Sea Grant Law Center

Sea Grant Law & Policy Journal

Volume 6.2 April 2014

NSGLC-14-01-01

TABLE OF CONTENTS

Articles

The Sea Grant Law & Policy Journal was prepared by the National Sea Grant Law Center under award NA090AR4170200 from NOAA, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the Sea Grant Law Center or the U.S. Department of Commerce.

"The Time Has Come … To Talk of Many Things": Legal Impediments to the Future of Shellfish Relay in Rhode Island

Melissa R. Chalek, Rhode Island Sea Grant[1]

Abstract: Relay is the process by which shellfish are transferred from closed waters, where harvesting is prohibited, into approved waters, where the shellfish will purge contaminants from their tissues and eventually become safe for human consumption. In some states, management authorities permit harvest of relayed shellfish after just a few weeks, but in Rhode Island the shellfish must remain in approved waters for one year. This Article examines the justifications for this long requirement–consumer protection, lack of enforcement resources, and lack of need for a shorter period–and presents counterarguments for these justifications that are rooted in scientific literature and the policies of other states.

I. Introduction

The Walrus and The Carpenter
Walked on a mile or so,
And then they rested on a rock
Conveniently low:
And all the little Oysters stood
And waited in a row.

[1] Research Assistant, Rhode Island Sea Grant; J.D., Roger Williams University School of Law; Masters of Marine Affairs, University of Rhode Island. This article was funded through NOAA Award No. NA10OAR4170076 to the Rhode Island Sea Grant College Program. Thanks to Julia Wyman and Alan Desbonnet of Rhode Island Sea Grant for their tireless editing and advice.

'The time has come,' The Walrus said,
'To talk of many things …'[2]

The Walrus in Lewis Carroll's *Through the Looking-Glass* did not worry about the quality of the water in which the oysters he dined upon were grown.[3] However, that is not a luxury that can be enjoyed by shellfish consumers or regulators today. Poor water quality can lead to contaminated shellfish and resulting human illness.[4] This Article focuses on a process, known as shellfish relay, in which shellfish are transplanted from closed waters, where harvesting is prohibited due to poor water quality, into approved waters, where the shellfish will purge contaminants from their tissues as they filter the clean waters of the approved area.[5] From there, the shellfish may be harvested for safe human consumption.[6]

This Article examines legal and policy issues regarding the potential use of shellfish relay in Rhode Island. Many states allow transfer of seed from closed waters to approved waters,[7] and some states also allow transfer of market-sized shellfish for a relatively short depuration period, which opens closed waters to shellfish aquaculture.[8] Currently in Rhode Island, shellfish transferred from closed waters must remain in approved waters for one year before they may be harvested.[9] This long depuration requirement significantly limits the economic viability of using closed waters to culture shellfish, and it limits the potential benefits of using seed from closed waters.

This article examines Rhode Island's shellfish relay regulations and compares it with the regulations of neighboring states, federal mandates, and foreign law. Part II provides insight into the need to promote aquaculture expansion. Part III provides greater detail on the relay process. Part IV lays out the national standards regulating shellfish relay. Parts V and VI discuss aquaculture and relay in Rhode Island, and Part VII provides a comparison by examining relay in select states and Canada. Finally, Part VIII argues that the policy and science of shellfish relay provide support for liberalizing Rhode Island's relay regulations and promoting the use of relay to expand the aquaculture industry in the state.

II. The Importance of Shellfish Aquaculture

[2] LEWIS CARROLL & SIR JOHN TENNIEL, THROUGH THE LOOKING-GLASS AND WHAT ALICE FOUND THERE 80 (Henry Altemus Co. ed., 1897).
[3] *See id.* at 82.
[4] BARBARA BRENNESSEL, GOOD TIDINGS: THE HISTORY AND ECOLOGY OF SHELLFISH FARMING IN THE NORTHEAST 113, 115 (2008).
[5] *See* N.Y. COMP. CODES R. & REGS. tit. 6, § 45.1(i).
[6] N.Y. Dept. of Environmental Conservation, *Shellfish Safety*, N.Y. STATE WEBSITE, http://www.dec.ny.gov/outdoor/9161.html (last visited Dec. 6, 2013) [hereinafter *Shellfish Safety]*.
[7] This Article will specifically examine the policies of Rhode Island, Massachusetts, Connecticut, New York, and Washington State, all of which allow shellfish relay in some form. Relay is federally approved by the U.S. Food and Drug Administration through the National Shellfish Sanitation Program.
[8] *See, e.g.*, N.Y. COMP. CODES R. & REGS. tit. 6, § 45.4(e)(1).
[9] 12-080-053 R.I. CODE R. § 8.9.

There is a large demand for shellfish in New England, the United States, and the world at large, but meeting that demand is becoming a greater challenge as wild harvest fisheries are declining.[10] Wild populations are decreasing globally because of overharvesting, disease, pollution, and habitat degradation.[11] As wild sources of shellfish dwindle, global demand continues to increase,[12] leaving a growing gap between supply and demand. Shellfish aquaculture, however, is poised to fill this gap.[13]

Public acceptance of cultured shellfish has been improving, especially with increasing awareness of the need to supplement wild harvest, the ecological benefits that can be gained from increasing shellfish populations through aquaculture, and the sustainability of shellfish aquaculture.[14] However, not everyone is on board with increasing aquaculture. Specifically, some commercial fishermen oppose expansion of shellfish aquaculture, fearing competition for seabed space and market sales.[15] The strong political pulls from aquaculture and wild harvest can leave regulators struggling to accommodate the needs of the various, often conflicting, interest groups, the public, and the environment.

Rhode Island is in a prime position to capitalize on the economic potential of shellfish aquaculture. Today, Canada, specifically Prince Edward Island (PEI), is the major source for mussels in the United States.[16] The current aquaculture industry in PEI provides employment for more than 1,500 people and creates over $100 million in annual sales.[17] However, PEI has met its biological carrying capacity for mussel farming.[18] In contrast, Rhode Island aquaculture has not even approached the carrying capacity of Narragansett Bay ("the Bay"), which is projected to be capable of supporting 625 times the current level of oyster aquaculture.[19] The large detritus pool in the Bay makes it one of the best shellfish production sites in the world,[20] and capitalizing on this capacity would allow Rhode Island to meet the ever increasing demand for shellfish while significantly bolstering the state's economy.

However, a major limitation to the potential of expanding shellfish aquaculture in Rhode Island is water contamination. Many substances present in the water are considered contaminants, including both naturally occurring biotoxins, such as certain species of phytoplankton, bacteria, or viruses,[21] and

---

[10] *See* BRENNESSEL, *supra* note 4, at 3; Dorothy Leonard & Sandra Macfarlane, *Best Management Practices for Shellfish Restoration: Prepared for the ISSC Shellfish Restoration Committee* 8 (Oct. 1, 2011), http://www.issc.org/client_resources/publications/final%20draft%20bmps-01-23-12.pdf (citation omitted).

[11] BRENNESSEL, *supra* note 4, at 3.

[12] *Id.*

[13] *Id.* at 183.

[14] Carrie Byron et al., *Calculating Ecological Carrying Capacity of Shellfish Aquaculture Using Mass-Balance Modeling: Narragansett Bay, Rhode Island*, 222 ECOLOGICAL MODELING 1743, 1743 (2011) (noting that "bivalve aquaculture is one of the most ecologically sustainable types of aquaculture").

[15] COASTAL RES. MGMT. COUNCIL, COASTAL RES. MGMT. PROGRAM § 200.4(B)(2) (2012) [hereinafter *Red Book*].

[16] BRENNESSEL, *supra* note 4, at 34. Other shellfish species are also cultured in Canada and could be cultured in Rhode Island, but oysters, quahogs, and mussels are the Rhode Island target species. *Red Book, supra* note 15.

[17] Scott Lindell, R.I. Sea Grant Project Summary: Extending the Capacity and Capability of Longline Mussel Farming in R.I. 2 (2012) (unpublished) (on file with R.I. Sea Grant and author).

[18] Byron et al., *supra* note 14, at 1744 (citations omitted).

[19] *Id.* at 1743. Oysters are currently the dominant cultured shellfish in Rhode Island, representing 99% of all state shellfish aquaculture. *Id.*

[20] *Id.* at 1743, 1752.

[21] Although these organisms can be naturally occurring, they can also be anthropogenic. *See* BRENNESSEL, *supra* note 4, at 118.

anthropogenic contaminants, such as heavy metals, oil, and other pollutants.[22] In Rhode Island, the specific persistent contaminants of concern are bacteria and heavy metals, with periodic problems from others such as toxins produced by dinoflagellates or bacterial contamination from sewer overflows or spills.[23]

Because shellfish are filter feeders, those growing in contaminated waters will siphon in contaminants as they feed,[24] which then accumulate in the shellfish tissue.[25] Contamination generally cannot be detected through taste, smell, or appearance, and cooking may not eliminate it.[26] Therefore, shellfish that have been harvested from contaminated waters have an increased potential to cause illness in consumers.[27] The severity of the illness can range from minor stomach discomfort from consuming low levels of sewage-based bacteria up to fatal illness, such as paralytic shellfish poisoning caused by consuming shellfish tissue tainted with toxins produced by various dinoflagellate species.[28]

To reduce the risk of "shellfish poisoning" and other shellfish-related illnesses, states generally test waters and ban shellfish harvest from any water deemed to contain unsafe levels of contaminants.[29] Many of the "most productive" shellfish beds in the Bay are currently closed to direct market harvesting for a large portion of the year[30] and therefore are incapable of supporting shellfish aquaculture sites under the current regulatory scheme, limiting aquaculture potential in Rhode Island.

Despite the ban on harvesting for market in closed waters, there are two potential methods to culture shellfish in contaminated waters: facility-based depuration and relay depuration.[31] Facility-based depuration requires shipping contaminated shellfish to a land-based depuration facility where the shellfish are intensively cleansed with clean water.[32] However, this process is expensive and causes stress to the shellfish, which may reduce the efficacy of the cleansing process.[33] The alternative – relay depuration – relies on the natural cleansing process that occurs when contaminated shellfish are transferred to approved, clean waters.[34]

---

[22] *Id.* at 113, 118, 121, 122. Unless specifically noted, these various pollutants will be referred to throughout this Article broadly as "contaminants."

[23] Telephone Interview with Joe Migliore, Principal Environmental Scientist, RI-DEM, Division of Water Resources (Dec. 18, 2012) [hereafter Migliore Interview].

[24] PRINCE EDWARD ISLAND DEP'T OF AGRICULTURE, FISHERIES AND AQUACULTURE, AQUA INFO: AQUACULTURE NOTES: SANITARY TESTING OF MOLLUSCAN SHELLFISH 1 (2005), *available at* http://www.gov.pe.ca/photos/original/FARD_ain20.2005.pdf [hereinafter PEI FACT SHEET].

[25] BRENNESSEL, *supra* note 4, at 115.

[26] *Id.*

[27] *Id.* at 113.

[28] *See id.* at 115.

[29] This prohibition is mandated by the National Shellfish Sanitation Program, which all states must meet in order to sell their shellfish in interstate commerce. *See* NAT'L SHELLFISH SANITATION PROGRAM MODEL ORDINANCE § II, ch. I, §.01(A)(1) (2007), *available at* http://www.fda.gov/food/guidanceregulation/federalstatefoodprograms/ucm2006754.htm [hereinafter NSSP-MO].

[30] *See Red Book, supra* note 15, at § 200.4(B)(1).

[31] BRENNESSEL, *supra* note 4, at 120.

[32] *Id.*

[33] *Id.* The advantage of depuration is that it can be accomplished in as little as three days. *Id.*

[34] CANADIAN SHELLFISH SANITATION PROGRAM - MANUAL OF OPERATIONS ch. 2 (2012) [hereinafter CSSP]; *Shellfish Safety*, *supra* note 6.

III. The Relay Process and Regulation

Relay involves the transfer of shellfish cultured in, or collected from, closed waters into approved waters where the shellfish will purge contaminants from their tissues by filtering clean water.[35] This process is generally recognized to take from a few days to a week[36] to reduce contaminants to levels safe for human consumption, provided that water temperatures are sufficiently high.[37] Shellfish growers therefore could collect seed from contaminated waters and grow their stock in approved waters, or they could culture shellfish in contaminated waters and then transfer market-sized shellfish to approved waters for a brief depuration period.[38] By employing relay depuration techniques, shellfish growers can utilize otherwise unusable shellfish seed from contaminated waters or submerged bottom located in closed areas.

In addition to expanding the available submerged bottom and seed for production, shellfish relay depuration has the potential to provide environmental benefits. By filtering out particles from the water column, shellfish remove contaminants present in the water and metabolize them, improving water quality.[39] This particulate removal also reduces turbidity, which allows light to penetrate deeper in the water column and encourages growth of plants such as eel grass.[40] Therefore, expansion of aquaculture in areas with poor water quality can improve the water quality by promoting an increase in overall shellfish biomass and therefore increased water filtration. The above mentioned benefits of shellfish aquaculture make enhancing relay capabilities an important component of state shellfish policies to provide "a healthy food source, an economic boon to local economies … and numerous ecosystem services."[41]

Relay can be executed through a public transplant program, which has been carried out in Rhode Island,[42] or through private aquaculture relay, which is the topic of this paper. During private aquaculture relay, a private individual collects seed from or cultures shellfish in restricted waters before

---

[35] NSSP-MO, *supra* note 29, at § II, Definitions (2)(88).

[36] As described below, longer periods are needed for depuration of heavy metals.

[37] *See* NSSP-MO, *supra* note 29, at § IV, ch. II, §.06; Michael R. Pietrak et al., *Potential Role of* Mytilus edulis *in Modulating the Infectious Pressure of* Vibrio anguillarum *02β on an Integrated Multi-Trophic Aquaculture Farm,* 326-329 AQUACULTURE 36, 36, 38 (2012); Karin Röder et al., *Accumulation and Depuration of Yessotoxin in Two Bivalves,* 30(1) J. SHELLFISH RESEARCH 167, 171 (2011).

[38] Email from Kristin DeRosia-Banick, Environmental Analyst II, Conn. Dept. of Agriculture, Bureau of Aquaculture, to author (Sept. 18, 2012, 09:00 EST) (on file with author).

[39] EAST COAST SHELLFISH GROWERS ASSOCIATION, DID YOU KNOW? SHELLFISH AQUACULTURE IS GOOD FOR THE ENVIRONMENT!, *available at* http://www.ecsga.org/Pages/Sustainability/BenefitsBrochure.pdf.

[40] Michael A. Rice, *Environmental Impacts of Shellfish Aquaculture: Filter Feeding to Control Eutrophication*, MARINE AQUACULTURE AND THE ENVIRONMENT: A MEETING FOR STAKEHOLDERS IN THE NORTHEAST 77, 79 (2001).

[41] Leonard & Macfarlane, *supra* note 10.

[42] *See Shellfish Transplant Program*, NARRAGANSETT BAY COMMISSION, http://www.narrabay.com/en/About%20Us/CommunityOutreachPrograms/ShellfishTransplantProgram.aspx (last visited Nov. 1, 2013); *see also* R.I. GEN. LAWS § 20-6-26 (1981) (authorizing the public transplant program).

transferring the shellfish to approved waters for the grow-out depuration process.[43] In contrast, a public transplant consists of the state collecting shellfish from restricted waters and transferring them to approved waters.[44] The waters where the shellfish are transferred into are then closed to harvest until the state re-opens the waters because sufficient time has passed that the contaminants in the shellfish will have depurated to a safe level.[45] The physical act of transplant is often carried out by wild harvest shellfishers, as has been the case in Rhode Island.[46] As public transplant is already carried out in Rhode Island, this Article focuses exclusively on private aquaculture relay.

IV. National Shellfish Sanitation Program

The relay process and all other aspects of shellfish management are regulated both by individual states and by the federal government. Federal intervention on shellfish harvest arose out of a 1924 outbreak of typhoid that was traced to shellfish consumption.[47] In response to this outbreak, the U.S. Surgeon General held a conference to compile recommendations for sanitation procedures to avoid similar future shellfish-related outbreaks.[48] The result of this conference was a confirmation that control of shellfish harvesting and distribution was primarily the responsibility of the individual states, but the conference also recognized that there was a role for the federal government in providing support and ensuring uniformity among the states.[49] The Interstate Shellfish Sanitation Conference (ISSC) was formed to meet this coordination need.[50]

Working with the U.S. Food and Drug Administration (FDA), the ISSC put together the National Shellfish Sanitation Program Model Ordinance ("NSSP-MO" or "model ordinance"), which sets the minimum requirements for shellfish sanitation that all states must meet in order to ship their shellfish via interstate commerce.[51] The NSSP-MO is a comprehensive document that addresses the various aspects of shellfish culture and production from water quality requirements, harvest methods, and tagging to storage, preparation, and shipping labels. The purposes of the NSSP-MO are "to promote and improve the sanitation of shellfish" and ensure the health and safety of consumers.[52]

Standards for shellfish relay depuration are among the numerous provisions of the NSSP-MO.[53] The model ordinance recognizes the value of allowing use of "shellstock resource that would otherwise not be available for human consumption."[54] The NSSP-MO requires that state authorities conduct "sanitary surveys" of all state waters and use the results of these surveys to classify the waters into several categories including approved (shellfish can be harvested), restricted (shellfish can be grown but must

[43] *See* NSSP-MO, *supra* note 29, at § II, Definitions (2)(88); BRENNESSEL, *supra* note 4, at 121.
[44] *See* R.I. GEN. LAWS § 20-6-26 (1981).
[45] *See id.* §§ 20-6-26, 20-6-27 (1981, 1988).
[46] *See* Narragansett Bay Commission, *supra* note 42.
[47] NSSP-MO, *supra* note 29, at § III, Introduction.
[48] *Id.*
[49] *Id.* (quoting a 1925 letter from the U.S. Surgeon General).
[50] *Id.*
[51] *Id.* at §§ II, Purpose, ch. I, §.01(E)(2), III, Introduction.
[52] *Id.* at § III, Introduction.
[53] *See id.* at § II, ch. V.
[54] *Id.* at § III, ch. V, §.01.

be relayed for depuration before final harvest), and prohibited (shellfish cannot be harvested at all).[55] States then use these water classifications to regulate harvest of shellfish for both wild harvest and aquaculture.[56]

When shellfish cultured in restricted waters are transferred to approved waters for relay depuration, the NSSP-MO requires that the state set minimum requirements, such as minimum grow-out times, to ensure that the contaminant levels in the shellfish are reduced to levels safe for human consumption.[57] The basic minimum depuration period required by the NSSP-MO is fourteen days.[58] Additionally, a contaminant reduction study is required for each individual project to ensure that fourteen days is sufficient to reduce contamination to safe levels.[59] Projects seeking a grow-out period of less than fourteen days must conduct a "more intensive" contaminant reduction study to show with certainty that the desired grow-out period is sufficiently long.[60]

Recognizing that some projects may not want to incur the costs of the extensive contaminant reduction study, the NSSP-MO allows for relay projects without these studies as long as certain protective requirements are met. Waiver of the contaminant reduction study is only available if the shellfish in question have been exposed exclusively to microbial contaminants.[61] Also, the waters from which the shellfish are being relayed must meet particular bacteriological water quality standards to ensure that the level of contamination is not excessive.[62] Finally, to ensure that the shellfish have sufficient time to purge contaminants from their tissues, a minimum grow-out period of sixty days is required.[63]

In addition to setting minimum grow-out time requirements, the NSSP-MO recognizes that depuration rates of shellfish are impacted by many other factors including level of contamination, water quality parameters like temperature and salinity, and the container in which the shellfish are cultured.[64] The model ordinance's general call for contaminant reduction studies is in response to these various impacts.[65] However, certain parameters have consistent impacts and are directly addressed by the model ordinance. Temperature has a major impact on depuration rate because shellfish filtration

---

[55] *See id.* at § II, ch. IV, §.01(A)(1). Classification as prohibited does not require a sanitary survey, although the results of a survey may dictate a prohibited classification. *Id.* at § II, ch. IV, §.01(B)(2). Surveys also require annual review to ensure that they still represent the current water quality. *Id.* at § II, ch. IV, §.01(C)(5).

[56] *Id.* at § II, ch. VI, §.02(G).

[57] *Id.* at §§ II, ch. V, §.01(B), (C).

[58] *Id.* at § II, ch. V, §.02(D).

[59] *Id.* The study must include testing for bacteria as well as every identified contaminant of concern. Testing for bacterial contamination must indicate that post-harvest contamination levels do not exceed bacterial contamination levels in shellfish grown entirely in approved waters. If other contaminants have been identified in the conditional or restricted waters, such as heavy metals, the contaminant reduction study must demonstrate that any remaining levels at harvest time are within established FDA tolerance levels. *Id.* at § II, ch. V, §.02(B).

[60] *Id.* at § II, ch. V, §.02(E).

[61] *Id.* at § II, ch. V, §.02(C)(1). The model ordinance recognizes that contamination with heavy metals or strong chemicals may create too many variables in purification rate and therefore should always be accompanied by a contaminant reduction study. *See id.* at § IV, ch. II, §.06.

[62] *Id.* at § II, ch. V, §.02(C)(2).

[63] *Id.* at § II, ch. V, §.02(C)(3).

[64] *Id.* at § III, ch. V, §.02.

[65] *Id.*

rate slows or stops when water temperatures are too low.[66] Therefore, the model ordinance requires state authorities to determine whether seasonal restrictions are necessary.[67] The NSSP-MO also requires that grow-out requirements be individually set for each project in order to account for these multiple variables that will change the depuration rates for each project.[68] Most states that employ the relay process have incorporated these variables into their regulations.

V. Rhode Island and the Shellfish Industry

Although Rhode Island has significant exports of quahogs and oysters, it imports other shellfish, such as mussels, to supplement its own production and wild harvest.[69] Additionally, wild harvest shellfish landings are decreasing in Rhode Island.[70] Increasing aquaculture production in the state could increase the availability of various shellfish species for both the local market and exports. Relay systems could allow growers to make use of closed waters, providing more jobs, more locally-grown shellfish into the economy, and even potentially improving the water quality of contaminated areas.

However, existing Rhode Island regulations inhibit successful aquaculture relay projects; the current regulations require a purification period that often equals or exceeds the time required for growth to market size.[71] Therefore, aquaculture utilizing relay would require longer grow-out time before harvest than facilities located solely in approved waters, reducing economic viability due to increased maintenance costs.

While other states require a relay depuration period of three months or less,[72] Rhode Island Department of Environmental Management ("RI-DEM") requires a depuration period of twelve months.[73] Engaging in aquaculture relay also requires prior approval from the directors of both RI-DEM and Rhode Island Department of Health ("RI-DOH"), but this mechanism has not yet been used for private aquaculture, perhaps largely because of the financial burden of the one-year grow-out requirement.[74]

While RI-DEM and RI-DOH control the grower's ability to harvest and sell cultured shellfish, the Rhode Island Coastal Resources Management Council ("RI-CRMC") must grant an assent to allow operation of a shellfish farm on leased state bottomlands.[75] Although applications for RI-CRMC assents are addressed on a case-by-case basis, RI-CRMC policy is to deny applications for private shellfish

[66] *Id.* at § IV, ch. II, §.06.
[67] *Id.* at § II, ch. V, §.02(F).
[68] *See id.* at § II, ch. V, §.02(B).
[69] *See* BRENNESSEL, *supra* note 4, at 34; Lindell, *supra* note 17, at 2.
[70] *See Red Book, supra* note 15, at § 200.4(B)(2).
[71] *See* 12-080-053 R.I. CODE R. § 8.9; Lindell, *supra* note 17, at 2 (noting that mussels grown in southern New England waters can grow from seed size to market size in 10-12 months).
[72] Massachusetts requires three months, Connecticut requires fourteen days, and New York requires twenty-one days. Although these purification period lengths all have provisions that will extend them beyond these accepted minimums, the minimum specified length is sufficient for the majority of projects. Email from Wade Carden, Biologist, N.Y. Dep't of Envtl. Conservation, Bureau of Marine Resources, to author (Oct. 15, 2012, 10:00 EST) (on file with author).
[73] 12-080-053 R.I. CODE R. § 8.9.
[74] 12-080-053 R.I. CODE R. §§ 8.9, 8.9.2; Migliore Interview *supra* note 23.
[75] *Red Book, supra* note 15, at § 300.11(C)(2).

aquaculture projects in closed areas that have "significant shellfish stocks potentially available for relay into approved areas for free and common fishery"[76] – i.e., the public transplant programs discussed above. Taken together, these regulations and policies place serious constraints on the potential of expanding shellfish aquaculture in Rhode Island, although RI-DEM's twelve month grow-out requirement is the greatest constraint.

VI. Recent Proposed Changes in Rhode Island Policy

Recognizing the restrictive nature of the regulations surrounding shellfish relay, RI-DEM recently proposed changes to its regulations,[77] seeking to accommodate requests by the state aquaculture industry for shorter grow-out periods. The proposed changes would reduce grow-out time from twelve months to six months.[78] However, RI-DEM has included new restrictions in the revised regulations;[79] shellfish must be transferred as seed and increase in weight by at least ninety percent after transfer before they can be harvested.[80] Any shellfish transferred beyond seed size continue to require special, prior approval by the directors of RI-DEM and RI-DOH.[81]

Although the proposed regulation amendments would lower the minimum grow-out period, the additional growth requirements effectively eliminate any value in the change since RI-DEM anticipates that twelve months is required to achieve the stated size increases.[82] Therefore, even with the new six-month requirement, shellfish growers will still need to employ a longer grow-out period, perhaps even as long as the current twelve-month period.

Election of grow-out regulations and other requirements related to relay involves a complex regulatory process and many policy decisions. RI-DEM partially justifies the additional restrictions in its proposed regulation changes as required to maintain compliance with the federally mandated NSSP-MO.[83] However, less restrictive regulations are sufficient to meet the NSSP-MO requirements. The NSSP-MO sets a minimum grow-out period of fourteen days with verification studies, and even in the absence of these studies, harvest is permitted after sixty days.[84] Neighboring states must also meet the

[76] *Id.* at § 300.11(B)(8). Although, it should be noted that this policy prohibition does not apply to spat collection. *Id.* at § 300.11(B)(8)(a).

[77] Email from Peter A. Duhamel, Principal Planner, RI-DEM, to author (Sept. 11, 2012, 14:58 EST) (on file with author). These regulatory changes have been put on hold while RI-DEM begins drafting its comprehensive shellfish management plan, but the changes will be considered as the planning process proceeds.

[78] Aquaculture of Marine Species in Rhode Island Waters (proposed Aug. 21, 2012) (to be codified at 12-080-053 R.I. CODE R. § 9.9.4); Duhamel, *supra* note 77.

[79] Duhamel, *supra* note 77.

[80] Aquaculture of Marine Species in Rhode Island Waters (proposed Aug. 21, 2012) (to be codified at 12-080-053 R.I. CODE R. § 9.9.3). For oysters and quahog, specific maximum relay sizes and minimum harvest sizes are proposed. All other shellfish will need to meet the ninety percent weight increase standard. *Id.* at §§ 9.9.1, 9.9.2, 9.9.3.

[81] *Id.* at §§ 9.8, 9.11.

[82] Duhamel, *supra* note 77.

[83] *Id.*

[84] NSSP-MO, *supra* note 29, at §§ II, ch. V, §.02(C), (D).

model ordinance requirements, but their grow-out periods are all three months or less.[85] Therefore, even with the proposed changes, Rhode Island's regulations would remain well in excess of national requirements set to protect consumer safety.

VII. Regulations of Other Jurisdictions[86]

A. Massachusetts[87]

Massachusetts does not have a relay program that allows private enterprise. Instead, like Rhode Island, relay in Massachusetts is carried out by government-sponsored programs only,[88] mainly individual municipalities.[89] In Massachusetts, shellfish relayed from restricted areas must remain in approved waters for a minimum of three months, including at least one spawning season, before harvest.[90] As a final protective measure, the shellfish must be tested for contaminants both at the time of relay and before harvest.[91] Although these regulations exceed the minimum requirements of NSSP-MO, they are still less onerous than the Rhode Island regulations.

B. Connecticut[92]

Connecticut has an extensive aquaculture relay program,[93] largely due to its more liberal relay regulations. Private aquaculture relay has been occurring for over two decades in Connecticut, and in

---

[85] *See* CONN. GEN. STAT. § 26-192k; N.Y. COMP. CODES R. & REGS. tit. 6, § 45.4(e)(1); Massachusetts Division of Marine Fisheries, *Shellfisheries Management*, EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS, http://www.mass.gov/eea/agencies/dfg/dmf/programs-and-projects/shellfisheries-management.html (last visited Dec. 8, 2013) [hereinafter *Shellfisheries Management*].

[86] A table providing a broad overview comparison of the various state regulations and the federal requirements is provided in the Appendix to this Article. The selected states were initially chosen to provide a local comparison for Rhode Island: Massachusetts, Connecticut, and New York. Washington State was added upon recommendation because its relay regulations closely mirror the federal standards. Finally, Canada is included to provide a foreign example – particularly the inclusion of Prince Edward Island, which is one of the world's largest mussel sources.

[87] In Massachusetts, aquaculture is primarily managed by the Department of Fish and Game, Division of Marine Fisheries, which is the agency that manages aquaculture permits. However, permits are required from several other state agencies depending on various aspects of the individual projects. The Department of Food and Agriculture is also highly involved in management of aquaculture. *See generally*, MASSACHUSETTS DEP'T OF FOOD AND AGRICULTURE, MASSACHUSETTS AQUACULTURE PERMITS GUIDANCE DOCUMENT (1998), *available at* http://www.mass.gov/eea/docs/agr/aquaculture/aquaculture-permit-guidance-document.pdf.

[88] Telephone Interview with Gregory Sawyer, Aquatic Biologist II, Mass. Dep't of Fish and Game, Division of Marine Fisheries (Aug. 27, 2012) [hereafter Sawyer Interview]. This restriction may be due less to a concern for protecting public health and more a concern for protecting the wild shellfish industry and a general state dislike for aquaculture. *See Shellfisheries Management, supra* note 85.

[89] Sawyer Interview, *supra* note 88.

[90] *Shellfisheries Management, supra* note 85.

[91] *Id.*

[92] In Connecticut, aquaculture is managed by the Connecticut Department of Agriculture, Bureau of Aquaculture. CONN. GEN. STAT. § 26-192a.

[93] Email from Tessa Getchis, Aquaculture Extension Specialist, Connecticut Sea Grant, to author (Sept. 17, 2012, 12:02 EST) (on file with author).

1989 was already described as "expand[ing] rapidly."[94] Connecticut requires just a fourteen-day grow-out period, yet still complies with the NSSP-MO.[95] However, Connecticut does call for several specific additional requirements to ensure that this short grow-out period is sufficient to reduce contaminants to safe levels for public health protection.

Chief among these extra precautions is a requirement for testing of fecal coliform bacteria levels in the shellfish before they can be harvested.[96] If the results of these tests indicate that the contamination level has not been reduced to safe levels during depuration, the Connecticut Department of Agriculture, Bureau of Aquaculture ("CT-DA/BA") will require a longer grow-out period.[97] However, the fourteen-day minimum is generally sufficient in practice, with most shellfish showing sufficient depuration in just one week.[98] CT-DA/BA rarely has to extend grow-out times; although extensions are often significantly long when they are required.[99] While most relay projects in Connecticut utilize bottom culture, some hold oysters in cages after relay.[100] Testing of cage-cultured oysters has shown a slower depuration rate, therefore mandating post-relay depuration periods several weeks or even months longer than the required minimum.[101]

Another extra protective measure found in Connecticut regulations, which is lacking from the regulations in Rhode Island and Massachusetts, is a minimum temperature requirement of fifty degrees Fahrenheit.[102] This temperature must be maintained throughout the grow-out period in recognition that most shellfish reduce metabolism rate at low temperatures and therefore will experience slower depuration rates.[103] By requiring a minimum temperature throughout the grow-out period, Connecticut regulations ensure that shellfish will be actively undergoing depuration throughout the entire fourteen days. Through detailed regulations of several variables, Connecticut has been able to capitalize on culture potential and has many private aquaculture projects utilizing relay depuration techniques. At the same time, Connecticut stays within the confines of the NSSP-MO, so shellfish are able to be sold via interstate commerce.

---

[94] T.C. Visel et al., *Bag Shellfish Relaying Systems in Connecticut* 1, 2 (1989), *available at* http://www.soundschool.com/Sound%20School%20Publications/bagshellfish.pdf.

[95] CONN. GEN. STAT. § 26-192k; *accord* NSSP-MO, *supra* note 29, at § II, ch. V, §.02(D). The Connecticut statute specifically states that all aquaculture employing relay must comply with all NSSP-MO minimum requirements. *Id.* § 26-192k. This compliance is also mandated by the enabling statute that places the Department of Agriculture as the lead agency. *Id.* § 26-192a.

[96] Email from Kristin DeRosia-Banick, Environmental Analyst II, Conn. Dept. of Agriculture, Bureau of Aquaculture, to author (Sept. 18, 2012, 09:00 EST) (on file with author).

[97] *See* CONN. GEN. STAT. § 26-192k.

[98] DeRosia-Banick, *supra* note 96.

[99] *Id.*

[100] *Id.*

[101] Email from David M. Lamoureux, Jr., Environmental Analyst II, Conn. Dept. of Agriculture, Bureau of Aquauculture, to author (Nov. 5, 2013, 08:07 EST) (on file with author). The skill of the grower can also have a significant impact on the required grow-out depuration length. *Id.*

[102] *Shellfishing Area Classifications*, CONN. DEP'T OF AGRICULTURE, STATE OF CONN. WEBSITE http://www.ct.gov/doag/cwp/view.asp?a=1369&q=259172 (last visited Dec. 6, 2013).

[103] BRENNESSEL, *supra* note 4, at 38.

C. *New York*[104]

Like Connecticut, New York also has several private aquaculture projects that employ relay depuration for shellfish grown in restricted waters. Approximately seventeen percent of New York's total growing waters are closed to harvesting because of poor water quality, and relay depuration allows use of those closed waters.[105] As opposed to Connecticut's requirement of a fourteen-day grow-out, New York sets the minimum grow-out length at twenty-one days.[106] Like Connecticut, New York places additional restrictions on relay to ensure that this short grow-out period is sufficient, such as microbial testing.[107]

New York requires microbial testing of shellfish to ensure that the grow-out period has allowed for contaminant reduction to a level safe for human consumption.[108] Although the regulations allow extension of the twenty-one day grow-out period based on the results of these tests, an extension has never been necessary.[109] However, very few aquaculture projects in New York actually utilize the twenty-one day minimum because most projects relay the shellfish while they are still seed size,[110] which requires a minimum six-month grow-out.[111] This preference for seed relay is likely due to the increased expense of market-size relay because New York regulations require that projects pay additional fees, such as the salary of a monitor, when relay is done after the shellfish have grown beyond seed size.[112] Therefore, New York does permit relay of shellfish of any size, but there are distinct financial incentives to relay shellfish earlier in the life cycle.

D. *Washington*[113]

Washington State's regulations are more liberal than any of the regulations in the New England states examined, yet the regulations still comply with the requirements of the NSSP-MO. Like the

---

[104] In New York, aquaculture is managed by the Department of Environmental Conservation's Bureau of Marine Resources. *Marine Permits and Licenses*, N.Y. DEP'T OF ENVTL. CONSERVATION, N.Y. STATE WEBSITE, http://www.dec.ny.gov/permits/6084.html (last visited Dec. 6, 2013).

[105] *Shellfish Safety*, N.Y. DEP'T OF ENVTL. Conservation, N.Y. STATE WEBSITE, http://www.dec.ny.gov/outdoor/9161.html (last visited Dec. 6, 2013).

[106] N.Y. COMP. CODES R. & REGS. tit. 6, § 45.4(e)(1).

[107] New York addresses the slow rate of shellfish purification in cold waters by prohibiting relay from October 11 through March 31 and requiring a minimum temperature of fifty degrees Fahrenheit during the twenty-one day grow-out period. *Id.* §§ 45.4(a)(2), 45.4(e)(1).

[108] *Id.* § 45.4(e)(1); Carden, *supra* note 72.

[109] N.Y. COMP. CODES R. & REGS. tit. 6, § 45.4(e)(1); Carden, *supra* note 72.

[110] *Id.* There has been only one aquaculture project in the last decade to employ relay of market-sized shellfish. In comparison, in 2012, seven permits were issued for aquaculture projects employing seed relay. *Id.*

[111] NSSP-MO, *supra* note 29, at § II, ch. VI, Requirements for the Harvester/Dealer § .03(A).

[112] N.Y. COMP. CODES R. & REGS. tit. 6, §§ 45.5(c), (e) (2012); Carden, *supra* note 72.

[113] In Washington, the state Department of Fish and Wildlife is the primary agency responsible for managing aquaculture, although many other agencies also have roles in relevant regulations and permitting depending on the specifics of the operation. *Aquatic Farm Registration*, *Environmental Permit Handbook,* WASHINGTON STATE GOVERNOR'S OFFICE OF REGULATORY ASSISTANCE, http://apps.oria.wa.gov/permithandbook/permitdetail.asp?id=26 (last visit Dec. 1, 2013); *see also Shellfish Aquaculture*, DEPT. OF ECOLOGY, STATE OF WASHINGTON, http://www.ecy.wa.gov/programs/sea/aquaculture/shellfish.html (last visited Dec. 6, 2013).

newly proposed regulations in Rhode Island, Washington regulations allow harvest of relayed shellfish after six months of grow-out, but unlike Rhode Island, Washington's six-month grow-out does not come with additional caveats.[114] Further, Washington also includes provisions that allow for significant reductions in grow-out time.

Grow-out periods of between fourteen days and six months are permitted provided that the growers conduct validation studies on the relay sites (both the source site and the grow-out site) to verify that the depuration period is sufficient to reduce contaminants to safe levels.[115] Projects can also utilize a grow-out period of between seven and fourteen days provided that more stringent contamination reduction studies are performed.[116] A grow-out period of less than fourteen days requires sampling of every lot of shellfish at both the time of relay and just before harvest to ensure sufficient contaminant reduction.[117]

By employing this three-tiered system, Washington allows shellfish growers to weigh the benefits of shorter relay periods against the costs of additional testing and select the most economically beneficial option. By requiring growers to pay the cost of additional testing, the state agency opens up greater possibilities of employing shellfish relay without placing significant additional burden on the agency itself and maintaining compliance with the NSSP-MO.

E. Canada[118]

Prince Edward Island is one of the largest sources of mussels for the United States market.[119] PEI mussels come from both wild harvest and large aquaculture programs.[120] Relay is a part of the Canadian shellfish aquaculture industry,[121] and relay projects are governed under the Canadian Shellfish Sanitation Program (CSSP), which is the Canadian equivalent of the U.S. NSSP-MO.[122] In 1948, Canada and the United States entered into an agreement that each would allow import of the others shellfish provided that they followed the same basic framework to ensure consumer safety.[123] Like the NSSP-MO, the CSSP sets up a basic framework where the regulatory agencies classify the waters according to water quality and allow relay from contaminated waters to approved waters for natural depuration

---

[114] WASH. ADMIN. CODE § 246-282-032(7). Although Washington's six-month grow-out regulations do not set additional requirements such as temperature, the regulations do explicitly require that projects meet all NSSP-MO requirements, and therefore a temperature requirement can be implied. *See id.* § 246-282-032(1)(c).

[115] *Id.* § 246-282-032(1)(e).

[116] *Id.* § 246-282-032(3)(c).

[117] In comparison, relay projects that employ a grow-out period of fourteen days or more may continue to use the set grow-out period for future lots once that grow-out period has been established by contaminant reduction studies on the initial lot. *Id.* § 246-282-032(4).

[118] In Canada, Fisheries and Oceans Canada is the primary body responsible for regulating aquaculture in the nation, although it "works closely with other federal government departments, the provinces and territories, and the aquaculture industry to support" sustainable aquaculture. *Roles and Responsibilities*, FISHERIES AND OCEANS CANADA, http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/roles-eng.htm (last visited Dec. 6, 2013).

[119] BRENNESSEL, *supra* note 4, at 34.

[120] Lindell, *supra* note 17, at 2.

[121] PEI FACT SHEET, *supra* note 24, at 2.

[122] *Id.*

[123] CSSP, *supra* note 34, at Foreword.

prior to harvest.[124] Additionally, the CSSP also includes the requirement for bacteriological testing before a lot of relayed shellfish can be harvested in order to ensure sufficient depuration.[125]

The CSSP calls for varying levels of testing dependent upon the length of time for grow-out. Grow-outs of less than fourteen days but no less than six days are permitted, but require extensive testing.[126] Only a single test for fecal coliform is required for any shellfish lot undergoing a grow-out period between fourteen and twenty-one days.[127] If the grow-out period exceeds twenty-one days, then no testing of the shellfish is required, although the regulatory agency has the discretion to require testing for these longer grow-outs.[128] If the shellfish are transplanted as seed, a minimum six-month grow-out period is required.[129] Since the seed are likely to take at least six months to reach market size, this requirement is unlikely to place any economic burden or restrictions on the grower and their associated farm or business models.

VIII. The Future of Shellfish Aquaculture in Rhode Island

A. Justification for Rhode Island's Protective Regulations and Counterarguments

As noted above, Rhode Island's shellfish relay regulations are more restrictive than those of other states reviewed here. States like Connecticut and New York have relay regulations that are just above the minimums set by the NSSP-MO.[130] However, the model ordinance itself makes clear that these are only minimums, and states are free to set more restrictive regulations as they deem appropriate.[131]

RI-DEM partially justifies its regulations as a need to comply with the requirements of NSSP-MO,[132] but as previously noted, far more liberal regulations would still comply. RI-DEM supports its more conservative regulations with three basic arguments: (1) more restrictive regulations will provide additional public health protection, (2) RI-DEM enforcement does not have the man-power to properly enforce less stringent regulations, and (3) there is sufficient submerged bottom to support the needs of shellfish wild harvest and aquaculture. It is likely, also, that RI-DEM is influenced by the often antagonistic relationship between shellfish aquaculture and wild harvest in Rhode Island.[133]

---

[124] *See id.* §§ 2.2, 2.3.1, 10.3, 10.4.
[125] *Id.* §§ 10.3.7, 10.4.7.
[126] *Id.* § 10.3. Before approval of the project, twenty lots of shellfish must be tested to prove that the contaminants are reduced to safe levels. Afterwards, every lot must be tested for fecal coliform before it can be sold. *Id.* §§ 10.3.7, 10.3.8. Additionally, this short-term relay is only permitted when the shellfish are held in containers after relay rather than transplanted onto the bottom. *Id.* § 10.3.
[127] *Id.* § 10.4.7.
[128] *Id.*
[129] *Id.* § 2.3.6(a).
[130] NSSP-MO, *supra* note 29, at §§ II, ch. V, §.02(D), (E); CONN. GEN. STAT. § 26-192k; N.Y. COMP. CODES R. & REGS. tit. 6, § 45.4(e)(1).
[131] NSSP-MO, *supra* note 29, at § II, Purpose.
[132] Duhamel, *supra* note 77.
[133] BRENNESSEL, *supra* note 4, at 98; *see* Ray Huling, Presentation at University of Rhode Island Marine Affairs Seminar Course (Oct. 31, 2012).

RI-DEM coordinates with the RI-DOH on shellfish sanitation regulations, and RI-DOH's stance is for elimination of all potential risk to consumers.[134] The desire to provide maximum protection dictates grow-out purification times longer than the federally mandated minimum. However, Rhode Island's excessive increase in depuration time correlates to RI-DEM's second justification – a lack of enforcement manpower.[135]

Throughout the shellfish industry, there is a fear that persons will harvest shellfish from closed waters and these contaminated shellfish will reach the market, causing illness.[136] RI-DEM enforcement staff is already worn thin trying to patrol closed waters to prevent harvest.[137] By permitting culture in and relay from closed waters, the jobs of enforcement staff could become increasingly difficult as they need to distinguish between those legally tending gear or harvesting in closed waters and those illegally harvesting contaminated stocks.[138] Loosening the regulations would increase the monitoring requirements of RI-DEM's enforcement staff, and RI-DEM views the potential benefits of opening up more areas to relay as not worth the increase in associated time, cost, and risk. Despite RI-DEM's reasons to justify the one-year grow-out requirement, there are valid counterarguments that support changing the current regulations.

In regards to the public health concern, the only scenario in which an extended grow-out period is justified is when the shellfish are collected from waters that are contaminated by heavy metals or other non-biological contaminants. Such contaminants take a significantly longer period of grow-out to reach levels safe for human consumption, often several months.[139] Such contamination is common in shellfish grown in or around marinas where there are more frequent and intense inputs of anthropogenic contamination.[140] Therefore, shellfish grown in marina waters would typically require significantly longer grow-out periods than the federal minimums. However, for shellfish transferred from waters impacted exclusively by biological contamination, the public health concern will likely be satisfied with the minimum grow-out periods called for in the model ordinance, as other states have successfully demonstrated.[141]

The bigger problem is that RI-DEM lacks sufficient resources to adequately patrol restricted waters with relay projects underway.[142] However, alternative funding methods could be employed to ease this burden. For example, in New York, growers must pay to have a monitor aboard their vessels as they carry out relay depuration projects.[143] In fact, Rhode Island employs this same technique for

---

[134] *Shellfish Inspection Program: Mission*, RHODE ISLAND DEP'T OF HEALTH, http://www.health.ri.gov/programs/shellfish/ (last visited Dec. 6, 2013); *see* Interview with Michael Rice, Professor of Fisheries and Aquaculture, University of Rhode Island, in Kingston, R.I. (Dec. 24, 2012) [hereinafter Rice Interview].

[135] Migliore Interview, *supra* note 23.

[136] *Id.*

[137] *Id.*

[138] *See id.*

[139] NSSP-MO, *supra* note 29, at § IV, ch. II, §.06.

[140] Rice Interview, *supra* note 134; *see also* NSSP-MO, *supra* note 29, at § II, ch. IV, Requirements for the Authority, § .05(A) (limiting the available water classifications for marina waters to conditionally approved, conditionally restricted, or prohibited).

[141] *See* Carden, *supra* note 72; Getchis, *supra* note 93.

[142] *See* Migliore Interview, *supra* note 23.

[143] Carden, *supra* note 72.

aquaculture sites that have been grandfathered in conditionally approved waters. If the growers want to work on their sites while the area is closed, they must pay to have an enforcement officer accompany them to the site.[144] This shifts the cost from the state agency onto the industry, although it is unclear if this pay-to-play system would be too costly for private projects.[145] However, expanding regulations to include new options will allow the individual growers to determine whether the additional cost provides worthwhile benefits.

RI-DEM's final supporting reason examined here, that there are sufficient sites currently available, is only true based on a status quo view of the Rhode Island shellfish industry. Furthermore, the fact that a site may be located in open waters does not necessarily mean that the site is suitable or practical for aquaculture. Many people foresee expansion of shellfish aquaculture in the future both locally and globally.[146] Expansion of the Rhode Island shellfish aquaculture industry may require more access to submerged bottom than currently available, although the greater need is likely to be seed taken from restricted waters.[147]

Current seed supply is from cultured sources, often from upwellers[148] in marina waters or in approved waters,[149] but the supply is unlikely to support anticipated expansion.[150] With a shortage of seed from approved waters, growers are likely to seek wild seed, perhaps from restricted waters.[151] Utilizing restricted waters as a seed source may also require relay of some adults out of these closed waters in order to reduce population density and improve reproductive success.[152] Therefore, a benefit could be gained from regulatory change in regards to both seed size and market-size shellfish. However, it should be noted that seed collected from marina waters or other waters contaminated with heavy metals will face the likely problem of necessary longer grow-out periods.

Despite the existence of justifications for changes to relay regulations, RI-DEM has chosen to maintain its restrictive regulations. The balancing of risks against potential benefits may be skewed by

---

[144] Migliore Interview, *supra* note 23.

[145] *Id.* This expectation is supported because in New York there is only one project that takes advantage of the state's option to pay for monitors and relay market-size shellfish. Carden, *supra* note 72.

[146] BRENNESSEL, *supra* note 4, at 3; Lindell, *supra* note 17, at 3.

[147] *See* Rice Interview, *supra* note 134; Migliore Interview, *supra* note 23.

[148] An upweller is a container in which shellfish seed is placed to be grown to a sufficient size to be transplanted to an aquaculture site. The upweller is connected to a water source – often estuaries or other marine waters – through pipes that allow water to flow without allowing the seed to escape. The water flow provides plankton for the seed to feed upon. Gef Flimlin, *Nursery and Growout Methods for Aquacultured Shellfish*, Northeastern Regional Aquaculture Center Publication No. 00-002 (on file with author).

[149] Rice Interview, *supra* note 134. The seed cultured in marina waters must undergo a relay-style transfer to approved waters and comply with the twelve-month grow-out requirement of the RI-DEM regulations. Aquaculture of Marine Species in Rhode Island Waters (proposed Aug. 21, 2012) (to be codified at 12-080-053 R.I. CODE R. § 8.9).

[150] Lindell, *supra* note 17, at 5.

[151] *Id.* Currently, RI-DEM also prohibits collection and possession of wild shellfish seed, so a regulatory change to permit relay of wild seed from restricted waters would additionally require a regulatory change permitting collection of wild seed. *See* 12-080-053 R.I. CODE R. §§ 4.21, 4.35.1-2, 4.35.6-2 (establishing minimum sizes for shellfish and prohibiting possession of shellfish below the minimum size).

[152] *See* Dora Carolina Marroquin-Mora & Michael A. Rice, *Gonadal Cycle of Northern Quahogs,* Mercenaria mercenaria *(Linne, 1758), from Fished and Non-Fished Subpopulations in Narragansett Bay*, 27 J. SHELLFISH RESEARCH 14 (2008) [on file with author].

the tension between wild harvest and aquaculture in Rhode Island. The RI-CRMC explicitly recognizes this tension historically[153] and also implicitly addresses its continued existence by setting a policy to deny private shellfish aquaculture leases in uncertified waters "which contain significant shellfish stocks available … for the free and common fishery."[154] RI-DEM's relay regulations are likely also in response to this same concern for avoiding conflict between the wild harvest fishery and aquaculture.

B. Potential Regulatory Changes in Rhode Island

Although the existing regulations comply with federal requirements, they remain a constraint on potentially viable industry expansion. The RI shellfish aquaculture industry is limited because lease sites are typically only available in approved waters.[155] Given that many viable shellfish culture and seed sites are currently within closure lines, the ability of shellfish aquaculture to flourish without utilizing relay is limited.[156] As noted above, Canadian producers of mussels have reached their biological and social carrying capacities, and therefore Rhode Island is poised to meet an anticipated gap in supply availability with the comparatively high carrying capacity of the Bay.[157]

However, in order to become a major source of shellfish via relay and aquaculture, Rhode Island regulations would need to be altered to allow for faster delivery to market after transfer out of restricted waters for depuration. Under the current regulatory scheme, the shellfish must undergo grow-out for one year following transfer, which reduces economic viability of relay projects because, even when relayed as seed, mussels and some other shellfish will reach market size in less than a year.[158]

The key to increasing the utility of shellfish relay is to reduce grow-out time requirements. These reductions have been called for by aquaculture industry representatives, and RI-DEM has responded with the proposed regulation changes discussed above.[159] Although these changes are a step in the direction of improving viability of aquaculture relay depuration, the actual impact of the regulations on project timeframes, and therefore economic viability, is negligible.

Even though the new regulations cut the grow-out time requirements in half, six months is still a significant grow-out period. The inclusion of minimum growth requirements effectively eliminates any time reduction as the growth requirements are designed to mimic the anticipated growth of shellfish over a twelve-month period.[160] This addition of a growth requirement may also place greater restrictions on relay of market-sized shellfish because they grow at a slower rate than shellfish transferred at seed size. Alternative changes could expand options for shellfish growers without placing increased risk on consumers. These changes could be blanket reductions for all species or they could be species-specific.

---

[153] *Red Book, supra* note 15, at § 200.4(B)(2).
[154] *Id.* at § 300.11(E)(2).
[155] *See id.*
[156] *See id.* at § 200.4(B)(1); RAY HULING, HARVESTING THE BAY 140 (2012).
[157] *See* Byron et al, *supra* note 14, at 1743, 1744 (citations omitted).
[158] 12-080-053 R.I. CODE R. § 8.9; Lindell, *supra* note 17, at 3; *see* CSSP, *supra* note 34, at § 2.3.6(a).
[159] Duhamel, *supra* note 77.
[160] *Id.*

C. Justifications for Grow-out Time Requirement Reductions

With few exceptions, shellfish naturally reduce contaminant levels within their tissues to levels that are safe for human consumption in three days to one week.[161] This short depuration time is recognized by federal regulations in permitting relays with grow-out periods of as little as six days.[162] Although depuration rates are affected by factors such as temperature and the specific contaminant at issue, these variables can be addressed by inclusion of additional protective requirements and still allow for a shorter grow-out period.[163]

The rate at which shellfish filter water through their systems is directly related to water temperature.[164] Because depuration occurs via water filtration, shellfish will not purge contaminants from their tissues when they are not actively filtering water.[165] Many states take this factor into account by requiring minimum water temperatures throughout the minimum grow-out period, and drops in temperature below a given threshold necessitate a restart of the minimum time period.[166] Some states also adopt seasonal restrictions, prohibiting relay during the winter months in recognition of lower temperatures.[167] Adding these temperature or seasonal requirements could allow RI-DEM to reduce relay grow-out timeframes without increased risk to consumer safety.[168]

Requiring contaminant reduction studies is another method to protect consumer safety while still allowing for reduced grow-out periods. Except for Rhode Island, every state examined here requires

---

[161] Pietrak et al., *supra* note 37, at 36 (noting reduction to safe levels after seventy-two hours); E. Strogyloudi et al., *Estimating the Accumulation and Transfer of* Nodularia spumigena *Toxins by the Blue Mussel* Mytilus edulis: *An Appraisal from Culture and Mesocosm Experiments*, 48 TOXICON 359, 359 (2006) (noting reduction to safe levels after seventy-two hours); *cf.* R.J. Pruell et al., *Uptake and Depuration of Organic Contaminants by Blue Mussels (*Mytilus edulis*) Exposed to Environmentally Contaminated Sediment*, 91 MARINE BIOLOGY 497, 497 (1986) (noting half-lives of highly toxic contaminants such as PCBs of sixteen to forty-six days).

[162] NSSP-MO, *supra* note 29, at §§ II, ch. V, §.02(C), (E).

[163] *Id.* at § IV, ch. II, §.03; BRENNESSEL, *supra* note 4, at 38; Pruell et al., *supra* note 161, at 505. Additional factors impacting depuration rate include size of the shellfish (*see* Strogyloudi et al, *supra* note 161, at 370), shellfish species (*see* Röder et al, *supra* note 37, at 173), and salinity (*see* NSSP-MO, *supra* note 29, at § IV, ch. II, §.03).

[164] BRENNESSEL, *supra* note 4, at 38.

[165] *See* Lee-Ann Jaykus, Mary T. Hemard, & Mark D. Sobsey, *Human Enteric Pathogenic Viruses*, *in* ENVIRONMENTAL INDICATORS AND SHELLFISH SAFETY 124 (Cameron R. Hackney & Merle D. Pierson, eds. 1994); Strogyloudi et al., *supra* note 161, at 368.

[166] N.Y. COMP. CODES R. & REGS. tit. 6, § 45.4(e)(1) (requiring a minimum temperature of fifty degrees Fahrenheit); *Shellfishing Area Classifications*, CONN. DEPT. OF AGRICULTURE, http://www.ct.gov/doag/cwp/view.asp?a=1369&q=259172 (last visited Dec. 6, 2014) (requiring a minimum temperature of fifty degrees Fahrenheit).

[167] N.Y. COMP. CODES R. & REGS. tit. 6, § 45.4(a)(2) (prohibiting relay between Oct. 11 and Mar. 31).

[168] Although monitoring of water temperatures could increase RI-DEM's operating costs, these cost increases can be avoided through simple adoption of a seasonal restriction. The costs can also be mitigated by requiring the growers to perform the monitoring or pay for RI-DEM's monitoring. Passing the cost of the test on to the growers will allow greater flexibility because each individual can decide whether her business model is better supported by a longer relay grow-out period at a reduced cost or a shorter period with increased costs.

contaminant reduction studies for some or all of their relay projects.[169] These studies can be costly, but the costs can be passed on to growers. Many states require that the grower provide either his or her own testing or funding for state tests.[170] By passing the costs on to the grower, each can make an independent determination of whether it is economically advantageous to pay for these tests to obtain a shorter grow-out period.[171]

Requiring these contaminant reduction studies also serves the purpose of accounting for potential risks in shorter grow-out periods. Although one-week grow-out periods are sufficient for most shellfish with most contaminants, certain variables reduce the depuration rate and necessitate a longer grow-out period.[172]

One of the major sources of increase in necessary depuration time is contamination with heavy metals or highly toxic substances such as PCBs (polychlorinated biphenyls).[173] Heavy metals can take up to eighty-four days to decrease to levels that are safe for human consumption.[174] In order to avoid overly complex regulations accounting for these various factors, contaminant reduction studies can indicate on a case-by-case basis where additional depuration time is required. Employing these studies would allow greater flexibility for aquaculture relay projects with little additional cost to RI-DEM and should improve the economic position of Rhode Island in the shellfish market.

D. Justifications for Species-Specific Regulations

Regulation changes may be more appropriate if they are specialized to deal differently with individual species rather than by a blanket change for all species. Although many factors influence the filtration rates of shellfish, filtration rate is largely species-specific.[175] For example, filtration rates

---

[169] CONN. GEN. STAT. § 26-192k (noting that Conn. requires testing before harvest); N.Y. COMP. CODES R. & REGS. tit. 6, § 45.4(e)(1) (noting that N.Y. requires testing before harvest, and for relay of market-sized shellfish, testing is also required at the time of relay); WASH. ADMIN. CODE §§ 246-282-032(3)(c), (4), (7) (Wash. requires testing for any relays of less than six months); Sawyer Interview, *supra* note 88 (explaining that Mass. requires testing at the time of relay and again when the shellfish are harvested). The NSSP-MO also requires contamination reduction studies for any relay less than sixty days and any relay involving contaminants other than microbial contaminants. NSSP-MO, *supra* note 29, at § II, ch. V, §.02(C). In Rhode Island, the regulations do not expressly require contaminant reduction studies. However, all current relay programs are carried out by the state, and in practice, the state does conduct these studies. Migliore Interview, *supra* note 23.

[170] *See, e.g.*, N.Y. COMP. CODES R. & REGS. tit. 6, § 45.5(c) (requiring payment of "supervision fees" to pay for salary of employee required to conduct the extensive testing required for relay of market-sized shellfish).

[171] In New York, for example, only one project has selected to incur the extensive supervision fees for market-sized relay. However, this program has proven economically viable, has continued for many years, and has never required an extension of the grow-out requirement beyond the twenty-one day minimum. Carden, *supra* note 72.

[172] *See* NSSP-MO, *supra* note 29, at §§ III, ch. V, §.02; IV, ch. II, §.06.

[173] *Id.* at § IV, ch. II, §.06; Pruell et al., *supra* note 161. Currently, seed cultured in upwellers in marinas typically have heavy metal contamination, and such contamination would likely be presumed even from wild shellfish collected from an area close to a marina or other industrialized area. *See* Rice Interview, *supra* note 134.

[174] NSSP-MO, *supra* note 29, at § IV, ch. II, §.06.

[175] B.L. Bayne, R.J. Thompson, & J. Widdows, *Physiology: I, in* MARINE MUSSELS: THEIR ECOLOGY AND PHYSIOLOGY 121, 142-43 (B.L. Bayne ed., 1976); F. Møhlenberg & H.U. Riisgård, *Filtration Rate, Using a New Indirect Technique, in Thirteen Species of Suspension-Feeding Bivalves,* 54 MARINE BIOLOGY 143, 146 (1979); Hans Ulrik Riisgård, *On Measurement of Filtration Rates in Bivalves – The Stony Road to Reliable Data: Review and Interpretation,* 211 MARINE ECOLOGY PROGRESS SERIES 275, 278 (2001).

compiled by Riisgard indicate that blue mussels, *Mytilus edulis*, filter at more than double the rate of quahogs, *Mercenaria mercenaria*.[176] With these large differences in filtration rate, species-specific grow-out requirements could allow relay projects of species with faster filtration rates, like mussels, to proceed in shorter time periods without increased risk to consumer safety, while longer grow-out times could be required for species with slower filtration rates, like quahogs.

Potential complications do exist for species-specific regulations, and these potential problems need to be carefully considered before making any regulatory changes. First, having different regulations for every species could become overly complicated, leading to difficulty for both the regulated community and enforcement personnel. Second, as noted above, filtration rate is influenced by many factors, for example temperature, in addition to species.[177] Adequately determining a safe grow-out period for every shellfish species could potentially be an intensive task for RI-DEM because of the influence of other factors.

One way to overcome the burden of species-specific regulations would be to limit specialized regulations to only a few, major species. Extensive research is already available on the major aquaculture species, including filtration rates.[178] With extensive knowledge already available, less agency time and resources will be required to set specialized regulations. Additionally, by highlighting only the few most common species, there is less potential for confusion among the regulated industry or enforcement personnel from complexity of the regulations. RI-DEM has already begun this species distinction in the proposed relay regulation changes by distinguishing separate growth requirements after relay for oysters and quahogs, leaving all other species with one generic requirement.[179] RI-DEM could continue this species distinction to allow for expansion of the shellfish aquaculture industry without increased risk to consumer safety.

If RI-DEM determines that species-specific regulations are unwarranted even for key species, a simpler distinction could be made between shellfish transferred as seed and those transferred beyond seed-size. The distinction between seed and post-seed size is already made in the regulations, but the relay grow-out times are the same for both groups.[180] However, shortening the grow-out requirements for seed-size relay alone may easily be justified because (1) all contaminants will be reduced below levels of concern by the time the seed reach market size, and (2) the enforcement difficulties will be lessened because RI-DEM already regulates based on shellfish size. Increasing the potential for seed relay would also be beneficial because seed source is likely to be the limiting resource for future shellfish aquaculture expansion, particularly mussel aquaculture.[181]

---

[176] Riisgård , *supra* note 175 (indicating filtration rate as a function of shellfish weight); *see also* Bayne, Thompson, & Widdows, *supra* note 175, at 138 (noting that *Mytilus edulis* has been shown to have higher filtration rates when compared with another *Mytilus* species as well as a species of *Modiolus*).

[177] John Widdows & Peter Donkin, *Mussels and Environmental Contaminants: Bioaccumulation and Physiological Aspects, in* THE MUSSEL MYTILUS: ECOLOGY, PHYSIOLOGY, GENETICS AND CULTURE 389 (Elizabeth Gosling ed., 1992).

[178] *See* D. Roberts, *Mussels and Pollution, in* MARINE MUSSELS: THEIR ECOLOGY AND PHYSIOLOGY 67, 67 (B.L. Bayne ed., 1976); *see also* Riisgård, *supra* note 175, at 275, 278.

[179] *See* Aquaculture of Marine Species in Rhode Island Waters (proposed Aug. 21, 2012) (to be codified at 12-080-053 R.I. CODE R. §§ 9.9.1, 9.9.2, 9.9.3).

[180] 12-080-053 R.I. CODE R. §§ 8.8, 8.9.

[181] Lindell, *supra* note 17, at 5; *see also* Marroquin-Mora & Rice, *supra* note 152, at 1.

Shellfish relayed as seed will require at least six months to reach market size, likely longer.[182] By the time seed reach market size, all non-metal contaminants will be below levels of concern because of both depuration through filtration and dilution through tissue growth.[183] Metals contamination is often viewed as the more significant problem, but in Rhode Island metal levels are already below federally set tolerance levels, and by the time relayed seed reach market size, the metals in their tissues are no longer detectable.[184] Even seed collected from within contaminated sediment, which have greater contaminant levels in their tissues, still have undetectable levels of contaminants in their tissues by the time they reach market size after relay grow-out.[185]

Therefore, because shellfish relayed as seed will be safe for human consumption by the time they reach market size, seed relay grow-out times could be reduced without increasing consumer risk and without adding undue burden to enforcement personnel. The current Rhode Island regulations permit relay of seed from other than approved waters,[186] and therefore RI-DEM enforcement personnel are already charged with monitoring for illegal versus permitted seed relay. Lowering the grow-out requirement would only shift the enforcement personnel's duties post-relay. If RI-DEM finds that these additional monitoring duties are still overly burdensome, shifting the cost of the additional monitoring to the grower would permit each to decide whether bearing the additional cost is worthwhile for her business model. As this section has described, there are many potential regulatory changes that could permit expansion of shellfish relay in Rhode Island and therefore allow for expansion of the Rhode Island shellfish industry, most with minimal impact to RI-DEM and its shellfish industry regulation and enforcement mandates.

IX. Conclusion

With the growing demand for shellfish in southern New England, nationally, and globally, the economic potential of shellfish aquaculture is high. Unfortunately, lease space and seed source for aquaculture is limited, and the non-use of contaminated waters increases this limitation. Relay depuration provides a method to expand aquaculture operations without increased consumer risk. While many states are already effectively utilizing relay programs to promote their local economies, RI has reduced the efficacy of this possibility by placing highly restrictive time requirements on post-depuration grow-out periods. If Rhode Island wishes to compete in the shellfish marketplace, improve its economy, and provide new job opportunities to the state from this industry, RI-DEM should reevaluate its relay depuration regulations and consider reducing the minimum required grow-out time.

---

[182] *See* Lindell, *supra* note 17.

[183] Robert Rheault, History of the Proposal to Culture Seed in Uncertified Waters for Aquaculture: Prepared for RI-DEM 1, 2 (June 2012) [on file with author]; Rice Interview, *supra* note 134.

[184] Rheault, *supra* note 183, at 3; Rice Interview, *supra* note 134.

[185] *Id*.

[186] 12-080-053 R.I. CODE R. §§ 8.8, 8.9. Again, currently only seed cultured in other than approved waters may be transferred as current regulations prohibit collection of wild seed. *See* 12-080-053 R.I. CODE R. §§ 4.21, 4.35.1-2, 4.35.6-2 (establishing minimum sizes for shellfish and prohibiting possession of shellfish below the minimum size).