), the crisis called for dramatic changes.

Commissioner Crie first attempted to alleviate problems via a mass advertising campaign promoting the consumption of lobster, along with lobbying the Federal government to outlaw the importation of Canadian lobsters (Acheson, 1997). Neither campaign was successful. Crie dedicated his efforts to promoting the double gauge law, which would protect small lobsters while conserving the large reproductive lobsters. The industry was sharply divided in favorability to the double gauge law. After several failed bills, the 1933 Maine Legislature passed the double gauge law: a 3 1/16 inch minimum and 4 3/4 inch maximum size limit. Commissioner Crie's hard fought battle for the legislation continues to function in the fishery today. Although slightly different in measurements, the double gauge law remains one of the most prominent laws in the Maine lobster fishery.

The second phase of policymaking in the Maine Lobster fishery also marked a sharp increase in conservation ethic practiced by fishermen. Towards the end of the 1930s, the rampant disregard for conservation policies was drastically cut back. Lobstermen began to develop conservation ethics in response to crises such as sharply declining stocks, record low catches, and extremely low prices.

Fishermen caught violating laws, for example by scrubbing eggs off a female or taking short lobsters, were subject to not only being reported by other fishermen, but

potentially being driven out of business (Acheson, 1997). From 1930-1970, there were very little major changes seen in legislation on the Maine lobster fishery. One major exception to this was the passage of the of the 1948 v-notch law (Acheson, 1997).

The 1948 v-notch law heralded the birth of the modern lobster conservation efforts. Under this law, a fisherman who caught an egg-bearing female could voluntarily cut a notch in one of her tail flippers. Any lobster caught with a v-notch in her tail flipper could not be taken or sold, regardless of whether she was still carrying eggs. Many fishermen began voluntarily cutting notches in the tail of eggging lobsters to promote this program. The law carried a great deal of industry support and was unique to the Maine lobster fishery.⁸

The third phase of policy-making introduced a new player, the Federal government. The Fisheries Conservation and Management Act of 1977 (FCMA) (Magnuson-Stevens Fishery Conservation and Management Act, 2006) was created to address foreign fishing along the coast of the United States. It established that the jurisdictional rights of the United States extended 200 miles off shore, the area known as the Exclusive Economic Zone. The law also gave the Federal government power to regulate fishing within 200 miles of the United States. FCMA created the New England Regional Fisheries Management Council which regulated fisheries in federal waters (3-200 miles). In practice, state managers and the regional councils were expected to avoid promulgating different legislation for state and Federal zones (Acheson, 1997). Prior to this, lobster management in federal waters was coordinated through the Atlantic States

⁸ Other lobster fisheries, both in the U.S. and abroad, recognize the success of the v-notch law in Maine and have implemented management practices mirror the original Maine law.

Marine Fisheries Commission with the State-Federal program, which was deemed unsuccessful (Acheson, 2004).

Less than a year after the implementation of FCMA, the Federal government began seriously considering plans that would drastically impact the Maine lobster fishery. Among these proposals was establishing a moratorium on entry into the industry, raising the minimum measure to 3.5 inches, and totally abolishing the maximum measure and v-notch law (Acheson, 1997). Federal biologists did not believe in the success of the v-notch program and supported the abolition. Specifically, they believed it was statistically unlikely that the v-notch program could be successful. Their calculations suggested that “a female lobster had to get really, really lucky to end up with a V-notch” because she must “reach puberty far ahead of schedule, have sex almost immediately, avoid traps until she extruded her eggs, then make sure she entered a trap during the few months she was carrying eggs” for the v-notch program to work (Corson, 2004, p. 111).

Maine fishermen were strongly opposed to this plan. Most fishermen saw v-notching as vital to the success of the industry. The Federal government's newfound involvement in the fishery led to a period of lobbying by fishermen, stakeholders, and scientists. Fishermen and state scientists worked together to collect data and show the success of the v-notch program to the federal government and scientists (Corson, 2004).⁹ In response to fierce lobbying, the State of Maine entered a compromise with the federal government, specifically the New England Fisheries Management Council, to maintain the v-notch law. In exchange for allowing a strongly opposed increase in the legal minimum from 3 1/16 inches to 3 1/2 inches, Maine maintained v-notch and oversized

⁹ State scientists (notably Bob Steneck) and federal scientists differed significantly on this issue.

laws. This compromise demonstrates that the Maine lobster industry is willing to make huge sacrifices. Lobstermen sacrificed their preferred legal measurements in order to keep the valued v-notch law. The Federal government's attempt to abolish the v-notch law was the only serious attempt by any stakeholder in the fishery since the creation of the law (Acheson & Knight, 2016). This period of policymaking in the industry was certainly dominated by efforts of the lobster industry to ward off bureaucratic proposals by the Federal government.

Although Maine and the Federal government reached a compromise to keep the v-notch and oversize laws, Federal pressures prompted state fishery managers to seek a more comprehensive management plan. As a result, the 1995 Maine Legislature passed the Zone Management Bill. This law established an individual 1,200 trap limit per fishermen statewide, a trap tag program to identify trap owners, an apprenticeship program for new entrants, and eligibility criteria to qualify for a license. It also established the co-management system of regulation, a unique management style where the authority to manage and implement rules is shared between resource users and agencies of the government (Acheson, 2013). Specifically, it gave the lobster industry control over certain aspects of management while the Department of Marine Resources (DMR) and Maine Legislature retained a large amount of power (Acheson, Stockwell, & Wilson, 2000).

The zone management bill created seven management zones, overseen by zone councils comprised of democratically elected lobster license holders. These councils originally had the power to rule on three things; the maximum number of traps each license holder may fish, the number of traps that may be fished on a single line, and the

time of day when fishing is allowed. In 1999, zone councils were also given the power to limit entry into their zones (Acheson, Stockwell, & Wilson, 2000). If a proposed rule passes the zone council by a two-thirds vote, the zone council is obligated to convey the results to the Commissioner of Marine Resources. If the commissioner finds the rule to be reasonable, it becomes enforceable by wardens (Acheson, Stockwell, & Wilson, 2000).

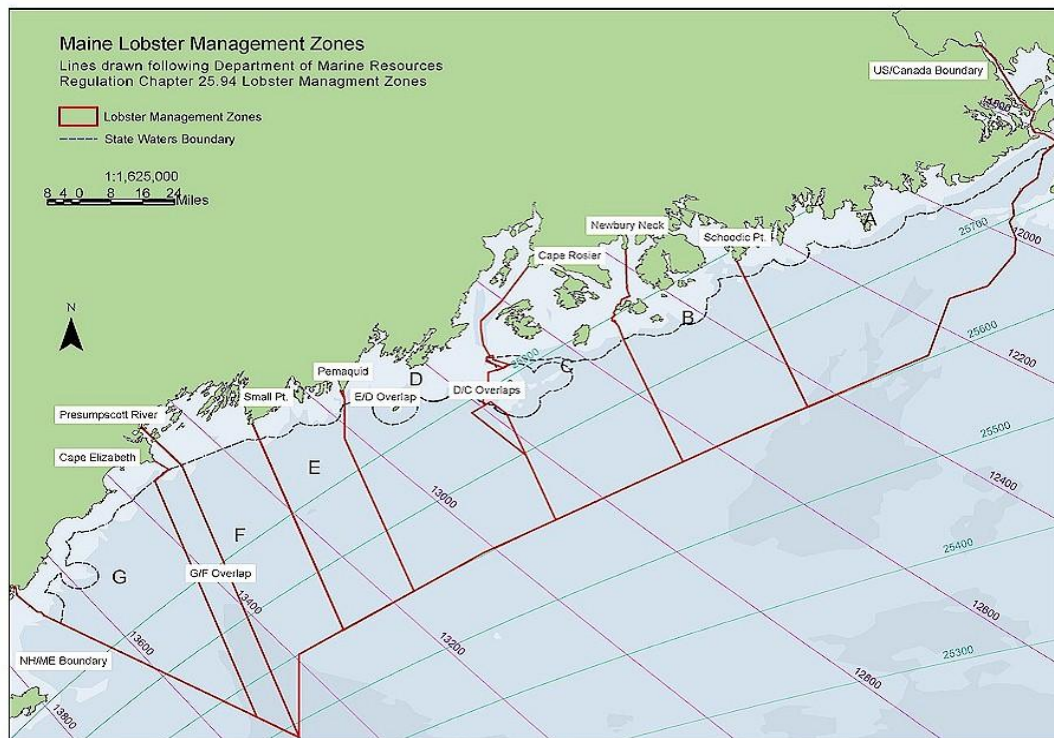


Figure 5: Maine Lobster Management Zones (DMR)

V-Notch Favorability

Research conducted in the early 1990s on the bust and boom in the Maine lobster industry showed that fishermen continued to support the v-notch law (Acheson & Steneck, 1997). Specifically, researchers found that fishermen attributed the “boom” in the resource to two main variables: low amounts of ground fish predation and the strong

breeding stock that has flourished under the v-notch and oversize conservation laws.¹⁰

Researchers concluded that fishermen are astute observers of lobsters and the ocean. Not every idea they have for the industry should be accepted at face value, but fishermen have come to many of the right conclusions (Acheson & Steneck, 1997).

The support for the v-notch law has continued into the 21st century as evidenced by the results of the Maine Sea Sampling program. In 2008, the program revealed that 82% of egg-bearing lobsters in Maine waters were notched, which reflects strong compliance among fishermen. Acheson and Gardner (2010) conducted a mail survey of lobster license holders asking them “How effective are each of the following laws in conserving the lobster stock?” and 90.9% of respondents rated the v-notch law as “very effective.” They attributed the positive feelings towards the v-notch law to the role the industry played in creating the law.

However, as discussed earlier, there is some concern that indicates that v-notching practices are declining. Since the peak in 2008, the amount of egg-bearing lobsters with a v-notch has declined nearly every year (Figure 1). The Executive Director of the Maine Lobstermen’s Association, Patrice McCarron, described a decline in notching as dangerous stating, “Previous generations of lobstermen made financial sacrifices on your behalf by v-notching lobsters, essentially putting some landings in the bank for the future. If lobstermen continue to choose not to v-notch, the lobster resource could be headed for a serious decline” (Hall, May 2014). Former head lobster biologist in the state of Maine, Carl Wilson, echoed her sentiments stating,

¹⁰ This research compared fishermen views of the bust and boom of the fishery to scientist and managers views. The research found that scientists and managers identified market prices, water temperature, and fishing effort as reasons for the bust and boom of the resource.

We can't attribute all the success of the fishery to v-notching, nor can we say that it gets all the blame for any potential decline. By not v-notching, that's taking a tool out of the toolbox that's been beneficial in the past. By participating in v-notching, you are participating in the future. We need to double down on the investment in the future. (Hall, May 2014).

The decline in notching efforts is concerning for the future of the fishery and should be taken seriously. This research examines current v-notch practices and perceptions to address these concerns.

METHODS

Part one is a review of v-notch focused legislative and Maine Supreme Court proceedings from the past 10 years. Part two is an analysis of oral history interviews with Maine lobstermen.

Part 1: Review of Legislation and Supreme Court Case

To create an updated examination of the v-notch law, the researcher sought to analyze the legislative record for any bills related to v-notching from 2008-2018. The Maine Law and Legislative Reference Library holds all materials referencing v-notching in that time frame. The researcher queried the online Maine Law and Legislative Reference Library database, using the terms “v-notch”, “v-notching”, “v notch”, and “notch” to find relevant material in the legislative record.¹¹ The researcher analyzed documents less than ten years old that specifically discussed the v-notch law and were directly related to changing or implementing v-notch law in the state of Maine. The search produced very limited results and no documents were excluded.

Given the importance of the v-notch law, the researcher expected to find plenty of legislative material from the past 10 years to sort through. However, assisted by the reference librarian, further searching for legislation only yielded one result from both the Maine State Law and Legislative Library and its digital database. Expanding the search from just bills and legislation, the researcher discovered a supreme court case. The legislative review, presented in narrative format, includes information gleaned from committee materials relevant to the of *An Act Regarding Violations of Lobster*

¹¹ This digital library can be accessed at: <https://legislature.maine.gov/lawlibrary/law-and-legislative-digital-library/9223/>

Conservation Laws in the 124th Maine Legislature and the court case, *State of Maine v. Dale Richard Weeks*.

Part 2: Oral History Interviews with Maine Lobstermen

The researcher completed oral history interviews to gain insight on how lobstermen feel about and practice the v-notch law today. Unlike structured interviews, oral history interviews allow for an in-depth account of personal experience and reflections, with sufficient time for the interviewee to elaborate and bring up new ideas. The relaxed style of oral history interviews can provide insight into the individual's identity, along with their community identity (Gubrium, 2006). For this research, oral history interviews allowed the interviewer to learn about all aspects of a lobstermen's life and career in a detailed and comprehensive manner.

A total of 32 lobstermen participated in the interviews. Lobstermen were selected through snowball sampling. Although age was an important factor in this research (Figure 6), as generational differences were expected to be important, all participants were over the age of 18, per human subjects research protocols approved by the University of Maine's Institutional Review Board.

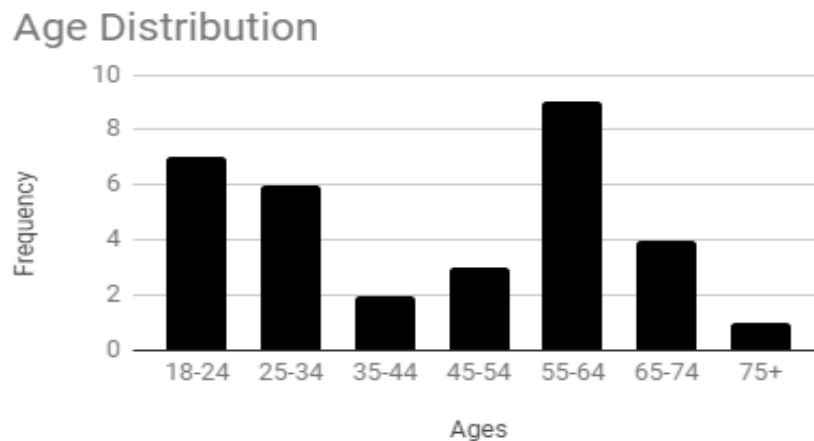


Figure 6: Age distribution of interviews (n=32).

Participation in the interviews was voluntary. Participants could terminate an interview at any time, or skip any questions they wished to refrain from answering. There were no penalties for refusing to participate or withdraw from this study. Interviewees chose the location of the interview and, with permission, interviews were audio-recorded. The researcher obtained informed consent to audio record and photograph lobstermen for the interview. Participants could keep a copy of the informed consent form. Participants were also invited to submit their oral history to the University of Maine Folklife Center or National Oceanographic Atmospheric Administration (NOAA) “Voices of the Fisheries” archive.¹²

During the interviews, participants had the opportunity to share their opinions and perspective on a variety of topics. These include, but are not limited to, their perceptions of the fishery, the sustainability of the fishery, their personal lobster fishing career, their life outside the lobster fishery, their opinions of fishery regulations, and of fishing communities. This research focuses section of interview questions regarding fishermen’s practices and attitudes on the v-notch law. These questions are as follows:

- What do you think about v-notching?
- Does your crew v-notch?
- Do you instruct your crew to v-notch?
- Do you trust your crew to decide what’s a notch and what’s not?
- Do you v-notch if you are busy?
- Do you have a v-notch tool?

¹² NOAA’s Voices of the Fisheries project can be accessed at: <https://www.st.nmfs.noaa.gov/humandimensions/index>

- If questionable, do you re-notch?
- Have you noticed a change in the v-notch practice overtime?
- When did you notice this change?

The Verbalink transcription service transcribed the completed interviews. The researcher reviewed these transcriptions for errors and fixed them accordingly.

The researcher utilized NVivo 11 Pro to analyze the interviews. NVivo allows the analysis of qualitative data (Hilal et al., 2013). The software reduces a great number of manual tasks and gives the researcher more time to discover tendencies, recognize themes and derive conclusions (Hilal et al., 2013). The researcher was working with PhD candidate Mackenzie Mazur to collect and code interviews. NVivo is ideal for researchers working in a team since it facilitates combining the work of individuals into one project (Hilal et al., 2013).

The researcher specifically used a process known as coding, a method in which data is categorized into groups and subgroups, to facilitate analysis. Codes are “tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study” (Miles & Huberman, 1994, p.56). Codes often adhere to words, phrases, or paragraphs. Codes can be combined in order to realize the connection between them (Miles & Huberman, 1994). For example, the researcher coded all statements made by interviewees that had the word “v-notch”. The statements containing the word “v-notch” were then reviewed and paired down into smaller groups of codes like “statements about v-notching in reference to sustainability” or “statements in reference to legal ramifications.” The researcher also coded all the statements about v-

notching by demographic factors such as age, zone, and whether the fishermen came from a generational fishing family.

The researcher coded the interviews in two phases. The first phase was an initial coding of all the dialogue in the interviews. This coding included informant characteristics, community perceptions, experience in the fishery, issues of vulnerability and resilience, and fishery management. Initial coding duties were split between Ms. Mazur and the researcher. An intercoder reliability test confirmed that the two coders showed a high level of agreement on how content was sorted into the coding scheme. The intercoder reliability test required both to code three of the same interviews. After coding, NVivo analyzed the interviews and reported a high level of agreement between the two researchers in how they coded. In the second phase of coding, the researcher independently coded only the v-notch related dialogue from the interviews. No intercoder reliability test was needed for the second phase.

RESULTS

Part 1: Legislative Review Results

Senator Rector of Knox County presented the only bill relevant to the v-notch laws in the last decade: LD 246: “An Act Regarding Violations of Lobster Conservation Laws.”¹³ The bill specifically proposed changes to the magnitude of penalties for violators of multiple lobster conservation laws, including the v-notch law. At the time, the existing penalties for keeping a v-notched lobster were \$50 for each violation and \$50 for each lobster involved. LD246 proposed an increase to \$500 for each violation (a 900% increase), \$100 for the first 5 lobsters involved, and for every lobster in excess to the original 5, a \$400 fine per lobster. It also added that if the number of lobsters involved could not be determined, a fine of no less than \$1000 and no more than \$5000 will be imposed (Public Law 394, Section 11, 2009). Finally, it added a mandatory license suspension upon conviction of a 2nd offense of having 5 or more illegal lobsters (Public Law 394, Section 4, 2009).

Most of the testimonies made for LD246 were supportive. The testimonies made by the DMR, Downeast Lobstermen’s Association, and Senator Rector on behalf of the Lobster Advisory Council stood out as particularly supportive in terms of making stronger penalties for violations against conservation laws, including the v-notch.

Deputy Commissioner David Etnier delivered the DMR’s testimony, highlighting the importance of increasing penalties for violations of conservation laws in order to deter illegal behavior. In his opening statement, he explained:

¹³ The Director of Marine Policy at the DMR confirmed this was true in a phone conversation with the researcher.

I am testifying on behalf of the Department in support of LD 246. The bill before you today represents the efforts of both the Lobster Advisory Council and the Department to bring up to date a number of the most important statutes which protect the conservation ethic of Maine's lobster fishery. At the request of the Council, and with the assistance of a subcommittee they appointed for the purpose, Department staff carefully scrutinized all of the violations that all too frequently occur in this important fishery and made a series of changes that are meant to amplify the importance of these laws and to enhance their purpose as a deterrent (Testimony by the Department of Marine Resources, 2009).

In his testimony, Etnier also explained that industry stakeholders have informed the DMR that if the penalties are insufficient, some lobstermen will consider the fines as the "cost of doing business." In other words, without harsh negative incentives in place it would be easier for fishermen to free-ride on the efforts of others rather than participating themselves. The DMR supported the increase in penalties set forth by LD246 in order to avoid the free-rider line of thinking. They argued that increasing penalties would ultimately decrease the proportion of illegal behaviors.

The Executive Director of the Downeast Lobstermen's Association, Sheila Dassatt, presented her testimony on behalf of the organization in favor of LD246:

May I first say that D.E.L.A. is pleased that the Department of Marine Resources is stepping up its efforts to protect this valuable but yet vulnerable lobster resource. [...] This bill (LD 246) does make great strides to help close several loopholes that need to be closed in order to protect the lobster resource. At this time, this bill will give the D.M.R. enforcement sector a better opportunity to be able to get convictions and suspensions on people who blatantly violate lobster laws. [...] Although LD 246 makes several improvements, we feel that there will be room for improvements at a later time. [...] The D.E.L.A supports LD 246, but would like to see tougher revisions" (Testimony by the Downeast Lobstermen's Association, 2009).

Senator Rector's testimony on behalf of the Lobster Advisory Council was short and to the point, asserting that the bill "received unanimous support of the Lobster Advisory Council" (Testimony by Senator Rector, 2009).

The Maine Lobstermen's Association, the Southern Maine Lobstermen's Association, Zone D Lobster Council, and several individual lobstermen were recorded as supporting LD246. Only two testimonies included in the committee materials for LD246 opposed portions of the law unrelated v-notching. Rather, they opposed a different part of the law crafted to change the legality of license holders fishing off more than one boat. There were also two testimonies that were neither for nor against.

In summary, the bill set out to strengthen penalties (in the form of mandatory license suspensions and increased fines) against the violation of lobster conservation laws, including the v-notch law. LD246 unanimously passed the legislature. Governor John Baldacci signed it into law in June of 2009. No other laws concerning v-notching have been proposed since this piece of legislation was enacted.

In 2009, the same year LD246 passed, the Maine supreme court deliberated the case State of Maine vs. Dale Richard Weeks. During a search, wardens discovered Mr. Weeks possessed four v-notched lobsters. He was convicted of this violation. He contended the v-notched lobsters did not fall under the law because each lobster showed evidence of regeneration through the molting process. He claimed that marine patrol officers had previously told him that possessing lobsters with regenerated right center flippers was legal. The evidence he submitted to corroborate this claim was the Bureau of Marine Patrol policy that states: "For the purpose of this policy, a naturally regenerated flipper is considered legal" (Bureau of Marine Patrol, Ch. 5/Policy 2.A).

In response to Mr. Week's argument, the court was tasked with determining whether the v-notch law included the prohibition of possessing v-notched lobsters with naturally regenerated right center flippers being evidence previous v-notching. The court

concluded the v-notch law does prohibit possession of the lobsters in question, thus affirming the trial court's judgment against Mr. Weeks. The court determined that even if a lobsterman was confused by the Marine Patrol policy, "more specific and quite clear publicly available materials place a lobster licensee on explicit notice of precisely what is required, of what is prohibited, and of the fact that this law creates a strict liability situation" (State of Maine v. Dale Richard Weeks, 2009). The decision also held that lobster license holders are responsible for being aware regulations when they purchase a license. The court also decided that the Marine Patrol handbook policy is consistent with the v-notch law when considering it in its full scope. The law and the Marine Patrol policy both assert that a regenerated right center flipper bearing evidence that it was previously mutilated in a manner hides or obliterates a v-notch falls inside the law's protection. A regenerated right center flipper that bears no such evidence falls outside that protection. The court declared that Mr. Weeks' interpretation of the v-notch policy would, "would undermine its purpose of protecting the breeding stock of the lobster fishery" (State of Maine v. Dale Richard Weeks, 2009).

Part 2: Interview Results

Reported V-notch Behavior

Twenty-two interviews included specific questions about behaviors related to v-notching. Most lobstermen interviewed indicated they v-notched even when they were busy (68.2%) and that their crew took part in v-notching (87%) (Figure 7). The specific tasks stern men are responsible for vary captain to captain, but the tasks often include measuring, v-notching, picking the lobsters out of the trap, and baiting. One fisherman elaborated on how important he felt it was to have a crew dedicated to notching:

I've, like, freaked my shit a couple times [over crew not v-notching]. And I've had sternmen who would, like, come on for a day—well, not for a day, but like, guys who don't know what they're doing. It's like, when you teach it, if you don't drill it into their fuckin' heads that, like, that's [v-notching] one of the most important things, if not the most important thing—like, keep your God damn breeders alive, you know, and everything will be alright, you know? (Interviewee age 21).

Only half of the fishermen interviewed reported re-notching questionably notched lobsters and only 41% percent of respondents reported using a v-notch tool (Figure 7).

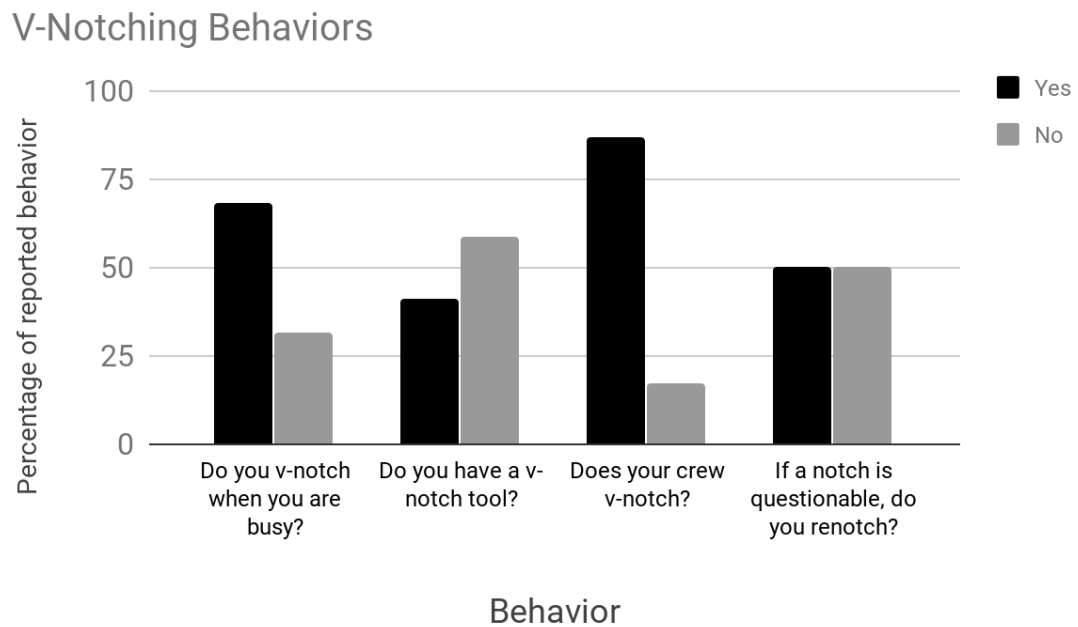


Figure 7 Reported V-Notch Behaviors (n=22)

Support for the V-Notch Law

The level of support for the v-notch law was one of the most striking results from the interview analysis. When asked, “What do you think about the v-notch law?”, 87.5% of thirty-two interviewees expressed support. Some examples of these supportive comments are “we'd be ruined without it,” “it's one of the best things we ever did,” “it's a necessity to maintain the industry,” and “I think it's wonderful. I think it's absolutely wonderful. I think it needs to be done more.” No interviewees indicated they were

opposed to v-notching.¹⁴ Only one lobsterman, age 65, reported a decline in his own v-notching efforts. He briefly explained that his lower notching efforts were due to his belief that lobstermen are “putting too many lobsters back” (Interviewee age 65) and that there just wasn’t enough time for him to notch since he did not take crew.

Perceptions of V-Notching

Interviewees regularly referenced their perceptions of other lobstermen when discussing fishing practices. In five of the thirty-two interviews, generational differences related to v-notching were mentioned. All five of these interviewees indicated that they felt older fishermen were more invested in v-notching than the younger generation. These interviewees were between 33 and 60 years old. One lobsterman explained:

The older generation was more worried about the resource. I think more careful, better stewards of the resource. The younger generation, I think, are more greedy. They're buying boats that \$6-800,000 right now, and to make that work, you've got to go fast, you've got to go hard. And you don't take the time to v-notch, you don't take the time to handle the lobsters properly, and I don't think they see the overall big picture. They just see it as a money making machine right now and that's what they see. They don't have that special feeling that I think the older fishermen that taught me, when I was a kid, the reverence they have for the resource, you know? (Interviewee age 60)

A younger fisherman described the devotion the older generation had to v-notching he saw when he was a young teen:

I can remember in the '90s, again, you did [notched] a female loaded down with eggs and it was almost a reverent moment. You took the time. My grandfather would practically stop the boat, and put a huge notch in it and cradle it back into the water (Interviewee age 33).

¹⁴ The remaining 12.5% interviewees expressed statements that did not address the matter of support directly. For example, one lobsterman responded by saying “I think v-notching is v-notching” (Interviewee age 20). The interviews in this group did not express explicit support or opposition to the v-notch law, thus could not be categorized as either supporting or not supporting in the coding process.

Interviews also reflect perceived changes in the v-notch practice. When directly asked if they had noticed a change in v-notching practices, about 40% (n=32) respondents indicated they had noticed fewer people v-notching in recent years. One lobsterman suggested that this was due to the large abundance of lobster landings:

I have to admit, we don't v-notch like we used to because we mainly aren't – there's so many. Like it gets to a point of ridiculousness. Like I couldn't have my guys v-notch all day long because we would never get done. (Interviewee age 45)

The perceived decrease in v-notching effort is a concern for some fishermen. For example, one fisherman explained:

I think it's a great system and I wish that people would continue to do it. A lot of people complain about there being too many v-notched lobsters and I've heard guys who say they don't v-notch anymore, which is just insane. (Interviewee age 28).

Other less frequent responses to the question about changes in the v-notch practice included: no observed change in v-notching effort (five interviewees), an increase in v-notching efforts (two interviewees), changes in v-notch technique (two interviewees), and changes in how the v-notch is legally interpreted (two interviewees).

Motivation for V-Notching

Interviewees reported several different motivations for v-notching. Based on 32 interviews, the most prevalent of these were sustainability, competition, and legal ramifications. 43.75% of the thirty-two fishermen interviewed reported sustainability as their primary motivator (Figure 7). One fisherman strongly expressed this belief when he said, “v-notch—I've been preaching v-notch for 30 years, and I'm gonna continue preaching v-notch 'til I die, because I think it's the most important thing we can do to sustain this fishery (Interviewee age 60). Another lobsterman similarly said:

As long as we have people that like to follow the laws and the rules instead of keeping that one v-notch female instead of looking ahead and saying, 'That's

going to make a lot more lobsters.’ I think if we've got more people like that, it's absolutely sustainable. (Interviewee age 19).

This sentiment was reiterated throughout the interviews that identified v-notching as a contributor to sustainability.

Interviewees identified competition among lobstermen as another motivation for v-notching (Figure 8). All the interviewees who identified this motivator explained that they notched, or re-notched, lobsters in order to ensure another lobsterman could not legally take them. One lobsterman explained this method of thinking particularly well:

So fishermen, they may not be actually v-notching any ones quite as readily or regularly as they used to, but that's sort of a competitiveness amongst themselves. It will make them, if there's a sort of mutilation in a tail or slight notch in a tail that they're not gonna take, they quite often would v-notch that – even though they're not an egged lobster – just because it's, ‘Well, if I'm not gonna take that lobster, why should Joe Schmoe take that lobster?’ (Interviewee age 68).

Another lobsterman said, “I notch, sometimes even re-notch things, because you look at one and you go somebody else might take that. [Pounds table] They won't now” (Interviewee age 33).

Finally, 19.05% of the interviewees cited potential legal ramifications and penalties as their motivation for v-notching lobsters (Figure 8). One lobsterman said, “Yes, we v-notch all the time. You don't have any choice. I'm not gonna save lobsters I'm gonna get busted for” (Interviewee age 68). A second lobsterman reaffirmed this when he said, “Just throw them [v-notched lobsters] back over. If you're not sure, when in doubt, throw them over. It's not worth losing the license or getting searched by any wardens and having any issues with them” (Interviewee age 20).

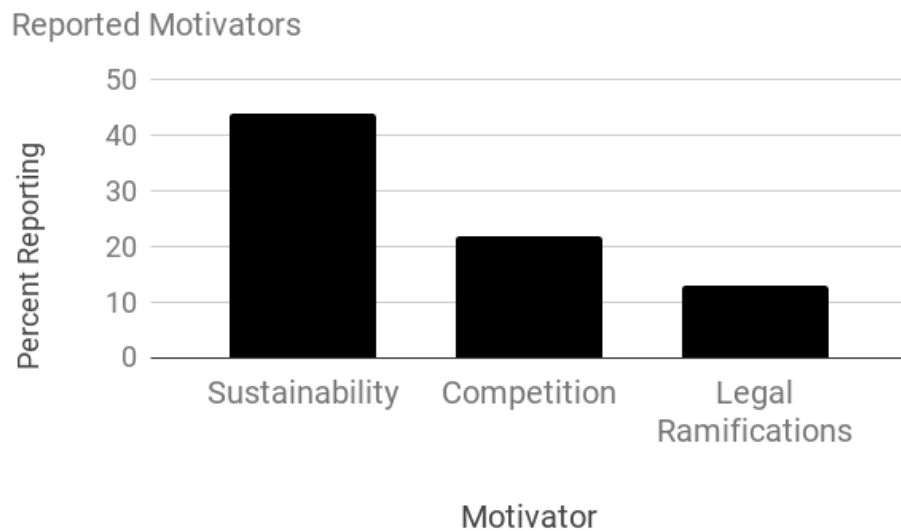


Figure 8: Reported Motivations for V-Notching (n=32)

Concerns and Challenges of V-Notching

Interviewees identified several concerns about the v-notch program. Two interviewees were concerned that the v-notch program was playing a role in the spread shell disease/shell rot in the fishery. One lobsterman explained:

I'm a big believer in switching the v-notch, because like I said, a lot of the big females that never shed, they don't shed for years, have got shell disease and you know it's spreading to other lobsters. (Interviewee age 51)

Another lobsterman concerned with shell rot reiterated this when he said:

A few years ago, I was approached by a game warden that said, 'you guys ought to get together and change the v-notch to the other side for a bunch of years to get rid of some of the disease'—because what I've been seeing in a lot of the bigger v-notched lobsters with eggs is shell disease. So, and me and him talked about it at length one day, and we kind of agreed that, to get rid of the shell disease, get rid of those egged [and diseased] lobsters. (Interviewee age 61)

The v-notching requires cutting into the lobster, whether it be with a notching tool, knife, or other means. One lobsterman was concerned with the specific method of v-notching.

He explained,

I wish there was a better way to do it without cutting a notch on the tail. I wish there was just a way to mark that lobster without cutting the tail, 'cause I don't like to rupture its shell and make the chance for infection, particularly if it has eggs on it. I know it's mandatory but I don't like to cut those tails if that lobster has eggs on it 'cause I just feel like you're just asking to cause a problem for it. I mean you wouldn't walk up to a pregnant lady and poke a hole in her [laughs] for any reason. You know, it's kind of the same thing. There should be a better way to notch them than v-notching. (Interviewee age 51)

Four lobstermen expressed concern that there may be too many v-notched lobsters on the ocean floor. One stated, “There’s a lot of v-notched lobsters, though, in the ocean, which is also kind of worrisome, because you don’t know if they're all gonna be v-notched lobsters. It’s kinda—there’s a fine line there” (Interviewee age 24). Four other lobstermen discussed their concern about the lower v-notching efforts among lobstermen who believe there are too many notched lobsters in the water such as described above. One lobsterman explained:

A lot of guys don’t do it. They just think it’s a waste of time. Just because we're seeing so much, the mentality is, you know, there’s so many more on bottom, why bother with it? But, you know, it’s like an insurance policy to me. It’s like, why wouldn’t you just—maybe that’s also me being greedy is that, if I notch it, I know that guy next to me is not gonna keep it, so I don’t have to worry about it (Interviewee age 25).

The other three lobstermen who identified the excess of v-notched lobsters being a deterrent to v-notching practices stated a similar concern.

Similar to the defendant in *State of Maine vs. Dale Richard Weeks*, some fishermen find that the difference between a legal versus an illegal v-notch is not always clear. One lobsterman explained,

Well, like the v-notch law. A good example. It used to be plain and simple; we knew what it was [...] Now nobody knows – every warden tells you something different. Some, a little nick is no good; some, a wave is okay; some, a wave isn't okay. That's one of the worst things. (Interviewee age 61).

The second lobstermen who addressed the topic reaffirmed this issue when he said;
“There's always this long drawn out debate about what exactly is a legal or not legal v-
notch. That debate has been going on forever” (Interviewee age 68).

DISCUSSION

Concerns about the state of the lobster fishery due to climate change, shell disease, and other issues are rising while the v-notching practice is in decline. This research specifically explores the question of whether younger fishermen have different views and behaviors related to v-notching compared to elder fishermen. After reviewing the last ten years of v-notch legislation, a Maine supreme court case, and interviews with Maine lobstermen, this study showed that younger fishermen are also invested in upholding v-notching as a means of effective fishery management. The findings demonstrate that fishermen of all ages hold attitudes and behaviors reflective of their commitment to the v-notch law that protects the future of their industry.

The results of the interview analysis indicate strong support of the v-notch law across all ages, despite DMR research indicating a decline in v-notching practices. 87.5% of interviewees explicitly discussed favorability for the v-notch law and no interviewees discussed opposition to the law. These findings are consistent with Acheson & Steneck's (1997) and Acheson & Gardner's (2010) measurements of v-notching favorability in 1993 and 2009. Interviewees report both favorability of and compliance with participating in the v-notch program. The only legislative change made over the past decade demonstrates fishermen's commitment to resource conservation as evidenced by "An Act Regarding Violations of Lobster Conservation Laws." This act strengthened the penalties for violations of the v-notch law and increased the fine by 900%.

The lack of proposed legislation in the last ten years reflects industry-wide satisfaction with and commitment to the v-notch law. Lobstermen lobby for legislative

changes when they feel it is necessary (Acheson, 1997). Lobstermen are successfully solving collective action problems by using selective incentives. The use of selective incentives is to reward those who cooperate in the action or punish those who do not (Oliver, 1980). The 900% increase in fines represents a negative selective incentive. The positive selective incentive is that the resource of lobsters is preserved and all fishermen can reap the benefits from higher catches. If there was any major dissatisfaction with the v-notch law, lobstermen would likely have lobbied to enact change and would not have chosen to support an increase in the severity of negative selective incentives (penalties) to encourage compliance. The harsher penalties are effective negative selective incentives for some lobstermen as evidenced by 12.5% of interviewees identifying their fear of legal ramifications as driving their compliance with the law. 68.2% of lobstermen reported that they continue to v-notch, even when they are busy, in order to preserve the resource. This reflects how much they value the positive incentive to protect and preserve the resource for all. 43.75% of lobstermen identify sustainability as the primary motivation for v-notching as an investment in the future of the fishery. This motivation reflects the lobstermen's role as steward for the resource.

This research suggests that lobstermen of all ages report compliance with the v-notch law because they believe it is an effective management tool necessary to preserve their shared resource. Interviews reveal that the second most identified motivation for v-notching and re-notching is lobstermen competitors. Specifically, lobstermen v-notch so their competitors, who may be more willing to take a questionably notched lobster than a clearly notched lobster, are forced to comply with the law. This vigilance around ensuring questionably notched egg-bearing females are re-notched clearly makes it more

difficult to free-ride due to the negative incentive of strict penalties for keeping these lobsters.

The researcher did not identify any generational differences in complying with the v-notch law based on the interviewees reported behaviors. However, five lobstermen perceived there was a difference. These fishermen believed that younger fishermen do not have the social memory of hardship in the industry to appreciating the regulatory laws in place to conserve this resource. While this research did not substantiate generational differences in v-notching behavior, it did indicate that some lobstermen perceive this as a concern.

Analysis of the oral history interviews revealed several other important v-notching trends and topics that merit further research. These topics include the effect of v-notching on the health of lobsters, the use of a v-notch tool, and the confusion over how to determine an illegal notch. Interviews revealed concern about the effect of v-notching on the lobster. These concerns are important to address when considering the future of the fishery. Shell rot and disease susceptibility could potentially devastate a market for lobsters and harm the species as a whole (Canfield, August 2013). These concerns are playing out in Southern New England (SNE) where the prevalence of lobsters with shell disease ranges from 10% to 40% depending on the location. Glenn and Pugh (2006) write that temperature may be a primary factor related to the recent outbreak of epizootic shell disease. The abundance of lobsters in SNE has experienced a “decline coincident with a rise in shell disease prevalence” (Castro et al., 2010). Fishermen, researchers, and managers in the Gulf of Maine must be proactive in dealing with this issue so they may avoid the complications seen in the SNE lobster fishery.

Concern over how a v-notch effects the spread of shell disease is not new. Federal biologists identified this concern when they were fighting to abolish the v-notch law in the late 1970s and early 1980s (Acheson & Knight, 2016). Contrary to the federal biologists, the fishermen who identified this concern did not want to abolish the v-notch law, rather, they wanted to improve it to conserve and sustain the fishery. Although DeAngelis et al. (2010) concluded that v-notching did not have a significant impact on survival or disease susceptibility, very few other studies have been completed to corroborate these findings. Further research on the impact of shell rot in lobsters should be conducted in construct an appropriate response to the concerns of how v-notching effects disease susceptibility. There is a \$28.00 tool designed to appropriately notch lobsters and only 41% of interviewees report using the v-notch tool. Could a more effective v-notch tool encourage higher participation in v-notching and be healthier for lobsters? The critiques of the tool reported in these interviews could be important in helping managers and retailers redesign the v-notch tool to improve dependability, ease of use, and the effect it has on a lobster.

This research reiterates fishermen's concern about determining if a notched lobster was legal to keep. Despite the "zero-tolerance" policy set forth by the v-notch law, these interviewees felt there was a lack of consistency in identifying what lobsters were legal. These concerns are echoed in the State of Maine v. Dale Richard Weeks case, where the defendant argued there was conflicting information available on how to determine a legal notch. The court's ruling set the precedent for future v-notch related court cases by asserting that lobster license holders were responsible for understanding the fishery regulations. The case establishes a legal precedent enforcing a strict, zero-

tolerance practice of the v-notch law. Difficulty in determining a legal notch should be concerning for fishermen, managers, and law enforcement alike. The v-notch law would be more successful if all fishermen and law enforcement officers could agree on what constitutes a legal notch. Agreement among law enforcement would provide the definitive answer to what constitutes a v-notch and free riders would have less opportunity to push the boundaries of acceptable v-notching practices. Further research should be completed to evaluate whether the law should remain “zero-tolerance”, or if creating more specific criteria for determining a notch would be more successful.

There are alternative methods for judging a notch in other lobster fisheries. For example, in federal waters off the coast of Southern Massachusetts and Rhode Island, fishermen may not possess any female lobster that has a notch or indentation that is at least as deep as $\frac{1}{8}$ of an inch. It may be worthwhile for industry stakeholders to explore these options, weighing the benefits of uniform enforcement against the strict “zero-tolerance” conservation method.

Finally, the trends identified in this research could be used to craft questions further addressing topics of interest for v-notching. For example, questions could be formed to explicitly ask all interviewees if they feel the penalties for v-notching are appropriate. A structured survey would be an efficient way of further evaluating the trends found in this research. Replicating these interviews in a different commercial lobster fishery may help determine what other factors, aside from v-notching, could contribute to a yet more successful fishery management. A comparison of the two fisheries would create useful information for policymakers and fishermen in both locations.

There are several limitations of this research. Firstly, the sample size of interviewees was small and not representative of all lobstermen. Women, fishermen from Zone F, and fishermen from Zone G were all absent from this sample. There is a growing number of women lobstermen and Zones F and G account for a large portion of the southern most parts of the state. It is important to have participants from all parts of the coast and of both genders. Due to small size and groups of people missing from the sample, the results could not be generalized to the population. It should also be noted that the researcher cannot guarantee the honesty of interviewees, especially when talking about compliance with a law. Participants in self-reporting interviews may feel uncomfortable discussing their personal habits. An anonymous structured survey on v-notching habits may result in more honest answers from participants.

CONCLUSION

The Maine lobster industry is a unique success story among fisheries worldwide, due largely to effective conservation methods; the v-notch law standing chief among these. Amid concern over 2017's fall in landings and price, the researcher predicted the younger generation, who has experienced an extended period of lobstering success, has not developed a social memory that equips them to successfully address threats and solve collective action problems. Based on this, the researcher predicted that younger fishermen's behaviors and attitudes would result in lower v-notching efforts and favorability to the law among their age group. The research did *not* support this prediction. Instead, the analysis of legislation and interviews revealed strong support and compliance among lobstermen of all ages. Five fishermen perceived that there was a generational difference identifying social memory as the reason. The researcher also identified several other v-notching trends meriting further research. These include concern over how lobsters are affected by a v-notch, the use of a v-notch tool, and the difficulty in determining a legal notch.

This research is important because it provides unique insight into how lobstermen feel about and practice the v-notch law. Researchers and fishermen consider the v-notch law a key component to the sustaining the fishery, which makes this information valuable to people creating methods to improve management in the face of declining stocks. Further research on the v-notch law is needed to understand the role of v-notching as the fishery changes.

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AUTHOR'S BIOGRAPHY

Kathleen A. Murphy was born in Bar Harbor, Maine on February 16th, 1998. She was raised in Bass Harbor, Maine and graduated from Mount Desert Island High School in 2014. She then enrolled at the University of Maine's College of Liberal Arts and Sciences and Honors College. Kathleen will graduate in May 2018 with a Bachelor of Arts degree in political science with a minor in psychology. She is a member of Golden Key International Honour Society, Phi Kappa Phi, and Pi Sigma Alpha. She has been lobster fishing for over 3 years and is currently pursuing her commercial license. In her free time, she enjoys camping and recreational fishing. Upon graduation, Kathleen will continue attending the University of Maine to receive her Masters of Arts in Teaching, beginning in the Summer 2018 term. She also plans to continue lobstering.