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“OVER-HAULING” THE LAW GOVERNING LOBSTER FISHING

By Tyler Lauzon¹

ABSTRACT

Lobster fishing is one of Maine’s most famous and important industries. In order for the industry to thrive, it is necessary that the lobster stock continue to be bountiful. One way to achieve a bountiful stock of lobster is to place limits on the amount of lobster that can be fished in any given year. The legal world offers a number of ways to achieve this end. Some mechanisms that have been employed in various jurisdictions include minimum and maximum legal sizes, v-notching, and trap limits. Although these laws can be very effective in reducing the number of lobsters caught and therefore increasing the number of lobster in the ocean, they may paint with too broad a brush. More selective laws that are crafted based on lobster biology could lead to an increased lobster stock while also allowing for a large, profitable harvest from year to year. Through insights gained by a survey of selected laws governing lobster fishing from Maine, New Hampshire, Massachusetts, and Canada, and a review of the biology of the American lobster, this article suggests new laws and a new approach to drafting the law, both aimed at increasing the stock of Maine lobster and maintaining large harvests.

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I. INTRODUCTION

Lobster and lobstering are vital aspects of life in Maine, both economically and culturally. The lobster fishery is the “largest commercial fishery in Maine, comprising more than 80 percent of all of the commercial fishing revenue in the state.”² The Maine Department of Marine Resources reports that the lobster catch was worth \$495.4 million in 2015.³ The history of lobster harvesting goes back hundreds of years. The first recorded lobster catch occurred in 1605,⁴ predating the admission of Maine to the Union by over two hundred years. From its modest beginnings as fertilizer for Native Americans and the cheap food to give to “prisoners, apprentices, and slaves,”⁵ lobster has become one of the most sought after, prestigious foods,

² Bill Trotter, *Maine’s 2015 Lobster Catch Value Jumps by \$37 Million*, BANGOR DAILY NEWS (Mar. 3, 2016), <http://goingcoastal.bangordailynews.com/2016/03/03/fisheries/maines-2015-lobster-catch-value-jumps-by-37-million/> [https://perma.cc/X86Y-MNGN]. In 2010, lobster sales valued in at \$309,626,512, whereas the second closest fishery was salmon at \$76,284,793. Todd M. Gabe, James C. McConnon Jr & Richard Kersbergen, *Economic Contribution of Maine’s Food Industry*, 20 ME. POL’Y REV. 36, 39 (2011).

³ *Maine Lobstermen Set Record with \$495 Million Haul*, PORTLAND PRESS HERALD (Mar. 4, 2016), <http://www.pressherald.com/2016/03/03/maine-lobstermen-set-record-with-495-million-haul-in-2015/> [https://perma.cc/JDB6-ML5D].

⁴ *Lobstering Basics – History*, LOBSTER INST., <http://umaine.edu/lobsterinstitute/education/lobstering-basics/history/> [https://perma.cc/5KMH-M4YG].

⁵ Megan Willett, *The Remarkable Story of How Lobster Went from Being Used as Fertilizer to a Beloved Delicacy*, BUS. INSIDER (Aug. 16, 2013), <http://www.businessinsider.com/the-history-of-gourmet-lobster-2013-8> [https://perma.cc/K8YV-7ACA].

considered fit company for caviar, filet mignon, and champagne.⁶ Lobstering has cemented itself as part of the Maine way of life. In fact, Maine even allows citizens of the state to pursue lobstering as a hobby — by offering non-commercial licenses that allow individuals to harvest lobster from up to five traps — so long as they meet certain requirements, such as passing a test on the lobstering laws.⁷

As lobster became more valuable as a commodity, lobstering became a more attractive profession to pursue. People began commercially fishing for lobster as a way to make a living. Naturally, as lobster became pricier, the industry would appear more lucrative, and lobster fishing would become more competitive. This leads to varying market pressures. Competition naturally leads to technological developments, which have been seen in the world of lobstering. From the development of open-well “smack” boats (allowing for the transportation of live lobsters); from hoop nets to lathe pots, to wooden parlor traps, to wire parlor traps; from bare-hand pulling to hydraulic pulley haulers,⁸ the technology of lobster harvesting has developed to allow lobstermen to catch as many lobsters with as little effort and time as possible.

Technology, however, is not the only thing to respond to market pressure; the law must respond as well. In the United States, there are both state and federal laws governing lobstering.

⁶ Christina Lemieux, *Which Bubbles Go Best with Lobster? Five Recommendations from a Champagne Specialist*, BANGOR DAILY NEWS (Feb. 8, 2015), <http://mainelylobster.bangordailynews.com/2015/02/08/home/champagne-lobster-pairings/> [<https://perma.cc/M8VJ-2QYJ>].

⁷ *A Guide to Lobstering in Maine - July 2009, Non-Commercial Lobster/Crab Harvesters*, STATE OF ME. DEP'T OF MARINE RES. (July 2009), <http://www.maine.gov/dmr/science-research/species/lobster/guide/index.html#noncom> [<https://perma.cc/F8Z7-K8YJ>].

⁸ See LOBSTER INST., *supra* note 4.

Canada also has a plethora of laws, with the part of the Atlantic Ocean that is under Canadian jurisdiction being divided up into many Lobster Fishing Areas.⁹ Whereas improvements in lobstering technology typically strive toward the singular goal of making lobstering more efficient (more lobsters caught using no more effort), the law attempts to balance multiple goals.

One goal the law focuses on is maximizing the economic efficiency of lobstering. Generally, a decrease in the supply of lobster will lead to an increase in the price (assuming there is not an offsetting decrease in demand). Therefore, less lobster in the market could make lobster more valuable and create a greater total market value. Conversely, an increase in the supply of lobster will lead to a decrease in the price (assuming there is not an offsetting increase in demand). Thus, a less expensive product, sold at a greater volume, could lead to a greater total market value (“the fast food model”¹⁰). The key is to find the point where supply and demand meet, reaching economic equilibrium.¹¹ The more money that is paid per pound of lobster, the more lobstermen are paid and the more worthwhile their investment of time is. The more worthwhile their time is, the more money that goes into the state economy via taxes. This balance can be manipulated through laws limiting how many individuals are allowed licenses, how many traps licensed individuals can fish, what sizes of lobster are considered legal to keep,

⁹ Melissa Waterman, *Entering and Exiting the Lobster Fishery — Canadian and U.S. Perspectives*, LANDINGS (Apr. 2002), <http://mlcalliance.org/2012/04/09/entering-and-exiting-the-lobster-fishery-canadian-and-u-s-perspectives/> [<https://perma.cc/X7YN-J49Z>].

¹⁰ See generally *Fast Food Industry Analysis 2018 – Cost & Trends*, FRANCHISE HELP, <https://www.franchisehelp.com/industry-reports/fast-food-industry-report/> [<https://perma.cc/6YZE-DDW4>].

¹¹ See generally *The Law of Supply and Demand*, QUICKONOMICS, <https://quickeconomics.com/2014/10/the-law-of-supply-and-demand/> [<https://perma.cc/4QRD-3CKR>].

and whether certain lobsters (e.g., egg-bearing) can be kept at all. Although finding the perfect balance will be difficult, one could assume that there would be a major drive to increase the volume of lobster in the market when lobster is in high demand.

Whereas certain market pressures may drive the law to allow an increase in the volume of lobster fished in the present year, other pressures may push lawmakers to conserve lobster. The optimal and economically efficient amount of lobster to be fished may change from year to year, potentially leading to over-fishing in some years, if left unchecked.¹² A short-sighted pursuit of profit, and years of over-fishing, could lead to a greatly diminished stock of lobster. This, of course, could take years to recover from and greatly harm the market in the process. Fishermen would likely abandon lobstering, and that part of the Maine economy would collapse, at least until the stock sufficiently replenished for lobstering to be a livable trade. This is where the need for conservation comes in. What is economically ideal in one year may not be the best course for the sustainability of the industry, if such calculus does not take into account the ramifications likely to occur in future years. If lobster is selling at premium price of fifteen dollars a pound at the market, the short-sighted individual may be inclined to fish all the lobster out of the ocean and sell it, but the conservationist knows better. It is far better that some lobster is preserved so that the industry can thrive for years to come. License limits, trap limits, minimum sizes, and other regulations that are manipulated to bring about economic-based goals can also be

¹² See generally Garrett Hardin, *The Tragedy of the Commons*, 162 *Sci.* 1243, 1244 (1968) (in the context of a hypothetical in which herdsmen all have unlimited access to a common field: “[a]s a rational being, each herdsman seeks to maximize his gain.” I.e., it is in the interest of the individual to maximize his gain at the expense of others in a system where resources can be depleted by another market player at any time, hence “the tragedy of the commons.”).

manipulated to bring about conservation-based goals. Although it may seem that economic-based goals and conservation-based goals are destined to be at odds, this need not be the case, as long as those with economic concerns are not too short-sighted. Specifically, through proper regulations, it is possible to both preserve lobstering profits and ensure bountiful harvests for years to come.

This paper will propose new ways to regulate the lobster industry in the state of Maine. In order to enact laws that will affect the amount of lobsters, it is important to understand the life cycle of the lobster. Based on certain specifics of the lobster as a species, especially the way in which lobster breed, it is possible to tailor laws so that reproduction rates stay high, but fishermen are also able to land large amounts of lobster. In order to analyze current laws and suggest possible new ones based on how they may affect the lobster as a breeding, living species, this paper will begin with an overview of lobster biology.

Next, this paper will give an overview of lobstering laws in the United States, by assessing the laws of individual states and the federal laws. The paper will analyze the structure of the laws and will attempt to find what goals the laws seek to achieve. Based on the discussion of lobster biology from the previous section, this paper will discuss how effective the United States laws are in their attempts to achieve their goals.

Following the overview of United States laws, the paper will discuss the lobster fishing laws in Canada. As in the previous section, an overview of the laws will be given, and they will be discussed from the viewpoint of how effective they would likely be if implemented in Maine.

Next, this paper will analyze the laws governing lobstering by comparing and contrasting the laws governing lobstering in effect in the United States and Canada. The analysis of these laws will demonstrate what elements of the industry the legislatures aim to protect. Furthermore,

different reports highlight what the laws hope to achieve, distinct from what the goals merely derived from analysis of the statutes. This information will help to answer the question, “what is the best way to regulate the lobster industry?” How should the law react to different factors, such as catch rates, market price, water temperature, last year’s catch, etc.?

Lastly, this paper will conclude with proposed laws for the state of Maine. These laws will aim to allow the state to remain a highly competitive player in the lobstering industry, by keeping lobster landings extremely high, while also preserving the lobster stock by keeping sufficient amounts of the right lobsters in the ocean for optimal breeding to occur. These proposed laws would be adaptable, so as to not lock the state in a course of action that will not work forever. Instead of being rigid, the laws would adequately respond to data in such a way as to keep the supply of lobster strong. Hopefully, such laws could be enacted, with great benefits to the fishing industry. If these laws were passed and were to achieve their stated goals, they would likely be adopted by other lobstering states, as the laws would produce both short and long-term benefits, making them extremely attractive options for any state looking to effectively manage its lobster fisheries.

II. THE BIOLOGY OF THE AMERICAN LOBSTER

The American lobster, *Homarus americanus*, is found from “Labrador to North Carolina,” with the greatest bulk of the species found “in the shoal waters off Maine and the Canadian Maritimes.”¹³ “About 62% of lobster landings are in Canada and 38% in the U.S. Maine lands

¹³ *A Guide to Lobstering in Maine - July 2009*, STATE OF ME. DEP’T OF MARINE RES. (July 2009), <http://www.maine.gov/dmr/science-research/species/lobster/guide/index.html> [<https://perma.cc/KNF3-KL9W>].

approximately 62% of the U.S. catch, followed by Massachusetts at 18%.”¹⁴ Although female lobsters can bear significant amounts of eggs, ranging from about 6,000 to an astonishing 100,000, it is estimated that only about one percent of fertilized eggs hatch and, furthermore, only one tenth of those eggs that hatch actually live long enough to reach the minimal legal size in the state of Maine.¹⁵

Lobsters grow by molting, a process by which they discard their old shell and form a new one.¹⁶ After about twenty-five molts and five to seven years of life, a lobster has typically reached maturity, at which point it is capable of breeding.¹⁷ “Temperature is the primary driving force [of molting] as it influences a lobster’s metabolism, spawning, development, and growth. The ideal temperature range for lobsters is 12-18°C and the hatching of eggs typically occurs when surface water temperatures are above 12°C.”¹⁸ In most states, the minimum size for a

¹⁴ *Life of the American Lobster - Habitat*, LOBSTER INST., <http://umaine.edu/lobsterinstitute/education/life-of-the-american-lobster/habitat/> [<https://perma.cc/E598-ZK75>].

¹⁵ STATE OF ME. DEP’T OF MARINE RES., *supra* note 13.

¹⁶ *Life of the American Lobster - Life Cycle & Reproduction*, LOBSTER INST., <http://umaine.edu/lobsterinstitute/education/life-of-the-american-lobster/life-cycle-reproduction/> [<https://perma.cc/TA87-CZEL>].

¹⁷ *Id.*

¹⁸ JOHN HOENIG ET AL., ATL. STATES MARINE FISHERIES COMM’N, AMERICAN LOBSTER STOCK ASSESSMENT PEER REVIEW REPORT 1 (Aug. 2015), http://www.asmfc.org/uploads/file/55d61d73AmLobsterStockAssmt_PeerReviewReport_Aug2015_red2.pdf [<https://perma.cc/K7PT-RRFD>].

lobster is such that it has had the chance to go through at least one breeding cycle.¹⁹ There is a question of when exactly lobster maturity occurs. One report highlights the concern that the estimates of the size at which maturity occurs are outdated; they come from studies conducted in the 1980s.²⁰ Members of the lobstering industry are unsure if the size at maturity has changed and new studies would certainly be helpful.²¹ Other reports have voiced similar concerns: “[a] recurrent theme in the stock assessment report and in the review of the assessment was the need for updated information on growth and maturity.”²²

Not only are we unsure of when maturity occurs, but studies suggest its occurrence is not consistent from location to location. Variations among “thermal regimes” are shown to result in different sizes at maturity and affect “overall somatic growth.”²³ Furthermore, size at maturity is not only affected by differing temperatures in various locations, but also by temperature in a given location over time. “Female size at maturity has been negatively correlated to warm

¹⁹ *Canadian & U.S. Lobster Fishery Sustainability Code of Conduct*, LOBSTER INST.,

<http://umaine.edu/lobsterinstitute/files/2011/12/Sustainability-Code-of-Conduct.pdf>

[<https://perma.cc/3QBY-FDEJ>].

²⁰ FISHERIES & OCEANS CAN., EASTERN CAPE BRETON LOBSTER (LFAs 27-30), STOCK STATUS REPORT 2004/032 8 (Mar. 2004), <http://waves-vagues.dfo-mpo.gc.ca/Library/281608.pdf> [<https://perma.cc/P63L-K8VC>].

²¹ *Id.*

²² HOENIG ET AL., *supra* note 18, at 5.

²³ ROBERT GLENN ET AL., ATL. STATES MARINE FISHERIES COMM’N, 2015 AMERICAN LOBSTER STOCK ASSESSMENT FOR PEER REVIEW 8 (Aug. 2015),

http://www.asmfcr.org/uploads/file/55d61d73AmLobsterStockAssmt_PeerReviewReport_Aug2015_red2.pdf

[<https://perma.cc/K7PT-RRFD>].

summer water temperatures.”²⁴ This means that lobsters will tend to reach maturity at smaller sizes when the summer months are warmer.²⁵ Lastly, size at maturity is not consistent across lobster sex; male lobsters reach maturity at smaller sizes than females.²⁶

A sampling of New England areas reveals the variation among lobster size in maturity:

- Gulf of Maine: The estimated size at which 50% of females are mature is 91 mm CL [Carapace Length].²⁷
- Georges Bank: “The estimated size at which 50% of females are mature is 100 mm CL.”²⁸
- Southern New England: The estimated size at which 50% of females are mature is 76 mm CL.²⁹

Clearly, this is a wide disparity between the sizes at which maturity is statistically reached over a relatively small geographic area.

²⁴ *Id.* at 22.

²⁵ *Id.*

²⁶ FISHERIES & OCEANS CAN., CANADIAN SCIENCE ADVISORY SECRETARIAT, AMERICAN LOBSTER, HOMARUS AMERICANUS, STOCK STATUS IN THE SOUTHERN GULF OF ST. LAWRENCE: LFA: 23, 24, 25, 26A, 26B(3) (2013), <http://waves-vagues.dfo-mpo.gc.ca/Library/348839.pdf> [<https://perma.cc/DA2N-BHRA>]; PROCEEDINGS OF THE STANDING SENATE COMMITTEE ON FISHERIES AND OCEANS, THE STUDY ON THE LOBSTER FISHERY IN ATLANTIC CANADA AND QUEBEC, SENATE OF CANADA 12:189 (Nov. 2012), <https://sencanada.ca/Content/SEN/Committee/411/pofo/pdf/12issue.pdf> [<https://perma.cc/8Q32-4FAJ>].

²⁷ GLENN ET AL., *supra* note 23, at 23-24.

²⁸ GLENN ET AL., *supra* note 23, at 24.

²⁹ *Id.* at 24-25.

Once the lobster reaches maturity, it will typically molt once a year if it is male, and once every other year if it is female.³⁰ This is vital information, because females typically breed when they are still “soft-shells,” i.e., immediately after a molting.³¹ Thus, “females [typically] mate once every two years.”³² However, “[f]emales can also mate in the hard-shelled condition. This may be important for very large females who molt infrequently.”³³ The larger the female, the more eggs it can carry. A one-pound female (typically right around minimum legal size in Maine) often carries 8,000 eggs, while some of the largest females, around nine pounds, carry up to 100,000 eggs.³⁴ Thus, the larger a female becomes the more potential it has to add lobsters to the stock. Whereas a mere eight lobsters might survive to minimum legal size from a small female’s breeding, up to 100 could reach the minimum legal limit from a large female’s breeding.

Although it appears that any sexually mature male lobster can mate with any sexually mature female lobster, there is a consideration to be made regarding size. The male lobster must be of “approximately the same size as the female,” because the male must maneuver the female

³⁰ LOBSTER INST., *supra* note 16.

³¹ *Id.*

³² *American Lobster - Life Cycle*, ST. LAWRENCE GLOB. OBSERVATORY 11 (Nov. 1, 2017), <http://catalogue.ogsl.ca/dataset/46a463f8-8d55-4e38-be34-46f12d5c2b33/resource/c281bcd4-2bde-4f3e-adbe-dd3ee01fb372/download/american-lobster-slgo.pdf> [<https://perma.cc/6NTS-YLEK>].

³³ *Lobster Biology*, THE LOBSTER CONSERVANCY, <http://www.lobsters.org/tlcbio/biology5.html> [<https://perma.cc/558T-JR88>].

³⁴ LOBSTER INST., *supra* note 16.

during the mating process.³⁵ Because females are most often freshly molted and very vulnerable when mating, the male must be capable of moving the female without crushing her.³⁶ However, there appears to be no data on exactly how similar in size the sexes need to be in order to mate successfully.

III. LOBSTERING LAWS IN THE UNITED STATES AND CANADA

“NOAA Fisheries, also known as the National Marine Fisheries Service [NMFS], is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.”³⁷ The agency of the NMFS promulgates regulations “to effectively manage the lobster fishery.”³⁸ In order to pass helpful regulations, the NMFS works with the Atlantic States Marine Fisheries Commission (“the Commission”).³⁹ The Commission is made of all the states bordering the Atlantic Ocean, from Maine to Florida.⁴⁰ The Commission and the NMFS work together through the Atlantic Coastal Fisheries Cooperative Management Act, with the Commission providing advice “in response to many things relating to the health and sustainability of the lobster fishery” and the NMFS creating regulations based on the advice

³⁵ *Inseminated Female Lobsters, Ask the Lobster Doc*, THE LOBSTER CONSERVANCY (Sept. 1999), <http://www.lobsters.org/ldoc/ldocpage.php?did=423> [<https://perma.cc/Y5KJ-75QU>].

³⁶ *See id.*

³⁷ *About Us*, NAT’L OCEANIC & ATMOSPHERIC ADMIN., <https://www.fisheries.noaa.gov/about-us> [<https://perma.cc/28EV-M7MW>].

³⁸ *American Lobster Information Sheet*, NAT’L OCEANIC & ATMOSPHERIC ADMIN. 1 (June 22, 2016), <https://www.greateratlantic.fisheries.noaa.gov/regs/infodocs/lobsterinfosheet.pdf> [<https://perma.cc/NZ93-U8US>].

³⁹ *See id.*

⁴⁰ NAT’L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 38.

received.⁴¹ The states manage the state waters from “0 – 3 nautical miles offshore,” and NMFS manages the federal waters from “3 – 200 nautical miles offshore,” this zone being called the “Exclusive Economic Zone (EEZ).”⁴²

Federal law follows a “most restrictive rule”⁴³ standard:

[t]he regulations in this part do not preempt more restrictive state laws, or state enforcement of more restrictive state laws, with respect to weakfish fishing and American lobster fishing. If a requirement of this part and a management measure required by state or local law differ, any vessel owner permitted to fish in the EEZ must comply with the more restrictive requirement or measure.⁴⁴

A. Minimum and Maximum Sizes

For purposes of comparison to Canadian laws, this paper will give the United States laws in both their original imperial measurements, and in metric. Additionally, all imperial fractions have been standardized to denominators of thirty-two. As the Canadian & U.S. Lobster Fishery Sustainability Code of Conduct states, minimum sizes are “designed to allow lobsters to become of age to be capable of at least one reproduction cycle before it can be legally landed.”⁴⁵

1. The United States

a. Maine

⁴¹ *Id.*

⁴² *Id.*

⁴³ *Id.* at 4.

⁴⁴ 50 C.F.R. § 697.3(c) (2017).

⁴⁵ LOBSTER INST., *supra* note 19.

In Maine, the minimum carapace size for a lobster that is legal to keep is 3 ⁸/₃₂ inches (82.55 mm).⁴⁶ The maximum size is five inches (127 mm).⁴⁷ The Maine Revised Statutes provide that “[m]easurement shall be made from the rear of the eye socket along a line parallel to the center line of the body shell to the rear end of the body shell.”⁴⁸ It is illegal to possess a lobster that is mutilated in any way that would make it impossible to properly measure said lobster.⁴⁹ Lobsters must be measured with a certified lobster measure, approved by the Department of Agriculture, Conservation and Forestry, Office of Sealer of Weights and Measures.⁵⁰ A measurement made to prove that a kept lobster does not meet the size requirements must be made with a certified measure.⁵¹ However, when an individual catches a lobster that does not meet the size requirements “[n]o violation of this section shall occur if the illegal lobster is immediately liberated alive into the coastal waters when taken.”⁵² Thus, if a fisherman catches a lobster, measures it and finds it to be undersized, the lobster can simply be tossed back into the ocean without penalty.

b. *New Hampshire*

In New Hampshire, lobster is measured in the same manner as it is in Maine, from behind the eye socket to the end of the first section of the carapace, in a straight line parallel to the

⁴⁶ ME. REV. STAT. ANN TIT. 12, § 6431(1) (2017).

⁴⁷ *Id.*

⁴⁸ ME. REV. STAT. ANN TIT. 12, § 6431(2).

⁴⁹ ME. REV. STAT. ANN TIT. 12, § 6431(4).

⁵⁰ ME. REV. STAT. ANN TIT. 12, § 6431(3).

⁵¹ *Id.*

⁵² ME. REV. STAT. ANN TIT. 12, § 6431 (5).

centerline.⁵³ Unlike Maine, the minimum and maximum sizes of lobsters are not set by statute, but are instead set by agency rulemaking.⁵⁴ The rules are to be adopted “by the executive director of the fish and game department with the approval of the fish and game commission, and upon the advice and cooperation of the advisory committee on marine fisheries.”⁵⁵ Currently, the minimum size in New Hampshire is also set at $3 \frac{8}{32}$ inches (82.55 mm) and the maximum size is set at five inches (127 mm).⁵⁶

Unlike the provision against keeping lobsters made unmeasurable by mutilation as seen in Maine, New Hampshire provides in its regulations that “[p]ossession of mutilated lobster . . . will be prima facie evidence that they are not of legal length.”⁵⁷ In effect, this would function in the same way as Maine’s law. Whereas any legal length lobster may be kept in Maine if it can be measured, in New Hampshire a mutilated lobster will be presumed to be of illegal length. However, if the mutilation does not render the lobster unmeasurable, then the presumption will likely be rebutted. If the lobster is not capable of being measured, the presumption will stand. In either state, a lobster mutilated so as not to be measurable cannot be kept.

c. Massachusetts

The approach to lobster size requirements is more flexible in Massachusetts than in both Maine and New Hampshire. Statute sets the minimum size for lobster at $3 \frac{8}{32}$ inches (82.55

⁵³ N.H. REV. STAT. ANN. § 211:27(I) (2017).

⁵⁴ N.H. REV. STAT. ANN. § 211:27 (I, III).

⁵⁵ N.H. REV. STAT. ANN. § 211:62 (I).

⁵⁶ *Lobster & Crab*, N.H. SALTWATER FISHING DIG.,

<http://www.eregulations.com/newhampshire/fishing/saltwater/lobster-crab/> [<https://perma.cc/VN6N-28ZP>](.

⁵⁷ *Id.*

mm), the same as the statutory minimum of Maine and the current minimum in New Hampshire; however, “the director may, by regulation approved by the marine fisheries advisory commission” adjust the minimum size upwards, and may even set different minimum sizes for different locations in the state “if he determines that such increases are necessary to achieve compliance with the Atlantic States Marine Fisheries Commission Fisheries Management Plan for American lobster.”⁵⁸ While providing the ability to change sizes through regulation, in a manner similar to New Hampshire, this further allows Massachusetts to divide the state waters into different areas for purposes of minimum sizes. This allows for responding to the needs of specific areas within the state and does not require the state to be treated as a whole, when doing so would be needlessly burdensome on some areas or too lenient on others. Although the statute does not make mention of maximum sizes, maximum sizes are provided in the regulations. The regulations provide for:

- LCMA 1 – minimum: $3 \frac{8}{32}$ inches (82.55 mm), maximum: 5 inches (127 mm).
- LCMA2 – minimum: $3 \frac{12}{32}$ inches (85.725 mm), maximum: $5 \frac{8}{32}$ inches (133.35 mm).
- LCMA3 – minimum: $3 \frac{17}{32}$ inches (89.6937 mm), maximum: $6 \frac{24}{32}$ inches (171.45 mm).
- OCC LCMA – minimum: $3 \frac{12}{32}$ inches (85.725 mm), maximum: none, but $6 \frac{24}{32}$ inches is the Federal limit and will apply.⁵⁹

⁵⁸ MASS. GEN. LAWS ch. 130, § 44 (2013).

⁵⁹ *Commercial lobster and crab regulations*, MASS.GOV, (Jan 19, 2017), <https://www.mass.gov/service-details/commercial-lobster-crab-regulations> [<https://perma.cc/CWH5-D248>].

Massachusetts requires that measurements be taken in the same way as they are in Maine and New Hampshire,⁶⁰ and the statute imposes a prima facie standard of guilt when a lobster is mutilated in a way that affects measurement, as seen in New Hampshire.⁶¹ Massachusetts specifically provides that either side of the lobster being of the minimum length is sufficient for the lobster to be kept legally.⁶²

2. Canada

Unlike the United States, which has both state and federal lobster licenses, there are only federally issued lobster licenses in Canada.⁶³ “Fisheries and Oceans Canada (DFO) has the lead federal role in managing Canada’s fisheries and safeguarding its waters.”⁶⁴ DFO has divided Canadian waters into different Lobster Fishing Areas (LFAs).⁶⁵ Not all the areas are open at once, instead they open and close on a “rolling schedule throughout the year,” which DFO claims helps to “ensur[e] a steady supply of lobsters to dealers and processors.”⁶⁶ DFO issues minimum sizes for each LFA, and they can vary considerably.

⁶⁰ MASS. GEN. LAWS ch. 130, § 44 (2013).

⁶¹ *Id.*; N.H. SALTWATER FISHING DIG., *supra* note 56.

⁶² *Id.* (“If the measurement of any such lobster taken from 1 or the other eye sockets is of the required length, such lobster shall be deemed to be a legal lobster”).

⁶³ Waterman, *supra* note 9.

⁶⁴ *Our Organization*, FISHERIES & OCEANS CAN. (June 1, 2016), <http://www.dfo-mpo.gc.ca/about-notre-sujet/org/index-eng.htm> [<https://perma.cc/SD8S-MTZD>].

⁶⁵ Waterman, *supra* note 9.

⁶⁶ Waterman, *supra* note 9.

In general, the lobster industry in Canada seems to be more closely monitored and regulated than it is in the United States.⁶⁷ “The minimum legal carapace size is based on the ‘size at the onset of maturity,’ that is, the size at which 50% of female lobsters are sexually mature.”⁶⁸ This approach of adjusting minimums based on expected onset of maturity relative to carapace size is a good way to ensure that a large amount of propagation occurs. However, many factors affect when, and at what size, females reach maturity.⁶⁹ Because of these variations, a minimum size regime that is meant to be relative to the realities of a changing species must be willing and capable of changing over time. As discussed in the biology section above, the size at which 50% of the female population reaches maturity is estimated to range from 100 mm in Georges Bank to 76 mm in Southern New England.⁷⁰ Furthermore, the size at which 50% of females reach maturity is not strictly tied to merely location, but will change over time, as temperature and other factors affect lobster development.

The Province of Newfoundland and Labrador contains a number of LFAs.⁷¹ DFO sets the minimum size for all of these LFAs is 82.5 mm.⁷² This is virtually equivalent to the minimum

⁶⁷ See generally *Benchmarking Study on Canadian Lobster*, GARDNER PINFOLD CONSULTING ECONOMISTS LTD. (Mar. 2006), <http://umaine.edu/lobsterinstitute/files/2011/12/Bench-mark-study-on-Cdn-Lob.pdf> [<https://perma.cc/GV3K-ZDKH>].

⁶⁸ SENATE COMM. ON FISHERIES & OCEANS, *THE LOBSTER FISHERY: STAYING ON COURSE* 31 (May 2013), http://publications.gc.ca/collections/collection_2013/sen/yc25-0/YC25-0-411-10-eng.pdf [<https://perma.cc/WQ7E-6NJP>] (Can.).

⁶⁹ See, e.g., HOENIG ET AL., *supra* note 18, at 8, 22.

⁷⁰ *Id.* at 24-25.

⁷¹ SENATE COMM. ON FISHERIES & OCEANS, *supra* note 68, at 8. These LFAs include: 3-12, 13a, 13b, 14a to 14c.

⁷² *Id.* at 9.

size in Maine, the current minimum in New Hampshire, and the statutory minimum in Massachusetts (all 82.55 mm).

LFA 25 has a current minimum of only 72 mm, or $2\frac{27}{32}$ inches.⁷³ However, “[f]emale lobsters in most of the [southern Gulf of St. Lawrence] have a size at 50% maturity (SOM50) of 72 mm carapace length.”⁷⁴ Therefore, although almost a half-inch shorter than the legal minimums in Maine, New Hampshire, and Massachusetts, the size comports with the goal that has been set for lobster and, as is discussed later, this goal seems reasonable.

B. V-Notching

V-notching is a process whereby a fisherman cuts a v-shaped incision into one of the flippers on the tail of a female lobster.⁷⁵ Generally, this is done when a lobsterman catches a lobster that is berried, i.e. carrying eggs.⁷⁶ Recall that lobsters grow by molting; a v-notch cut into the tail of a lobster will gradually grow out as the lobster molts. Typically, it takes “about two molts or roughly two to three years” for a v-notch to grow out entirely.⁷⁷ As discussed

⁷³ *Lobster Conservation Harvesting Plan Lobster Fishing Area 25 for 2013*, FISHERIES & OCEANS CAN. (July 19, 2013), <http://www.dfo-mpo.gc.ca/decisions/fm-2013-gp/atl-022-eng.htm> [<https://perma.cc/Z5SK-FLGT>].

⁷⁴ FISHERIES & OCEANS CAN., AMERICAN LOBSTER, HOMARUS AMERICANUS, STOCK STATUS IN THE SOUTHERN GULF OF ST. LAWRENCE, SCIENCE ADVISORY REPORT 2013/029 3 (June 2013), <http://waves-vagues.dfo-mpo.gc.ca/Library/348839.pdf> [<https://perma.cc/9T6B-BM86>].

⁷⁵ MLA Staff, *V-Notch Survey Provides Critical Data*, LANDINGS (Mar. 2011), <http://mlcalliance.org/2011/03/07/v-notch-survey-provides-critical-data/> [<https://perma.cc/F39N-XP3B>].

⁷⁶ *Id.*

⁷⁷ Jessica Hall, *V-Notched Lobster Decline is a Threatening Sign in Maine*, PORTLAND PRESS HERALD (May 8, 2014), https://www.pressherald.com/2014/05/08/v-notch_decline_is_a_threatening_sign/ [<https://perma.cc/CX47-4ZWL>].

below, retention of v-notched lobsters is illegal in most locations. By v-notching a lobster in one of these locations, a lobsterman ensures that a lobster that is capable of breeding actually remains in the stock for a significant period of time after it has excreted its eggs. During this time in which the lobster is v-notched but not berried, the lobster has the opportunity to breed again without being legally retainable. If the lobster does breed again and become berried, a new v-notch can be cut into the tail, thus allowing breeding lobster to perpetually stay in the stock.⁷⁸

1. The United States

a. *Maine*

In Maine, it is illegal to “take, transport, sell or possess” a v-notched female lobster.⁷⁹ Furthermore, it is required that all lobsterman v-notch any egg bearing lobsters that they catch.⁸⁰ The v-notch is to be cut 8/32 inch into the lobster tail.⁸¹ Maine has a zero tolerance policy as regards v-notching; a lobster that has anything resembling a v-notch, no matter how shallow, or any mutilation in the flipper of the tail that would be v-notched, may not be legally kept.⁸²

b. *New Hampshire*

⁷⁸ See generally James Acheson & Roy Gardner, *The Evolution of the Maine Lobster V-Notch Practice: Cooperation in a Prisoner's Dilemma Game*, 16(1) *ECOLOGY & SOC'Y* 41 (2011), <http://www.jstor.org/stable/pdf/26268854.pdf?refreqid=excelsior%3Abd442590ae15b38e0730f1cb3831240e> [<https://perma.cc/ZB36-C7BX>].

⁷⁹ ME. REV. STAT. ANN. tit. 12, § 6436(1) (2017).

⁸⁰ 13-188-025 ME. CODE R. 25 § 25.15 (LexisNexis 2017).

⁸¹ *A Guide to Lobstering in Maine - July 2009*, STATE OF ME. DEP'T OF MARINE RES. (July 2009), <http://www.maine.gov/dmr/science-research/species/lobster/guide/index.html> [<https://perma.cc/R8E5-3FWM>].

⁸² *Id.*

New Hampshire also makes it illegal to possess a v-notched female lobster.⁸³ New Hampshire currently requires that any berried lobster that is caught by a commercial or limited commercial lobsterman be v-notched, though this requirement apparently does not extend to the part-time commercial or recreational licenses that the state offers.⁸⁴ New Hampshire requires the v-notch be cut to a depth between 8/32 and 16/32 inch.⁸⁵ Like Maine, New Hampshire has a zero tolerance definition of a v-notch; a cut of any depth on the flipper of a female, or any mutilation, is considered a v-notch and may not be kept.⁸⁶

c. Massachusetts

Massachusetts takes a distinct approach to v-notching. Although it is illegal to possess a v-notched lobster, the definition of a v-notch actually varies from one Lobster Conservation Management Area (LCMA) to another, and between commercial and non-commercial fishermen. For commercial lobstermen: LCMA 1 has zero tolerance, LCMA 2-6 define a v-notch as being 4/32 of an inch deep or deeper (thus a lobster with a shallower cut would be legal to retain), and the Outer Cape Cod LCMA is the least restrictive — defining a v-notch as being 8/32 inch or deeper.⁸⁷ For non-commercial lobstermen, a v-notch is 8/32 inch or deeper, regardless of location.⁸⁸ The only lobstermen in Massachusetts who are required to v-notch egg-bearing lobsters are commercial lobstermen fishing in LCMA 1 and 2.⁸⁹

⁸³ N.H. CODE ADMIN. R. ANN. FIS. 602.11 (2017).

⁸⁴ *Id.*

⁸⁵ *Id.*

⁸⁶ *Id.*

⁸⁷ 322 MASS. CODE. REGS. 6.02 (LexisNexis 2017).

⁸⁸ 322 MASS. CODE. REGS. 6.02(5)(e)(4).

⁸⁹ *Id.*

2. Canada

Currently, v-notching is voluntary in Canada.⁹⁰ It appears as though v-notching is not a mandatory practice for any lobstermen in Canada. Canada focuses mainly on “input control,” which is a “limit [] placed on fishing efforts;” Canada achieves this through limiting licenses issued, when lobster can be fished (fishing seasons), minimum and maximum sizes, and “ongoing monitoring and enforcement of fishing regulations.”⁹¹ Because the practice is voluntary, there is no available definition of a v-notch. This could be problematic, as although the act of v-notching is voluntary, possession of a v-notched lobster is illegal.⁹² The only exceptions are currently LFAs 27 and 31A, in which v-notched lobsters may legally be retained.⁹³

IV. ANALYSIS

A. Goals that these Proposals Intend to Accomplish

⁹⁰ *Lobster, Conservation Measures*, FISHERIES & OCEANS CAN. (Mar. 6, 2015), <http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/lobster-homard-eng.htm> [<https://perma.cc/7ZKX-T96N>].

⁹¹ *Id.*

⁹² Sam Whiffen, *Court Fines Total \$18,000 for Illegal Lobster*, FISHERIES & OCEANS CAN. (Oct. 22, 2009), <https://www.canada.ca/en/news/archive/2009/10/court-fines-total-18-000-illegal-lobster.html> [<https://perma.cc/8TZJ-3SEX>].

⁹³ FISHERIES & OCEANS CAN., *LOBSTER (HOMARUS AMERICANUS) OFF THE ATLANTIC COAST OF NOVA SCOTIA (LOBSTER FISHING AREAS 27-33): 2015 STOCK STATUS UPDATE 3 (May 2015)*, <http://waves-vagues.dfo-mpo.gc.ca/Library/363754.pdf> [<https://perma.cc/XT4K-9PKA>].

A fishery should strive to balance current demand for fish with the need to maintain the stock of fish for future seasons. As outlined above, the size of lobsters at maturity is influenced by a number of factors, though chief among those factors appears to be the water temperature. The size of a mature lobster varies from region to region. To illustrate the danger of unresponsive legislation, consider the possible threat posed by global warming and the changing temperatures of the oceans.⁹⁴ If the current standard in Maine of $3 \frac{8}{32}$ inches had been imposed at a time such that roughly 50% of female lobsters in Maine were mature at that size when the law was created but the temperature of the oceans has since changed considerably, then $3 \frac{8}{32}$ inches may no longer be the size at which there is a 50% chance of a female being mature. It may be the case that the temperature has increased and a much greater proportion of lobsters are mature at this size. This could lead to under-exploitation; there are theoretically many more lobsters that could be harvested, helping fishermen and the economy without harming the population. Conversely, if the temperature has since dropped, a significant portion of lobster of legal size may not actually be mature. This could lead to over-exploitation and a decreased lobster stock being harvested. Should this occur, the lobster population would likely not recover until legislation changed, setting the legal minimum at a greater length to ensure that more lobsters have a chance to reproduce before being harvested for sale. Even then, it would likely take a few seasons for significant harvests to be landed again. In theory, it would take as long as a lobster under the old minimum to molt and grow to the size of the new minimum.

⁹⁴ See generally Amanda MacMillan, *Global Warming 101*, NAT. RES. DEF. COUNCIL (Mar. 11, 2016), <https://www.nrdc.org/stories/global-warming-101> [<https://perma.cc/844A-N5GQ>].

These hypothetical situations evidence a number of concerns. First, the law must be willing and able to adapt to the changing world. If the average size at maturity continually changes,⁹⁵ then no set size will remain effective, provided the goal of size limits is to allow the maximum harvest that still allows for the species to effectively reproduce and remain bountiful.

Second, the law should have reasoned principles in place to guide the lawmakers. These could be thought of as first principles or axioms. This has been the general goal of the lobstering industry in Maine. Minimum sizes were implemented in Maine in 1874,⁹⁶ with the far-sighted goal of keeping the lobster stock reproducing for future seasons and generations. The ban on taking egg-bearing females had occurred two years earlier, in 1872.⁹⁷ V-notching started in Maine in 1917, but was not mandatory until 2002.⁹⁸ Whereas size minimums applied universally, regardless of lobster sex, v-notching only applied to female lobsters and, furthermore, only to those bearing eggs. This practice recognizes the extra value that a mature, breeding female has in terms of maintaining the lobster population. Although mature males are also necessary for breeding, one berried female lobster can produce hundreds of new lobster. Furthermore, it is possible to identify a breeding female by the fact that it is berried with eggs and mark it as a breeding female. Although a male lobster of significant size can be caught, there is, as of yet, no way to actually know if it is mature and if it is actually capable of breeding. This system of v-notching females is quite innovative and valuable, and similar innovations in the law should be made going forward, as this paper will suggest.

⁹⁵ See HOENIG ET AL., *supra* note 18, at 8, 22.

⁹⁶ LOBSTER INST., *supra* note 16.

⁹⁷ *Id.*

⁹⁸ Hall, *supra* note 77.

However useful the laws have historically been, they have been relatively static. The minimum size for a legal lobster has been $3 \frac{8}{32}$ inches in Maine since 1991.⁹⁹ By extracting general principles, such as giving lobsters the chance to breed at least once before they can be harvested, and then incorporating those standards into the law, the law could theoretically always be optimally efficient.

Third, the law must have data to react to. First principles governing what changes should be made to the law are not alone sufficient; there must be a current and accurate data set for those principles to be applied to. If the principle is setting the legal minimum at the length at which 50% of lobsters have reached maturity, the principle can only be effective if lawmakers actually know what that size is for the lobsters in their jurisdiction.

B. Proposals

1. Changing the Statutory System — Moving to Principles laid out in Statutes, to be Altered Yearly by Regulation in Response to New Data

Currently, the minimum and maximum sizes for lobster in Maine are set by statute. A legal lobster is any non v-notched, non egg-bearing lobster whose size falls within $3 \frac{8}{32}$ inches (82.55 mm) and 5 inches (127 mm.). This is in contrast to New Hampshire's regulation based approach, and Massachusetts' mix of statutes and rules. Because the legislature is in control of all lawmaking for any field that it does not essentially delegate to an agency, an agency, by being limited in scope to a certain field, e.g. Marine Resources, has the potential for being much more efficient and effective in promulgating rules in a timely manner. Due to this, Maine's current

⁹⁹ See 1991 ME. LEGIS. SERV. CH. 31 (S.P. 132) (West).

system could pose problems in that the legislature may not have time to adequately respond to changing circumstances surrounding lobster fishing. An agency based approach, such as the one used in New Hampshire, would allow rules and regulations to be promulgated in a timelier manner.

The legislature should establish a set of first principles and a set of standards (based on the first principles) and codify both as law. The law would call for certain data to be periodically gathered, and that data would be applied to the standards to continually refine the law so that the effects of the law would always be in accordance with the goals of the law, as expressed through the standards. The legislature would delegate to the Department of Marine Resources the authority to conduct the necessary research and to create rules based on the information gathered from the research. For a discussion of the specific principles that this comment suggests that the legislature adopts, see the “First Principles” section, below.

A system such as this allows the legislature to effectuate its goals. Traditionally, the legislature would think of a principle and then derive a law from that principle. That system assures that the law is enforced, but not necessarily that the principle underlying the law is enforced. Although the law may have been appropriate at the time of enactment, a change in underlying conditions, such as a change in the size at which 50% of lobster reach maturity, can result in the law becoming arbitrary and unrelated to its original purpose, or at least more tenuously related. By codifying both the principle and the standard, the legislature would ensure that one well-crafted law could remain effective and relevant even through the changing circumstances that come with the passing of years. The principle would be expressed in the statute in a manner such as, “The purpose of the minimum size is to allow the lobster population sufficient opportunity to reproduce and keep the stock bountiful.” The legislature would also

adopt a standard. The standard would be the language that guides the Department of Marine Resources in setting the regulations governing lobster fishing. For example, a standard might read, “the minimum size shall be set by the Department of Marine Resources such that 50% of lobster are mature at the minimum size.” The principle would serve as guidance for future sessions of the legislature when deciding if a standard and the accompanying delegation to the Department have proven effective. If the Department has dutifully set the minimum size so that 50% of lobster are mature at the minimum size, but the research also demonstrates that the stock is declining in amount, then the Department would report this information to the legislature. At the next session, the legislature would then increase the minimum size reflected in the standard, perhaps to 60%, to better effect the goal of the principle. Thus, the system would move from a relatively static one in which the law stays the same until a new statute is passed, to a more fluid one. This new law would be able to adapt and provide for the best interests of the industry, without having to rely on the legislature going through the legislative process to simply make a change to the law that would be in line with the thinking of the original law and that simply reflects recognition of the changes in underlying circumstances. However, when the standard proves ineffective, legislative process would be required.

For ease of use for the fishermen, such updates to the law should only be made once annually, ideally always at the same time of year.

2. First Principles for Law Makers to Operate on¹⁰⁰

¹⁰⁰ By first principles, I mean something akin to axioms as used in Euclidean Geometry. Essentially, these principles can be combined with any factual information of the world, i.e., as would be derived from studies, and thus produce

a. *Where Minimum Sizes Should be Set*

As previously stated, both the United States and Canada have based their minimum sizes on the belief that 50% of lobsters in a given area should have reached maturity by the time they are of minimum size.¹⁰¹ However, there is no necessary reason why the minimum should be set at 50% instead of some other number. Of course, 50% gives an equal chance in either direction

a coherent system of laws. Or, put another way, these are the principles that an ideal system of laws would be reduced to when the facts are removed. For example, a perfect minimum size might be one that allows a lobster the opportunity to reproduce once before it can legally be caught. However, this principle alone could not be the law. So, the law must take the facts from the world and apply that principle to the facts, thus putting a concrete number to the minimum size, instead of a simple statement of what *would* be ideal. In effect, this principle must mesh with reality, so a percentage of likelihood would have to be applied. As has been discussed, sizes are often set so that there is 50% likelihood that a given lobster at minimum size is actually mature. I have called these first principles and not axioms because, although they are based on the concept of axioms, they are different in that they must be made to mesh with a reality that cannot be perfectly known, unlike mathematical concepts. Although we can estimate the size at which lobsters are mature, they are members of evolving species and thus not subject to mathematical simplicity. Whereas we can coherently talk about idealized concepts in math, such as how triangles always have a hypotenuse equivalent to the sum of the squares of the other sides, and then take those principles and see them effected in the real world (e.g., real triangles always act as ideal triangles), there is no perfect analog to organisms, as they exist only in the phenomenal world. There is no *ideal* lobster in a Platonic “forms” sense; these principles are only approximating what works, on average, and attempting to treat mathematically a purely physical phenomenon.

¹⁰¹See LOBSTER INST., *supra* note 19 (The Code states: “[t]his is designed to allow lobsters to become of age to be capable of at least one reproduction cycle before it can be legally landed” however, most laws were designed so as to only have a 50% chance of a given having gone through a reproduction cycle, i.e. it’s just as likely as not that they went through a reproduction cycle).

that a lobster has or has not reached maturity. Even if a given lobster has reached maturity, it may not have necessarily had the chance to breed before being caught. Assume a Maine lobster is $3 \frac{8}{32}$ inches, and assume that the assumption that this is the size of 50% maturity is correct. There is a 50% chance that this lobster is mature. In addition, even if it is mature, it may have never actually had the chance to breed. This is a chance built upon a chance. To illustrate, assume that of all lobsters caught that are within a millimeter or two of the minimum size have had a 50% chance of breeding before being caught. If this were the case, then only 25% of caught lobster that are substantially close to the minimum size have had a chance to breed (50% chance of maturity, and if mature only a 50% chance of having bred). This would be a rather slim figure. If the minimum size were to go up, *arguendo*, to the size at which 75% of lobster have reached maturity, then not only would more legal-sized lobster *actually* be mature, but there would also be a much greater chance that all mature caught lobster have actually had a chance to breed. There is, unfortunately, not enough data available to know exactly what percentage of threshold lobsters would have actually reproduced at any given minimum.

The legislature should adopt the principle: “the purpose of the minimum size is to allow the lobster population sufficient opportunity to reproduce and keep the stock bountiful.” They should also adopt the standard: “the minimum size shall be set by the Department of Marine Resources at a size at which 50% of lobster are mature.” If the Department has dutifully set the minimum size so that 50% of lobster are mature at the minimum size, but also finds that the stock is declining in amount, then the Department would report this information to the legislature. The legislature would increase the minimum size reflected in the standard, perhaps to 60%, to better effect the goal of the principle. Although the minimum size was set so that 50% of lobsters would be mature when they reached that size, legally enshrining the goal of the

minimum as a principle, and 50% as the standard, would go a long way to provide future guidance.

b. *Sex-Dependent Measurement System —Recognizing Biological Differences in Minimum Sizes*

As discussed previously, the larger a female lobster is the more eggs it produces and the more eggs it can potentially have fertilized by a male lobster.¹⁰² In addition, female lobsters typically mate once every two years.¹⁰³ Lastly, male lobsters tend to reach maturity at smaller sizes than female lobsters.¹⁰⁴ These facts about lobster biology lead to the conclusion that it may be beneficial to set different minimum and maximum sizes for male and female lobsters.

Because female lobsters can produce more lobsters the larger they get, there is an inherent value in having more large female lobsters. To have more large female lobsters, more female lobsters need the opportunity to grow large, i.e., they need to live longer. The single most effective way that this result can be obtained is for the legislature to allow for the harvest of fewer female lobsters. Although one way to do this would be to allow for the harvesting of a specified, limited number of female lobsters in a given season, this would put a large burden on both fishermen and the state by requiring every harvested female lobster to be accounted for and recorded. It would require altering the very way in which the harvest is kept within reasonable limits. A less burdensome way of achieving the same result, allowing more female lobsters to grow to a large size, would simply be to bifurcate the minimum and maximum sizes between the

¹⁰² LOBSTER INST., *supra* note 14.

¹⁰³ *Id.*

¹⁰⁴ CANADIAN SCIENCE ADVISORY SECRETARIAT, FISHERIES AND OCEANS CANADA, *supra* note 26 at 3; SENATE OF CANADA, *supra* note 26.

lobster sexes. This would limit the number of females caught in a way similar in kind to how the lobster catch as a whole is currently limited. This would be less burdensome than the alternative; instead of requiring a count of all female lobsters caught, a lobsterman would simply have to check the sex of any caught lobster and use the proper gauge depending on the lobster's sex. The minimum sizes could be established so that the minimum size for females is larger than the minimum size for males, and the maximum size for females could be smaller than the maximum size for males.

Since not all lobsters are caught in their lifetime, decreasing the range of legal sizes creates a greater chance that any given lobster will not be caught while it can legally be kept. Imagine, *arguendo*, that the typical lobster spends ten years between the current minimum and maximum sizes in the state of Maine. That represents ten years in which if that lobster is caught (as long as it is not an egg-bearing or v-notched female) it will, in all likelihood, be kept, sold, and eaten. Now assume the minimum size for females is increased half an inch and the maximum size is decreased half an inch. That could shave years off of the legally harvestable period for that lobster.

The effect of putting more limitation on the harvest of female lobsters than male lobsters would, in time, change the ratio of mature male to female lobsters in the ocean. Although this may sound like a potential problem, it is not necessarily one. Although there must be enough male lobsters for all or substantially all female lobsters to breed, any excess males beyond that point are unnecessary from the viewpoint of trying to both have as large of a lobster population as possible and as large of a harvest as possible, at the same time. The question then becomes: what is the proper ratio of male to female lobsters such that all mature, non-sterile females have the opportunity to breed? Because female lobsters typically breed once every two years, it would

stand to reason that the lobster population could thrive with twice as many female lobsters as male. Assuming the males could impregnate half of the females one year, the second half could be impregnated the next year, and then the first half would be available again the next year. This process could continue *ad infinitum*. There is, as of yet, no listed data on how often male lobsters breed, so this is based on the assumption that they breed yearly. The research often points out that females breed every other year. The silence on males would seem to indicate that they breed on a different timeline than females — otherwise it would make more sense to simply say that lobsters breed every other year. It would need to be known how often male lobsters actually breed. Furthermore, the real world seldom works in ways that comport perfectly with simple examples. Although a 2:1 ratio of female to male lobsters may work perfectly in theory, research would need to be conducted to assess how practical this would be in reality.

c. Limiting Fishing Areas to Environments that can be Adequately Regulated — the Benefits of Subdividing

The current minimum and maximum sizes in Maine are the same throughout the entire state, as long as the lobsterman is in state and not federal waters.¹⁰⁵ Whether someone is fishing out of Camp Elis or Bangor, a lobster that is 3 inches is too small and a lobster that is $5\frac{4}{32}$ inches is too big.¹⁰⁶ This presents potential for problems if the goal is to allow for the harvest of all likely mature lobsters. Because a number of factors have an effect on lobster growth and size at maturity,¹⁰⁷ a 3-inch lobster might be mature in Southern Maine, even though it could not be

¹⁰⁵ Me. Rev. Stat. Ann. Tit. 12 § 6431(1).

¹⁰⁶ *Id.*

¹⁰⁷ HOENIG ET AL., *supra* note 18, at 8, 22 (temperature, location); CANADIAN SCIENCE ADVISORY SECRETARIAT, FISHERIES AND OCEANS CANADA, *supra* note 26 (sex); SENATE OF CANADA, *supra* note 26 (sex).

kept, and a $3\frac{16}{32}$ inch lobster might not be mature in Northern Maine, even though it could legally be kept. Even if the state were to adopt a system whereby the statutory minimum would be the size at which an appropriate percentage of the lobster population is mature, to do so would result in problems as highlighted above if a size derived from that percentage is applied to the state as a whole. The 50% mark for the state as a whole may be $3\frac{8}{32}$ inches, but that would be too big in some areas and too small in others.

To alleviate this problem, the state could subdivide the water into different fishing zones, each of which would apply the general principles, as spelled out by the legislature, to the specific facts of their region. If the legislature sets the minimum size at the size at which 50% of lobsters are mature, then each fishing zone would find, through research conducted by the appropriate department, what exactly that size would be for its region and set that actual size, e.g., 3 inches, as the minimum. As long as the fishing zones are of a small enough size that there is not significant deviation between lobsters in that zone with respect to size at maturity, this proposal would be effective.

There would be a risk in having fishing zones that are too small because that would lead to having too many zones in the state. Too many zones would present a regulatory problem: each zone needs to have data from research to base its sizes off. If there were too many zones, the state may not have adequate resources to conduct all of the necessary research. The ideal would be to have as many zones as possible to reflect the different environments that lobsters live in and are affected by, but limited in such a way that every zone presents meaningful differences and does not impose an undue burden on the state. If there were two adjacent zones, with differences so slight that in one zone lobsters are mature at 3 inches, but in the other zone lobsters are mature at $3\frac{1}{32}$ inches, then to regulate these as two separate zones would be

virtually pointless. Although there are differences in the zones, those differences are so slight that the cost of separate regulation could outweigh the benefit of perfect tailoring. The lobster industry can afford to have a few not-yet-mature lobsters caught in the one area or, conversely, a few lobsters that have been mature longer than the principle dictates in the other. The benefit of catching the “perfect” number of lobsters in both areas would not be worth the cost of regulating the zones separately.

d. *V-Notching — Recognizing the Value that Breeding Lobsters Have for the Stock*

The system of v-notching berried female lobsters is unique in that it reflects the importance of breeding lobsters and that a berried lobster represents the clearest indication of whether a given lobster is capable of breeding. A lobster can be over the minimum size and not be mature; most minimums were roughly placed at the size at which 50% of lobsters are mature. Furthermore, even if a lobster has grown to maturity, it could have been rendered sterile. There is, as of yet, no way to know if a given lobster is capable of breeding. Thus, we have resorted to estimations based on average sizes. However, there is one exception to this general rule. If one catches a female lobster that is berried, then that lobster has clearly bred. Although it may be the case that the berried lobster may never be able to breed again, we can say with a much higher degree of certainty that the berried lobster will breed in the future (if it lives long enough) than any other lobster based on a mere measurement of size. Furthermore, we can say with absolute certainty that the berried lobster is mature, while the same cannot be said of a lobster based on size alone.

For these reasons, berried female lobsters are highly valuable — we know something about them that we cannot know about other lobsters.¹⁰⁸ It is due to this value that legislatures

¹⁰⁸ The only way we currently could know this would be if the other lobsters were monitored in captivity, which is irrelevant to this paper.

have introduced v-notching. V-notching, allows future lobstermen who catch the marked lobster to know that it was recently berried and therefore mature and likely to breed again. This introduces even more knowledge into the system. If v-notching is mandatory and followed by all who participate in lobstering, then a lobsterman knows that any non-v-notched female lobster that he catches either has not bred in the time that it would take for a v-notch to grow out (about 3 molts),¹⁰⁹ has not bred at all, or was not caught while it was berried. This presents a decent likelihood that the lobster will not breed again, and is therefore a prime choice to send to the market. In most jurisdictions, it is illegal to keep a v-notched lobster.¹¹⁰ Because of the potential breeding capabilities of v-notched lobsters, this is an extremely wise choice by jurisdictions that mandate v-notching. Currently, Maine requires all lobstermen to v-notch any berried female lobsters they catch,¹¹¹ and it is illegal to keep a v-notched lobster.¹¹² Unless more reliable ways to identify mature, breeding-capable lobsters are discovered in the coming years, the v-notching system should certainly be kept in place to allow lobsters to continue to have as many chances to reproduce as possible, while also maintaining strong landing numbers.

One possible adjustment that could be made to the v-notching system is varying the required depth of the notch itself. By requiring a deeper notch, a potential future-breeder could

¹⁰⁹ Hall, *supra* note 77.

¹¹⁰ ME. STAT. ANN. tit. 12, § 6436 (2017); N.H. CODE ADMIN. R. ANN. FIS. 602.11 (2017)); 322 MASS. CODE. REGS. 6.02 (LexisNexis 2017). (Massachusetts, but with varying definition of v-notch depending on location). *But see* CANADIAN SCIENCE ADVISORY SECRETARIAT, FISHERIES AND OCEANS CANADA, CANADIAN SCIENCE ADVISORY SECRETARIAT, FISHERIES AND OCEANS CANADA, *supra* note 26, at 3.

¹¹¹ 13-188-025 ME. CODE R. 25 § 25.15 (LexisNexis 2017).

¹¹² ME. STAT. ANN. tit. 12, § 6436 (2017).

stay in the system longer, as it would take more molts for the v-notch to fully grow-out. Contrariwise, requiring a shallower notch would allow fewer molts to occur before a potential future-breeder would be legal for harvest again. Varying of the required notch depth could be done in response to the projected size of the lobster stock. If there is strong evidence that numbers are high and that there is an abundance of lobster, then a shallower notch and fewer opportunities for breeding would take advantage of the current situation and allow a larger harvest. Alternatively, if the stock is low and needs a chance to recuperate, a deeper notch would give the female lobster more opportunities to breed and would let the lobster stock replenish itself.

e. Performing New Research on a Regular Basis

This paper has argued for putting “first principles” in place to determine how lobstering laws should be established. These principles are rational ideas that essentially provide a method by which to take relevant data and produce from said data effective laws. It can be thought of as a lens that takes the distorted mess created by a set of data and, from that mess, makes a clear picture of what the law should be. To return to a prior example, lawmakers may decide that the most efficient minimum size is that at which 50% of lobsters are mature. The research may suggest that, in area X, 25% of lobster are mature at 3 inches, 50% are mature at $3\frac{16}{32}$ inches, and 75% are mature at $3\frac{24}{32}$ inches. Alone, the research says nothing. However, with the principle put in place by the legislature, the appropriate governmental agency could then impose a regulation stating that, in area X the minimum size is $3\frac{16}{32}$ inches. A further principle might suggest adjusting the minimum size to reflect a different percent if it is found that the catch rate is increasing at a certain rate but the amount of berried females is decreasing, as such a trend over a prolonged period would lead to a decrease in total number of lobster.

However effective these principles may be, they presuppose an ongoing amount of research which lawmakers can actually react to. The principles are meant to be applied to discreet sets of facts; without any data — or when only outdated or foreign data is available¹¹³ — the principles are worthless.

Sadly, research into this field of law has shown that oftentimes the data that is available to lawmakers is scarce or outdated. Reports have stated “[t]his is something that had not been looked at in decades”¹¹⁴ and that “[a] recurrent theme in the stock assessment report and in the review of the assessment was the need for updated information on growth and maturity.”¹¹⁵

Although there is an admitted lack of sufficient research, research that is in place has frequently noted that temperature plays a large role in the development of the American lobster and the size at which it reaches maturity.¹¹⁶ This obviously highlights the need for research, as the ocean temperatures have not been at all stable, but have been experiencing an upward trend in temperature for the last hundred years, at least on the surface.¹¹⁷ Because the temperature of the ocean is unlikely to stop changing, there will also be a constant need to see how lobster are affected by their changing environment. Researchers should be frequently determining the size at maturity for lobsters, in order for legislators or agency rule-makers to be able to impose size

¹¹³ *I.e.*, data that was obtained in a location significantly different from the one in which lawmakers intend to apply it.

¹¹⁴ SENATE OF CANADA, *supra* note 26, at 12:184 (Writing about when lobsters reach maturity).

¹¹⁵ HOENIG ET AL., *supra* note 18, at 5.

¹¹⁶ HOENIG ET AL., *supra* note 18, at 8, 22.

¹¹⁷ *Climate Change Indicators: Sea Surface Temperature* EPA, <https://www.epa.gov/climate-indicators/climate-change-indicators-sea-surface-temperature> [<https://perma.cc/5QD4-PX5W>].

regulations that coincide with principles decided on by the legislature. If the legislature establishes that the minimum size should be that at which 25, 50, or 75% of lobsters are mature, then those responsible for implementing the minimum sizes must *actually* know at which size 25, 50, or 75% of the lobsters in their area are mature. In addition, because that size is likely changing year to year, or at least every few years, as the temperature of the oceans and other factors that influence lobster continue to change, it is necessary for this research to be performed on a regular basis.

If this proves to be burdensome, lawmakers, at the very least, need to be aware of the effect of different water temperatures on lobster maturity, and perhaps have different minimums based on the average temperature of the ocean in the area concerned for a certain number of years. For example, if the water averaged thirty degrees Celsius over a three year period, the appropriate minimum would likely be lower than if the water averaged twenty degrees Celsius for the past three years, as warmer water results in faster maturity and smaller mature lobsters.¹¹⁸ Clearly, it would be very difficult to set standards based on average temperature without decades of research in itself, but it could be instructive to look to the research of other areas. By surveying other regions, one could get a rough idea of size at maturity in different temperatures. However, to do this would be to assume that temperature is the *only* influencing factor on lobster development, which could prove to be a risky assumption. It would certainly be preferable to perform direct research only on lobsters in the area in question, if this proves fiscally feasible.

One of the most important types of research that could be performed is simply to measure new types of rules against catch rates. When a lobster is caught, after it is brought to land, it is “bought by a co-op or dealer,” who in turn sells the lobster to another dealer, or series of

¹¹⁸ See HOENIG ET AL., *supra* note 18, at 22.

dealers.¹¹⁹ These transactions create a paper trail, which allows the state to track how many legal lobsters are caught and sold in the state. This is data that is readily available; for example, the Maine Department of Marine Resources reports that the lobster catch was worth \$495.4 million in 2015.¹²⁰ The National Oceanic and Atmospheric Administration (NOAA) publishes detailed records of the fishery landings for the various states. They have reports going back to 1950, when the total harvest of lobster was only 18,352,600 pounds, up to 2015, when the harvest had skyrocketed to 122,401,538 pounds, more than a ten-fold increase.¹²¹

The wealth of knowledge that is available through the research that is already being performed, and the knowledge that it will continue to provide, should be thoroughly utilized by researchers going forward and shared with the legislature. For example, say the legislature sets

¹¹⁹ Jessica Hall, *From Caught to Bought, all About Lobster Economics*, PORTLAND PRESS HERALD (Aug. 11, 2014), https://www.pressherald.com/2012/08/11/market-forces-make-everyone-feel-the-pinch_2012-08-12/ [<https://perma.cc/BZ57-GCXK>].

¹²⁰ *Maine Lobstermen Set Record with \$495 Million Haul*, PORTLAND PRESS HERALD (Mar. 4, 2016), <https://www.pressherald.com/2016/03/03/maine-lobstermen-set-record-with-495-million-haul-in-2015/> [<https://perma.cc/R25A-8ZXB>].

¹²¹ Commercial Fisheries Statistics, Annual Commercial Landings Statistics, NAT'L OCEAN AND ATMOSPHERIC ADMIN., U.S. DEP'T OF COMMERCE, (last visited Apr. 22, 2017) <https://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index> [<https://perma.cc/2X79-WMW4>]. It is interesting to note that there is a 6 million dollar discrepancy between the Maine Department of Marine Resources' and the NOAA's reports for the value of lobster landings in the state of Maine in 2015. *C.f.* PORTLAND PRESS HERALD, *supra* note 119 (reporting \$495,400,000) *with* NAT'L OCEAN AND ATMOSPHERIC ADMIN., *supra* note 120 (reporting 501,194,343). However, this discrepancy is beyond the scope of this article.

the standard at the size at which 50% of lobster are mature. Research is performed and the size at which 50% are mature is discovered. The department or agency responsible for setting the size sets the minimum length (e.g., 3 ¹⁶/₃₂) at that size discovered. Research is regularly performed, and it is discovered that lobsters are now reaching maturity at larger sizes, so researchers inform the agency and the minimum size is increased accordingly. This trend continues for a few years, with the minimum size always accurately reflecting the principle that the legislature put in place, i.e., that the minimum size should be that at which 50% of lobster are mature. However, further suppose that researchers are also utilizing catch rate trends as distributed by the NOAA, and they realize that the lobster catch has actually been steadily declining for the last five years. This information could be given to the legislature, which could then reasonably decide to adjust the minimum size up for a trial period to see if the catch-rates would rebound. The legislature sets minimum at the size at which 60% of the lobster population reaches maturity. The research is performed to find at what size that occurs at in the appropriate areas, and then the minimum could properly be adjusted up. This would likely lead to a decline in catch rate for a couple of years, due to the minimum being higher. However, once a greater percentage of lobster population has had a chance to breed without being caught and sold, an upward trend should be observed in the lobster landings. This highlights the need for researchers to regularly perform research, not just on the minimum sizes that the legislature currently has in place, but on a range of sizes so that a shift to a new minimum, or maximum, is always possible. This also highlights the usefulness of the data provided by NOAA and the Maine Department of Marine Resources concerning lobster landings, as they essentially give the legislature and the agency feedback on whether their laws and regulations are working effectively or need to be reconsidered.

Requiring research would impose a financial burden on the state, but it could likely be mitigated by taking proper actions. In any scheme that imposes rules, regulations, and fines, it is likely that there will be rule-breakers. These rule-breakers, and consequently fine-payers, could help to subsidize the research that this paper calls for. When an enforcement official fines an individual who is in possession of an illegal lobster (e.g., one that is under the minimum, over the maximum, or that has a v-notch on its tail), then a fine is levied against that person. The money collected from the fine could go directly to the researchers who are studying lobster in the state. In a way, the industry would be paying to regulate itself. If this method of funding is pursued, there would need to be sufficient enforcement officials on the water to catch as many violations as possible. However, those enforcement officials would also need to be paid, and the more enforcement officials that are present, the less likely an individual is to break the law — assuming an individual both knows the law and of the increased presence of enforcement officials. So, enough enforcement officials would be needed to catch most of the violators, though not so many that the presence of the officials actually becomes cost prohibitive. Furthermore, it should not be a goal of the system to encourage rule violation to increase profits; the goal of this paper is to propose meaningful, reasoned rules that are only in place to benefit the lobster fishery as a sustainable, economically beneficial institution. Therefore, violation of the rules proposed would be a *per se* harm, and the imposition of a fine would simply be recompensing the state, to some degree, for the harm done. The state should simply strive to catch all the rule violations that do and will occur and to mitigate the damage that would have occurred had the violation gone un-noticed. In addition, enforcement of the rules will likely lead to fewer violations. Since the rules are designed to help the industry, fewer violations is certainly a good thing for the industry, in that it will increase future landings and decrease the harms to

those fishermen who do follow the rules, but it also will lead to a decrease in available funding for research.

Given that collecting fines for rule violation will lead to fewer violations occurring, an additional source of funding is likely to be needed. A moderate tax on lobsters, at some level of the chain could serve well, although consumers are typically averse to paying more for the same product. The benefit of a tax would be that it would be another example of the industry paying for its own research, which keeps it self-contained and only puts a burden on those who are benefitting from the industry, i.e., buyers and sellers of the product. If none of these sources of funding are successful, the state would likely need to turn to its funds derived from existing sources.

V. CONCLUSION

Lobstering has long been a quintessential part of Maine life. It is one of the most significant aspects of the Maine economy, representing “75 percent of the state’s total commercial fishery value”¹²² and Maine accounts for a significant majority of the lobster that is landed in the United States, catching 75 to 80 percent of all the lobster caught.¹²³ Because lobstering is such a vital part of both the Maine economy and way of life, it is wise to put measures in place to ensure that lobstering remains such a vibrant industry in the future, by keeping landing numbers high while at the same time maintaining or hopefully increasing the stock of the lobster fishery. That is why this paper has suggested a new way of how to think

¹²² Penelope Overton, *Maine Lobster Catch Tipped the Scale at a Record 130 Million Pounds in 2016*, PORTLAND PRESS HERALD (Mar. 3, 2017), <https://www.pressherald.com/2017/03/03/maine-lobster-landings-set-records-in-2016/> [<https://perma.cc/82YD-W3H9>].

¹²³ Hall, *supra* note 119.

about regulating the lobster industry. By surveying the laws of Maine, New Hampshire, Massachusetts, and Canada and analyzing those laws in reference to how lobsters live, reproduce, and adapt over time to their environment, one can begin to see what laws should be the most effective in creating a more efficient fishery.

It has been repeatedly observed that the size at which lobster reach maturity is not static, and one of the biggest influences on maturity size is water temperature. This, coupled with the fact that the temperature of the oceans has been changing, mandates that minimum sizes should not stay the same from year to year, if the minimum size is supposed to bear a relation to lobster maturity, as both the United States and Canada purport to do with their minimum sizes.¹²⁴ Because a species must reproduce for its existence to continue into the future, it only makes sense to allow lobsters to reach a size where they have likely been able to breed at least once before fishermen are allowed to legally keep them. Since the “appropriate” minimum size will change due to the lobster’s biology, e.g., reaching maturity later due to colder water, the law should be adaptable to reflect the facts of lobster biology.

Due to this need for adaptability, the system in Massachusetts provides for a combination of laws and rulemaking, with a statutory minimum that can be adjusted upwards by regulation. That state’s system helped inspire this paper to propose that the Maine legislature set the minimum at whatever size a given percent of lobsters have reached maturity, and for a regulatory agency to adjust the actual minimum in response to data received, so it is always at the appropriate percent as set by the legislature.

By observing the biology of the lobster, both how males tend to be mature at smaller sizes and how it is valuable to have more large female lobsters in the stock due to their ability to

¹²⁴ LOBSTER INST., *supra* note 19.

produce more lobster eggs at larger sizes, this paper has suggested a measuring system that is segregated based on lobster sex. Such a system has the potential to keep harvests up in the meantime and, once enough females have gotten to a large size, let harvest numbers grow to exceeding heights due to the increase in egg production.

The system should recognize that lobster biology is not dependent on state lines, because temperature changes not only over time, but also from one location to another.. Given their geographic proximity, lobster off the coast of Camp Ellis will likely reach maturity at a size more similar to a lobster living off the coast of Portsmouth than to a lobster off the coast of Machias. Yet the minimum size for the whole state of Maine remains 3 8/32 inches.¹²⁵ Lobster management areas that are small enough to reflect this reality, while also large enough to be reasonably enforceable, would greatly help the state's conservation efforts by allowing the state to have minimums that make sense relative to all the lobster populations in the state.

The ingenuity of the v-notching system is, in some degree, recognized in all states. To further push the v-notch system as an effective tool for controlling the number of landings and fostering a robust lobster stock for years to come, the state should consider varying the required depth of a v-notch. If the stock is declining, a deeper v-notch would give a breeding female lobster more opportunities to breed again before it becomes legal to possess by virtue of losing its notch.

The purpose of this paper is to make the lobstering industry in Maine more efficient. The primary way this paper proposes to meet this goal is to move to a system in which the Maine Legislature sets standards, based on sound principles, from which a state agency could then impose reasoned regulations after conducting appropriate research. This paper has provided a

¹²⁵ ME. REV. STAT. ANN. tit. 12 § 6431 (1) (2017).

number of possible principles, which could be used to improve the industry going forward.

Although any of these proposals could work in isolation, hopefully they will be considered as a whole, for they work best in conjunction. They are all based on the principle that we should take advantage of the resources we are given, while not abusing them. If the lobster stock is especially strong, measures can be put in place to allow for increased harvesting. If it is weak, then it needs the chance to replenish itself. Applied in harmony, these proposals have the potential to bolster an already thriving industry.